Kennedy Space Center
Center Campus Study

100% Final

May 5, 2009
PCN 98745

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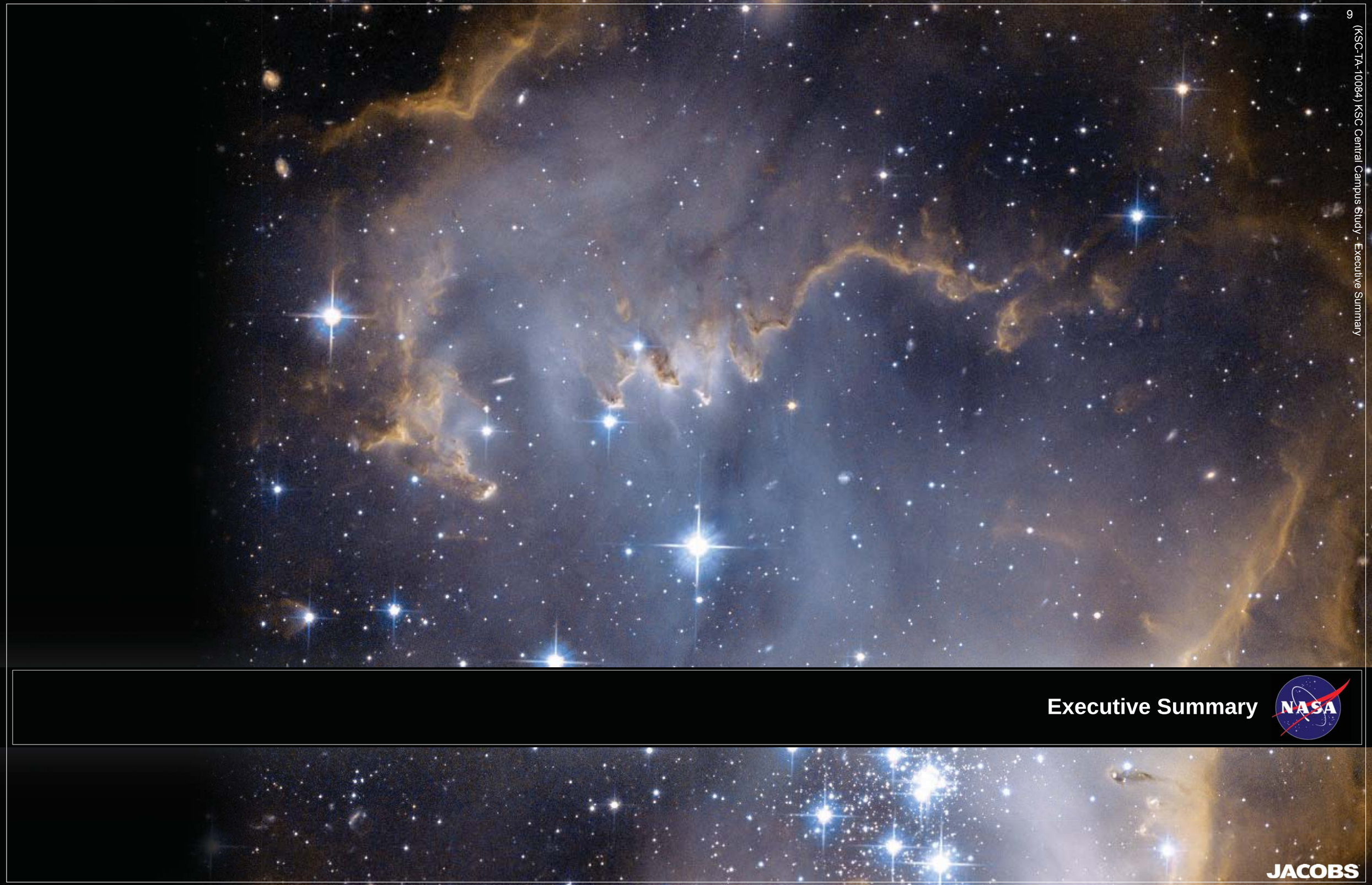

Executive Summary

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1. Executive Summary

1.1 Introduction

This report deals with the facts and figures required to ecologically and intelligently make use of existing Kennedy Space Center (KSC) systems whenever possible to keep costs down, while entertaining the concepts of sustainability, energy consumption, and space constraints. The data compares the renovation of existing buildings to the construction of a new facility, thereby determining the most ideal situation for moving forward on KSC's campus.

The scope of this study is to provide a complete report encompassing an investigation of the existing site, proposed sites, existing building conditions and operations for the facilities in the study, and user groups associated with the project. The data, program analysis, and concept development are used to develop four project options and recommendations for the consolidation of the Headquarters (HQ) Building and its KSC supporting facilities.

Option 1 (minor renovation) includes a minor renovation of the current building systems in the Headquarters Building, and in other study buildings as necessary; option 2 (major renovation) includes the elements of option one, plus major renovations to the interior, and possibly to some exterior elements of the Headquarters Building, and other study buildings as necessary; option 3 (major renovation & new addition) includes all the elements of options one and two, and additional items such as the consolidation of selected surrounding buildings into the Headquarters Building, demolition of abandoned existing buildings, and the new construction of an addition for the Employee Shared Services; option 4 (new construction) includes the construction of completely new facilities incorporating all of the requirements of the existing HQ Building, along with the other supporting facilities and Shared Services in the industrial area.

In three of the four options, the availability of consolidating functions is derived from the following facilities: Operations & Checkout Building, Space Station Processing Facility, Environmental Health Facility, Base Operations Building, Central Instrumentation Facility, Auditorium and Training Building, Industrial Area Support Building, Electromagnetic Lab, Technical Records Center, existing Headquarters Building. These facilities have all been identified to contain compatible functions and are all located currently within the industrial area of KSC.

The need to generate a study is based on the current maintenance and operation burden the existing facilities require; almost all of the buildings included in the study are nearing the end of their 50 year life expectancy. High operating and maintenance costs could be remedied with consolidation efforts, producing a more efficient facility following a stricter standard for efficiency, both in terms of energy usage and workplace spatial standards. Based on existing NASA data, the current study facilities generate energy costs of approximately $4 million a year, O&M costs of around $6 million a year. Due to its existing condition, the HQ Building cannot be optimized for the most efficient use of its space. The current average area occupied per person is 367 square feet of space, which is above the modern government average of 250 square feet per person in a typical office setting.

At the conclusion of the study, conceptual site and building development is presented with attention to NASA's sustainable design commitment, project scheduling, energy use, and economic and life cycle cost. A full set of findings, analyses, recommendations and justifications is included.

1.2 Study Objective

The overall goal of the effort is to deliver a dynamic process rather than a static end-product. The KSC Central Campus Study is a "living document" which will require on-going monitoring by KSC. Some of the data used in the study changes on a regular basis. Another goal is to compile data that lends itself to adaptation by incorporating new information. This will allow KSC to continue to manage its growth in an orderly and coherent fashion well beyond the initial effort put forth in the study.

The objective of this document is to provide a factual basis justifying the proposed revitalization or replacement of the Headquarters Building and consolidation of various facilities in Kennedy Space Center's industrial area, as well as a final recommendation for the best final approach.

1.3 Planning Steps and Milestones

The study process has been divided into phases, with the first four sections of the document representing Phase I of the process for gathering baseline data for existing conditions of KSC and its associated program. The baseline includes all existing conditions for the included eight proposed sites and facilities for possible consolidation. The next phases of this process, Phase II and III, include more detailed current and future requirements, as well as future opportunities and development concepts. The sections of the document were created after the KSC Facilities Division reviewed and approved all data within the existing conditions portion of the document. The latter sections of the document include facility recommendations for possible expansion, realignment, and development in conjunction with the four project options of the scope of work. Refer to Figure 1.1 for complete project milestones.

1.4 Content and Organization of the Study

Section One: **Executive Summary** — Provides an introduction to the overall description of the project and gives background for the purpose, content, and project findings. As part of the findings, the final recommendation is included.

Section Two: **Introduction to Project and Planning** — Covers the project description and the processes used throughout the project. The planning process and approach sets the framework for the project with a diagrammatic graphic (See Figure 2.1). The vision describes KSC's aspirations for the strategy and includes the plan goals, planning principles, and objectives.

Section Three: **Existing Conditions** — The first part of the section is divided into three major subsections: Regional Location, Natural Environment and Built Environment. The Natural Environment is divided into several different categories, all of which affect the proposed facility and the relationship to its location in the region. The Built Environment discusses security, parking, site circulation and facility siting issues. The last subsection finishes with Development Suitability and Opportunities and Constraints. Also, Section Three captures the components of the development program and outlines future analysis requirements. The guiding principles and their supporting planning objectives are an addition to the existing conditions data gathered in Phase I. The guiding principles provide an understanding of what is being planned for and the development conditions of the properties, if any exist. All of the aforementioned items, along with the site evaluation matrices, introduce the Concept Development section and set a foundation for future design.

Section Four: **Facility Conditions Assessment** — Provides an introduction to the overall description of the programming data, describes in detail the existing space types, and gives an overview of all of the study tenant lists and functions. A large portion of the section is the Facility Conditions Assessment, organized by building.

Section Five: **Concept Development** — Includes the exploration of ideas and optional ways to accommodate the identified vision and planning goals. The results of this process are proposed alternatives that will form the basis of the culmination of the planning process, including the ultimate realignment of development conditions for KSC.

Section Six: **Sustainability** — Discusses the impact that the current facilities and any future development could have on the environment in and around KSC. Project team members worked corroboratively to reach productive, creative, practical, and economic ways to approach the various environmental issues involved in facility related projects.

Section Seven: **Parametric Cost Estimates** — Includes the comprehensive cost analysis spreadsheets, including an over-all roll-up and summary sheet with supporting calculations. The calculations identify project square footage, and costs associated with energy and construction. Within the spreadsheets, the costs are then compared and analyzed. The cost comparison spreadsheets are utilized along with all of the study's matrices and data to identify a recommended solution. The ECONPACK is included with the study, but is a separate deliverable.

Appendices — Several appendices are included at the end of the document. The appendices detailed documentation to supplement the individual sections. Items cover detailed background information, raw data analysis, charrette sessions, and project spreadsheets.

1.5 Findings to Date

Section Two: **Introduction to Project and Planning** — In the Introduction to Project and Planning section, Jacobs identified the needs of KSC through a study, and how to arrive at the most appropriate solution. Jacobs established different ways to look at objectives, parameters, and solutions. The study takes into consideration all aspects of KSC. The main topics in the section are:

- Purpose
- Description
- Vision
- Planning Process
- Approach and Technique
- Project Goals
- Guiding Principles and Planning Objectives
- Implementation Plan

The three key principles and objectives that were established early in the study (consolidation, operational efficiencies, and sustainability), play a continued, primary role in arriving at the final solution and recommendation. A survey conducted by KSC facilities personnel concluded the two criteria considered to be the most important to pre-design were: employee safety, and energy efficiency.

Section Three: **Existing Conditions** — Within the existing site conditions, Jacobs identified that KSC is predominantly a sprawling development. Florida's climate, with seasonal rain, hot summer days, and generally sunny forecasts, lends itself to a campus-like development. With over 4,000 employees working in the study facilities (including the O&C and SSPF Buildings), and almost as many parking spaces interspersed throughout the center, the ultimate solution should centralize the density of the workforce.

The main sections and primary ideas in the section are:

- Natural conditions
- Environment
- Built environment
- Walking
  - Time
  - Distance
- Identification of potential sites
- Infrastructure
- Opportunities and constraints
  - Available land
  - Utility availability
- Development suitability

The site stainability matrix outlines all eight sites (A through H), and evaluates which site would be most appropriately suited for a potential addition, or a new facility. According to the criteria listed in the chart, which was agreed upon by the project team, the most suitable site for potential construction is site G, with sites A and B coming in second and third, respectively.

Section Three also acts as a precursor to Section Five, which explores the various project options of the study. The site evaluation criteria rank multiple sites with regards to the appropriateness for the two ultimate options. The key items identified are:

- How the comparisons were set up
- Site evaluation matrix
  - Renovation site: center employee center to the east
  - New site: same condition

The results of the site evaluation matrices are as follows: For new construction, sites G and D are equally the most appropriate. For a renovation/addition, site G is most suitable.

Section Four: **Facility Conditions Assessment** — The majority of the buildings in the study need extensive maintenance, have high operation costs, and are buildings near the end of their 50-year life. As Jacobs evaluated the buildings, the findings were a factor in determining whether it is more fiscally responsible to renovate, or to build new and replace the existing HQ Building. A key part to the overall equation, is the square footage reconciliation: How does KSC grow and maintain the existing inventory of facilities and square footage?

Section Five: **Concept Development** — The Concept Development section begins to integrate design with the project requirements, and shows a possible volumetric solution responsive to environmental issues and planning drivers. The site plan strives to delineate public space, parking adjacencies, and new program requirements.

Key items represented in the section are:

- Initial concepts
- 3-D study models
- Concept findings
- Site planning versus new design

The employee shared services facility needs to be the link between the existing facilities and the HQ Building. Moving the majority of the workforce within the proximity of the O&C and SSPF would be benefit the KSC industrial area. To close the concept development section, Jacobs revisited all conclusions from previous sections and compiled them to reach a comprehensive decision. The decision did not include any financial data on which site would be most suitable. Following Charrette II, senior leadership from KSC eliminated sites A and H because it was deemed both were not in compliance with the overall guiding principles of the study. The decision was reached that site G is the most appropriate site on which to build new, or to place a renovation/addition.

Section Six: **Sustainability** — The Sustainability section describes the basis behind the concept of sustainable design, and how different aspects of sustainability are more or less applicable to the solution. The LEED checklist also identifies potential sustainable practices applicable to each option. Other topics in the section include:

- Definition of sustainability
- Eco charrette approach and findings
- Identification of principles and application to existing HQ facility
- Integration of ideas into new versus existing facility
- How site relates to facility
- Cost of upgrades

Applying 'green' ideas to outdated facilities can be more difficult than designing a new facility. A new facility can integrate various new design philosophies with fewer boundaries.

Section Seven: **Parametric Cost Estimates** — The Parametric Cost Estimates section provides numeric data and analysis, and compiles cost data for each site and option. The raw extracted numbers indicate the financial scenarios associated with each site and ultimately focus upon the most objective conclusion. After the project team narrowed the six sites to four, the three solutions based on lowest cost, by site, by option are: 1) New on G, 2) New on D and 3) New on B. The back-up data shows the cost for addition/renovation never provides for a more cost effective solution.

The costs analysis reveals the differences between the maintenance updates and code upgrades (option 1), major upgrades and interior (option 2), major renovation and interior space planning along with new shared services addition (option 3) and the new Headquarters and shared services facility (option 4). Although the CoF (cost of facility) numbers are relatively similar, it is the future costs that are identified for energy savings and a reduction in operations and maintenance costs.

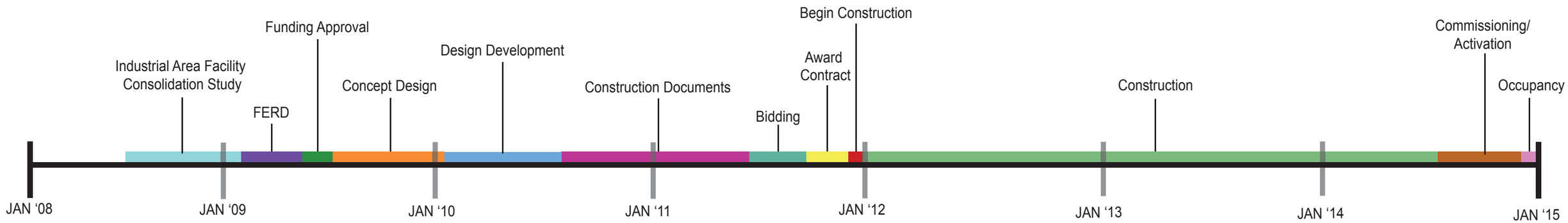
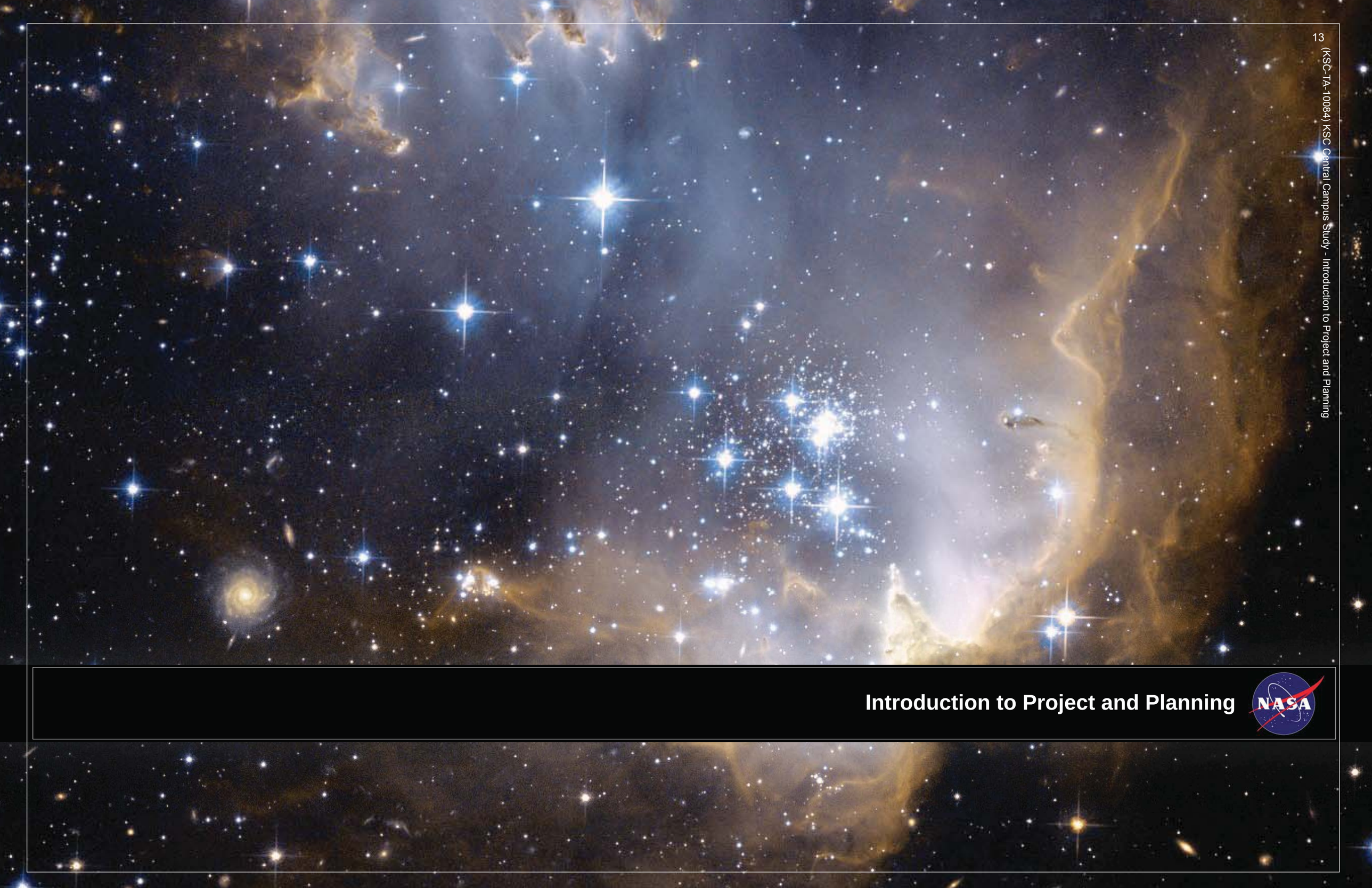


Figure 1.1 Project Milestones



Introduction to Project and Planning

2. Introduction to Project and Planning

2.1 Introduction

Section two provides a thorough overview of the theoretical and project specific aspects of the planning framework to assist in developing a long-term study for KSC. The following major elements in the planning process are explained in this section:

- Project Purpose
- Option Description
- Vision
- Planning Process
  - Visioning, existing conditions and requirements analysis
  - Synthesized basis of planning
  - Concept options development
  - Options evaluated
  - Study development
- Approach and Technique
- Project Goals
- Guiding Principles and Planning Objectives
- Implementation Plan

2.2 Project Purpose

Over the last several years, KSC has been mostly in a reactionary mode because of the positive things continuing to happen with the space program. Typically, new facilities are required, funding is requested, and buildings are built or remodeled on an ad hoc basis. KSC is now at a pivotal point in time where they would like to pause, evaluate several issues, and move towards a more consolidated effort to streamline maintenance and operational costs. Currently, KSC's building program standards are not applied universally, and the overall site plan does not incorporate an environment that promotes pedestrian interaction. A campus-like approach to any new construction project at KSC would help to foster a more pedestrian-friendly atmosphere, and would encourage and support a healthier workplace by providing more opportunities for interaction and activity among the workforce in a safe manner.

The overall intent of the study is to prepare a logical and sustainable implementation plan guiding KSC into the future over a long-term horizon. A plan is warranted to incorporate current and future NASA missions and the overall future vision improvements. In guiding the study, the following major phases were conducted:

1. Collect and analyze various data sources relevant to a long-term study for KSC.
   - Identify current or anticipated changes to the mission
   - Solicit the development vision from senior leadership
   - Analyze existing site and facility conditions
   - Determine long-range organizational relationships and functional adjacency requirements needing to be accommodated

2. Integrate the analyzed data into fully articulated goals/objectives and principles guiding the planning process as it unfolds.
   - Identify KSC internal resources and capabilities, as well as the natural and man-made constraints and opportunities for development
   - Determine obstacles to development and select appropriate measures to avoid, minimize, or mitigate those challenges
   - Analyze the Program of Requirements and functional adjacencies to identify future program and facility needs

3. Establish concept options based upon existing conditions, planning goals, facility needs, constraints and opportunities that represent potential development scenarios that realistically address issues and visions identified by the Jacobs and KSC Team.
   - Evaluate each alternative with respect to the established KSC vision and goals balanced with realistic budgetary considerations
   - Determine how constraints affect development opportunities
   - Evaluate alternatives with respect to layout, circulation, parking, land use adjacencies and sustainability

4. Identify a Preferred Concept Plan that becomes the foundation of the study and prepares the Plan to reflect a strategy providing needed programs and facilities.
   - Define land use and functional relationships that support the KSC mission and vision
   - Follow goals and objectives defined early in the planning process
   - Provide an action-oriented Implementation Plan

2.3 Option Description

The KSC Central Campus Study includes four options, as described below. Each option contains specific requirements and recommendations developed by both KSC and Jacobs.

Minor Renovation:
Includes a minor renovation of the current building systems in the Headquarters Building, and in other study buildings as necessary. Minor interior modifications would be made to include restroom upgrades, but would not include any upgrades to existing furniture, flooring, or layout. Mechanical systems, including plumbing, boiler, and piping systems would be upgraded. Electrical system upgrades would include installing new lighting fixtures, wiring upgrades, and transmission line upgrades. Finally, Information Technology (IT) communication systems are proposed to be upgraded, as well as fire alarm systems.

Major Renovation:
Includes all the elements of option one, plus major renovations to the interior, and possibly to some exterior elements of the Headquarters Building, and other study buildings as necessary. Interior spatial revitalization modifications are included, along with a fire detection and new suppression system. An exterior fenestration replacement is also included. The possibility that a consolidation of spaces could occur, if the study is able to implement an adjusted set of workplace standards.

Renovation & New Addition:
Includes all the elements of options one and two. Additional items included in this option are a consolidation of selected surrounding buildings into the Headquarters Building, demolition of abandoned existing buildings, and the construction of Employee Shared Services. The backfill strategy is an important aspect of this option.

New Construction:
Includes the construction of completely new facilities incorporating all of the requirements of the existing HQ Building, along with the other supporting facilities and Shared Services in the industrial area. Consolidation of existing surrounding buildings will be part of the objective of this option, along with the demolition of the abandoned buildings. For the option, the project team recommended 8 sites for the new building.

In order to make a recommendation for the options, Jacobs will gain an understanding of the building program, adjacency requirements, and security. Facility assessments have been completed to understand existing building structures. The assessments also aid in the ability to perform cost analysis studies involved with each option.

Complete List of Study Facilities:

- Headquarters Building (HQ) M6-0399
- Environmental Health Facility (EHF) L7-1557
- Base Operations Building (BOB) M6-0339
- Central Instrumentation Facility (CIF) M6-0342
- Auditorium & Training Building M7-0351
- Industrial Area Support Building (IASB) M6-0493
- Electromagnetic Lab (EML) M6-0336
- Space Station Processing Facility (SSPF) M7-0360
- Operations & Checkout Building (O&C) M7-0355
- Occupational Health Facility (OHF) M6-0495
- Technical Records Center (TRC) M6-0489
- Engineering Design Lab (EDL) M7-0409
- Engineering Design Lab (EDL) Mechanical Building M7-0409A
- Engineering Design Lab (EDL) Storage Building M7-0409B

2.4 Vision

The vision statement for the study evolved from the NASA KSC senior leadership session with Jacobs. After several user group meetings, the project team decided on the following vision statement:

Kennedy Space Center will maintain an advanced technological and functional installation that embodies all of the elements of a self-sustainable corporate community while supporting launch-related activities.

- Image: To be viewed by unit customers, tenants, and the world as the leader in space exploration
- Customer-friendly: organization working hard to provide a safe and productive environment
- Usage: To facilitate the training, research, and security of NASA and other tenants in support of Federal missions
- Operational Efficiency: The plan will be arranged and located so that the adjacencies developed lend themselves to working efficiently
- Study: The plan needs to be executable over many years and through many changes of leadership. The plan also needs to accommodate expansion and recognize the impact that changing program requirements will have on the evolution of the Center

2.5 Planning Process

The planning process, which guides the KSC Central Campus Study, is, by its nature, collaborative and interactive. Jacobs and the NASA representatives have created a team whose sole function is to build a strategic, multi-dimensional, and multi-functional road map connecting the present KSC with its envisioned future. The principal steps in building this road map, are part of the simple, effective, and proven methodology that when achieved, will result in the following benefits for KSC:

- A defensible study that employs a proven process to reach a desired end state.
- A collaborative plan involving all stakeholders
- A flexible study meeting the ever-changing mission of NASA, but remain true to its initial purpose

In creating an ongoing, long-term sustainable development strategy for the Headquarters Building, it was important to establish a framework that ultimately determines the preliminary planning goals and objectives. The process and approach followed in this study is diagrammed in Figure 2.1, with this study producing the Preferred Concept Plan.

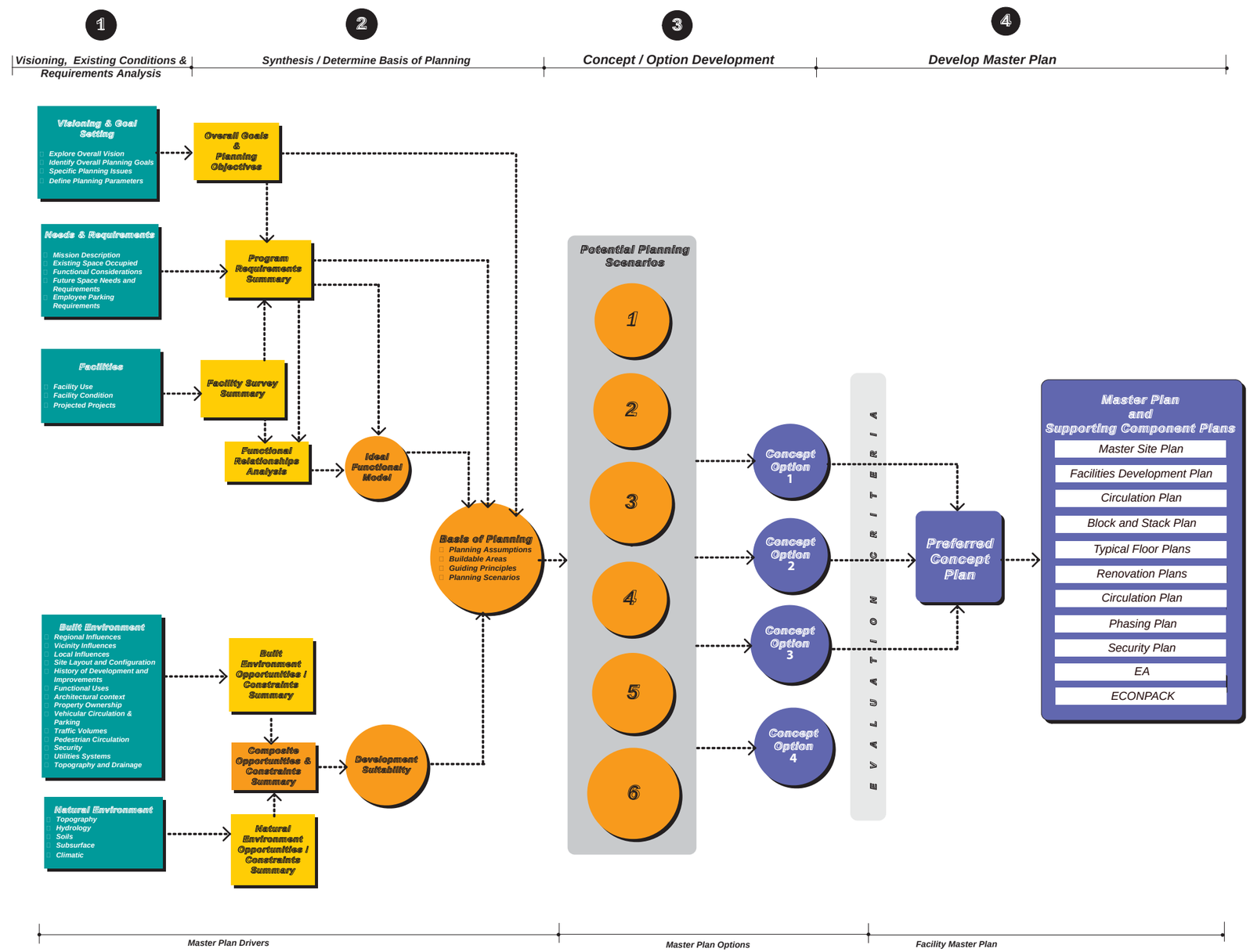


Figure 2.1 Master Project Schedule

The study process typically commences with solicitation of principles and goals designed to carry out the overall vision statement. To that end, the study team interacted with KSC leadership and personnel to develop a set of project goals (refer to Section 2.7) and guiding principles and planning objectives (refer to Section 2.8). The objectives and study goals provide a foundation of criteria for executing the overall study vision statement throughout the duration of the ongoing strategy.

Parallel to the visioning sessions conducted to capture the study principles and goals, an intensive data collection process was carried out as part of the Existing Conditions Analysis. The purpose of that analysis was to determine development suitability at KSC. The site existing conditions are separated into two categories: Natural Environment and Built Environment. Each category is subdivided into the following analysis components.

Natural Environment:
- Topography and Slope Analysis
- Hydrology
- Vegetation and Habitat
- Wetlands and Floodplains

Built Environment:
- Existing Land Use
- Site Map
- Access and Circulation
- Parking
- Utility Infrastructure

Findings and supportive graphics from the existing conditions analysis are referenced in Section Three, where the existing conditions are translated into constraints and opportunities affecting the overall development suitability at KSC.

During the initial visioning and data collection phases, the study team analyzed a preliminary proposed project list developed by KSC personnel. The project list established a foundation for conducting a more detailed study program analysis. The analysis included identification of the various unit groups and tenant agencies that collectively form the KSC community. Existing and proposed future organizational relationships, functional adjacency requirements, and general future visions for each group/agency were also addressed within this study. The information provided a key component in developing a future study program. The program is supplemented with the various development projects to be carried out at KSC over the ongoing study horizon. Additional projects in the “wish list” category are also identified. The study team conducted work sessions with KSC stakeholders to develop preliminary building footprints for these projects, for which higher-level detail will be established after the conclusion of this study.

Ultimately, the multi-day, on-site work sessions, called charrettes, identified potential areas in KSC’s industrial area to accommodate each option comprised in the study program. For a detailed breakdown of the unit groups, tenant agencies, and the potential future projects that were included in this study, refer to Section Four.

Collectively, that information aids in forming a synthesized Basis of Planning, which can be summarized as a set of study goals to guide and reinforce the ongoing development strategy at KSC. The Basis of Planning recognizes key drivers, or parameters, that remain factors to consider in planning or development decisions over the life of this long-term study.

The key drivers have been grouped into several general categories. As the study advances to future submissions, additional categories may emerge; however, the categories outlined below are supported with additional detail in this section. The key planning drivers are:

Consolidation/Dispersion:
- The Consolidation/Dispersion driver considers how the development of facilities occurs on KSC. Consolidation of programs into a close-knit set of facilities reduces the requirements for supporting infrastructure and sets up a ‘campus-like’ atmosphere for tenants and employees. This atmosphere provides human-scale spaces for various types of activities and interactions. Currently, KSC is spread out and provides little public space for the employees or tenants. It is important to consider how development patterns occur at KSC with respect to the environment and the ever-growing costs associated with operations and maintenance.
- Dispersion is the opposite of consolidation, moving facilities out of a core area. Core infrastructure may still be consolidated, but operations would be relocated to outer areas or districts.
- Combinations of consolidation and dispersion may also play a factor depending on operational and security requirements.

Sustainability:
- Sustainability is a key driver in any type of study. Planning for a sustainable installation reduces operational costs and energy consumption, and thereby lessens the adverse effects on the environment. Development should fit specific areas (i.e. solar orientation, thermal mass, and wind). Environmental education and stewardship will be integrated into the study concepts to support parent groups on KSC.

Infrastructure:
- Infrastructure is a key driver for development costs. The majority of the existing infrastructure is old, therefore, new infrastructure may be required as development occurs. The final report will phase the infrastructure and provide a strategy for the implementation plan process.

Boundaries/Security:
- KSC’s boundary includes 140,000 acres and has approximately 1,900 miles of property line. The large size of the property makes security a problem, therefore, securing the main industrial area is a priority.
- The Highways (405/SR3) that travel through KSC present an average ‘face’ to the community. Demolition of old structures and the creation of a ‘soft edge’ through the corridor may create a better image to the community.

Operational Efficiency:
- Operations need to be as efficient as possible not only to reduce downtime in circulation, but also to reduce operational costs and the environmental footprint.
- Efficiency has a direct relationship to consolidation.

Development Strategy:
- A primary development strategy is expandability and flexibility of the Core area. This driver addresses KSC’s ability to grow as its mission changes. A phasing plan will provide a road map for how the development strategy happens.

In combining the Existing Conditions Analysis completed in Section Three with analysis of the planning drivers, various constraints and opportunities are identified. Those opportunities and constraints affect overall development suitability at KSC and are key factors to be considered in arriving at development decisions.

The planning drivers, development opportunities and constraints, and analysis create a foundation from which the Basis of Planning can be established. Once established, the Basis of Planning considers development strategies to initiate action on achieving the guiding principles, goals, and objectives set forth in this study. At the data gathering stage of the study, a strategy is considered a high-level framework that is flexible in nature so as to allow for inevitable changes to its various courses of action as more detailed conceptual studies emerge. A total of four functional component categories are listed below and will be described in greater detail in Section Five.

- Major Components
- Support Components
- Ancillary Components
- Relocated Components

Concept Options Development

Various concept options have been established based on existing conditions, planning goals, facility and operational components, training needs, opportunities and constraints that are included as part of the Existing Conditions Analysis. Both programmatic alternatives and land development alternatives are prepared in an interactive approach, refined through regular information exchanges with KSC personnel, and coordinated with the visioning results of the charrette to ensure participation and input from all concerned parties. The synthesized Basis of Planning in Section Three provides a foundation to evaluate concept options reflecting the future development strategy at KSC.

Following the submission of the 30 percent draft report, a concept charrette (Charrette II) was conducted with KSC senior leadership to develop concept options and ultimately reach a consensus on the optimal course of action for accommodating major development projects over the long-term horizon.

Evaluation of Options

Each of the four concept options developed during Charrette II were analyzed with respect to established KSC visions and goals, and in terms of realistic budgetary and scheduling considerations and the Basis of Planning, as stated above. Each option is subjected to various tests that will determine if those conceptual action plans are possible, and to what extent they can be implemented. Following that analysis, a preferred course of action has been identified by KSC leadership entities that minimizes constraints and maximizes sustainable development opportunities. The selected course of action is that which best embodies the vision for KSC and thus becomes the foundation on which the study is built.

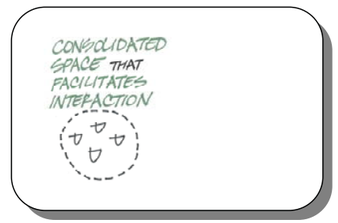
2.6 Approach and Technique

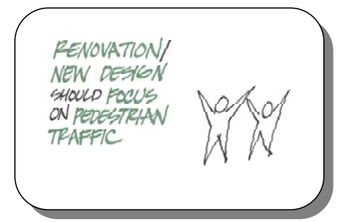
During the course of the project, Jacobs utilized the charrette process to gather data, interact with users and formulate the study. There were several charrettes conducted as part of this study. The first one set the vision, and was an opportunity to gather all required data and validate the programmatic requirements. The second charrette tested multiple concepts using the selected sites and spacial requirements of the program. There was also an eco-charrette, conducted as means to gather ideas and discuss environmental impacts the ongoing plan could have at KSC. Also, several smaller, mini-charrettes were held at various points throughout the study, during which issues and questions were discussed and decided.

Jacobs led Charrette I at the Kennedy Space Center (KSC) during the week of August 25, 2008. Jacobs met with user group representatives and collected 'high-level' information regarding user group functions, head count, and area requirements.

During the first charrette, Jacobs documented information using an analysis card technique, and documented user group requirements on 5" x 8" cards and displayed the cards on the walls of the meeting room. This orderly display of information provided a format for classifying information and facilitating a dialogue between the team members.

Two analysis card techniques are shown below (please refer to the Appendix for a complete set of cards developed during the charrette).





Also, during the first charrette, Jacobs reviewed existing floor plans for the following buildings: HQ, CIF, BOB, EHF, and OHF. The floor plans were displayed on the wall of the meeting room and were marked to show the current location of each NASA Directorate. The list of Directorates was supplied to Jacobs by NASA via the FSPA spreadsheets. The FSPA spreadsheets contain Directorate information by building, as well as space type, area, and room number, among other topics. The data were further refined during the charrette to include information for Common Building Services (CBS), such as shared conference rooms, the cafeteria, and other shared amenities. The NASA Facilities Group main contacts were on hand to verify the blocking plans for the existing conditions.

NASA Directorates:

- KSC Organizational Chart
- AA - Center Director
- AJ - Diversity and Equal Opportunity
- BA - Human Resources- HCIE
- CC - Chief Counsel
- GG - Chief Financial Officer
- IT - IT and Comm Services
- JP - CCSMO
- KT - Applied Technology
- LX - Constellation Project
- MK - Launch Integration
- NE - Engineering
- OP - Procurement
- PH - Launch Vehicle Processing
- SA - Safety and Mission Assurance
- TA - Center Operations
- UB - ISS & Spacecraft Processing
- VA - Launch Services Program
- XA - External Relations
- Resident Office - JSC Orbiter
- Resident Office - JSC ISSP
- Resident Office - MSFC
- 45th Space Wing

Results

At the conclusion of the charrette, Jacobs presented key findings of the user group meetings and facility assessments (refer to the Appendix for the Out-Brief Presentation).

Guiding Principles from Charrette I:

- Flexibility of new spaces
- Make sustainable, environmentally responsible decisions
- Ensure efficiency of operations and maintenance
- Consolidate space to promote interaction across facilities
- Focus on pedestrian traffic
- Improve the quality of life of the employees
- Ensure the safety and security of KSC
- Consolidated spaces should facilitate interaction
- Consider Kennedy Space Center as a self-sustainable corporate community
- Implement strategies in multiple, prioritized phases

Space Requirements:

- Consider area requirements of each user group
- Consider providing a consolidated cafeteria with food court concept
- Consider adjacency requirements among user groups

Sustainability:

- The utilization of sustainable design in all aspects of the project is an overall project goal. The study will make every attempt to incorporate sustainability where possible, provided it is practical and economically viable, and addresses the needs of the proposed facility
- The KSC Central Campus Study will employ Leadership in Energy and Environmental Design (LEED) certification requirements for at the Silver level at a minimum, but striving for the highest level possible as is cost efficient in terms of the life-cycle

Site Security:
- Site perimeter is currently controlled
- Consider implementing minimum Department of Defense (DoD) anti-terrorism standards for buildings

Building Assessments Overview:
Jacobs performed the following assessments for the HQ, O&C, SSPF, CIF, OHF, Auditorium & Training, CDC, BOB, and EHF buildings:

- Security
- LEED
- Architectural
- Structural
- Mechanical
- Electrical

As of December 2008, six additional buildings were added to the study. Jacobs validated existing facility inspection reports for the buildings, and included additional support data. The six buildings included the EDL, EDL Mechanical Building, EDL Storage Building, IASB, TRC, and the EML.

Pre-design Criteria

An internal survey was conducted by senior KSC project managers as a way to gather information from current building occupants as to what they considered to be the most important pre-design criteria for new KSC facilities. The survey contained three main categories, Function, Form, and Economic Viability, with each category containing numerous items to be ranked. The participants were asked to choose the significance of each item, ranging from: Low (No/negligible importance toward pre-design decision making); Medium (Need to be considered, however, not essential in final decision; and, High (Must be considered as high priority during decision making).

For the purposes of the study, the findings are summarized here, and have been narrowed to what the occupants consider to be the five most important criteria in each of the three main categories (1=most important). The complete survey results may be found in the electronic appendix of this document.

Function:
- 1 - Employee Safety
- 2 - ADA Requirements
- 3 - Utilities Proximity
- 4 - Proximity of Employee Services (cafe, bank, hairshop...)
- 5 - Flexibility of Space

Form:
- 1 - Energy Efficiency
- 2 - Flood Zone
- 3 - Tied between:
  - Green Spaces
  - Lines of Sight (Radar, Comm., visual...)
- 5 - Contamination (groundwater - no health issues)

Economic Viability:
- 1 - Energy Efficiency
- 2 - Life Cycle Costs
- 3 - Employee Productivity
- 4 - Construction Costs
- 5 - Sustainability (LEED, EO 13423, EPACT, EISA...)

In conclusion, the three main categories utilized in the occupant survey directly correspond to the Site Suitability Matrix (See Figure 3.36), and to a correlating economic evaluation spreadsheet, located in Section Seven of this document. Energy efficiency ranked as the most important pre-design criteria in both the Form and Economic Viability categories. If the criteria were adhered to in the design of a future KSC facility, then it would create a employee-friendly campus, taking advantage of sustainable opportunities, which could in turn reduce energy and construction costs while improving employee productivity.

2.7 Project Goals

Project goals are broad in nature, provide macro-level guidance, and transcend specific components of the study. Common to all components, project goals establish the basis and direction for the development of the study and include the following elements:

- Maximize use of existing and remaining facilities balanced with condition and functional adequacy
- Sustainable design, using LEED, New Construction criteria, 2008 version as a guide
- Reduce Operations and Maintenance Costs (O&M) with sustainable design
- Identify and promote efficiently utilized common spaces and adjacencies
- Promote a walkable, pedestrian-oriented layout with a hierarchy of open spaces that relate to the local environment and help create a stimulating and attractive sense of place, specifically in regards to NASA's history, if an addition or new construction is recommended as a final solution
- Create a development that responds to the unpredictable Florida coastal climate
- Establish a study that integrates sustainable principles to minimize adverse environmental effects and maximizes the use of available local resources
- Establish a study that incorporates security as a design element
- Minimize transportation conflicts and enhance safe circulation and access, if an addition or new construction is recommended as a final solution

2.8 Guiding Principles and Planning Objectives

During the Charrette I, the Jacobs team worked with NASA senior leadership and the above project goals to establish the vision for the KSC Central Campus Study. The following guiding principles and planning objectives represent a detailed breakdown of the previously mentioned goals.

While driven by the specific needs of the Kennedy Space Center, this framework is also guided by planning principles that support the overall vision and mission of NASA worldwide. Guiding principles and planning objectives are an outgrowth of the visioning session with senior leadership, analysis and understanding of existing conditions of the site, programmatic requirements, and planning opportunities and constraints.

These guiding principles will set the direction for the future planning effort. Planning objectives further define ways to achieve the goals outlined in the guiding principles. These more detailed planning objectives recognize the highest aspirations of NASA, balanced with an understanding of the unique characteristics of the property, and surrounding area influences.

Guiding principles and associated planning objectives cover a variety of planning topics, each with a special focus and message, as outlined below:

Flexibility and Implementation

Principle:
The study shall be flexible and include an implementation strategy.

Planning Objectives:
- Develop phased implementation plans in anticipation of future changes
- Make sure the plan is cost effective
- Emphasize minimal relocations and temporary space assignments
- Limit disruption to operations and support functions
- Define construction staging areas for each phase of the implementation plan

Maintain site and building security during implementation

Principle:
Operational efficiencies integrated into the structure of the study.

Planning Objectives:
- Adjacencies drive Directorate locations
- Minimize walking distances
- Floor plan promotes community rooms and interaction spaces

Principle:
When future footprints are formulated, they should conform to a more integrated environment among various site components.

Planning Objectives:
- Design a campus atmosphere that encourages interaction among employees, if an addition or new construction becomes the preferred course of action
- Develop a site promoting a healthy and safe workplace
- Balance future growth demands with quality of life, visual, and environmental concerns
- Consider airspace criteria, as well as urban design principles relative to building heights

Safety and Security

Principle:
Emphasize and integrate safety and security through design.

Planning Objectives:
- Promote proper safety and security on the site and the surrounding areas
- Provide safe environments for paths of travel, if an addition or new construction becomes the preferred course of action
- Include consideration of Department of Defense Antiterrorism/ Force Protection and other security criteria where appropriate, as per Unified Facilities Criteria 4-010-01
- Define level of control at entry points

Public Image and Visual Character

Principle:
Reinforce the best first impressions for the Kennedy Space Center.

Planning Objectives:
- Define the impression that KSC wants to make and develop options to establish that impression for visitors and employees
- Have each option generate pride of place
- Project the image of a leader in space exploration
- Improve entry visibility and pedestrian orientation for the site and all buildings, if an addition or new construction becomes the preferred course of action

Principle:
The Core campus shall be operationally efficient, flexible and user friendly.

Planning Objectives:
- Create a more welcoming and distinct “front door” for both visitors and employees to the site, if an addition or new construction becomes the preferred course of action
- Create more distinct zones that reflect their corresponding activities
- Accommodate public accessibility for visitation purposes

Quality of Life

Principle:
Improve the workforce’s quality of life at KSC.

Planning Objectives:
- Provide an environment which enables multiple experiences
- Provide a safe and positive environment
- Promote programs and activities for on-site employees
- Define potential site amenities
- Promote higher quality of life through providing opportunities for physical activity

Site Specific Aspects

The remaining guiding principles are of particular significance if the outcome of the study points to any site modifications, as would occur in options three and four.

Access and Circulation

Principle:
Improve site access and vehicle circulation.

Planning Objectives:
- Segregate, to a reasonable level, employee/visitor automobiles from large ‘over the road’ trucks
- Minimize pedestrian and vehicle conflict points, if an addition or new construction becomes the preferred course of action
- Provide vehicular hierarchy within the core area, if an addition or new construction becomes the preferred course of action

Principle:
Provide adequate site parking that is strategically placed and environmentally responsible.

Planning Objectives:
- Provide sufficient parking to meet the needs of current and future NASA programs
- Design parking to be as visually appealing as possible
- Provide equally distributed parking areas

Principle:
Create pedestrian-friendly links into and around various buildings and open space.

Planning Objectives:
- Provide a hierarchy of walkways that reflect the importance of the path
- Provide walkways that accommodate a health/walk function
- Design pedestrian crossings of roadways to minimize vehicular and pedestrian conflicts
- Provide a continuous ADA accessible route for all pedestrians

Development Program / Land Allocation / Mix Uses

Principle:
Develop areas on site that form a cohesive network of buildings as well as open space.

Planning Objectives:
- Expand buildings in ways to maximize adjacencies and efficiencies
- Create recreational areas in undeveloped KSC owned property
- Provide open spaces which promote human interaction

Environmental, Recreation and Open Space

Principle:
Develop the site in compliance with current environmentally responsible procedures.

Planning Objectives:
- Acknowledge and protect the existing flora and fauna
- Environmental intent, leave the site cleaner than when it was found
- Provide for proper permitting on state and local levels
- Maintain/upgrade current utilities to meet environmental controls
- Provide for proper site drainage with retention/detention zones
- Utilize materials that will not create disposal issues in the future
- Create a built environment that is in tune with its surroundings

Principle:
Create pleasant open spaces around buildings that organize the site with usable exterior space.

Planning Objectives:
- Develop a variety of open space designs to provide a range of choices for personnel to enjoy and interact
- Integrate recreational activities and walking paths into the development plan in locations that activate the spaces

Utility Systems

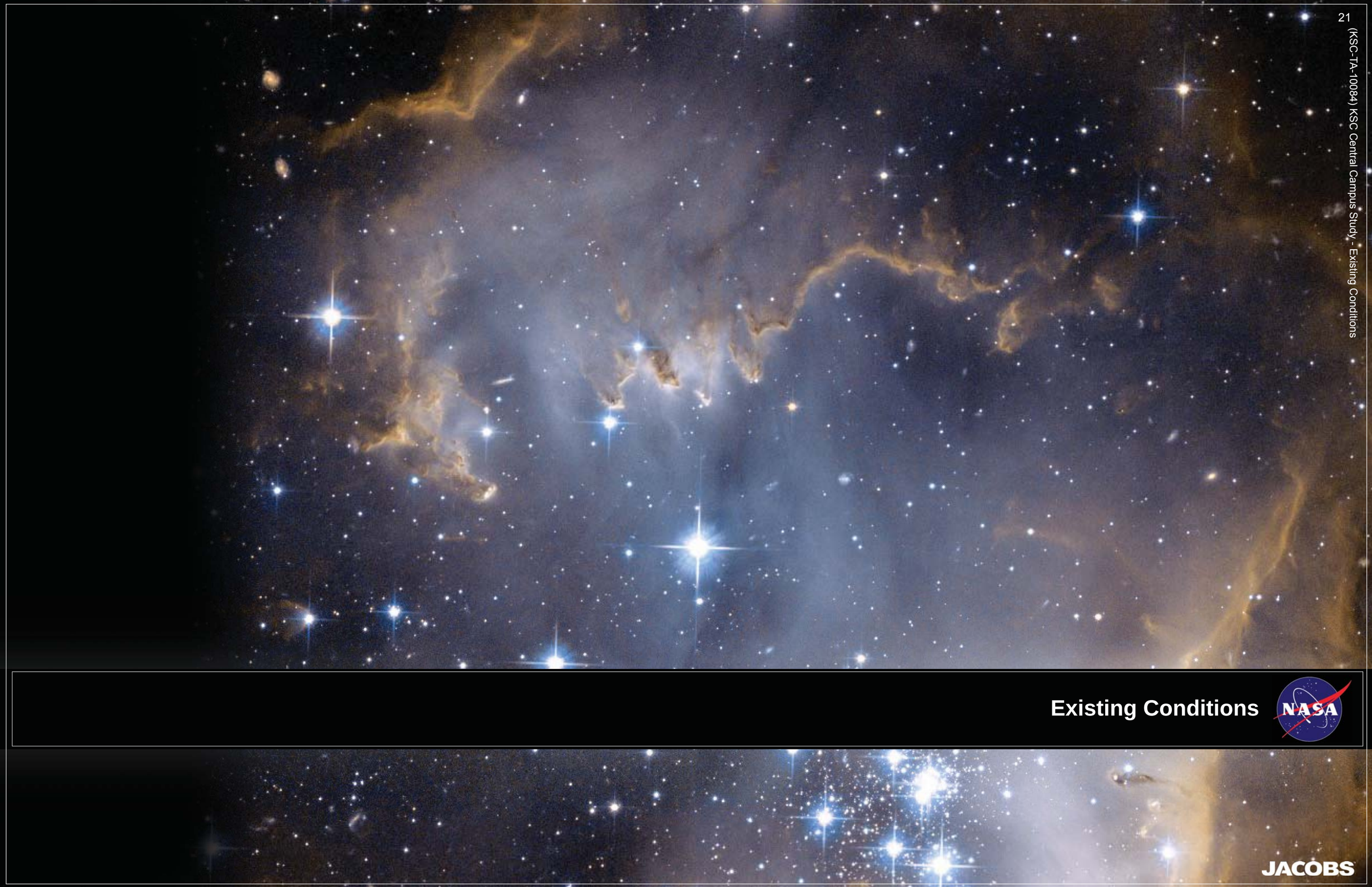
Principle:
Develop a utility system to meet future capacity needs and maximize energy conservation and efficiency.

Planning Objectives:
- Consider new technologies for heating and cooling
- Incorporate new utilities with expansion areas
- Route utilities in logical routes to avoid future disruption and allow easy expansion
- Create an implementation strategy for a utility system modification

2.9 Implementation Plan

The process used to implement the future space allocations will be a vital element in achieving the proposed benefits of any future construction and consolidation of facilities at KSC. For example, according to GSA, the ideal average area per person in an office environment is 225 square feet. In the current conditions at KSC, the average area per person of the facilities involved in the study are above that average, at 350 square feet.

KSC can improve interior efficiencies and will be able to utilize space allocation better by implementing a retrofitting of the spaces. Escalated costs directly associated with an exaggerated per person area could be eliminated by consistently applying an established set of office workplace standards. Jacobs will assist KSC in designing a logical, verifiable set of standards to simplify the transitions associated with the consolidation process, and verify both existing and future office conditions. Such a process will not only make the varied office areas more efficient, but will also make the proposed facility a more fluid and efficient space.



Existing Conditions

JACOBS

3. Existing Site Conditions

3.1 Introduction

Kennedy Space Center (KSC) was named after John F. Kennedy, the 35th President of the United States in November of 1963. KSC supports NASA's Launch Services Program and achieves exploration milestones by opening the minds and imaginations of those interested in understanding what lies outside of planet Earth. KSC occupies approximately 140,000 acres on Merritt Island, of which only about 9 percent is developed due to ground, wildlife, and other environmental constraints (Figure 3.1). KSC achieves their mission goals by employing anywhere from 9,000 to 16,000 NASA employees and contractors using facilities designed to develop and house new ideas, technologies, and instruments used in the advancement of space exploration. KSC also supports a Visitor's Center, serving millions of visitors per year. The center lies about 15 miles southeast of Titusville, Florida, and about 50 miles east of Orlando, Florida; Miami, Florida is approximately 220 miles south of KSC, and Jacksonville, Florida is about 150 miles to the north.

The existing site conditions analysis has two main objectives: The first is to identify existing site conditions affecting project cost, schedule, operations, or the overall project outcome based on an assessment of each site and facility involved in the scope of work; The second objective is to determine the most appropriate location for new facilities on site. If the final recommendation of the study involves an addition or new construction, it will be necessary to understand where the optimal location for the construction is. Site conditions are divided into two sections, and include the natural environment and the built environment. Natural environmental conditions examined include: soils, topography, solar angles, hydrogeology, weather, flora, fauna, and protected habitat. Built environmental conditions examined include: each facility involved in the project, site circulation, parking, security, land use, site plan, building usage, land adjacencies, visual connections, development patterns, utility assessment, opportunities and constraints, and development suitability.

3.2 Regional Location

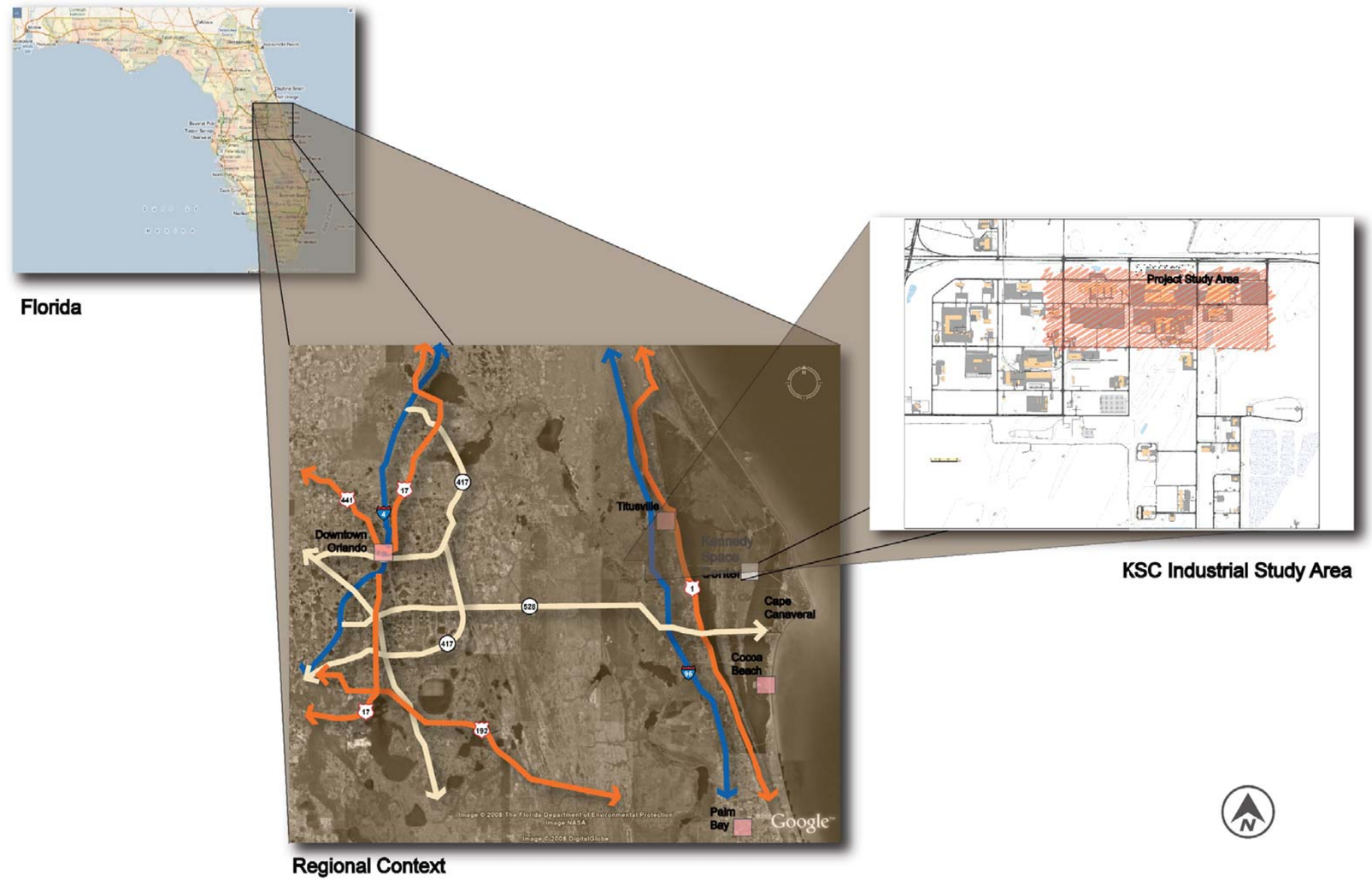


Figure 3.1 Regional Location

3.3 Natural Environment

3.3.1 Surface Soils

Based on data supplied by NASA, surface soils at KSC are classified into four categories. They include clean sands, silty or clayey sands, sandy clays and silts, and compact silts and clays. Clean sands extend from the surface to approximately a minus 30 to 50 foot depth. Silty or clayey sands extend from approximately minus 35 feet to minus 70 foot depth. Sandy clays and silts reach from approximately minus 70 feet to minus 120 feet, while the compact silts and clays reach depths of minus 120 feet to bedrock.

Central Merritt Island and KSC contain predominately five main soil surface materials. They include Myakka, Eau Gallie, Immokalee, Copeland, and Wabasso. Myakka has a gray sandy surface; Eau Gallie has a sandy gray surface and interspersed loamy subsurface layers; Immokalee also has a gray surface; the Copeland materials have a thick black surface; finally, Wabasso has a sandy surface layer.

Soil stability and site settlement characteristics are important concerns when pinpointing potential future building sites. It is permissible to site a moderately large building having a relatively narrow and widely spaced footing carrying dead loads of 3,000 pounds per square foot or less. In the event of a greater load capacity, a careful analysis of foundation designs must be conducted at the potential building site. The sandy soils may require densification strategies to achieve greater load capabilities, or the building piles may require depths of approximately 100 feet or greater to reach stable load bearing limestone bedrock.

Settlement concerns are associated with soils lying between minus 30 to minus 70 feet below the surface. These soils contain several interbedded layers of silts and clays capable of becoming compressed under heavy building weights where the load is primarily dead weight. The compression can occur due to the consolidation of the above mentioned soils. Preloading the site with caissons or piles driven into the ground at depths to support the structure may be required. Weight bearing values can differ between different soil horizons, therefore making it important to take test samples from the soils at proposed building sites, as well as from adjacent locations in order to properly check for similar compaction characteristics across soils. It is important not to assume soil characteristics taken at a particular building site will be the same as soil samples taken some distance away. Figure 3.2 illustrates the soil layers. Limestone is shown to lay approximately 100 feet below the surface.

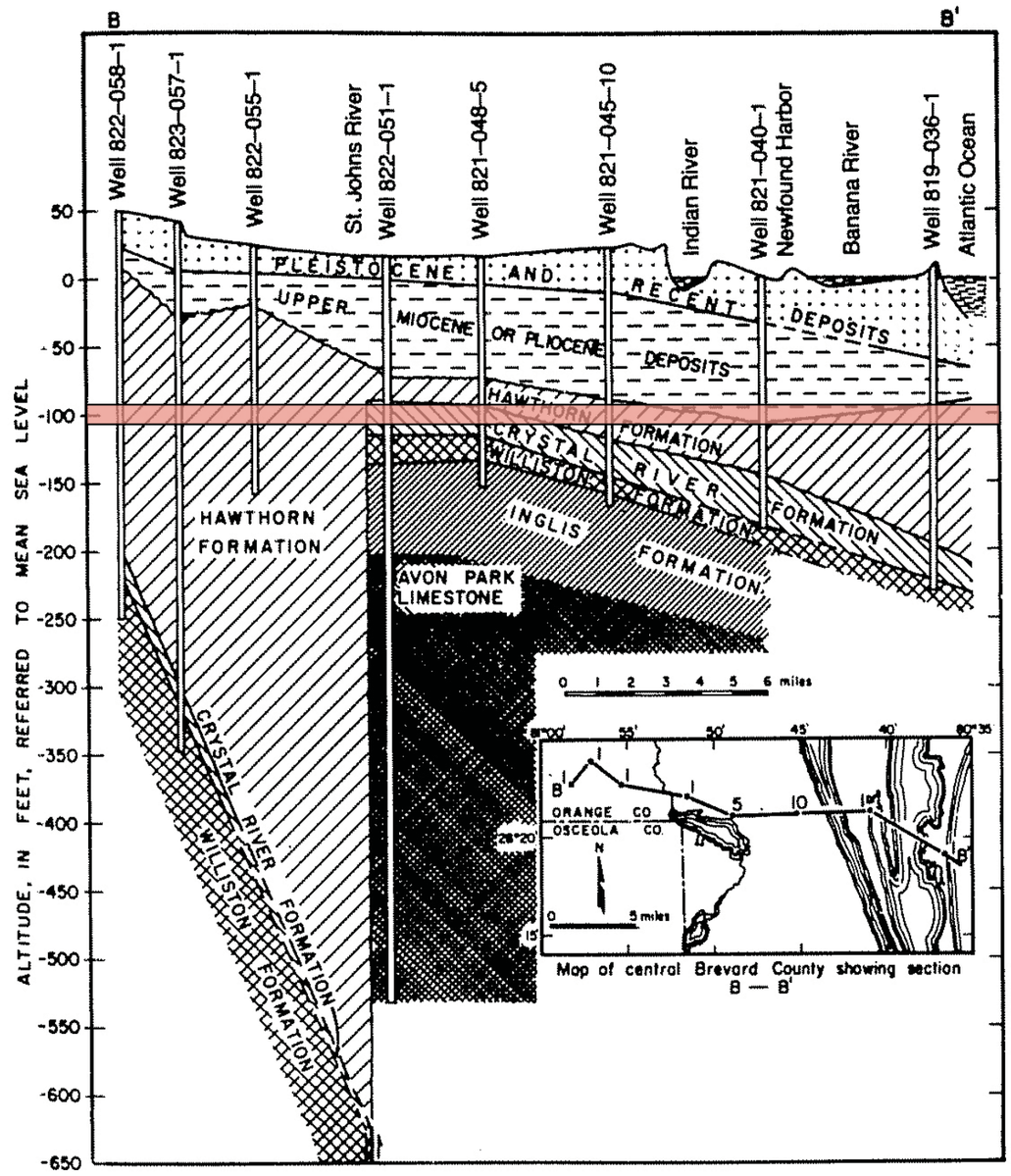


Figure 3.2 Brevard County Geological Section

3.3.2 Topography

Topography at KSC is typical of most coastal Florida areas. Most of the terrain is relatively flat. Slight reliefs range in elevation from sea level to 10 feet above for the inland areas of Merritt Island. Cape Canaveral itself has peaks reaching 20 feet above sea level in man-made regions that support KSC operations. Ridges and swales existing in KSC reflect the past history of the interaction between the sea and the land. See Figure 3.3 for reference.

Two surface water drainage plains exist in KSC's industrial area, and an additional flood plain exists north of NASA Parkway. Water on the west side of E Avenue Southeast is channeled and generally drains to the southwest into a stormwater retention basin located near the intersection of E Avenue Southeast and 9th Street Southeast. Water on the east side of E Avenue Southeast is channeled and generally drains to the southeast into the Banana River. Water falling north of NASA Parkway East is also channeled eastward draining into the Banana River. Figure 3.4 indicates watersheds.

KSC's industrial area is outside of the 100-year floodplain. The floodplain which assumes a one percent chance of water rising in a certain area to a certain height during any given year is outside of the area. The 500-year floodplain, which assumes 0.2 percent chance of water rising to a certain level in a certain area in any given year is also outside of KSC's industrial area. Over 80 percent of KSC does fall within the 500-year floodplain.

Future development at KSC will require impervious area calculations to determine if any sizing changes to drainage channels or water retention basins are required to accommodate future stormwater runoff.

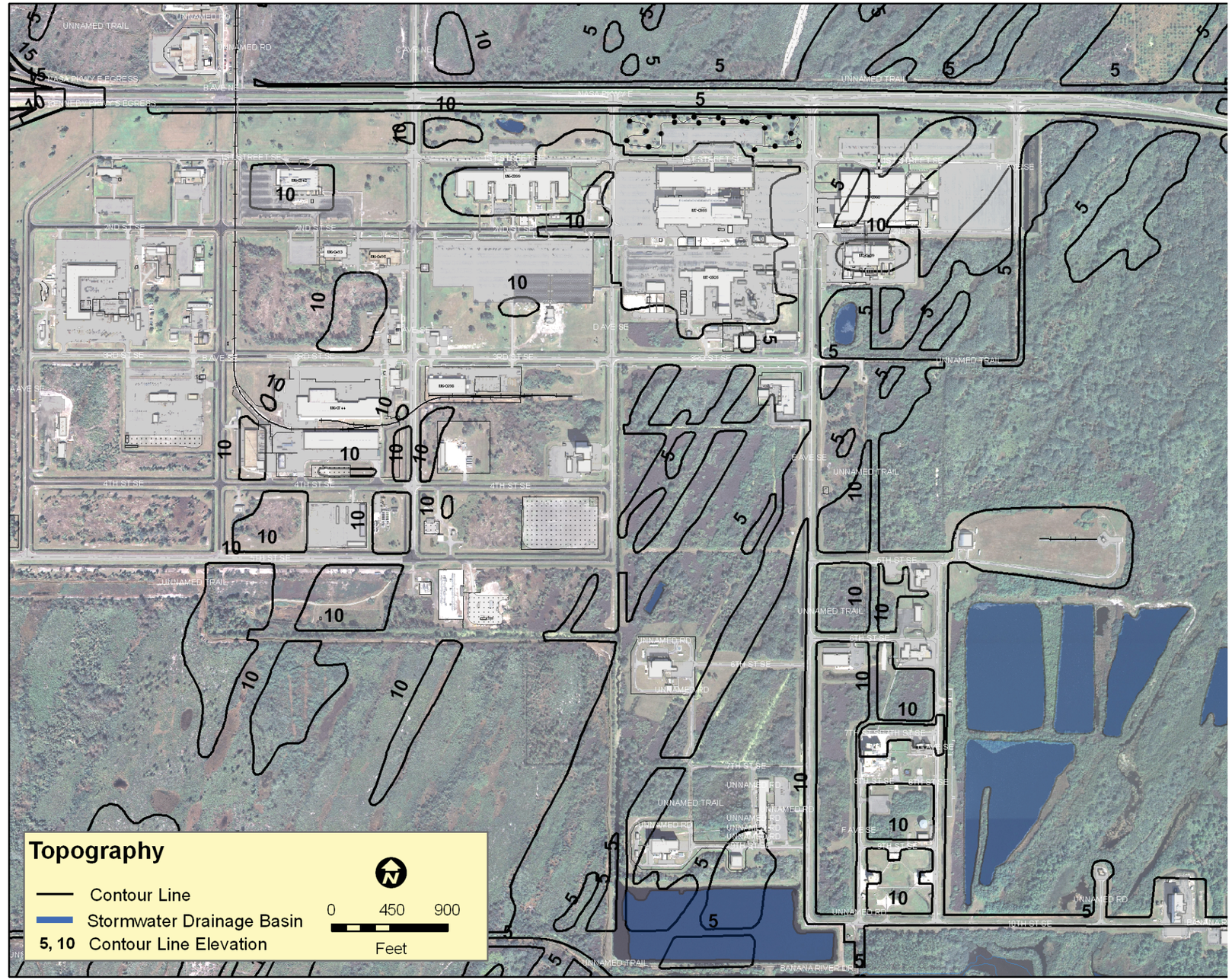


Figure 3.3 Topography

3.3.3 Hydrogeology

Hydrogeology is the study of water movements and the chemistry involved with the movements within the Earth. KSC has four main aquifers influencing the behavior of soils. They include surficial aquifers, non-artesian aquifers, confining layer Hawthorne Formation, and artesian aquifers. The subsurface soils at KSC are permeable enough to allow water flow.

The water table is the uppermost portion of an aquifer or a saturated surface zone. KSC has the highest water table in September and October due to the reoccurring wet season. Its lowest levels occur during the months of March and April. Construction sites are often manually drained on a regular basis due to the high level of the surficial aquifer during the wet season. Water from the Floridian aquifer is non-potable at KSC.

Engineering constraints consist of establishing structural elevations due to the regular high water table. The high water table will also dictate fill requirements, depth of foundations, and water drainage feasibility. Rapid fluctuations in water table should be anticipated depending on precipitation and surface runoff. Concrete slab and footing underdrains should be considered in areas of high water table levels.

Regulatory constraints consist of obtaining the proper federal and state permits to limit environmental damage to KSC construction sites. The St. Johns River Water Management District issues permits for the State of Florida, while the United States Army Corps of Engineers issues federal permits. If a wetland area, lowland area, or river is being considered for alteration due to construction activity, a special permit is required.

Stormwater runoff engineering is crucial and often a design constraint when developing a site at KSC. Water typically drains into ponds, sloughs, burrows, man-made pits, canal excavations, and drainage ditches. External drainage by man-made structures is often needed to properly drain developed areas, or a combination of several controls is used as site conditions warrant the need. (See Figure 3.4)

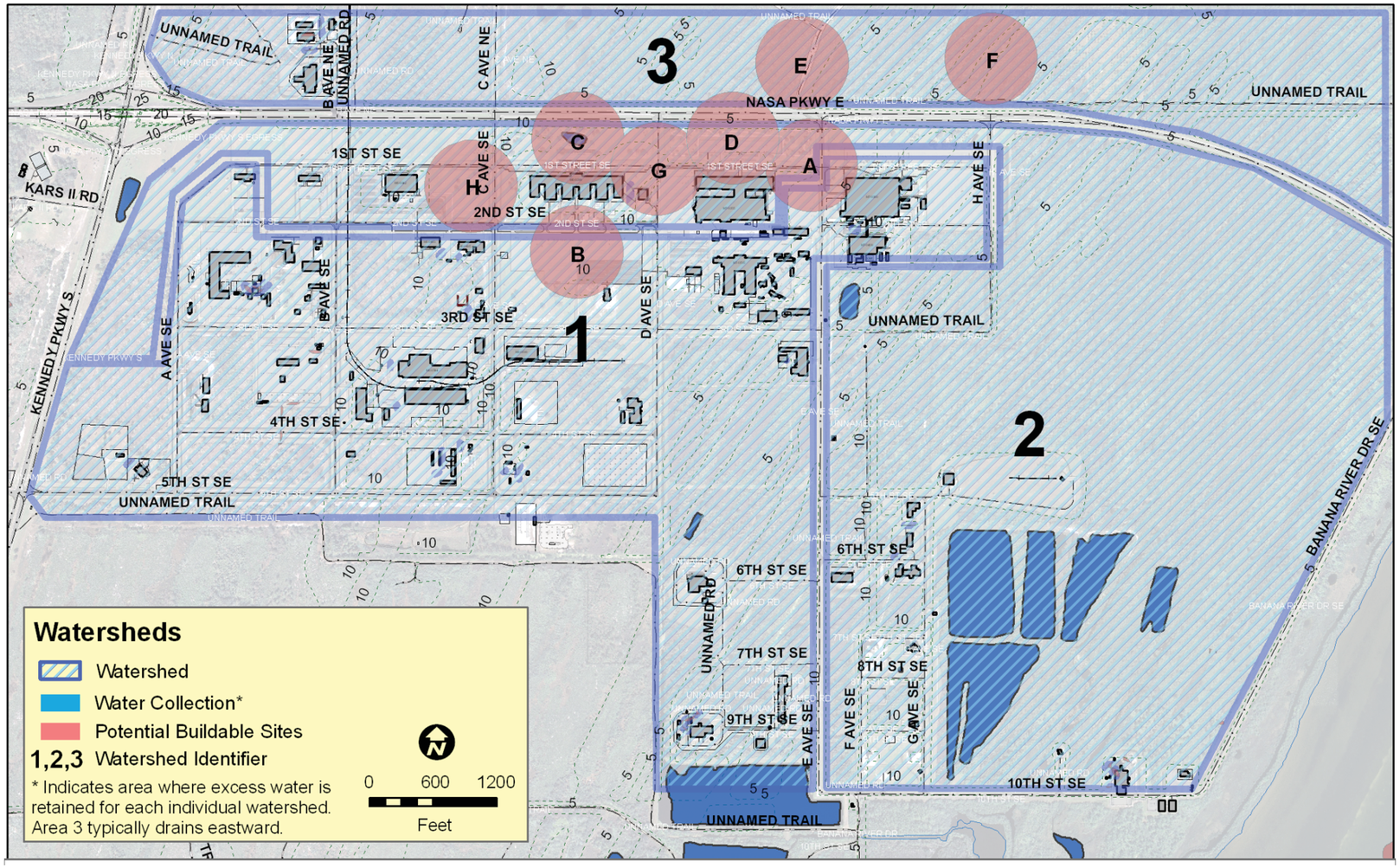


Figure 3.4 Watersheds

3.3.4 Solar Angles

Solar angle is the angle of the sun in relation to the horizon and is often expressed as solar altitude angle. Essentially, it describes how high the sun appears to be in the sky. The sun is at its highest point in the sky during the summer solstice, which is June 21st. Figure 3.5 demonstrates the interaction between the solar altitude angle and the built environment.

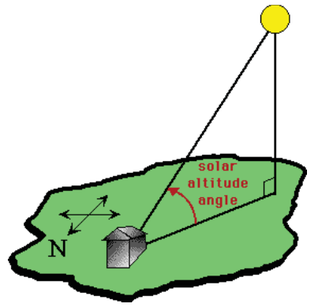


Figure 3.5 Solar Angle

Solar azimuth is often associated with solar altitude angle. Often expressed as solar angle azimuth, it is the angle between due south and the projection of the line of sight to the sun on the ground. Knowing the solar angle and the azimuth are important because they aid in determining when the most amount of sunlight is falling on any given object on the earth's surface at any given time. Therefore, it is important to site a building in a fashion to gain the maximum amount of natural solar sunlight. Figure 3.6 demonstrates the solar azimuth by portraying a building on a site situated to gain the maximum amount of solar light coming from the east. The orientation of the building responds to the natural light provided by the sun at certain times of the day by season. The other implication of orientation is to minimize the solar heat gain to the building envelope.

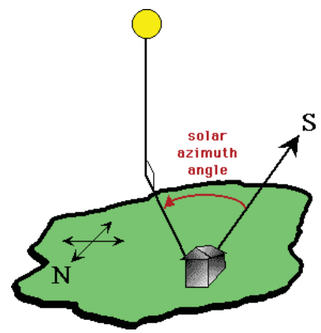


Figure 3.6 Solar Azimuth

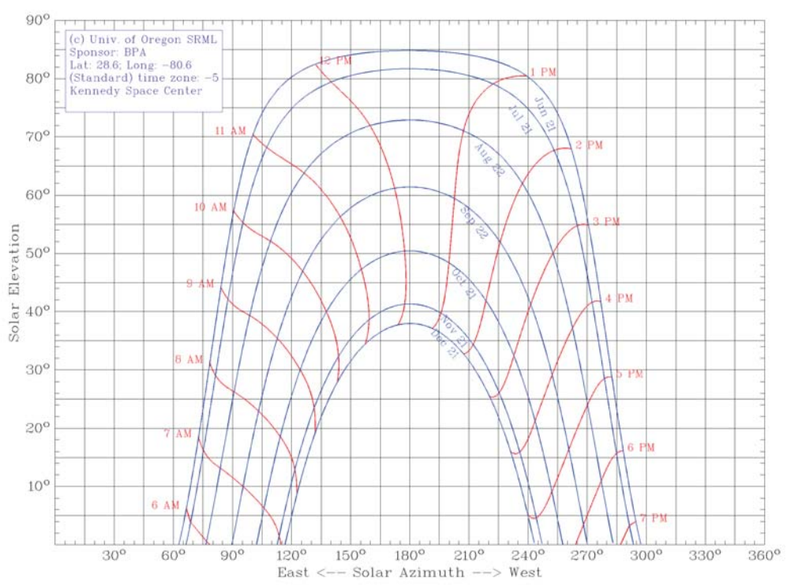


Figure 3.7 Solar Elevation

Figure 3.7 indicates that between 12pm and 1pm on the summer solstice (June 21st), KSC solar elevation is approximately 83 to 85 degrees and the solar azimuth is approximately 130 to 210 degrees.

3.3.5 Weather

Weather conditions at KSC are dynamic and change rapidly. Due to the nature of launch operations at KSC, a number of weather support systems are set in place to monitor weather conditions and to aid in forecasting future weather patterns. Weather extremes range from sunny and pleasant during the winter to intense thunderstorm activity during the summer.

A multitude of weather forecasting and monitoring equipment exists at KSC. Equipment, such as C-Band color radar, detects precipitation intensity; 50 megahertz Doppler radar wind profiler detects high altitude wind shear; field mill network aids in detecting electrical fields; Geostationary Operational Environment Satellite (GOES) is used for continuous weather information; Jimsphere is a radar tracked balloon for mid level wind data; Lightning Location and Protection (LLP) tracks lightning occurrences in the area; Lightning Detection and Ranging (LDAR) locates lightning strikes in three dimensions; MESONET weather towers system monitor weather at 53 sites throughout KSC; Meteorological and Range Safety Support System (MARSS) defines toxic hazard safety corridors; Meteorological Interactive Data Display System (MIDDS) is a network of computers used to display weather information at KSC; RAWINSONDE is a weather balloon tracked by radar; weather rockets are launched to take high altitude weather measurements using radio telemetry; and Atlantic ocean weather buoys supply off shore weather data to KSC. Buildings and structures for KSC must be designed to withstand high winds, hurricanes, or tropical storms. Building codes are outlined by NASA in Handbook NHB 7320.1.

Temperatures at KSC are recorded in Celsius. High temperatures of 32 degrees Celsius (89 degrees Fahrenheit) or above only occur about 20 days out of the year. Ocean breezes cool and moderate temperatures along the coast. Freezing temperatures are much less frequent, occurring about four times during the year as the ocean and lagoon environment keeps the area slightly warmer inland. Extreme temperatures were recorded at 37 degrees Celsius (98 degrees Fahrenheit) and a low of negative 7 degrees Celsius (19 degrees Fahrenheit) sometime between the years of 1978 to 1995 as recorded by SLF weather station. Frost is an occasional occurrence each year during the winter months and is usually associated with a cold front. No measurable snowfall has ever been recorded at KSC.

Winds are of special importance at KSC. Heavy wind can be hazardous to numerous outdoor activities and to the tall structures. Wind speeds often fluctuate as weather systems patterns cross over the Cape Canaveral area. Annual mean wind speed is 11.3 kilometers per hour (7 miles per hour) at the surface, and a maximum wind observed is 107.8 kilometers per hour (67 miles per hour). Figure 3.8 demonstrates general wind direction, where the measurements were taken at the surface. Generally, wind direction is out of the northwest during the morning hours. Evening hours typically see wind directions from the southeast.

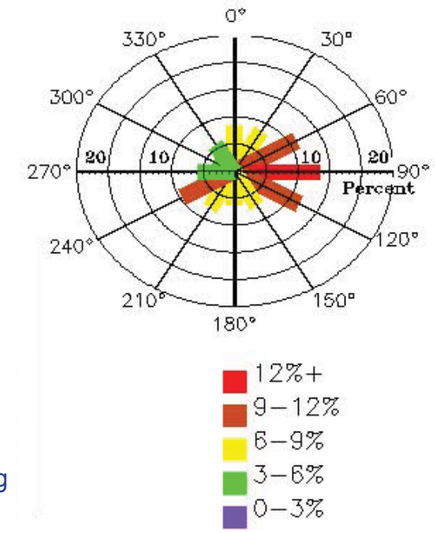


Figure 3.8 Wind Direction

Precipitation mainly comes in the form of rapidly developing thunderstorms occurring on a daily basis during the summer and fall months. Precipitation can also be expected from passing fronts occurring during the later fall months through the spring. KSC typically receives the most precipitation during the month of July with an averaging of 6.5 inches, unless tropical storm activity causes a rise in precipitation. Annual mean precipitation is 1.23 meters (48 inches) with a maximum precipitation of 1.39 meters (55 inches). Minimum annual precipitation is 0.98 meters (39 inches). Rapid accumulation of rainfall can significantly affect the water table, making it essential that construction sites are well prepared to handle drainage and

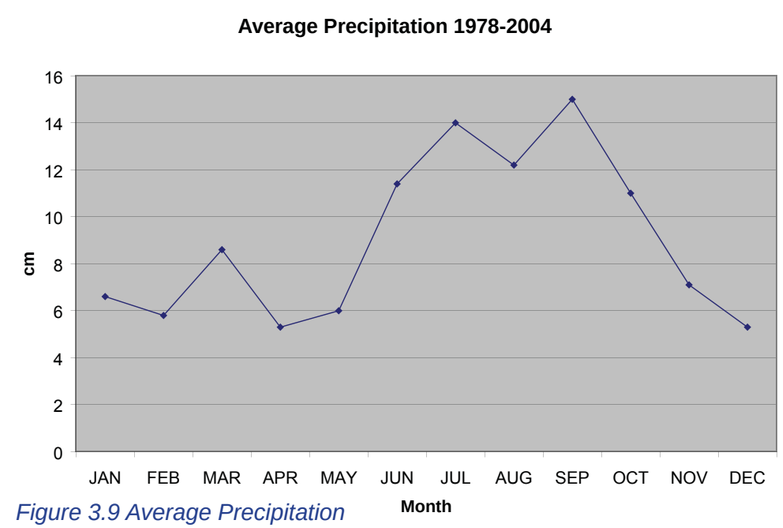


Figure 3.9 Average Precipitation

runoff of project sites. Project sites must also consider lightning associated with rapidly forming afternoon thunderstorm activity by placing lightning rods on roofs of structures. Any material conducive to damage from hail stones during thunderstorms should be properly protected or safeguarded. Figure 3.9 portrays mean rainfall amounts by months in centimeters.Lightning from passing thunderstorms is a main weather concern at KSC. Due to the constant threat of lightning, a two-phase warning system has been developed to alert personnel. Lightning strikes are most frequent in the summer months during the time between 4pm and 8pm. An average of six cloud-to-ground strikes occur per square mile per month.

Hurricanes are non-frontal low pressure weather systems developing over tropical or subtropical ocean water. Categories range from one to five, with category five having the highest wind speeds. High winds, rain and destruction are often associated with hurricanes. Hurricanes are organized in a circular formation, and turn in a counter-clockwise direction. Energy for the storm is gained from the condensation of water vapor supplied from warm ocean water. KSC's hurricane season lasts from June 1 through November 30. Typical Atlantic hurricanes range from 100 to 700 miles in diameter at maturity with the eye being 10 to 80 miles in diameter. The eye is used to track the position of the storm and aids in forecasting its direction and speed. Storm surges from a category five storm can reach up to 18 feet.

Development of facilities at KSC require examination of weather and climate to adequately situate a building to gain maximum wind ventilation of the interior of buildings and outdoor areas.

3.3.6 Flora

KSC has a rich abundance of local diverse floral areas. The diverse areas are a direct effect of its location in a warm tropical coastal setting with a long environmental history that includes changes in temperature and ocean water levels. KSC flora is broken into four main types. The areas include hammock, swamp, savanna, and marshland.

Hammock areas are generally considered closed forests with tall dense stands of trees. A high canopy keeps most sunlight from reaching the forest floor leaving areas of standing water. Midstory vegetation is nearly nonexistent. Seventy-three of the threatened or endangered plant species at KSC occur in the scattered hammock communities. The cabbage palm, oak-cabbage palm, red bay-laurel oak-live oak, red cedar-live oak, and xeric plant types exist in the hammock areas.

Swamp areas cover over 8,000 acres at KSC. These areas are characterized by nearly level, poorly drained soils with a dense cover of hardwood trees including mangrove trees, cypress trees, vines, and shrubs. Swamp areas usually occur in areas of natural drainage or depressions. The swamps are typically flooded with fresh or brackish waters. The three swamp classification types found at KSC include hardwood, willow, and mangrove.

Savanna areas cover the least amount of land at KSC. These areas total approximately 5,400 acres. The cabbage palm savanna is the dominant type of savanna. It includes palm trees and grasses conducive to growth in this type of environment. Often these types of savanna are transitional zones between brackish marshes and the uplands.

Marshland areas cover approximately 47,000 acres and are home to many endangered birds. Marshlands at KSC can be broke up into two types including saltwater and freshwater. The saltwater marshes generally are located along the edges of Merritt Island next to rivers and lagoons. Several types of grasses can be found in the saltwater marshes including cordgrass and caesar weed. Freshwater marshes are generally found in the central portion of Merritt Island within large swales or drainage areas. These areas transition from woody grasses including sand cordgrass and sawgrass to early hardwoods such as willow, maple, and wax myrtle.

A variety of flora mitigation efforts are required to build outside the KSC industrial area. These efforts are the responsibility of the St. Johns Water Management District.

3.3.7 Fauna

Fauna type at KSC includes five main categories: (1) mosquitoes, (2) birds, (3) fish, (4) reptiles, and (5) amphibians. Mosquito populations are controlled under a joint effort between KSC, FWS, NPS, and Brevard County. Birds, fish, reptiles, and amphibians are protected under the federal and state list of Endangered and Threatened Species.

Mosquitoes are primarily controlled by the use of 76 diked impoundment water bodies encompassing over 21,000 acres. The dikes control the water level within the water bodies, ultimately giving control to authorities on the breeding habits of the mosquitoes. Chemicals are only minimally utilized to battle the mosquito population due to residual effects on other wildlife habitat.

Birds, fish, reptiles, and amphibians are protected under Federal and State endangered or threatened species lists. Currently KSC supports 22 of the species on the list which is produced by the U.S. code of Federal Regulations, Florida Wildlife Code, and the Florida Committee on Rare and Endangered Plants and Animals. Protected birds include the Florida Scrub Jay, Southern Bald Eagle, Wood Stork, Pelicans, Egrets and other birds. Protected fish include the Common Snook. Protected reptiles include turtles, snakes, and alligators.

Turtle protection is specially enforced due to the specific and rare nesting habits of the Loggerhead Turtle and the Atlantic Green Turtle. KSC and CCAFS is taking measures to control the lighting at launch pads 39A, 39B, 40, and 41 as to not confuse hatchlings attempting to crawl to the ocean.

A variety of fauna mitigation and permitting efforts are required to build at KSC. These efforts are the responsibility of several agencies including the U.S. Code of Federal Regulations, Florida Wildlife Code, and the Florida Committee on Rare and Endangered Plants and Animals.

3.3.8 Protected Habitat

An Environmental Resources Document (ERD) (KSC-DF-3080) also outlines requirements set forth in the NMI 8800.7D "Procedures for Implementing the National Environmental Policy Act." This document outlines the implementation process for the protection of land, air, water resources, natural vegetation, endangered and threatened species, habitat and wildlife management, historical and archeological developments, hazardous and non-hazardous materials, and launch pad related impacts to the surroundings.

Future development at KSC will require the proper permitting and mitigation by an appropriate agency in order to protect endangered wildlife and vegetation.

3.4 Built Environment

3.4.1 Security

3.4.1.1 Applicable Criteria

One criterion governs the site security requirements at NASA's Kennedy Space Center, the NASA Procedural Requirements (NPR) 1620.3 entitled Physical Security Requirements for NASA Facilities and Property, in particular, Chapter Six, entitled Physical Barriers. Chapter Six of the NPR 1620.3 outlines the minimal physical security barriers and openings at NASA Centers. Its objectives are:

1. Additionally, facilities and operations, when established under the provisions of the NASA mission essential infrastructure protection program (MEIPP), must meet specific criteria established in Chapter 6 of this NPR.
2. Physical barrier requirements are designed to deny, impede, or discourage access to NASA areas by unauthorized personnel or groups. This is accomplished by one or more of the following:

- Defining the perimeter of the installation and any security areas
- Creating a physical and psychological deterrent to entry, as well as making a legal statement that entry is not permitted
- Delaying intrusion into security areas, thus making more likely the detection and apprehension of intruders by protective forces
- Facilitating the effective and economical utilization of protective forces
- Directing the flow of personnel and vehicles through designated portals, in a manner that permits efficient operation of a personnel identification and control system

NPR 1620.3 is applicable to NASA Headquarters and NASA Centers, and to NASA contractors to the extent specified in their contracts. It is our understanding the NPR 1620.3 document will be undergoing a revision to include many, if not all, of the requirements identified in Interagency Security Committee (ISC) security standards.
After the bombing of the Alfred P. Murrah Federal Building in Oklahoma City, the U.S. Marshal's Service assessed the vulnerability of federal buildings. The General Services Administration (GSA) was then directed by Executive Order 12977 to set construction standards for buildings that required specialized security measures, such as blast resistance. The result was the Interagency Security Committee (ISC) ISC Security Design Criteria for New Federal Office Buildings and Major Modernization Projects (ISC, 2001). The criteria apply to new construction or major renovation of those office buildings and courthouses occupied by federal employees in the United States that are not under the jurisdiction or control of the Department of Defense, which has its own criteria. The ISC criteria reflect a "flexible and realistic approach to the reliability, safety, and security of Federal office buildings."
In November 1999, GSA and the U.S. Department of State convened a symposium to discuss the apparently conflicting objectives of security from terrorist attack and the design of public buildings in an open society. The symposium sponsors rejected the notion of rigid, prescriptive design approaches. The symposium concluded with a challenge to the design and security professions to craft aesthetically appealing architectural solutions that achieve balanced, performance-based approaches to both openness and security.

In response to a request from the Office of the Chief Architect of the Public Buildings Service, the National Research Council (NRC) assembled a panel of independent experts, the Committee to Review the Security Design Criteria of the Interagency Security Committee. This committee was tasked to evaluate the ISC Security Design Criteria to determine whether particular provisions might be too prescriptive to allow a design professional "reasonable flexibility" in achieving desired security and physical protection objectives.

"Facility Security Level Determinations for Federal Facilities—an Interagency Security Committee Standard" (the Standard) defines the criteria and process to be used in determining the facility security level (FSL) of a Federal facility, a categorization which then serves as the basis for implementing protective measures under other ISC standards. Consistent with the authority contained in Executive Order 12977, "Interagency Security Committee," dated October 19, 1995, this Standard is applicable to all buildings and facilities in the United States occupied by Federal employees for nonmilitary activities. These include existing buildings, new construction, or major modernizations; facilities owned, to be purchased, or leased; stand-alone facilities, Federal campuses, and, where appropriate, individual facilities on Federal campuses; and special-use facilities.

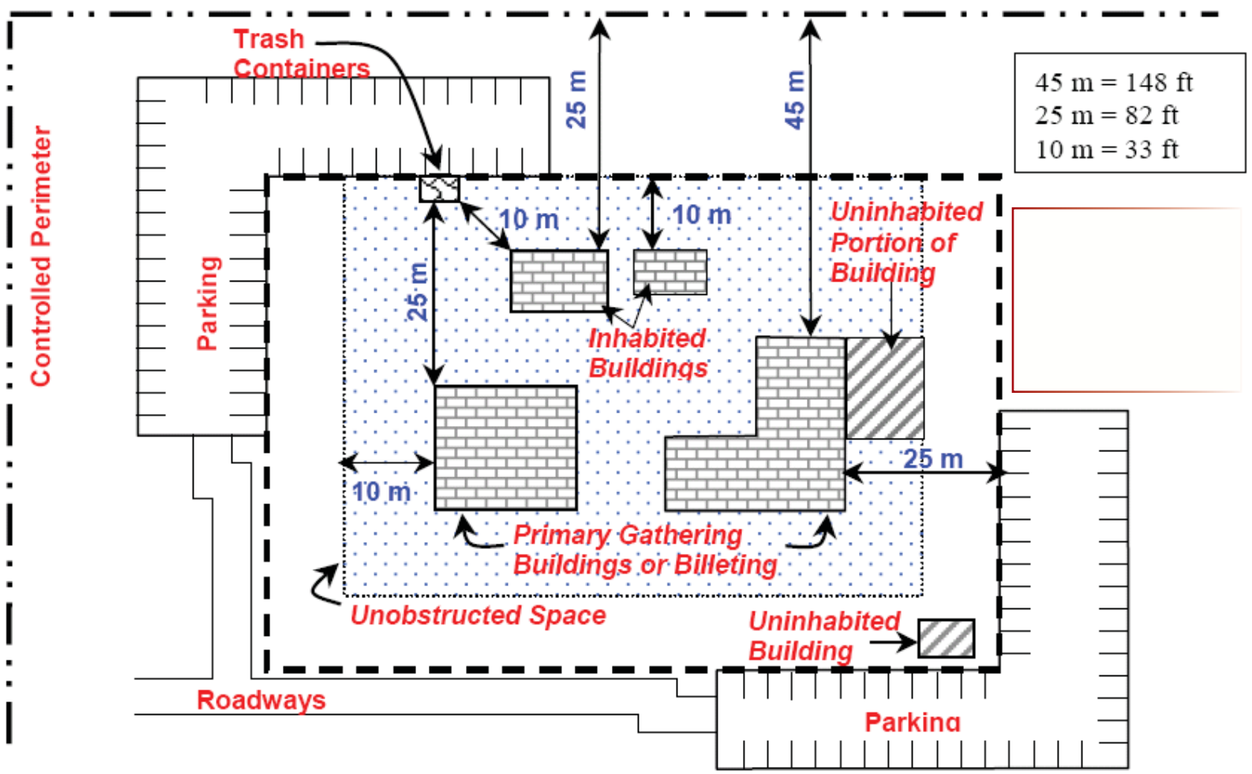


Figure 3.10 Site Security Recommendations

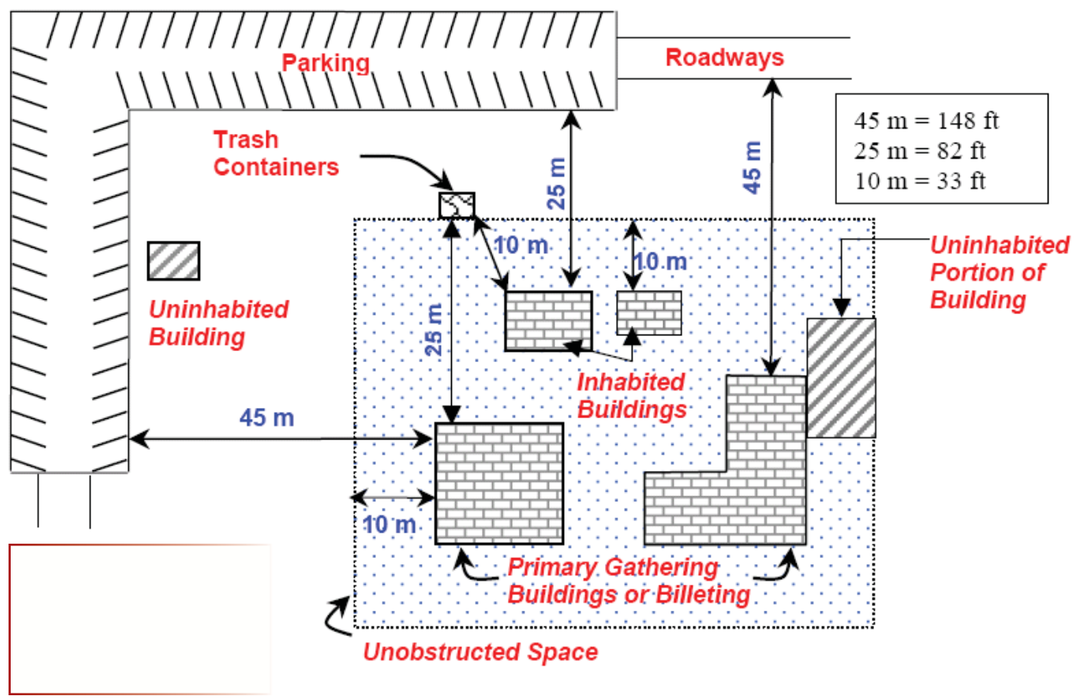


Figure 3.11 Site Security Recommendations

3.4.1.2 Existing Site Security System Discussion

In terms of overall site security, KSC can be defined having a "controlled" perimeter. Controlled perimeter can be defined as a physical boundary at the perimeter of the overall installation. The KSC industrial area is within an installation with restrictive access. A physical boundary with Access Control Points (ACP) will be considered a sufficient means to channel vehicles into the installation. Four ACP points exist at KSC. At a minimum, access control at a controlled perimeter requires the demonstrated capability to search for and detect explosives. Where the controlled perimeter includes a shore line and there is no defined perimeter, the boundary will be at the high water mark. **For the purposes of the study, site security discussions will be limited to setback and vehicular encroachment issues.**

It is recommended that KSC consider the United States Department of Defense (DoD) AT/FP (Anti-terrorism/Force Protection) site security recommendations (Figures 3.10-3.12), and the United Facilities Criteria (UFC) 4-010-01 guideline for a controlled perimeter, dated January 22, 2007.

The site security recommendations for a controlled perimeter include:

- 148-foot (45 meter) set-back between perimeter roads and exterior walls of primary gathering facilities (areas where 12 or more permanent staff are present)
- 82-foot (25 meter) set-back between on-site personally owned vehicle (POV) parking areas and exterior walls of primary gathering facilities
- 33-foot (10 meter) set-back between trash enclosures and exterior walls of facilities

Figure 3.12 illustrates specific site security setbacks for KSC industrial area. The 82-foot building setback can significantly lessen the amount of buildable area. Also, the majority of facilities do not currently meet the required 82-foot setback from roadways and POV parking areas. The relocation of POV parking areas should be considered in order to achieve the DoD setback requirement.

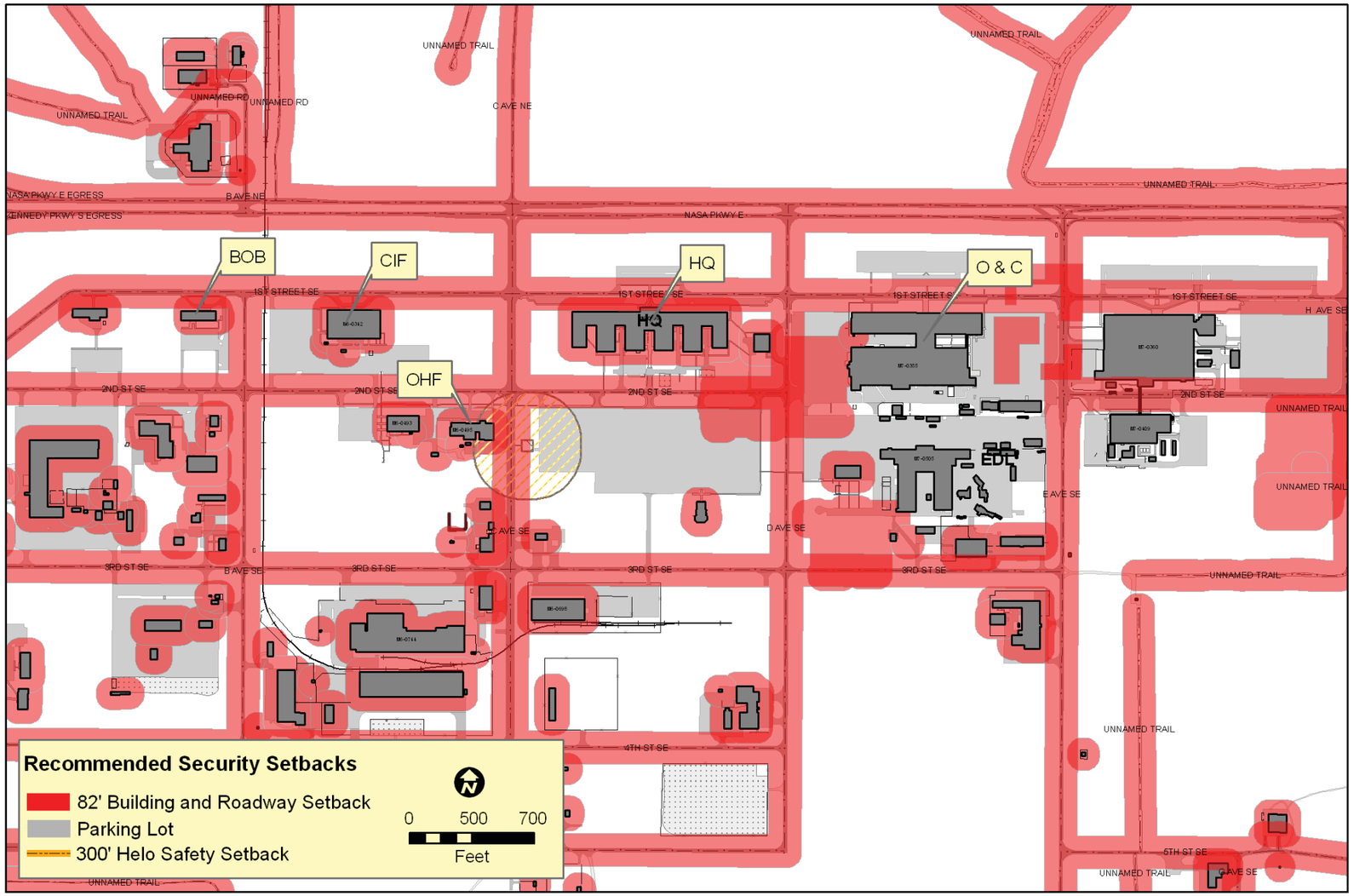


Figure 3.12 Recommended Security Setbacks

3.4.1.3 Facility Discussion

M6-0399 Headquarters Building

The minimum setback requirements along the northern side of the building are currently met. Additional removable bollards are installed at the drop-off area entrance to maintain the setback. However, Jacobs could not determine the force penetration rating of the installed bollards. It should be noted that countermeasures are not in place to maintain the setback on all four sides of the building. The only exception is the drop-off area.

M6-0342 Central Instrumentation Facility

The minimum setback requirements along the 1st Street side of the building exist. Additional removable bollards are installed at the drop off area entrance to maintain the setback. However, we could not determine the force penetration rating of the installed bollards. It should be noted that countermeasures are not in place to maintain the setback on all four sides of the building. The only exception is the drop-off area.

M6-0339 Base Operations Building

Zero setbacks exist on the eastern, southern and western sides of the building. Without a defined setback, vehicles can easily come in close proximity to the building and critical utilities.

M6-0495 Occupational Health Facility

Zero setbacks exist at the building. Without a defined setback vehicles can easily come in close proximity to the building and critical utilities.

L7-1557 Environmental Health Facility

Zero setbacks exist at the building. Without a defined setback vehicles can easily come in close proximity to the building and critical utilities.

M6-0883 Child Development Center

Zero setbacks exist at the building. Without a defined setback vehicles can easily come in close proximity to the building and critical utilities.

3.4.2 Site Circulation

Pedestrian circulation is generally heavy between buildings within the area of HQ, O&C, and SSPF. The HQ Building is a destination point for various reasons, including work related activities and the cafeteria services. This type of relationship among the three buildings places the HQ as the prime destination point. This condition equates to a large amount of pedestrians moving throughout the site. Sidewalks cover most areas between buildings, although several areas exist where pedestrians come into conflict with vehicles. These areas include the crossing of 1st Street and 2nd Street, D Avenue, and E Avenue, and within the circulation patterns of the parking lots.

Conflicts exist where pedestrian traffic and vehicular traffic meet. There are several conflict points throughout the site with varying degrees of safety concerns. A conflict occurs when pedestrians cross an active street where the crossing site is not properly addressed. This is the case for all three buildings where pedestrians cross 1st Street to reach the adjacent parking. This is also the case with the HQ Building occupants crossing 2nd Street in order to reach the main parking lot for the building. Pedestrians are crossing both service access roads and vehicular traffic to reach their cars.

There is a strong connection between the HQ (M6-0399) and the O&C (M7-0355) Buildings. Pedestrians cross D Avenue to and from each of these buildings. This puts pedestrians crossing an active street as well as a main parking lot. Walking distance is about ½ mile from the south exit of the HQ Building to the west side entry of the SSPF Building. This takes approximately 10 minutes to walk.

Figure 3.13 Site Circulation

Figure 3.14 portrays rings indicating pedestrian walking distances. The rings range from 5 minutes (1/4 mile) to 20 minutes (1 mile.) The graphic indicates walking times between buildings is quite lengthy. The project team has identified that the existing physical separation of most of the major employment facilities is a determinate for the spatial arrangement of the proposed future site plan. The amount of time an employee spends walking between buildings was calculated in terms of dollars. The preliminary analysis resulted in a finding of approximately $1.2 million that could be regained in productivity per year.

It was determined that if, hypothetically, 5 percent of the total workforce of the buildings included in the study were to walk from one building to another, there would be a total of 195 trips made per day. At 72 walking trip options, removing the 9 “reflective trips” where the matrix crosses, and the trips between O&C and SSPF, it reduces the number of potential trips to 66.

At an average of 20 minutes per round trip, the total minutes per day, with 195 employees, equals 3,900 minutes per day or 65 hours per day of regainable productive hours. If one applies an average wage rate of $73 per hour to that time, it amounts to approximately $4,745 per day that could be reinvested in working. The idea of consolidation within the industrial area could potentially result in the savings of $1.2 million in recaptured productivity annually.

There is access to the site via NASA Parkway (405) East over the inlet. Visitors stop at the badging building for passes to access NASA. Badges and vehicles are checked at the Access Control Point (ACP). Once through the ACP, traffic continues east on NASA Parkway until the HQ Building (M6-0399). Access onto the secondary streets occurs from D Avenue or E Avenue as shown in Figure 3.15.

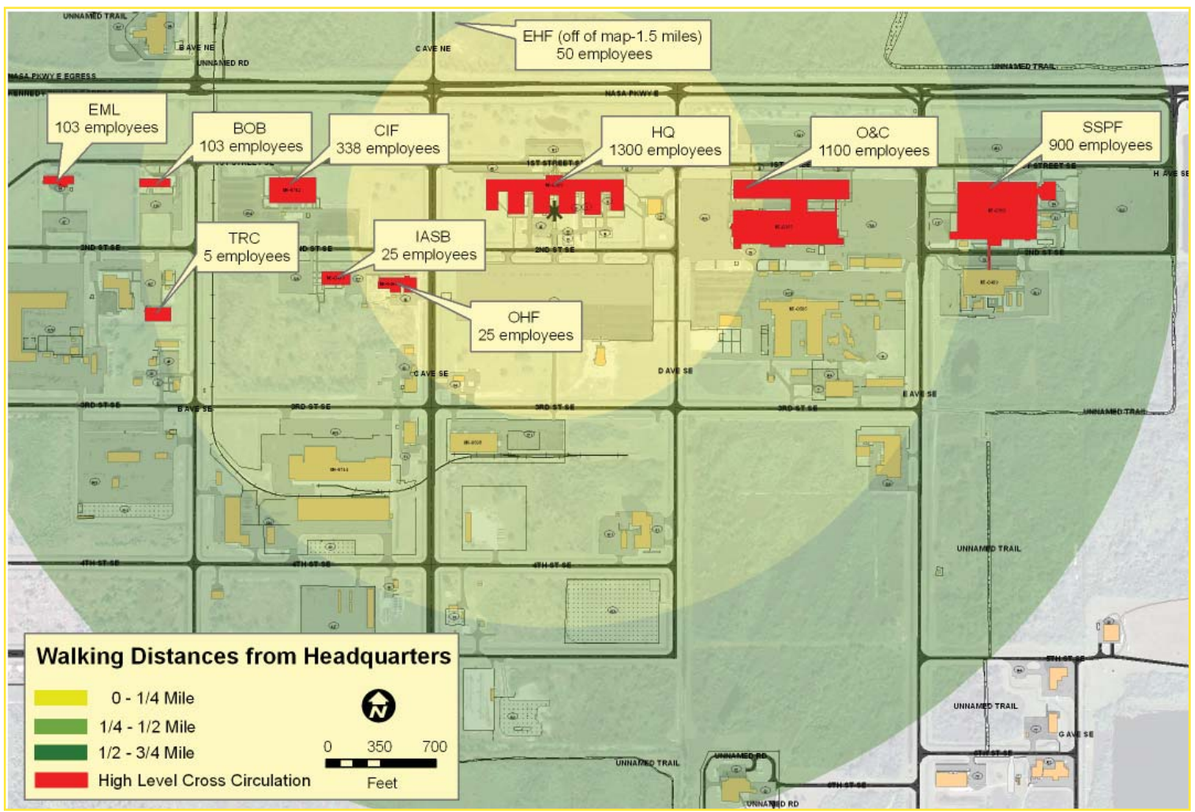


Figure 3.14 Walking Distances

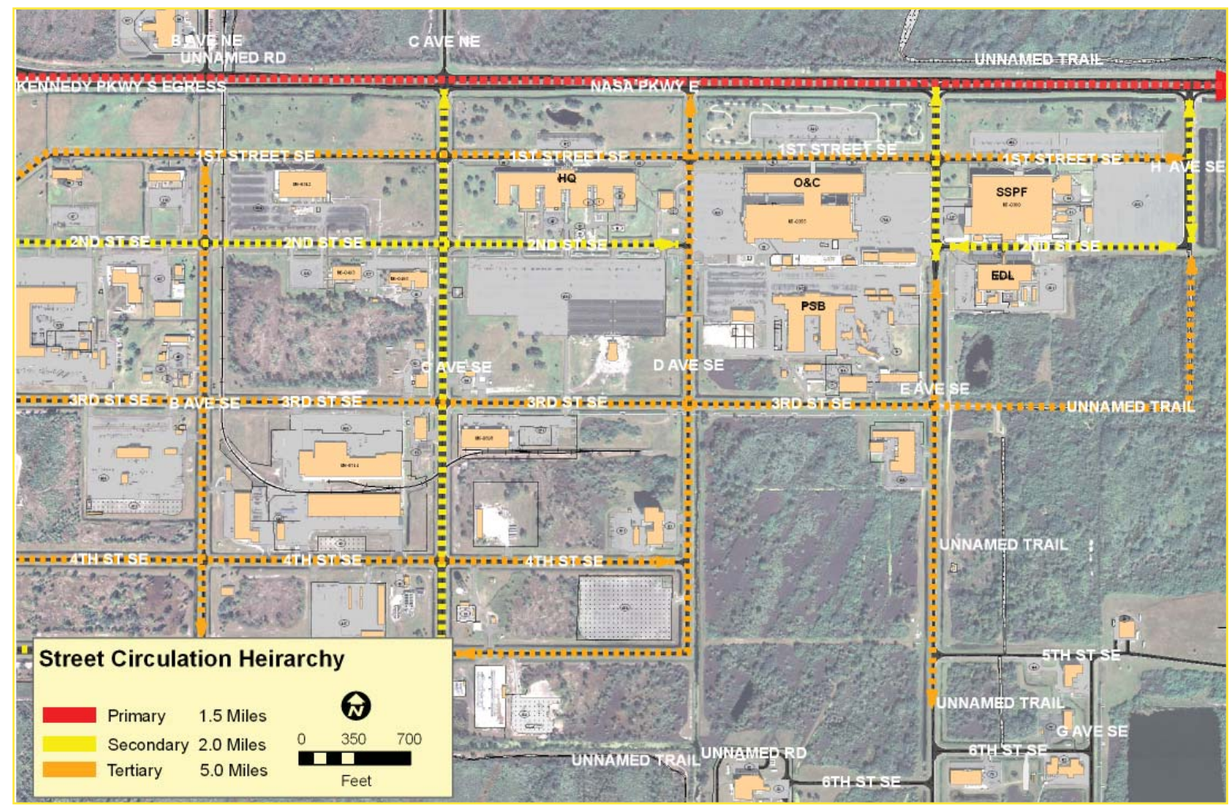


Figure 3.15 Street Circulation Hierarchy

Figure 3.16 indicates pedestrian conflict points within KSC's industrial area. Additionally, employees are exposed to the outdoor elements due to the length in outdoor walking distances. Long-distance covered walkways are not present, therefore, potentially causing weather related safety issues.

Pedestrian safety is a concern when crossing active vehicular circulation such as roads and parking lots. Pedestrian circulation should not interact with these active vehicular circulation patterns. Where conflict does occur, clear indicators or markings should show caution to passing vehicles. If possible, all pedestrian circulation should be kept away from conflicts through the use of sidewalks or defined pedestrian walkways. Planning of connection corridors for pedestrians can create linkages to other buildings both physically and visually.

The HQ, O&C and SSPF Buildings have pedestrians crossing active parking lots. There are no defined pedestrian corridors or sidewalks present. This increases the risk of pedestrian injury from vehicles backing out of spaces or driving.

Privately Owned Vehicle (POV), and Government Owned Vehicles (GOV) parking is located adjacent to each building. The HQ Building has 111 handicap accessible parking located south of 1st Street flanking each side of the entry. Access to handicap accessible parking is via drives off of 1st Street. North of 1st Street is permitted parking for upper management personnel. Access to permitted parking is through driveways on either end of the parking lot. The majority of parking for the HQ Building is located on the south side of 2nd Street behind the HQ Building. The parking lot contains approximately 1595 spaces and is accessed from D Avenue and E Avenue. Multiple access drives enter the parking lot off of 2nd Street. The main entry in the center of the parking lot is blocked off for pedestrian crossing into the parking area. An auxiliary access is from 3rd Street from the south. The service parking lot holds approximately 55 parking spaces and is on the south side of the building. An additional 9 parking spaces exist in HQ Building courtyards. Approximately 1,808 parking spaces are provided for 1,283 employees reporting to the HQ Building daily. A surplus parking of 525 spaces exists at the HQ Building.

A portion of HQ POV parking lies within the 82' building setback.

Approximately 120 (90 POV, 30 GOV) parking spaces are affected by the non-compliant setback and will require relocation to become compliant. Two additional parking spaces at the Auditorium and Training Building also fall into the area of non-compliant security setbacks. (See Figure 3.17)

The O&C Building parking is adjacent to the building. Handicap accessible parking is located south of 1st Street flanking the north front entry into the building, providing a total of 26 spaces. Access to these parking spaces is directly from the street. Permitted parking is located on the north side of 1st Street and is allocated for upper management. A total of 341 parking spaces exist and access to this parking lot is from two access drives off 1st Street. The bulk of the parking for O&C is located on the east and west sides of the building, providing a total of 1,323 parking spaces. Access to these parking areas is from D Avenue and E Avenue. Circulation between the east and west parking lots is not possible due to fencing and structures to the south of the building. Twenty nine service parking spaces are provided on the south side of the building. Approximately 1,300 parking spaces are

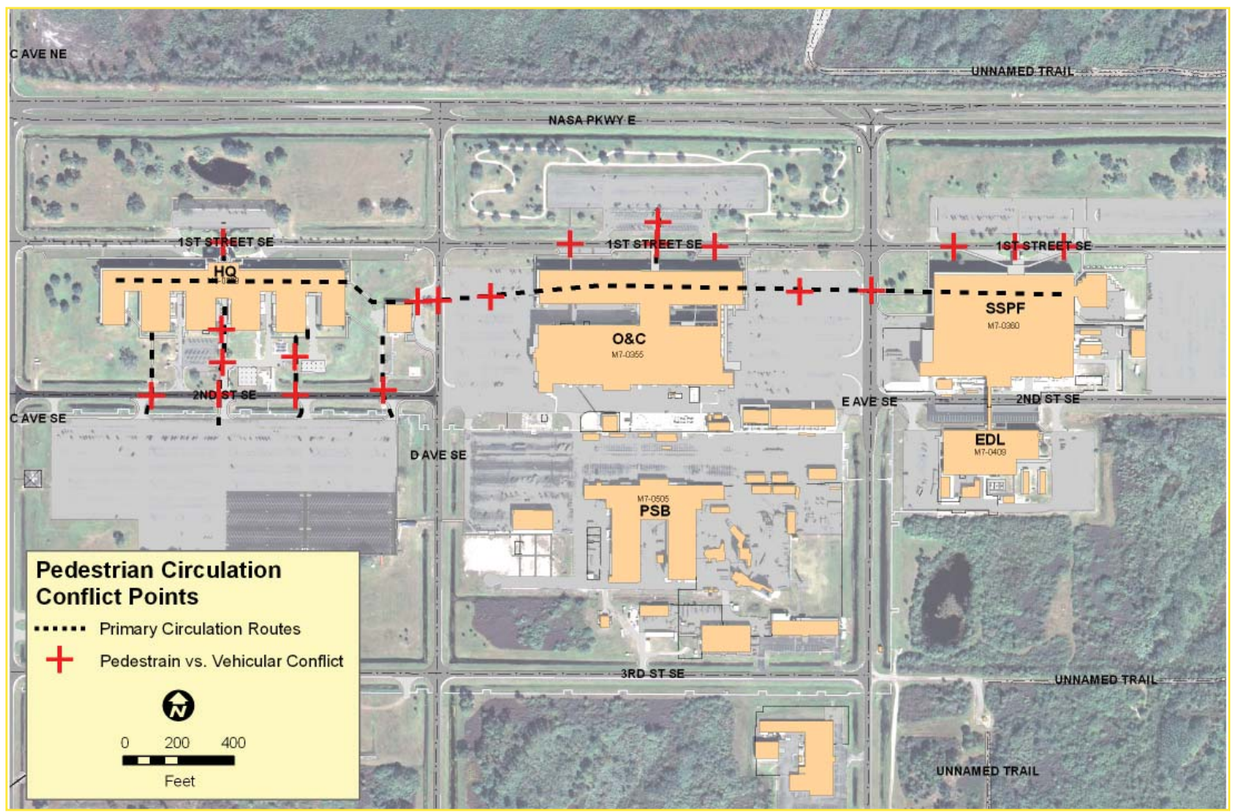


Figure 3.16 Pedestrian Conflicts

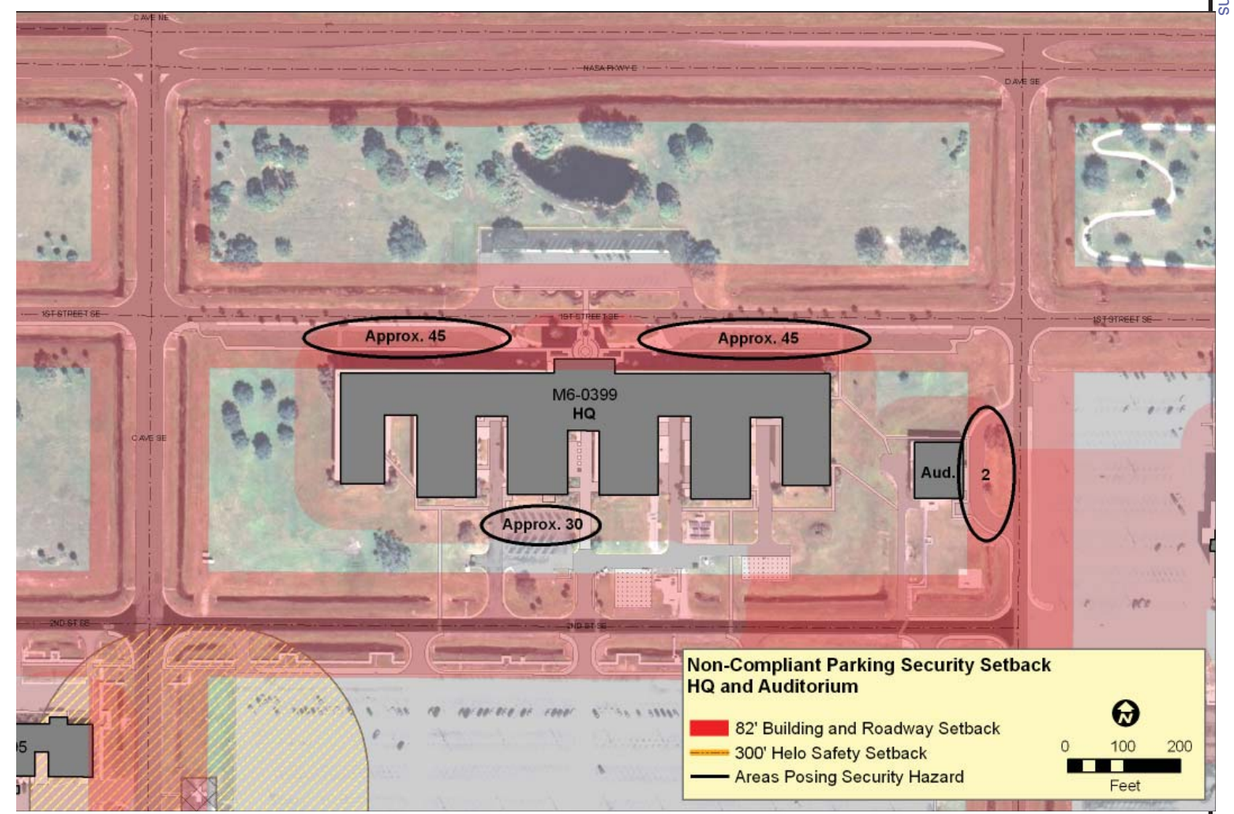


Figure 3.17 Non-compliant Parking, HQ & Auditorium

provided for 804 employees. A surplus exists of approximately 500 parking spaces exist at the O&C Building.

Similar non-compliant POV parking security setbacks exist at the O&C and PSB Buildings. Approximately 355 (25 POV, 330 GOV) parking spaces are affected by the proposed security setback at the O&C. Approximately 300 POV, and 100 GOV additional spaces are affected at the PSB. (See Figure 3.18)

Parking lots at the SSPF are similar to HQ and O&C Buildings. Handicap accessible parking is located on the east side of the building along with the bulk of the parking. A total of 65 handicap parking spaces exist and access to this parking lot is from 1st Street and H Avenue. Permitted parking is located on the north side of 1st Street with a total of 432 spaces. Access to this parking area is from three access drives off of 1st Street. Service parking is on the west side of the facility with 117 spaces provided. A total of 1,322 parking spaces exist for 852 employees. A surplus of 470 parking spaces exist at the SSPF Building. (See Figure 3.19)

POV parking security setbacks all appear to be compliant at the SSPF, although approximately 60 GOV spaces are non-compliant. Zero POV parking spaces are recommended to be relocated in this area. Approximately 70 POV, and 90 GOV parking spaces are affected at the EDL because they lie within the building security setback.

Reserved and handicap parking is located in the front of each facility; all other personnel and visitors park in the rear of the facility. Service is also located near the rear of each building for easy access. Minimal buildable land exists adjacent to the buildings without displacing either parking or circulation. Roads and parking lots could be removed or relocated to provide more developable area or to accommodate DoD AT/FP criteria. Overall, a surplus of parking exists among the HQ, O&C, and SSPF.

The HQ Building has its service access from the south side of the building. Service access conflicts with pedestrian traffic entering the south side of the HQ Building. The O&C Building has its service access from the south side of the building. Service access conflicts with vehicular traffic entering the parking areas are found on the east and west sides of the building. The SSPF Building has its service access on the west and east sides of the building. Service access conflicts with pedestrian and vehicular circulation are found on the east side of the building.

If the final recommendation includes an addition or new construction, depending on the final location of the new HQ facility, service may be interrupted to one or more of the other facilities. A combined service area and drive might alleviate some of the issues with pedestrian and vehicular conflicts. Separation of the service traffic from all other circulation will reduce the chances of incidents.

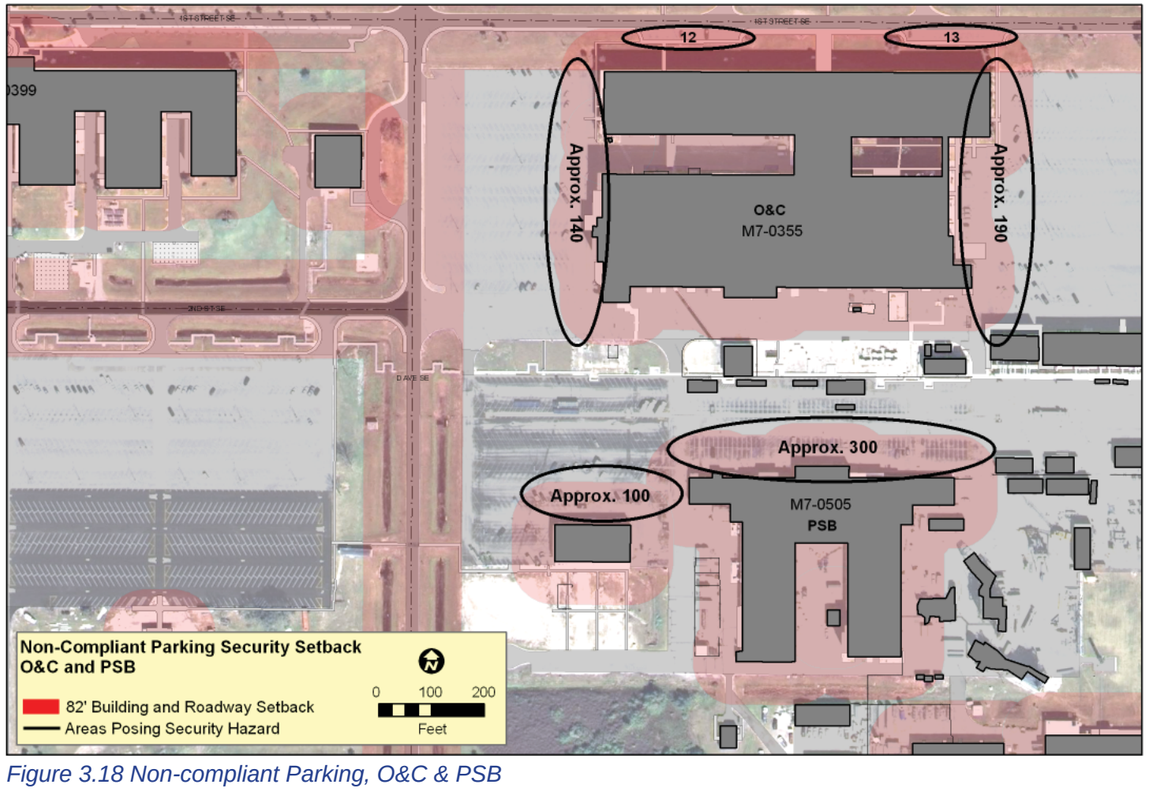


Figure 3.18 Non-compliant Parking, O&C & PSB

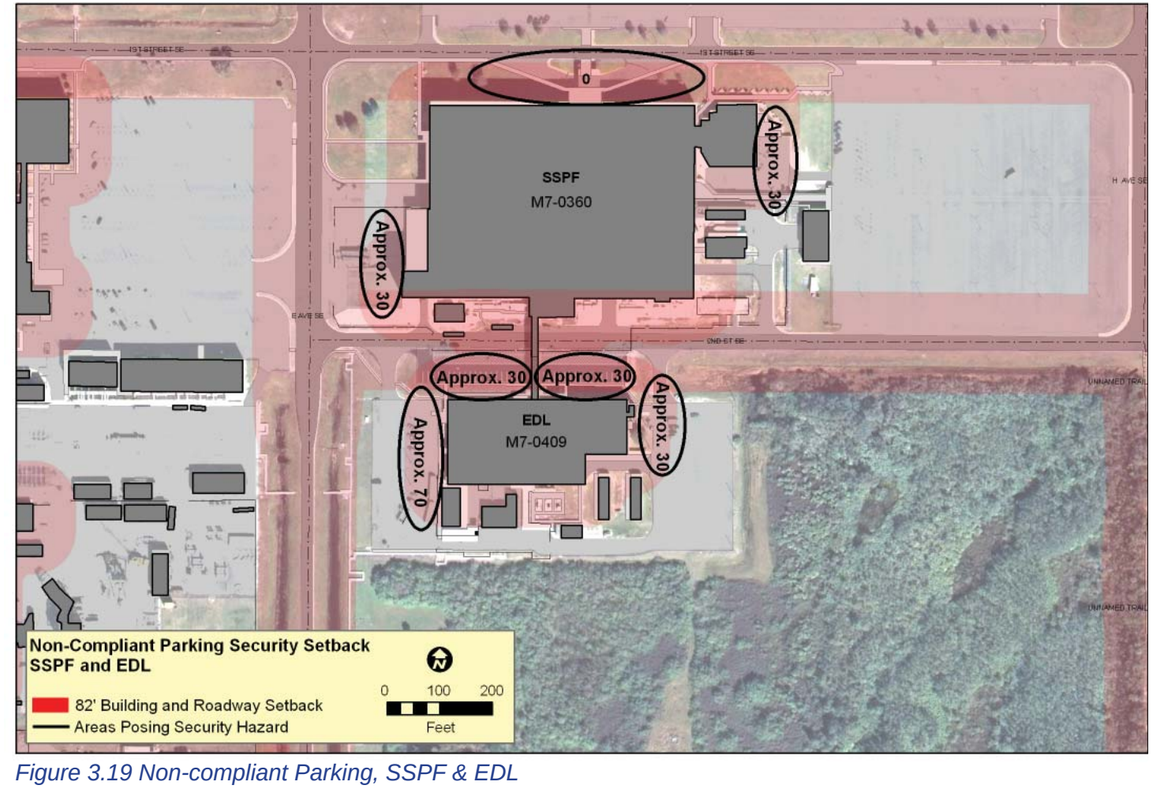


Figure 3.19 Non-compliant Parking, SSPF & EDL

A total of approximately 817 POV parking spaces are affected in order to meet the required DoD building security setbacks. This equates to 163,400 square feet, or 3.75 acres, of POV parking to be relocated; although a surplus of 1,881 POV parking spaces exist among the HQ, O&C, and SSPF altogether, providing an opportunity to relocate dislocated POV parking spaces that do not meet security criteria as shown in Figures 3.20-3.22. If the POV parking that needs relocating is taken out of the total surplus spaces, the total number of surplus spaces shrinks to 1,064 spaces.

A total of approximately 280 GOV parking spaces are affected in order to meet the suggested DoD security setback requirements. As long as the industrial area continues to need a controlled perimeter, GOV parking areas will require an 82' setback from buildings, according to UFC 4-010-01, January 22, 2007, although local and operational regulations may also apply. The affected 280 spaces equate to 56,000 square feet (1.29 acres) of GOV parking to be relocated.

	Number of Workers	Worker Parking Spaces Provided	Surplus of Worker Parking Spaces
HQ	1283	1808	525
O&C	804	1690	886
SSPF	852	1322	470
Total			**1881**

Figure 3.20 Existing Employee Parking

	Approximate POV Spaces dislocated	
HQ	90	
Auditorium	2	
O&C	330	
PSB	300	
SSPF	0	
EDL	70	
Total	792	x200 sq. ft.=158,400 sq. ft.=3.64 acres

Figure 3.21 Dislocated POV Parking

	Approximate GOV Spaces dislocated			
HQ	30			
Auditorium	0			
O&C	25			
PSB	100			
SSPF	60			
EDL	90			
Total	305	x200 sq. ft.=61,000 sq. ft.=1.40 acres		
Summary:				
0 GOV parking surplus exists. Approx. 305 GOV parking spaces will need relocation				

Figure 3.22 Dislocated GOV Parking

3.4.3 Building Usage

The industrial area of KSC occupies approximately 350 acres. The predominate buildings in the industrial area are the Headquarters Building (HQ), Operations and Checkout Building (O&C), Space Station Processing Facility (SSPF), Payload Support Building (PSB), and the Engineering Development Lab (EDL) (See Figure 3.23). Several outlying buildings also exist within the industrial area, most of which are temporary or small storage structures with a few main building support structures used to house utilities. Buildings are generally orientated in an east-west orientation with the majority of parking allocated on the north and south of each building.

Streets are laid out in a grid-like fashion, providing maximum vehicular efficiency between buildings. The grid pattern separates large open spaces for future expansion of facilities. The majority of the streets are two-lane and provide adequate directional traffic flow. Avenue C SE is a four-lane street; the northerly portion of Avenue E SE is a four-lane street; and H Avenue, on the east side of the SSPF, is four-lane as well. All four-lane streets are 48 feet wide, and the two-lane streets are 24 feet wide. Three signaled intersections occur at NASA Parkway East, which is on the north side of the industrial area.

Existing open space areas within KSC industrial area are prime locations for future proposed building additions or construction of new buildings. Pinpointing the exact location of any possible new construction will be a function of adjacency analysis along with building footprint square footage and parking requirements.

Four main buildings exist within KSC's industrial area. They are the HQ, O&C, SSPF, and the EDL. Each facility has a unique function and carries a specific roll in accomplishing the missions of NASA.

The HQ Building footprint is approximately 150,000 square feet and houses administrative offices, a gift shop, hair salon, library, post office, printing services, AV storage, cafeteria, and a credit union. The building footprint of the O&C is approximately 244,000 square feet and houses a cafeteria, gift shop, gym, rehabilitation/wellness area, general offices, and a high bay processing area. The SSPF building footprint is approximately 204,000 square feet and includes a cafeteria and a gift shop, along with general offices and a processing area. The EDL Building footprint is approximately 50,640 square feet and contains laboratories, tourist activities and offices.

Several smaller temporary and storage buildings also exist within the industrial area. Next to the HQ is the Auditorium and the Kennedy Learning Institute. Next to the O&C is the high pressure gas storage facility, two MBSI trailers, three temporary construction trailers, an equipment building, an electric motor control building, two cooling towers, and an industrial area chiller plant. Next to the SSPF

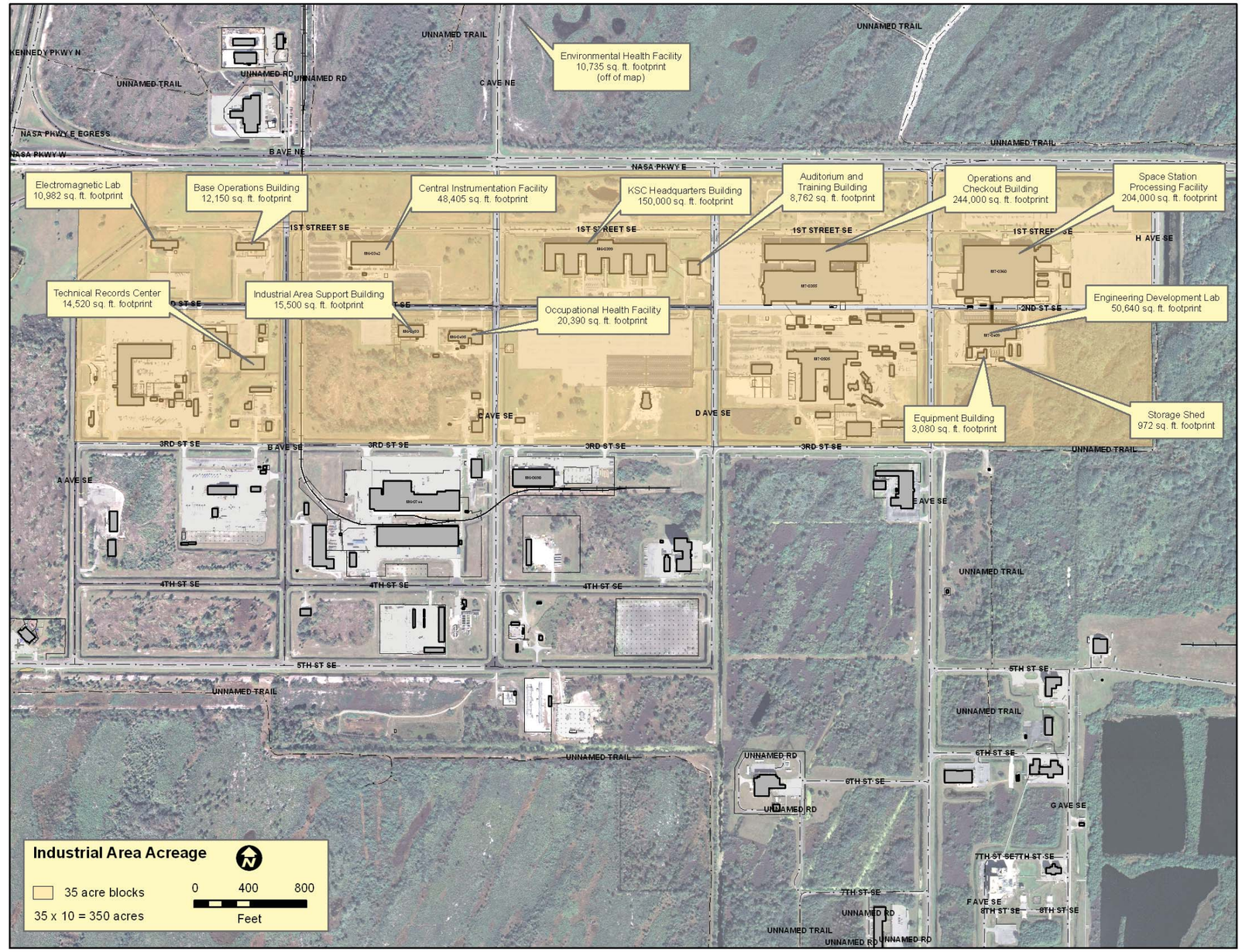


Figure 3.23 Industrial Area

are three trailers, an ammonia vapor containment building, an OPS support building, and support building #2. A guard house, three storage sheds, an equipment building, and an ISSC concession building are next to the Engineering Development Lab.

Future expansion or additions to buildings within KSC's industrial area will require interior space allocations to accommodate the exchange of offices and employees between facilities as needed.

3.4.4 Buildable Sites

In the event that the final recommendation involves an addition or new construction, there are eight existing, appropriate buildable sites at KSC. Six of the sites are directly within the industrial area, and the two sites remaining are located outside of the industrial area. These sites were predetermined by project senior leadership based on initial adjacency requirements and the amount of space needed to accommodate a facility consolidation of this size. Each site contains potential opportunities and constraints as outlined in Section 3.4.12.

Sites A, B, C, D, and G all contain excellent adjacencies to existing facilities where the majority of the KSC personnel work. These sites have also been predeveloped, therefore, requiring less ground or mitigation preparations, and would also aid in creating a more compact environment. Site H is the most remote site in terms of adjacencies to existing facilities where the majority of employees are located. Sites E and F do not contain good adjacencies to the employees, are physically separated by NASA Parkway East, have no existing utilities, and would require an extensive building permit process due to historic landscape features in these areas. Specific site ranking criteria can be found in Figure 3.36.

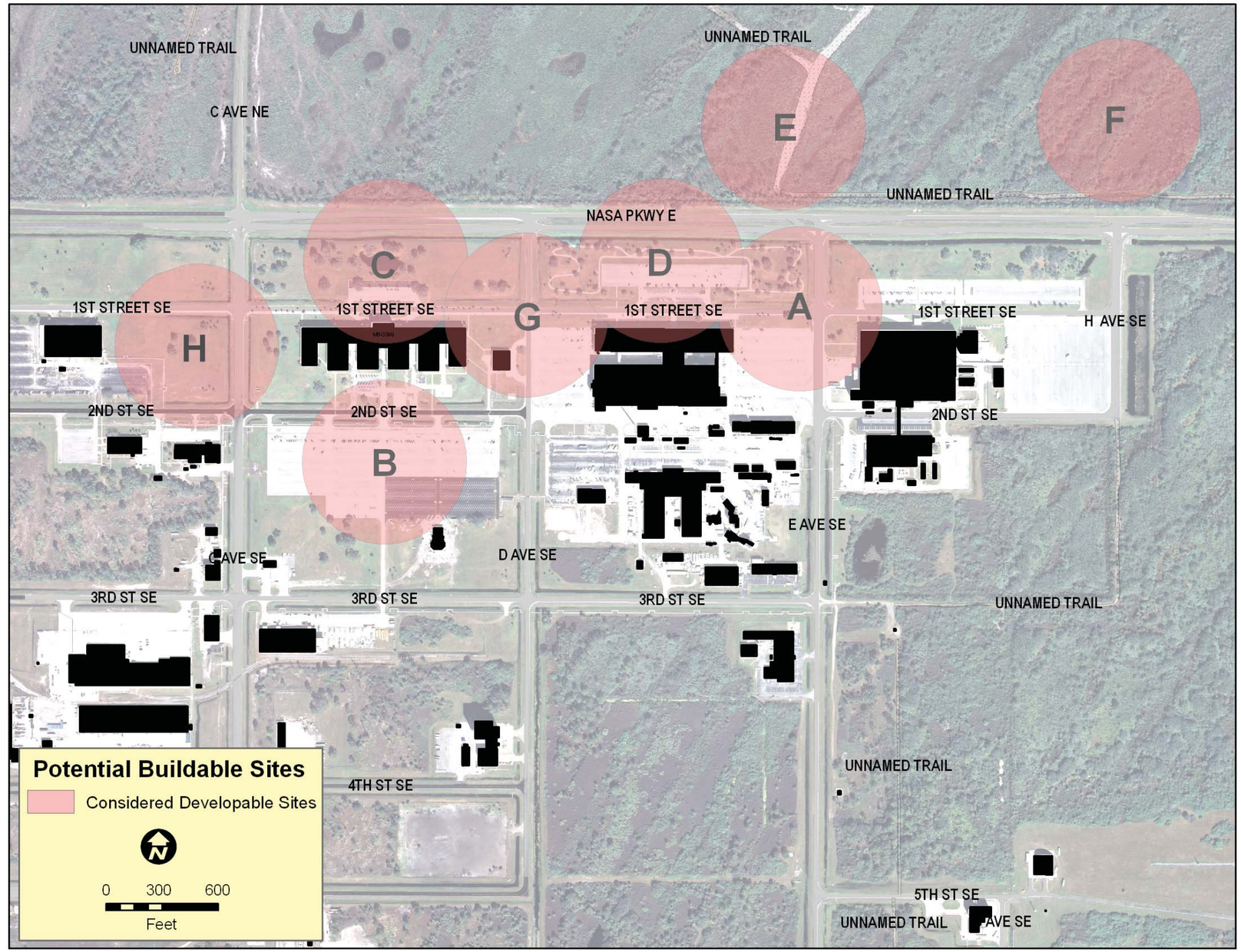


Figure 3.24 Buildable Sites

3.4.6 Visual Connections

Visual connections play an important role in campus planning by providing opportunities to connect different parts of the campus. This can be done by incorporating the same use of materials, a certain type of look, or maintaining the same feel throughout the campus by use of landscape elements. Opportunities for visual connections can also come in the form of deliberately directing a view to a monumental object, structure, or icon in the distance, thus giving the site a feel of importance, prestige, or permanency.

Opportunities for visual connections at KSC come in two forms. They include long distance views directed toward the NASA launch and landing operations facilities from the industrial area, and short distance views within KSC's industrial area.

Long distance directed views from the industrial area are directed generally northward toward the shuttle landing site, Vehicle Assembly Building (VAB), shuttle launch pads, and the active and historic rocket launch pads (See Figure 3.25). Each visual connection is approximately five to seven miles away from KSC's industrial area.

Short distance directed views within the KSC industrial area are very specific. These views are directed toward and in-between buildings of prestige. The directed views are toward the HQ, O&C, and SSPF when approaching the industrial area on NASA Parkway East. Once inside the industrial area, views are directed between the different facilities. The facilities are in human scale, making them visually attainable and within a walkable distance. Opportunities also exist for additional visual connection points within the industrial area. Two primary additional locations are on the north side of the HQ, O&C, and SSPF. One secondary visual connection point exists behind the HQ Building. All three locations are depicted in Figure 3.26.

Planning for future facility developments within KSC's industrial area should take advantage of the long distance views towards NASA launch operations by providing ground level or elevated event observation areas. Paths and other outdoor passive observation nodes can also provide views towards launch facilities as well.

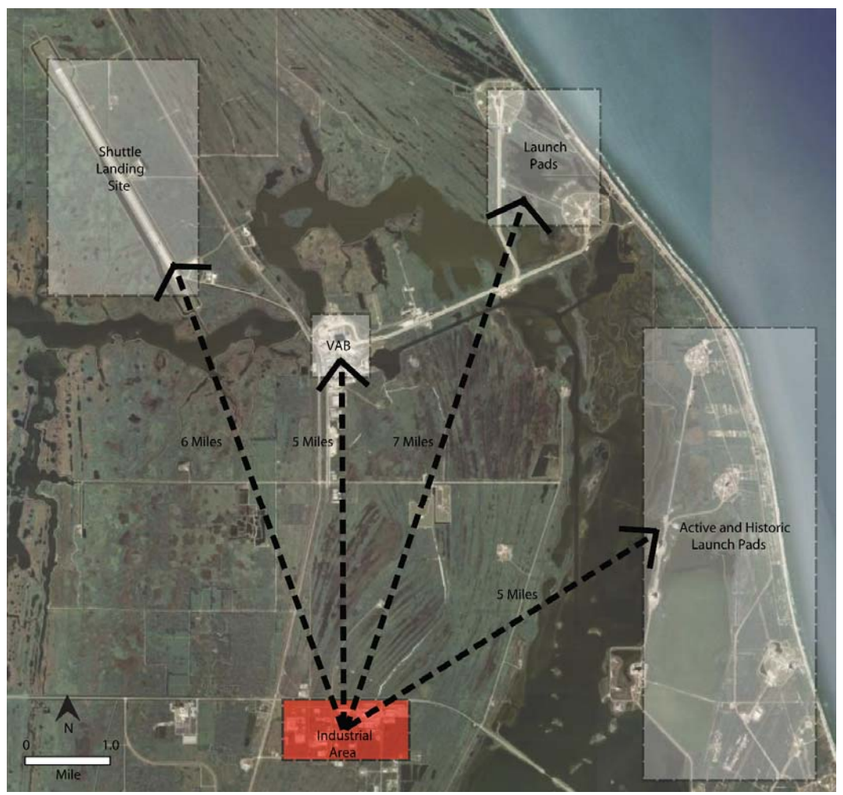


Figure 3.25 Long-distance Views

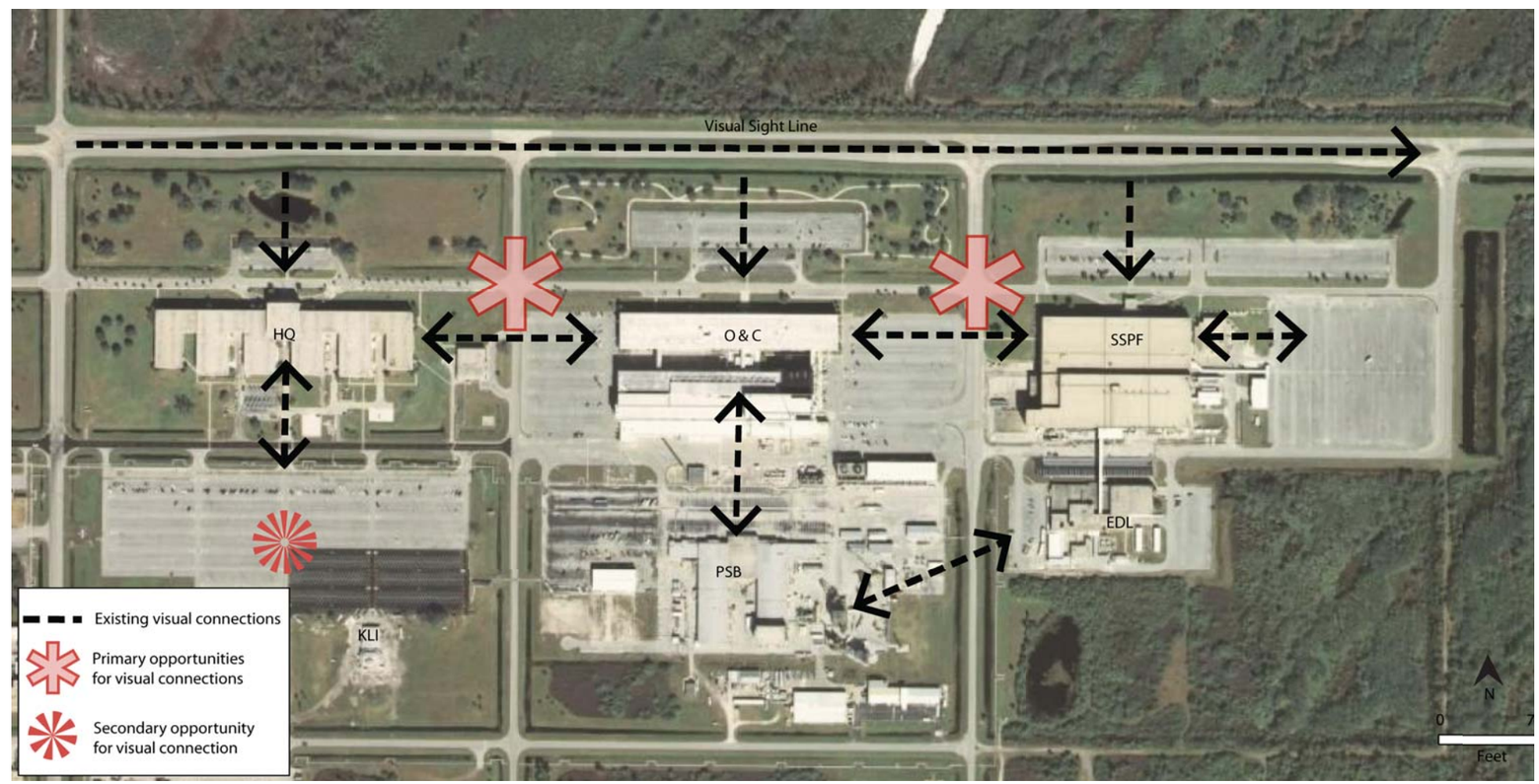


Figure 3.26 Short-distance Views

3.4.7 Line of Sight

Lines of sight (LOS) are invisible lines that observe, monitor, or communicate with a near or distant object. The potential buildable sites at KSC contain approximately ten lines of sight. The lines originate from a single point and transmit a frequency aimed toward NASA launch sites and CCAFS (Cape Canaveral Air Force Station) sites. Figure 3.27 portrays the types of lines and their paths of travel through the KSC industrial area. The heights of the lines range from approximately 8 feet MSL (Mean Sea Level) to 72 feet MSL and are contained within an invisible cone. Lines of sight heights will aid in predicting the heights and placement of future facilities in the industrial area.

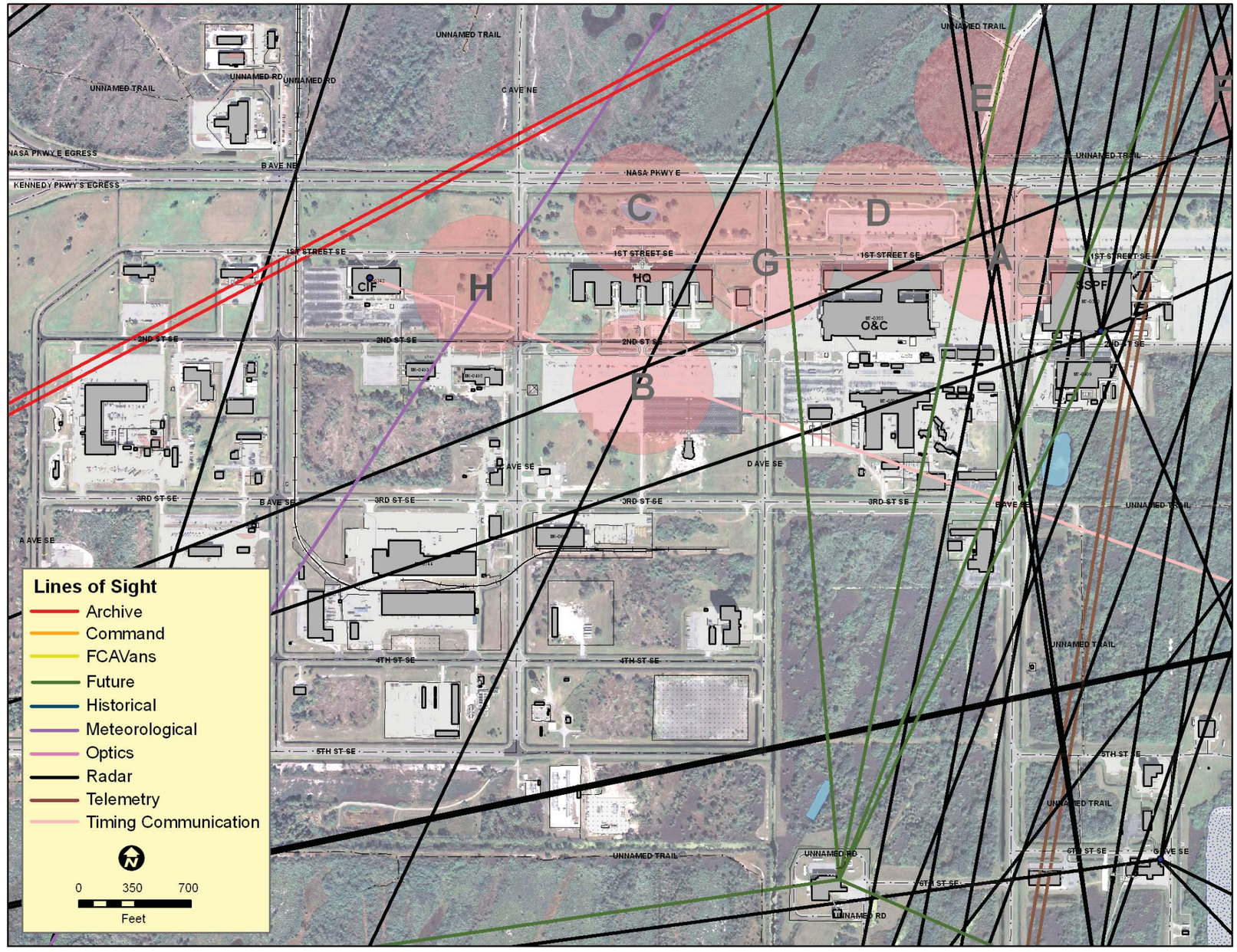


Figure 3.27 Lines of Sight

As of February 2009, there was limited line-of-sight data available to the project team to make an accurate determination of the impacts associated with each potential buildable site. Before a final building site is officially determined, a full LOS study should be undertaken to determine the origin locations, heights, distances, targets, and angles of projection.

3.4.8 Development Patterns

Development patterns are reoccurring growth trends pertaining to the built environment in an urban setting. These patterns are often a design standard used to promote a certain type of growth. In an urban environment, these patterns often come in the form of a square or rectangle. The square and rectangular shapes promote ease of accessibility and efficiency within the urban space.

Over the past 40 years, KSC's industrial area has seen a repeated rectangular growth pattern. This means the industrial area has been broken up into rectangular shapes, called blocks. Generally six blocks exist, with each block encompassing approximately 35 acres. The blocks are stacked in pairs of two, for a total of two rows. Each row encompasses approximately 175 acres, therefore, KSC's industrial area encompasses approximately 350 acres in total.

Streets separate the blocks and provide a border around each. The street intersections change direction at 90 degree corners providing efficient flow within the industrial area. Nine streets, with a combined length of approximately 14,400 feet (2.8 miles), are included in the industrial area. Three four-lane collector streets are provided off of NASA Parkway SE leading into the industrial area. The four-lane streets merge into two-lane streets approximately 0.5 miles once inside the industrial area.

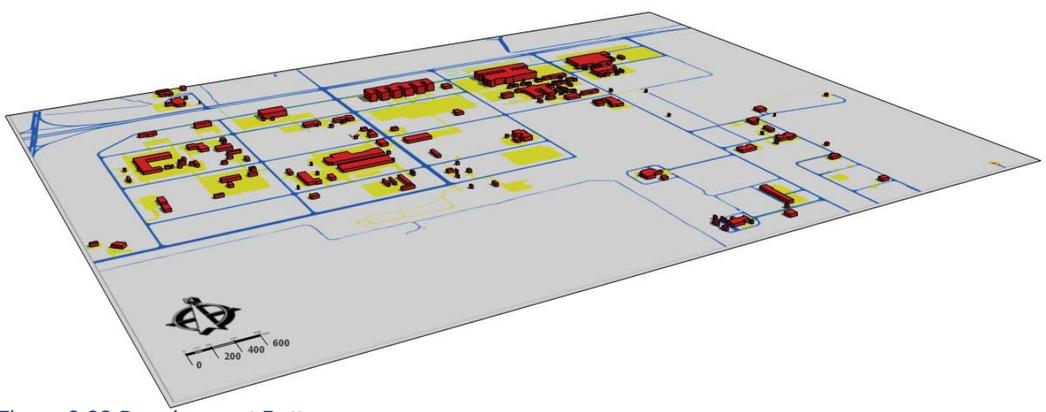


Figure 3.28 Development Patterns

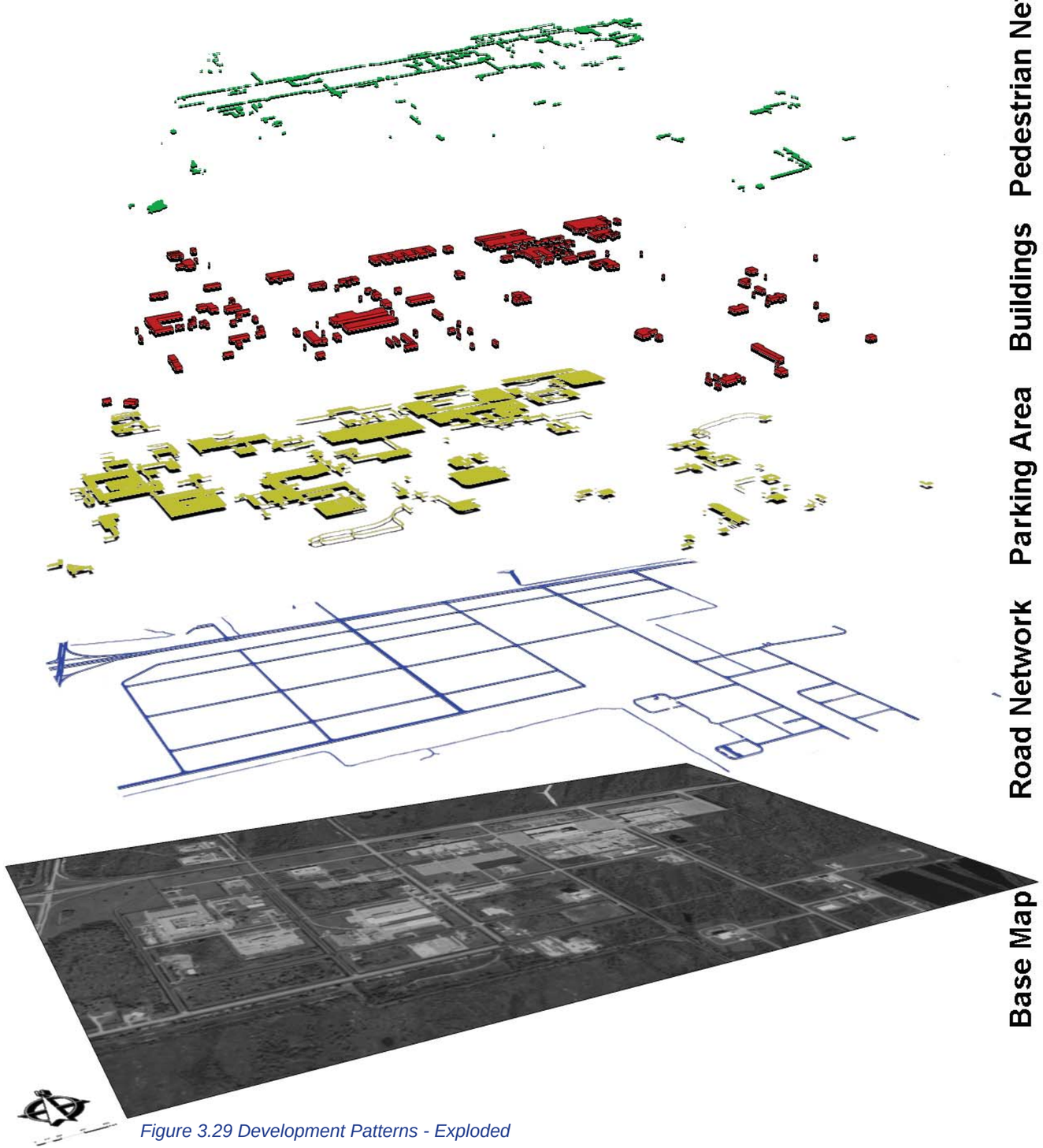


Figure 3.29 Development Patterns - Exploded

3.4.9 Utility Assessment

The purpose of this investigation is to analyze the existing site utilities in relation to the proposed development of an addition to the existing NASA headquarters or a new facility. It was established that the proposed population and building area of the eventual development will not increase from current levels. Therefore, the main focus of this analysis is to determine if utility systems exist in the areas where future demands will be placed upon them.

Jacobs analyzed four project options for the study. The first two options involve internal renovations to the existing Headquarters Building and will utilize existing utility connections. If one of these options is chosen, then a cursory review of the age and condition of utility lines will be performed to assure continued service.

The second two options include either an addition to the Headquarters Building, or the replacement altogether of this facility. With the fourth option, there are approximately eight general locations for the new Headquarters Building. Six of those locations are located in the industrial area. The industrial area is from NASA Parkway south to 3rd Street SE, and from west of the existing Headquarters Building east, to the east side of the O&C Building. The two other locations are north of NASA Parkway just east of the existing Headquarters Building and are designated as being outside the industrial area. Below is a summary of the findings of the site investigation and discussions with KSC team members. The summary breaks down each utility into industrial area locations and outside industrial area locations.

3.4.9.1 Communication

Industrial area locations: All core locations have existing communication service. Based on the conclusion mentioned above, along with discussions with KSC communications personnel, adequate supply is currently available for the redevelopment of the Headquarters Building. Figure 3.30 portrays the locations of communication utilities by proposed buildable areas.

Outside industrial area locations: the two locations will require service to be brought from the south right-of-way of the NASA Parkway.

3.4.9.2 Natural Gas

Industrial area locations: All core locations are currently supplied by existing natural gas service. Based on the aforementioned conclusion, along with discussions with KSC O&M personnel, an adequate supply is currently available for the redevelopment of the Headquarters Building. Additional information on future demands for gas will be needed to determine if any additional service will be required.

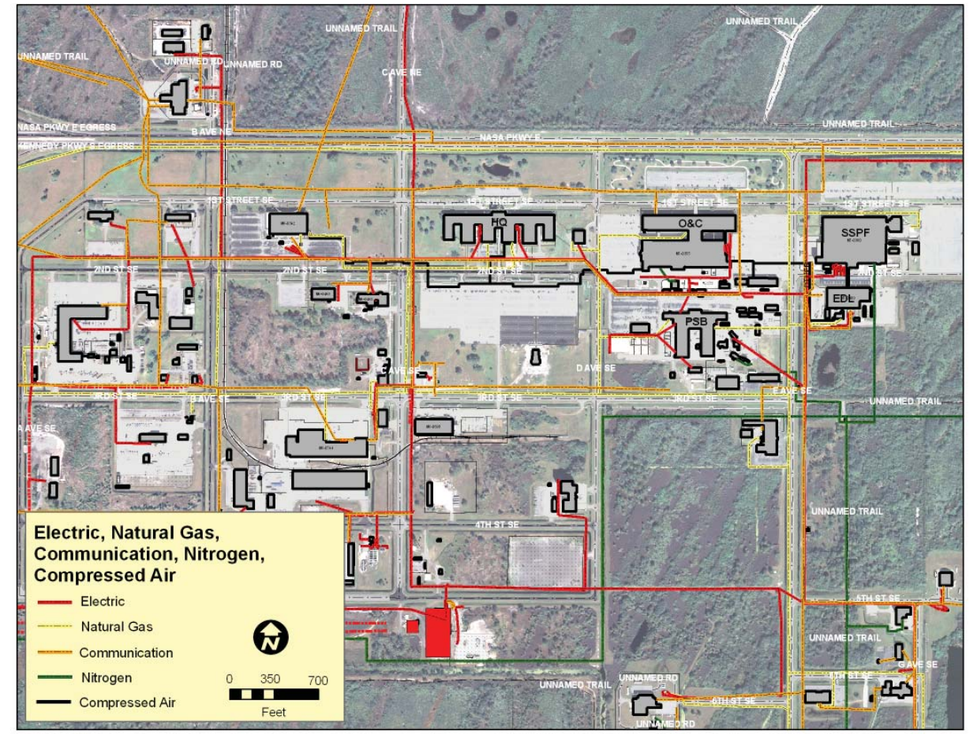


Figure 3.30 Utility Assessment Electric, Natural Gas, Communication, Fuel, Compressed Air

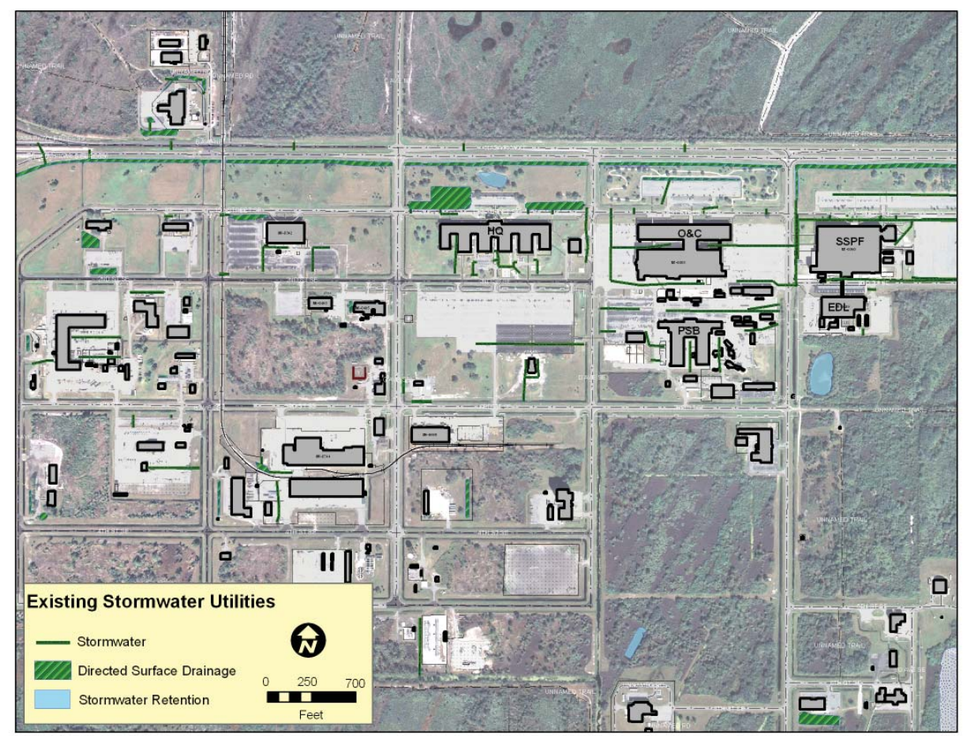


Figure 3.31 Utility Assessment Existing Stormwater Utilities

Figure 3.30 portrays the locations of natural gas utilities by proposed buildable areas.

Outside industrial area locations - the two locations will require service to be brought from across the NASA Parkway.

3.4.9.3 Nitrogen

Industrial area Locations: Existing nitrogen lines run along 3rd Street from the western end near Avenue “A”, east to East Avenue, and beyond. All major buildings within the study area have nitrogen service from this main line. As the analysis of the needs and demands for nitrogen are completed, the supply will be reviewed and revised as necessary. Figure 3.30 portrays the location of nitrogen utilities.

Outside industrial area locations: The two locations will require service to be brought from the south right-of-way of the NASA Parkway.

3.4.9.4 Electric

Industrial area locations: All core locations have existing electrical service. Based on the conclusion above, along with discussions with KSC personnel, adequate supply is currently available for the redevelopment of the Headquarters Building. Figure 3.30 portrays the locations of electric utilities by proposed buildable areas.

Outside industrial area locations: The two locations will require service to be brought from the south right-of-way of the NASA Parkway.

The existing utility system located near the Headquarters Building contains adequate capacity for it to remain fully operational while the potential new Headquarters facility is built and commissioned. The feeders would originate from existing load break switches located on the corner of D avenue and 1st Street. The work at the switch would require coordination with NASA contractors, who maintain the existing utility system. It is recommended that the new facility trench to the accepted location, and provide a new electrical switch, which would serve the new HQ Building. Once the existing HQ Building is demolished, the existing utility system would gain two additional feeders, which currently serve the existing HQ Building.

3.4.9.5 Heating and Cooling

Industrial area locations: All core locations have existing fuel service. Based on the assumption above, along with discussions with KSC personnel, adequate supply is currently available for the redevelopment of the Headquarters Building. Additional information on future demands for heating and cooling will be needed to determine if any additional service will be required. Figure 3.30 portrays the locations of heating and cooling utilities by proposed buildable areas.

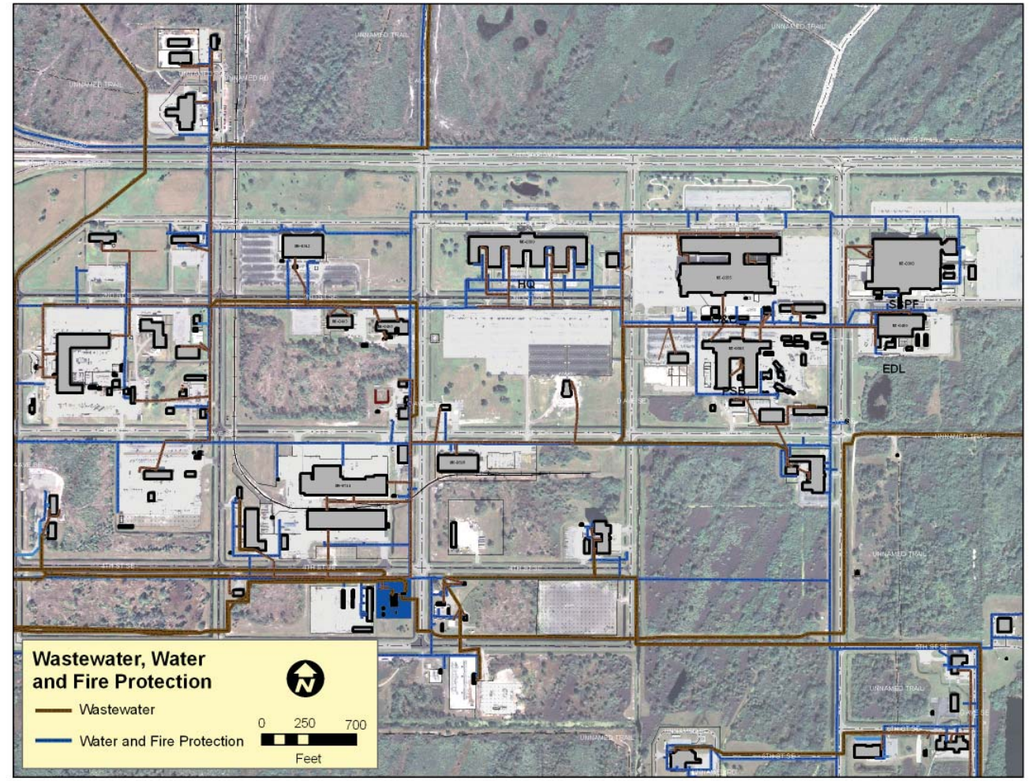


Figure 3.32 Utility Assessment Wastewater, Water, Fire Protection

Outside industrial area Locations: these two locations will require service to be brought from the south right-of-way of the NASA Parkway.

3.4.9.6 Compressed Air

Industrial area locations: All core locations have existing fuel service. Based on the conclusion above, along with discussions with KSC personnel, adequate supply is currently available for the redevelopment of the Headquarters Building. Additional information on future demands for compressed air will be needed to determine if any additional service will be required. Figure 3.30 portrays the locations of compressed air utilities by proposed buildable areas.

Outside industrial area locations: the two locations will require service to be brought from the south right-of-way of the NASA Parkway.

3.4.9.7 Stormwater

Industrial area locations: All prime building locations (sites A through D and G through H) have been included in the master stormwater basin area previously designed and permitted. The basin, within the core area, includes west to Avenue A, and east to Avenue E. The northern boundary of the basin is the NASA Parkway. The southern boundary of the developed portion of the basin is 5th Street. The runoff from the basin drains toward Avenue E into a roadside swale. This swale runs south to the storm water pond located at the south end of Avenue E. Refer to Figure 3.4 for reference. In areas with unlimited outfall, such as the one determined here, only treatment volumes are usually required to be calculated. The treatment volume takes into consideration the total basin area with no designation of pervious or impervious area, therefore, any redevelopment in this area will not require the expansion of the existing stormwater system. Furthermore, an underground stormwater utility system aids in the drainage of the impervious areas of the KSC industrial area. Figure 3.31 portrays the locations of underground stormwater utilities by proposed buildable areas.

Outside industrial area locations: The two locations (sites E and F) will require a study and the design of a new stormwater treatment system. This area is currently mostly undeveloped and also includes potentially environmentally sensitive areas. Given the existing system in the core area, these two locations would be both labor and time intensive to develop.

3.4.9.8 Wastewater

Industrial area locations: All core locations have existing wastewater lines. Based on the conclusion previously reached, along with a discussion with wastewater personnel, adequate supply is currently available for the redevelopment of the Headquarters Building.
The current plan has an 800k GPD capacity and is running at approximately 60 to 70 percent of capacity. Wastewater personnel are confident that adequate capacity exists for the scale of the potential redevelopment project. Figure 3.32 portrays the locations of water and fire utilities by proposed buildable areas.

Outside industrial area locations: The two locations will require service to be brought from the south right-of-way of the NASA. Parkway.

3.4.9.9 Water and Fire

Industrial area locations: All prime building locations (sites A-D, and G-H) have existing water and fire service lines. Service to existing buildings are fed from 14 inches to 18 inches mains. Based on the conclusions above, along with discussions with KSC water and fire personnel (KSC water system foreman), adequate supply is currently available for the redevelopment of the Headquarters Building. The W1 Water Pump Station, running at full capacity, has recently provided flow rates in excess of 3500 gpm: This confirms the adequate capacity. The KSC water supply is provided through the City of Cocoa. Figure 3.32 portrays the locations of water utilities by proposed buildable areas.

From discussions with fire protection personnel, several existing buildings currently located in this area do not have fire sprinkler systems. However, the current capacity in the water system will allow the addition of a sprinkler system to existing buildings, or the construction of a new building that would include a fire sprinkler system. This area also has adequate hydrant coverage. The existing spacing of hydrants varies due to the age of that portion of the system, as well as the infrastructure nearby. Facility personnel did mention that they have had minor issues with residual pressures on upper floors of updated buildings. The use of booster pumps may be necessary to provide adequate flow on floors three and above.

As the option to be developed is decided, an analysis of that option will be required to confirm that adequate flow and residual pressure will be available. The existing fire fighting equipment is currently limited to reach of six stories. If a new facility is constructed at any point that exceeds the reach of the existing equipment, new equipment may be required.

Outside industrial area locations: the two locations will require service to be brought from the south right-of-way of the NASA Parkway.

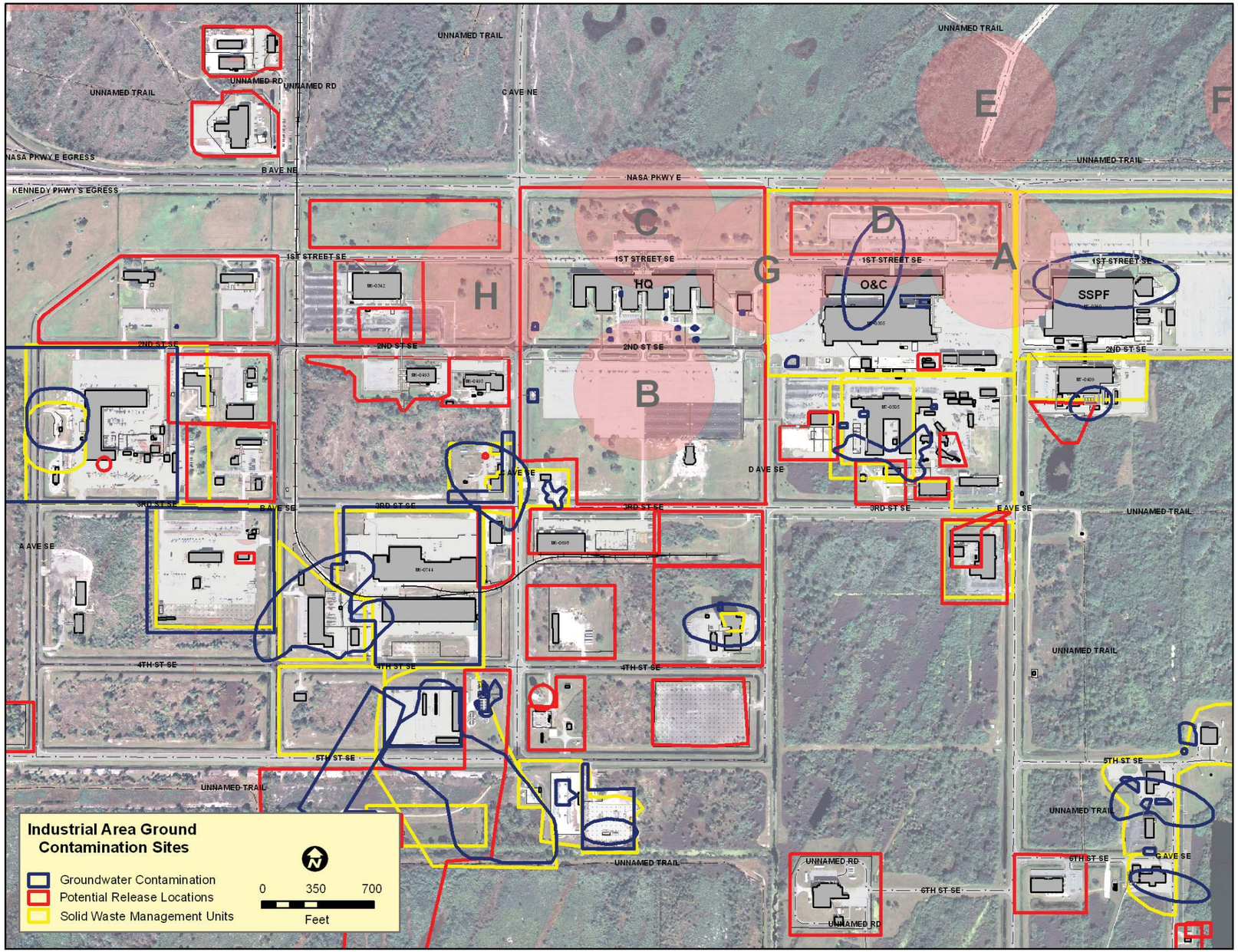


Figure 3.33 Ground Contamination

3.4.10 Ground Contamination Sites

Several ground contamination sites exists on KSC's industrial area. The largest concentrations exist near the O&C and SSPF and are outlined in three different categories including; groundwater contamination, potential release locations, and solid waste management units as Figure 3.33 portrays. All three categories exist within the industrial area. Plans to develop on these sites will require coordination with KSC environmental personnel. Groundwater contamination sites generally lie underneath a major building such as the O&C or SSPF. Potential release locations are also near major facilities and may contain toxic elements harmful to the environment when disturbed. Solid waste management units are generally located around major facilities and may contain buried solid waste.

Groundwater contamination, solid waste management units, and potential release locations affect sites A, D and G. Sites B, C, and H are predominately clear of solid waste management units, but lie within potential release locations. Sites E and F are completely outside of any potential contamination sites.

NASA is currently remediating or has plans to clean up contaminated sites prior to any construction that start before 2012. NASA has the ability to target specific sites, thus any currently contaminated sites would have no impact on future development.

	Contamination Type		
Site	GC	PR	SWMU
A	x	x	x
B		x	
C		x	
D	x	x	x
G		x	x
H		x	

GC = Groundwater Contamination
PR = Potential Release Locations
SMWU = Solid Waste Management Units

Note - Sites E and F have no detectable contaminates

Figure 3.34 Ground Contamination Table

3.4.11 Blast Arcs

Blast arcs portray maximum distance boundaries of disruption when a blast occurs at the Launch Equipment Test Facility (LETF). The LETF is currently situated for LH2 flow operations, not exceeding quantities of more than 13,000 gallons. At this quantity, the Payload Support Building (PSB) and Parachute Refurbishment Facility (PRF) are affected by an arc radius of 600 feet. Future Constellation GSE testing procedures may require additional LH2 storage on site with flow capacities of approximately 17,000 gallons. A majority of the O&C and a portion of the SSPF could be affected by a potential blast arc radius of 1200 feet. (See Figure 3.35) This information is based on a NASA Facility Plan for the LETF: *Launch Equipment Test Facility (LETF) Facility Plan* by Eric Ernst/DX-B as Part of Task Order 4MMS00335, May 2, 2006.

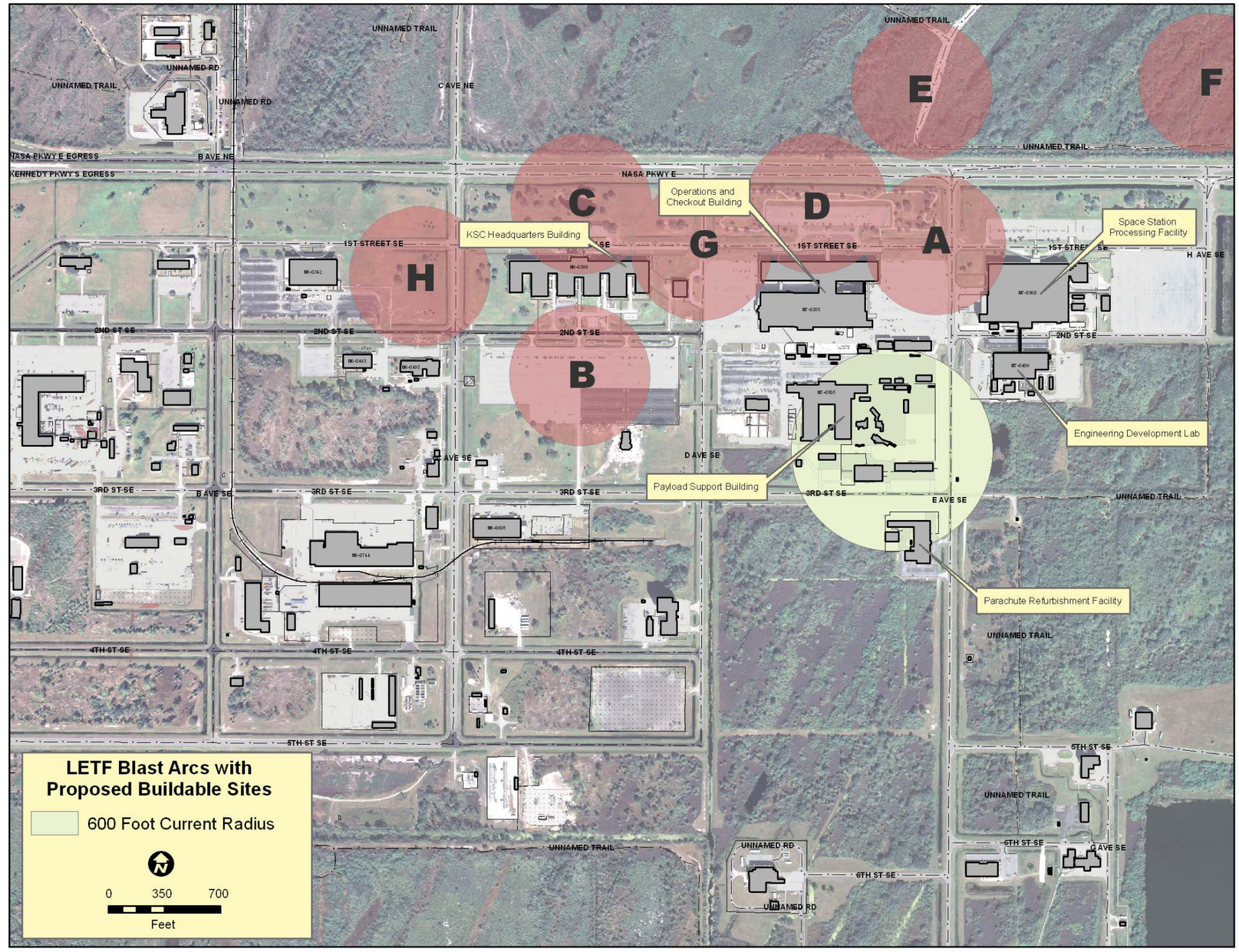


Figure 3.35 Blast Arcs

3.4.12 Opportunities and Constraints

In the event that the final recommendation involves an addition or new construction, there are eight existing, appropriate buildable sites at KSC. Each proposed buildable site poses its own unique opportunities and constraints for potential development or addition of the HQ Building. The eight potential sites are lettered A through H. Sites A through D, and G and H are within KSC's industrial area, while sites E and F lie outside the industrial area (See Figure 3.24).

Site A would make the HQ Building a prominent feature of the industrial area. This area would be good for a building addition or a new stand alone facility. Building in this area would aid in developing an enclosed, campus-like environment since the O&C and SSPF are nearby. It also poses an opportunity for phased development of the site. Utilities are already in place in site A and would only require connections along the main lines. The site is graded, but building on the site would require a large amount of fill in order to achieve a finished floor elevation comparable to existing surrounding facilities. The site would pose very little threat to vegetation or animal habitat. The site would require a large amount of existing roadway demolition and the relocation of a fitness trail. NASA Parkway would likely need to become rerouted to accommodate the new facility, causing a large scale vehicular circulation disruption. The site may pose security setback limitations if roadways were not reconfigured.

Site B is located directly behind the existing HQ Building, in what is currently a parking lot. This area would be good for a building addition onto the existing HQ Building or a completely new facility. The area contains a large amount of open space, providing adequate room for phased development and parking expansion. Utilities are already present, providing ease of connection. Minimal street circulation disruption would occur if this site were developed. Minimal vegetation and animal habitat permitting would be required in this location, as it is already a parking lot; security setbacks could also easily be met. If the HQ Building were placed in this location, it would not be a prominent feature in the industrial area, unless major roadways were reconfigured. Partial demolition of parking would have to occur if this site were chosen.

Site C is located directly in front of the existing HQ Building and would be a prime location for an existing building addition. The HQ would become a prominent feature of the industrial area, and currently provides space for expansion. There would be minimal vehicular circulation disruption if this site were chosen. Utilities are present, giving ease of future connection. Security setbacks would be non-restricted if the tertiary roadways were removed. Minimal ground fill would be required in this area. Habitat mitigation permitting in this area would be extensive, as a water retention pond exists in this area. A relocation of permitted parking spaces would also be required. Overall, however, this site would not be adequate to build a completely new HQ Building.

Site D contains many of the same characteristics as site A. The area is a good location for an addition onto the O&C Building, or constructing a completely new HQ Building. Developing a HQ facility on this site would make it a dominate feature in the landscape and provide an opportunity to phase its construction. A minimal security constraint would occur as long as roadways were realigned, which would be necessary to make room for the HQ Building. A large amount of ground fill would be needed to fill in the low lying areas, but the fill is readily available on site at a low cost. Partial habitat mitigation would be required on this site because part of the site being is across NASA Parkway. A large scale vehicular circulation disruption would occur if site D were to be developed. NASA Parkway would require relocation around the HQ Building. Parking relocation would also need to occur and the permit parking lot in front of the O&C would be eliminated. Additionally, a lengthy permitting process would occur, as disruption of the historic dune area north of NASA Parkway would likely occur. Facility utilities would also need to be developed in this area.

Site E is located on the north side of NASA Parkway. The site is only suitable for building a completely new HQ Building, as it contains a large amount of space, providing minimal security setback constraints if the area were to be developed. A large amount of ground fill would be needed in this area, especially in the very low lying areas. Intense permitting would be required to build in this area, as historic sand dunes are present. No utility infrastructure is present in this location, causing a longer construction time and overall higher cost. Large scale circulation disruption would occur as roadways would have to be relocated to gain access to the new HQ facility.

Site F is also located on the north side of NASA Parkway. The site is completely removed from the existing KSC industrial area. There is a large amount to space to build on, but it would require the removal of a large amount of vegetation. Incorporation of security setbacks would not be an issue in this area, as it is a very large space. Large amounts of ground fill would be needed to adequately build in this area. Intense habitat mitigation and permitting would be required in order to develop in this area. No existing utilities are present and a large scale vehicular disruption would occur. Historic sand dunes are also present, requiring permitting.

Site G is located within the existing KSC industrial area. The site contains excellent adjacencies to the existing HQ, O&C and SSPF Buildings, and would create a condensed, campus-like environment. The site has the ability to be phased as additions onto the exiting HQ, and building security setbacks are achievable. All required utilities are present and would only require new connections. Minimal vehicular or pedestrian circulation disruptions would occur if the site were to be developed. There are no historical or environmental permitting restrictions in this area. A possible constraint exists due to the HQ and O&C Buildings constraining the space. Security setbacks would be somewhat constrained if proper site surveying were not accomplished prior to construction. Demolition and relocation of existing parking lots and roads would be required in order to build in this area.

Site H is located between the existing HQ and the CIF Buildings. This site is suitable to be used for a building addition or a completely new HQ Building. A large amount of open space exists on site and gives the opportunity for a phased development. Minimum security, habitat, and vehicular circulation constraints exist in this area. Demolition of existing roadways and parking lots would be required to build on this site. The site has poor adjacencies to the existing HQ, O&C and SSPF Buildings.

3.5 Development Suitability

To further discuss the previous section, a site evaluation matrix was designed to evaluate the general land area encompassing each potential buildable site. The sites (A-H) are depicted in Figure 3.24. Four main evaluation criteria were used to determine the best buildable site on the site evaluation matrix. The criteria include form, function, economy, and time. The criteria are used to assess whether each proposed site contains the essential characteristics needed for future development. Each of the main evaluation criteria are broken into itemized secondary selection criteria and assigned an importance factor (IF) of 1=low, to 3=high. The numeric IF multiplier is incorporated into each site value and subtotaled (See Figure 3.36).

Form considers the site, environment, and quality of existing characteristics. Sites A and G ranked the highest because they both lie within the industrial area. The sites also provide a opportunity to build a condensed, campus-like environment. Sites E and F ranked the lowest due non-existing infrastructure and high efforts needed to environmentally remediate each site.

Function takes a look at the people, activities, and relationships between built entities of each site. Sites A, B, and G ranked the highest, with sites A and B tying. Site A contains a good adjacency to the O&C and SSPF, and site B contains a large amount of space for expansion and is also next to the existing HQ Building. Site G contains a good relationship adjacency between the existing HQ and O&C facilities and is also very close to the existing HQ Building.

Time is taken into account in order to understand any environmental or historical existing conditions. All the sites, with the exceptions of E and F, ranked high, meaning they are suitable for development from an environmental standpoint. The areas where sites A-D and G-H are located on previously developed and would require little mitigation of plants or animals, and do not threaten historic landscape features.

Form, function and time are important factors to consider when attempting to site a new facility. Each criterion is assigned an importance factor which indicates and aids in determining the best suitable site for development as it is spread across the chart and totaled. Ultimately, the most suitable site stands out by achieving the highest total score. Periodically, a tie occurs between multiple sites requiring further analysis. Further investigations will determine the overall best site at KSC for HQ development, however, site G, which lies in the vicinity of the current HQ and O&C, is the primary site for development according to site suitability, if the final recommendation is to include an addition or new construction.

Site

				A		B		C		D		E		F		G		H	
		Selection Criteria	IF	Value	Total	Value	Total	Value	Total	Value	Total	Value	Total	Value	Total	Value	Total	Value	Total
FORM	Site, Environment, Quality	Neighborhood Context	**2**	3	6	3	6	3	6	2	4	1	2	1	2	3	6	2	4
		Topography	**1**	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
		Flood Zone	**1**	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
		Hydrology	**1**	2	2	2	2	2	2	2	2	1	1	1	1	2	2	2	2
		Soils	**1**	2	2	2	2	2	2	2	2	1	1	1	1	2	2	2	2
		Existing Vegetation	**1**	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
		Constituency Appeal	**3**	1	3	3	9	3	9	2	6	1	3	1	3	4	12	1	3
		Visibility	**2**	2	4	1	2	2	4	3	6	1	2	1	2	2	4	1	2
		Campus Environment	**3**	3	9	2	6	2	6	2	6	1	3	1	3	3	9	2	6
		Sub Total			**29**		**30**		**32**		**29**		**15**		**15**		**38**		**22**
FUNCTION	People, Activities, Relationships	Utilities	**3**	3	9	2	6	2	6	1	3	1	3	1	3	3	9	1	3
		Land Use Compatibility	**2**	3	6	2	4	2	4	2	4	1	2	1	2	3	6	2	4
		GOV Access	**1**	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
		Vehicular Access (POV)	**1**	2	2	2	2	2	2	2	2	2	2	2	2	3	3	2	2
		Public Transit Access	**1**	2	2	2	2	2	2	2	2	2	2	2	2	3	3	2	2
		Security (AT/FP)	**2**	2	4	3	6	1	2	1	2	4	8	4	8	2	4	1	2
		Land Availability / Buildable Acres	**2**	3	6	3	6	2	4	2	4	2	4	2	4	2	4	3	6
		Expansion/Flexibility	**2**	1	2	3	6	2	4	2	4	3	6	3	6	2	4	3	6
		Public Safety	**2**	3	6	2	4	2	4	3	6	4	8	4	8	3	6	3	6
		Blast Zones up to 1200 feet	**2**	1	2	2	4	3	6	3	6	3	6	3	6	2	4	3	6
		Site Configuration	**3**	3	9	3	9	2	6	1	3	1	3	1	3	3	9	3	9
		Lines of Sight	**3**	1	3	1	3	3	9	3	9	1	3	1	3	1	3	2	6
		Sub Total			**53**		**54**		**51**		**47**		**49**		**46**		**54**		**54**
TIME	Past, Present, Future	Environmental (NEPA)	**2**	1	2	3	6	2	4	1	2	1	2	1	2	1	2	3	6
		Historical Significance	**1**	1	1	2	2	1	1	2	2	3	3	3	3	1	1	3	3
		Sub Total			**3**		**8**		**5**		**4**		**5**		**5**		**3**		**9**
		Total Score			**85**		**92**		**88**		**80**		**69**		**66**		**95**		**85**
		Rank			**7**		**6**		**5**		**3**		**2**		**1**		**8**		**4**

Importance Factor (IF) - 1 = Low; 2 = Medium; 3 = High

Value Criteria - 1 thru 5 (1 = Least Desirable; 5 = Most Desirable)

Figure 3.36 Site Suitability Matrix

3.6 Basis of Planning

Information within the Basis of Planning identifies functions, components, and other land- or relationship-based requirements that are correlated to existing conditions and development suitability to achieve the proposed program of future facilities for KSC. The basis of planning also builds upon information gathered during the charrette, visioning sessions, existing conditions analysis, and program development/requirements analysis in support of developing the framework for the implementation plan. The basis of planning forms the solid foundation on which the planning parameters, development program, and concept development alternatives are constructed.

The proposed development program includes components that will need to be accommodated at KSC, as well as site-wide factors that affect the development suitability of the installation, either in its entirety, or in various specific locations.

3.6.1 Functional Adjacency Models

Functional relationships for the various land use elements will be presented in this report at the next phase. Such information serves as a foundation for determining the overall basis of master planning for KSC. A useful tool in developing the basis, is a functional land use adjacency matrix. The matrix will be developed to describe the expected critical adjacencies on the following categories:

- Low Adjacency/Desirability
- Medium Adjacency/Desirability
- High Adjacency/Desirability
- No Adjacency/Association: land uses/functions demonstrate no positive or negative associations and thus the relationship is neutral.
- Adverse Adjacency/Association: land use relationship is negative or adverse and adjacency should be avoided or minimized.

3.6.2 Functional Land Use Models

The adjacencies outlined in the above mentioned matrix will be transposed into functional land use models in the reports. In all, eight potential locations were identified for the KSC Central Campus Study. The functional land use models are non-site specific. Rather, the models are macro-level depictions that propose ideal functional relationships between planned and future organizations and activities. These relationships serve to enhance efficiency and optimize overall site utilization.

3.6.3 Development Program

The functional land use models reflect macro-level relationships across the various land use elements. A development program comprised of more detailed functions and activities to be accommodated at KSC is presented below. These activities do not necessarily reflect an individual building, but rather potential components of a multi-function building, or, if large enough, a building of its own. The development program is comprised of four functional component categories. These categories are combined and summarized in chart form (See Figure 4.4 in Section 4). Categories and sub-components under each category are as follows.

Major Components

- Administration
- Mission Related
- Assembly
- Research
- Maintenance/Industrial
- Recreation/Physical Training

Support Components

- Climate Controlled and Uncontrolled Storage
- POV Parking
- GOV Parking
- Crash/Fire/Rescue
- Cooling towers/ Chillers
- Fuel Point
- Utilities/Communications

Ancillary Components

- Recreation
- Visitor/ Gift Shop
- Others
- Library
- Cafeterias

Relocated Components

- O&C cafeteria relocation
- O&C Gift shop relocation
- O&C Gym/ Offices
- SSPF Cafeteria Relocation
- SSPF Gift Shop Relocation

Currently, there are four security gates. No additional gates will be provided at this time. The other secondary gates with limited activities should also be included to provide access to the property with reduced security improvements based on the intent and use of the gate.

3.6.4 Buildable Area Analysis

Buildable areas for future development take into consideration existing conditions and development suitability. Eight potential sites were preliminarily evaluated as the study moved forward into concept development (see Section 6). Numerous development parameters influence the determination of development suitability and buildable areas. These parameters include:

Development Controls and Setbacks: Setbacks from the property line fronting primary roads, as well as side and rear yard setbacks and setbacks from existing buildings are primary determinates of buildable areas. Any new facilities will incorporate DoD AT/FP criteria as deemed appropriate. (See Figures 3.10-3.12)

Topography: Steeper slopes present a constraint to development, which can also be mitigated via construction techniques and higher costs. Fortunately, the industrial area is relatively flat.

Hydrology: Stormwater runoff generally follows the topographic land form and may be altered by future development expansion. Existing storm water detention facilities may need to be relocated and/or reconfigured to accommodate future development expansion.

Utility Systems: Future development will need to consider potential re-routing of existing utilities, as well as their expansion. Tie-in points should be established, as well as the utility demand of the future development.

Open Space Relationship: A hierarchy of open spaces, including pedestrian gathering areas, should be connected by a network of pedestrian ways. Open Space/Landscaping ratios will be evaluated as part of the future design concepts.

- Buildable Area Scenario:
  - Total buildable area
  - Minus ROW
  - Set backs
  - AT/FP
  - Insert developable area graphic
  - Summary of the components of the chart

3.6.5 Site Evaluation Matrices

The following study shows the evaluation criteria that have been applied to each potential future site in order to determine the optimal site where the project could be located, if the final recommendation includes an addition or new construction. The evaluation criteria resulted from the KSC project team request, site pros and cons, and sustainable criteria. The study was guided by analyzing new concepts, renovation/addition sketches, and the evaluation criteria, paying special attention to the strengths and weaknesses of each site. The comparison between the two schedules shows how the evaluation criteria affect each site consideration differently. (See Figures 3.37-3.38)

The matrix provided applies a basic scoring system to simplify the evaluation of each site. A plus (+) is given to each site if the corresponding evaluation criteria are found to be applicable. Conversely, a minus (-) is given if the site does not meet the evaluation criteria, or it will be zero when an impact has minimal effect on the valuation.

Renovation And Addition

The study was guided by analyzing new concepts, renovation/addition sketches and the evaluation criteria, paying special attention to the strengths and weaknesses of each site, not only to determine the best site, but also the preferable action to take.

Following this evaluation exercise, each site achieved positive scores. The matrix shows the eight sites with their associated total scores in terms of their suitability. The following positive and negative issues will affect the site selection.

Positive issues:

- If there is an addition: Make it adjacent to the existing HQ Building. The proximity allows for a compact development, connectivity and a campus concept
- Use the addition to create connections, green spaces and walking distance reduction
- Facility reuse: This allows for the facility functionality to improve, for resource conservation and to gain sustainable aspects

Negative issues:

- Increased costs overtime: Maintenance issues, systems that need improvement, structural repairs
- Functions forced into a form: Shape of the building may not accommodate the potential tenants and their function
- “Have/Have Not”: There may be an issue among employees that want to work in the new facility

The schedules show that the three highest scores are: Site G renovation/addition, followed by Site G and D new concepts:

- Site G Renovation/addition: Compact development, creation of green spaces, campus concept, parking and services proximity, and building connection with a reduced automobile dependence
- Site G New concept: Compact development, creation of green spaces, campus concept, parking and services proximity, building connection with a reduced automobile dependence, construction waste management, and sustainability
- Site D New concept: Sustainability, compact development, services proximity, reduced automobile dependence and pedestrian connectivity

New Concept

Following this evaluation exercise, each site achieved positive scores with the exception of Site H. The matrix shows that the sites with the most positive attributes are G and D, followed by A and C. The following positive and negative issues will affect the site selection.

Positive issues:

- Build to promote consolidation: Building a new facility allows KSC to create connections, green spaces, plazas and a campus concept
- Use new facility to create pedestrian connection: The new facility will be utilized as a connector to the new employee center, which will reduce walking distances
- The benefits of new construction:
  - Energy
  - Sustainability
  - Waste management
  - O&M
  - Quality of life

Negative issues:

- High initial costs: As shown on the cost spreadsheets (Refer to Section Seven) the initial costs may be higher, despite the possible of being offset by decreased O&M costs over time
- Demolition of historic and functional structure: The Headquarters is a building with a concrete structure that still functions properly. It is still functional despite needing a renovation to decrease the energy costs and improve its functionality

+	Applicable to the site
0	Minimum impact
-	Not applicable to the site

RENOVATION AND ADDITION

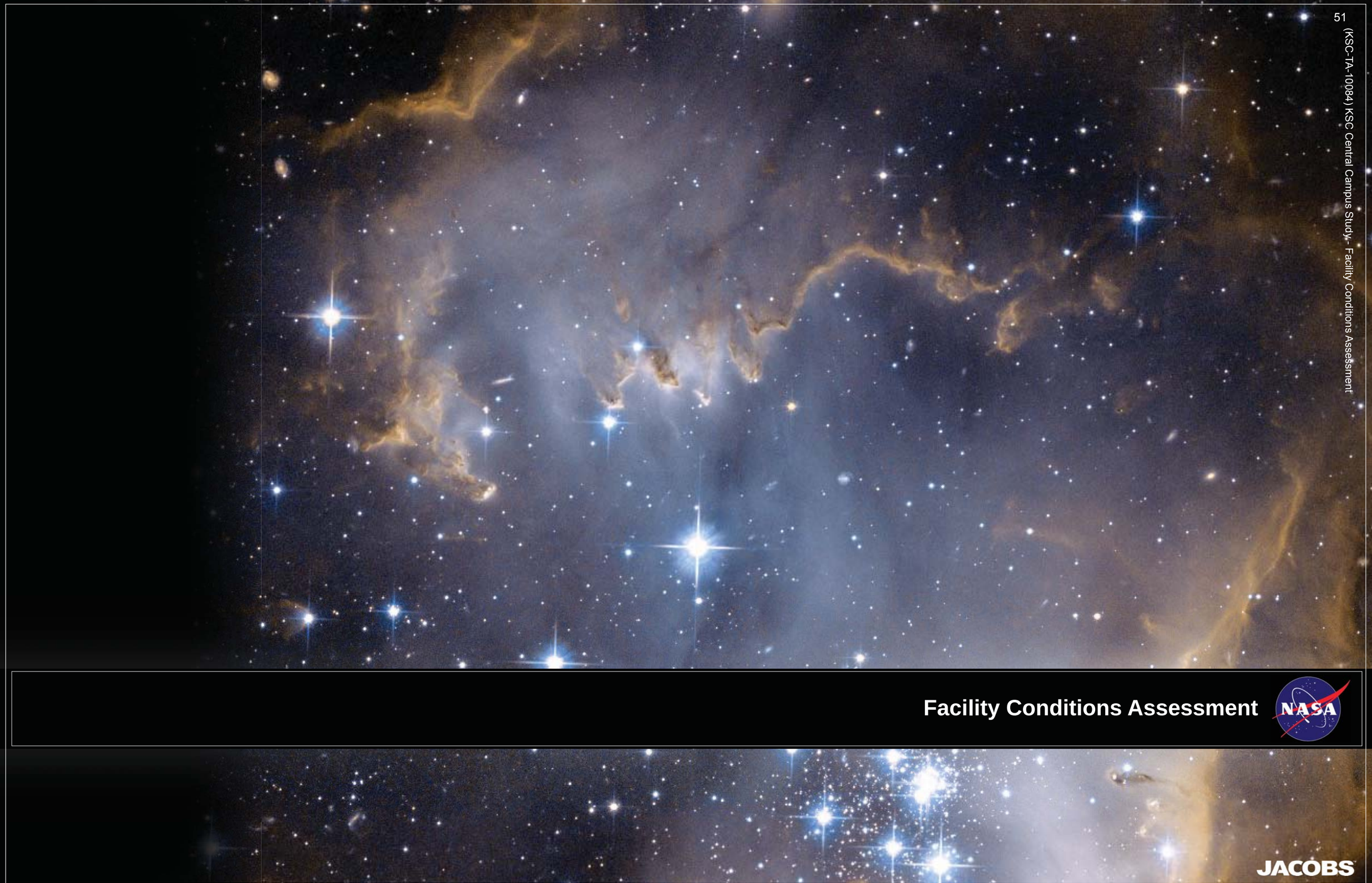
	EVALUATION CRITERIA	SITE A	B	C	D	G	H
1	DISTRIBUTION. Encourage an efficient building's distribution on the new concept study.	+	0	+	+	+	-
2	GREEN SPACE. Encourage the creation of green public space	+	+	+	+	+	+
3	CAMPUS CONCEPT. Composed by correlated buildings hosting different functions.	+	0	+	+	+	-
4	BACKFILL STRATEGY	+	0	+	+	+	+
5	NEW VEHICULAR PATH. Close the existing road in order to create connection between the building	+	+	+	+	+	+
6	ENERGY EFFICIENCY IN BUILDINGS. Design and construction of energy efficient buildings to reduce air, water and land pollution and environmental impacts from energy production and consumption.	+	+	+	+	+	+
7	NOT OBSTRUCTION TO ASTRONAUT PATH. The new facility building will not obstruct the astronaut path.	+	+	+	+	+	+
8	PARKING PROXIMITY. The parking area will be located in proximity of the new buildings in order to have a close access to the facility.	-	+	+	+	+	+
9	SUSTAINABILITY. Meeting the needs of the present without compromising the ability of future generations to meet their own needs. Use methods, systems and materials that won't deplete resources or harm natural cycles. Identification of a concept and attitude in development that looks at a site's natural land, water, and energy resources as integral aspects of the development. Sustainability integrates natural systems with human patterns and celebrates continuity, uniqueness and placemaking.	+	+	+	+	+	+
10	SERVICES PROXIMITY. Shares services will be located in proximity of the existing buildings to assure the use of those from the other facilities employees.	+	0	0	0	+	-
11	BUILDING CONNECTION. Encourage an efficient building connection between existing and new facilities.	-	0	0	0	+	-
12	IMAGE. New Headquarter will be a mark, a recognizable building on the site.	-	-	+	+	+	-
13	PREFERRED LOCATION. Encourage development within existing communities and developed places to reduce multiple environmental harms associated with sprawl. Reduce development pressure beyond the limits of existing development. Conserve natural and financial resources required for construction and maintenance of infrastructure.	+	+	+	0	+	0
14	AXIAL VIEW. New Headquarters design will pay attention to the axial view and the relationship between the new construction and the site.	+	-	+	+	0	0
15	PROXIMITY TO WATER AND WASTEWATER INFRASTRUCTURE. Encourage new development within and near existing communities in order to reduce multiple environmental impacts caused by sprawl. Conserve natural and financial resources required for construction and maintenance of infrastructure.	+	+	+	+	+	+
16	CONSTRUCTION WASTE MANAGEMENT. Divert construction and demolition debris from disposal in landfills and incinerators. Redirect recyclable recovered resources back to the manufacturing process. Redirect reusable materials to appropriate sites.	-	-	-	-	-	-
17	IMPERILED SPECIES AND ECOLOGICAL COMMUNITIES	0	0	0	0	0	0
18	WETLAND AND WATER BODY CONSERVATION	+	+	+	+	+	+
19	REDUCED AUTOMOBILE DEPENDANCE. Encourage development in locations that exhibit superior performance in providing transportation choices or otherwise reducing motor vehicle use.	+	+	0	+	+	-
20	COMPACT DEVELOPMENT. Conserve land. Promote livability, transportation efficiency, and walkability.	+	+	0	+	+	-
21	PEDESTRIAN CONNECTIVITY. Provide appealing and comfortable pedestrian street environments in order to promote pedestrian activity. Promote public health though increased physical activity.	+	0	0	+	+	-
22	ACCESS TO PUBLIC SPACES. To provide a variety of open spaces close to work and home to encourage walking, physical activity and time spent outdoors.	+	0	0	+	+	+
23	BUIDING REUSE AND ADAPTIVE REUSE. Extend the life cycle of existing building stock, conserve resources, reduce waste, and reduce environmental impacts of new buildings as they relate to materials manufacturing and transport.	+	+	+	+	+	+
24	HISTORIC. Improvement of the historic Headquarters asset.	+	0	+	0	+	-
25	ENVIRONMENTALLY SENSITIVE	-	+	+	+	+	+

Figure 3.37 Renovation/ Addition Matrix

NEW CONCEPT

	EVALUATION CRITERIA	SITE A	B	C	D	G	H
1	DISTRIBUTION. Encourage an efficient building's distribution on the new concept study.	0	+	+	+	+	-
2	GREEN SPACE. Encourage the creation of green public space	+	+	+	+	+	+
3	CAMPUS CONCEPT. Composed by correlated buildings hosting different functions.	+	+	+	+	+	-
4	BACKFILL STRATEGY	+	0	+	+	0	+
5	NEW VEHICULAR PATH. Close the existing road in order to create connection between the building	+	-	+	+	+	-
6	ENERGY EFFICIENCY IN BUILDINGS. Design and construction of energy efficient buildings to reduce air, water and land pollution and environmental impacts from energy production and consumption.	+	+	+	+	+	+
7	NOT OBSTRUCTION TO ASTRONAUT PATH. The new facility building will not obstruct the astronaut path.	+	+	+	+	+	+
8	PARKING PROXIMITY. The parking area will be located in proximity of the new buildings in order to have a close access to the facility.	0	+	+	0	+	+
9	SUSTAINABILITY. Meeting the needs of the present without compromising the ability of future generations to meet their own needs. Use methods, systems and materials that won't deplete resources or harm natural cycles. Identification of a concept and attitude in development that looks at a site's natural land, water, and energy resources as integral aspects of the development. Sustainability integrates natural systems with human patterns and celebrates continuity, uniqueness and placemaking.	+	+	+	+	+	+
10	SERVICES PROXIMITY. Shares services will be located in proximity of the existing buildings to assure the use of those from the other facilities employees.	+	-	-	+	+	-
11	BUILDING CONNECTION. Encourage an efficient building connection between existing and new facilities.	+	-	-	+	+	-
12	IMAGE. New Headquarter will be a mark, a recognizable building on the site.	0	0	+	+	+	-
13	PREFERRED LOCATION. Encourage development within existing communities and developed places to reduce multiple environmental harms associated with sprawl. Reduce development pressure beyond the limits of existing development. Conserve natural and financial resources required for construction and maintenance of infrastructure.	+	+	+	+	+	0
14	AXIAL VIEW. New Headquarters design will pay attention to the axial view and the relationship between the new construction and the site.	0	-	0	0	0	0
15	PROXIMITY TO WATER AND WASTEWATER INFRASTRUCTURE. Encourage new development within and near existing communities in order to reduce multiple environmental impacts caused by sprawl. Conserve natural and financial resources required for construction and maintenance of infrastructure.	+	+	+	+	+	+
16	CONSTRUCTION WASTE MANAGEMENT. Divert construction and demolition debris from disposal in landfills and incinerators. Redirect recyclable recovered resources back to the manufacturing process. Redirect reusable materials to appropriate sites.	+	+	+	+	+	+
17	IMPERILED SPECIES AND ECOLOGICAL COMMUNITIES	0	0	0	0	0	0
18	WETLAND AND WATER BODY CONSERVATION	+	+	+	+	+	+
19	REDUCED AUTOMOBILE DEPENDANCE. Encourage development in locations that exhibit superior performance in providing transportation choices or otherwise reducing motor vehicle use.	+	0	0	+	+	-
20	COMPACT DEVELOPMENT. Conserve land. Promote livability, transportation efficiency, and walkability.	+	0	+	+	+	-
21	PEDESTRIAN CONNECTIVITY. Provide appealing and comfortable pedestrian street environments in order to promote pedestrian activity. Promote public health though increased physical activity.	+	0	0	+	+	-
22	ACCESS TO PUBLIC SPACES. To provide a variety of open spaces close to work and home to encourage walking, physical activity and time spent outdoors.	+	+	+	+	+	+
23	BUIDING REUSE AND ADAPTIVE REUSE. Extend the life cycle of existing building stock, conserve resources, reduce waste, and reduce environmental impacts of new buildings as they relate to materials manufacturing and transport.	-	-	-	-	-	-
24	HISTORIC. Improvement of the historic Headquarters asset.	-	-	-	-	-	-
25	ENVIRONMENTALLY SENSITIVE	-	+	+	+	+	+

Figure 3.38 New Construction Matrix



Facility Conditions Assessment

JACOBS

4. Facility Conditions Assessment

4.1 Introduction

The existing conditions section establishes the physical baseline of the proposed study. This section of the report thoroughly explains the programmatic elements of the study. An in-depth review of all of the space types is explained and delineated by building. The report summarizes the identified Tenant List along with their functions. In this section, the Jacobs field team has captured the assessment findings along with narratives and photographs of critical areas. Organizational adjacencies have been graphically depicted and described, first by how they currently are located, and secondly, by how they ought to be in an optimal condition. The Directorate adjacency table was supplied by the KSC facilities team.

4.1.1 Methodology

Benchmarking/Efficiency Gains

1. Jacobs compared the current individual workspaces (private offices and workstations) and conference rooms within the Headquarters Building to three separate industry benchmarks:
- The Operations and Checkout (O&C) Building,
- A Federal Government Client, and
- A Private Commercial Client.
2. A weighted average was applied to the private office and workstation benchmarking to refine the calculation for office sizes/positions that are the most commonly used throughout the industry. Square footages are referenced in NSF (Net Square Feet), which is that area defined as gross square footage, less the space occupied by outside walls and interior partitions.
- Manager – Private Office
- Director – Private Office
- Non-Supervisory Employee – Open Workstation
- Secretary – Open Workstations
- Supervisory / Lead – Open Workstation
3. Private Office and Workstation Standards – Federal Government:
- Workstations:
  - Secretary = 60-70 NSF
  - Non Supervisory = 40-50 NSF
  - Non Supervisory / Technical = 60-70 NSF
  - Supervisory Lead = 90-100 NSF
- Private Offices:
  - Director = 220-240 NSF
  - Managerial = 140-160 NSF
4. Private Office and Workstation Standards – Private Commercial Industry:
- Workstations:
  - Secretary = 65-75 NSF
  - Non Supervisory = 50-60 NSF
  - Non Supervisory / Technical = 60-70 NSF
  - Supervisory Lead = 70-80 NSF
- Private Offices:
  - Executive = 290-310 NSF
  - Director = 220-240 NSF
  - Managerial = 140-160 NSF
5. Conference Room Industry Standards:
- Break Out (4 people) – Industry standard = 90-100 NSF
- Small (6-8 people) – Industry standard = 140-160 NSF
- Medium (8-10 people) – Industry standard = 200-250 NSF
- Large (12-18 people) – Industry standard = 350-400 NSF
- Large (16-25 people) – Industry standard = 400-500 NSF
- Multi-Purpose (up to 56 people) – Industry standard = 600 NSF
- Large Multi-Purpose (up to 70 people) – Industry standard = 750 NSF
6. Conference Room Standards – A Federal Government Client:
- Small Conference Room – Seats 6-8: 150 NSF. 1 per 75 people in facilities greater than 75 people
- Medium Conference Room – Seats 8-10: 225 NSF. 1 per 75 people in facilities greater than 75 people
- Large Conference Room – Seats 12-18: 375 NSF. 1 per 100 people in facilities greater than 100 people
- Small Multi-purpose Room – Seats 50 people: 600 NSF. 1 per 150 people in facilities greater than 150 people
7. Existing HQ Building Conference Rooms (number, size, and location) information was taken from the FSPA spreadsheet provided by NASA and dated 7.29.08.
8. Existing HQ Building "office" space information (overall square footage within building) was taken from the 7.29.08 FSPA spreadsheet. This information was used to calculate a square footage for possible space regain within the building by multiplying the overall square footage in the building (designated "office") by the benchmarking percentage (over industry).
9. See Section 8.4 for the Square Footage spreadsheet referencing these calculations.

Building Spreadsheets

1. The Program of Requirements for each building within the study will be calculated at a 1:1 ratio in terms of current square footage. The current footprint of each Directorate space and each Common Building Space (CBS) will be captured in the future plans. All future growth, if any, will be accommodated within the current square footage calculations.
2. All block plans shown at the charrette were prepared with information from the 7.29.08 FSPA spreadsheet. Each room number was located on the floor plans for the HQ, CIF, BOB, EHF, and OHF Buildings and an appropriate Directorate color code was applied to complete the block plans.
3. The block plans for all buildings within the study were reviewed at Charrette I. All Directorate locations were also verified in Charrette I.
4. Certain rooms were reclassified as Common Building Services (CBS) to offset the impact to a Directorate Density, such as removing the Cafeteria square footage from the TA Directorate density calculation. Examples of CBS rooms are:
- Cafeteria
- Printing
- Shared Conference Rooms
5. Jacobs prepared spreadsheets for each building that separated out the following items:
- Occupied Directorate Space
- Vacant Directorate Space
- Total USF by Directorate
- CBS Spaces
- Core Spaces
- Density by Directorate
6. Core Spaces consist of:
- Miscellaneous Spaces (rooms designated on the FSPA spreadsheet)
- Excluded Spaces (rooms designated on the FSPA spreadsheet)
- Building core spaces, such as lobby space, rest rooms, major building circulation, mechanical rooms and vertical shafts
- Existing HQ Building "office" space information (overall square footage within building) was taken from the FSPA spreadsheet provided by NASA and dated 7.29.08. This information is the basis of knowing what the overall square footage in the building is considered "office" and then applying the benchmarking percentage (over industry) to calculate the possible space regain
7. All USF totals on the Jacobs prepared spreadsheets are from AutoCAD electronic file takeoffs.
8. Directorate headcounts were provided by KSC via the 1400 report.
9. The block plans for all buildings within the study were reviewed at Charrette I. All Directorate locations were also verified in the charrette. Certain rooms were reclassified as CBS to offset the impact to a Directorate Density, such as removing the Cafeteria square footage from the TA Directorate density calculation.
10. Existing to remain items within the HQ Building were captured in the overall USF of the building within the HQ Building Summary spreadsheet.
11. Existing to Relocate and New to Program Facility Items were added to the Summary Program Information and Options Matrix spreadsheet.

12. Directorate Block Plans include all spaces designated by the FSPA spreadsheet as:

- Office
- Laboratory
- Tech Facility
- Conference
- Shop/Industry
- Storage

4.1.2 Benchmarking/Efficiency Gains

Jacobs compared the current individual workspaces (private offices and workstations) and conference rooms within the Headquarters Building to three separate industry benchmarks:

1. The Operations and Checkout (O&C) Building,
2. A Federal Government Client, and
3. A Private Commercial Client.

Individual Workspace (Enclosed Offices and Open Workstations)

Jacobs compared benchmarking data for private offices and workstations against the KNPR New Standard Position and Maximum Office Square Feet List. This list contains all positions at KSC and the range of offices sizes available to employees. During the charrette, Jacobs established that an average size of all office size ranges would be used as the basis of benchmarking for the HQ Building.

Position	Range of Office Size Square Feet	Average Size
Heads of Primary NASA & Contractor Orgs	150 - 360	255
Deputy Heads of Primary NASA & Contractor Orgs	150 - 300	225
Associate Director of Primary NASA & Contractor Orgs	110 - 190	150
Heads of 2nd-Level Directorates, Heads of Subcontractors	110 - 190	150
Deputy Heads of 2ns-Level Dirs., Dep. Heads of Subcontractors	110 - 190	150
Chiefs of Division / Office, Managers	110 - 190	150
Technical Assistants to Directors/Branch Chiefs	110 - 190	150
Supervisors	90 - 120	105
Leads, Non-Supervisors (GS-15)	90 - 110	100
Any other private office	90 - 110	100
Secretaries to Managers	120 - 140	130
Secretaries to Supervisors	70 - 90	80
General Staff	70 - 90	80

Figure 4.1 KSC Workplace Standards

(NASA language) Private office space is defined as space with floor-to-ceiling walls and a door. Private office space and maximum office sizes will be authorized and assigned as follows:

Position	Range of Office Size Square Feet (SQ M)	Average Size
General Staff	70 - 90	80
Non Supervisors GS-15, Leads	90 - 120	105
Supervisors, Senior Staff	110 - 190	150
Secretaries to Supervisors	70 - 90	80
Deputy Directors/Managers/Head of Primary Organizations	150 - 300	225
Directors/Managers/Head of Primary Organizations	150 - 360	255
Secretaries to Managers	120 - 140	130

Figure 4.2 KSC Workplace Standards

The NASA O&C Building utilizes the following space requirements for private offices and workstations:

- Workstations
  - All workstations = 75-85 NSF
- Private Offices:
- Type A = 350-375 SF
- Type B = 275-325 SF
- Type C = 175-200 SF
- Type D = 110-125 SF

Benchmarking data for a Federal Client shows the use of the following private office and workstation sizes:

- Workstations
- Secretary = 60-70 NSF
- Non Supervisory = 40-50 NSF
- Non Supervisory / Technical = 60-70 NSF
- Supervisory Lead = 90-100 NSF
- Private Offices:
  - Director = 220-230 NSF
  - Managerial = 140-160 NSF

Benchmarking data for a Private Commercial Client shows the use of the following private office and workstation sizes:

- Workstations
- Secretary = 65-75 NSF
- Non Supervisory = 50-60 NSF
- Non Supervisory / Technical = 60-70 NSF
- Supervisory Lead = 70-80 NSF
- Private Offices:
  - Executive = 290-310 NSF
  - Director = 220-240 NSF
  - Managerial = 140-160 NSF

Weighted Average

Comparing NASA data to the three benchmarks shows that NASA's office space could yield the same square footage results by utilizing more efficient workstations at a different size. To better refine this concept, Jacobs applied a weight to particular space types bases on industry standard sizes, i.e., the most popular positions within any industry are as follows:

- Manager – Private Office
- Director – Private Office
- Non-Supervisory Employee – Open Workstation
- Secretary – Open Workstations
- Supervisory / Lead – Open Workstation

Jacobs took the averages from these particular "weighted" space types and calculated that KSC could gain 19 percent more efficiency. This percentage was used in the "Summary Program Information and Option Matrix" within Section Four of this document (See Figure 4.3).

Conference Space

Jacobs compared the net area utilized by Parent Groups in the Headquarters Building to similar space utilized by three benchmarks. Currently, Parent Groups located in the Headquarters Building utilize approximately 1 percent additional conference space than the three combined benchmarks.

Jacobs gathered the NASA HQ conference room sizes from the NASA supplied FSPA spreadsheets (July 29, 2008) and tallied any room labeled "conference" in the space type classification column. Few existing HQ conference rooms were identical in size, and, because of this, Jacobs placed each room (and area) into a category as follows:

- Break Out (4 people) – Industry standard = 90-100 NSF
- Small (6-8 people) – Industry standard = 140-160 NSF
- Medium (8-10 people) – Industry standard = 200-250 NSF
- Large (12-18 people) – Industry standard = 350-400 NSF
- Large (16-25 people) – Industry standard = 400-500 NSF
- Multi-Purpose (up to 56 people) – Industry standard = 600 NSF
- Large Multi-Purpose (up to 70 people) – Industry standard = 750 NSF

The existing HQ conference rooms were placed into these categories according to industry standard, i.e., if a room in the HQ Building was 575 SF, then it was categorized as a "multi-purpose" room and compared to benchmarking data at 600 sf. All NASA existing conference rooms placed within this category "technique" were averaged to compare with benchmarking information.
NASA has rooms that are both undersized and oversized in comparison to benchmarking data, but the overall average is only one percent over the data for the O&C, Federal Client, and Private Commercial Client.

Direct Comparison with Federal Client

A direct comparison with the NASA HQ data and that of the Federal Client yielded quite a different calculation. The Federal Client utilizes a sophisticated system of calculating the number of conference rooms by size according to the overall headcount of the building, for purposes of site wide shared rooms. When applying this standard to NASA, KSC had 46 rooms with a total of 23,110 NSF, but using the Federal Client standard (benchmark) NASA would need 56 rooms with a NSF of 16,500 — more rooms with less space requirements. The details of the benchmarking can be found on the "Benchmarking Data" spreadsheet with Section 4.2.1 of this document.
If NASA adopted conference space standards similar to the standards of the Federal Client, then Parent Groups would utilize approximately 6,500 less NSF in the Headquarters Building.

In the overall programmatic requirements, Jacobs was able to associate efficiency gains with several categories. The office usage was calculated to gain upwards of a 19 percent efficiency resulting from the benchmarking study, and applied that number directly back to the base square footage. Food service gained efficiency in two ways. The first way stemmed from the efficiency of the total seating amounts. When combining several smaller cafeterias, the total seating capacity was able to be reduced by approximately 12 percent. Sharing of the kitchen equipment also contributed to the gain. Instead of utilizing several kitchens, Jacobs theoretically consolidated the equipment, which in turn saved some additional square footage. The conference spaces did not have any efficiency gains. The core facility of the potential addition was able to capitalize on the adjacency of the existing elevator towers to the stair towers. Another programmatic efficiency gain was between the gift shops and merchandise storage area. Consolidation enables operations to become more efficient with both staffing and the total square footage of the display space. With multiple existing gift shops at KSC, the total amount of square footage is large, though each of them are all selling the same items. Consolidation of the multiple spaces, and subsequent efficiency gains helped to identify ways of becoming more operationally efficient, with a possible reduction in programmatic square footage.

4.1.3 Security

Applicable Criteria

Two criteria govern the physical security requirements at NASA's Kennedy Space Center: (1)The NASA Procedural Requirements (NPR) 1620.3 entitled Physical Security Requirements for NASA Facilities and Property, and (2) the Director of Central Intelligence Directive (DCID) entitled DCID 6/9 Physical Security Standards for Sensitive Compartmented Information Facilities.

NPR 1620.3 outlines physical security requirements and responsibilities for safeguarding NASA assets. Its objectives are to:

1. Establish standardized physical security requirements for specific categories of NASA assets.
2. Base physical security requirements on an established physical security vulnerability risk assessment process, outlined in NPR 1620.2, "NASA Physical Security Vulnerability Risk Assessments," that allows Center management the flexibility to: (1) Prioritize assets based on their risk level and criticality to the overall mission, and (2) Tailor risk level 2 and 3 security requirements to meet local needs provided that risk level 1 or other more appropriate compensatory physical security enhancements have been implemented. Risk level definitions are as follows:
   - Risk Level I - Assignment of this risk level designation indicates that the asset has been appropriately assessed and, due to its criticality and attractiveness, determined to be at the lowest level of risk for threat by criminals, terrorists, protestors, or other aggressors
   - Risk Level II - Assignment of this risk level designation indicates that the asset has been appropriately assessed and, due to its criticality and attractiveness, determined to be at the mid-level of risk for threat by criminals, terrorists, protestors, or other aggressors
   - Risk Level III - Assignment of this risk level designation indicates that the asset has been appropriately assessed and, due to its criticality and attractiveness, determined to be at the highest level of risk for threat by criminals, terrorists, protestors, or other aggressors
3. Reduce loss, theft, misuse, and damage of NASA assets cost effectively.

NPR 1620.3 is applicable to NASA Headquarters and NASA Centers, including Component Facilities, to the Jet Propulsion Laboratory (JPL), and NASA contractors to the extent specified in their contracts. It is understood that the NPR 1620.3 document will be undergoing a revision to include many, if not all, of the requirements identified in Interagency Security Committee (ISC) security standards. On April 20, 1995, the day after the bombing of the Alfred P. Murrah Building in Oklahoma City, Oklahoma, the President directed the U.S. Department of Justice (DOJ) to assess the vulnerability of Federal office facilities to terrorism and other acts of violence. On June 28, 1995, DOJ issued the "Vulnerability Assessment of Federal Facilities" report (1995 Report) establishing Government wide facility security standards. The 1995 Report laid the foundation for all subsequent Interagency Security Committee (ISC) security standards documents. It also contained criteria for categorizing Federal office facilities into five security levels, with the number of Federal employees housed and the size of the facility being prominent criteria. The ISC relied on those same criteria for designating security levels in all subsequent documents.

In 2006, the ISC members agreed to update and coordinate all ISC standards published to date and consolidate them into one compendium. Since this issue had not been addressed since 1995, the first step was to review and update the standards for existing facilities as set forth in the 1995 Report. The ISC established the Existing Facilities Security Standards Working Group to accomplish that task. The working group determined that the process for designating a facility's security level needed updating, particularly in light of the increased threat made apparent by the terrorist attacks of September 11, 2001.

"Facility Security Level Determinations for Federal Facilities—an Interagency Security Committee Standard" (the Standard) defines the criteria and process to be used in determining the facility security level (FSL) of a Federal facility, a categorization which then serves as the basis for implementing protective measures under other ISC standards. Consistent with the authority contained in Executive

Order 12977, “Interagency Security Committee,” dated October 19, 1995, this Standard is applicable to all buildings and facilities in the United States occupied by Federal employees for nonmilitary activities. These include existing buildings, new construction, or major modernizations; facilities owned, to be purchased, or leased; stand-alone facilities, federal campuses, and, where appropriate, individual facilities on federal campuses; and special-use facilities.

The DCID 6/9 document identifies the physical security standards for the construction and protection of facilities for storing, processing, and discussing Sensitive Compartmented Information (SCI) which requires extraordinary security safeguards. Compliance with this DCID 6/9 is mandatory for all Sensitive Compartmented Information Facilities (SCIFs), including those that make substantial renovations to existing SCIFs.

A SCIF is an accredited area, room, group of rooms, buildings, or installation where SCI may be stored, used, discussed, and/or electronically processed. SCIFs will be afforded personnel access control to preclude entry by unauthorized personnel. Non-SCI indoctrinated personnel entering a SCIF must be continuously escorted by an indoctrinated employee who is familiar with the security procedures of that SCIF. The physical security protection for a SCIF is intended to prevent as well as detect visual, acoustical, technical, and physical access by unauthorized persons. Physical security criteria are governed by whether the SCIF is in the United States or not, according to the following conditions: closed storage, open storage, continuous operations, secure working area.

Existing Building Security System Discussion

Entry control into selected spaces/areas is provided by either mechanical push-button or digital push-button locks. However, in response to the Homeland Security Presidential Directive 12 (HSPD-12), NASA has begun to transition to a credential based entry control system. Homeland Security Presidential Directive 12 (HSPD-12) requires a Federal standard for secure and reliable forms of identification, as further defined by Department of Commerce regulations. All federal government employees and contractors are now transitioning to FIPS 201-1 compliant credentials–the Personal Identity Verification card, known as the PIV card.
As a result of the mandated migration to a FIPS 201-1 environment, NASA is beginning to transition from cipher locks to proximity card reader technology. The proximity system is an interim step until more FIPS 201-1 compliant readers become prevalent. The proximity card reader system is administered and managed through a security management system developed by Lenel. The Lenel OnGuard system is an integrated access control and alarm monitoring system. The Lenel system is administered from the JCCC (JBOSC Security Consoles). Intrusion detection system (IDS) devices are installed within select spaces where required by either the NPR or the DCID regulation. System alarms are transmitted via the OnGuard system to the JCCC.

4.1.4 NASA and Sustainability

Per the NASA Policy Directive (NPD 8820.2C), beginning in FY 2006, all new NASA building projects should be built at a certified level through the LEED Green Building Rating System, where a minimum of a Silver LEED rating is encouraged.

The general design philosophy as stated in the Directive also declares a commitment to sustainable design. It includes provisions for sustainable design, maintainable design, building commissioning, and safety, security and maximum benefits in occupants’ health and productivity.

Sustainability in building design, construction and operation is fundamental to providing a functional and efficient workplace for Federal work and superior value for the American taxpayer. The goal of NASA KSC Facilities Engineering Division is to design and construct sustainable and energy efficient facilities to support the Agency’s mission. The government wants to be part of transforming society’s perception of building ‘green’ so that it becomes the standard way of doing business. From excavation through construction, to occupancy, to use, the Federal government as a whole is committed to creating superior workplaces that reduce negative impacts on the environment, while enhancing the health and comfort of the building occupants.

4.2 Space Types

NASA utilizes the following space type classifications within the HQ, BOB, CIF, EHF and OHF Buildings:

Offices:
- Office Reception
- Regular Office
- Office Entrance
- Executive Suite
- Office Conf
- Office Files
- Office Support
- Office Break Area
- Transient Office
- Veh Flow Office

Laboratory:
- Life Science
- Elec/Electrl
- Mech/Opt/Flu
- Chemical Lab
- Medical Lab
- Calibration
- Pc Sustaining
- Photo/ Multi-Media

Tech Facility:
- Shuttle Proc
- Payload Proc
- Data Process
- Exp Veh Proc
- Control Room
- Launch Equip
- Flight Crew

Conference:
- Regular Conf
- Chart/Projct
- Classroom
- Temp Board

Shop/Industry:
- Shop Office
- Electronic
- Electrical
- Fluids/Gases
- Mech/Optical
- Automotive
- Life Support

Storage:
- A/C Whse
- Non A/C Whse
- Pol
- Record Stor
- Ordnance
- Org.Storage
- Hazd Waste
- Operational

Misc.Intln.Supt
- Inst Service
- Mat Svc Ctr
- Pub Exhibits
- Emp Services
- Const/Mods
- Docs/Pubs
- Print/Repro

Excluded Space
- Public Space
- Custdl/Serv
- Toilet
- Mech/El/Com
- Unusable
- Mothballed

For the purposes of this document, Jacobs has shown all block plans by building, by floor, by Directorate, via AutoCAD, and therefore has derived all calculations of block square footage from these takeoffs. This decision was discussed and decided upon by both NASA and Jacobs during Charrette I.

Based on AutoCAD takeoffs and feedback provided by Facilities department representatives during Charrette I, Jacobs calculated the area occupied by each Directorate in the Headquarters, BOB, CIF, EHF, and OHF Buildings, as well as spaces for specific facility items to be relocated to the HQ Building from the O&C, SSPF, and CIF Buildings.

All calculations for Occupied and Vacant Space include the following NASA space classifications (from the FSPA spreadsheet space type classification designations):
- Office
- Storage
- Conference
- Tech Facility
- Laboratory
- Shop/Industry

All calculations for Core spaces include the following NASA space classifications:
- Miscellaneous Spaces
- Excluded Spaces

Core Spaces also include:
- Building Core Areas, such as mechanical rooms and vertical shafts
- Major Building Circulation

* The floor plans on the following pages are for graphic representation only. They are not to scale.

LEGEND

- Conference
- Excluded Space
- Laboratory
- Misc. Install
- Offices
- Storage
- Tech. Facility
- Shop/Industry

N

NASA
Kennedy Space Center, FL
JFI Project #F5W93600

Existing Conditions - Space Type
HQ - 1st Floor

NASA HQ Building
M6-0399
1st Floor

LEGEND

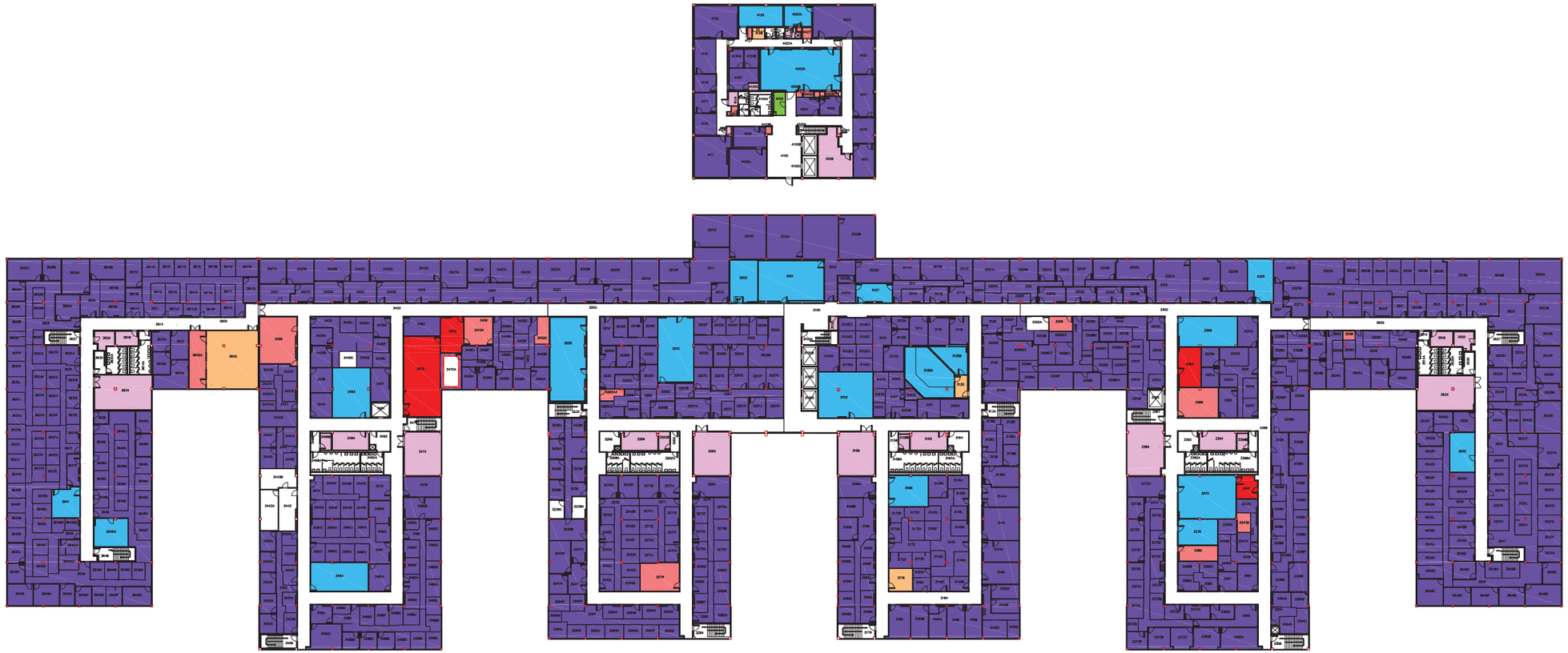
- Conference
- Excluded Space
- Laboratory
- Misc. Install
- Offices
- Storage
- Tech. Facility
- Shop/Industry

N

NASA
Kennedy Space Center, FL
JFI Project #F5W93600

Existing Conditions - Space Type
HQ - 2nd Floor

NASA HQ Building
M6-0399
2nd Floor



LEGEND

- Conference
- Excluded Space
- Laboratory
- Misc. Install
- Offices
- Storage
- Tech. Facility
- Shop/Industry

N

Existing Conditions - Space Type
HQ - 3rd Floor
HQ - 4th Floor

NASA
Kennedy Space Center, FL
JFI Project #F5W93600

NASA HQ Building
M6-0399
3rd Floor
4th Floor

JACOBS

4.2.1 Benchmarking Calculations

Jacobs compared the existing area (office and conference space only) located in the Headquarters Building to an average of the existing area of the O&C building and the workspace standards of Federal and Private Commercial Clients.

Benchmarking Data

Space Type	NASA KSC Headquarters			NASA KSC O&C	Federal Client			Private Sector	Average O&C, Federal, and Private Sector	% NASA Over / Under Average	Weighted % - Industry wide most commonly used spaces
Office	NSF	Quantity	Total NSF	NSF	NSF	Quantity	Total NSF	NSF	NSF		
Enclosed - Managerial / Executive	150			123	150			150	141	6% ⇧	19%
Enclosed - Director	225			181	225			225	210	7% ⇧	
Enclosed - Deputy Head / Vice-President	330			306	225			300	277	16% ⇧	
Enclosed - Head / President	440			369	225			300	298	32% ⇧	
Open - Non-Supervisory	80			79	48			54	60	25% ⇧	
Open - Non-Supervisory / Technical	80			79	64			64	69	14% ⇧	
Open - Secretary	80			79	64			64	69	14% ⇧	
Open - Secretary to Supervisor	80			79	64			64	69	14% ⇧	
Open - Secretary to Manager	130			79	64			64	69	47% ⇧	
Open - Non-Supervisory / Lead / Technical / Professional	105			79	96			75	83	21% ⇧	
Open - Supervisory / Lead	150			79	96			75	83	45% ⇧	
									Total Average	22% ⇧	
Conference	NSF	Quantity	Total NSF	NSF	NSF	Quantity	Total NSF	NSF	NSF		
Break-Out (4 people)	112	1	112	138	96	0	0	100	111	1% ⇧	
Small (6-8 people)	166	2	332	150	150	17	2,550	150	150	10% ⇧	
Medium (8-10 people)	244	9	2,196	300	225	17	3,825	225	250	-2% ⇩	
Large (12-18 people)	348	10	3,480	369	375	13	4,875	375	373	-7% ⇩	
Large (16-25 people)	510	6	3,060	500	450	0	0	varies	475	7% ⇧	
Multi-Purpose (up to 56 people)	589	5	2,945	700	600	9	5,400	varies	650	-10% ⇩	
Large Multi-Purpose (up to 70 people)	845	13	10,985	731	750	0	0	varies	741	12% ⇧	
		Totals	23,110			Totals	16,650		Total Average	1% ⇧	

Direct Comparison with Federal Client with established calculation of rooms to headcount:
23,110 - 16,650 = 6,460 Potential Gain in Conference Space NSF
28% decrease in space with total renovation and reorganization

Figure 4.3 Benchmarking Calculations

4.3 Overall Tenant List and Function

Summary Program Information and Option Matrix

Jacobs developed a summary spreadsheet, which outlines the combined amount of area in the HQ, BOB, CIF, EHF, and OHF Buildings across four options. (See Figure 4.4)

Specifically, the spreadsheet delineates the following:

- Space Types
- Total Occupied Useable Square Feet (USF)
- Total Vacant USF
- Total Common Building Systems (CBS) USF
- Total Core USF
- Area Requirements of:
  - Existing Facility Items to Remain in Headquarters Building
  - Existing Facility Items to Relocate to Headquarters Building
  - New Facility Items
  - New Core Space
  - Benchmarking Calculations
- Description of Options 1–4

Below are the descriptions of each option:

- Minor Renovations to Headquarters Building - includes existing area of Headquarters Building, excludes other buildings and benchmarking calculations
- Major Renovations to Headquarters Building - includes existing area of Headquarters Building, “regained” area from four additional buildings, new program requirements, and benchmarking calculations
- Major Renovations and Addition to Headquarters Building - includes existing area of and new addition to Headquarters Building, “regained” area from four additional buildings, new program requirements, new building core area, and benchmarking calculations
- All New Campus Concept - includes existing area of Headquarters Building and four additional buildings, new program requirements, and new building core area

* The floor plans on the following pages are for graphic representation only. They are not to scale.

Headquarters

CIF

OHF

BOB

EHF

Summary Program Information and Option Matrix

Space Types	Total Occupied USF (Office, Stor, Conf, Tech, Lab, Shop)	Total Vacant (USF)	Total CBS (USF)	Total Core (USF)	Area Requirements (NSF)	Quantity	Total USF	Headcount	Density per person	Total USF
Existing Conditions - By Building										
HQ	238,064	49,427	37,851	103,447			428,789	1,283	334	
BOB	12,147	1,622	0	6,302			20,071	103	195	
CIF	68,147	29,880	0	34,415			132,442	337	393	
EHF	5,770	1,398	0	3,799			10,967	50	219	**626,428**
Auditorium	9,224	0					9,224			
Industrial Area Support	15,449	0					15,449			
Electromagnetic Lab	9,486	0					9,486			
Existing Facility Items to Remain at HQ										
AV Storage					3,000	1	Square Footage included in the overall HQ count as shown above			
Printing + EDC					4,853	1				
Post Office					6,257	1				
Library					16,000	1				
Hair Shop					2,555	1				
Credit Union						1				
Lobby Display Space					1,685	1				
Snack Bar and Vending					1,742	1				
Exchange Services					178	1				
Cafeteria					10,279	1				
Gift Shop					1,005	1				
Existing Facility Items to Relocate to HQ										
Gift Shop (from O&C Building)					1,040	1	1,040			
Gift Shop (from SSPF Building)					1,136	1	1,136			**16,435**
Cafeteria (from O&C Building)					4,828	1	4,828			
Gym (from O&C Building)					9,431	1	9,431			
New Facility Items to Program										
Restaurant					3,000	2	6,000			
Gym (new)					6,000	1	6,000			**13,480**
Retail					1,480	1	1,480			
Benchmarking / Efficiency Gains										
New Construction									**83,197**	**12.7%**
Major Construction									**43,314**	**6.6%**
Remodeling									**43,314**	**6.6%**

Space Types	Options 1	Options 2	Options 3	Options 4
	Minor Renovations - 1:1, with no benchmarking calculations, and no other facility list items	**Major Renovations** - 1:1, with benchmarking calculations, with regained space to be decided by NASA for use in Existing to Relocate and New to Program Facility Items	**Major Renovations and Addition** - Two SF Calculations: 1:1 with Benchmarking, and 1:1 without Benchmarking. Core Space added for new Facility Items. Costs for existing renovation and new construction. Includes all Existing to Relocate and New to Program Facility Items.	**All New Campus Concept** - Two SF Calculations: 1:1 with Benchmarking, and 1:1 without Benchmarking. All Existing to Remain spaces without existing Core Space, but new overall 15%. Costs for all new construction. Includes all Existing to Relocate and New to Program Facility Items.
Existing Conditions - By Building	☒	☒	☒	☒
HQ	☒	☒	☒	☒
BOB	☒	☒	☒	☒
CIF	☒	☒	☒	☒
EHF	☒	☒	☒	☒
Auditorium	☒	☒	☒	☒
Industrial Area Support	☒	☒	☒	☒
Electromagnetic Lab	☒	☒	☒	☒
Existing Facility Items to Remain at HQ	☒	☒	☒	☒
AV Storage	Square Footage included in the overall HQ count	Square Footage included in the overall HQ count	Square Footage included in the overall HQ count	Square Footage included in the overall HQ count
Printing + EDC				
Post Office				
Library				
Hair Shop				
Credit Union				
Lobby Display Space				
Snack Bar and Vending				
Exchange Services				
Cafeteria				
Gift Shop				
Existing Facility Items to Relocate to HQ		☒	☒	☒
Gift Shop (from O&C Building)		☒	☒	☒
Gift Shop (from SSPF Building)		☒	☒	☒
Cafeteria (from O&C Building)		☒	☒	☒
Gym (from O&C Building)		☒	☒	☒
New Facility Items to Program		☒	☒	☒
Restaurant		☒	☒	☒
Gym (new)		☒	☒	☒
Retail		☒	☒	☒
Benchmarking / Efficiency Gains		☒	☒	☒
New Construction				☒
Major Construction		☒		
Remodeling			☒	
Total Required SF by Options	**626,428**	**613,029**	**656,343**	**656,343**
			OR	**OR**
Minus Efficiency Gains			**613,029**	**573,146**

Notes:
* - EDL (Building , Mechanical, and Storage) has been removed from the project calculations
** - Study data does not support relocation

Figure 4.4 Program and Option Matrix

4.3.1 Building Summary - HQ

Jacobs developed spreadsheets that outline the existing area of the Headquarters Building.

Specifically, each spreadsheet delineates the following items based on Parent Group and building:

- Existing Headcount
- Existing Area (Occupied and Vacant)
- Existing Common Building Systems and Core
- Existing Density (USF per person)

Building Calculations - HQ

Building	Floor			Parent						Common Building Systems and Core					Density	Comments
	Floor	Total Headcount	Total USF (Parent + CBS + Core)	Parent	Headcount	Occupied USF (Office, Stor, Conf, Tech, Lab, Shop)	Vacant (USF)	Parent Subtotal USF	Total USF Parent	CBS	CBS Room	CBS USF	CBS Subtotal USF	Core Subtotal USF	Per Person	Core space includes major building circulation, excluded spaces, miscellaneous spaces, and building core spaces.
HQ	1	259	139,356	BA	10	1,144	375	1,519	80,261	Shared Conference Rooms	Conference Room	372	24,808	34,287	152	Shared Building Amenities include:
				CC *	1	203	767	970							970	AV Storage @ 3,000 NSF within TA space
				GG	5	1,579	0	1,579							316	Exchange Services @178 within TA space
				IT	27	6,312	2,217	8,529							316	Library @ 16,000 NSF within TA space
				MSFC	4	1,396	437	1,833		Shared Building Amenities	Hair shop	2,555			458	EDC @ 1,003 NSF within TA space
				NE	5	489	0	489			Credit Union				98	
				OP	12	2,080	74	2,153			Cafeteria	10,279			179	
				SPACEPORT	3	0	1,150	1,150			Gift Shop	1,005			383	
				TA	185	43,418	17,086	60,504			Print Shop	3,850			327	
				UB	3	118	943	1,061			Vending / Snack	490			354	
				VA	2	0	0	0			Post Office	6,257			0	
				XA	2	474	0	474							237	
	2	484	137,393	AA	1	379	0	379	102,951	Shared Conference Rooms	Conference Room	492	5,388	29,054	379	
				AJ	8	1,508	0	1,508			Conference Room	842			189	
				BA	52	266	0	266			Conference Room	814			5	
				CC	15	15,933	1,600	17,533			Conference Room	351			1,169	
				GG	106	14,795	2,440	17,235			Conference Room	519			163	
				IT	77	14,133	4,139	18,271			Conference Room	1,260			237	
				KT	4	510	0	510			Conference Room	488			128	
				NE	3	108	410	518			Conference Room	622			173	
				OIG	18	4,327	864	5,191		Shared Building Amenities					288	
				OP	66	10,959	2,696	13,655							207	
				PH	38	9,977	239	10,216							269	
				SA	36	6,756	0	6,756							188	
				SPACEPORT	35	0	0	0							0	
				TA	25	8,292	2,621	10,913							437	
	3	526	142,597	AA	4	1,643	0	1,643	98,181	Shared Conference Rooms	Conference Room	301	7,655	36,761	411	
				GG	22	1,653	184	1,837			Conference Room	1,133			84	
				JSC	1	0	0	0			Conference Room	522			0	
				KT	50	7,945	1,569	9,514			Conference Room	975			190	
				LX	2	135	0	135			Conference Room	1,269			68	
				MK	13	5,019	303	5,322			Conference Room	223			409	
				NE	189	29,820	3,352	33,172			Conference Room	327			176	
				OP *	1	267	0	267			Conference Room	564			267	
				PH	10	1,078	70	1,148			Conference Room	780			115	
				SA	52	10,849	765	11,614			Conference Room	308			223	
				SPACEPORT	98	0	0	0		Shared Building Amenities	Vending / Snack	1,252			0	
				TA **	52	22,567	4,500	27,067							521	
				VA	1	0	0	0							0	
				XA	31	5,931	531	6,462							208	
	4	18	9,443	AA	16	5,850	97	5,947	6,098	Shared Rooms			0	3,345	372	
				OP *	1	135	0	135							135	
				XA *	1	16	0	16							16	
Totals		**1,287**	**428,790**				**49,427**		**287,491**				**37,851**	**103,447**	**197**	

*** -** The overall headcount for HQ from the 1400 report is 1,283. 1,287 is shown on this spreadsheet because CC (1st Floor), OP (3rd Floor), OP (4th Floor), and XA (4th Floor) have no headcount from the 1400 report, but square footage is shown on the floor plan. In order to get a density calculation, one person had to be added under the headcount column for each of the four groups to complete the equation.

**** -** "Unassigned" employee headcount of three from the 1400 report has been added to the TA headcount on the 3rd Floor of this spreadsheet.

NOTE: All square footage calculations on this spreadsheet are from AutoCAD take-offs.

Figure 4.5 Building Calculations - HQ

LEGEND			
BA	MSFC	TA	MK
CC	NE	UB	OIG
DOD	Spaceport	XA	AF
GG	OP	AA	AJ
IT	PH	LX	Core/Circ
KT	SA	VA	Shared

N

NASA
Kennedy Space Center, FL
JFI Project #F5W93600

Existing Conditions - Directorates
HQ - 1st Floor

NASA HQ Building
M6-0399
1st Floor

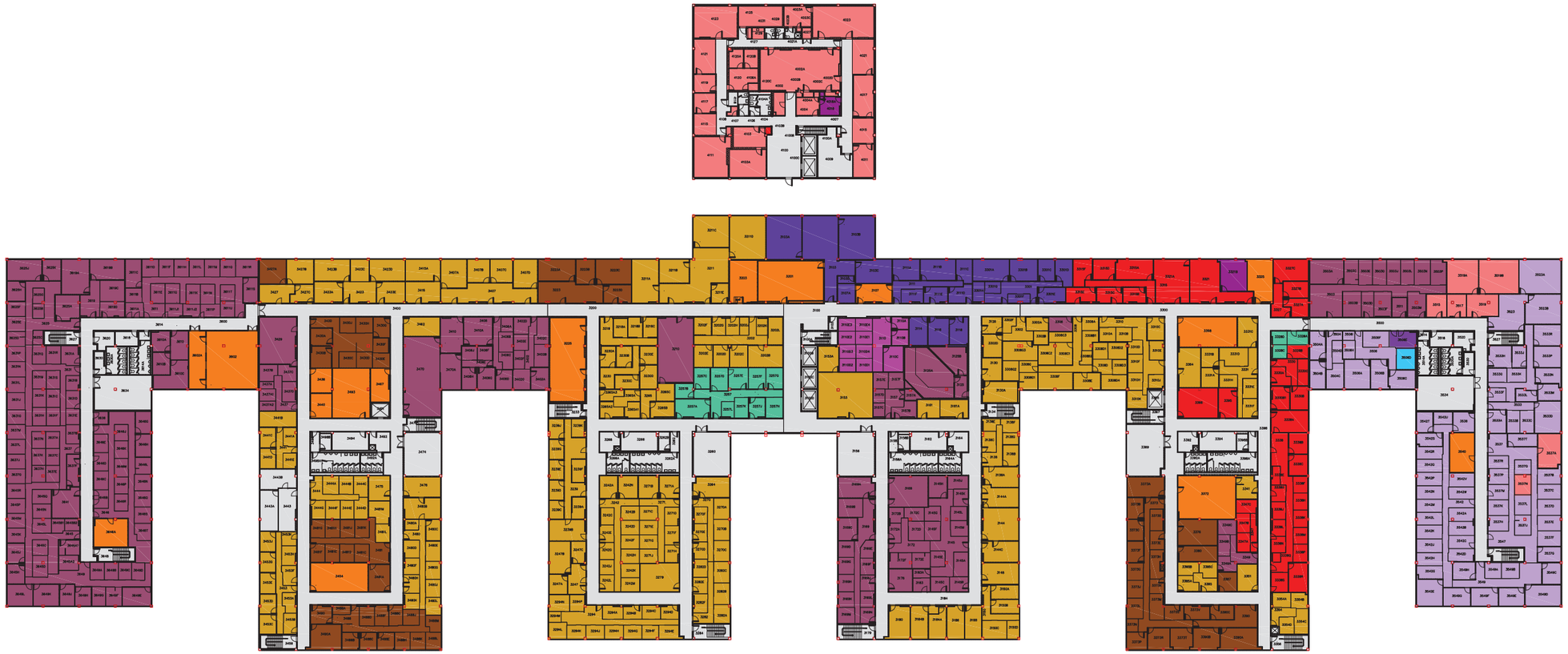
LEGEND			
BA	MSFC	TA	MK
CC	NE	UB	OIG
DOD	Spaceport	XA	AF
GG	OP	AA	AJ
IT	PH	LX	Core/Circ
KT	SA	VA	Shared

N

NASA
Kennedy Space Center, FL
JFI Project #F5W93600

Existing Conditions - Directorates
HQ - 2nd Floor

NASA HQ Building
M6-0399
2nd Floor



LEGEND			
BA	MSFC	TA	MK
CC	NE	UB	OIG
DOD	Spaceport	XA	AF
GG	OP	AA	AJ
IT	PH	LX	Core/Circ
KT	SA	VA	Shared

N

Existing Conditions - Directorates
HQ - 3rd Floor
HQ - 4th Floor

NASA
kennedy Space Center, FL
JFI Project #F5W93600

NASA HQ Building
M6-0399
3rd Floor
4th Floor

4.3.2 Building Summary - CIF

Jacobs developed spreadsheets that outline the existing area of the CIF Building.

Specifically, each spreadsheet delineates the following items based on Parent Group and building:

- Existing Headcount
- Existing Area (Occupied and Vacant)
- Existing Common Building Systems and Core
- Existing Density (USF per person)

Building Calculations - CIF

Building	Floor			Parent						Common Building Systems and Core					Density	Comments
	Floor	Total Headcount	Total USF (Parent + CBS + Core)	Parent	Headcount	Occupied USF (Office, Stor, Conf, Tech, Lab, Shop)	Vacant (USF)	Parent Subtotal USF	Total USF Parent	CBS	CBS Room	CBS USF	CBS Subtotal USF	Core Subtotal USF	Per Person	Core space includes major building circulation, excluded spaces, miscellaneous spaces, and building core spaces.
CIF	1	60	44,501	IT	9	1,587	536	2,123	28,804	Shared Rooms		0	0	15,697	236	
				PH	11	4,207	4,247	8,454							769	
				SA	2	0	0	0							0	
				TA	37	13,519	4,708	18,227							493	
				VA	1	0	0	0							0	
	2	110	43,972	IT	62	9,082	5,109	14,191	34,626	Shared Rooms		0	0	9,346	229	
				PH	5	1,693	467	2,160							432	
				TA	41	13,114	4,176	17,290							422	
				USAF *	1	985	0	985							985	
				XA	1	0	0	0							0	
	3	168	43,969	IT	132	17,292	5,306	22,598	34,597	Shared Rooms		0	0	9,372	171	
				PH	19	4,520	3,337	7,857							414	
				TA	16	2,061	1,994	4,055							253	
				VA	1	87	0	87							87	
Totals		**338**	**132,442**				**29,880**		**98,027**				**0**	**34,415**	**321**	

*** -** The overall headcount for CIF from the 1400 report is 337. 338 is shown on this spreadsheet because USAF (2nd Floor) has no headcount from the 1400 report, but square footage is shown on the floor plan. In order to get a density calculation, one person had to be added under the headcount column for each of the four groups to complete the equation.

NOTE: All square footage calculations on this spreadsheet are from AutoCAD take-offs.

Figure 4.6 Building Calculations - CIF

LEGEND

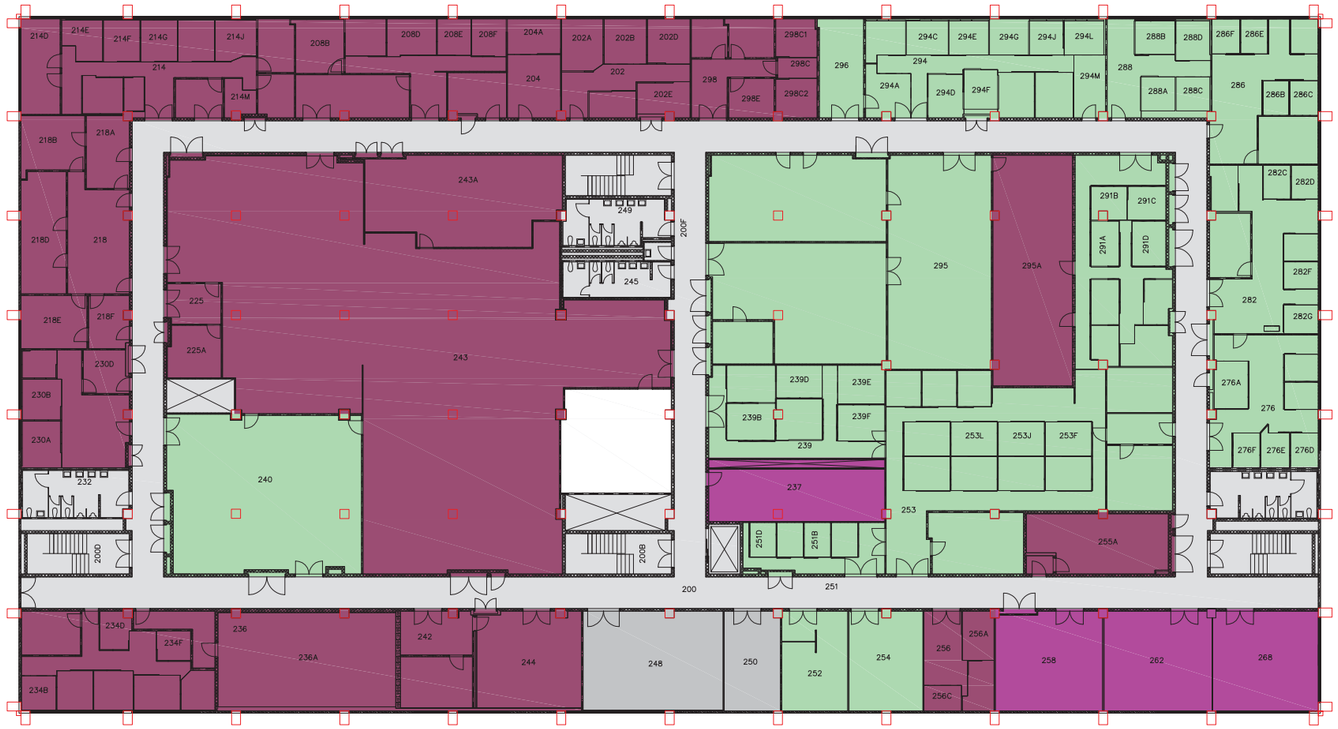
- TA
- PH
- SA
- XA
- VA
- IT
- Core/Circ

N

NASA
Kennedy Space Center, FL
JFI Project #F5W93600

Existing Conditions - Directorates
CIF - 1st Floor

NASA CIF
M6-0342
1st Floor



LEGEND

- TA
- PH
- SA
- XA
- VA
- IT
- Core/Circ

N

NASA
Kennedy Space Center, FL
JFI Project #F5W93600

Existing Conditions - Directorates
CIF - 2nd Floor

NASA CIF
M6-0342
2nd Floor

JACOBS

LEGEND

- TA
- PH
- SA
- XA
- VA
- IT
- Core/Circ

N

NASA
Kennedy Space Center, FL
JFI Project #F5W93600

Existing Conditions - Directorates
CIF - 3rd Floor

NASA CIF
M6-0342
3rd Floor

4.3.3 Building Summary - BOB

Jacobs developed spreadsheets that outline the existing area of the BOB Building.

Specifically, each spreadsheet delineates the following items based on Parent Group and building:

- Existing Headcount
- Existing Area (Occupied and Vacant)
- Existing Common Building Systems and Core
- Existing Density (USF per person)

Building Calculations -BOB

Building	Floor			Parent						Common Building Systems and Core					Density	Comments
	Floor	Total Headcount	Total USF (Parent + CBS + Core)	Parent	Headcount	Occupied USF (Office, Stor, Conf, Tech, Lab, Shop)	Vacant (USF)	Parent Subtotal USF	Total USF Parent	CBS	CBS Room	CBS USF	CBS Subtotal USF	Core Subtotal USF	Per Person	Core space includes major building circulation, excluded spaces, miscellaneous spaces, and building core spaces.
BOB	1	45	10,057	OP	7	1,228	715	1,943	6,722	Shared Rooms		0	0	3,335	278	
				TA **	37	4,206	573	4,779							129	
				XA	1	0	0	0							0	
	2	58	10,014	TA	58	6,713	334	7,047	7,047	Shared Rooms		0	0	2,967	122	
Totals		**103**	**20,071**				**1,622**		**13,769**				**0**	**6,302**	**132**	

** - "Unassigned" employee headcount of two from the 1400 report has been added to the TA headcount on the 3rd Floor of this spreadsheet.

NOTE: All square footage calculations on this spreadsheet are from AutoCAD take-offs.

Figure 4.7 Building Calculations - BOB

LEGEND

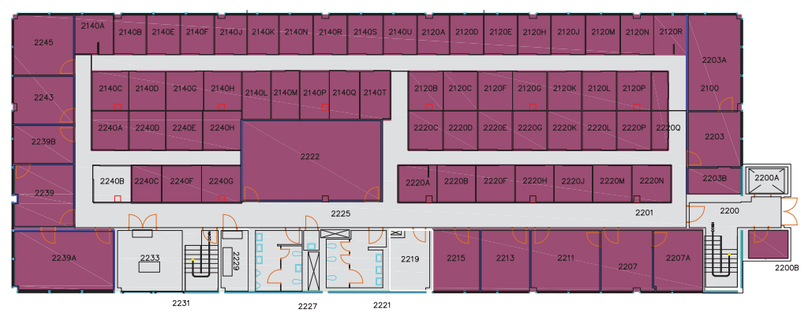
- TA
- OP
- Core/Circ

N

NASA
Kennedy Space Center, FL
IFI Project #F5W93600

Existing Conditions - Directorates
BOB - 1st Floor

NASA BOB
M6-0339
1st Floor



LEGEND

- TA
- OP
- Core/Circ

N

NASA
Kennedy Space Center, FL
JFI Project #F5W93600

Existing Conditions - Directorates
BOB - 2nd Floor

NASA BOB
M6-0339
2nd Floor

JACOBS

4.3.4 Building Summary - EHF

Jacobs developed spreadsheets that outline the existing area of the EHF Building.

Specifically, each spreadsheet delineates the following items based on Parent Group and building:

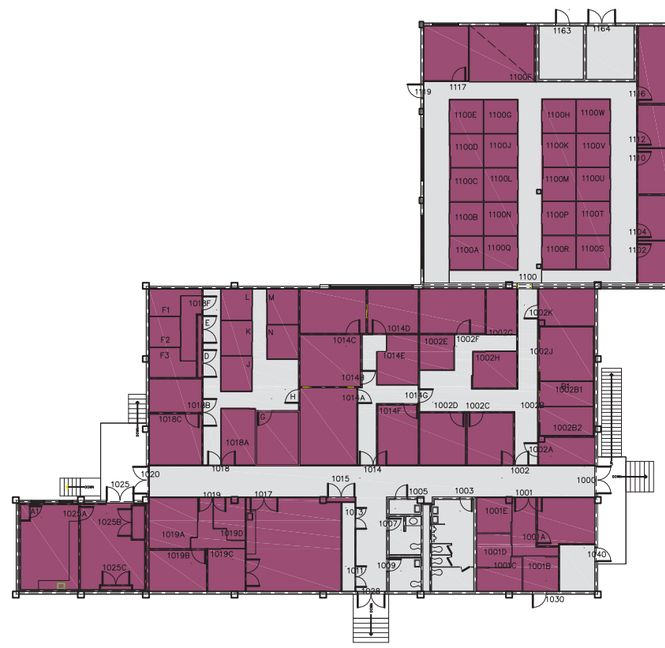
- Existing Headcount
- Existing Area (Occupied and Vacant)
- Existing Common Building Systems and Core
- Existing Density (USF per person)

Building Calculations - EHF

Building	Floor			Parent						Common Building Systems and Core					Density	Comments
EHF	Floor	Total Headcount	Total USF (Parent + CBS + Core)	Parent	Headcount	Occupied USF (Office, Stor, Conf, Tech, Lab, Shop)	Vacant (USF)	Parent Subtotal USF	Total USF Parent	CBS	CBS Room	CBS USF	CBS Subtotal USF	Core Subtotal USF	Per Person	Core space includes major building circulation, excluded spaces, miscellaneous spaces, and building core spaces.
	1	50	10,967	TA	50	5,770	1,398	7,168	7,168	Shared		0	0	3,799	143	
Totals		**50**	**10,967**				**1,398**		**7,168**				**0**	**3,799**	**143**	

NOTE: All square footage calculations on this spreadsheet are from AutoCAD take-offs.

Figure 4.8 Building Summary - EHF



LEGEND

TA

Core/Circ

N

NASA
Kennedy Space Center, FL
JFI Project #F5W93600

Existing Conditions - Directorates
EHF

NASA EHF
L7-1557

JACOBS

4.3.5 Building Summary - OHF

Jacobs developed spreadsheets that outline the existing area of the OHF Building.

Specifically, each spreadsheet delineates the following items based on Parent Group and building:

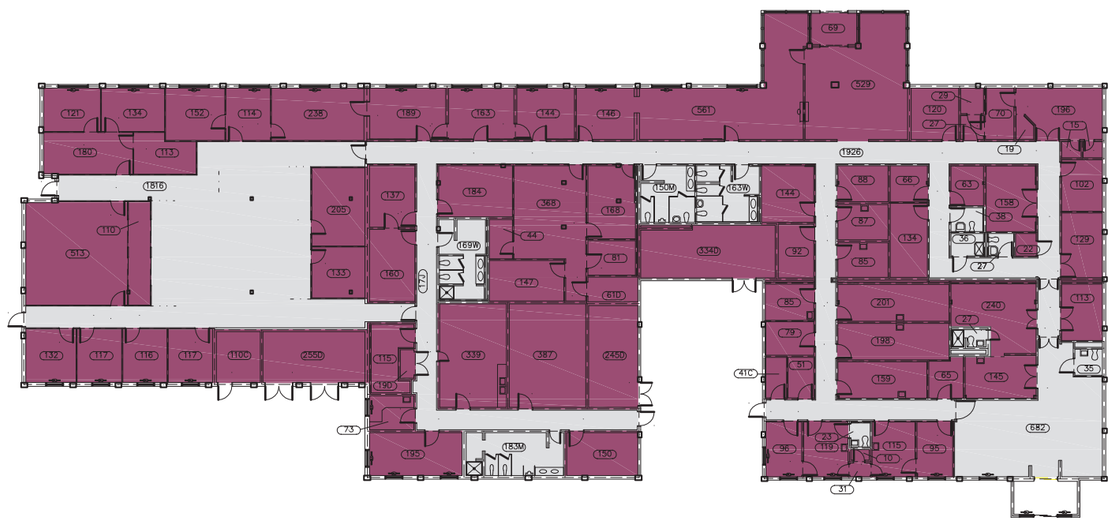
- Existing Headcount
- Existing Area (Occupied and Vacant)
- Existing Common Building Systems and Core
- Existing Density (USF per person)

Building Calculations - OHF

Building	Floor			Parent						Common Building Systems and Core					Density	Comments
OHF	Floor	Total Headcount	Total USF (Parent + CBS + Core)	Parent	Headcount	Occupied USF (Office, Stor, Conf, Tech, Lab, Shop)	Vacant (USF)	Parent Subtotal USF	Total USF Parent	CBS	CBS Room	CBS USF	CBS Subtotal USF	Core Subtotal USF	Per Person	Core space includes major building circulation, excluded spaces, miscellaneous spaces, and building core spaces.
	1	30	18,035	TA	30	12,167	0	12,167	12,167	Shared		0	0	5,868	406	
Totals		**30**	**18,035**				**0**		**12,167**				**0**	**5,868**	**406**	

NOTE: All square footage calculations on this spreadsheet are from AutoCAD take-offs.

Figure 4.9 Building Calculations - OHF



LEGEND

TA

Core/Circ

N

NASA
Kennedy Space Center, FL
JFI Project #F5W93600

Existing Conditions - Directorates
OHF

NASA OHF
M6-0495

JACOBS

4.4 Facilities Breakdown

4.4.1 Operations & Checkout Building (O&C)

Building Summary

The Operations and Checkout (O&C) Building (M7-0355) is a five-story, concrete structure with a built-up roof containing 604,912 square feet of offices, laboratories, astronaut crew quarters and spacecraft assembly areas that was built in 1964. The NASA Checkout, Assembly and Payload Processing Services contract holder is the primary user of the south wing of the O&C Building. M7-0355 actually consists of two buildings that are connected by elevated crossovers. The three-story North Building is primarily office space for CAPPS and other contractor personnel. The South Building contains a clean room that runs the entire length and height of the building where horizontally integrated payloads are received, assembled and integrated.

Architecture

The kitchen is in serviceable condition and it is not in need of an upgrade. The dining room will need accessibility improvements. This high ceiling room with large windows could be used for either a conference room function, or for office space if it were vacated by the cafeteria.

Mechanical

The building is cooled by a central chilled water system.

Gift Shop:
This area is served by the building main air handling system. The area is controlled by a VAV terminal with a wall mounted sensor. There is no designated rest room for this area.

Cafeteria and Bake Shop:

The area is served by the building main air handling system and is controlled by a VAV system. The HVAC system in the kitchen hood area appears to be inadequately sized to control the humidity in the area. Humidity levels were approximately 75% RH. Several wet spots in the existing ceiling indicate either supply air insulation leakage or roof damage. All hoods were installed in 2006 and are in good condition. The Dishwasher is in poor condition and is near the end of its life cycle. The cafeteria manager reported that the machine is at least 15 years old. There is an existing grease trap that is in good shape. The air curtains serving exterior doors appear to be approximately six years old and in good condition.

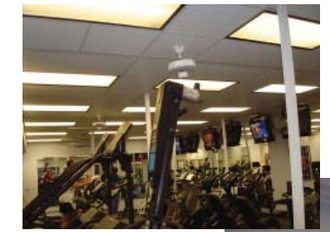
Gym:
The area is served by a dedicated air handler unit system located in a mechanical room within the gym and controlled by an electronic Johnson Controls' system. Ceiling fans were installed to meet the requirements of the Medicine Sport Standard Association. Temperatures were within the comfort indoor conditions (71 to 75 degrees). The rest rooms/locker rooms are working properly.

Electrical

Gift Shop:
There are no automatic switches for the lighting system. The current lay-in fixtures, which are in good condition, have track lighting that is inefficient, and are operating at 120V. The existing fixture set-up in the Gift Shop is typical to the O&C. The fixtures could be used more effectively at 277V. The ballasts were not originally specified to be multi-voltage.

Gym:
The panels are older GE panels. The lay in fixtures are dirty and the lenses are yellowing. Ten power poles will need to be inspected before being reused. Also, there is a body fat measuring machine that would require additional coordination to move. The exit lights are old and have a plug-in, battery backup.

Cafeteria & Bake Shop:
There is a mixture of original panels and new work. The original panels are greasy, old, and rusty but new panels have spares and are in good condition. Some surface conduits show oxidation. The lensed lights are in good condition; the unlensed fixtures need to be replaced. The front counter lighting is provided by incandescent lighting.



*** After the facility assessments were completed, it was determined that only the cafe, gift shop, and a small portion of the exercise facility would be included in the consolidation of the shared services.**

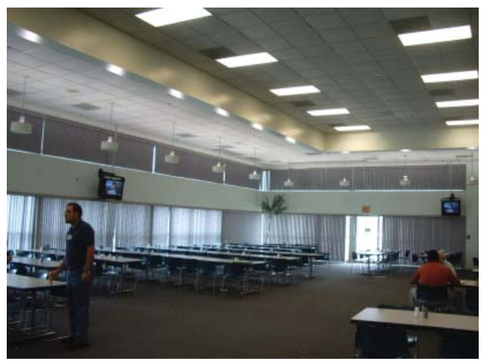
4.4.2 Space Station Processing Facility (SSPF)

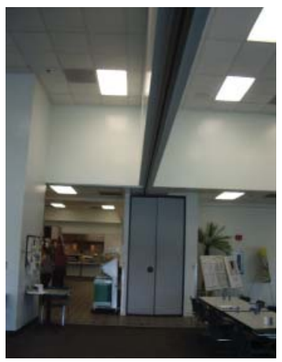
Building Summary

This facility (M7-0360) is a 522,313 square foot structure built in 1992. The construction type is steel frame with metal siding, concrete block, and a built-up roof. The facility is owned by NASA and is currently occupied by a contractor and houses the administrative personnel and payload processing operations for the Space Station.

Architecture

The SSPF cafeteria is the largest and newest of the dining facilities. The dining area can continue to be used as a conference center if the kitchen is relocated to central area.





Mechanical

The building is cooled by a central chilled water system.

Gift shop:
This area is served by the building main air handling system. The area is controlled by two VAV terminals with wall mounted sensors. There is no designated rest room for this area.

Cafeteria:
This area is served by the building main air handling system. The area is controlled by a VAV system. The HVAC system in the kitchen hood area appears to be inadequately sized to control the humidity in the area. There are several kitchen hoods, the largest is 22 feet in length. They are approximately five to ten years old and are in very good condition. The dishwasher area drain system tends to clog often and the technician complained of not having enough space to service the equipment. There is no grease trap system: the grease waste is collected by container instead of having a grease trap system in the ground.

Electrical

Cafeteria:
The panels are greasy and some are showing evidence of rust. The load center for the service counters is in very good condition. The kitchen surface conduits are in good condition. Most kitchen equipment is in excellent condition, except for the equipment in dishwasher room and the exterior equipment, which is only in good condition (50 percent life) due to the corrosive environment. The lights are in good condition and the lenses are still relatively clean. Metal halide lamps are used for the front counter lighting.

Gift Shop:
The lighting is not equipped with automatic switching, and the track lighting is inefficient (incandescent/ halogen). The lay-in light fixtures are in good condition.

*** After the facility assessments were completed, it was determined that only the gift shop would be included in the consolidation of the shared services.**

4.4.3 Child Development Center (CDC)

Building Summary

The CDC (M6-0883) is located remotely on the KSC installation to reduce the amount of non-essential persons from entering the main area of the KSC. It is a single story, CMU building, with an enclosed playground for the children, and was built in 1997.

Security

Entry to the building is controlled by digital push-button locks. Two video surveillance systems are installed for the interior and exterior of the building. The interior system is monitored and recorded at the CDC, while the exterior system is monitored and recorded at the JCCC. A wireless duress system has been provided for the staff. When activated, all duress alarms are transmitted to the JCCC.

Architecture

The CDC is in fair condition. A water intrusion problem, located at several window systems needs to be rectified. There are roof leaks and deteriorated insulation at the low end of the roof.

Structural

The condition of the existing building appears to be good, although the building manager noted some minor roof leaks from Tropical Storm Fay. There were also some visible structural issues at the porte cochere, where:

- The bottom of a concrete beam is visibly cracked, which is likely due to the corrosion and expansion of the bottom layer of steel rebar.
- At one location, the stucco appears to be cracked and not adhered tightly to the concrete wall/beam.
- There are several areas where rust is running down the walls. This typically occurs where a concrete beam connects with a concrete column. The cause is unclear, although it is possible the metal lath is rusting.
- Several of the existing concrete beams have been fitted with steel channels. It is unclear why the channels were added, but possibly to hide the cracked beams and prevent spalling.

Mechanical

The building is heated and cooled by three single zone rooftop air conditioning units that appear to be in good condition. A building addition is served by a window air conditioning unit. The building exhibits control problems where some areas are not able to meet temperature requirements.

Electrical

Existing System Descriptions:
The building lightning protection is in good condition. There is a need to repair missing air terminals and a loose conductor on the mechanical equipment. The lighting levels in the space are higher than the IES standards, even with the fixtures in need of some servicing and cleaning. The panels are in good condition and have more than half of their service life left, with limited spares available in both panels. The fire alarm system is in good condition. Most devices are in good or excellent condition and meet code.
The exterior electrical equipment is beginning to show wear due to environmental conditions. Lighting levels are low in the single bathrooms. Jacobs suggests replacing current compact fluorescent fixtures with a 2 foot by 4 foot wraparound for durability and better light levels.

*** As of December, 2008, the CDC has been removed from the KSC Central Campus Study. It has become a separate project, unrelated to the study.**

4.4.4 Environmental Health Facility (EHF)

Building Summary

The EHF (L7-1557) facility is approximately 10,735 square feet and consists of a concrete foundation, concrete masonry unit (CMU) walls, and a built-up roof. The facility was originally built in 1965, but two additions were added to the building in 1982 and 1990.

Security

Entry to the Environmental Services and Environmental Health Laboratories is controlled by digital push-button locks. Neither IDS nor video surveillance systems have been installed at the building.

Architecture

The building exhibits problems with roof leaks and rest room ventilation. The building is in a remote location and may be too remote for other uses.

Structural

The structural system of the existing building varies, and was built in three phases. Each phase of construction similarly consists of an elevated first floor, CIP concrete columns and beams, concrete tie beams around the roof, and CMU at the interior and exterior walls. The entire roof is covered with a built-up roof system.

Upon review of the available plans, the original construction occurred in 1965 with subsequent additions in 1982 and 1990. The plans from the 1990 addition reference the 1988 Standard Building Code (SBC).

Based on visual observation, the building appears to be constructed in only two phases. The roof of the first phase utilizes shallow CIP concrete planks that span across open-web steel bar joists, and the second phase of the roof utilizes metal deck over open-web steel bar joists.

Overall, the structure appears to be in good condition, although there were several roof leaks evident throughout the original phase of construction.

The leaks appear to occur directly below roof mounted components, where waterproofing around walls and curbs has proven to be difficult with the built-up roofing system.

Mechanical

The building is cooled by a pad mounted air-cooled chiller that was recently replaced. This chiller serves ceiling mounted fan coil units inside the building. There is apparently no provision for outside air to these units.

A building expansion occurred in 1990. This portion of the building is served by a DX split system with a pad mounted condensing unit and an air handling unit located in the mechanical room. All rooftop equipment has been removed and all existing curbs have been capped.

HVAC systems are controlled by outdated pneumatic controls. The building has several hot and cold areas where the controls are inadequate. Temperatures inside were met to indoor temperature comfort (72 to 75 degrees).

A sewer line was recently replaced due to deterioration. It is assumed that the remaining piping is in poor condition and will need renovation. The building has a deionized water system and nitrogen, isobutylene, methane and zero-air tanks and distribution system.

The building occupants report that the chiller is frequently out of service. The restroom exhaust systems do not adequately ventilate the restrooms.

Electrical

The exterior lighting is accomplished by inefficient flood light fixtures. The lenses are cloudy and need to be serviced or replaced. The lightning protection system is in poor condition. The building has experienced direct lightning strikes. There are several melted air terminals, and several carbonized portions of the ground loop. The system needs to recertified/replaced. The electrical distribution system is the original equipment, with the exception of one new panel and disconnect located in the existing electrical closet. These panels are old. It would be more cost effective to replace these panels in any type of renovation.

The interior corridor lighting levels are low, and the emergency lighting is inadequate. The exterior equipment located in the shed is in very poor condition. Although the fire alarm panel has been replaced, it is recommended that the fire alarm devices be updated.

4.4.5 Occupational Health Facility (OHF)

Building Summary

The OHF (M6-0495) is a one-story, concrete masonry unit building, located within KSC. It was built in 1964, and is approximately a 20,000 square foot facility. The building is used as management support offices, training rooms, clinical evaluation rooms, and as a quasi-emergency response clinic.

Security

Entry to selected spaces is controlled by digital push-button locks. The areas include medical supply, surgical and narcotic rooms.

Architecture

The building has a specific footprint suited to its current use. Reuse of the building for a different function would be difficult.

Structural

The structure was constructed in two phases, the original construction occurring in 1963, and the addition occurring in 1966. The original construction is CIP concrete columns, concrete tie beams, and CMU infill around the perimeter walls. The original roof construction utilizes a bulb-tee system with 2 inches of gypsum concrete over-form board and bulb-tees that span across open-web steel bar joists. The joists are supported with steel beams and steel columns that are located along the center of the original building.

The newer phase of construction is similar to the existing building at the exterior walls, but the roof construction consists of metal deck on bar joists and steel beams instead of the gypsum concrete/bulb-tee system. The entire roof system utilizes a built-up roof, and expansion joints are provided between each phase of construction.

The construction of the both phases appears to be in good condition, however, the facility manager indicated that the roof leaks near the expansion joint(s) when it rains. There is one area where previous repairs were noted at the tops of the columns above the roof near the main entrance. The tops of these columns have been previously patched at the corners, but the patching does not appear to have been painted (i.e., protected) and one of the patches is already cracked. The original construction also has a wood fascia and soffit, and some swelled fascia board and missing soffit were observed at

the Southeast corner of the building. There is also a piece of exterior steel at the Southeast corner of the building that is showing signs of rust, and requires regular maintenance such as sandblasting and repainting.

Mechanical

The building is cooled by central chilled water. Air handling units are located in interior mechanical rooms. These units appear to be operable, but dated and near the end of their life cycle. The mechanical rooms do not have adequate clearance for service or clearance required by code. Several areas are served by ceiling mounted fan coil units and many of these units do not appear to be operational.

HVAC systems are controlled by outdated pneumatic controls. The building has several hot and cold zones where the controls are inadequate. In addition there is an apparent humidity control problem.

The building is heated by new pulse fired condensing boilers. Boilers are located in the adjacent building, M6-0495E. The existing central heating water lines to the building have been capped and remain in place.

The plumbing fixtures appear to be in good condition. The occupants report frequent plumbing outages due to broken sanitary lines. A sanitary drain pipe was exposed and exhibited corrosion.

Electrical

Existing System Descriptions:
Interior:
Most electrical panels are original. Motor control center is original and needs to be upgraded. Interior lighting is mostly adequate. Emergency area lighting needs some improvements. Some light fixtures and devices need relocation. Communications cabinets can be consolidated.

Exterior:
Numerous penetrations are not sealed properly. The junction boxes and elbows have no covers. The disconnect switches and conduits are corroded. No lightning protection system exists on the building. Light fixtures that are mounted on the building exterior need upgrading and cleaning.

*** As of December, 2008, the OHF has been removed from the KSC Central Campus Study.**

4.4.6 Base Operations Building (BOB)

Building Summary

The Base Operations Building (M6-0339) is a 20,088 square foot concrete facility with a built-up roof, and was constructed in 1965. The original occupants of this facility consisted of NASA upper management personnel and their support teams. Currently, this facility houses the SGS construction, legal, projects, computer software, and internet/intranet web development departments. SGS and NASA upper management personnel frequently use the meeting rooms in this facility.

Security

Entry to the building is controlled by commercial door locking hardware. Neither IDS nor video surveillance systems have been installed at the building.

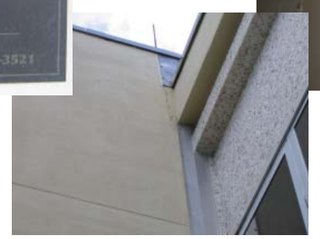
Architecture

The exterior concrete shell is in good condition, but would benefit from new glazing and joint sealant. The open office area could be renovated for other office use.

Structural

The structural system of the existing building consists of CIP concrete columns, CIP concrete slabs at floor and roof systems, and CMU at interior walls and stair towers. The exterior wall panels are precast concrete with a stone/pebble finish. The wall panels butt into the exterior concrete columns, and are bolted (at corners) to concrete floor beams at each level. The roofing system consists of a single-ply roof, which appears to be in very good condition. A plaque on the wall near the roof access ladder indicates the roof warranty is valid until November 1, 2024.

Although the structure appears to be in good condition, there were two areas on this building where some minor cracking was visible. Cracks were found at an interior CMU wall on the first floor, near the Janitor's closet, room 1225. The second area was at an exterior wall of the building, near the Northeast corner. It is possible that the cracking at the exterior wall is only in the stucco, and not a structural issue.



Mechanical

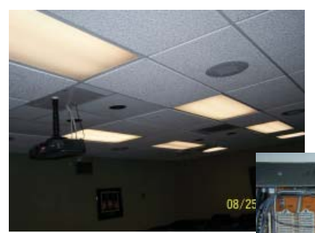
The building is cooled by pad mounted air-cooled chillers that are in good condition. A temporary chiller has been brought to the building which indicates the building has insufficient cooling capacity.

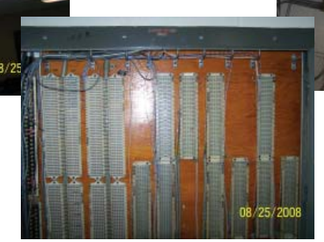
Air handling units are multi-zone systems and are located in interior mechanical rooms. These units are operable, but are dated and nearing the end of their life cycle. The ductwork is in poor condition. The building has several areas where the HVAC is not adequately controlled.

Electrical

Most electrical power panels are original. A transformer and some disconnect switches are corroded. A high voltage line conduit is corroded due to its location by a floor drain. The building has numerous NEC equipment clearance violations.

Most of the interior lighting is in good condition, although lighting levels by second floor elevator and egress emergency lighting levels are inadequate. A large number of the communications cabinets are almost or completely empty.





4.4.7 Central Instrumentation Facility (CIF)

Building Summary

The Central Instrumentation Facility (M6-0342) is the hub for instrumentation and data processing operations at KSC. The building houses offices, laboratories and test stations. Systems receive, monitor, process, display, and record information received from space vehicles during test, launch, flight and landing. Calibration laboratories for both the Joint Base Operations Support (JBOSC) and Space Flight Operations Contract (SFOC) are maintained in the CIF. It houses all of the JBOSC network computers and operations personnel, the computer "Care Center" and the KSC web hosting computers. Recently, computer networking personnel from all KSC contracts were relocated to the CIF. The CIF was built in 1965, has three stories, and 136,378 square feet of floor space. The facility is constructed of a concrete foundation, floor and exterior, and has a built-up roof that has been coated with a membrane system.

Security

Entry control into selected spaces is provided by either mechanical or digital push-button locks. The areas include space occupied by KICS, Wyle Laboratories, JBOSC, USA, ATF, and KNET. The transition to card readers has begun with the installation of readers for entry and exit from the server rooms.

Architecture

Office areas on upper floors generally have newer finishes: Corridors have old chipped ceiling tiles that should be replaced. Lab areas have been adapted and renovated for different uses during the life of the building, with obsolete features/equipment left in place.

Structural

The existing construction consists of CIP concrete beams and columns, and CIP concrete slabs at the floor and roof systems. The interior walls are constructed using CMU, and the exterior wall panels are precast concrete with an exposed aggregate finish. The panels butt into the exterior concrete columns, and are bolted (at corners) to the concrete floor beams at each level. The roofing system utilizes a single-ply membrane roof, which is in good condition.

The existing structure was found to be in good condition inside and out, although the facility manager noted leaks in some rooms at the Northwest and Southwest corners of the building. Wet ceiling tiles were also evident at the ends of the Southwest corridors. On the roof, there was a large amount of mechanical equipment and steel support frames. One steel column was found to be substantially rusted and requires maintenance.

Mechanical

The building is cooled by centrally chilled water. A temporary chiller has been brought to the building indicating the building has inadequate cooling capacity. The air distribution system is original to the building. There are two air handlers located on the roof that serve the majority of the building. These air handlers are in poor condition and are near the end of their life cycle. Due to inadequate HVAC controls, there are several areas where temperature and humidity requirements cannot be maintained.

The building has several computer rooms that are served by dedicated systems that are 41 years old and in good working order. The building has several lab areas that have special ventilation and filtration requirements. The building also has nitrogen tanks and a corresponding distribution system.

The building is heated by pulse fired condensing boilers that were recently installed. Boilers are located in the first floor mechanical room. The building heating system is new and in good condition.

Electrical

Communication wires for antennas and GPS satellite systems operate poorly. The equipment disconnects are badly weathered. The receptacles are in poor condition and are not GFCI type. The roof flood lights are highly inefficient, old, and need to be replaced. The circuit labels are not legible due to sun and weather exposure, and the existing fans have no disconnects or receptacles nearby.

Most of the electrical panels are old as are the motor control centers. The building has a large amount of power coming in. A large number of circuits are connected and are not being used. Some of the exterior disconnect switches are corroded. There is an exterior exposed junction box outside room 164 which could damage systems. Receptacles, disconnects and conduits are abandoned in place both inside and outside of the building. Most of the communication cabinets are empty or almost empty, while some cabinets have too many cables. The lighting for lobby and corridors needs to be upgraded. Some of the refurbished areas have better lighting with minor issues. Current egress/ emergency lighting levels are inadequate, and there are some NEC clearance violations.

4.4.8 Auditorium & Training Building

Building Summary

The Auditorium & Training Building (M7-0351), which is used primarily as a training facility, is a 9,224 square foot facility that was built in 1964. The facility is constructed of concrete block walls supported by a concrete foundation. The building consists of general offices and an auditorium that has a maximum capacity of 200 persons. The facility is used by multiple contractors for training, conferences, and meetings.

Architecture

The exterior pre-cast panels and concrete structure are generally in good condition with the exception of a small crack in the corner of a pre-cast panel on the west side, and deteriorated sealant in the joints. Water intrusion and lighting have been a problem with the auditorium interior.

Structural

The existing construction consists of CIP concrete columns, and CIP concrete beams with some CMU at interior walls. The roof construction utilizes a built-up roof over gypsum concrete and bulb-tees on bar joists. Exterior wall panels are precast, and have a stone/pebble finish. The panels butt into the exterior concrete columns, and are bolted to the foundations and roof tie beams. The Facility Manager indicated that the roof leaks near the mechanical room area. The existing structure was found to be in good condition inside and out.

Mechanical

The building is cooled by central chilled water. Air handling units are located in interior mechanical rooms. These units appear to be operable, but are dated and near the end of their life cycle. The mechanical rooms do not have adequate clearance for service or clearance required by code. The auditorium control booth is cooled by modified outside air application DX-system. The vibration created by this unit is transmitted to the control room basement support. The restroom plumbing fixtures are old and inefficient. The restroom exhaust fans are in good shape with no rust

Electrical

Most electrical power panels are the original panels. There is no lightning protection system in place on the building. Some of the interior light fixtures have sagging lenses. The fixtures need to be distributed more evenly throughout the space. The auditorium interior lighting needs major improvements. Exterior light fixtures are dirty, and have yellow lenses. Egress/emergency lighting levels are inadequate.

There is a large amount of equipment that is abandoned in place, as well as corroded conduits and receptacles. There are also unsealed wall penetrations. The door to an exterior cabinet does not close properly. There are code violations regarding equipment maintenance and clearance issues.

4.4.9 Headquarters Building (HQ)

Building Summary

The KSC Headquarters Building (M6-0399) was constructed in 1965, is 439,446 square feet, and is three stories, with a fourth story center section. The construction is reinforced concrete. The Headquarters Building is the administrative center for all Spaceport activities. This facility houses the offices of the Center Director, management staff, procurement, and several hundred contractor and support personnel. The Headquarters Building also houses the KSC Library, Travel Office, Film and Photo archive, photo processing shops, print shop, and KSC security offices.

Security

Entry control into selected spaces is provided by either mechanical or digital push-button locks. The areas include space occupied by PSSO, FBI, and the IG offices. IDS installations are limited to the Credit Union and SCIF locations. Duress buttons have been installed in the credit union and transmit to the JCCC if activated. Video surveillance is installed in the credit union, but its images are transmitted to the credit union's branch office located off-site. Contraband (x-ray) screening equipment is installed within the mail room for screening large and small packages.

Architecture

The concrete structure and exterior wall panels are in good condition, but need some cleaning. Water intrusion has been a problem due to poor joint sealant performance. Finishes in recently renovated office areas are generally in good condition, while corridors would benefit by upgrading.

Structural

The structure was constructed in several phases, Phase I construction occurred in 1963, and the Phase II addition occurred in 1967. The structural systems consist of CIP concrete columns, and CIP concrete slabs poured integrally with one-way (pan) joists at the floor and roof systems. The exterior wall panels are precast concrete, and have an exposed aggregate finish. The panels butt into the exterior concrete columns, and are bolted (at corners) to the concrete floor beams at each level. The roof system utilizes a built-up roof.

Although much of the structure is covered with finishes and not visible, Jacobs was able to view the exterior wall panels at stairwells, interior columns, and numerous one-way joists at the mechanical, janitor, and communications rooms.

Despite the age of the existing structure (45 years), the structural aspects of the building appear to be in very good condition inside and out. There are a couple of maintenance items, such as cracked caulking between some exterior wall panels and columns, however, no structural deficiencies worth noting were discovered. At one area, near the mail room (and stairwell door at Southeast corner of the building) Jacobs found one small “stair step” crack in the CMU wall just above a lintel at door 1546A.

Mechanical

The building is cooled by central chilled water. Chilled water enters each wing of the building. Stacked mechanical rooms are served by a chilled water riser. The chilled water piping is original. Each floor of each wing is served by an air handling unit located in an interior mechanical room. These units are dual-duct systems, and are original to the building. The building is currently undergoing replacement of air handling units. Approximately 75 percent of the units have already been replaced over the past three years. The air distribution system is a dual-duct design original to the building. The new air handling units have been designed to incorporate a future redesign of the ductwork.

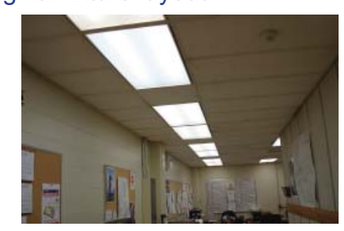
Several DX split systems are located throughout and are assigned to serve the computer rooms to maintain 24 hours a day, 7 days a week schedule. The building is heated by a central heat system. This system is being phased out and replaced by local boilers, but has not yet occurred. The original control system is pneumatic and is being replaced along with the air handling units.

First floor areas have abandoned water heating systems that are no longer needed. On the building exterior are pad mounted solar water heating and a storage tank that has been turned off and will be demolished in the near future. The building has approximately 15 rooftop exhaust fans and 25 wall mounted exhaust fans. The condition of these fans varies greatly.

Electrical

Existing substations have been replaced within the last 10 years, and are in excellent condition. The switchgear is obsolete and KSC maintenance confirmed that replacement equipment can no longer purchased. Most of the buildings’ panels are old, and some located in the mechanical rooms are in bad condition. Electrically, most of the building exterior seems to be well maintained. Switch gear SS2D shows some signs of oxidation on the outside. Concern about the ground conductor at the switchgear is minimal, though the building does have adequate grounding in its distribution system. It is highly recommended that all electrical distribution, other than the substations, be replaced.

Lighting throughout the building exceeds IES standards. The fixtures are inefficient because they have been retrofitted. The HQ Building currently has T-8 lamps in the original T-12 fixture housings and the original fixture layout.



Due to recent mechanical upgrades, there are a number of different fire alarm systems that exist within the building. This should be reviewed, as violations exist within the system.

The lightning protection systems have bases that are no longer attached to the roof. Some air terminals are missing and some have been replaced with smaller air terminals. Most of the metal roof drains are not connected to the lightning protection systems. Exhaust fans

on the roof are missing a second connection to the system. There are no roof mounted convenience receptacles. Only a few disconnects looked oxidized and old.

In terms of building mounted lighting, some fixtures are oxidized, and some need cleaning, relamping and new lenses. Several photocell operated lights were on during the day. The 3-pole mounted fixture by the middle back entry way of the building needs to be upgraded.

4.4.10 Engineering Design Lab (EDL)

Building Summary

The EDL Building (M7-0409) was constructed in 1966 and is a 68,755 square foot building. The building's construction is a poured concrete floor, concrete block walls, and a built-up roof. The facility is currently used as a research laboratory and office space. The facility also houses laboratory and office space for contractor personnel. The southwest corner of the building contains Space Station exhibits shown during the KSC Visitor Center tours.

Security

Zero AT/FP setback exists along the southern, eastern and western sides of the building. Without a defined setback, vehicles can easily come in close proximity to the building and critical utilities. Cipher locks are installed throughout the building. A scramble keypad is installed on the entry door of office 1060. If any renovations occur beyond basic systems, then full compliance of the ISC should be considered.

Architecture

The building has had extensive improvements in recent years including a new single-ply roof, new laminated glass windows and new HVAC. The building is scheduled to receive a wet pipe fire suppression system in the near future. Floor tile is mismatched in many areas. The restrooms have older fixtures and are not fully accessible per current ADAAG requirements. The former EMI lab has extensive water damage and mold, which was not remediated during previous renovations.

Installation of a wet pipe fire suppression system was imminent at the time of survey. The building occupants would also benefit from new water supply piping. Corrosion has made the water supply discolored and unfit for drinking; bottled water is provided.

Due to the extensive renovations underway or recently completed, the program would be served best by remaining in this facility.

*** As of December 2008, six additional buildings were added to the KSC Central Campus Study. Jacobs used facility reports completed in 2003 as a guide and verified that data. The complete reports can be found in the electronic appendix of this document, Nelson Engineering Co, Facility Inspection Reports.**

*** As of mid-December 2008, the EDL has been removed from the KSC Central Campus Study because it is in good condition, and is funded and scheduled for renovations under a separate project.**

4.4.11 EDL Mechanical Building

Building Summary

The EDL Mechanical Building (M7-0409A) was constructed in 1966. The purpose of this 2,983 square feet facility is to provide chilled water and reheat water for the EDL (M7-0409). It functions solely as an equipment building, supporting the EDL. The construction of this facility consists of a built up roof, concrete slab foundation, and concrete block exterior walls.

Security

Zero AT/FP setback exists along the southern side of the building. Without a defined setback, vehicles can easily come in close proximity to the building and critical utilities. If any renovations occur beyond basic systems upgrades, then full compliance of the ISC should be considered.

Architecture

Two new natural gas boilers were installed to replace the connection to the central plant. All existing systems appear to be in good condition. The building needs minor repairs, such as a broken louver vent that should be replaced. There are wooden steps and a wooden handrail leading to the main door that are not code compliant.

*** As of mid-December 2008, the EDL Mechanical Building has been removed from the KSC Central Campus Study because it is in good condition.**

4.4.12 EDL Storage Building

Building Summary

The EDL Storage Building (M7-0409B) was constructed in 1968, is 1,060 square feet, and is primarily used as a storage shed for the machine shop in the EDL. It traditionally stored metal bar stock and old equipment used by the machine shop. The structure of the building consists of a concrete foundation, a metal roof, and metal siding walls. Equipment and parts that are typically stored in the structure are not temperature sensitive, but need to be kept dry. The air temperature is not controllable, which limits storage to only certain items. The building is in poor condition but currently there are no major problems or deficiencies.

Security

Zero setback exists along the southern side of the building. Without a defined setback, vehicles can easily come in close proximity to the building and critical utilities. The perimeter doors have been secured with padlocks. If any renovations occur beyond basic systems upgrades, then full compliance of the ISC should be considered.

Architecture

The building has extensive corrosion from previous use as a battery storage facility and it is currently vacant. Many unprotected vent openings and damage to metal siding leave the interior exposed to weather and pests.

*** As of mid-December 2008, the EDL Storage Building has been removed from the KSC Central Campus Study.**

4.4.13 Industrial area Support Building (IASB)

Building Summary

The industrial area Support Building (M6-0493) was constructed in 1964. This 15,449 square foot building was constructed of concrete block walls, built on a concrete foundation, with a built-up roof. This facility is divided into two halves. Lackmann Culinary Services uses the east half of this facility for food storage and preparation. The west side of the facility is utilized by EG&G employees.

Security

Zero setback exists along the southern, eastern and western sides of the building. Without a defined setback vehicles can easily come into close proximity to the building and critical utilities. If any renovations occur beyond basic systems upgrades, then full compliance of the ISC should be considered.

Architecture

The eastern half of this facility has a fully equipped industrial kitchen which includes industrial stoves, sinks, and refrigerators. This portion has been completely renovated with new interior finishes and kitchen equipment. The rooftop HVAC equipment on the east half of the building also is new. The west side of the building consists of offices and administrative spaces.

Except for a newer ADA restroom, the restroom fixtures are original to the building and have many chips and rust stains. The running water is not used for drinking, due to corrosion in the piping.

The cubicle area near the large windows on the south side tends to be too hot for the occupants compared to other parts of the building. The offices on the north side are reported to be as much as 20 degrees cooler than the rest of the building. Exterior window areas on the north side of the facility are damp, continuously shaded by landscaping, and as a result, exhibit algae growth.

The interior of the east side of the building has been renovated, however, the windows and roof system are much older. The windows should be replaced with laminated glass for wind loads. The use of insulated glass in the larger offices would improve thermal comfort.

A direct expansion outdoor air unit was added to pre-treat intake air to the air handling unit. Air quality still suffers from a musty smell and particulate falling from the diffusers. This has been controlled with air filters inserted into all of the supply and return vents.

Lackmann Culinary Services has a newly renovated facility and would not likely benefit from relocating. If EG&G were to relocate, then the vacated area could receive HVAC remediation, domestic water piping and fire suppression system before a new tenant acquired the space.

4.4.14 Electromagnetic Lab (EML)

Building Summary

The Electromagnetic Lab (M6-0336), built in 1963, is a 9,486 square foot facility, and was the first building constructed in KSC's industrial area. It is climate-controlled and is constructed of concrete masonry units with a built-up roof. The facility is used by contractors in support of the Space Station project to perform experiments determining the effects of sound and magnetism.

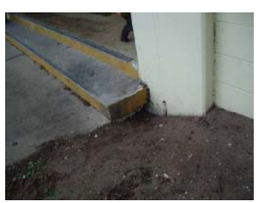
Security

Zero setback exists at the building. Without a defined setback, vehicles can easily come into close proximity to the building and critical utilities. If any renovations occur beyond basic systems, then full compliance of the ISC should be considered.

Architecture

The facility is in overall good structural condition, although many fixtures and hardware are worn and outdated. High voltage panels for the electrical system appear to be newer than other systems, and the roof system and expansion joints are in good condition. The roof was replaced in 1996. An antenna used for testing is anchored to the roof with sandbags, while other antennae are mounted to concrete foundations outside the west end of the building. Most areas have been renovated within the last ten years. The west end was completely renovated in the early 1990s to accommodate the electromagnetic lab shop personnel.

A problem with a pair of exit doors reported as non-code compliant has not been resolved. Each leaf is only 30 inches wide, with one active and one inactive leaf. Compliance requires that at least one leaf be 36 inches wide and that of the two leaves, that being the active leaf. Pairs of doors on the south side of the building are reported to allow water intrusion during storms and conditioned air to escape the building. The weather stripping on these doors does not completely close the gap between leaves, which in turn, undermines the integrity of the building envelope.



Local wildlife has burrowed under the concrete steps in front of the building, potentially undermining the concrete. Although there are only two steps to the front door, handrails would now be required to meet current code.

The building also has no fire suppression system. Drinking water is contaminated and cannot be consumed. An ADA compliant stall has been added to the existing restroom, but it is designed to an earlier code, and does not comply with the current code. The rear entrances have ramps between grade and the door, but there is no designated ADA accessible parking in the area.

Any consolidation move would require a site suitable for the antennae used at this facility.

4.4.15 Technical Records Center (TRC)

Building Summary

The Technical Records Center (M6-0489) is a 14,110 square foot facility that was built in 2001. Its construction consists of a concrete foundation, metal siding, and a metal roof. This building provides air-conditioned storage for NASA technical records, and also provides office space for personnel who manage the records.

Security

Zero setback exists along the north side of the building. Without a defined setback, vehicles can easily come into close proximity to the building and critical utilities. Entry control is provided at the main entry door via a cipher lock. If any renovations occur beyond basic systems upgrades, then full compliance of the ISC should be considered.

Architecture

This all-metal building has numerous dents in wall panels and bottom edge trim caused by lawn maintenance equipment. Although dents were reported to allow insect intrusion in a 2003 Facility Inspection Report, the siding and trim has not been repaired. Damage of this kind will be a recurring problem as long as the base of the building is unprotected from further damage.

The damage to this building is minor in scope, but could lead to further damage if not repaired. In addition to the insect intrusion already reported, a dented downspout does not allow rainwater to drain freely from the gutter. If sufficient damage of this kind occurs to the downspouts, the gutters could overflow and lead to water intrusion into a building that houses technical records. The damage documented in this assessment can be prevented by a concrete curb around the base of the building. This would prevent maintenance equipment from coming into contact with the metal panels or downspouts.

An addition to this facility was in design at the time of a previous Facility Inspection Report in 2003. The addition was never constructed.

*** As of February, 2008, the TRC has been removed from the KSC Central Campus Study because it is a new building and is in good condition.**

4.4.16 Sustainability Analysis

The following facilities were evaluated for issues concerning sustainability: CDC, EHF, OHF, BOB, CIF, Auditorium & Training, and HQ. Several negative environmental issues were common among the buildings:

- Inadequate energy performance
- Heat island effect: non-roof, non-compliance
- Lacking in on-site renewable energy and green power
- Lack of alternative transportation: insufficient public transportation access and alternative fuel vehicles
- Ineffective innovative wastewater technology implementation
- Lack of implementation of water use reduction
- Possible indoor air quality issues
- Lack of daylighting and views
- EHF, OHF, BOB, CIF, and HQ building envelopes are in poor condition

The majority of issues listed above are due to the age of the facilities. While it is possible to incorporate sustainable practices into any facility, the age and current condition of the buildings would complicate and the efforts and limit the sustainable possibilities.

4.4.17 Summary of Analyses

All facilities in the study were evaluated, and the findings have determined whether it was more fiscally responsible to renovate, or to build new and replace the lost square footage into the consolidated HQ Building. The findings for the facilities that remain included in the consolidation are listed below:

- **HQ:** Based on the age and interior condition of the facility, it is most cost efficient to either complete a major renovation, or to demolish the HQ Building.
- **EHF:** It is ultimately most cost efficient to demolish the EHF than to try to renovate the building.
- **BOB:** The structural elements of the building are in good condition, therefore, it would be most cost efficient to either facilitate a major renovation of the interior, or to demolish the building.
- **CIF:** It is most cost efficient to demolish the CIF than to renovate the building.
- **Auditorium & Training Building:** The building is structurally sound, but would need a major interior renovation if it were not demolished.
- **IASB:** It is most cost efficient to demolish the IASB than to renovate the building.
- **O&C:** The only areas in the O&C that are being consolidated into the potential new facility are the cafe, gift shop, and a portion of the exercise facility.
- **SSPF:** The only area in the SSPF that is being consolidated into the potential new facility is the gift shop.

4.5 Organizational Adjacencies

Each NASA Directorate and Major contractor has a Directorate Facility Utilization Manager (DFUM). DFUMs are the points of contact for employees to request moves, mods, furniture needs or excess, space assignments and additional space requests (www.kscmodsmoves.ksc.nasa.gov). This section analyzes the points of contact and their operational functional relation with the varied Directorates.

For the above purposes, a functional adjacency matrix was developed for the HQ Building Directorates (see Figure 4.10).

Based on this Figure, the high level and medium level adjacencies are graphically represented by two diagrams, as shown in Figures 4.11 and 4.12, respectively.

Adjacencies of support facilities:

HQ To the BOB Building:
OP and TA, as the only two tenants, were found in the BOB Building, which has two stories. In terms of the high level adjacencies, OP, adjacent to TA, was found on floor one. TA was the only Directorate on floor two.

HQ To the CIF Building:
PH, TA and IT were the only tenants found in the CIF Building, which has three floors. TA was adjacent to IT on all three floors, in terms of a medium level adjacency.

HQ To the EHF Building:
TA was the only Directorate appeared in the EHF Building.

HQ To the OHF Building:
TA was the Directorate was found in EHF Building.

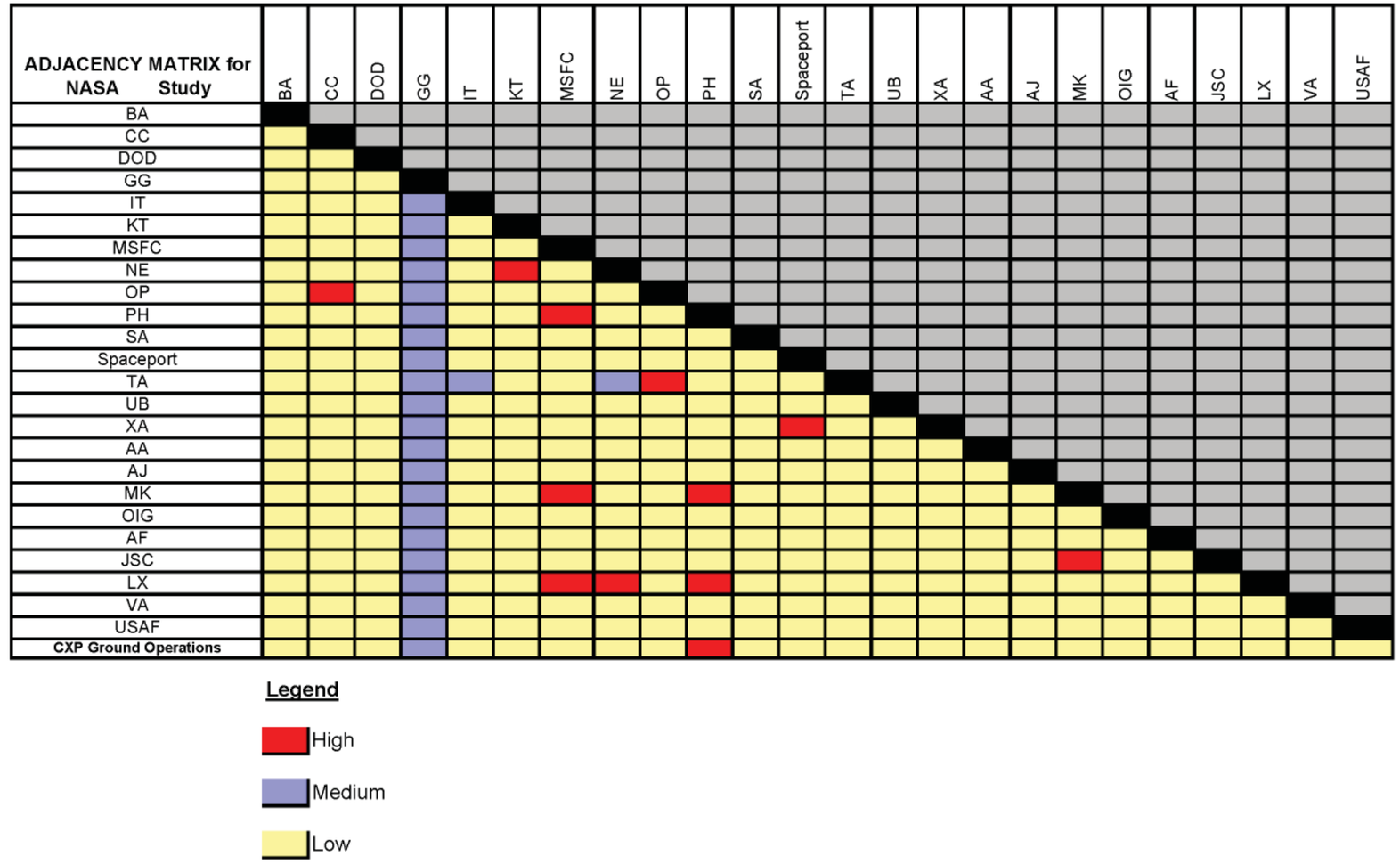
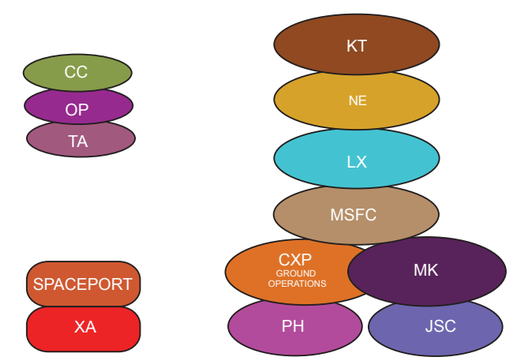
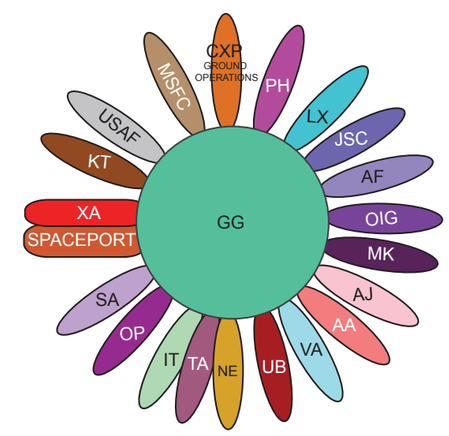


Figure 4.10 Adjacency Matrix



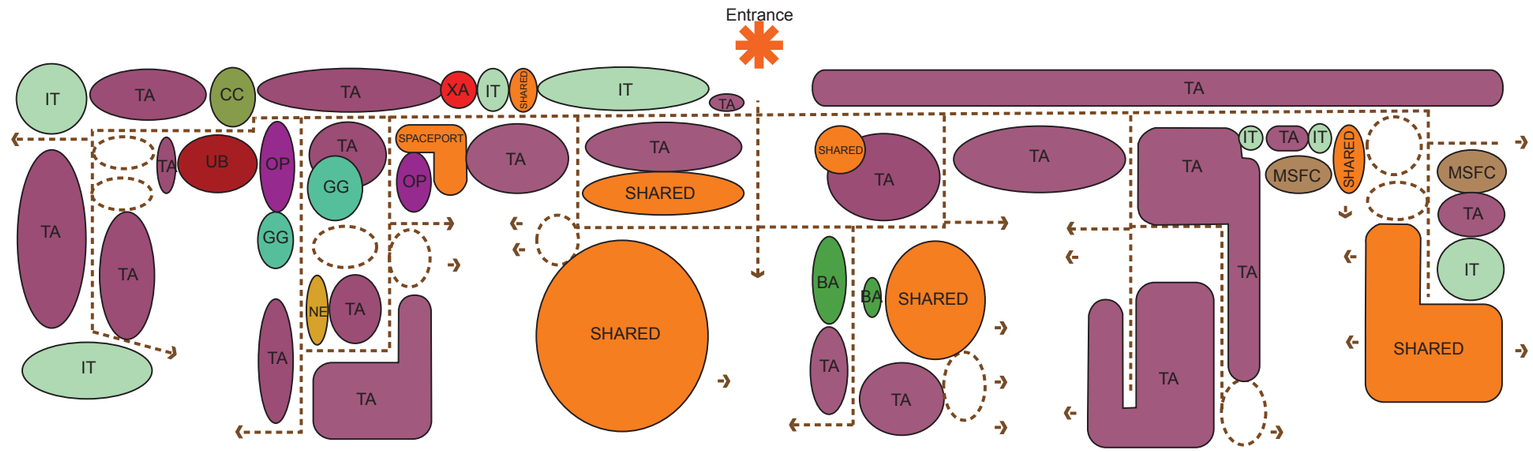
High Level
Adjacency Matrix Diagram
Figure 4.11 High Level Adjacencies



Medium Level
Adjacency Matrix Diagram
Figure 4.12 Medium Level Adjacencies

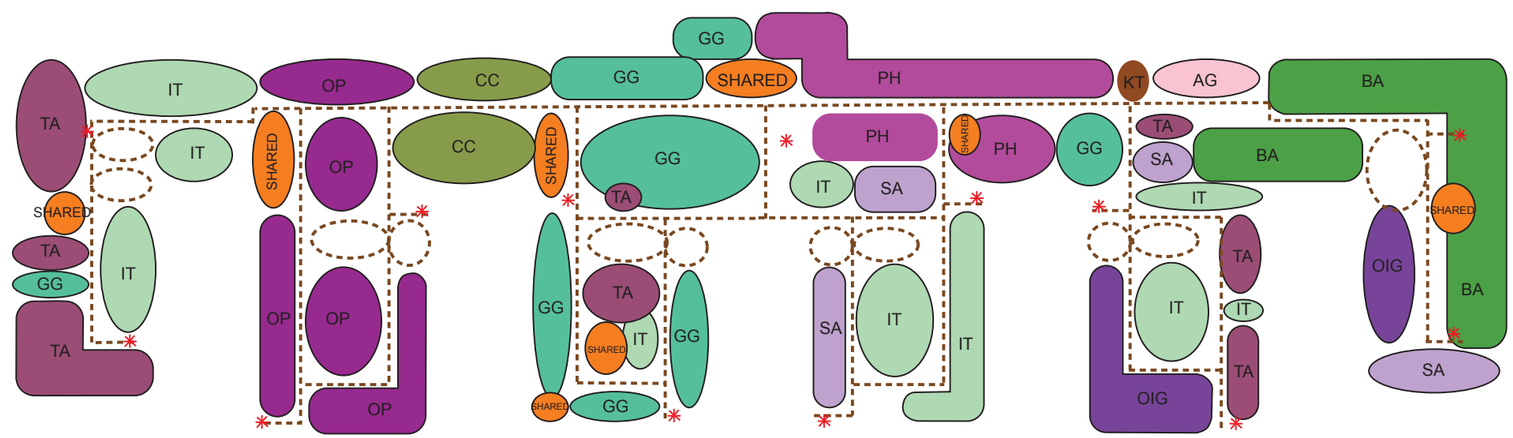
Several additional graphics were developed to describe critical adjacencies for HQ Directorates and facilitate adjacency model discussions as follows:

- To all adjacencies: CXP Ground Operations as a new functional relationship is required for the proposed option(s).
- High level adjacency: Directorates were formed into three groups:
  - Group One: CC, OP and TA
  - Group Two: Spaceport and XA
  - Group Three: KT, NE, LX, MSFC, PH, MK, JSC and CXP Ground Operations
- Medium level adjacency: GG is the most popular point of contact for NASA employees. GG is required to be adjacent to all NASA Directorates. In terms of adjacencies to GG, three groups were developed:
  - Group One: IT, TA and NE
  - Group Two: Spaceport and XA
  - Group Three: PH and CXP Ground Operations
- Low level adjacency: Those relationships described as low are not site specific and therefore could occur anywhere on site.
- No Adjacency: No relationship as specified; therefore it will not be considered.



Existing Conditions - Directorate Areas
HQ - 1st Floor
Functional Relationships

Figure 4.13 HQ Functional Relationships - 1st Floor



Existing Conditions - Directorate Areas
HQ - 2nd Floor
Functional Relationships

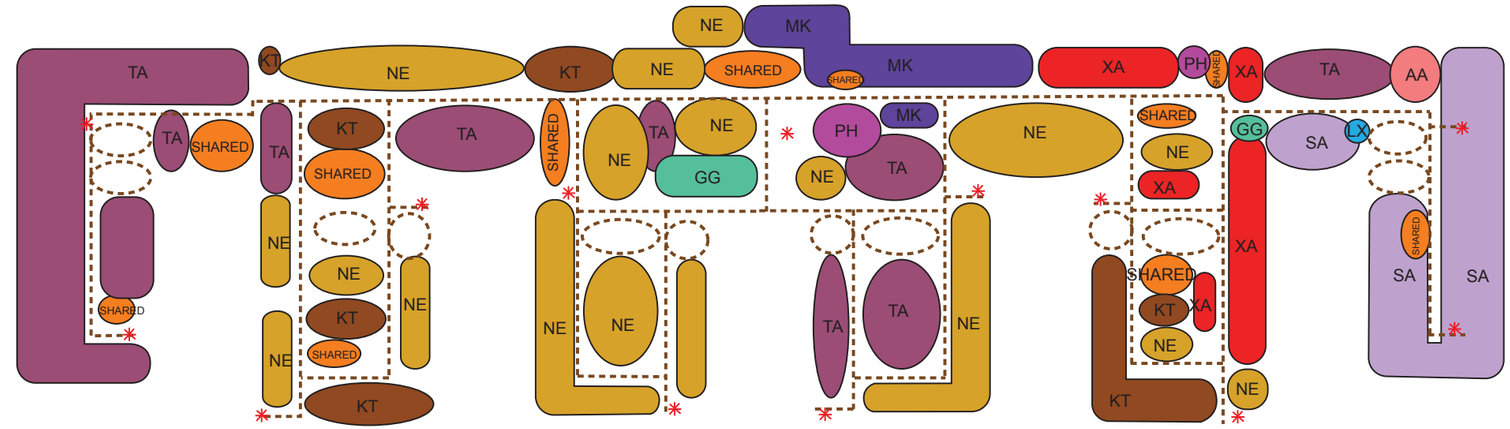
Figure 4.14 HQ Functional Relationships - 2nd Floor

4.5.1 Existing Organizational Adjacencies Analysis

At a macro-level, applying the findings from Figures 4.13-4.16 to all existing buildings, the results are as follows:

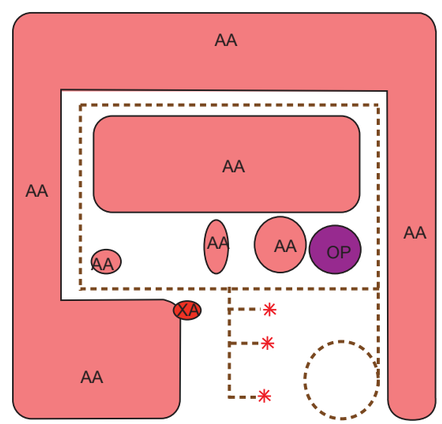
To the HQ Building:

- High level adjacency:
  - CC, OP and TA appeared as a group on floor one, but not on the remaining floors
  - Spaceport and XA appeared as a group on floor one, but not on the remaining floors
  - JSC was not found in the HQ Building. KT, NE, LX, MSFC, PH and MK directorates were scattered on all four floors within the HQ Building. PH was adjacent to MK, KT adjacent to NE, but only of floor three.
- Medium level adjacency:
  - GG was found on floors one, two and three, but not floor four
  - IT, adjacent to TA, was found on floors one and two; TA, adjacent to NE, was found on floors one and three; IT, TA and NE never appeared together on any floor.
  - Spaceport, adjacent to XA, was found on floor one, but not on the remaining floors.



Existing Conditions - Directorate Areas
HQ - 3rd Floor
Functional Relationships

Figure 4.15 HQ Functional Relationships - 3rd Floor



Existing Conditions - Directorate Areas
HQ - 4th Floor
Functional Relationships

Figure 4.16 HQ Functional Relationships - 4th Floor

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Concept Development

JACOBS

5. Concept Development

5.1 Introduction

In the event that the final recommendation involves an addition or new construction, there are eight existing, appropriate buildable sites at KSC. Six of the sites are directly within the industrial area, and two are located just outside of the industrial area. In Section Three, the sites were evaluated for their suitability. Here, in Section Five, each site is test-fitted based on initial adjacency requirements and amount of space needed to accommodate an addition or new facility of this magnitude.

The concept development section recognizes the program and the requirements of each site. The needs of the building program are taken into account, while developing the parameters outlined in Section Three, Basis of Planning. Items considered during the concept development phase are: the need to integrate and comply with Antiterrorism/Force Protection (AT/FP) security criteria, placement of building(s) and additional support buildings required by the consolidation, and parking lot expansions and access due to additional employees being moved to a certain location within the industrial area. Concept development graphically portrays the exploration of several courses-of-action (COA), providing KSC with options for consolidation and future development. The COAs not only take into consideration the program for the building and site, but also existing environmental and man-made conditions that may inhibit the opportunity to expand in a certain area.

In addition, alternative explorations were conducted in order to provide options for current facilities. An option for a current facility might include an addition onto an existing building to accommodate the program.

The building addition and new building concepts are based on program and represented with volumetric studies. The volume was calculated from the square footage program requirements spreadsheet (See Figure 4.4) with a 15 foot height per floor. Colored boxes shown in the concepts are not a depiction of the actual form an addition or new building. The concepts should be viewed as space placeholders that give an accurate representation of the amount of volume the preplanned phased new facility or new addition would occupy. This type of concept is useful to help understand the amount of buildable area the facility will require as it relates to site and surroundings.

In Section 5.2, new building concepts A1, C1, G1, were explored further as recommended by KSC leadership. Also, renovation

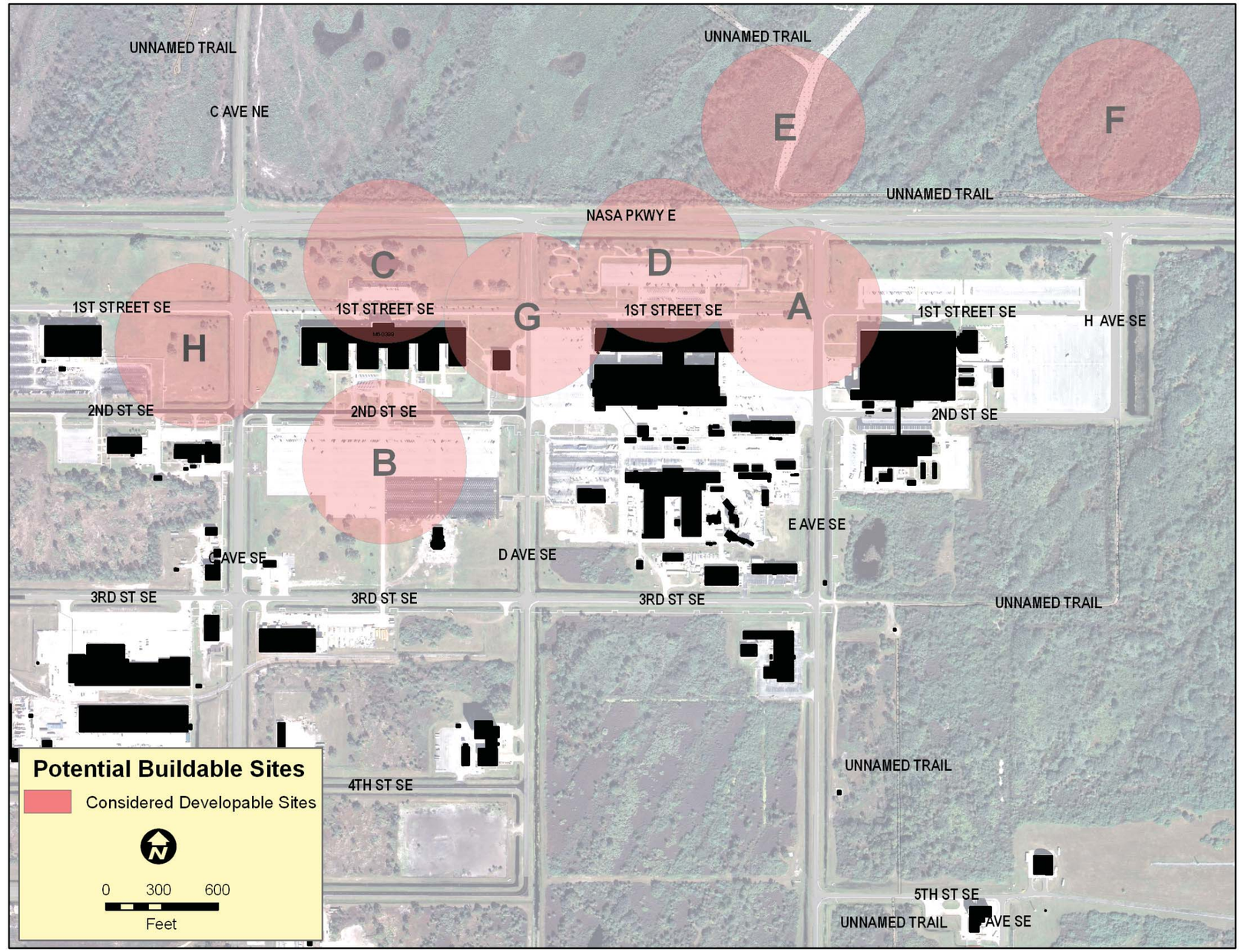


Figure 5.1 Potential Sites

and addition concepts G2 and G3 along with hybrid option G2 were further refined due to being designated as the options with the greatest potential by KSC leadership. The refinements required further study in order to give shape and form to the building, the site and surroundings.

5.2 Site Concepts

Concept A1 - Renovation & Addition

Concept A1 of Renovation and Addition category portrays a building addition onto the existing O&C on site A. Site A is situated on the northeast side of the O&C and northwest side of the SSPF, in the vicinity of the intersection of 1st Street and E Avenue. The site functions well, and has low levels of contamination. The building addition incorporates only the new program requirements of the study. The existing Headquarters Building remains in its current location and receives a major renovation. Approximately 350 parking spaces would be dislocated in this scheme, being relocated by expansions to the existing parking lots in front of the O&C and SSPF. Enough space exists to potentially provide up to 1,000 new parking spaces in these two areas.

Concept A1 - New Building

Concept A1 of the New Building category portrays a new building situated between the O&C and SSPF on site A. Site A is located in the vicinity of the current intersection of 1st Street and E Avenue. The phased new building includes the total square footage of the current Headquarters Building, the Auditorium and Training Building, and the additional square footage included in the consolidation. The potential exists to construct a monumental building in this location with differing multi-level towers. 1st Street and E Avenue are permanently closed in this concept and approximately 750 parking spaces would be dislocated. There is space to provide approximately 1,000 new parking spaces on the east and west sides of the proposed new facility. Ideally the two current parking lots in these locations would be expanded to accommodate parking needs.

Concept B1 - Renovation & Addition

Concept B1 of the Renovation and Addition category depicts a building addition onto the south side of the existing Headquarters Building on site B. Site B is situated on the south side of current Headquarters Building, in the vicinity of 2nd Street. The addition would have the same look and feel of the existing architecture. The site functions well, but contains a large network of existing utilities. The addition incorporates only the new program requirements of the study. The existing Headquarters Building remains in its current location and receives a major renovation along with an addition. Second Street is permanently closed along with approximately 100 parking spaces dislocated. The potential exists to expand current parking lots to accommodate up to 1,000 additional parking spaces.

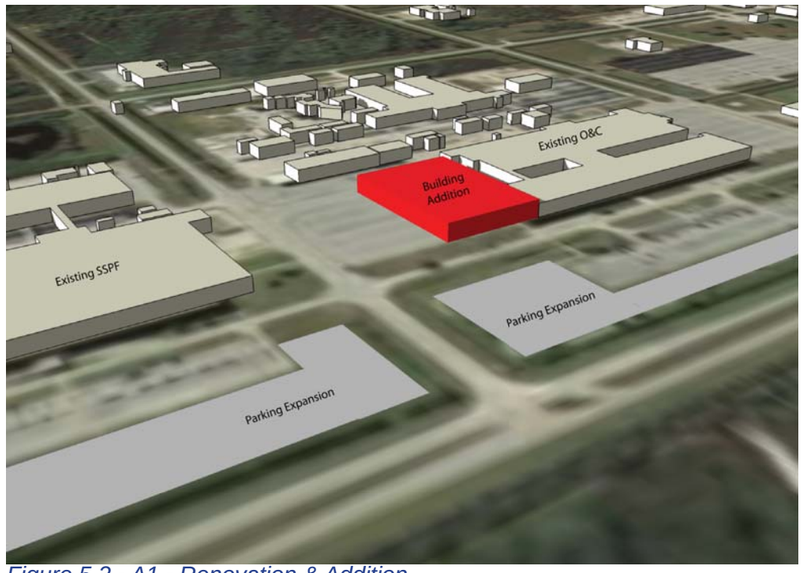


Figure 5.2 - A1 - Renovation & Addition

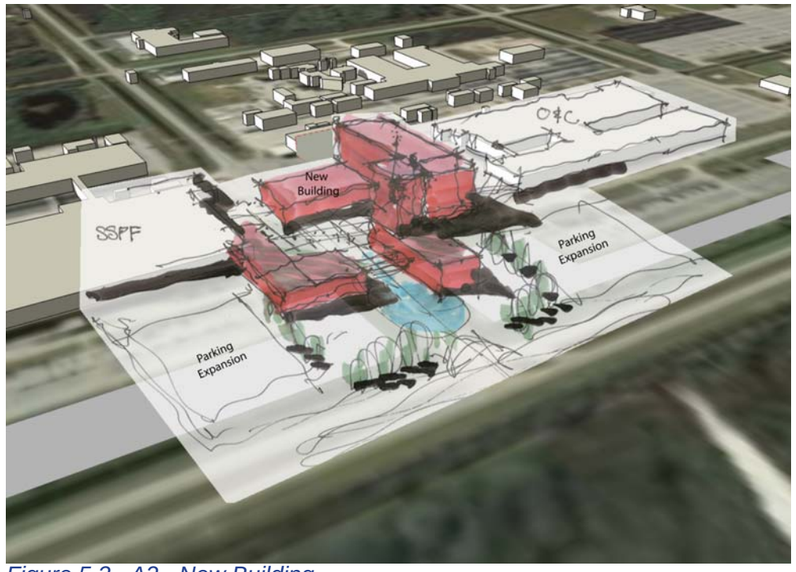


Figure 5.3 - A2 - New Building

Figure 5.4 - B1 - Renovation & Addition

Concept B1 - New Building

Concept B1 of the New Building category portrays a new building on site B. Site B is situated within the current Headquarters Building parking lot. Normal parking lot demolition costs are associated with the site. The development scheme completely demolishes the current Headquarters Building, leaving room for parking expansion of approximately 1,000 parking spaces. Approximately 800 parking spaces are dislocated if a new building were to be built on this site.

Concept C-0 - No Change

Concept C-0 of the No Change category depicts the current Headquarters Building with no change in form or function on site C. The facility receives a major interior and exterior renovation and an AT/FP parking setback to make it a monumental building. Site C already contains all the proper utilities and framework needed support a facility of this magnitude.

Concept C1 - Renovation & Addition

Concept C1 of the Renovation and Addition category situates a building addition onto a renovated Headquarters Building on site C. Site C is located in the vicinity of 1st Street, and includes demolishing the current parking lot and pond on the north side of the current Headquarters Building. The existing Headquarters Building remains in its current location and receives a major renovation along with the north side addition to accommodate the new program. The addition would provide an easy accessible drive up location for loading and unloading. Approximately 200 parking spaces are dislocated in the scheme, with the potential to add approximately 800 parking spaces on either side of the proposed addition. First Street is also permanently closed.

Figure 5.5 - B1 - New Building

Figure 5.6 - C-0 - No Change

Figure 5.7 - C1 - Renovation & Addition

Concept C1 - New Building

Concept C1 of the New Building category portrays a new building on site C. The concept demolishes the current Headquarters Building to make space for approximately 1,000 parking spaces. Extensive ground fill would be required to build in this area, but provides a space to place a prestige building demonstrating the mission of NASA. Approximately 200 parking spaces and a stormwater retention pond are dislocated in the scheme. All existing roadways remain open.

Concept D1 - Renovation & Addition

Concept D1 of the Renovation and Addition category places a building addition onto the north side of the existing O&C on site D. The current Headquarters Building receives a major renovation, but stays in its current location. Developing in this location places more activities closer to the O&C and SSPF. Approximately 340 parking spaces are dislocated due to the addition. Potentially 600 parking spaces are created with additional parking provided on either side of the new addition. First Street is permanently closed in the concept.

Concept D1 - New Building

Concept D1 of the New Building category situates a new building on site D. The facility is placed north of the existing O&C Building. The front of the existing O&C is no longer visible as the new building becomes the dominant facility in the industrial area. Approximately 340 parking spaces are dislocated, with the potential to gain 600 spaces through parking lot expansion on either side of the new building. All existing roadways remain open in this concept.

Figure 5.8 - C1 - New Building

Figure 5.9 - D1 - Renovation & Addition

Figure 5.10 - D1 - New Building

Concept G1 - Renovation & Addition

Concept G1 of the Renovation and Addition category portrays an addition onto the east side of the renovated Headquarters Building. The addition is on site G. Minimal vehicular circulation is disrupted on 1st Street, but D Avenue is permanently closed. A patio area is provided to accommodate outdoor activities next to the addition in the concept. Parking expansion of up to 800 is accommodated on the north side of the addition and the existing O&C Building. Very few existing parking spaces are dislocated in this scheme. C Avenue and 2nd Street would require upgrades to accommodate the delivery of payloads to the O&C.

Concept G1 - New Building

Concept G1 of the New Building category situates a new building on site G. The facility is placed in the intersection of D Avenue and 1st Street on the west side of the O&C and east of the existing Headquarters Building. The new facility provides prestige and is portrayed as multi-storied with outdoor space for pedestrian traffic and meeting areas. The existing Headquarters Building and Auditorium and Training Building are completely demolished. Approximately 700 vehicular parking spaces are dislocated with the potential to relocate those spaces, with an additional 100 spaces on the north side of the new building and where the existing Headquarters Building once stood. A total of approximately 800 parking spaces are created. First Avenue is rerouted to accommodate the new building and a portion of D Avenue is permanently closed. C Avenue and 2nd Street would require upgrades to accommodate the delivery of payloads to the O&C.

Concept H1 - Renovation & Addition

Concept H1 of the Renovation and Addition category places and addition onto the west side of the renovated Headquarters Building. Buildable area is not adequate in this area to support the entire program, therefore an additional building is placed across C Avenue next to the existing CIF. This location provides adjacency complications to the O&C and SSPF. Parking expansion of up to 275 parking spaces is added between the addition and the CIF and in front of the Headquarters Building to support the needs of the consolidation. The concept displaces zero parking spaces and has very minimal impact on existing vehicular traffic flow.

Figure 5.11 - G1 - Renovation & Addition

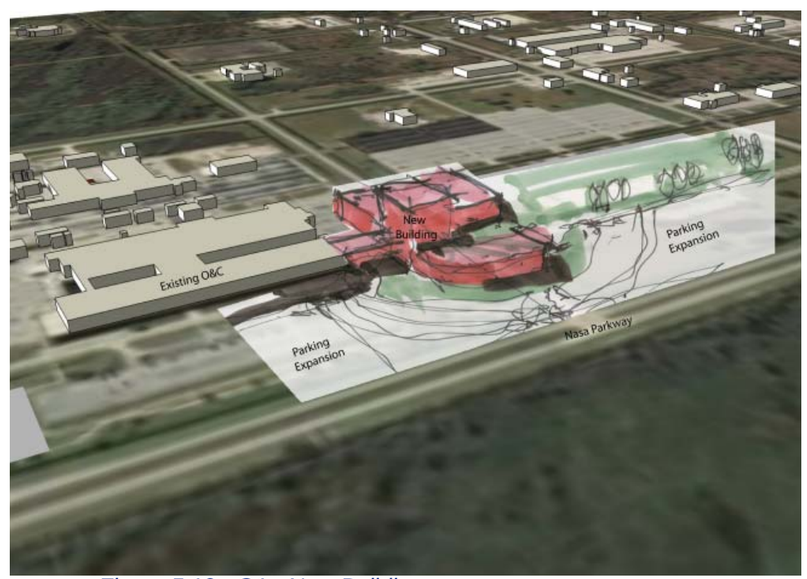


Figure 5.12 - G1 - New Building

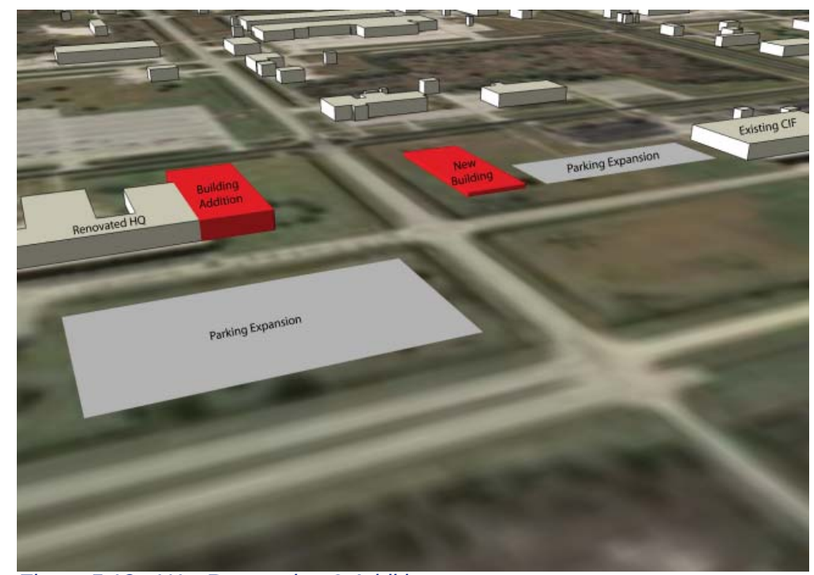


Figure 5.13 - H1 - Renovation & Addition

Concept H1 - New Building

Concept H1 of the New Building category portrays a new building on the east side of the existing CIF Building. This location provides adjacency complications to the O&C and SSPF. Approximately 150 parking spaces are dislocated. The existing Headquarters Building and auditorium are completely demolished, leaving space for parking expansion of approximately 1,000 vehicle spaces. Existing vehicular circulation is minimally disrupted in the concept.

5.3 Volume Studies

As part of the concept development progression the Jacobs team was asked to take the initial site 3-D massing models to the next level. The beginning technique was to do a simple site capacity test, which tested for adjacencies, massing and parking. The next step involved a more specific square footage representation along with initial phasing potential and the integration of a few of the sustainable ideas that were generated at the Eco-Charrette. The following 3-D models illustrate a new facility and a renovation site concept per each remaining site. The illustrations are screen captures from a 3-D SketchUp file that delineates phase one, phase two, parking, and an idea of a public “green” space. Along with the graphics, each scheme has an introduction statement and associated pro and con bullets.

Site A - Renovation

Concept A of the Renovation and Addition category, located between SSPF and O&C, emphasizes the connection between the buildings.

Pros:

- Construction can be completed in phases
- Provides connection between existing and new facilities
- Efficient building distribution
- Provides proximity to shared services
- Compact development

Cons:

- Potentially located on environmentally sensitive area
- Traffic
- Minimal proximity to parking
- New office square footage is remote from existing HQ

Figure 5.14 - H1 - New Building

Figure 5.15 - A - Renovation

Site A - New Building

Concept A of the New Building category is based on a campus approach that introduces a reduced automobile dependence and compact development. In this scheme, the vehicular circulation would require modification.

Pros:

- Construction can be completed in phases
- Terraces are aligned toward launch pads
- Reduced automobile dependence
- Compact centralized development
- HQ location prominence

Cons:

- Environmentally sensitive area
- Not efficient building distribution
- No parking proximity
- No axial view

Site B - Renovation

Concept B of the Renovation and Addition category is developed in a series of three buildings that correspond to potential phases of the project (first phase construction, second phase construction, HQ renovation). The first two phases would have a positive aspect in terms of new facility construction, but a negative aspect due to the “have” and “have not” situation, where many employees could want to be relocated to the new buildings. This scheme would maintain the existing auditorium.

Pros:

- Pedestrian link between new facilities
- Construction can be completed in phases
- Creates pedestrian connection between HQ, O&C and new facilities
- Efficient building distribution
- Compact development
- Reduce automobile dependence
- Not in environmentally sensitive area

Cons:

- Not located in close proximity to shared services
- No pedestrian connectivity for O&C and SSPF employees
- Shared services facility doesn’t act as a link
- Closing of existing roads, alternative routes

Site B - New Building

Concept B of the New Building category is located in the existing HQ parking area, is in good proximity to existing infrastructure, and is based on a campus approach. It is decentralized from O&C and SSPF, but is not far from the current location of the existing HQ Building.

Pros:

- Construction can be completed in phases
- Terraces provide views of launch pads
- Creates a covered public space
- Fulfills campus concept
- Parking in close proximity
- Not in an environmentally sensitive area

Cons:

- Does not create a connection between existing and new facilities
- No axial view
- Does not reduce automobile dependence
- No pedestrian connectivity for O&C and SSPF employees
- Parking problem during period of construction

Figure 5.16 - A - New Building

Figure 5.17 - B - Renovation

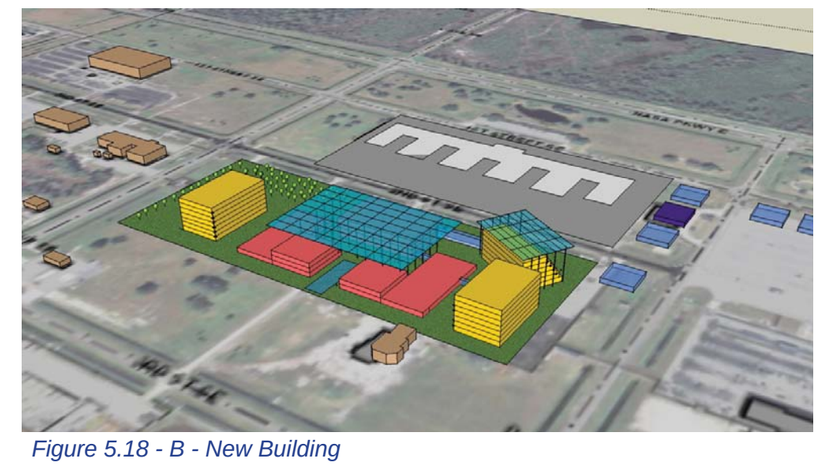


Figure 5.18 - B - New Building

Site C - Renovation

Concept C of the Renovation and Addition category is developed on a green field. Due to the proximity to the existing HQ Building, it is possible to use the existing infrastructure. This scheme presents open 'green' space between the buildings.

Pros:

- Construction can be completed in phases
- Would create a new first impression for visitors
- Efficient building distribution
- Axial view
- Provides connection of new buildings
- Reduces automobile dependence
- Not in an environmentally sensitive area

Cons:

- Does not provide proximity to shared services, BOB and OHF
- No pedestrian connectivity for O&C and SSPF employees
- Disruption existing road network

Site C - New Building

Concept C of the New Building category is located on a green field and does not disrupt the existing parking. Due to the proximity to the current HQ site, it would be possible to use the existing infrastructure. This scheme would create a prominent focal point on the site, and is reminiscent of the Space Station. At the end of the construction phases, the parking will be located on the area previously occupied by the HQ Building. The auditorium would be maintained in this scheme.

Pros:

- Construction can be completed in phases
- Pedestrian link between new facilities
- Parking in close proximity
- Not in an environmentally sensitive area

Cons:

- Does not create a connection between existing and new facilities
- Does not reduce automobile dependence
- No pedestrian connectivity for O&C and SSPF employees
- Traffic problem due to closure of 1st Street

Site D - Renovation

Concept D of the Renovation and Addition category is developed on a greenfield. Due to the proximity to the existing O&C Building, it is possible to use the existing infrastructure. This scheme presents decentralized office square footage from the existing offices located in the HQ, and also does not help to reduce the walking distance to the HQ or SSPF.

Pros:

- Construction can be completed in phases
- Would create a new first impression for visitors
- Efficient building distribution
- Axial view
- Not in environmentally sensitive area

Cons:

- Does not create proximity between HQ, SSPF and new facilities
- Disrupt existing road network
- Functional orientation is backward
- New office square footage is remote from existing HQ

Figure 5.19 - C - Renovation

Figure 5.20 - C - New Building

Figure 5.21 - D - Renovation

Site D - New Building

Concept D of the New Building category is a centralized concept that emphasizes the connectivity between existing and new facilities. This scheme would create a new prominent focal point for the site.

Pros:
- Construction can be completed in phases
- Provides a link between existing and new facilities
- Would create a new first impression for visitors
- Creates a covered public space
- Creates a proximity to shared services
- Fulfills a campus concept
- Reduces automobile dependence
- Compact development
- Creates pedestrian connectivity for O&C and SSPF employees
- Not in environmentally sensitive area

Cons:
- No proximity to parking
- Disrupt existing road network

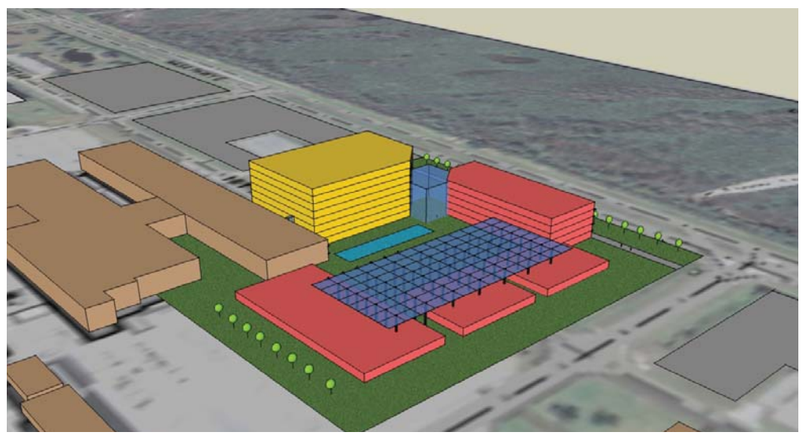


Figure 5.22 - D - New Building

Site G - Renovation

Concept G of the Renovation and Addition category is centrally located and provides an axial relationship with the existing roads. This scheme would involve creating a new vehicular path.

Pros:
- Construction can be completed in phases
- Creates a pedestrian link between existing and new facilities
- Would create a new first impression for visitors
- Efficient building distribution
- Axial view
- Reduces automobile dependence
- Provides a connection between existing and new facilities
- Not in environmentally sensitive area

Cons:
- Interrupts existing road network
- New office distribution

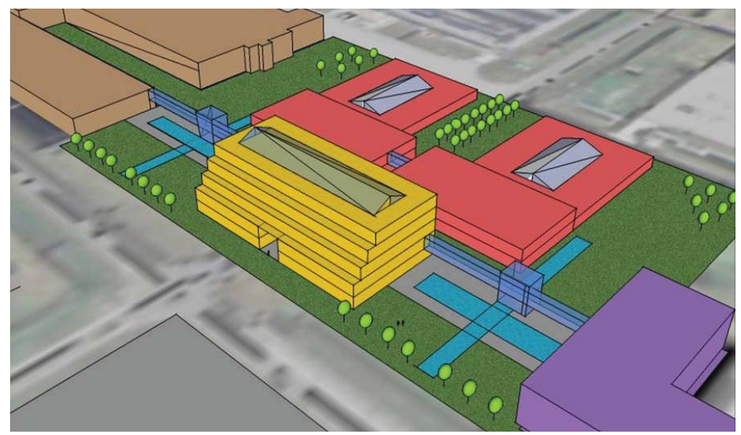


Figure 5.23 - G - Renovation

Site G - New Building

Concept G of the New Building category is oriented towards the launch site, and offers a good relationship between the new and existing buildings. New parking would be located on the site previously occupied by the HQ Building.

Pros:
- Construction can be completed in phases
- Creates a pedestrian link between existing and new facilities
- Would create a new first impression for visitors
- Efficient building distribution
- Fulfills a campus concept
- Creates proximity to shared services
- Reduces automobile dependence
- Compact development
- Not in environmentally sensitive area

Cons:
- Minimum centralization with regards to SSPF and O&C
- Interrupts existing road network

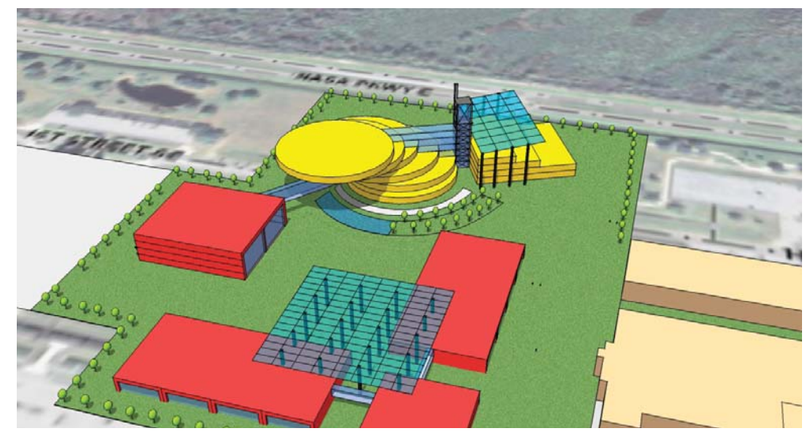


Figure 5.24 - G - New Building

Site H - Renovation/Addition

Concept H of the Renovation and Addition category is remotely located in respect to the existing facilities, which reduces the connectivity to the new facilities. This scheme would also involve the closure of an existing street.

Pros:
- Construction can be completed in phases
- Large amount of open space

Cons:
- Doesn't create a pedestrian link between existing and new facilities
- Doesn't reduce automobile dependence
- Poor adjacencies to existing facilities
- Disruption of existing road network

Site H - New Building

Concept H of the New Building category has a decentralized approach in respect the existing facilities, which reduces the connectivity to the new facilities.

Pros:
- Construction can be completed in phases
- Maintain existing road network
- Large amount of open space

Cons:
- Doesn't create a pedestrian link between existing and new facilities
- Doesn't reduce automobile dependence
- Poor adjacencies to existing facilities

Site G - Hybrid

At the conclusion of an on-site review session with the client, the team began to explore a new direction based on the discussions that came out of the 3-D models which were presented. The idea was based on a functional response to the layouts and locations of the programmatic square footage. The question we were asked was: If the project took on a renovation and addition, what would be the most appropriate adjacency be for those given functions? The following Hybrid G concept depicts an option that shows the renovation of the existing Headquarters Building, an office addition onto the front of existing Headquarters and a new employee shared services facility that acts as a link between the HQ and O&C Buildings.

Pros:
- Construction can be completed in phases
- Ease of sustainable design
- Creates a pedestrian link between existing and new facilities
- Would create a new first impression for visitors
- Creates a green space
- Fulfills a campus concept
- Efficient building distribution
- Reduces automobile dependence
- Provides a connection between existing and new facility
- Creates a new vehicular path
- Not in an environmentally sensitive area

Cons:
- No axial view

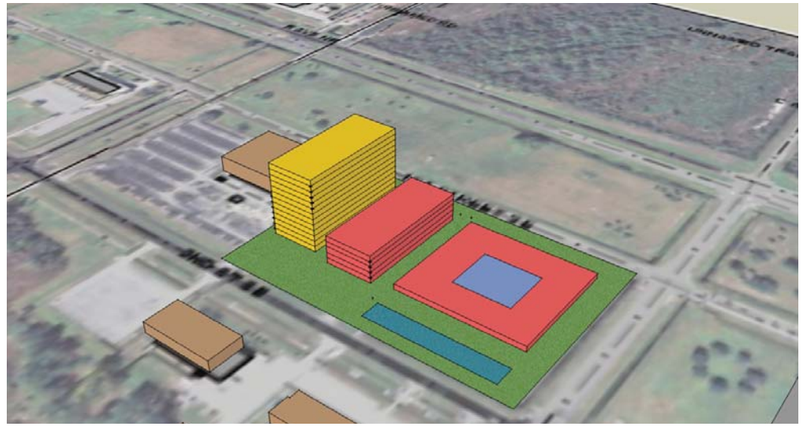


Figure 5.25 - H - Renovation/Addition

Figure 5.26 - H - New Building

Figure 5.27 - G - Hybrid

5.4 3-D Renderings

The 3D renderings (Figures 5.28 through 5.34) represent the image and character of the proposed Headquarters Building. The proposed facility is oriented on the site to gain maximum solar input and maintains proper adjacencies to surrounding support facilities. Indirect sunlight penetration through large north facing windows provides natural sunlight into work and meeting spaces. South facing windows are shaded with overhangs, and west facing windows are inset to reduce glare.

The concept images portray a highly technological facility, which will act as an icon for KSC. The monumental structure will aid in lowering energy costs, and have a positive impact on employees and visitors. The Headquarters Building will be distinguishable from other buildings and establish a sense of permanency for KSC.

The HQ complex is walkable with easily accessible pedestrian walkways. Covered passages, outdoor meeting areas, and skywalks provide linkages vertically and horizontally throughout the facility. The facility will be sustainable and sensitive to the environment, from ground-breaking to completion. Sustainable practices will be utilized throughout the life of the facility to reduce energy consumption and promote environmentally responsible design.

The goals of the concepts include creating a modern technological facility by utilizing existing facility adjacencies, orienting the new HQ facility to gain maximum solar gain, using renewable and sustainable materials, and creating a walkable complex. All of these goals are synthesized in the concepts giving a good representation of the character of the new energy efficient and sustainable facility.

Figure 5.29 View two.

Figure 5.32 View five.

Figure 5.30 View three.

Figure 5.33 View six.

Figure 5.28 View one.

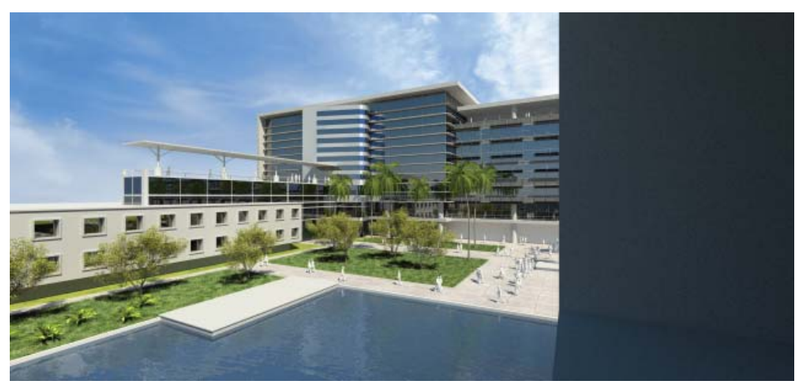


Figure 5.31 View four.

Figure 5.34 View seven.

5.5 Concept Findings

The goal of the study was to arrive at an unbiased recommendation for the most appropriate approach for the Headquarters Building. The direction received from KSC has been to have a defensible report which is based on objective research and data. After several months of data gathering, analysis, interactive charrettes, deliverables, and critiques, the study has identified the most important and objective findings from which to base our recommendation. The approach in the final sections of this study is to present the objective findings and to make a final recommendation based on the interrelationships of those findings.

Findings

The minor and major renovation options would not disrupt any sites outside of the existing HQ space, however, if the ultimate recommendation were to build an addition or new construction, a significant number of aspects could decide the most suitable location. The following findings have been identified as the major aspects which affected the type and placement of the proposed renovation / addition, and new facility for the study. These findings are an indicator of whether to build a new facility, or to renovate and add onto the existing Headquarters Building. The following aspects are not in any ranked order.

Planning Implications:

The topics that have a realistic relevance and existential determinates. The topics have locational outcomes based on realistic requirements that help shape the site, the plan, and the working environment. The top four concepts are:

- Consolidation
- Pedestrian Friendly
- Adjacencies
- Environmental

The findings based on the data, charts, and research, conclude it would easier to achieve the above mentioned concepts with a new facility, rather than renovating and adding onto the existing Headquarters Building.

Operational Efficiencies:

Are programmatic requirements that help shape the facility and affect how the employees interact with each other on a daily basis. The top four concepts are:

- Adjacencies
- Functional Layout
- Consolidation
- Migration

The findings based on the interviews, diagrams and research, delineate that it would easier to achieve the above mentioned concepts with a new facility, rather than renovating and adding onto the existing Headquarters Building. A new facility can be designed with flexibility, expandability, and sustainability as an integral part of the plan.

Site Planning:

Site planning contains the two-dimensional developable plane that remains after the opportunities and constraints are incorporated as a part of the overall proposed site. The below mentioned items have monetary and physical ramifications to the facility. The top items within this category are:

- Road Conditions
- Closing Roads
- Line of Sight (LOS)
- AT/FP stand off distances
- Blast Arcs

In site planning, the renovation / addition option is the most appropriate. Option 1, minor renovation, is typically easier and less expensive than a new site and/or facility (options 3 & 4). Infrastructure and parking produce minor costs if the existing site is added onto with a major renovation to the existing facility.

Maintenance:

Maintenance is a critical filter having serious financial ramifications, both in the short and long term. Higher up-front costs may be lower long-term costs in a life-cycle analysis. Even though new facilities require maintenance, existing facilities need more maintenance to update old equipment, and additional funds to maintain because of the older building age. The top three applicable concepts are:

- Life Cycle Dollars
- Age of Building
- Equipment

In terms of maintenance, our findings continually indicate that a new facility is the more financially responsible decision. Maintenance and equipment will also contribute to the emphasis on conserving energy and energy dollars.

Sustainability:

Sustainability is one of the most important factors of the present which has measurable impacts on the future. Today's ideas and approaches towards interior space, quality of work place, and the philosophy of materials, will have a profound effect on employees' productivity and attitude. The top three concepts of sustainability are:

- Natural Light
- Environmental
- Materials

The current construction type, footprint configuration, and orientation of the existing HQ Building, appear to be cost prohibitive if renovated versus building a new facility.

Infrastructure:

Infrastructure was a critical determinate as Jacobs evaluated the capacities and locations of the existing utilities. Capacity was not as important of an issue as location and condition were. There is a high cost associated with retention basin and civil grading for several of the selected sites. The top four issues that were addressed for site selection are:

- Storm Drainage
- Retention Basin Cost
- Loop System
- Alternative Energy

Similar to the site planning discussion, infrastructure lends itself to a renovation/addition, due to less disruption to the existing underground utilities. Upgrades and maintenance are less expense than the removal and creation of totally new systems.

Costs:

One of the most important factors is the cost of the recommended solution. Although it is a typical situation for the initial "bottom line" to influence the final decision, life-cycle costs are equally important if the solution is evaluated over a long-term scenario, and with an "all inclusive" philosophy. A few of the many items associated with costs are:

- Hard costs
- Soft Costs
- Life cycle
- Energy Costs
- Sustainability

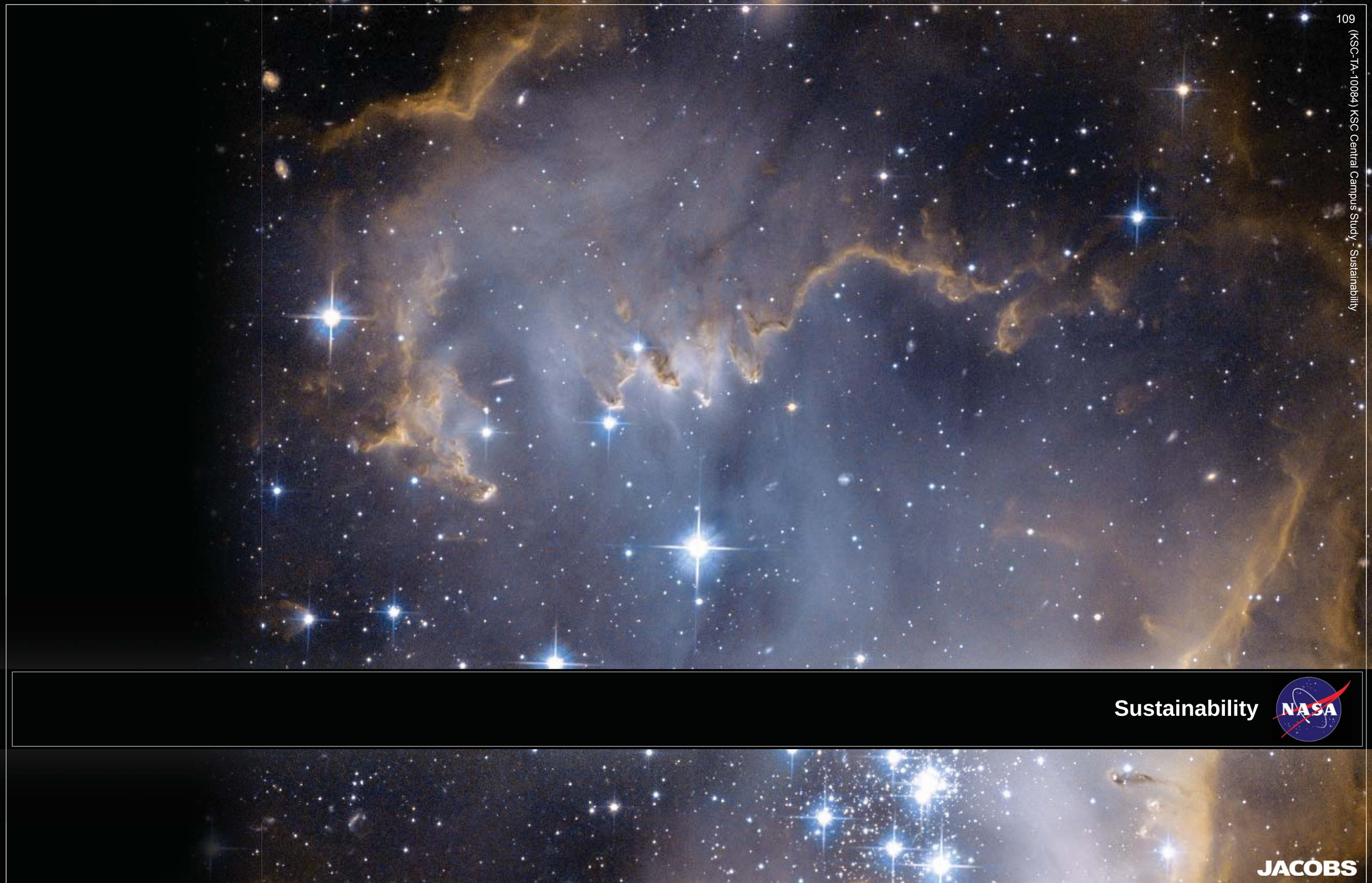
In our financial analysis, the data showed that if the project is evaluated over the life of the facility, comparing maintenance, depreciation, and quality of environment, it is more cost effective to build a new facility, and not renovate the existing one.

Summary:

In summary, four of the six evaluation topics indicated that a new facility concept was more beneficial, rather than a minor or major renovation, or a renovation / addition concept to the existing Headquarters Building. The consolidation of the remote facilities included in the study are also found to support the concept of efficiency gains, both in operational costs, and programmatic square footage, which in turn parlays into increased savings per square foot of facility.

Recommendation:

Pending review and comment from KSC leadership, Jacobs' recommendation, prior to cost analysis, and from an otherwise comprehensive standpoint, is for the construction of a new Headquarters facility, which would also incorporate the consolidation of the ancillary buildings identified in the study. The project team identified several potential buildable sites throughout the duration of the study, which have been narrowed to four with the input of the NASA facilities team (See Figure 3.36). With repeated reviews and testing, site G has come to light as the preferable choice for a new facility.



Sustainability

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6. Sustainability

6.1 Introduction

Sustainable design, at its most basic level, leaves a high quality of life for future generations. For a society to be sustainable, it must: (1) Use all resources (energy, water, material, and land) efficiently and minimize waste; (2) Protect the natural environment, the source of all resources; and (3) Create a healthy built environment for future generations. The life expectancies of buildings have been steadily decreasing throughout history as technology has been increasing. This trend needs to be reversed in order to spread diminishing resources and energies over a longer period of time. By utilizing sustainable building practices, or “green” strategies, today’s new and renovated facilities can begin to integrate old knowledge and new technologies into practice together. Strategies could range from simple techniques, such as utilizing the best building orientation to maximize natural light and ventilation, to complicated, but efficient, solar or wind energy converters on the roof of the facility. The options available to incorporate sustainability can be either easy or difficult, depending on the attitudes and choices made by the project team.

6.2 Approach & Process

From September 30 through October 1, 2008, the Jacobs team conducted Charrette II with the NASA team, which was held at KSC. The purpose of Charrette II was to present multiple site locations for the proposed consolidated facilities, and to discuss and conclude which sites should be further considered for development. This Charrette provided the opportunity to further evaluate the sites in regards to many aspects, including environment. Such discussions provided an easy transition to the eco-charrette, which was hosted by Jacobs in their office, on Thursday, October 2, 2008. More specific than a typical charrette, the eco-charrette focused on generating sustainable goals and then developing strategies to accomplish those goals for the integrated design of an environmentally responsible project.

The objectives of the charrette were to:

- Understand what sustainability means in terms of the built and natural environments
- Determine project goals and opportunities and establish measurable objectives
- Utilize the team’s various backgrounds and expertise to develop ideas and approaches
- Work collaboratively to reach solutions to sustainable issues
- Incorporate LEED credit requirements as guidelines for decisions

Throughout the day, the Jacobs and NASA teams collaborated to achieve the aforementioned objectives. Jacobs documented associated cost drivers, using LEED New Construction, Version 2.2 as a guide for design factors, and displayed the findings on the walls of the meeting room. A full version of this documentation may be found in Figures 6.1-6.2. The decisions on how sustainability will affect costs will be incorporated in more detail in Section Seven, Parametric Cost Estimates. The teams also conducted a brainstorming session, in which every person present contributed ideas for achievable, creative, green concepts that could be applicable to the KSC Central Campus Study. The concepts covered all aspects of a construction project, including site issues, energy efficiency, water conservation, renewable resources, and waste reduction.

6.3 Design Goals

Sustainable design is quickly becoming the standard for construction projects, including those involving the Federal government. In order for the facility to be a success, the green goals, ideas, and intentions must be in place before the design can be considered. The earlier in the project process that integrated design occurs, the greater the impact on building performance, and the lower the impact on costs. In terms of decision making in the process, NASA has an advantage over many conventional commercial facilities because it will be the sole owner-occupier of the renovated or new facility at KSC. Owner-occupiers are in the best position to make long-term investment decisions about their buildings. They can have a long-term perspective and stand to benefit directly from energy savings. This concept applies both to the option of specifying a new building that they will occupy, as well as to retrofitting an existing facility.

The design goals of a consolidated HQ Building incorporate the same overall goals of sustainability:

- To minimize life cycle costs
- To reduce resource consumption
- To reduce resource waste
- To increase equipment and system efficiency
- To emphasize source and waste reduction
- To create a healthy and safe environment

The overall project goals, previously listed and described in Section 2.8, also have aspects that are directly related to the goals listed above. The main objective headings — Safety and Security, Public Image and Visual Character, Quality of Life, Development Program / Land Allocation / Mixed Uses, Environmental, Recreation and Open Space, and finally Utility Systems — are further supported through the utilization of sustainable practices.

6.4 LEED - A Guideline

The United States Green Building Council (USGBC) is a non-profit community of leaders working to make green buildings available to everyone within a generation. The USGBC established the Leadership in Energy and Environmental Design (LEED) Green Building Rating System to provide building owners and operators with the tools they need to have a measurable and immediate impact on their buildings’ performance. LEED is a third-party certification program, and the nationally accepted benchmark for the design, construction and operation of high performance green buildings.

NASA has in place a Policy Directive (NPD 8820.2C) that mandates that:

> Industry-best practice of sustainable design, maintainable design, building commissioning, and safety and security shall be incorporated, to the maximum extent possible, into the planning and execution of facility projects.

The NPD also states that in all facility projects, life-cycle cost analyses should be used when evaluating sustainable design elements, and for all appropriate projects, the LEED Green Building Rating System should be used to rate the level of sustainable design. Therefore, the project team has elected to use the LEED rating system as a guide toward establishing green building practices in the study.

Three of the four previously defined options for the study would use LEED for New Construction, Version 2.2 as their official rating system. It is for this reason that the project team has introduced the LEED-NC as the sustainable design guideline, as it is applicable to both major renovations, and for new construction of a facility. LEED-NC has six major categories used for scoring and awarding points to a project:

1. Sustainable Sites (14 possible points)
2. Water Efficiency (5 possible points)
3. Energy & Atmosphere (17 possible points)
4. Materials & Resources (13 possible points)
5. Indoor Environmental Quality (15 possible points)
6. Innovation & Design Process (5 possible points)

Depending on the points awarded to a completed facility, the building could be rated as one of the following:

- Certified (26-32 points)
- Silver (33-38 points)
- Gold (39-51 points)
- Platinum (52-69 points)

The consolidated facility that the project team is working on should be designed to the highest level possible, striving to achieve at least a Silver rating. By designing to a high level of sustainability, the project team creates the most environmentally friendly, most efficient, healthiest, and safest building possible; a building whose standard is above that of a typical construction project.

During the eco-charrette, the project team used the LEED-NC checklist to establish how applicable each credit was to either a renovation of the existing HQ Building, or to a newly constructed facility. While a few of the credits were determined to lend themselves more easily to a renovation, it was discovered that many of the credits were more or entirely applicable to a newly constructed building. It could be concluded that a new facility would have an advantage over a retrofitted building in terms of sustainable ideas such as energy efficiency, and operating and maintenance costs, particularly over an extended period of time. Figures 6.1 and 6.2 show how each credit was determined to apply to either a renovated facility, or a newly constructed building. Within the graphic, there are three columns used for differentiating the credits. The “S” column (for Same) means that the credit is equally applicable to both renovation and new construction. The “R” column (Renovation), and “N” column (New Construction) were labeled with a weighed percentage that was determined to represent how applicable the credit was to the two options.

Section Seven, Parametric Cost Estimates, will strive to quantify the actual dollar amounts associated with LEED, and with operation and maintenance.

LEED-NC

LEED-NC Version 2.2 Registered Project Checklist

S	R	N	Sustainable Sites (14 Points)		
			Prereq 1	**Construction Activity Pollution Prevention**	Required
√			Credit 1	**Site Selection**	1
√			Credit 2	**Development Density & Community Connectivity**	1
√			Credit 3	**Brownfield Redevelopment**	1
√			Credit 4.1	**Alternative Transportation**, Public Transportation Access	1
	40	60	Credit 4.2	**Alternative Transportation**, Bicycle Storage & Changing Rooms	1
√			Credit 4.3	**Alternative Transportation**, Low-Emitting and Fuel-Efficient Vehicles	1
√			Credit 4.4	**Alternative Transportation**, Parking Capacity	1
	60	40	Credit 5.1	**Site Development,** Protect of Restore Habitat	1
√			Credit 5.2	**Site Development,** Maximize Open Space	1
	40	60	Credit 6.1	**Stormwater Design,** Quantity Control	1
√			Credit 6.2	**Stormwater Design,** Quality Control	1
	30	70	Credit 7.1	**Heat Island Effect,** Non-Roof	1
	45	55	Credit 7.2	**Heat Island Effect,** Roof	1
	40	60	Credit 8	**Light Pollution Reduction**	1

S	R	N	Water Efficiency (5 Points)		
	25	75	Credit 1.1	**Water Efficient Landscaping**, Reduce by 50%	1
	20	80	Credit 1.2	**Water Efficient Landscaping**, No Potable Use or No Irrigation	1
	20	80	Credit 2	**Innovative Wastewater Technologies**	1
√			Credit 3.1	**Water Use Reduction**, 20% Reduction	1
√			Credit 3.2	**Water Use Reduction**, 30% Reduction	1

S	R	N	Energy & Atmosphere (17 Points)		
			Prereq 1	**Fundamental Commissioning of the Building Energy Systems**	Required
			Prereq 2	**Minimum Energy Performance**	Required
			Prereq 3	**Fundamental Refrigerant Management**	Required
	10	90	Credit 1	**Optimize Energy Performance**	1 to 10
√			Credit 2	**On-Site Renewable Energy**	1 to 3
√			Credit 3	**Enhanced Commissioning**	1
	40	60	Credit 4	**Enhanced Refrigerant Management**	1
√			Credit 5	**Measurement & Verification**	1
√			Credit 6	**Green Power**	1

Figure 6.1 LEED Checklist

continued...

S	R	N	Materials & Resources		13 Points
			Prereq 1	**Storage & Collection of Recyclables**	Required
	100	0	Credit 1.1	**Building Reuse**, Maintain 75% of Existing Walls, Floors & Roof	1
	100	0	Credit 1.2	**Building Reuse**, Maintain 100% of Existing Walls, Floors & Roof	1
	100	0	Credit 1.3	**Building Reuse**, Maintain 50% of Interior Non-Structural Elements	1
√			Credit 2.1	**Construction Waste Management**, Divert 50% from Disposal	1
√			Credit 2.2	**Construction Waste Management**, Divert 75% from Disposal	1
√			Credit 3.1	**Materials Reuse**, 5%	1
√			Credit 3.2	**Materials Reuse**,10%	1
√			Credit 4.1	**Recycled Content**, 10% (post-consumer + ½ pre-consumer)	1
√			Credit 4.2	**Recycled Content**, 20% (post-consumer + ½ pre-consumer)	1
√			Credit 5.1	**Regional Materials**, 10% Extracted, Processed & Manufactured Regionally	1
√			Credit 5.2	**Regional Materials**, 20% Extracted, Processed & Manufactured Regionally	1
√			Credit 6	**Rapidly Renewable Materials**	1
√			Credit 7	**Certified Wood**	1

S	R	N	Indoor Environmental Quality		15 Points
			Prereq 1	**Minimum IAQ Performance**	Required
			Prereq 2	**Environmental Tobacco Smoke** (ETS) **Control**	Required
√			Credit 1	**Outdoor Air Delivery Monitoring**	1
	40	60	Credit 2	**Increased Ventilation**	1
√			Credit 3.1	**Construction IAQ Management Plan**, During Construction	1
√			Credit 3.2	**Construction IAQ Management Plan**, Before Occupancy	1
√			Credit 4.1	**Low-Emitting Materials**, Adhesives & Sealants	1
√			Credit 4.2	**Low-Emitting Materials**, Paints & Coatings	1
√			Credit 4.3	**Low-Emitting Materials**, Carpet Systems	1
√			Credit 4.4	**Low-Emitting Materials**, Composite Wood & Agrifiber Products	1
√			Credit 5	**Indoor Chemical & Pollutant Source Control**	1
√			Credit 6.1	**Controllability of Systems**, Lighting	1
√			Credit 6.2	**Controllability of Systems**, Thermal Comfort	1
	30	70	Credit 7.1	**Thermal Comfort**, Design	1
√			Credit 7.2	**Thermal Comfort**, Verification	1
	0	100	Credit 8.1	**Daylight & Views**, Daylight 75% of Spaces	1
	0	100	Credit 8.2	**Daylight & Views**, Views for 90% of Spaces	1

S	R	N	Innovation & Design Process		5 Points
√			Credit 1.1	**Innovation in Design**: Provide Specific Title	1
√			Credit 1.2	**Innovation in Design**: Provide Specific Title	1
√			Credit 1.3	**Innovation in Design**: Provide Specific Title	1
√			Credit 1.4	**Innovation in Design**: Provide Specific Title	1
√			Credit 2	**LEED® Accredited Professional**	1

Figure 6.2
LEED Checklist

6.5 Sustainable Ideas

The final endeavor at the eco-charrette was to use the team's varying backgrounds and areas of expertise to compile a list of sustainable ideas that could be applicable to the KSC HQ Consolidation study. The ideas developed during the eco-charrette covered all aspects of sustainability, including: resource consumption, reducing waste, increasing equipment and system efficiency, healthy and safe environments, etc. A few of the ideas are listed below (for a complete listing of these ideas, please refer to the Appendix):

- Create interior architectural features that naturally contribute to air flow within the building, both horizontally and vertically
- Incorporate recycling into the architecture by way of chutes to the collection areas
- Have a nursery within the facility to make an enjoyable public feature, and to cultivate native plants for use on the grounds of KSC
- Build a 'green roof', creating a useable outdoor garden area and enhancing the energy efficiency of the building
- Utilize raised flooring to integrate more efficient and controllable HVAC systems
- Design a water feature, interior or exterior, using recaptured rainwater, that also creates a microclimate by cooling the surrounding area
- Introduce reclaimed items from KSC projects, aka 'space junk' into feature design elements
- As a lobby feature, create an educational center, explaining how sustainability was incorporated into the building, and promoting sustainable practices in all aspects of life

These ideas, along with additional ones that may be introduced later, are intended to be used to determine the design of the facility, whether it be a renovation, a new building, or some combination of the two.

6.6 Conclusions

Federal and local governments have already initiated programs mandating sustainable practices in their facilities, whether those facilities are newly built, renovated, leased or owned. Soon, the higher education facilities will follow suit, if they have not already, using sustainability to motivate their students, faculty, and surrounding communities, presenting an image of cutting edge programs and ideas. At the same time, the private industry sector is beginning to see sustainability as being economical by providing a more substantial return on investment. Recently, even residential developers have begun to recognize sustainability as marketable, and as an attractive feature to offer their prospective buyers.

As a major consumer that spends $200 billion annually, the Federal government is the world's largest single buyer of many products. Federal purchasing helps to lower the cost of these products and services, and provides a model for other government purchasers, as well as the private sector. Acting as a world leader, the Federal government can also promote energy efficiency, water conservation, the use of renewable energy products, and help foster markets for emerging technologies, which correspond to the main goals of sustainability.

From the eco-charrette, the project team learned how sustainability is easily integrated into any construction project, whether it is a renovation, addition, or a brand new facility. Sustainable goals are possible and achievable, not through increased effort or expense, but by increased awareness and participation. NASA is paving the way for continued sustainable practices with their on-going facilities projects, not because it is the easy thing to do, but because it is the right thing to do for their Center, and more importantly, for the future of the environment.

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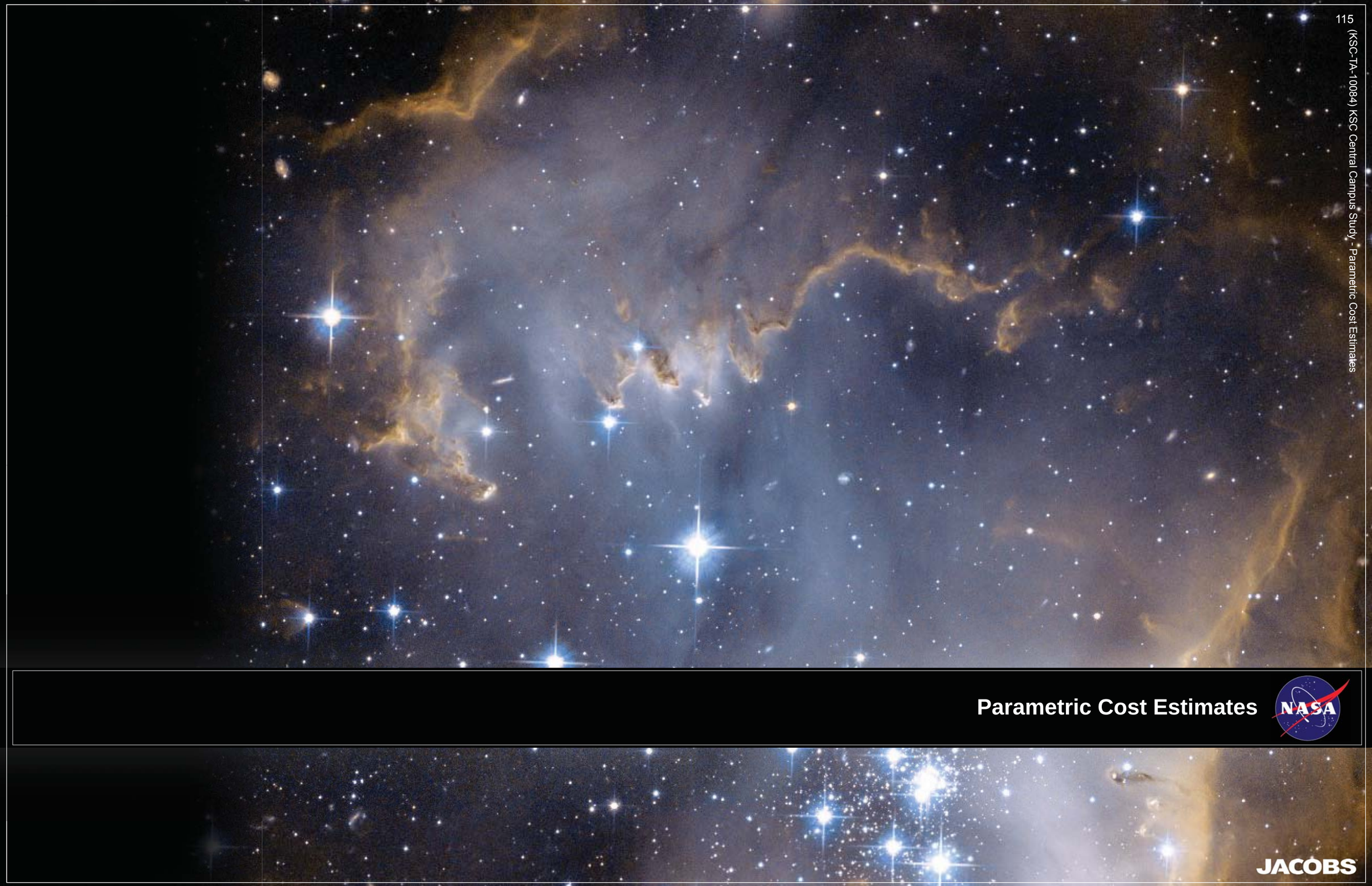

Parametric Cost Estimates

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7. Parametric Cost Estimates

Introduction

Some of the highlights identified within the financial analysis are as follows:

Minor Renovation (Option 1):

- Minor systems; interior quality of space remains the same
- Highest and most difficult migration strategy
- More demolition costs to renovate
- This option although the lowest cost is has the least amount of savings; both O&M and energy

Major Renovation (Option 2):

- Updated renovated facility
- Addition of shared services addition
- No consolidation of existing buildings at KSC
- Existing HQ structure remains for 50 more years

Major Renovation & New Addition (Option Three):

- More dollars to renovate the headquarters but do not get same level of efficiencies
- The highest overall project cost
- More square footage at more dollars compared to option 4
- 7% more square footage

New Construction (Option Four):

- Greatest amount of savings
- Ability to incorporate sustainability
- Flexibility of space
- Operations and maintenance savings
- Highest 20 year energy savings

7.0.0 and 7.0.1 Introduction and Cost Analysis

Provides data and compiles cost data for each site and option. The basis of the data contained herein was based on the following:

1. Data from Jacobs Construction Estimating Database.
2. Data from RS Means
3. Data from National Construction Estimator
4. Actual bids for Federal projects within the State of Florida in 2008. A total of 8 bids were used to compare square footage cost for “New Construction”. Two bids were used for Federal project “Renovation”, along with data from the renovation of the NASA KSC O&C building in the cost basis for the renovation unit cost.
5. Data and input from NASA KSC including historical data.

7.0.2 – Estimate Summary

Provides a summary of the square footage, personnel consolidated, initial cost, LEED cost, yearly energy cost, O&M cost, operational efficiencies, and life cycle cost.

7.1 – Site Totals

Provides a summary of building construction cost, site construction cost, demolition cost, furnishings cost, activation cost, and migration cost. Also included, are items for escalation and contingency. Escalation is calculated at 5 percent per year, and is based on historical data for KSC provided by NASA’s master planning personnel. Contingency has been set at 10% to allow for unforeseen building, site, and design conditions.

7.2 – Project Summary, Estimating

Provides additional data, comments, and insight into methods and assumptions used in preparing the cost data.

7.3 – Estimate Notes

Provides notes on the basis of the estimate for overall site conditions, construction labor, and working conditions.

7.4 – Square Footage Worksheet

Summarizes all buildings contained in the study, and how they are assembled in each option, including how efficiencies were calculated.

7.5 - Energy Cost

Estimates first-year energy cost for each option and site.

7.6 - Operations and Maintenance Cost

Estimates the operations and maintenance cost for each site and option at 5 year intervals from year 1 through 40.

7.7.1 – Building Cost Options 1 & 2

Provides a summary of square footage cost for Options 1 and 2, and includes LEED cost, labor and material rate adjustments for the area, material handling and flow adjustments, productivity/access adjustments for the option, and adjustments for current economic conditions.

7.7.2 – Building Cost Option 3

Provides a summary of square footage cost for Option 3 and includes LEED cost, labor and material rate adjustments for the area, material handling and flow adjustments, productivity/access adjustments for the option and adjustments for current economic conditions.

7.7.3 – Building Cost Option 4

Provides a summary of square footage cost for Option 4 and includes LEED cost, labor and material rate adjustments for the area, material handling and flow adjustments, productivity/access adjustments for the option, and adjustments for current economic conditions.

7.7.4 – Building Unit Cost – Renovation

Provides building unit cost for new construction by CSI Division for 15 different space types included in the buildings within this study.

7.7.5 – Building Unit Cost – New Building

Provides building unit cost for renovation of buildings by CSI Division for 15 different space types included in the buildings within this study.

7.7.6 – LEED Cost

Provides a summary of LEED cost by space type, and type of construction (New or Renovation).

7.8 – Demolition Cost

Summarizes demolition cost by site and by option.

7.9 – Site Work

Summarizes site work cost for each site for Options 3 and 4.

7.10 – Furnishings Cost

Summarizes furnishings cost for each site for Options 2, 3, and 4, based on historical percentages provided by NASA KSC. Option 1 assumes furnishings will be reused.

7.11 – Activation Cost

Summarizes activation cost for each site for Options 2, 3, and 4, based on historical percentages provided by NASA KSC.

7.12 – Migration Cost

Summarizes migration cost for each site and option, based on historical data provided by NASA KSC.

7.13 – Life Cycle Cost

Summarizes life cycle cost over 40 years of building life, including initial cost, energy cost, O&M cost, and debt interest, for each site and option.

7.14 – Operational Efficiency

Provides a summary of the calculation used for operational efficiency gains for personnel movement and consolidation.

Final Recommendation

A summary of the findings from the data gathered and analyzed is as follows:

- An internal survey concluded that the two criteria considered to be the most important to pre-design of a facility were employee safety, and energy efficiency.
- A site suitability matrix indicated that the most suitable site for potential building is site G.
- The result of site evaluation matrix indicates that, for new construction, sites G and D tie for being the most appropriate.
- It can be more difficult to apply 'green' ideas to outdated facilities, whereas a new facility can integrate various new design philosophies with fewer boundaries.
- The solution based on lowest cost, by site, by option is: New on G.

In short, constructing a new facility, and locating it on site G is the overall best option, and is the conclusion of the KSC Central Campus Study.

7.0.0 Summary Cost Analysis

CONSTRUCTION COST				
	Option 1	Option 2	Option 3	Option 4
CoF (CCE)	$ 136,300,000	$ 167,300,000	$ 174,800,000	$ 159,800,000
R&D	$ 11,200,000	$ 25,500,000	$ 26,900,000	$ 24,000,000
Demolition Cost	$ 12,900,000	$ 12,400,000	$ 12,300,000	$ 8,200,000
Migration Cost	$ 27,500,000	$ 27,500,000	$ 23,700,000	$ 12,500,000
Total Cost	$ 187,900,000	$ 232,700,000	$ 237,700,000	$ 204,500,000
SAVINGS SUMMARY				
7 Year O&M Savings	$ 30,100,000	$ 31,300,000	$ 34,200,000	$ 37,800,000
(Estimated)				
7 Year Energy Savings	$ 2,000,000	$ 2,900,000	$ 5,500,000	$ 7,000,000
(Estimated)				
7 Year Savings	$ 32,100,000	$ 34,200,000	$ 39,700,000	$ 44,800,000
20 Year O&M Savings	$ 151,100,000	$ 161,400,000	$ 180,900,000	$ 204,400,000
(Estimated)				
20 Year Energy Savings	$ 8,700,000	$ 12,600,000	$ 23,800,000	$ 30,500,000
(Estimated)				
20 Year Savings	159,800,000	174,000,000	204,700,000	234,900,000
40 Year O&M Savings	$ 264,100,000	$ 440,300,000	$ 481,400,000	$ 532,700,000
(Estimated)				
40 Year Energy Savings	$ 29,300,000	$ 42,300,000	$ 80,200,000	$ 103,000,000
(Estimated)				
40 Year Savings	$ 293,400,000	$ 482,600,000	$ 561,600,000	$ 635,700,000

7.0.1 Detailed Cost Analysis

	Option 1	Option 2	Option 3 - 1 For 1						Option 3 - Space Utilization					
			Site "A"	Site "B"	Site "C"	Site "D"	Site "G"	Site "H"	Site "A"	Site "B"	Site "C"	Site "D"	Site "G"	Site "H"
CoF (CCE)	136,244,150	167,205,835	183,872,199	181,376,285	184,633,273	187,327,318	186,209,766	184,968,105	172,388,523	169,892,609	173,149,597	175,843,642	174,726,090	173,484,429
R&D	11,147,249	25,436,746	28,762,526	28,762,526	28,762,526	28,762,526	28,762,526	28,762,526	26,864,397	26,864,397	26,864,397	26,864,397	26,864,397	26,864,397
Demolition Cost	12,869,043	12,338,718	11,443,478	11,443,478	11,443,478	11,443,478	12,266,022	11,443,478	11,443,478	11,443,478	11,443,478	11,443,478	12,266,022	11,443,478
Migration Cost	27,475,313	27,475,313	23,615,705	23,615,705	23,615,705	23,615,705	23,615,705	23,615,705	23,615,705	23,615,705	23,615,705	23,615,705	23,615,705	23,615,705

	Option 4 - 1 For 1						Option 4 - Space Utilization					
	Site "A"	Site "B"	Site "C"	Site "D"	Site "G"	Site "H"	Site "A"	Site "B"	Site "C"	Site "D"	Site "G"	Site "H"
CoF (CCE)	183,210,651	182,901,889	182,928,086	180,937,858	180,775,190	178,964,774	162,200,232	161,891,470	161,917,667	159,927,440	159,764,771	157,954,355
R&D	27,396,884	27,396,884	27,396,884	27,396,884	27,396,884	27,396,884	23,924,088	23,924,088	23,924,088	23,924,088	23,924,088	23,924,088
Demolition Cost	8,145,103	8,145,103	8,145,103	8,145,103	8,145,103	8,145,103	8,145,103	8,145,103	8,145,103	8,145,103	8,145,103	8,145,103
Migration Cost	12,436,459	12,436,459	12,436,459	12,436,459	12,436,459	12,436,459	12,436,459	12,436,459	12,436,459	12,436,459	12,436,459	12,436,459

7.0.2 – Estimate Summary

	Total SF	Personnel	Total Initial Cost 2013 Dollars	$ / Sq Ft	LEED Cost (Construction $)	Energy Cost $ / Yr	O & M Cost $ / Yr	Operational Efficiencies $ / Yr	Life Cycle Cost Total Dollars - 20Years	Life Cycle Cost Total Dollars - 40Years	$ / Sq Ft 2009 Dollars
Option 1 HQ Only	428,789	1283	$ 112,297,185	$ 261.89	$ 3,723,232	$ 805,480	$ 2,051,842	$ -	$ 523,173,336	$ 894,515,355	$ 228.23
Option 1 All Buildings	626,428	1819	$ 164,057,615	$ 261.89	$ 5,439,358	$ 1,612,169	$ 2,617,405	$ -	$ 707,021,497	$ 1,211,281,588	$ 228.23
Option 2 HQ Only	428,789	1283	$ 141,932,236	$ 331.01	$ 3,723,232	$ 758,099	$ 1,882,065	$ -	$ 562,941,860	$ 924,501,932	$ 288.45
Option 2 All Buildings	613,029	1819	$ 202,916,961	$ 331.01	$ 5,191,454	$ 1,262,148	$ 2,495,110	$ 19,377	$ 774,827,344	$ 1,276,645,151	$ 288.45
Option 3 Renovation / Addition	**1 For 1 Replacement**										
Site "A"	656,343	1897	$ 247,693,908	$ 377.38	$ 4,553,828	$ 1,015,363	$ 2,165,154	$ 1,183,244	$ 830,385,512	$ 1,297,655,464	$ 328.87
Site "B"	656,343	1897	$ 245,197,994	$ 373.58	$ 4,553,828	$ 1,015,363	$ 2,143,337	$ 974,937	$ 822,317,519	$ 1,285,474,853	$ 325.56
Site "C"	656,343	1897	$ 248,454,982	$ 378.54	$ 4,553,828	$ 1,015,363	$ 2,171,807	$ 974,937	$ 832,845,672	$ 1,301,369,677	$ 329.88
Site "D"	656,343	1897	$ 251,149,027	$ 382.65	$ 4,553,828	$ 1,015,363	$ 2,195,356	$ 1,117,406	$ 841,554,120	$ 1,314,517,210	$ 333.46
Site "G"	656,343	1897	$ 250,854,019	$ 382.20	$ 4,553,828	$ 1,015,363	$ 2,192,778	$ 1,117,406	$ 840,600,511	$ 1,313,077,505	$ 333.06
Site "H"	656,343	1897	$ 248,789,814	$ 379.05	$ 4,553,828	$ 1,015,363	$ 2,174,734	$ 838,055	$ 833,928,007	$ 1,303,003,727	$ 330.32
Option 3 With Efficiency Gains Renovation / Addition											
Site "A"	613,029	1897	$ 234,312,104	$ 382.22	$ 4,253,307	$ 948,356	$ 2,048,181	$ 1,183,244	$ 785,167,792	$ 1,226,485,522	$ 333.08
Site "B"	613,029	1897	$ 231,816,190	$ 378.15	$ 4,253,307	$ 948,356	$ 2,026,363	$ 974,937	$ 777,099,798	$ 1,214,304,911	$ 329.53
Site "C"	613,029	1897	$ 235,073,178	$ 383.46	$ 4,253,307	$ 948,356	$ 2,054,833	$ 974,937	$ 787,627,951	$ 1,230,199,735	$ 334.16
Site "D"	613,029	1897	$ 237,767,223	$ 387.86	$ 4,253,307	$ 948,356	$ 2,078,383	$ 1,117,406	$ 796,336,399	$ 1,243,347,268	$ 337.99
Site "G"	613,029	1897	$ 237,472,215	$ 387.38	$ 4,253,307	$ 948,356	$ 2,179,594	$ 1,117,406	$ 795,382,791	$ 1,255,426,004	$ 337.58
Site "H"	613,029	1897	$ 235,408,009	$ 384.01	$ 4,253,307	$ 948,356	$ 2,057,760	$ 838,055	$ 788,710,286	$ 1,231,833,785	$ 334.64
Option 4 New Building	**1 For 1 Replacement**										
Site "A"	656,343	1897	$ 231,189,098	$ 352.24	$ 2,347,876	$ 870,311	$ 2,020,882	$ 1,183,244	$ 772,788,362	$ 1,204,414,856	$ 306.96
Site "B"	656,343	1897	$ 230,880,336	$ 351.77	$ 2,347,876	$ 870,311	$ 2,018,183	$ 974,937	$ 771,790,294	$ 1,202,908,028	$ 306.55
Site "C"	656,343	1897	$ 230,906,533	$ 351.81	$ 2,347,876	$ 870,311	$ 2,018,412	$ 974,937	$ 771,874,976	$ 1,203,035,877	$ 306.58
Site "D"	656,343	1897	$ 228,916,305	$ 348.78	$ 2,347,876	$ 870,311	$ 2,001,015	$ 1,117,406	$ 765,441,603	$ 1,193,323,125	$ 303.94
Site "G"	656,343	1897	$ 228,753,637	$ 348.53	$ 2,347,876	$ 870,311	$ 1,999,593	$ 1,117,406	$ 764,915,780	$ 1,192,529,267	$ 303.72
Site "H"	656,343	1897	$ 226,943,221	$ 345.77	$ 2,347,876	$ 870,311	$ 1,983,767	$ 838,055	$ 759,063,645	$ 1,183,694,036	$ 301.32
Option 4 With Efficiency Gains New Building											
Site "A"	573,146	1897	$ 206,705,883	$ 360.65	$ 2,050,262	$ 759,991	$ 1,806,868	$ 1,183,244	$ 690,417,781	$ 1,075,277,284	$ 314.29
Site "B"	573,146	1897	$ 206,397,121	$ 360.11	$ 2,050,262	$ 759,991	$ 1,804,169	$ 974,937	$ 689,419,713	$ 1,073,770,456	$ 313.82
Site "C"	573,146	1897	$ 206,423,318	$ 360.16	$ 2,050,262	$ 759,991	$ 1,804,398	$ 974,937	$ 689,504,395	$ 1,073,898,304	$ 313.86
Site "D"	573,146	1897	$ 204,433,090	$ 356.69	$ 2,050,262	$ 759,991	$ 1,787,001	$ 1,117,406	$ 683,071,022	$ 1,064,185,553	$ 310.83
Site "G"	573,146	1897	$ 204,270,422	$ 356.40	$ 2,050,262	$ 759,991	$ 1,785,579	$ 1,117,406	$ 682,545,199	$ 1,063,391,695	$ 310.58
Site "H"	573,146	1897	$ 202,460,006	$ 353.24	$ 2,050,262	$ 759,991	$ 1,769,754	$ 838,055	$ 676,693,064	$ 1,054,556,464	$ 307.83

7.1 – Site Totals

	Option 1	Option 2	Site "A" - 1 for 1 Replacement		Site "B" - 1 For 1 Replacement		Site "C" - 1 For 1 Replacement		Site "D" - 1 For 1 Replacement		Site "G" - 1 For Replacement		Site "H" - 1 For 1 Replacement	
	Renovation	Renovation	Option 4	Option 3	Option 4	Option 3	Option 4	Option 3	Option 4	Option 3	Option 4	Option 3	Option 4	Option 3
Building SF	626,428	613,029	656,343	656,343	656,343	656,343	656,343	656,343	656,343	656,343	656,343	656,343	656,343	656,343
$ / SF (b4 Esc / Contin)	142	179	$242	$262	$242	$260	$242	$263	$240	$266	$239	$266	$238	$264
New Building Cost	0	0	$ 108,521,827		$ 108,521,827		$ 108,521,827		$ 108,521,827		$ 108,521,827		$ 108,521,827	
Renovation Cost	89,202,784	109,474,249		$ 75,540,082		$ 75,540,082		$ 75,540,082		$ 75,540,082		$ 75,540,082		$ 75,540,082
Addition Cost	0	0		$ 38,391,188		$ 38,391,188		$ 38,391,188		$ 38,391,188		$ 38,391,188		$ 38,391,188
Total Building Cost	89,202,784	109,474,249	$ 108,521,827	$ 113,931,270	$ 108,521,827	$ 113,931,270	$ 108,521,827	$ 113,931,270	$ 108,521,827	$ 113,931,270	$ 108,521,827	$ 113,931,270	$ 108,521,827	$ 113,931,270
Site Construction	0	0	$ 11,431,214	$ 6,454,905	$ 11,229,059	$ 4,820,761	$ 11,246,211	$ 6,953,201	$ 9,943,155	$ 8,717,066	$ 9,836,651	$ 7,985,374	$ 8,651,322	$ 7,172,424
Demolition Cost	10,680,597	10,240,457	$ 6,759,988	$ 9,497,457	$ 6,759,988	$ 9,497,457	$ 6,759,988	$ 9,497,457	$ 6,759,988	$ 9,497,457	$ 6,759,988	$ 10,180,123	$ 6,759,988	$ 9,497,457
Furnishings Cost	0	7,671,439	$ 9,332,877	$ 9,798,089	$ 9,332,877	$ 9,798,089	$ 9,332,877	$ 9,798,089	$ 9,332,877	$ 9,798,089	$ 9,332,877	$ 9,798,089	$ 9,332,877	$ 9,798,089
Activation	8,831,076	12,480,064	$ 12,371,488	$ 12,988,165	$ 12,371,488	$ 12,988,165	$ 12,371,488	$ 12,988,165	$ 12,371,488	$ 12,988,165	$ 12,371,488	$ 12,988,165	$ 12,371,488	$ 12,988,165
Migration Cost	22,802,998	22,802,998	$ 10,321,577	$ 19,599,736	$ 10,321,577	$ 19,599,736	$ 10,321,577	$ 19,599,736	$ 10,321,577	$ 19,599,736	$ 10,321,577	$ 19,599,736	$ 10,321,577	$ 19,599,736
Subtotal	131,517,455	162,669,208	$ 158,738,971	$ 172,269,622	$ 158,536,816	$ 170,635,479	$ 158,553,968	$ 172,767,918	$ 157,250,911	$ 174,531,783	$ 157,144,408	$ 174,482,757	$ 155,959,079	$ 172,987,142
CCE	18,732,585	22,989,592	$ 25,190,139	$ 25,281,097	$ 25,147,686	$ 24,937,927	$ 25,151,288	$ 25,385,739	$ 24,877,646	$ 25,756,151	$ 24,855,280	$ 25,602,495	$ 24,606,361	$ 25,431,776
Escalation	22,165,337	27,388,943	$ 27,133,774	$ 29,143,275	$ 27,097,689	$ 28,851,576	$ 27,100,751	$ 29,232,222	$ 26,868,151	$ 29,547,077	$ 26,849,140	$ 29,517,177	$ 26,637,556	$ 29,271,354
Contingency	15,320,378	19,408,868	$ 20,126,214	$ 20,999,914	$ 20,098,145	$ 20,773,013	$ 20,100,526	$ 21,069,103	$ 19,919,596	$ 21,314,016	$ 19,904,808	$ 21,251,589	$ 19,740,225	$ 21,099,542
TOTALS	187,735,754	232,456,611	$ 231,189,098	$ 247,693,908	$ 230,880,336	$ 245,197,994	$ 230,906,533	$ 248,454,982	$ 228,916,305	$ 251,149,027	$ 228,753,637	$ 250,854,019	$ 226,943,221	$ 248,789,814

NOTES:

1 Escalation:

	2008	Baseline (Yr)	Multiplier
	2009	3.50%	103.50%
	2010	3.50%	107.12%
	2011	3.50%	110.87%
Construction Midpoint	2013	3.50%	114.75%

2 Contingency: 8.7%

3 Site Cost Totals Are Based On 1 For 1 Replacement Options 3 & 4 And Adjusted For Space Utilization. Site Cost Totals Are Base On SF Worksheet For Options 1 & 2.

	Site "A" - Space Utilization		Site "B" - Space Utilization		Site "C" - Space Utilization		Site "D" - Space Utilization		Site "G" - Space Utilization		Site "H" - Space Utilization	
	Option 4	Option 3	Option 4	Option 3	Option 4	Option 3	Option 4	Option 3	Option 4	Option 3	Option 4	Option 3
Building SF	573,146	613,029	573,146	613,029	573,146	613,029	573,146	613,029	573,146	613,029	573,146	613,029
$ / SF (b4 Esc / Contin)	$248	$266	$248	$264	$248	$267	$246	$270	$245	$270	$243	$267
Total Building Cost	$ 94,765,729	$ 106,412,592	$ 94,765,729	$ 106,412,592	$ 94,765,729	$ 106,412,592	$ 94,765,729	$ 106,412,592	$ 94,765,729	$ 106,412,592	$ 94,765,729	$ 106,412,592
Site Construction	$ 11,431,214	$ 6,454,905	$ 11,229,059	$ 4,820,761	$ 11,246,211	$ 6,953,201	$ 9,943,155	$ 8,717,066	$ 9,836,651	$ 7,985,374	$ 8,651,322	$ 7,172,424
Demolition Cost	$ 6,759,988	$ 9,497,457	$ 6,759,988	$ 9,497,457	$ 6,759,988	$ 9,497,457	$ 6,759,988	$ 9,497,457	$ 6,759,988	$ 10,180,123	$ 6,759,988	$ 9,497,457
Furnishings Cost	$ 8,149,853	$ 9,151,483	$ 8,149,853	$ 9,151,483	$ 8,149,853	$ 9,151,483	$ 8,149,853	$ 9,151,483	$ 8,149,853	$ 9,151,483	$ 8,149,853	$ 9,151,483
Activation	$ 10,803,293	$ 12,131,036	$ 10,803,293	$ 12,131,036	$ 10,803,293	$ 12,131,036	$ 10,803,293	$ 12,131,036	$ 10,803,293	$ 12,131,036	$ 10,803,293	$ 12,131,036
Migration Cost	$ 10,321,577	$ 19,599,736	$ 10,321,577	$ 19,599,736	$ 10,321,577	$ 19,599,736	$ 10,321,577	$ 19,599,736	$ 10,321,577	$ 19,599,736	$ 10,321,577	$ 19,599,736
Subtotal	$ 142,231,654	$ 163,247,209	$ 142,029,499	$ 161,613,065	$ 142,046,651	$ 163,745,505	$ 140,743,594	$ 165,509,370	$ 140,637,091	$ 165,460,344	$ 139,451,762	$ 163,964,728
CCE	$ 22,301,358	$ 23,702,174	$ 22,258,906	$ 23,359,004	$ 22,262,508	$ 23,806,817	$ 21,988,866	$ 24,177,228	$ 21,966,500	$ 24,023,573	$ 21,717,581	$ 23,852,853
Escalation	$ 24,272,404	$ 27,579,334	$ 24,236,318	$ 27,287,635	$ 24,239,380	$ 27,668,281	$ 24,006,781	$ 27,983,136	$ 23,987,770	$ 27,953,236	$ 23,776,185	$ 27,707,413
Contingency	$ 17,900,467	$ 19,783,387	$ 17,872,398	$ 19,556,486	$ 17,874,779	$ 19,852,575	$ 17,693,850	$ 20,097,488	$ 17,679,062	$ 20,035,062	$ 17,514,478	$ 19,883,015
TOTALS	$ 206,705,883	$ 234,312,104	$ 206,397,121	$ 231,816,190	$ 206,423,318	$ 235,073,178	$ 204,433,090	$ 237,767,223	$ 204,270,422	$ 237,472,215	$ 202,460,006	$ 235,408,009

7.2 – Project Summary, Estimating

A. Project Information

1 Project

Owner:	NASA Kennedy Space Center
Architect:	Jacobs
Facility:	US Government
Building:	Headquarters Building

2 Contracting Method

Hard Bid

3 Total Building Square Footage

	Baseline
HQ Base Building:	428,789
Additional Facilities	214,074
	642,863

4 Project Construction Budget

Budget:	TBD	Project Construction Estimate Estimate:	$ 159,800,000

5 Construction Schedule

Duration:	3 Years
Start Date:	2012
Completion Date:	2015

B. Estimate Basis

1 Estimate Basis

Drawings:	N/A	No Dwgs:		Dated:
Specifications:	N/A	No Specs:		Dated:

2 Estimate Format

Estimate in CSI Format.

3 General Comments

A. We strongly recommend the owner and/or designated representatives review the estimate detail and address any items that may not be consistent with the actual conditions and/or design intent.

B. This estimate is not the final specification of the materials selection is not guaranteed quantity survey and does not represent guaranteed contract prices.

C. The estimate of probable construction cost is based on our collective experience. Since we do not have the ability to control the cost of labor, material and equipment furnished or used by others or over the contractor's methods of determining prices, or accomplishing the work we can not guarantee that proposals, bids, or actual construction cost will not vary from our opinion.

D. This estimate is based upon a competitive bid contracting method with five to seven responsible bidders. Any single source specification selection will have an increased impact on overall cost.

E. The Estimate does not include impacts due to contracting methods other than "open" competitive procurement. Pricing is not valid for negotiated contracts.

7.3 – Estimate Notes

1 Construction Description:

a. Building cost data for new construction (Option 4) is based on a 5 to 8 story office building with surrounding 2 to 3 story offices and employ services building.

b. Building cost data for renovation / addition construction (Option 3) is based on a full renovation of the existing HQ with surrounding 3 story offices and employee services building.

2 Labor Rates

b. Labor rates used in the square footage calculations are based on Davis-bacon rates for KSC as of Sept 19,2008.

3 Size of Project

a. Certain square footage cost have been adjusted down because of the large volume of work. Examples would be demolition, and finishes.

4 Layout and Installation

a. adjustments have been made in the renovation estimates to allow for additional cost associated with phased work in an operating building.

5 Labor Productivity

a. Labor productivity has been assumed to be high based on site conditions, weather, lack of elevation change, and standard work hours of 8 hours per day. Minor adjustments have been made for secure site conditions and Bacon-Davis requirements. Renovation has been adjusted for working an existing structure.

6 Temperature & Working Conditions

a. Year around higher level productivity has been assumed because of the lack of cold weather or freezing conditions at this site.

7 Quality Level

a. Basis of quality for the construction included in this estimate was median level and Jacobs data base, recent Federal project bids, Means database were used.

8 Mobilization & Demobilization

9 Tools And Equipment

10 Building Cost Data

a. Building cost data is based on data from Means, National Construction Cost Estimator, Jacobs Data Base, and bid data from Florida based Federal construction projects in 2008. 8 bids were selected and compared on a cost per Square foot basis and compared against Means, NCCE, and Jacobs data. Square footage cost used in this document were then adjusted for conditions, size, and scope of this project.

b. Site cost included in the building cost data is for work within the area of the building foot print and not beyond 5' outside of the building footprint.

7.4 – Square Footage Worksheet

	OPTION 4 & 3 SF Calcs	M6-0399 HQ	M6-0339 BOB	M6-0342 CIF	L7-1557 EHF	OHF Removed From Study	Subtotal	NEW	M7-0355 O&C	M7-0360 SSPF	M6-0489 RECORDS	M6-0336 EML	M7-0351 AUDITORIUM	M6-0493 IASB	TOTAL		Estimated Efficiency Gains (New Construction)	SF Savings	New SF	% Of Building Area	Estimated Efficiency Gains (Remodel)	SF Savings (Remodel)	New SF (Remodel)	% Of Building Area
1	Office Space	193,226	10,324	40,286	5,355		249,191					2,847			252,038	38.4%	16.0%	40,326	211,712	36.9%	11.0%	27,724	224,314	39.1%
2	Conference Space	49,848	689	4,901	717		56,155								56,155	8.6%	0.0%	-	56,155	9.8%	0.0%	-	56,155	9.8%
3	Auditorium Space						0						7,840		7,840	1.2%	0.0%	-	7,840	1.4%	0.0%	-	7,840	1.4%
4	Library / Records Area	17,685		3,311			20,996								20,996	3.2%	0.0%	-	20,996	3.7%	0.0%	-	20,996	3.7%
5	Medical Facility Space (Treatment / Surgery)						0								0	0.0%	0.0%	-	0	0.0%	0.0%	-	0	0.0%
6	Medical Clinic						0								0	0.0%	0.0%	-	0	0.0%	0.0%	-	0	0.0%
7	Laboratory Space			26,858			26,858					3,794			30,652	4.7%	0.0%	-	30,652	5.3%	0.0%	-	30,652	5.3%
8	Security Space (Office)	23,994	689	9,802	548		35,033								35,033	5.3%	16.0%	5,605	29,428	5.1%	8.0%	2,803	32,230	5.6%
9	Food Service Space	12,021		2,096			14,117	6,000	4,828					13,132	38,077	5.8%	17.0%	6,473	31,604	5.5%	12.0%	4,569	33,508	5.8%
10	White Box Space (Retail)	1,005					1,005	1,480	1,040	1,136					4,661	0.7%	7.0%	326	4,335	0.8%	5.0%	233	4,428	0.8%
11	Health / Gym Facility Space						0	6,000	9,431						15,431	2.4%	0.0%	-	15,431	2.7%	0.0%	-	15,431	2.7%
12	Mail / Reproduction / Printing	11,110	1,378	3,311	274		16,073					474			16,547	2.5%	0.0%	-	16,547	2.9%	0.0%	-	16,547	2.9%
13	Communications /Data / IT Space	24,440	689	7,462	274		32,865					948			33,813	5.2%	0.0%	-	33,813	5.9%	0.0%	-	33,813	5.9%
14	Finance / Banking Facility Space	2,733					2,733								2,733	0.4%	0.0%	-	2,733	0.5%	0.0%	-	2,733	0.5%
15	Core Space	92,727	6,302	34,415	3,799		137,243					1,423	1,384	2,317	142,367	21.7%	21.4%	30,467	111,900	19.5%	5.6%	7,985	134,382	23.4%
		428,789	**20,071**	**132,442**	**10,967**	**0**	**592,269**	**13,480**	**15,299**	**1,136**	**0**	**9,486**	**9,224**	**15,449**	**656,343**	**100.0%**	**12.7%**	**83,197**	**573,146**		**6.6%**	**43,314**	**613,029**	
	Building Headcount (Relocated Personnel)	**1283**	**103**	**337**	**50**	**0**	**1773**		**80**	**3**	**0**	**16**	**0**	**25**	**1897**									
	OPTION 4 - BUILDING DISPOSITION - NEW CONSTRUCTION	Demo	Relocate And Reuse Building	Demo	Demo	Not In Scope		New Construct	Convert To Office Space	Relocate Gift Shop Only	Not In Scope	Demo	Demo	Demo	TOTALS				**573,146**					
	Remodeled Square Footage								15,299	1,136			0		16,435									
	Demolition Square Footage	428,789		132,442	10,967							9,486	9,224		590,908									
	Abandon in Place (Future Reuse)		20,071								-			15,449	35,520									
	New Construction					0		556,711							556,711									
	Total Effected Area	428,789	20,071	132,442	10,967	0		556,711	15,299	1,136	0	9,486	9,224	15,449	1,199,574									
	Less Demo / Abandon in Place														626,428									
TOTAL															**573,146**									
	OPTION 3 - BUILDING DISPOSITION - HQ REMODEL WITH MAJOR ADDITION	Remodel	Relocate And Reuse Building	Demo	Demo	Not In Scope / Office SF Only		Added Through Efficiency Gains / Addition	Convert To Office Space	Relocate Gift Shop Only	Not In Scope	Demo	Remodel	Demo	TOTALS								**613,029**	
	Remodeled Square Footage	428,789							15,299	1,136			9,224		454,448									
	Demolition Square Footage			132,442	10,967							9,486			152,895									
	Abandon in Place (Future Reuse)		20,071								-			15,449	35,520									
	New Construction (Addition)					0		158,581							158,581									
	Total Effected Area	428,789	20,071	132,442	10,967	0		158,581	15,299	1,136	0	9,486	9,224	15,449	801,444									
	Less Demo / Abandon in Place														188,415									
TOTAL															**613,029**									

	OPTION 2 & 1 SF CALCS EXISTING CONDITIONS REMODEL	HQ	BOB	CIF	EHF	OHF (Entered as Office Space Only)	Subtotal	NEW	O&C	SSPF	RECORDS	EML	AUDITORIUM	IASB	TOTAL	% of Building Area	Estimated Efficiency Gains (Remodel)	SF Savings (Remodel)	New SF (Remodel)	% of Building Area
1	Office Space	193,226	10,324	40,286	5,355		249,191					2,847			252,038	38.4%	11.0%	27,724	224,314	36.6%
2	Conference Space	49,848	689	4,901	717		56,155								56,155	8.6%	0.0%	-	56,155	9.2%
3	Auditorium Space						0						7,840		7,840	1.2%	0.0%	-	7,840	1.3%
4	Library / Records Area	17,685		3,311			20,996								20,996	3.2%	0.0%	-	20,996	3.4%
5	Medical Facility Space (Treatment / Surgery)						0								0	0.0%	0.0%	-	0	0.0%
6	Medical Clinic						0								0	0.0%	0.0%	-	0	0.0%
7	Laboratory Space			26,858			26,858					3,794			30,652	4.7%	0.0%	-	30,652	5.0%
8	Security Space (Office)	23,994	689	9,802	548		35,033								35,033	5.3%	8.0%	2,803	32,230	5.3%
9	Food Service Space	12,021		2,096			14,117	6,000	4,828					13,132	38,077	5.8%	12.0%	4,569	33,508	5.5%
10	White Box Space (Retail)	1,005					1,005	1,480	1,040	1,136					4,661	0.7%	5.0%	233	4,428	0.7%
11	Health / Gym Facility Space						0	6,000	9,431						15,431	2.4%	0.0%	-	15,431	2.5%
12	Mail / Reproduction / Printing	11,110	1,378	3,311	274		16,073					474			16,547	2.5%	0.0%	-	16,547	2.7%
13	Communications /Data / IT Space	24,440	689	7,462	274		32,865					948			33,813	5.2%	0.0%	-	33,813	5.5%
14	Finance / Banking Facility Space	2,733					2,733								2,733	0.4%	0.0%	-	2,733	0.4%
15	Core Space	92,727	6,302	34,415	3,799		137,243					1,423	1,384	2,317	142,367	21.7%	5.6%	7,985	134,382	21.9%
		428,789	**20,071**	**132,442**	**10,967**	**0**	**592,269**	**13,480**	**15,299**	**1,136**	**0**	**9,486**	**9,224**	**15,449**	**656,343**	**100.0%**	**6.6%**	**43,314**	**613,029**	**100%**
	Building Headcount	**1287**	**103**	**338**	**50**		**1778**					**16**	**0**	**25**	**1819**					
	OPTION 2, BUILDING DISPOSITION - EXISTING CONDITION REMODEL WITH MINOR NEW CONSTRUCTION	Remodel	Relocate And Reuse Building	Remodel	Demo / Relocate Through Efficiency	Not In Scope		Added Through Efficiency Gains / Addition	Convert To Office Space	Relocate Gift Shop Only	Stays As Is	Demo / Relocate Through Efficiency	Remodel	Relocate And Reuse Building	TOTALS					
	Remodeled Square Footage	428,789		132,442					15,299	1,136			9,224		586,890					
	Demolition Square Footage				10,967							9,486			20,453					
	Abandon in Place (Future Reuse)		20,071											15,449	35,520					
	New Construction (Addition)							26,139							26,139					
	Remains as is										0				0					
	Total Effected Area	428,789	20,071	132,442	10,967	0		26,139	15,299	1,136	0	9,486	9,224	15,449	669,002					
	Less Demo / Abandon in Place														55,973					
TOTAL															**613,029**					
OPTION 1 Square Footage (All Buildings)		428,789	20,071	132,442	10,967		592,269					9,486	9,224	15,449	**626,428**					

7.5 - Energy Cost

	SF/Yr/Cost	Baseline Cost	Option 1	Option 2	Option 3	Option 3
Baseline (SF)	$ 2.21	428,789				
HQ Building ($)		$ 947,623.69				
Consolidation (SF)	$ 3.36	197,639				
Consolidation ($)		$ 664,545.22				
TOTAL BASELINE		$ 1,612,169				
Option 1	$ 2.19		626,428			
All Buildings			$ 1,370,344			
Option 2	$ 2.06			613,029		
All Buildings				$ 1,262,148		
Option 3	$ 1.55				613,029	
Efficiency					$ 948,356	
Option 4	$ 1.33					573,146
Efficiency						$ 759,991

Baselines	**$ / SF / yr**	**SF**	**Cost**
HQ	$ 2.21	428,789	$ 947,624
BOB	$ 2.76	20,071	$ 55,396
CIF	$ 3.79	132,442	$ 501,955
EHF ***	$ 2.91	10,967	$ 31,859
OHF	$ 5.79	0	$ -
Records	$ 1.68	0	$ -
EML	$ 1.99	9,486	$ 18,877
Auditorium ***	$ 2.91	9,224	$ 26,796
IASB	$ 1.92	15,449	$ 29,662
Subtotal	$ 3.36	197,639	$ 664,545
TOTAL	**$ 2.57**	**626,428**	**$ 1,612,169**

NOTES

1 Option 1 represents a 15% improvement in energy use.

2 Option 1 represents a 15% improvement in energy use.

3 Option 3 represents a 30% improvement in energy use.

4 Option 4 represents a 40% improvement in energy use.

	SF/Yr/Cost	Existing Option 1 & 2	Site "A" Option 4	Site "A" Option 3	Site "B" Option 4	Site "B" Option 3	Site "C" Option 4	Site "C" Option 3	Site "D" Option 4	Site "D" Option 3	Site "G" Option 4	Site "G" Option 3	Site "H" Option 4	Site "H" Option 3
Baseline	$ 2.21	428,789												
HQ Building		$ 947,624												
Consolidation	$ 3.36	197,639												
		$ 664,545												
TOTAL BASELINE		**$ 1,612,169**												
Option 1	$ 1.88	428,789												
HQ Only		$ 805,480												
Option 1	$ 2.19	626,428												
All Buildings		$ 1,370,344												
Option 2	$ 1.77	428,789												
HQ Only		$ 758,099												
Option 2	$ 2.06	613,029												
All Buildings		$ 1,262,148												
Option3	$ 1.55			656,343		656,343		656,343		656,343		656,343		656,343
1 For 1				$ 1,015,363		$ 1,015,363		$ 1,015,363		$ 1,015,363		$ 1,015,363		$ 1,015,363
Option 3	$ 1.55			613,029		613,029		613,029		613,029		613,029		613,029
Efficiency				$ 948,356		$ 948,356		$ 948,356		$ 948,356		$ 948,356		$ 948,356
Option 4	$ 1.33		656,343		656,343		656,343		656,343		656,343		656,343	
1 For 1			$ 870,311		$ 870,311		$ 870,311		$ 870,311		$ 870,311		$ 870,311	
Option 4	$ 1.33		573,146		573,146		573,146		573,146		573,146		573,146	
Efficiency			$ 759,991		$ 759,991		$ 759,991		$ 759,991		$ 759,991		$ 759,991	

Baselines	**$ / SF / yr**	**SF**	**Cost**
HQ	$ 2.21	428,789	$ 947,624
BOB	$ 2.76	20,071	$ 55,396
CIF	$ 3.79	132,442	$ 501,955
EHF ***	$ 2.91	10,967	$ 31,859
OHF	$ 5.79	0	$ -
Records	$ 1.68	0	$ -
EML	$ 1.99	9,486	$ 18,877
Auditorium ***	$ 2.91	9,224	$ 26,796
IASB	$ 1.92	15,449	$ 29,662
Subtotal	$ 3.36	197,639	$ 664,545
TOTAL	**$ 2.57**	**626,428**	**$ 1,612,169**

1	BOB	$ 2.76	20071
2	EML	$ 1.99	9486
3	KLI	$ 3.18	6600
4	IASB	$ 1.92	15449
5	Timing Complex	$ 1.84	2800
6	Transporter	$ 4.08	25121
7	Records Center	$ 1.68	14110
8	OHF	$ 5.79	18035
		$ 2.91	13959

*** Average of 8 KSC Facilities from 2800 SF to 25121 SF

NOTES

1 Option 1 represents a 15% improvement in energy use.
2 Option 2 represents a 20% improvement in energy use.
3 Option 3 represents a 30% improvement in energy use.
4 Option 4 represents a 40% improvement in energy use.

7.6 - Operations and Maintenance Cost

	Estimated Annual O&M Cost - Exisitng	Option 1 & 2				Site "A"		Site "A"		Site "B"		Site "B"		Site "C"		Site "C"	
		Option 1 HQ	Option 1 All	Option 2 HQ	Option 2 All	Option 4 - 1 For 1	Option 3 - 1 For 1	Option 4 - Space Util	Option 3 - Space Util	Option 4 - 1 For 1	Option 3 - 1 For 1	Option 4 - Space Util	Option 3 - Space Util	Option 4 - 1 For 1	Option 3 - 1 For 1	Option 4 - Space Util	Option 3 - Space Util
In Place Cost	$ 150,975,093	$ 187,784,731	$ 239,545,162	$ 187,224,764	$ 248,209,489	$ 231,189,098	$ 247,693,908	$ 206,705,883	$ 234,312,104	$ 230,880,336	$ 245,197,994	$ 206,397,121	$ 231,816,190	$ 230,906,533	$ 248,454,982	$ 206,423,318	$ 235,073,178
1 yr O&M	$ 4,555,020	$ 2,051,842	$ 2,617,405	$ 1,882,065	$ 2,495,110	$ 2,020,882	$ 2,165,154	$ 1,806,868	$ 2,048,181	$ 2,018,183	$ 2,143,337	$ 1,804,169	$ 2,026,363	$ 2,018,412	$ 2,171,807	$ 1,804,398	$ 2,054,833
5 yr	$ 35,525,281	$ 12,406,445	$ 15,826,121	$ 11,379,893	$ 15,086,666	$ 12,219,246	$ 13,091,590	$ 10,925,213	$ 12,384,309	$ 12,202,927	$ 12,959,671	$ 10,908,893	$ 12,252,390	$ 12,204,311	$ 13,131,816	$ 10,910,278	$ 12,424,535
10 yr	$ 88,157,732	$ 30,787,203	$ 39,273,297	$ 28,239,765	$ 37,438,304	$ 30,322,660	$ 32,487,424	$ 27,111,452	$ 30,732,272	$ 30,282,163	$ 32,160,061	$ 27,070,955	$ 30,404,909	$ 30,285,599	$ 32,587,246	$ 27,074,391	$ 30,832,094
15 yr	$ 164,141,193	$ 57,322,802	$ 73,123,091	$ 52,579,718	$ 69,706,511	$ 56,457,868	$ 60,488,449	$ 50,478,909	$ 57,220,526	$ 56,382,466	$ 59,878,931	$ 50,403,507	$ 56,611,008	$ 56,388,864	$ 60,674,308	$ 50,409,905	$ 57,406,385
20 Year Major Renovation/Replacement	$ 273,196,834	$ 339,805,679	$ 433,468,717	$ 338,792,390	$ 449,147,241	$ 418,348,009	$ 448,214,272	$ 374,044,431	$ 423,999,241	$ 417,789,288	$ 443,697,794	$ 373,485,710	$ 419,482,763	$ 417,836,694	$ 449,591,474	$ 373,533,116	$ 425,376,443
20 yr	$ 545,572,094	$ 434,926,916	$ 554,808,891	$ 426,042,971	$ 564,817,955	$ 512,033,976	$ 548,588,570	$ 457,808,937	$ 518,950,760	$ 511,350,134	$ 543,060,659	$ 457,125,095	$ 513,422,850	$ 511,408,156	$ 550,274,186	$ 457,183,116	$ 520,636,376
25 yr	$ 609,856,832	$ 457,376,986	$ 583,447,032	$ 446,635,446	$ 592,118,018	$ 534,145,301	$ 572,278,443	$ 477,578,645	$ 541,360,775	$ 533,431,929	$ 566,511,820	$ 476,865,272	$ 535,594,151	$ 533,492,456	$ 574,036,850	$ 476,925,800	$ 543,119,181
30 yr	$ 705,097,834	$ 490,637,870	$ 625,875,848	$ 477,144,211	$ 632,564,403	$ 566,904,317	$ 607,376,156	$ 506,868,440	$ 574,562,314	$ 566,147,193	$ 601,255,867	$ 506,111,316	$ 568,442,024	$ 566,211,433	$ 609,242,405	$ 506,175,555	$ 576,428,563
35 yr	$ 842,593,631	$ 538,655,337	$ 687,128,709	$ 521,188,549	$ 690,955,304	$ 614,197,257	$ 658,045,384	$ 549,152,998	$ 622,494,108	$ 613,376,972	$ 651,414,521	$ 548,332,713	$ 615,863,244	$ 613,446,570	$ 660,067,322	$ 548,402,311	$ 624,516,045
40 yr	$ 1,038,448,482	$ 607,053,457	$ 774,379,885	$ 583,927,175	$ 774,129,784	$ 681,563,328	$ 730,220,783	$ 609,384,918	$ 690,770,190	$ 680,653,073	$ 722,862,637	$ 608,474,663	$ 683,412,044	$ 680,730,305	$ 732,464,490	$ 608,551,895	$ 693,013,897

	Site "D"		Site "D"		Site "G"		Site "G"		Site "H"		Site "H"	
	Option 4 - 1 For 1	Option 3 - 1 For 1	Option 4 - Space Util	Option 3 - Space Util	Option 4 - 1 For 1	Option 3 - 1 For 1	Option 4 - Space Util	Option 3 - Space Util	Option 4 - 1 For 1	Option 3 - 1 For 1	Option 4 - Space Util	Option 3 - Space Util
In Place Cost	$ 228,916,305	$ 251,149,027	$ 204,433,090	$ 237,767,223	$ 228,753,637	$ 250,854,019	$ 204,270,422	$ 237,472,215	$ 226,943,221	$ 248,789,814	$ 202,460,006	$ 235,408,009
1 yr O&M	$ 2,001,015	$ 2,195,356	$ 1,787,001	$ 2,078,383	$ 1,999,593	$ 2,192,778	$ 1,785,579	$ 2,179,594	$ 1,983,767	$ 2,174,734	$ 1,769,754	$ 2,057,760
5 yr	$ 12,099,120	$ 13,274,206	$ 10,805,087	$ 12,566,926	$ 12,090,523	$ 13,258,614	$ 10,796,489	$ 13,178,900	$ 11,994,835	$ 13,149,513	$ 10,700,801	$ 12,442,232
10 yr	$ 30,024,562	$ 32,940,596	$ 26,813,354	$ 31,185,444	$ 30,003,226	$ 32,901,903	$ 26,792,018	$ 32,704,089	$ 29,765,773	$ 32,631,162	$ 26,554,565	$ 30,876,011
15 yr	$ 55,902,837	$ 61,332,211	$ 49,923,878	$ 58,064,288	$ 55,863,113	$ 61,260,168	$ 49,884,154	$ 60,891,858	$ 55,420,997	$ 60,756,076	$ 49,442,038	$ 57,488,153
20 Year Major Renovation/Replacement	$ 414,235,279	$ 454,466,479	$ 369,931,701	$ 430,251,448	$ 413,940,923	$ 453,932,648	$ 369,637,344	$ 429,717,617	$ 410,664,886	$ 450,197,367	$ 366,361,308	$ 425,982,336
20 yr	$ 507,000,231	$ 556,240,913	$ 452,775,191	$ 526,603,104	$ 506,639,955	$ 555,587,534	$ 452,414,916	$ 530,761,330	$ 502,630,275	$ 551,015,765	$ 448,405,235	$ 521,377,955
25 yr	$ 528,894,182	$ 580,261,240	$ 472,327,526	$ 549,343,572	$ 528,518,349	$ 579,579,646	$ 471,951,692	$ 554,609,196	$ 524,335,517	$ 574,810,452	$ 467,768,860	$ 543,892,784
30 yr	$ 561,331,148	$ 615,848,536	$ 501,295,270	$ 583,034,694	$ 560,932,264	$ 615,125,140	$ 500,896,387	$ 589,940,982	$ 556,492,900	$ 610,063,453	$ 496,457,023	$ 577,249,610
35 yr	$ 608,159,156	$ 667,224,557	$ 543,114,897	$ 631,673,281	$ 607,726,997	$ 666,440,812	$ 542,682,738	$ 640,948,132	$ 602,917,287	$ 660,956,863	$ 537,873,028	$ 625,405,587
40 yr	$ 674,862,960	$ 740,406,742	$ 602,684,549	$ 700,956,149	$ 674,383,401	$ 739,537,035	$ 602,204,990	$ 713,604,883	$ 669,046,154	$ 733,451,598	$ 596,867,744	$ 694,001,005

Note: Current HQ Maintenance Values of approx $1,000,000 per year were escalated to 2013 and used as a basis for this sheet. This escalation resulted in an annual maintenance value of .83%. The cost of Option 1 and option 2 were inflated by 20% and 10% to account for current conditions and current FCI scores against improvements.

FCI Score

FCI Score	Factor	Multiplier	Year
5	0%	100%	1
4.5	10%	110%	3
4	20%	120%	6
3.5	30%	130%	9
3	40%	140%	12
2.5	50%	150%	15
2	60%	160%	18
1.5	70%	170%	21
1	80%	180%	24
0.5	90%	190%	27
0	100%	200%	30

Year	Maintenance Cost		Option 1 Cost Per	Option 2 Cost Per	Option 3 Cost Per	Option 4 Cost Per
Baseline	0.83%	Escalation	$ 1.000	$ 1.000	$ 1.000	$ 1.000
1	0.83%	105.00%	$ 10.93	$ 10.05	$ 9.18	$ 8.74
2	0.87%	110.25%	$ 12.05	$ 11.08	$ 10.12	$ 9.64
3	0.92%	115.76%	$ 13.25	$ 12.19	$ 11.13	$ 10.60
4	0.94%	121.55%	$ 14.34	$ 13.20	$ 12.05	$ 11.48
5	0.97%	127.63%	$ 15.50	$ 14.26	$ 13.02	$ 12.40
6	1.00%	134.01%	$ 16.73	$ 15.40	$ 14.06	$ 13.39
7	1.03%	140.71%	$ 18.07	$ 16.62	$ 15.18	$ 14.46
8	1.05%	147.75%	$ 19.48	$ 17.92	$ 16.36	$ 15.58
9	1.08%	155.13%	$ 20.99	$ 19.31	$ 17.63	$ 16.79
10	1.11%	162.89%	$ 22.61	$ 20.80	$ 18.99	$ 18.09
11	1.14%	171.03%	$ 24.33	$ 22.38	$ 20.44	$ 19.46
12	1.17%	179.59%	$ 26.16	$ 24.07	$ 21.98	$ 20.93
13	1.19%	188.56%	$ 28.14	$ 25.89	$ 23.64	$ 22.51
14	1.22%	197.99%	$ 30.23	$ 27.81	$ 25.39	$ 24.18
15	1.25%	207.89%	$ 32.45	$ 29.85	$ 27.26	$ 25.96
16	1.28%	218.29%	$ 34.85	$ 32.06	$ 29.27	$ 27.88
17	1.30%	229.20%	$ 37.38	$ 34.39	$ 31.40	$ 29.90
18	1.33%	240.66%	$ 40.07	$ 36.86	$ 33.66	$ 32.06
19	1.36%	252.70%	$ 42.97	$ 39.53	$ 36.09	$ 34.37
20	1.39%	265.33%	$ 46.03	$ 42.35	$ 38.66	$ 36.82

$ 1.00	1	$ 1.00		
$ 1.05	2	$ 1.05		
$ 1.10	3	$ 1.10		
$ 1.16	4	$ 1.16		
$ 1.22	5	$ 1.22		
$ 1.28	6	$ 1.28		
$ 1.34	7	$ 1.34	$	8.14
$ 1.41	8	$ 1.41		
$ 1.48	9	$ 1.48		
$ 1.55	10	$ 1.55		
$ 1.63	11	$ 1.63		
$ 1.71	12	$ 1.71		
$ 1.80	13	$ 1.80		
$ 1.89	14	$ 1.89		
$ 1.98	15	$ 1.98		
$ 2.08	16	$ 2.08		
$ 2.18	17	$ 2.18		
$ 2.29	18	$ 2.29		
$ 2.41	19	$ 2.41		
$ 2.53	20	$ 2.53		
$ 2.65	21	$ 2.65		
$ 35.72	22	$ 2.79		
	23	$ 2.93		
	24	$ 3.07		
	25	$ 3.23		

Note: Using the Jacobs data base life cycles of 323 different major items including: exterior closure, roofing, interiors and interior finishes, stairways, plumbing & fixtures, HVAC systems, fire protection, electrical and communication systems, elevators and lifts, equipment, and site utilities used in office building were reviewed using historical data and data provided by Means Maintenance & Repair (2008). These 323 items yielded an average life span of 24.8 years. For this purpose at the 20 year mark we have included a major renovation to account for the replacement of all these items and systems. Using the same data the super structure and site was reviewed using 105 data points which yielded an average life of 49.6 years. Based on the combination of 24.8 year cycle and 49.6 year cycle we have assigned this building a life span of 40 years for this study. The 323 items represent 66.2% of project cost. At the 20 year mark we have included a major renovation/systems replacement totaling 66.2% of cost (escalated) to account for these life cycles.

7.7.1 – Building Cost Options 1 & 2

Option 2 - Complete Renovation - Existing Buildings	Type	Baseline Cost	LEED Silver 5%	Total W/ LEED Cost	Labor & Material Rate Adjustments	Material Handling & Flow	Subtotals	Productivity / Access	Economic Conditions	TOTAL			SF	Total Cost
					87.70%	3.70%		92.25%	98.00%	100.00%				
1	Office Space	$ 154.89	$ 7.74	$ 162.63	$ 142.63	$ 5.28	$ 147.91	$ 160.33	$ 157.13	$ 157.13			224,314	$ 35,245,750.35
2	Conference Space	$ 191.50	$ 9.58	$ 201.08	$ 176.35	$ 6.52	$ 182.87	$ 198.23	$ 194.27	$ 194.27			56,155	$ 10,909,132.82
3	Auditorium Space	$ 189.63	$ 9.48	$ 199.11	$ 174.62	$ 6.46	$ 181.08	$ 196.29	$ 192.36	$ 192.36			7,840	$ 1,508,133.79
4	Library / Records Area	$ 169.69	$ 8.48	$ 178.17	$ 156.26	$ 5.78	$ 162.04	$ 175.65	$ 172.14	$ 172.14			20,996	$ 3,614,180.35
5	Medical Facility Space (Treatment / Surgery)	$ 305.76	$ 15.29	$ 321.05	$ 281.56	$ 10.42	$ 291.98	$ 316.51	$ 310.18	$ 310.18			0	$ -
6	Medical Clinic	$ 228.52	$ 11.43	$ 239.94	$ 210.43	$ 7.79	$ 218.21	$ 236.55	$ 231.82	$ 231.82			0	$ -
7	Laboratory Space	$ 203.69	$ 10.18	$ 213.88	$ 187.57	$ 6.94	$ 194.51	$ 210.85	$ 206.63	$ 206.63			30,652	$ 6,333,736.31
8	Security Space (Office)	$ 211.48	$ 10.57	$ 222.05	$ 194.74	$ 7.21	$ 201.95	$ 218.91	$ 214.53	$ 214.53			32,230	$ 6,914,483.81
9	Food Service Space	$ 171.76	$ 8.59	$ 180.35	$ 158.17	$ 5.85	$ 164.02	$ 177.80	$ 174.24	$ 174.24			33,508	$ 5,838,523.92
10	White Box Space (Retail)	$ 171.76	$ 8.59	$ 180.35	$ 158.17	$ 5.85	$ 164.02	$ 177.80	$ 174.24	$ 174.24			4,428	$ 771,543.43
11	Health / Gym Facility Space	$ 170.44	$ 8.52	$ 178.96	$ 156.95	$ 5.81	$ 162.76	$ 176.43	$ 172.90	$ 172.90			15,431	$ 2,668,038.42
12	Mail / Reproduction / Printing	$ 154.06	$ 7.70	$ 161.76	$ 141.87	$ 5.25	$ 147.11	$ 159.47	$ 156.28	$ 156.28			16,547	$ 2,586,041.39
13	Communications /Data / IT Space	$ 234.15	$ 11.71	$ 245.86	$ 215.62	$ 7.98	$ 223.60	$ 242.38	$ 237.53	$ 237.53			33,813	$ 8,031,700.43
14	Finance / Banking Facility Space	$ 238.44	$ 11.92	$ 250.36	$ 219.57	$ 8.12	$ 227.69	$ 246.82	$ 241.88	$ 241.88			2,733	$ 661,061.59
15	Core Space	$ 178.93	$ 8.95	$ 187.87	$ 164.77	$ 6.10	$ 170.86	$ 185.22	$ 181.51	$ 181.51			134,382	$ 24,391,922.39
Option 2 Totals										**$ 178.58**			**613,029**	**$ 109,474,249.01**
OPTION 1		**$ 147.39**	**$ -**	**$ 147.39**	**$ 129.26**	**$ 4.78**	**$ 134.04**	**$ 145.31**	**$ 142.40**	**$ 142.40**			**626,428**	**$ 89,202,784.02**

7.7.2 – Building Cost Option 3

Option 3 - Renovated Building Space Type	Baseline Cost	LEED Silver 5%	Total W/ LEED Cost	Labor & Material Rate Adjustments	Material Handling & Flow	Subtotals	Productivity / Access	Economic Conditions	TOTAL			SF	
				87.70%	3.70%		92.25%	98.00%	100.00%				
Office Space	$ 154.89	$ 7.74	$ 162.63	$ 142.63	$ 5.28	$ 147.91	$ 160.33	$ 157.13	$ 157.13			193,226	$ 30,361,015.46
Conference Space	$ 191.50	$ 9.58	$ 201.08	$ 176.35	$ 6.52	$ 182.87	$ 198.23	$ 194.27	$ 194.27			49,848	$ 9,683,883.05
Auditorium Space	$ 189.63	$ 9.48	$ 199.11	$ 174.62	$ 6.46	$ 181.08	$ 196.29	$ 192.36	$ 192.36			0	$ -
Library / Records Area	$ 169.69	$ 8.48	$ 178.17	$ 156.26	$ 5.78	$ 162.04	$ 175.65	$ 172.14	$ 172.14			17,685	$ 3,044,236.02
Medical Facility Space (Treatment / Surgery)	$ 305.76	$ 15.29	$ 321.05	$ 281.56	$ 10.42	$ 291.98	$ 316.51	$ 310.18	$ 310.18			0	$ -
Medical Clinic	$ 228.52	$ 11.43	$ 239.94	$ 210.43	$ 7.79	$ 218.21	$ 236.55	$ 231.82	$ 231.82			0	$ -
Laboratory Space	$ 203.69	$ 10.18	$ 213.88	$ 187.57	$ 6.94	$ 194.51	$ 210.85	$ 206.63	$ 206.63			0	$ -
Security Space (Office)	$ 211.48	$ 10.57	$ 222.05	$ 194.74	$ 7.21	$ 201.95	$ 218.91	$ 214.53	$ 214.53			23,994	$ 5,147,510.75
Food Service Space	$ 171.76	$ 8.59	$ 180.35	$ 158.17	$ 5.85	$ 164.02	$ 177.80	$ 174.24	$ 174.24			12,021	$ 2,094,586.33
White Box Space (Retail)	$ 171.76	$ 8.59	$ 180.35	$ 158.17	$ 5.85	$ 164.02	$ 177.80	$ 174.24	$ 174.24			1,005	$ 175,115.15
Health / Gym Facility Space	$ 170.44	$ 8.52	$ 178.96	$ 156.95	$ 5.81	$ 162.76	$ 176.43	$ 172.90	$ 172.90			0	$ -
Mail / Reproduction / Printing	$ 154.06	$ 7.70	$ 161.76	$ 141.87	$ 5.25	$ 147.11	$ 159.47	$ 156.28	$ 156.28			11,110	$ 1,736,321.98
Communications /Data / IT Space	$ 234.15	$ 11.71	$ 245.86	$ 215.62	$ 7.98	$ 223.60	$ 242.38	$ 237.53	$ 237.53			24,440	$ 5,805,304.43
Finance / Banking Facility Space	$ 238.44	$ 11.92	$ 250.36	$ 219.57	$ 8.12	$ 227.69	$ 246.82	$ 241.88	$ 241.88			2,733	$ 661,061.59
Core Space	$ 178.93	$ 8.95	$ 187.87	$ 164.77	$ 6.10	$ 170.86	$ 185.22	$ 181.51	$ 181.51			92,727	$ 16,831,047.22
									$ 176.17			**428789**	**$ 75,540,081.99**
Option 3 - Additional Buildings (New)		**2%**		**87.70%**	**2.55%**		**97.25%**	**98.00%**	**100.00%**				
1 Office Space	$ 162.29	$ 3.25	$ 165.54	$ 145.17	$ 3.70	$ 148.88	$ 153.09	$ 150.03	$ 150.03			58,812	$ 8,823,270.71
2 Conference Space	$ 199.25	$ 3.99	$ 203.24	$ 178.24	$ 4.55	$ 182.78	$ 187.95	$ 184.19	$ 184.19			6,307	$ 1,161,712.08
3 Auditorium Space	$ 218.06	$ 4.36	$ 222.42	$ 195.06	$ 4.97	$ 200.04	$ 205.69	$ 201.58	$ 201.58			7,840	$ 1,580,373.17
4 Library / Records Area	$ 177.19	$ 3.54	$ 180.74	$ 158.51	$ 4.04	$ 162.55	$ 167.14	$ 163.80	$ 163.80			3,311	$ 542,345.13
5 Medical Facility Space (Treatment / Surgery)	$ 336.76	$ 6.74	$ 343.50	$ 301.25	$ 7.68	$ 308.93	$ 317.66	$ 311.31	$ 311.31			0	$ -
6 Medical Clinic	$ 192.68	$ 3.85	$ 196.54	$ 172.36	$ 4.40	$ 176.76	$ 181.76	$ 178.12	$ 178.12			0	$ -
7 Laboratory Space	$ 205.86	$ 4.12	$ 209.98	$ 184.15	$ 4.70	$ 188.85	$ 194.19	$ 190.30	$ 190.30			30,652	$ 5,833,163.40
8 Security Space (Office)	$ 226.72	$ 4.53	$ 231.25	$ 202.81	$ 5.17	$ 207.98	$ 213.86	$ 209.58	$ 209.58			11,039	$ 2,313,581.30
9 Food Service Space	$ 184.28	$ 3.69	$ 187.97	$ 164.85	$ 4.20	$ 169.05	$ 173.83	$ 170.36	$ 170.36			26,056	$ 4,438,770.23
10 White Box Space (Retail)	$ 150.82	$ 3.02	$ 153.83	$ 134.91	$ 3.44	$ 138.35	$ 142.26	$ 139.42	$ 139.42			3,656	$ 509,712.31
11 Health / Gym Facility Space	$ 183.14	$ 3.66	$ 186.80	$ 163.83	$ 4.18	$ 168.00	$ 172.75	$ 169.30	$ 169.30			15,431	$ 2,612,457.16
12 Mail / Reproduction / Printing	$ 163.32	$ 3.27	$ 166.58	$ 146.09	$ 3.73	$ 149.82	$ 154.05	$ 150.97	$ 150.97			5,437	$ 820,842.24
13 Communications /Data / IT Space	$ 201.95	$ 4.04	$ 205.98	$ 180.65	$ 4.61	$ 185.25	$ 190.49	$ 186.68	$ 186.68			9,373	$ 1,749,780.68
14 Finance / Banking Facility Space	$ 258.57	$ 5.17	$ 263.74	$ 231.30	$ 5.90	$ 237.20	$ 243.91	$ 239.03	$ 239.03			0	$ -
Core Space	$ 174.45	$ 3.49	$ 177.94	$ 156.05	$ 3.98	$ 160.03	$ 164.56	$ 161.26	$ 161.26			49,640	$ 8,005,179.71
									$ 168.71			**227,554**	**$ 38,391,188.11**
Option 3 - Renovation & Addition Totals									**$ 173.58**			**656,343**	**$ 113,931,270.10**

7.7.3 – Building Cost Option 4

	Option 4 - New Construction Type	Baseline Cost	LEED Silver 2%	Total W/ LEED Cost	Labor & Material Rate Adjustments	Material Handling & Flow	Subtotals	Productivity / Access	Economic Conditions	TOTAL			SF	Total Cost
					87.70%	2.55%		97.25%	98.00%	100.00%				
1	Office Space	$ 162.29	$ 3.25	$ 165.54	$ 145.17	$ 3.70	$ 148.88	$ 153.09	$ 150.03	$ 150.03			252,038	$ 37,812,002.72
2	Conference Space	$ 199.25	$ 3.99	$ 203.24	$ 178.24	$ 4.55	$ 182.78	$ 187.95	$ 184.19	$ 184.19			56,155	$ 10,343,418.72
3	Auditorium Space	$ 218.06	$ 4.36	$ 222.42	$ 195.06	$ 4.97	$ 200.04	$ 205.69	$ 201.58	$ 201.58			7,840	$ 1,580,373.17
4	Library / Records Area	$ 177.19	$ 3.54	$ 180.74	$ 158.51	$ 4.04	$ 162.55	$ 167.14	$ 163.80	$ 163.80			20,996	$ 3,439,165.89
5	Medical Facility Space (Treatment / Surgery)	$ 336.76	$ 6.74	$ 343.50	$ 301.25	$ 7.68	$ 308.93	$ 317.66	$ 311.31	$ 311.31			0	$ -
6	Medical Clinic	$ 192.68	$ 3.85	$ 196.54	$ 172.36	$ 4.40	$ 176.76	$ 181.76	$ 178.12	$ 178.12			0	$ -
7	Laboratory Space	$ 205.86	$ 4.12	$ 209.98	$ 184.15	$ 4.70	$ 188.85	$ 194.19	$ 190.30	$ 190.30			30,652	$ 5,833,163.40
8	Security Space (Office)	$ 226.72	$ 4.53	$ 231.25	$ 202.81	$ 5.17	$ 207.98	$ 213.86	$ 209.58	$ 209.58			35,033	$ 7,342,304.00
9	Food Service Space	$ 184.28	$ 3.69	$ 187.97	$ 164.85	$ 4.20	$ 169.05	$ 173.83	$ 170.36	$ 170.36			38,077	$ 6,486,607.84
10	White Box Space (Retail)	$ 150.82	$ 3.02	$ 153.83	$ 134.91	$ 3.44	$ 138.35	$ 142.26	$ 139.42	$ 139.42			4,661	$ 649,827.43
11	Health / Gym Facility Space	$ 183.14	$ 3.66	$ 186.80	$ 163.83	$ 4.18	$ 168.00	$ 172.75	$ 169.30	$ 169.30			15,431	$ 2,612,457.16
12	Mail / Reproduction / Printing	$ 163.32	$ 3.27	$ 166.58	$ 146.09	$ 3.73	$ 149.82	$ 154.05	$ 150.97	$ 150.97			16,547	$ 2,498,156.43
13	Communications /Data / IT Space	$ 201.95	$ 4.04	$ 205.98	$ 180.65	$ 4.61	$ 185.25	$ 190.49	$ 186.68	$ 186.68			33,813	$ 6,312,315.61
14	Finance / Banking Facility Space	$ 258.57	$ 5.17	$ 263.74	$ 231.30	$ 5.90	$ 237.20	$ 243.91	$ 239.03	$ 239.03			2,733	$ 653,262.83
15	Core Space	$ 174.45	$ 3.49	$ 177.94	$ 156.05	$ 3.98	$ 160.03	$ 164.56	$ 161.26	$ 161.26			142,367	$ 22,958,771.54
Option 4 Totals										**$ 165.34**			**656,343**	**$ 108,521,826.73**

7.7.4 – Building Unit Cost – Renovation

	Space Types	1 Office Space	2 Conference Space	3 Auditorium Space	4 Library / Records Area	5 Medical Facility Space (Treatment / Surgery)	6 Medical Clinic	7 Laboratory Space	8 Security Space (Office)	9 Food Service Space	10 White Box Space (Retail)	11 Health / Gym Facility Space	12 Mail / Reproduction / Printing	13 Communications /Data / IT Space	14 Finance / Banking Facility Space	15 Core Space	Option 1
CSI Unit Cost	Division																
	2 Site Improvements & Remediation	$ 15.45	$ 15.45	$ 15.45	$ 15.45	$ 17.28	$ 16.37	$ 17.28	$ 15.84	$ 16.37	$ 15.45	$ 15.45	$ 15.45	$ 15.84	$ 15.84	$ 15.93	$ 5.57
	3 Concrete	$ 0.43	$ 0.43	$ 0.68	$ 0.43	$ 0.87	$ 0.43	$ 0.43	$ 0.43	$ 0.43	$ 0.43	$ 0.43	$ 0.43	$ 0.43	$ 0.43	$ 0.48	$ 0.43
	4 Masonry	$ 0.41	$ 0.41	$ 1.37	$ 0.41	$ 3.87	$ 0.41	$ 0.41	$ 0.41	$ 0.41	$ 0.41	$ 0.41	$ 0.41	$ 0.41	$ 0.41	$ 0.73	$ 0.07
	5 Metals	$ 1.02	$ 1.02	$ 2.16	$ 1.02	$ 1.88	$ 1.02	$ 1.02	$ 1.02	$ 1.02	$ 1.02	$ 1.02	$ 1.02	$ 1.02	$ 1.02	$ 1.16	$ 0.12
	6 Wood, Plastic	$ 1.62	$ 5.07	$ 2.30	$ 1.62	$ 3.31	$ 1.62	$ 1.62	$ 1.62	$ 1.62	$ 1.62	$ 1.62	$ 1.62	$ 1.87	$ 4.89	$ 2.29	$ 0.34
	7 Thermal & Moisture Protection	$ 4.21	$ 4.21	$ 4.21	$ 4.21	$ 4.67	$ 4.21	$ 4.21	$ 4.21	$ 3.61	$ 3.61	$ 4.53	$ 4.21	$ 4.42	$ 4.21	$ 4.20	$ 0.84
	8 Doors & Windows	$ 12.32	$ 12.32	$ 8.67	$ 8.67	$ 8.67	$ 8.67	$ 12.32	$ 22.85	$ 12.32	$ 12.32	$ 8.67	$ 8.67	$ 8.67	$ 24.44	$ 12.11	$ 0.61
	9 Finishes	$ 17.35	$ 33.83	$ 29.17	$ 17.43	$ 76.53	$ 17.43	$ 17.43	$ 47.55	$ 17.43	$ 15.81	$ 21.20	$ 17.43	$ 17.43	$ 17.43	$ 25.96	$ 25.96
	10 Specialties	$ 1.51	$ 1.51	$ 1.51	$ 1.51	$ 1.72	$ 1.51	$ 1.63	$ 1.72	$ 1.51	$ 1.51	$ 1.51	$ 1.51	$ 1.51	$ 1.51	$ 1.55	$ 1.55
	11 Equipment	$ 0.56	$ 0.56	$ 0.56	$ 0.56	$ 0.56	$ 0.56	$ 0.56	$ 0.56	$ 0.56	$ 0.56	$ 0.56	$ 0.56	$ 0.56	$ 0.56	$ 0.56	$ 0.56
	12 Furnishings	$ 0.06	$ 0.06	$ 0.06	$ 0.06	$ 0.06	$ 0.06	$ 0.06	$ 0.06	$ 0.06	$ 0.06	$ 0.06	$ 0.06	$ 0.06	$ 0.06	$ 0.06	$ 0.06
	13 Special Construction	$ 0.18	$ 0.36	$ 0.36	$ 0.18	$ 0.18	$ 0.18	$ 0.18	$ 0.63	$ 0.18	$ 0.18	$ 0.72	$ 0.18	$ 0.18	$ 0.18	$ 0.28	$ 0.28
	14 Conveying	$ 0.15	$ 0.13	$ 0.13	$ 0.13	$ 0.13	$ 0.13	$ 0.13	$ 0.13	$ 0.13	$ 0.13	$ 0.13	$ 0.13	$ 0.13	$ 0.13	$ 0.13	$ 0.13
	21 Fire Suppression	$ 6.19	$ 6.19	$ 6.19	$ 8.36	$ 6.56	$ 6.56	$ 6.69	$ 6.19	$ 6.19	$ 6.19	$ 6.19	$ 6.19	$ 6.31	$ 6.56	$ 6.47	$ 6.47
	22 Plumbing	$ 4.97	$ 4.97	$ 4.97	$ 4.97	$ 21.37	$ 20.28	$ 24.95	$ 4.97	$ 4.97	$ 4.97	$ 6.86	$ 4.97	$ 3.48	$ 4.97	$ 8.69	$ 8.69
	23 HVAC Systems	$ 33.92	$ 33.92	$ 25.69	$ 39.52	$ 33.92	$ 37.25	$ 38.86	$ 33.92	$ 38.86	$ 19.78	$ 39.19	$ 33.92	$ 51.88	$ 33.92	$ 35.33	$ 35.33
	26 Electrical Systems	$ 22.81	$ 22.81	$ 26.46	$ 22.81	$ 22.81	$ 41.71	$ 29.65	$ 22.81	$ 20.76	$ 20.30	$ 22.81	$ 22.81	$ 31.02	$ 37.41	$ 26.21	$ 26.21
																	$ -
														$ 27.00			$ 1.80
	Subtotals	**$ 123.16**	**$ 143.25**	**$ 129.94**	**$ 127.34**	**$ 204.39**	**$ 158.40**	**$ 157.43**	**$ 164.92**	**$ 126.43**	**$ 104.35**	**$ 131.36**	**$ 119.57**	**$ 172.22**	**$ 153.97**	**$ 142.13**	**$ 115.02**
	Division 1 Contractor GC's & Fees 25.0%	$ 30.79	$ 35.81	$ 32.49	$ 31.84	$ 51.10	$ 39.60	$ 39.36	$ 41.23	$ 31.61	$ 26.09	$ 32.84	$ 29.89	$ 43.06	$ 38.49	$ 35.53	$ 28.75
	Arch & Eng Fee Total 0.0%	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
	Sub-Total Cove	**$ 153.95**	**$ 179.06**	**$ 162.43**	**$ 159.18**	**$ 255.49**	**$ 198.01**	**$ 196.79**	**$ 206.15**	**$ 158.04**	**$ 130.43**	**$ 164.20**	**$ 149.47**	**$ 215.28**	**$ 192.47**	**$ 177.66**	**$ 143.77**
Common Additives	**Equipment, Systems, & Furnishings (R&D)**																
	Security Systems (Expanded)								$ 4.00								$ 0.27
	Surveillance Systems			$ 0.99											$ 1.73	$ 0.33	$ 0.20
	Forced Entry Protection																$ -
	Communications (Expanded)																$ -
	Seating (Auditorium)			$ 14.75													
	Sound Systems	$ 0.94	$ 0.94	$ 0.94	$ 0.94	$ 0.94	$ 0.94	$ 0.94	$ 0.94	$ 0.94		$ 0.94	$ 0.94	$ 0.94	$ 0.94	$ 0.94	$ 0.88
	Banking Equipment														$ 29.90		
	Vault Door Systems														$ 10.71		
	Lab Equipment (Basic)					$ 3.07	$ 3.07	$ 3.07									
	Access Flooring		$ 2.69	$ 2.69		$ 2.69		$ 2.69					$ 2.69	$ 17.93	$ 2.69		$ 2.27
	Weight Equipment, Saunas, Whirlpools											$ 5.30					
	Med Gas Systems					$ 8.09	$ 8.09										
	Patient Headwall Systems					$ 5.32	$ 5.32										
	Nurses Stations					$ 1.77	$ 1.77										
	Nurses Bedside Station					$ 4.37	$ 2.41										
	Hospital Furnishings (No Equipment)					$ 24.02	$ 8.91										
	Prefab Holding Cells								$ 0.39								
	Library Furnishings				$ 9.56												
	Projection Screens & Equipment		$ 8.81	$ 7.83													
	Scales and Mailroom Equipment												$ 0.59				
	Dock Equipment							$ 0.20		$ 0.16	$ 1.30		$ 0.37				
	Kitchen Equipment									$ 7.45							
	Walk-in Refrigerator									$ 5.17							
	Sub-Total R&D	**$ 0.94**	**$ 12.44**	**$ 27.20**	**$ 10.50**	**$ 50.28**	**$ 30.51**	**$ 6.90**	**$ 5.33**	**$ 13.72**	**$ 1.30**	**$ 6.24**	**$ 4.59**	**$ 18.87**	**$ 45.97**	**$ 1.27**	**$ 3.62**
	TOTAL COST / SF	**$ 154.89**	**$ 191.50**	**$ 189.63**	**$ 169.69**	**$ 305.76**	**$ 228.52**	**$ 203.69**	**$ 211.48**	**$ 171.76**	**$ 131.74**	**$ 170.44**	**$ 154.06**	**$ 234.15**	**$ 238.44**	**$ 178.93**	**$ 147.39**
		Office Space	Conference Space	Auditorium Space	Library / Records Area	Medical Facility Space (Treatment / Surgery)	Medical Clinic	Laboratory Space	Security Space (Office)	Food Service Space	White Box Space (Retail)	Health / Gym Facility Space	Mail / Reproduction / Printing	Communications /Data / IT Space	Finance / Banking Facility Space	Core Space	Option 1

7.7.5 – Building Unit Cost – New Building

	Space Types	1 Office Space	2 Conference Space	3 Auditorium Space	4 Library / Records Area	5 Medical Facility Space (Treatment / Surgery)	6 Medical Clinic	7 Laboratory Space	8 Security Space (Office)	9 Food Service Space	10 White Box Space (Retail)	11 Health / Gym Facility Space	12 Mail / Reproduction / Printing	13 Communications /Data / IT Space	14 Finance / Banking Facility Space	15 Core Space
CSI Unit Cost	Division															
	2 Site Improvements	$ 3.26	$ 3.26	$ 3.75	$ 3.75	$ 3.57	$ 3.57	$ 3.57	$ 3.57	$ 3.57	$ 3.57	$ 3.57	$ 3.26	$ 3.26	$ 3.81	$ 3.52
	3 Concrete	$ 21.27	$ 21.27	$ 25.32	$ 21.27	$ 21.27	$ 21.27	$ 21.27	$ 23.33	$ 21.27	$ 21.27	$ 21.27	$ 21.27	$ 21.27	$ 23.33	$ 21.85
	4 Masonry	$ 6.18	$ 6.18	$ 6.74	$ 6.18	$ 17.13	$ 6.18	$ 6.74	$ 7.26	$ 6.18	$ 6.18	$ 6.18	$ 6.18	$ 6.18	$ 7.26	$ 7.20
	5 Metals	$ 8.11	$ 8.11	$ 14.76	$ 8.11	$ 10.95	$ 8.11	$ 10.95	$ 8.11	$ 8.11	$ 8.11	$ 8.11	$ 8.11	$ 8.11	$ 8.11	$ 8.99
	6 Wood, Plastic	$ 1.49	$ 4.77	$ 2.12	$ 1.49	$ 3.02	$ 1.49	$ 1.49	$ 1.49	$ 1.49	$ 1.49	$ 1.49	$ 1.49	$ 1.79	$ 4.32	$ 2.10
	7 Thermal & Moisture Protection	$ 3.93	$ 3.93	$ 9.17	$ 3.93	$ 9.17	$ 3.93	$ 9.17	$ 3.93	$ 9.17	$ 9.17	$ 9.17	$ 3.93	$ 3.93	$ 9.17	$ 6.55
	8 Doors & Windows	$ 10.12	$ 10.12	$ 8.02	$ 8.02	$ 8.02	$ 8.02	$ 10.12	$ 23.85	$ 10.12	$ 10.12	$ 8.02	$ 8.02	$ 8.02	$ 25.44	$ 11.15
	9 Finishes	$ 16.07	$ 33.10	$ 26.89	$ 16.07	$ 75.12	$ 16.07	$ 16.07	$ 46.67	$ 16.07	$ 14.57	$ 19.54	$ 16.07	$ 16.07	$ 16.07	$ 12.96
	10 Specialties	$ 0.77	$ 0.77	$ 0.77	$ 0.77	$ 0.87	$ 0.77	$ 0.83	$ 0.87	$ 0.77	$ 0.77	$ 0.77	$ 0.77	$ 0.77	$ 0.77	$ 0.79
	11 Equipment	$ 0.52	$ 0.52	$ 0.52	$ 0.52	$ 0.52	$ 0.52	$ 0.52	$ 0.52	$ 0.52	$ 0.52	$ 0.52	$ 0.52	$ 0.52	$ 0.52	$ 0.52
	12 Furnishings	$ 0.05	$ 0.05	$ 0.05	$ 0.05	$ 0.05	$ 0.05	$ 0.05	$ 0.05	$ 0.05	$ 0.05	$ 0.05	$ 0.05	$ 0.05	$ 0.05	$ 0.05
	13 Special Construction	$ 0.06	$ 0.12	$ 0.12	$ 0.06	$ 0.06	$ 0.06	$ 0.06	$ 0.21	$ 0.06	$ 0.06	$ 0.28	$ 0.06	$ 0.06	$ 0.06	$ 0.10
	14 Conveying	$ 1.74	$ 1.74	$ 1.74	$ 1.74	$ 1.74	$ 1.74	$ 1.74	$ 1.74	$ 1.74	$ 1.74	$ 1.74	$ 1.74	$ 1.74	$ 1.74	$ 1.74
	21 Fire Suppression	$ 5.29	$ 5.29	$ 5.29	$ 7.13	$ 5.60	$ 5.60	$ 5.71	$ 5.29	$ 5.29	$ 5.29	$ 5.29	$ 5.29	$ 5.38	$ 5.60	$ 5.29
	22 Plumbing	$ 4.04	$ 4.04	$ 4.04	$ 4.04	$ 17.37	$ 16.65	$ 20.30	$ 4.04	$ 4.04	$ 4.04	$ 5.56	$ 4.04	$ 2.82	$ 4.04	$ 7.08
	23 HVAC Systems	$ 25.11	$ 25.11	$ 19.02	$ 29.15	$ 48.96	$ 25.11	$ 28.89	$ 25.11	$ 28.89	$ 13.97	$ 28.89	$ 25.11	$ 37.85	$ 25.11	$ 27.59
	26 Electrical Systems	$ 21.07	$ 21.07	$ 24.37	$ 21.07	$ 29.90	$ 21.07	$ 21.69	$ 21.07	$ 19.11	$ 18.69	$ 21.07	$ 21.07	$ 28.64	$ 34.68	$ 21.07
	Subtotals	**$ 129.08**	**$ 149.45**	**$ 152.69**	**$ 133.35**	**$ 253.32**	**$ 140.21**	**$ 159.17**	**$ 177.11**	**$ 136.45**	**$ 119.61**	**$ 141.52**	**$ 126.98**	**$ 146.46**	**$ 170.08**	**$ 138.54**
	Contractor Fees 25.0%	$ 32.27	$ 37.36	$ 38.17	$ 33.34	$ 63.33	$ 35.05	$ 39.79	$ 44.28	$ 34.11	$ 29.90	$ 35.38	$ 31.75	$ 36.62	$ 42.52	$ 34.64
	A & E Fee Total 0.0%	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
	Sub-Total Cove	**$ 161.35**	**$ 186.81**	**$ 190.86**	**$ 166.69**	**$ 316.65**	**$ 175.26**	**$ 198.96**	**$ 221.39**	**$ 170.56**	**$ 149.51**	**$ 176.90**	**$ 158.73**	**$ 183.08**	**$ 212.60**	**$ 173.18**
Common Additives	**Equipment, Systems, & Furnishings (R&D)**															
	Security Systems (Expanded)								$ 4.00							
	Surveillance Systems			$ 0.99											$ 1.73	$ 0.33
	Forced Entry Protection															
	Communications (Expanded)															
	Seating (Auditorium)			$ 14.75												
	Sound Systems	$ 0.94	$ 0.94	$ 0.94	$ 0.94	$ 0.94	$ 0.94	$ 0.94	$ 0.94	$ 0.94		$ 0.94	$ 0.94	$ 0.94	$ 0.94	$ 0.94
	Banking Equipment														$ 29.90	
	Vault Door Systems														$ 10.71	
	Lab Equipment (Basic)					$ 3.07	$ 3.07	$ 3.07								
	Access Flooring		$ 2.69	$ 2.69		$ 2.69		$ 2.69					$ 2.69	$ 17.93	$ 2.69	
	Weight Equipment, Saunas, Whirlpools											$ 5.30				
	Med Gas Systems					$ 8.09	$ 8.09									
	Patient Headwall Systems					$ 5.32	$ 5.32									
	Nurses Stations					$ -	$ -									
	Nurses Bedside Station					$ -	$ -									
	Hospital Furnishings (No Equipment)					$ -	$ -									
	Prefab Holding Cells								$ 0.39							
	Library Furnishings				$ 9.56											
	Projection Screens & Equipment		$ 8.81	$ 7.83												
	Scales and Mailroom Equipment												$ 0.59			
	Dock Equipment							$ 0.20		$ 0.16	$ 1.30		$ 0.37			
	Kitchen Equipment									$ 7.45						
	Walk-in Refrigerator									$ 5.17						
	Sub-Total R&D	**$ 0.94**	**$ 12.44**	**$ 27.20**	**$ 10.50**	**$ 20.11**	**$ 17.42**	**$ 6.90**	**$ 5.33**	**$ 13.72**	**$ 1.30**	**$ 6.24**	**$ 4.59**	**$ 18.87**	**$ 45.97**	**$ 1.27**
	TOTAL COST / SF	**$ 162.29**	**$ 199.25**	**$ 218.06**	**$ 177.19**	**$ 336.76**	**$ 192.68**	**$ 205.86**	**$ 226.72**	**$ 184.28**	**$ 150.82**	**$ 183.14**	**$ 163.32**	**$ 201.95**	**$ 258.57**	**$ 174.45**
		Office Space	Conference Space	Auditorium Space	Library / Records Area	Medical Facility Space (Treatment / Surgery)	Medical Clinic	Laboratory Space	Security Space (Office)	Food Service Space	White Box Space (Retail)	Health / Gym Facility Space	Mail / Reproduction / Printing	Communications /Data / IT Space	Finance / Banking Facility Space	Core Space

7.7.6 – LEED Cost

Option 4 - New Construction	$ /SF	SF	Total
Office Space	$ 3.25	252,038	$ 818,065
Conference Space	$ 3.99	56,155	$ 223,780
Auditorium Space	$ 4.36	7,840	$ 34,191
Library / Records Area	$ 3.54	20,996	$ 74,407
Medical Facility Space (Treatment / Surgery)	$ 6.74	0	$ -
Medical Clinic	$ 3.85	0	$ -
Laboratory Space	$ 4.12	30,652	$ 126,201
Security Space (Office)	$ 4.53	35,033	$ 158,851
Food Service Space	$ 3.69	38,077	$ 140,338
White Box Space (Retail)	$ 3.02	4,661	$ 14,059
Health / Gym Facility Space	$ 3.66	15,431	$ 56,521
Mail / Reproduction / Printing	$ 3.27	16,547	$ 54,048
Communications /Data / IT Space	$ 4.04	33,813	$ 136,567
Finance / Banking Facility Space	$ 5.17	2,733	$ 14,133
Core Space	$ 3.49	142,367	$ 496,714
Averages / Totals	**3.58**	**656,343**	**$ 2,347,876**
Option 3 - Renovation & Addition			
Renovation	**$ /SF**	**SF**	**Total**
Office Space	$ 7.74	193,226	$ 1,496,439
Conference Space	$ 9.58	49,848	$ 477,301
Auditorium Space	$ 9.48	0	$ -
Library / Records Area	$ 8.48	17,685	$ 150,045
Medical Facility Space (Treatment / Surgery)	$ 15.29	0	$ -
Medical Clinic	$ 11.43	0	$ -
Laboratory Space	$ 10.18	0	$ -
Security Space (Office)	$ 10.57	23,994	$ 253,711
Food Service Space	$ 8.59	12,021	$ 103,238
White Box Space (Retail)	$ 8.59	1,005	$ 8,631
Health / Gym Facility Space	$ 8.52	0	$ -
Mail / Reproduction / Printing	$ 7.70	11,110	$ 85,580
Communications /Data / IT Space	$ 11.71	24,440	$ 286,133
Finance / Banking Facility Space	$ 11.92	2,733	$ 32,583
Core Space	$ 8.95	92,727	$ 829,571
Averages / Totals	$ 8.68	428,789	$ 3,723,232
New Construction	**$ /SF**	**SF**	**Total**
Office Space	$ 3.25	58,812	$ 190,892
Conference Space	$ 3.99	6,307	$ 25,134
Auditorium Space	$ 4.36	7,840	$ 34,191
Library / Records Area	$ 3.54	3,311	$ 11,734
Medical Facility Space (Treatment / Surgery)	$ 6.74	0	$ -
Medical Clinic	$ 3.85	0	$ -
Laboratory Space	$ 4.12	30,652	$ 126,201
Security Space (Office)	$ 4.53	11,039	$ 50,054
Food Service Space	$ 3.69	26,056	$ 96,033
White Box Space (Retail)	$ 3.02	3,656	$ 11,028
Health / Gym Facility Space	$ 3.66	15,431	$ 56,521
Mail / Reproduction / Printing	$ 3.27	5,437	$ 17,759
Communications /Data / IT Space	$ 4.04	9,373	$ 37,857
Finance / Banking Facility Space	$ 5.17	0	$ -
Core Space	$ 3.49	49,640	$ 173,193
Averages / Totals	3.65	227,554	$ 830,596
Averages / Totals	**$ 6.94**	**656,343**	**$ 4,553,828**
Option 2 - LEED Cost			
Reno	586,890	$ 8.68	$ 5,096,044
New	26,139	3.65	$ 95,410
Totals	**613,029**	**8.47**	**$ 5,191,454**

7.8 – Demolition Cost

	Site "A"		Site "B"		Site "C"		Site "D"		Site "G"		Site "H"		Option 1	Option 2
	Option 4	Option 3	Option 4	Option 3	Option 4	Option 3	Option 4	Option 3	Option 4	Option 3	Option 4	Option 3	Option 1	Option 2
Demolition - HQ	428,789		428,789		428,789		428,789		428,789		428,789			20,453
Demolition - Auditorium	9,224	0	9,224	0	9,224	0	9,224	0	9,224	9,224	9,224			
Demolition - Consolidation Buildings	152,895	152,895	152,895	152,895	152,895	152,895	152,895	152,895	152,895	152,895	152,895	152,895		
Total Square Footage	590,908	152,895	590908	152895	590908	152895	590908	152895	590908	162119	590908	152895	0	20,453
Demolition Cost	$ 6,759,988	$ 1,749,119	$ 6,759,988	$ 1,749,119	$ 6,759,988	$ 1,749,119	$ 6,759,988	$ 1,749,119	$ 6,759,988	$ 2,431,785	$ 6,759,988	$ 1,749,119	$ -	$ 233,982
Selective Demolition		454,448		454,448		454,448		454,448		454,448		454,448	626,428	586,890
Demolition Cost	$ -	$ 7,748,338	$ -	$ 7,748,338	$ -	$ 7,748,338	$ -	$ 7,748,338	$ -	$ 7,748,338	$ -	$ 7,748,338	$ 10,680,597	$ 10,006,475
Total Building Demolition Cost	**$ 6,759,988**	**$ 9,497,457**	**$ 6,759,988**	**$ 9,497,457**	**$ 6,759,988**	**$ 9,497,457**	**$ 6,759,988**	**$ 9,497,457**	**$ 6,759,988**	**$ 10,180,123**	**$ 6,759,988**	**$ 9,497,457**	**$ 10,680,597**	**$ 10,240,457**

7.9 – Site Work

	Site "A"		Site "B"		Site "C"		Site "D"		Site "G"		Site "H"	
	Option 4	Option 3	Option 4	Option 3	Option 4	Option 3	Option 4	Option 3	Option 4	Option 3	Option 4	Option 3
Parking Demolition	199500	122500	280000	35000	35000	35000	119000	122500	181275	152775	51800	25900
$1.85 SF	$ 369,075	$ 226,625	$ 518,000	$ 64,750	$ 64,750	$ 64,750	$ 220,150	$ 226,625	$ 335,359	$ 282,634	$ 95,830	$ 47,915
New Parking Areas	199500	122500	280000	35000	35000	35000	119000	122500	216000	216000	216000	216000
$7.76 SF	$ 1,548,120	$ 950,600	$ 2,172,800	$ 271,600	$ 271,600	$ 271,600	$ 923,440	$ 950,600	$ 1,676,160	$ 1,676,160	$ 1,676,160	$ 1,676,160
Roadway Demolition	14400	0	36000	14400		36000	28000	36000	61704	14400	0	6792
$1.80 SF	$ 25,920	$ -	$ 64,800	$ 25,920	$ -	$ 64,800	$ 50,400	$ 64,800	$ 111,067	$ 25,920	$ -	$ 12,226
Roadway Construction	0	0	0	0		0	0	0	0	0	0	0
$8.14 SF												
Pond Relocation	0	0	0	0	60000	0	0	0	0	0	0	0
$48 SF	$ -	$ -	$ -	$ -	$ 2,880,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Storm Sewer												
$4725 / 5000 SF	$ 188,528	$ 115,763	$ 264,600	$ 33,075	$ 33,075	$ 33,075	$ 112,455	$ 115,763	$ 204,120	$ 204,120	$ 204,120	$ 204,120
Site Lighting												
$2850 / 5000 SF	$ 113,715.00	$ 69,825.00	$ 159,600.00	$ 19,950.00	$ 19,950.00	$ 19,950.00	$ 67,830.00	$ 69,825.00	$ 123,120.00	$ 123,120.00	$ 123,120.00	$ 123,120.00
Site Clearing (Acre)	29.4	24.8	34.4	20.3	21.6	20.9	25.3	25.8	30.6	28.6	25.4	24.9
$6,250	$183,674	$154,760	$215,026	$127,185	$135,015	$130,894	$158,366	$160,941	$191,500	$178,485	$158,675	$155,394
Foundation and Load Bearing Elements (Piles) $ /SF Footprint	135384	61413	135384	61413	135384	61413	135384	61413	135384	61413	135384	61413
$16.66	$2,255,504	$1,023,146	$2,255,504	$1,023,146	$2,255,504	$1,023,146	$2,255,504	$1,023,146	$2,255,504	$1,023,146	$2,255,504	$1,023,146
Dewatering $/SF Footprint	135384	61413	135384	61413	135384	61413	135384	61413	135384	61413	135384	61413
1.39	$ 188,184	$ 85,364	$ 188,184	$ 85,364	$ 188,184	$ 85,364	$ 188,184	$ 85,364	$ 188,184	$ 85,364	$ 188,184	$ 85,364
Water Distribution	700	400	1400	500	500	600	900	600	1000	550	800	400
$69.82	$48,874.00	$27,928.00	$97,748.00	$34,910.00	$34,910.00	$41,892.00	$62,838.00	$41,892.00	$69,820.00	$38,401.00	$55,856.00	$27,928.00
Sanitary Sewerage	600	650	800	600	1400	1000	600	400	800	550	600	1000
$27.60	$16,560.00	$17,940.00	$22,080.00	$16,560.00	$38,640.00	$27,600.00	$16,560.00	$11,040.00	$22,080.00	$15,180.00	$16,560.00	$27,600.00
Electrical Distribution	650	400	1500	400	800	1600	800	1000	700	600	700	300
$134.82	$87,633.00	$53,928.00	$202,230.00	$53,928.00	$107,856.00	$215,712.00	$107,856.00	$134,820.00	$94,374.00	$80,892.00	$94,374.00	$40,446.00
Natural Gas Distribution	750	600	1000	600	800	400	800	1000	500	350	600	500
$87.82	$65,865.00	$52,692.00	$87,820.00	$52,692.00	$70,256.00	$35,128.00	$70,256.00	$87,820.00	$43,910.00	$30,737.00	$52,692.00	$43,910.00
Drainage & Containment												
$2,000,000	$2,000,000	0	0	0	$2,000,000	$2,000,000	$2,000,000	$2,000,000	$0	$0	0	$0
Earthwork (Building & Parking Areas)	1540430	1297934	1803374	1066670	1132334	1097774	1328174	1349774	1606064	1496906	1330766	1303250
$2.45 SF / 6' Depth Excav / Spread / Compaction	$ 3,774,053	$ 3,179,938	$ 4,418,266	$ 2,613,341	$ 2,774,218	$ 2,689,546	$ 3,254,026	$ 3,306,946	$ 3,934,856	$ 3,667,420	$ 3,260,377	$ 3,192,963
Irrigation	308086	259587	360675	213334	226467	219555	265635	269955	321213	299381	266153	260650
$0.86 SF	$ 264,954	$ 223,245	$ 310,180	$ 183,467	$ 194,761	$ 188,817	$ 228,446	$ 232,161	$ 276,243	$ 257,468	$ 228,892	$ 224,159
Landscaping	308086	259587	360675	213334	226467	219555	265635	269955	321213	299381	266153	260650
$1.26 SF	$ 388,188	$ 327,079	$ 454,450	$ 268,801	$ 285,348	$ 276,639	$ 334,700	$ 340,143	$ 404,728	$ 377,220	$ 335,353	$ 328,419
TOTAL SITE COST	**$ 11,431,214**	**$ 6,454,905**	**$ 11,229,059**	**$ 4,820,761**	**$ 11,246,211**	**$ 6,953,201**	**$ 9,943,155**	**$ 8,717,066**	**$ 9,836,651**	**$ 7,985,374**	**$ 8,651,322**	**$ 7,172,424**

7.10 – Furnishings Cost

Partition Systems Furniture		Option 1	Option 2	Option 3	Option 4
Furnishings Design	0.60%	$ -	$ 535,217	$ 683,588	$ 651,131
Outfitting Furniture	4.40%	$ -	$ 3,924,922	$ 5,012,976	$ 4,774,960
Outfitting Equipment / Demountables	3.60%	$ -	$ 3,211,300	$ 4,101,526	$ 3,906,786
	8.60%	$ -	$ 7,671,439	$ 9,798,089	$ 9,332,877

Partition Systems Furniture		Site "A"		Site "B"		Site "C"		Site "D"		Site "G"		Site "H"		Option 2
		Option 4	Option 3	Option 4	Option 3	Option 4	Option 3	Option 4	Option 3	Option 4	Option 3	Option 4	Option 3	Option 2
Furnishings Design	0.60%	$ 651,131	$ 683,588	$ 651,131	$ 683,588	$ 651,131	$ 683,588	$ 651,131	$ 683,588	$ 651,131	$ 683,588	$ 651,131	$ 683,588	$ 535,217
Outfitting Furniture	4.40%	$ 4,774,960	$ 5,012,976	$ 4,774,960	$ 5,012,976	$ 4,774,960	$ 5,012,976	$ 4,774,960	$ 5,012,976	$ 4,774,960	$ 5,012,976	$ 4,774,960	$ 5,012,976	$ 3,924,922
Outfitting Equipment / Demountables	3.60%	$ 3,906,786	$ 4,101,526	$ 3,906,786	$ 4,101,526	$ 3,906,786	$ 4,101,526	$ 3,906,786	$ 4,101,526	$ 3,906,786	$ 4,101,526	$ 3,906,786	$ 4,101,526	$ 3,211,300
	8.60%	**$ 9,332,877**	**$ 9,798,089**	**$ 9,332,877**	**$ 9,798,089**	**$ 9,332,877**	**$ 9,798,089**	**$ 9,332,877**	**$ 9,798,089**	**$ 9,332,877**	**$ 9,798,089**	**$ 9,332,877**	**$ 9,798,089**	**$ 7,671,439**

7.11 – Activation Cost

	% CoF	Option 1	Option 2	Option 3	Option 4
Activation - Outfitting Construction Fees	3.0%	$ 1,338,042	$ 3,284,227	$ 3,417,938	$ 3,255,655
Activation - KICS Contract	6.0%	$ 5,352,167	$ 6,568,455	$ 6,835,876	$ 6,511,310
Activation - Contingency	2.0%	$ 1,784,056	$ 2,189,485	$ 2,278,625	$ 2,170,437
Lead R&D Commissioning	0.4%	$ 356,811	$ 437,897	$ 455,725	$ 434,087
Based On Of CoF	**11.4%**	$ 8,831,076	$ 12,480,064	$ 12,988,165	$ 12,371,488

	%	Site "A"		Site "B"		Site "C"		Site "D"		Site "G"		Site "H"		Option 2	Option 1
	CoF	Option 4	Option 3	Option 4	Option 3	Option 4	Option 3	Option 4	Option 3	Option 4	Option 3	Option 4	Option 3	Option 2	Option 1
Activation - Outfitting Construction Fees	3.0%	$ 3,255,655	$ 3,417,938	$ 3,255,655	$ 3,417,938	$ 3,255,655	$ 3,417,938	$ 3,255,655	$ 3,417,938	$ 3,255,655	$ 3,417,938	$ 3,255,655	$ 3,417,938	$ 3,284,227	$ 1,338,042
Activation - KICS Contract	6.0%	$ 6,511,310	$ 6,835,876	$ 6,511,310	$ 6,835,876	$ 6,511,310	$ 6,835,876	$ 6,511,310	$ 6,835,876	$ 6,511,310	$ 6,835,876	$ 6,511,310	$ 6,835,876	$ 6,568,455	$ 5,352,167
Activation - Contingency	2.0%	$ 2,170,437	$ 2,278,625	$ 2,170,437	$ 2,278,625	$ 2,170,437	$ 2,278,625	$ 2,170,437	$ 2,278,625	$ 2,170,437	$ 2,278,625	$ 2,170,437	$ 2,278,625	$ 2,189,485	$ 1,784,056
Lead R&D Commissioning	0.4%	$ 434,087	$ 455,725	$ 434,087	$ 455,725	$ 434,087	$ 455,725	$ 434,087	$ 455,725	$ 434,087	$ 455,725	$ 434,087	$ 455,725	$ 437,897	$ 356,811
Based On Of CoF	**11.4%**	**$ 12,371,488**	**$ 12,988,165**	**$ 12,371,488**	**$ 12,988,165**	**$ 12,371,488**	**$ 12,988,165**	**$ 12,371,488**	**$ 12,988,165**	**$ 12,371,488**	**$ 12,988,165**	**$ 12,371,488**	**$ 12,988,165**	**$ 12,480,064**	**$ 8,831,076**

7.12 – Migration Cost

Migration Cost		Option 1	Option 2	Option 3	Option 4
Number Of People Relocated		1819	1819	1808	1897
Comm ($/Person) New Connections	$ 2,000	$ 3,638,000	$ 3,638,000	$ 3,616,000	$ 3,794,000
Existing Furniture Move ($/Person)	$ 2,800	$ 5,093,200	$ 5,093,200	$ 5,062,400	$ -
Box Move ($/Person)	$ 521	$ 1,895,398	$ 1,895,398	$ 1,883,936	$ 988,337
		$ 10,628,417	$ 10,628,417	$ 10,564,144	$ 4,784,234
Lost of Productivity - Separation					
40Hrs at:	HQ	$ 10,622,960	$ 10,622,960	$ 7,516,080	$ 3,758,040
$73	Other Bldgs	$ 1,553,440	$ 1,553,440	$ 1,521,320	$ 1,781,200
		$ 12,176,400	$ 12,176,400	$ 9,037,400	$ 5,539,240

		Site "A"		Site "B"		Site "C"		Site "D"		Site "G"		Site "H"		Option 1 & 2
		Option 4	Option 3	Option 4	Option 3	Option 4	Option 3	Option 4	Option 3	Option 4	Option 3	Option 4	Option 3	Option 1 & 2
Moving Cost		1897	1808	1897	1808	1897	1808	1897	1808	1897	1808	1897	1808	1819
Comm ($/Person) New Connections	$ 2,000	$ 3,794,000	$ 3,616,000	$ 3,794,000	$ 3,616,000	$ 3,794,000	$ 3,616,000	$ 3,794,000	$ 3,616,000	$ 3,794,000	$ 3,616,000	$ 3,794,000	$ 3,616,000	$ 3,638,000
Comm ($/Person) Desk to Desk	$ -													
New Furniture ($/Person)	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Existing Furniture Move ($/Person)	$ 2,800		$ 5,062,400		$ 5,062,400		$ 5,062,400		$ 5,062,400		$ 5,062,400		$ 5,062,400	$ 5,093,200
Box Move ($/Person)	$ 521	$ 988,337	$ 1,883,936	$ 988,337	$ 1,883,936	$ 988,337	$ 1,883,936	$ 988,337	$ 1,883,936	$ 988,337	$ 1,883,936	$ 988,337	$ 1,883,936	$ 1,895,398
Total Moving Cost		$ 4,782,337	$ 10,562,336	$ 4,782,337	$ 10,562,336	$ 4,782,337	$ 10,562,336	$ 4,782,337	$ 10,562,336	$ 4,782,337	$ 10,562,336	$ 4,782,337	$ 10,562,336	$ 10,626,598
Temporary Housing Cost														
Lost of Productivity - Separation														
40Hrs at:	1287	$ 3,758,040	$ 7,516,080	$ 3,758,040	$ 7,516,080	$ 3,758,040	$ 7,516,080	$ 3,758,040	$ 7,516,080	$ 3,758,040	$ 7,516,080	$ 3,758,040	$ 7,516,080	$ 10,622,960
$73	521	$ 1,781,200	$ 1,521,320	$ 1,781,200	$ 1,521,320	$ 1,781,200	$ 1,521,320	$ 1,781,200	$ 1,521,320	$ 1,781,200	$ 1,521,320	$ 1,781,200	$ 1,521,320	$ 1,553,440
	1808	$ 5,539,240	$ 9,037,400	$ 5,539,240	$ 9,037,400	$ 5,539,240	$ 9,037,400	$ 5,539,240	$ 9,037,400	$ 5,539,240	$ 9,037,400	$ 5,539,240	$ 9,037,400	$ 12,176,400
Lost of Productivity - Environment														
		$10,321,577	**$19,599,736**	**$10,321,577**	**$19,599,736**	**$10,321,577**	**$19,599,736**	**$10,321,577**	**$19,599,736**	**$10,321,577**	**$19,599,736**	**$10,321,577**	**$19,599,736**	**$22,802,998**

Moving Basis	New	Reno
New Connections	$ 2,000.00	$ 2,000.00
Comm Baseline Desk to Desk	$ -	$ -
New Furniture	$ -	$ -
Existing Furniture		$ 2,800.00
Box Move	$ 521.00	$ 1,042.00
	$ 2,521.00	$ 5,842.00

7.13 – Life Cycle Cost

Life Cycle Cost Analysis					Site "A"				Site "B"				Site "C"			
	Option 1 HQ	Option 1 - All	Option 2 - HQ	Option 2 - All	Option 4 - 1 for 1	Option 3 - 1 For 1	Option 4 - Space Util	Option 3 - Space Util	Option 4 - 1 for 1	Option 3 - 1 For 1	Option 4 - Space Util	Option 3 - Space Util	Option 4 - 1 for 1	Option 3 - 1 For 1	Option 4 - Space Util	Option 3 - Space Util
Initial Cost	$ 112,297,185	$ 164,057,615	$ 141,932,236	$ 202,916,961	$ 231,189,098	$ 247,693,908	$ 206,705,883	$ 234,312,104	$ 230,880,336	$ 245,197,994	$ 206,397,121	$ 231,816,190	$ 230,906,533	$ 248,454,982	$ 206,423,318	$ 235,073,178
O&M Cost (40 Years)	$ 607,053,457	$ 774,379,885	$ 583,927,175	$ 774,129,784	$ 681,563,328	$ 730,220,783	$ 609,384,918	$ 690,770,190	$ 680,653,073	$ 722,862,637	608474662.8	683412044	680730305	732464490.3	608551894.7	693013897.1
Energy Cost (40 Years)	$ 70,487,567	$ 119,918,766	$ 66,341,239	$ 110,450,578	$ 76,160,900	$ 88,854,383	$ 66,506,835	$ 82,990,607	$ 76,160,900	$ 88,854,383	$ 66,506,835	$ 82,990,607	$ 76,160,900	$ 88,854,383	$ 66,506,835	$ 82,990,607
Interest (Discount Rate = 3.75)	$ 104,677,147	$ 152,925,322	$ 132,301,282	$ 189,147,828	$ 215,501,530	$ 230,886,390	$ 192,679,648	$ 218,412,621	$ 215,213,720	$ 228,559,839	$ 192,391,838	$ 216,086,071	$ 215,238,139	$ 231,595,821	$ 192,416,257	$ 219,122,053
40 Years	$ 894,515,355	$ 1,211,281,588	$ 924,501,932	$ 1,276,645,151	$ 1,204,414,856	$ 1,297,655,464	$ 1,075,277,284	$ 1,226,485,522	$ 1,202,908,028	$ 1,285,474,853	$ 1,073,770,456	$ 1,214,304,911	$ 1,203,035,877	$ 1,301,369,677	$ 1,073,898,304	$ 1,230,199,735
Initial Cost	$ 112,297,185	$ 164,057,615	$ 141,932,236	$ 202,916,961	$ 231,189,098	$ 247,693,908	$ 206,705,883	$ 234,312,104	$ 230,880,336	$ 245,197,994	$ 206,397,121	$ 231,816,190	$ 230,906,533	$ 248,454,982	$ 206,423,318	$ 235,073,178
O&M Cost (20 Years)	$ 339,805,679	$ 433,468,717	$ 338,792,390	$ 449,147,241	$ 418,348,009	$ 448,214,272	$ 374,044,431	$ 423,999,241	$ 417,789,288	$ 443,697,794	$ 373,485,710	$ 419,482,763	$ 417,836,694	$ 449,591,474	$ 373,533,116	$ 425,376,443
Energy Cost (20 Years)	$ 23,576,404	$ 40,109,956	$ 22,189,556	$ 36,943,074	$ 25,473,998	$ 29,719,664	$ 22,244,944	$ 27,758,371	$ 25,473,998	$ 29,719,664	$ 22,244,944	$ 27,758,371	$ 25,473,998	$ 29,719,664	$ 22,244,944	$ 27,758,371
Interest (Discount Rate = 3.75)	$ 47,494,068	$ 69,385,208	$ 60,027,678	$ 85,820,067	$ 97,777,257	$ 104,757,669	$ 87,422,523	$ 99,098,076	$ 97,646,672	$ 103,702,067	$ 87,291,938	$ 98,042,475	$ 97,657,752	$ 105,079,552	$ 87,303,018	$ 99,419,959
20 Years	$ 523,173,336	$ 707,021,497	$ 562,941,860	$ 774,827,344	$ 772,788,362	$ 830,385,512	$ 690,417,781	$ 785,167,792	$ 771,790,294	$ 822,317,519	$ 689,419,713	$ 777,099,798	$ 771,874,976	$ 832,845,672	$ 689,504,395	$ 787,627,951

Life Cycle Cost Analysis	Site "D"				Site "G"				Site "H"			
	Option 4 - 1 for 1	Option 3 - 1 For 1	Option 4 - Space Util	Option 3 - Space Util	Option 4 - 1 for 1	Option 3 - 1 For 1	Option 4 - Space Util	Option 3 - Space Util	Option 4 - 1 for 1	Option 3 - 1 For 1	Option 4 - Space Util	Option 3 - Space Util
Initial Cost	$ 228,916,305	$ 251,149,027	$ 204,433,090	$ 237,767,223	$ 228,753,637	$ 250,854,019	$ 204,270,422	$ 237,472,215	$ 226,943,221	$ 248,789,814	$ 202,460,006	$ 235,408,009
O&M Cost (40 Years)	$ 674,862,960	$ 740,406,742	$ 602,684,549	$ 700,956,149	$ 674,383,401	$ 739,537,035	$ 602,204,990	$ 713,604,883	$ 669,046,154	$ 733,451,598	$ 596,867,744	$ 694,001,005
Energy Cost (40 Years)	$ 76,160,900	$ 88,854,383	$ 66,506,835	$ 82,990,607	$ 76,160,900	$ 88,854,383	$ 66,506,835	$ 82,990,607	$ 76,160,900	$ 88,854,383	$ 66,506,835	$ 82,990,607
Interest (Discount Rate = 3.75)	$ 213,382,960	$ 234,107,059	$ 190,561,078	$ 221,633,290	$ 213,231,330	$ 233,832,069	$ 190,409,448	$ 221,358,300	$ 211,543,762	$ 231,907,932	$ 188,721,880	$ 219,434,163
40 Years	$ 1,193,323,125	$ 1,314,517,210	$ 1,064,185,553	$ 1,243,347,268	$ 1,192,529,267	$ 1,313,077,505	$ 1,063,391,695	$ 1,255,426,004	$ 1,183,694,036	$ 1,303,003,727	$ 1,054,556,464	$ 1,231,833,785
Initial Cost	$ 228,916,305	$ 251,149,027	$ 204,433,090	$ 237,767,223	$ 228,753,637	$ 250,854,019	$ 204,270,422	$ 237,472,215	$ 226,943,221	$ 248,789,814	$ 202,460,006	$ 235,408,009
O&M Cost (20 Years)	$ 414,235,279	$ 454,466,479	$ 369,931,701	$ 430,251,448	$ 413,940,923	$ 453,932,648	$ 369,637,344	$ 429,717,617	$ 410,664,886	$ 450,197,367	$ 366,361,308	$ 425,982,336
Energy Cost (20 Years)	$ 25,473,998	$ 29,719,664	$ 22,244,944	$ 27,758,371	$ 25,473,998	$ 29,719,664	$ 22,244,944	$ 27,758,371	$ 25,473,998	$ 29,719,664	$ 22,244,944	$ 27,758,371
Interest (Discount Rate = 3.75)	$ 96,816,021	$ 106,218,949	$ 86,461,287	$ 100,559,357	$ 96,747,223	$ 106,094,181	$ 86,392,489	$ 100,434,588	$ 95,981,540	$ 105,221,162	$ 85,626,806	$ 99,561,570
20 Years	$ 765,441,603	$ 841,554,120	$ 683,071,022	$ 796,336,399	$ 764,915,780	$ 840,600,511	$ 682,545,199	$ 795,382,791	$ 759,063,645	$ 833,928,007	$ 676,693,064	$ 788,710,286

Notes:

1. Discount Rate 3.75% Cost Per Period (40 Years) = $ 4.0253

2. 40 Years Escalation @ 3.5% equals 396%, totaling these years would be by a factor of: 396% 87.51

3. Discount Rate 3.75% Cost Per Period (20 Years) = $ 5.9289

4. 20 Years Escalation @ 3.5% equals 199%, totaling these years would be by a factor of: 199% 29.27

7.14 – Operational Efficiency

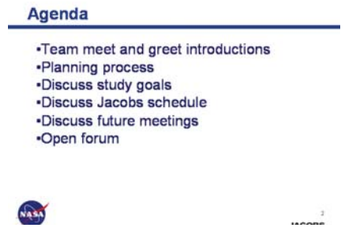
Operational Efficiency Calcs - People Movement					
Building Population	3806	People			
Traveling Population %	5%			**Building Population**	
Traveling Population	190	People		HQ	1283
Average Round Trip	20	Minutes		BOB	103
Minutes Per Day	3806	Minutes		CIF	337
	60	Minutes / Hr		EHF	50
Hours Per Day	63	Hours		O&C	1095
Employee Cost Per Hour	$ 73.00	Dollars		SSPF	897
Cost per Day	$ 4,630.63	Dollars		Records	0
Working Weeks / Year	48	Average		EML	16
Working Days / Week	5	Days		Auditorium	0
Number Of Working Days	240	Days		IASB	25
Total Cost Per Year	$ 1,111,352				3806
Trips Per Year	45,672				
% of Trips With Vehicle Use.	3.73%			**Vehicle Use**	
				EML	16
Vehicle trip Length	3	Miles (round trip)		EHF	50
Federal Government Mileage Rate	$ 0.55				66
Cost Per Trip	$ 3.55			Travelers @ 5%	3
Vehicle Trips Year	1705			Working Days	240
Transportation Cost	$ 6,054			Vehicle Trips	792
				Rain Days @ 2%	913
Total Travel Cost	**$ 1,117,406**			Total Vehicle Trips	1705
Total Minutes Year:	**913,440**				
Site Efficiency	Additional Minutes/Yr	%	Factor	Yearly Efficiency ($)	
Site "A"	53820	6%	105.9%	$ 1,183,244	
Site "B"	-116464	-13%	87.3%	$ 974,937	
Site "C"	-116464	-13%	87.3%	$ 974,937	
Site "D"	0	0%	100.0%	$ 1,117,406	
Site "G"	0	0%	100.0%	$ 1,117,406	
Site "H"	-228360	-25%	75.0%	$ 838,055	
Option 2 All Buildings	-897600	-98%	1.7%	$ 19,377	

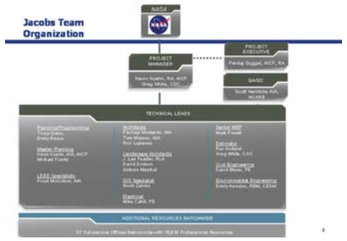
Appendix

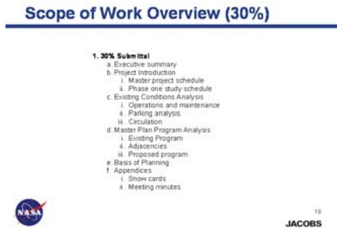
JACOBS

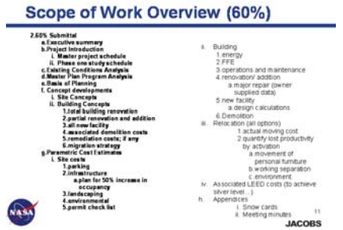
Appendix

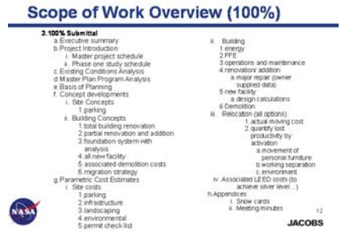
Appendix 1. Project Kick Off Presentation

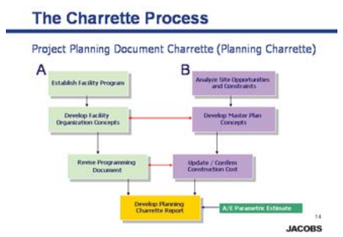


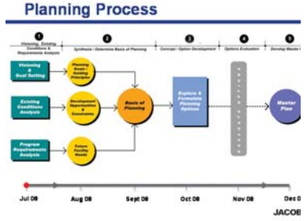


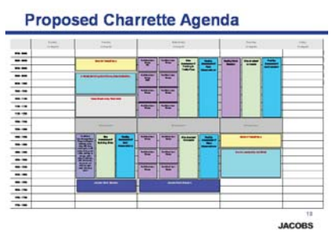


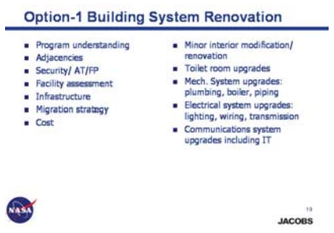


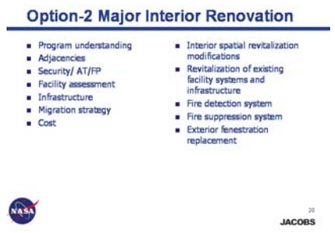


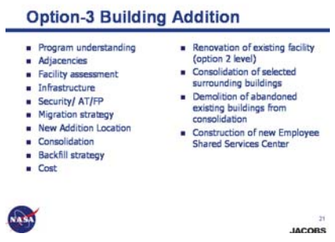


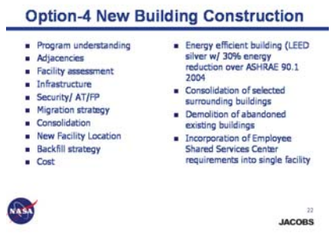


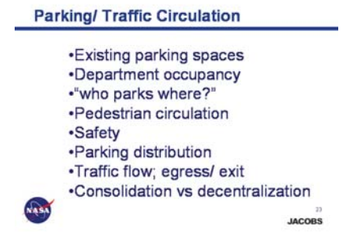


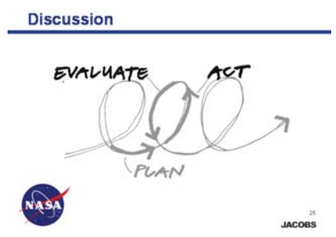




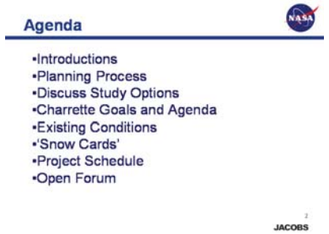


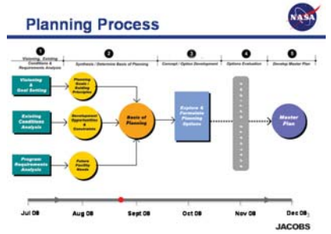


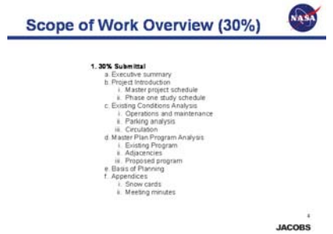


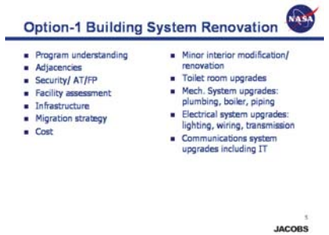


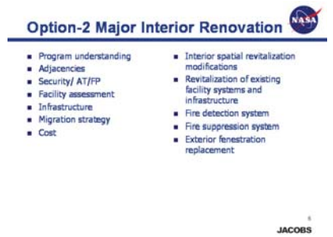
Appendix 2. Charrette I In Brief

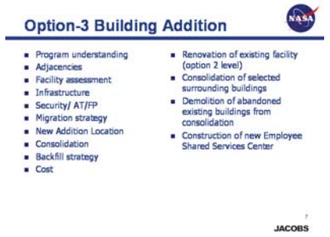


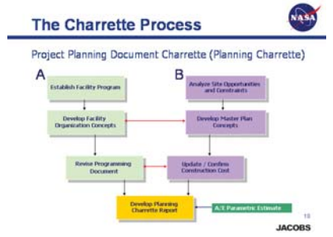


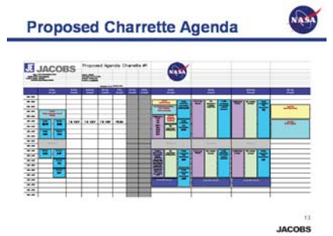


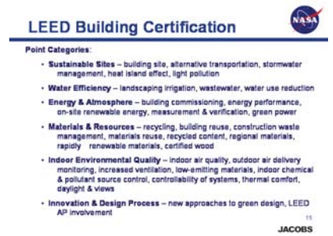


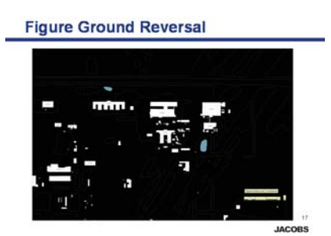


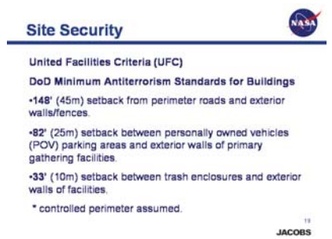


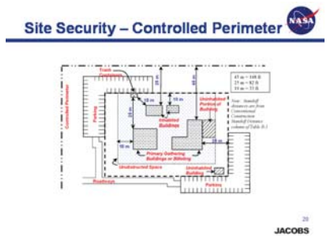


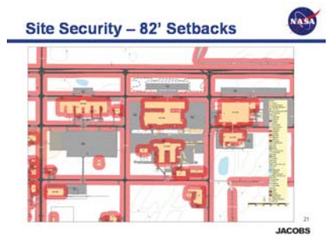


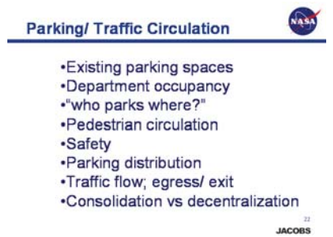




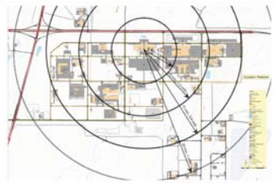








Existing Site Circulation



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Existing Site Circulation

JACOBS

Existing Site Utilities

JACOBS

Existing Site Wetlands

- 100' Setback – LEED SSc1

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Existing Site Vegetation

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Probable Building Locations

Constraints considered

1. *DoD Security*
2. *Parking*
3. *Wetlands*
4. *Others?*

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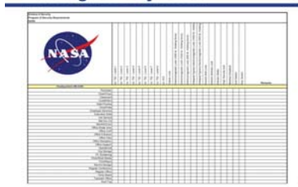
Building Security Matrix



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Headquarters Building

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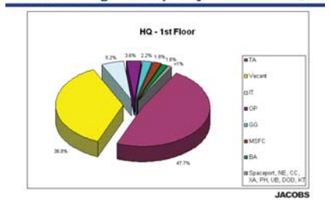
HQ Building by DFUM (Parent group)

1st Floor

JACOBS

HQ Building – Occupancy



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HQ Building by Space Type

1st Floor

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BOB by DFUM (Parent Group)

1st Floor

JACOBS

CIF by DFUM (Parent Group)

1st Floor

JACOBS

EHF by DFUM (Parent Group)

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O & C Building

JACOBS

SSPF Building

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Overall Project Schedule and Milestones

Project Kick-Off and Data Collection	**9 July 08**
▪ Visioning Session	**12-14 Aug 08**
▪ **Charrette 1 – Work Sessions**	**25-29 Aug 08**
30% Submittal	**12 Sept 08**
▪ Government Review Complete	**23 Sept 08**
▪ Review Comment Incorporation	**24-29 Sept 08**
▪ Charrette 2 – Work Sessions	**30 Sept-1 Oct 08**
60% Submittal	**24 Oct 08**
▪ Government Review Complete	**4 Nov 08**
▪ Review Comment Incorporation	**5-12 Nov 08**
100% QC Submittal	**5 Dec 08**
▪ Government Review Complete	**12 Dec 08**
Final Submittal	**23 Dec 08**

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Next Steps

- 30% Submittal
- 30% Review and Comments
- Prepare for Charrette-2
- Charrette-2
- Keep our eyes on the target!
- Others…

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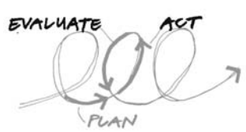
Discussion



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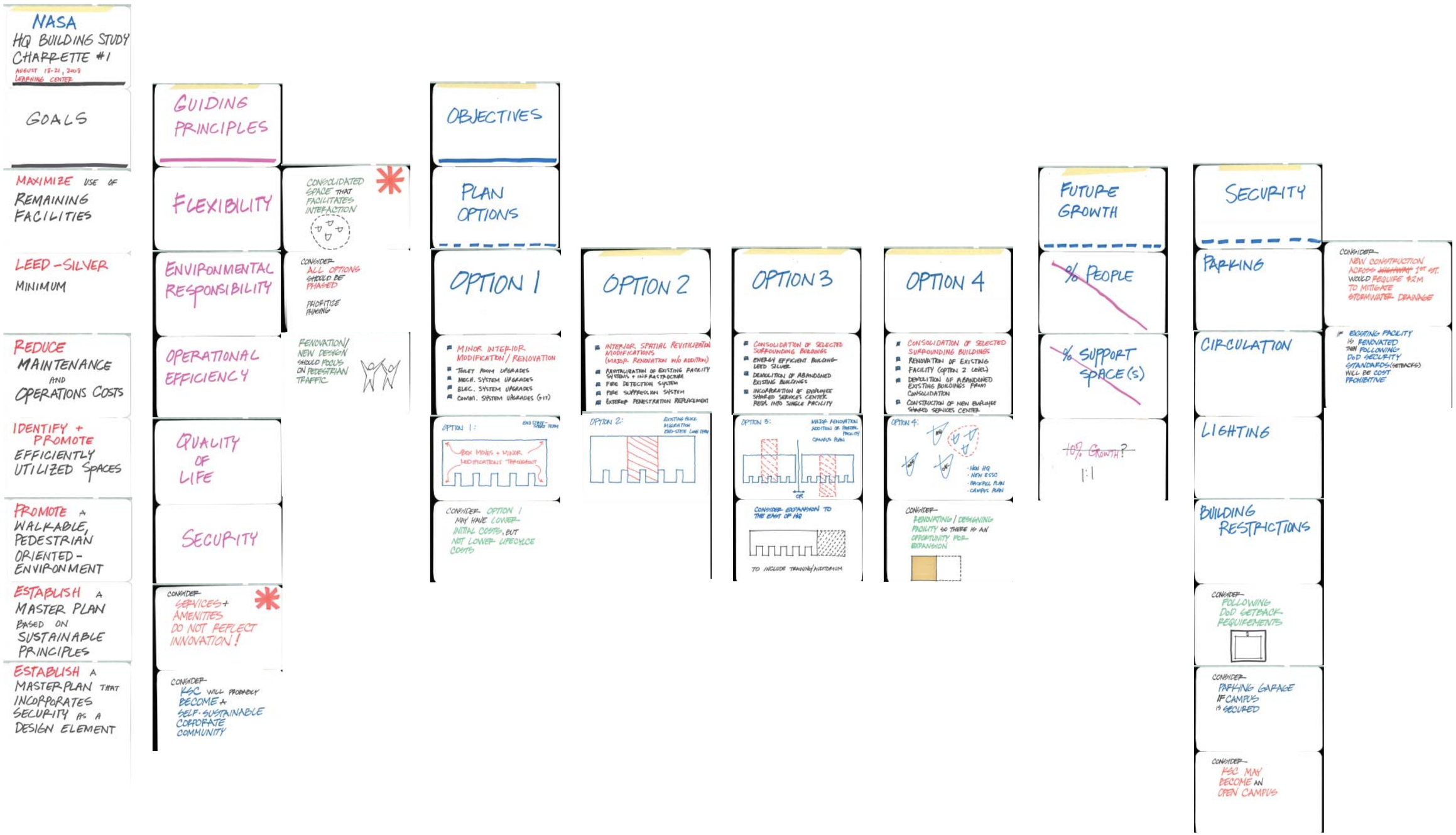
Appendix 3. Snow Cards from Charrette I



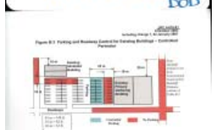
SECURITY ATFP

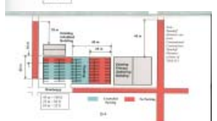
148' PERIMETER TO BLDG DOD

82' POV TO BLDG DOD

33' BLDG TO BLDG DOD

33' BLDG TO DUMPSTER DOD





SUSTAINABILITY

LEED

LEADERSHIP IN ENERGY AND ENVIRONMENTAL DESIGN

NASA HQ STUDY

TO EMPLOY THE NEW CONSTRUCTION VERSION 2.2

MINIMUM SILVER CERTIFICATION

2008 LEVELS

* CERTIFIED = 26-32 POINTS
* SILVER = 33-38 POINTS
* GOLD = 39-51 POINTS
* PLATINUM = 52-69 POINTS

2009 LEVELS

* CERTIFIED = 40-49 POINTS
* SILVER = 50-59 POINTS
* GOLD = 60-79 POINTS
* PLATINUM = 80+ POINTS

POINT CATEGORIES

- SUSTAINABLE SITES
- WATER EFFICIENCY
- ENERGY + ATMOSPHERE
- MATERIALS + RESOURCES
- INDOOR ENVIRONMENTAL QUALITY
- INNOVATION + DESIGN PROCESS

WETLANDS

- THE FUTURE PLATINUM LEVEL LEED CERTIFIED BUILDING IS CREATING MAN-MADE WETLANDS, WHICH COULD OFFSET THE IMPACT OF REMOVING EXISTING ONES

* CONFIRMED *

- ALL SUSTAINABLE EFFORTS SHOULD BE GUIDED BY AT LEAST A SILVER CERTIFICATION LEVEL, IN LEED NC, VERSION 2.2.

LEED Building Certification

Point Categories

- Sustainable Sites - building site, alternative transportation, stormwater management
- Water Efficiency - landscaping irrigation, wastewater, water use reduction
- Energy & Atmosphere - building commissioning, energy performance, refrigerant management, renewable energy, measurement & verification, green power
- Materials & Resources - recycling, building reuse, construction waste management, materials reuse, recycled content, regional materials, rapidly renewable materials, certified wood
- Indoor Environmental Quality - indoor air quality, outdoor air delivery monitoring, ventilation effectiveness, construction IAQ management plan, low-emitting materials, controllability of systems, thermal comfort, daylight & views
- Innovation & Design Process - new approaches to green design, LEED AP, innovation

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CONSIDER

LEED SILVER CERTIFICATION WILL VARY DEPENDING ON EXISTING (RENOVATION) AND NEW CONSTRUCTION

EXISTING CONDITIONS

1 FOR 1 RATIONALE

% OF SPACE NOT # PER DPUM

TO GET FOOT PRINT, BUT NOT DIRECT COMPARISON

- WE NEED TO DETERMINE WHICH POINT IN TIME (SNAPSHOT) WE WANT TO USE TO GUIDE ALL FACILITIES DRAWINGS

BOMA STANDARDS FOR DIVISION OF PARENT FOOTPRINT

- WE NEED VERIFICATION OF THE VACANT SPACES IN THE BUILDINGS THAT ARE BEING USED FOR "PET PROJECTS"
- WILL AFFECT ALL DRAWINGS & CALCULATIONS

FOOTPRINT OF PARENT

BY BUILDING
BY FLOOR
BY PARENT

- CURRENT VACANCIES SHOULD BE INCORPORATED INTO THE OPTIONS AT THE 1:1 RATIO; THEY BECOME PART OF THE GROWTH (POSSIBLY)

VACANTS W/IN PARENT: ONLY DESKS + ROOMS, NOT CIRCULATION SPACE

SQUARE FOOTAGE CALCULATIONS BY DPUM

SOME STATISTICS: PERSONNEL DENSITY BY PARENT

VACANTS - NOW ONLY AT PROGRAM LEVEL NOT BUILDING → USED FOR OPTION 1

DOCUMENT ALL MISC SPACE IN DOC

GG SPACE CALCS:

ASSIGNED TO OTHER PARENTS WILL YIELD EITHER A SMALLER OR SPOT-ON # → NEED TO BUFFER TO GET TO 250#/225#

OFFICE
MISC
VACANT
} % PER DPUM

CONFERENCE = "X" OF BUILDING
STORAGE = GOES TO PARENT
LAB = PARENT
OFFICE = PARENT
MISC = GG
EXCLUDED = CORE
TECH FACILITY = PARENT

CAMPUS ENVIRONMENT

BUILDING

SITE

CODES

FIRE

FBC

WEATHER

KSC STANDARDS

SPACE REQUIREMENTS

STANDARD SIZES + RANGE OF SIZES

OFFICE SPACE HARD WALL

- 400-420
- 300-350
- 200-250
- 200-240
- 150-200
- 150-180
- 150-300
- 150-300
- 110-130

BENCHMARK

USE SIZE IN KEEPING WITH #/PERSON AS GUIDE LINE?

225 #/PERSON

OFFICE SPACE WORKSTATIONS

- 90-120
- 90-110
- 70-90
- 120-140

BENCHMARK

BENCHMARK SF/PERSON ACROSS OTHER GOVT AGENCIES

USE AVERAGE WITHIN RANGES?

BENCHMARKING

- EST. GENERAL STANDARDS F/DPUM'S & CONF SPACES
- ADD SECTION TO DOC THAT CAN BE REMOVED

SUPPORT SPACES

1 FOR 1 RATIONALE?

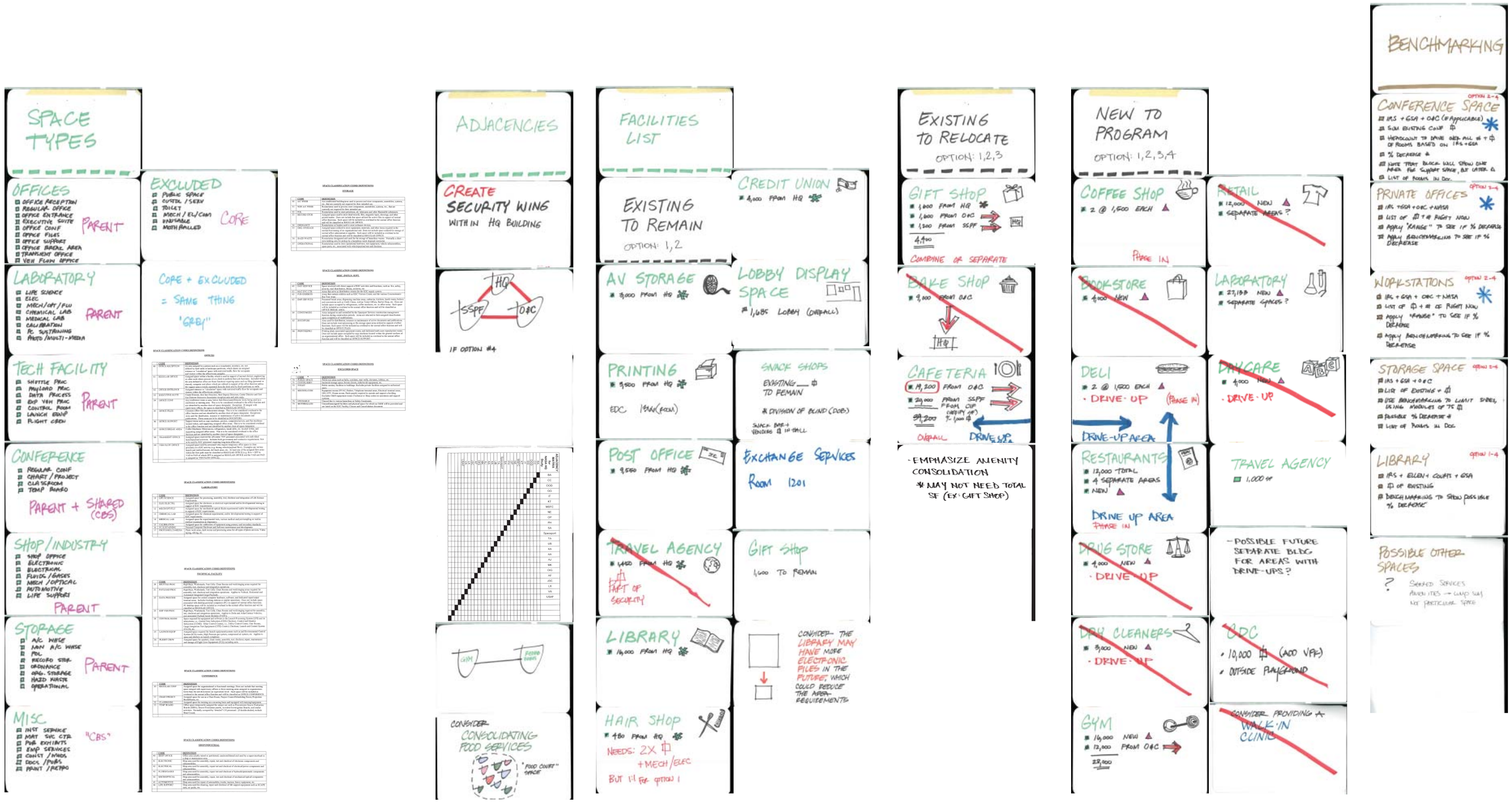
YES

KSC HAS APPROVED NEW OFFICE STANDARDS (OF 15 SHOWN IN RANGES)

AVG = 125 PER PERSON

125# = SF EXEC

RANGE IS RELATED TO FURNITURE MANUFACTURER


SPACE TYPES
OFFICES
OFFICE RECEPTION
REGULAR OFFICE
OFFICE ENTRANCE
EXECUTIVE SUITE
OFFICE CONF
OFFICE FILES
OFFICE SUPPORT
OFFICE BREAK AREA
TRANSIENT OFFICE
VEH FLEET OFFICE
PARENT
EXCLUDED
PUBLIC SPACE
CUSTOD / SERV
TOILET
MECH / ELC / COM
UNUSABLE
MOTH BALLED
CORE
LABORATORY
LIFE SCIENCE
ELEC
MECH/OPT/FLU
CHEMICAL LAB
MEDICAL LAB
CALIBRATION
PC SUSTAINING
PHOTO / MULTI-MEDIA
PARENT
CORE + EXCLUDED
= SAME THING
"GREY"
TECH FACILITY
SHUTTLE PROC
PAYLOAD PROC
DATA PROCESS
EXP VEH PROC
CONTROL ROOM
LAUNCH CONT
FLIGHT CREW
PARENT
CONFERENCE
REGULAR CONF
CHART / PROJECT
CLASSROOM
TEMP BOARD
PARENT + SHARED (CBS)
SHOP / INDUSTRY
SHOP OFFICE
ELECTRONIC
ELECTRICAL
FLUID / GASES
MECH / OPTICAL
AUTOMOTIVE
LIFE SUPPORT
PARENT
STORAGE
A/C WHSE
NON A/C WHSE
POL
RECORD STOR
ORDNANCE
ORG. STORAGE
HAZD WASTE
OPERATIONAL
PARENT
MISC.
INST SERVICE
MAT SVC CTR
PUB EXHIBITS
EMP SERVICES
CONST / MODS
DOCS / PUBS
PAINT / REPAIR
"CBS"
ADJACENCIES
CREATE SECURITY WING WITHIN HQ BUILDING
HQ
SSPF
O&C
IF OPTION #4
GYM
FOOD COURT
CONSIDER CONSOLIDATING FOOD SERVICES
"FOOD COURT" SPACE
FACILITIES LIST
EXISTING TO REMAIN
OPTION: 1,2
CREDIT UNION
4,000 FROM HQ
AV STORAGE
3,000 FROM HQ
LOBBY DISPLAY SPACE
1,685 LOBBY (OVERALL)
PRINTING
3,900 FROM HQ
EDC 1,500 (FROM)
SNACK SHOPS
EXISTING ___ #
TO REMAIN
* DIVISION OF BLDG (CODE)
SNACK BAR + VENDING # IN HALL
POST OFFICE
3,560 FROM HQ
EXCHANGE SERVICES
ROOM 1201
TRAVEL AGENCY
1,450 FROM HQ
PART OF SECURITY
GIFT SHOP
1,600 TO REMAIN
LIBRARY
16,000 FROM HQ
CONSIDER THE LIBRARY MAY HAVE MORE ELECTRONIC FILES IN THE FUTURE, WHICH COULD REDUCE THE AREA REQUIREMENTS
HAIR SHOP
480 FROM HQ
NEEDS: 2X #
+ MECH / ELEC
BUT 1:1 FOR OPTION 1
EXISTING TO RELOCATE
OPTION: 1,2,3
GIFT SHOP
1,600 FROM HQ
1,600 FROM O&C
1,200 FROM SSPF
4,400
COMBINE OR SEPARATE
BAKE SHOP
9,000 FROM O&C
HQ
CAFETERIA
14,200 FROM O&C
20,000 FROM SSPF
FROM CUF (VERY OF)
34,200
1,000 #
OVERALL
DRIVE UP
- EMPHASIZE AMENITY CONSOLIDATION
* MAY NOT NEED TOTAL SF (EX: GIFT SHOP)
NEW TO PROGRAM
OPTION: 1,2,3,4
COFFEE SHOP
2 @ 1,500 EACH
RETAIL
12,000 NEW
SEPARATE AREAS?
PHASE IN
BOOKSTORE
4,000 NEW
LABORATORY
27,198 NEW
SEPARATE SPACES?
DELI
2 @ 1,500 EACH
· DRIVE · UP
(PHASE IN)
DRIVE-UP AREA
DAYCARE
4,000 NEW
· DRIVE · UP
RESTAURANTS
12,000 TOTAL
4 SEPARATE AREAS
NEW
DRIVE UP AREA
PHASE IN
TRAVEL AGENCY
1,000 SF
DRUG STORE
4,000 NEW
· DRIVE UP
- POSSIBLE FUTURE SEPARATE BLDG FOR AREAS WITH DRIVE-UPS?
DRY CLEANERS
3,000 NEW
· DRIVE UP
ODC
10,000 # (ADD VPF)
· OUTSIDE PLAYGROUND
GYM
16,000 NEW
12,000 FROM O&C
28,000
CONSIDER PROVIDING A WALK-IN CLINIC
BENCHMARKING
CONFERENCE SPACE
OPTION 2-4
IRS + GSA + O&C (IF APPLICABLE)
SUM EXISTING CONF #
HEADCOUNT TO DRIVE DEP. ALL # + # OF ROOMS BASED ON IRS + GSA
% DECREASE #
NOTE THAT BLACK WILL SHOW OVER AREA FOR SUPPORT SPACE, BUT LATER.
LIST OF ROOMS IN DOC.
PRIVATE OFFICES
OPTION 2-4
IRS + GSA + O&C + NASA
LIST OF # + # RIGHT NOW
APPLY "RANGE" TO SEE IF % DECREASE
APPLY BENCHMARKING TO SEE IF % DECREASE
WORKSTATIONS
OPTION 2-4
IRS + GSA + O&C + NASA
LIST OF # + # OF RIGHT NOW
APPLY "RANGE" TO SEE IF % DECREASE
APPLY BENCHMARKING TO SEE IF % DECREASE
STORAGE SPACE
OPTION 2-4
IRS + GSA + O&C
LIST OF EXISTING + #
USE BENCHMARKING TO LIMIT SPACE USING MODULES OF 75 #
POSSIBLE % DECREASE #
LIST OF ROOMS IN DOC
LIBRARY
OPTION 1-4
IRS + ELLEN + COURT + GSA
OF EXISTING
BENCHMARKING TO SEEK POSSIBLE % DECREASE
POSSIBLE OTHER SPACES
?
SHARED SERVICES
AMENITIES → CAMP SUN
NOT PARTICULAR SPACE

BUILDING INVENTORY

CALCULATIONS TAKEN FROM NASA SUPPLIED BUILDING SPREADSHEETS

HQ

AMENITIES
- TO REMAIN:
  - ✓ AV STORAGE
  - ✓ PRINTING
  - ✓ POST OFFICE
  - ✓ TRAVEL AGENCY
  - ✓ LIBRARY
  - ✓ HAIR SHOP
  - ✓ CREDIT UNION

AMENITIES
- RELOCATED OR NEW:
  - LAUNDRY/DRY
  - GIFT SHOP
  - BANK SHOP
  - CAFETERIA
  - COFFEE SHOP
  - BOOK STORE
  - DELI
  - RESTAURANTS
  - DRIVE STORE
  - DRY CLEANERS
  - ETC..

BUILDING COUNTS
- 396,045 USF (FROM SPREADSHEET)
- 439,446 GSF
- 4 FLOORS
- 211 ft²/PERSON

PEOPLE COUNTS
1,878 TOTAL PEOPLE (IN OFFICE (FROM SPREADSHEET))
- 1302 TOTAL OCCUPIED
- 7 TOTAL TO BE FILLED
- 569 TOTAL VACANT

PEOPLE COUNTS - BY FLOOR
- 1ST FLOOR: 214 OCCUPIED; 3 TO BE FILLED; 194 VACANT
- 2ND FLOOR: 502 OCCUPIED; 3 TO BE FILLED; 214 VACANT
- 3RD FLOOR: 567 OCCUPIED; 1 TO BE FILLED; 158 VACANT
- 4TH FLOOR: 19 OCCUPIED; Ø TO BE FILLED; 3 VACANT

% CALCULATIONS
- 69% OCCUPIED
- LESS THAN 1% TO BE FILLED
- 30% VACANT

PARENT COUNTS
- 24 ASSIGNED DPUM
- 1 "UNASSIGNED" DPUM

SPACE TYPE COUNTS
- 49 CONFERENCE AREAS
- 71 EXCLUDED AREAS
- 15 LAB AREAS
- 90 MISC AREAS
- 96 STORAGE AREAS
- 15 TECH FACILITY AREAS

ADJACENCIES

BOB

BUILDING COUNTS
- 15,432 USF
- 20,088 GSF
- 2 FLOORS
- 113 ft² / PERSON

PEOPLE COUNTS
136 TOTAL PEOPLE (IN OFFICE (FROM SPREADSHEET))
- 107 TOTAL OCCUPIED
- Ø TOTAL TO BE FILLED
- 29 TOTAL VACANT

PEOPLE COUNTS - BY FLOOR
- 1ST FLOOR: 44 OCCUPIED; Ø TO BE FILLED; 22 VACANT
- 2ND FLOOR: 63 OCCUPIED; Ø TO BE FILLED; 7 VACANT

% CALCULATIONS
- 79% OCCUPIED
- 0% TO BE FILLED
- 21% VACANT

PARENT COUNTS
- 2 ASSIGNED DPUM

SPACE TYPE COUNTS
- 4 STORAGE AREAS
- 3 CONFERENCE AREAS
- 3 EXCLUDED AREAS

ADJACENCIES

CIF

BUILDING COUNTS
- 122,329 USF
- 136,838 GSF
- 4 FLOORS
- 298 ft² /PERSON

PEOPLE COUNTS
410 PEOPLE (IN OFFICE (FROM SPREADSHEET))
- 293 TOTAL OCCUPIED
- Ø TOTAL TO BE FILLED
- 117 TOTAL VACANT

PEOPLE COUNTS - BY FLOOR
- 1ST FLOOR: 35 OCCUPIED; Ø TO BE FILLED; 17 VACANT
- 2ND FLOOR: 100 OCCUPIED; Ø TO BE FILLED; 49 VACANT
- 3RD FLOOR: 158 OCCUPIED; Ø TO BE FILLED; 51 VACANT
- 4TH FLOOR: Ø OCCUPIED; Ø TO BE FILLED; Ø VACANT

% CALCULATIONS
- 71% OCCUPIED
- Ø % TO BE FILLED
- 29% VACANT

PARENT COUNTS
- 7 ASSIGNED DPUM

SPACE TYPE COUNTS
- 3 CONFERENCE AREAS
- 10 EXCLUDED AREAS
- 65 LAB AREAS
- 14 MISC AREAS
- 1 SHOP/INDUSTRY AREAS
- 9 STORAGE AREAS
- 15 TECH FACILITY AREAS

ADJACENCIES

EHF

BUILDING COUNTS
- 82,215 USF
- 10,735 GSF
- 1 FLOOR
- 119 ft² / PERSON

PEOPLE COUNTS
69 TOTAL PEOPLE (IN OFFICE (FROM SPREADSHEET))
- 52 TOTAL OCCUPIED
- Ø TOTAL TO BE FILLED
- 17 TOTAL VACANT

PEOPLE COUNTS - BY FLOOR
- 1ST FLOOR: 52 OCCUPIED; Ø TO BE FILLED; 17 VACANT

% CALCULATIONS
- 75% OCCUPIED
- Ø% TO BE FILLED
- 25% VACANT

PARENT COUNTS
- 2 ASSIGNED DPUM

SPACE TYPE COUNTS
- 2 CONFERENCE AREAS
- 12 EXCLUDED AREAS
- 1 LAB SPACE
- 1 MISC SPACE
- 5 STORAGE SPACES

ADJACENCIES

SSPF

BUILDING COUNTS
- 414,607 USF (OVERALL)
  - 20,000 USF CAFETERIA
  - 1,200 USF GIFT SHOP
  - 21,200 TOTAL MOVING

PEOPLE COUNTS
NO PERSONNEL MOVING

PARENT COUNTS
N/A

ADJACENCIES

OHF

BUILDING COUNTS
- 22,550 USF
- 34,046 GSF
- 1 FLOOR
- 705 ft²/PERSON

CONSIDER... SWING ONLY
OHF MAY RELOCATE OFFSITE
(POSSIBLY EXPLORATION PARK)

PEOPLE COUNTS
32 TOTAL PEOPLE (IN OFFICE (FROM SPREADSHEET))
- 25 TOTAL OCCUPIED
- Ø TOTAL TO BE FILLED
- 7 TOTAL VACANT

PEOPLE COUNTS - BY FLOOR
- 1ST FLOOR: 25 OCCUPIED; Ø TO BE FILLED; 7 VACANT

% CALCULATIONS
- 78% OCCUPIED
- Ø % TO BE FILLED
- 22% VACANT

PARENT COUNTS
- 2 ASSIGNED DPUM

SPACE TYPE COUNTS
- 12 STORAGE SPACES
- 2 MISC SPACES
- 30 LAB SPACES
- 8 EXCLUDED SPACES
- 2 CONFERENCE SPACES

ADJACENCIES
EMERGENCY "DRIVE UP"

O&C

BUILDING COUNTS
- 604,578 USF (OVERALL)
  - 19,200 USF CAFETERIA
  - 1,600 USF GIFT SHOP
  - 18,000 USF PEOPLE SPACE FROM O&C
- 38800 TOTAL

PEOPLE COUNTS
- 80 PEOPLE TOTAL - MOVING TO HQ
- 60 PEOPLE OF 80 ALREADY MOVED
- 18,000 USF SPACE NEEDS

PARENT COUNTS
N/A

ADJACENCIES

CONSIDER THAT AS ORION PROJECT IS UNDERWAY, THE WEST SIDE ENTRANCE OF O&C MAY NOT BE ACCESSIBLE

CDC
Appendix

BUILDING COUNTS
- 6571 USF (FROM TAKE-OFF)
- 1 FLOOR

+ EXISTING AREA FOR OUTSIDE PLAY AREA.

CONSIDER THAT CDC MUST BE WITHIN SECURED AREA AND WITHIN OWN GATE PERIMETER

PLAYGROUND WILL REQUIRE ___ ACRES

DEMOGRAPHICS OF PARENTS
30% NASA EMPLOYEES
70% CONTRACTORS

APPROX. 16,000 TOTAL WORKFORCE
→ 2,100 NASA EMPLOYEES

OCCUPANCY
125 sf/CHILD (INTERIOR) 35 MINIMUM
45 sf/CHILD 1+ YEARS OLD (EXTERIOR/PLAYGROUND)

PARENTS ARE SURVEYED PERIODICALLY REGARDING LEVEL OF SERVICE

CURRENT ENROLLMENT
AVG. ENROLLMENT = 105

PLAYGROUND IS COMPRISED OF 3 SECTIONS

ENROLLMENT DEMAND
WAITING LIST = 300 APPROX. (NOT INCL. NASA WORKFORCE)
COULD BE 400 CHILDREN

CONSIDER PLAYGROUND COULD BE ON ROOF WITH PROPER SAFETY PRECAUTIONS

AREA REQUIREMENTS
400 CHILDREN
× 25 sf PER CHILD
10,000 sf TO MEET DEMANDS

CONSIDER PROPOSAL FOR 3,000 sf/ $1.3M ADDITION TO EXISTING FACILITY

DROP-OFF/PICK-UP
10 VEHICLES IN QUEQUE

FOOD SERVICES

RANDOLF SHEPARD ACT
100+ CIVIL SERVANTS MUST ~~HAVE~~ COMPLY

14,000
2,000 CIVIL SERVANTS
12,000 CONTRACTORS

CONTRACTORS NEED TO BE CLOSE → ½ HR FOR LUNCH.

- CONSOLIDATION: 'SIMPLIFIED STAFF'
- QUICK PICK-UP SPACES

BLIND STAND MUST GET FIRST CHANCE AT CONTRACT
ACCORDING TO PROVISIONS OF BLIND MUST RUN THE SAME BARS + VENDING

OVERALL CAFETERIA USAGE
50% EAT-IN
50% TAKE-OUT

- REF / FREEZER
- TRAVEL TO CAFE? DISTANCE
- WANTS TO INCLUDE E.U.L. SERVICE (FAST FOOD)

ALL FOOD SERVICES (INCLUDING VENDING OF BLIND) MUST BE ON 1ST FLOOR

CONCEPT

CONCEPT "BUY/EAT ALONG THE WALK"
'ANCHOR' 'FOOD'

QUESTION: WILL THE EMPLOYEES TRAVEL FROM BLDG TO BLDG?

PROVIDE COVERED, OUTDOOR SEATING

* CONSIDER A NEW CONSOLIDATED CAFETERIA WILL POTENTIALLY LOWER THE OVERALL AREA REQUIREMENTS (DUE TO EFFICIENCIES GAINED BY CONSOLIDATING)

FOOD SERVICES
- EXCHANGE SELF SERVICE VARIETY
- BLIND SERVICES SNACK BAR + VENDING REVISE
- CAFETERIA REVISE

HOURS: CAFETERIA 0630 — 1300
DIV. OF BLIND: 0730 — 1530

CONSIDER DESIGN CONCEPT FOR NEW CONSOLIDATED CAFETERIA THAT ALLOWS FOR EXPANSION

CONSIDER THAT CAFETERIA VENDOR COULD HAVE CONTACT FOR FAST FOOD

11:00 11:30

seating/occupancy
LC-39 : 650
SSPF : 336
O&C : 124
HQ : 850
CAFETERIA 1360 (2008)

56% of population GOES OUT TO LUNCH.

DELIVERY:
- LOADING DOCK
  - SEMI - DELIVERY "DAILY"
- LARGE TRASH AREA.

CONSIDER ONE CENTRALIZED CAFETERIA

- DAILY & PICK-UP

CONSIDER THAT THE WEAKNESS OF THE HQ CAFETERIA IS OUTDATED FACILITIES

$10,000 PER DAY COMBINED INCOME W/ ALL 4 CAFETERIAS
CAN REVERSE MATH FOR REVENUE

- $ MADE @ VENDING

NASA EXCHANGE 1ST FLOOR CAFETERIA SNACK/VENDING MITER FLOORS FOOD SERVICE

KITCHENS + LOADING DOCKS CURRENTLY ALL UNDERSIZED

VENDING

LOCATE VENDING NEAR ELEVATORS

ACTION ITEMS

MARK PLANS FOR VENDING AREAS IN HALL

ACQUIRE CAD OF UTILITIES & TOPO IF AVAILABLE

- DEFINE PRINTING AREA VS. DFUM (OR EXTERNAL GRAPHICS)

OHF OPERATIONS ACTION ITEM.

- VERIFY 19,200# FOR O&C CAFETERIA

- SIMPLIFY SPACE TYPES W/ELI FOR NEXT ROUND OF DRAWINGS

* POST 30%
- SEND TOP 5-6 SITES FOR POSSIBLE FUTURE HQ BLDG TO ENVIR. PPL TO FIND OUT MAJOR ISSUES

QUESTIONS
- 10% growth: Define?
- capacity of exist. bldg.

NASA TO PROVIDE SETBACK REQUIREMENTS

FOLLOW-UP WITH RENEE REGARDING WHICH PART OF CHF WOULD RELOCATE OFFSITE/ STAY ON CAMPUS

TAKE-OFFS CIF CAFETERIA

ADJACENCY DIAGRAMS

- TARGET: 30yr...
  HQ BLDG.: life span?
  - 2042
  - ~~10% growth from now~~
  - TO MID-POINT OF CONSTRUCTION
- PROVE EFFICIENCY
  - O&C DATA
  - EFFICIENCY VS. ENERGY
  - DEMO $ VS. MOVE ×2
  - OPTION MATRIX
  - NET COST
- 30% more than ASHRAE
  - RENOVATE
  - NEW CONSTRUCTION

HQ SPACE SAVINGS V. ENERGY $
"ELI'S SPREADSHEET"

"Doing things right" LEED

- SHOW GRAPHIC FOR O&M COSTS OVER 10, 20, 30 YRS:

- ZERO NET CARBON FOOTPRINT
  - HOW TO APPROACH?

ISSUES

ABSTRACT CHART SUMMARIZING BENEFITS OF SCENARIOS

NEXT STEPS

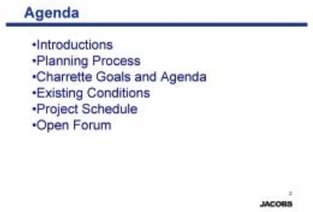
NASA KSC HQ STUDY
OUT-BRIEF PRESENTATION
AUGUST 28, 2008

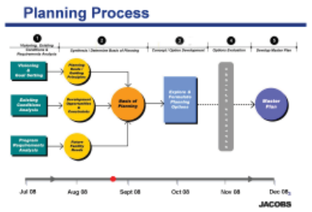
CONSIDER COSTS INVOLVED WITH RELOCATING STAFF FOR ALL 4 OPTIONS

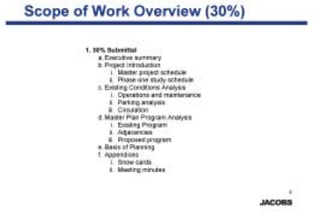
BENCHMARKING WILL INCLUDE GSA + IRS STANDARDS

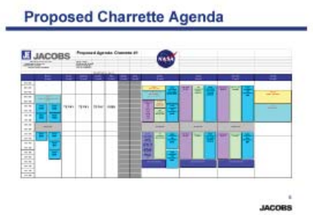
HQ STUDY WILL ADDRESS FLEXIBLE SPACE FOR FUTURE EXPANSION

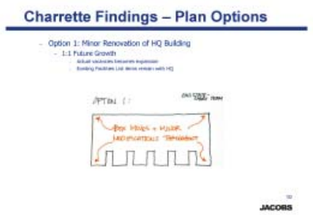
Appendix 4. Charrette I Out Brief

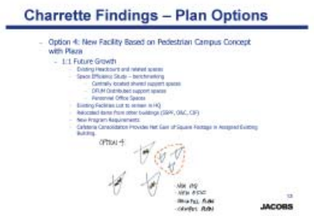


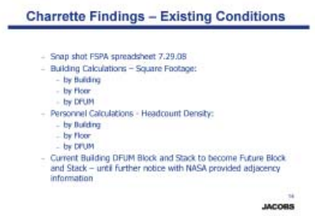


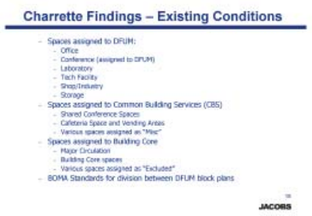


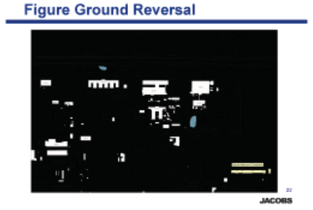


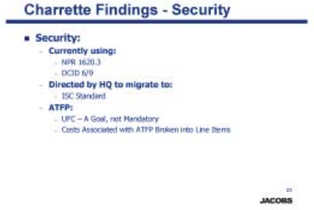


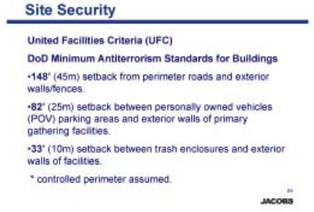


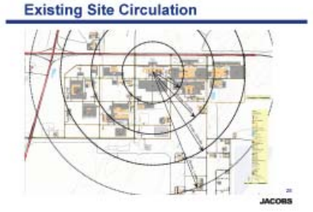


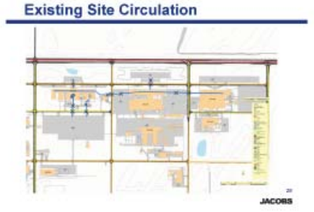












Existing Site Utilities

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Site Goals

- Option 3 – Major renovation and phased additions
- Proper adjacencies to O & C and SSPF
- Ease of connection to existing utilities
- Least disruption of site circulation
- No negative disruption to environment
- Eliminate pedestrian circulation issues between HQ and O & C

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Core Sites – Utilities & Environment

Water & Fire
- Existing potable system **adequate** for proposed development assuming overall demand remains constant. Further analysis required to determine capacities over existing demands up to 25% growth. **Additional fire protection demands will require further capacity analysis to comply with updated fire protection standards.**

Sewer
- Existing sewer capacity is **adequate** for proposed demand. Further analysis to local lift stations and central waste treatment will be required to determine availability for future demands up to 25%.

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Core Sites – Utilities and Environment

Gas
- Existing gas capacity is **adequate** for proposed demand. Further analysis to local lift stations and central waste treatment will be required to determine availability for future demands up to 25%.

Communications
- Existing communications utility **adequate** for proposed development. Lines are easily relocated.

Storm Water
- Already included in a storm water management area, **no further analysis** required at this time.

Environment
- **SWMU present on west side of proposed site. Mitigation and permitting required**

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Sites E and F – Utilities & Environment

Water & Fire
- Existing potable and fire system **adequate** for proposed development assuming overall demand remains constant. Further analysis required to determine capacities over existing demands up to 25% growth. **Additional fire protection demands will require further capacity analysis to comply with updated fire protection standards.**

Sewer
- Existing sewer capacity is **adequate** for proposed demand. Further analysis to local lift stations and central waste treatment will be required to determine availability for future demands up to 25%.

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Sites E and F – Utilities and Environment

Gas
- Existing gas capacity is **adequate** for proposed demand. Further analysis to local lift stations and central waste treatment will be required to determine availability for future demands up to 25%.

Communications
- Existing communications utility **adequate** for proposed development. Lines are easily relocated.

Storm Water
Already included in a storm water management area, **no further analysis** required at this time.

Environment
- **Extensive permitting process to mitigate historic and natural features.**

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Building Assessment Overview - SSPF

Mechanical
- Cafeteria is served by the central chilled water system.
- Cafeteria kitchen equipment is very good condition.
- Any future use of the cafeteria area for an alternate use will require major HVAC modifications.
- Gift shop is served by the building VAV system and can be easily modified for an alternate future use.

Architectural
- SSPF cafeteria is largest and newest; all dining services could be consolidated here for less cost than a totally new facility.

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Building Assessment Overview – O & C

Mechanical
- Humidity is not being kept within design criteria (65% was recorded)
- Any future use of the cafeteria area or the gym for an alternate use will require major HVAC modifications.
- Cafeteria grease waste is a portable system, instead of typical grease trap.

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Building Assessment Overview - HQ

Structural
- There was one area near the mailroom where CMU has started to crack above stairwell lintel, and several other areas where additional caulking is required where the wall panels butt into concrete columns.
- Large majority of existing structure appears to be in good condition.

Electrical
- Switchgear is original and obsolete. Replacement parts cannot be found.
- Older equipment is expensive to maintain.
- Grounding issues exist on building panels.
- NEC panel clearance code violations exist in the mechanical/ electrical rooms.

Security
- IDS installations are limited to the Credit Union and SCIF locations. Duress buttons are installed in the Credit Union. Video surveillance is not installed in the building. Contraband screening equipment is installed within the mail room.

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Building Assessment Overview - HQ

Architectural
- Concrete structure and exterior wall panels are in good condition.
- Only half of restrooms are ADA accessible.
- Cafeteria kitchen floor and wall tile is in good condition.

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Building Assessment Overview - CIF

Structural
- The existing structure was found to be in very good condition inside and out.
- Water leaks are present at west corners of the building.

Electrical
- Due to Roof Modifications/Addition of Communication equipment, Lightning Protection System need to recertified.
- Egress emergency lighting levels are inadequate
- Some NEC equipment clearance violations
- Communications cabinets are over loaded, while in other areas, they are almost empty.
- Abandoned in place equipment is common.

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Building Assessment Overview - CIF

Security
Entry control into selected spaces is provided. The transition to card readers has begun. Video surveillance is not installed in the building.

Architectural
- White roof membrane roof reflects heat and helps with building cooling load.
- First floor lab spaces have been subdivided with partitions build against some doors that are now not useable.
- CMU corridor walls do not allow easy modification of electrical and communication systems.

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Building Assessment Overview - CIF

Mechanical
- Air distribution systems are original to the building.
- Due to inadequate HVAC controls, there are several areas where temperature and humidity requirements can not be maintained.
- Sewer system has frequent problems.
- Computer server rooms are served by 41 year old units.

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Building Assessment Overview - OHF

Structural
- Roof leaks near the expansion joint.
- The existing construction of the newer Phase appeared to be in very good condition.
- The existing construction also has a wood fascia, maintenance is required. An area at the rear of building near the emergency entrance has a section of soffit missing.

Electrical
- No lighting protection system on building.
- Generator response time needs to be improved to meet code.
- Lighting in emergency area needs improvements.

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Building Assessment Overview - OHF

Security
Entry control into selected spaces is provided by Best Systems electronic cipher locks. Neither IDS nor video surveillance is installed.

Architectural
- Water intrusion to interior.
- Toilet rooms in patient treatment areas lack floor area for ADA requirements.

Mechanical
- Mechanical rooms do not have adequate clearance for maintenance or for code requirements.
- Due to inadequate pneumatic HVAC controls, there are several areas that are warm.
- Sewer system has frequent problems.

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Building Assessment Overview - Auditorium

Structural
- Roof leaks near the mechanical room area.
- Structure is in good condition inside and out.

Electrical
- No lightning protection system
- Auditorium lighting needs improvement

Mechanical
- Rooftop AC unit was installed inside mechanical room to serve projector room area. AC system inefficient due to the application

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Building Assessment Overview - CDC

Structural
- The stucco is cracked and pulling away from the concrete beams near the top.
- Concrete beams have started spalling, near the bottom of the beams. Expansion of the reinforcing is visibly cracing the bottom of the concrete beams.
- Several areas have rust is running down the walls

Architectural
- Water intrusion problem at window system.
- Roof leaks and deteriorated insulation at low end of roof.

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Building Assessment Overview - CDC

Mechanical
- Due to inadequate HVAC controls, there are several areas that are warm.

Electrical
- Panels are in good condition but have very limited space and spare breaker available.
- Exterior equipment beginning to show wear due to environmental conditions.

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Building Assessment Overview - BOB

Structural
- The existing structure was found to be in good condition inside and out.

Mechanical
- Due to inadequate HVAC controls, there are several areas that are warm.

Electrical
- Lighting protection and grounding in good condition.
- Interior lighting mostly in good condition.
- Egress emergency lighting levels inadequate
- Numerous NEC equipment clearance violations.

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Building Assessment Overview - BOB

Architectural
- Exterior concrete shell is in good condition.
- Carpet is patchwork of different colors.

Security
Security is limited to builder's hardware. Neither IDS nor video surveillance is installed.

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Building Assessment Overview - EHF

Electrical
- Egress emergency lighting levels inadequate
- Lighting protection is bad shape. Several melted air terminals and carbonized/burned conductors. Recommend changing/ recertifying entire system.
- Large Ungrounded Antenna attached to building.
- All existing panels are nearing or have exceeded life expectancy.

Security
- IDS nor video surveillance is installed.

Structural
- Built-up roof with several roof leaks.

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Building Assessment Overview - EHF

Architectural
- Two year old roof has been patched recently, without correcting roof leak problem.
- Wood steps and handrail loading dock should be removed/ replaced.

Mechanical
- Building is served by several types of systems that are past their useful life. (Air-cooled chiller, fan coil units, DX split system) The chiller often goes down.
- Building has laboratory gas and DI water systems that will need to be relocated with the building occupants.
- Building domestic water has low pressure during peak loads.

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HQ Building by DFUM (Parent group)

1st Floor

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HQ Building by DFUM (w/vacancies)

1st Floor

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Overall Project Schedule and Milestones

Project Kick-Off and Data Collection	**9 July 08**
■ Visioning Session	**12-14 Aug 08**
■ **Charrette 1 – Work Sessions**	**25-28 Aug 08**
30% Submittal	**12 Sept 08**
■ Government Review Complete	**23 Sept 08**
■ Review Comment Incorporation	**24-29 Sept 08**
■ Charrette 2 – Work Sessions	**30 Sept-1 Oct 08**
60% Submittal	**24 Oct 08**
■ Government Review Complete	**4 Nov 08**
■ Review Comment Incorporation	**5-12 Nov 08**
100% QC Submittal	**5 Dec 08**
■ Government Review Complete	**12 Dec 08**
Final Submittal	**23 Dec 08**

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Next Steps

- 30% Submittal
- 30% Review and Comments
- Prepare for Charrette-2
- Charrette-2
- Keep our eyes on the target!
- Others…

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Jacobs Project Team

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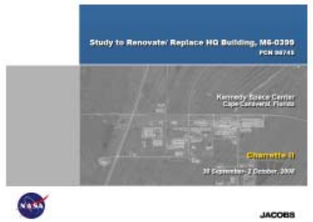
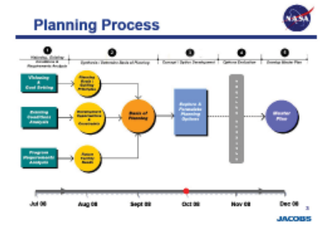
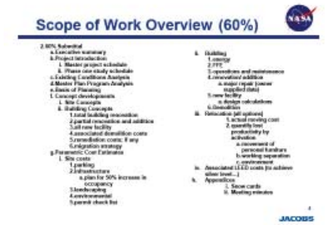
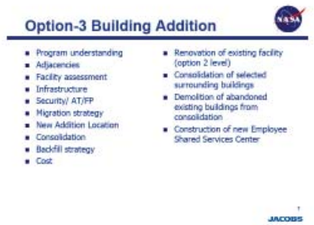
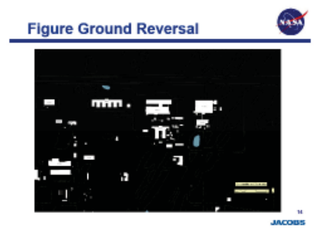
Appendix 5. Charrette II In Brief

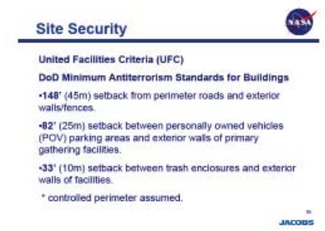


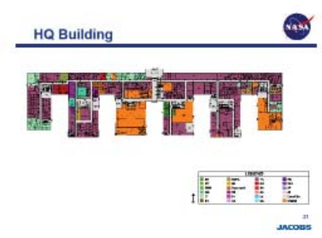


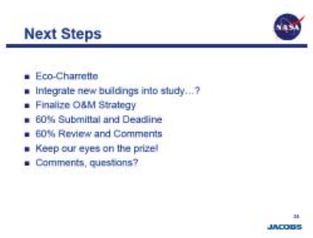




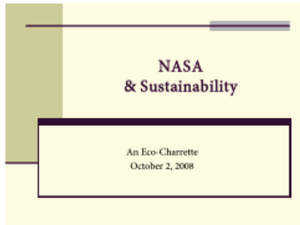


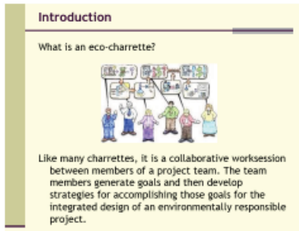


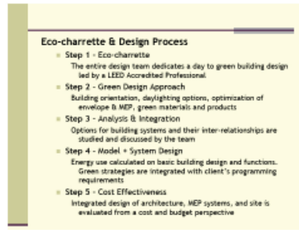


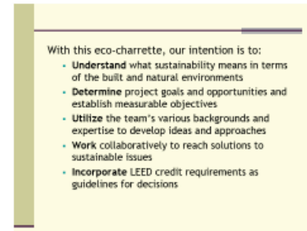


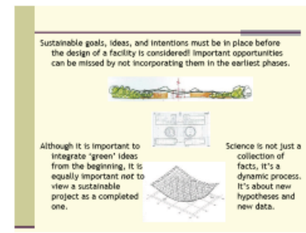
Appendix 6. Eco-charrette Presentation

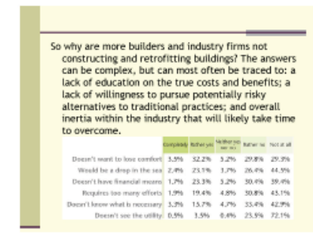


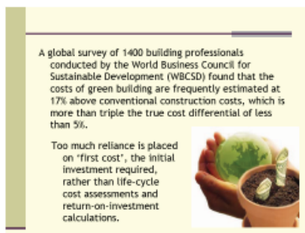


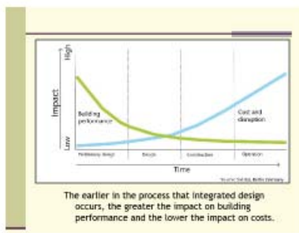


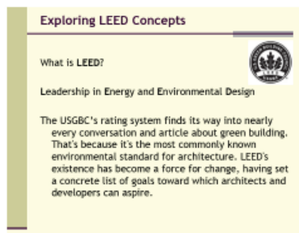


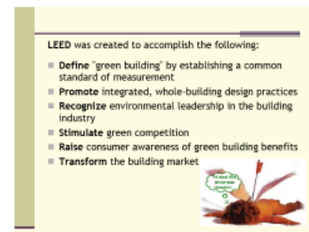


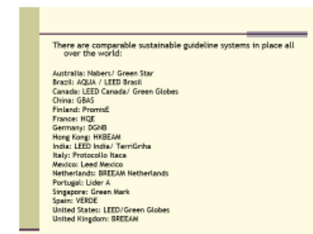


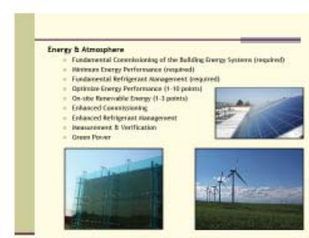


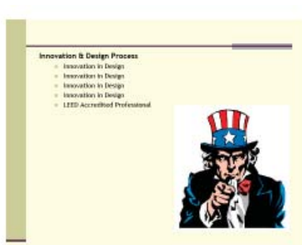


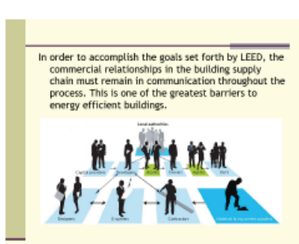


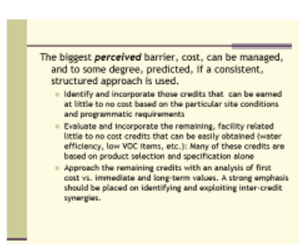


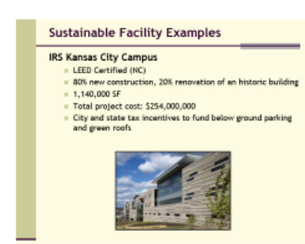


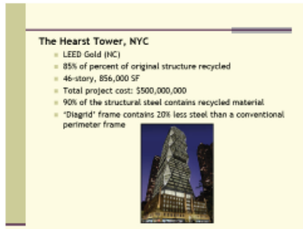


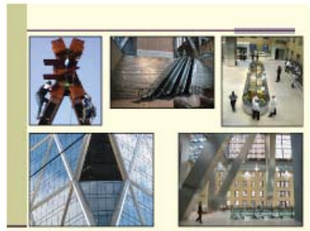


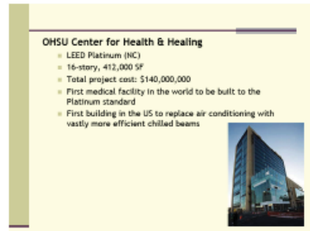




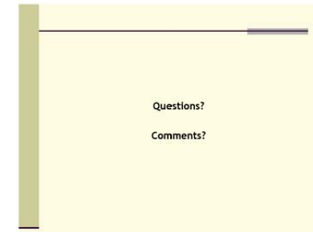


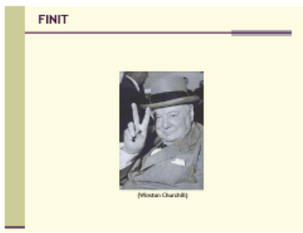

The Hearst Tower, NYC
LEED Gold (NC)
85% of percent of original structure recycled
46-story, 856,000 SF
Total project cost: $500,000,000
90% of the structural steel contains recycled material
'Diagrid' frame contains 20% less steel than a conventional perimeter frame




OHSU Center for Health & Healing
LEED Platinum (NC)
16-story, 412,000 SF
Total project cost: $140,000,000
First medical facility in the world to be built to the Platinum standard
First building in the US to replace air conditioning with vastly more efficient chilled beams

NASA Needs to be Sustainable
Why?
NASA Policy Directive
You are expected to pursue state-of-the-art design
NASA serves and leads the national community
You want to attract and retain emerging professionals
NASA wants to grow and prosper as an agency
The Federal government is the world's largest single buyer of many products. Federal purchasing helps to lower the cost of these products and services, and provides a model for other government purchasers, as well as the private sector…
It's the right thing to do.


Questions?
Comments?


FINIT
(Winston Churchill)

Appendix 7. Eco-charrette Participants' Sustainable Ideas

Eco-charrette Participant List of Sustainable Ideas

- Wind to harness energy
- Modern industrial interior
- Phasing strategy
- "Green screen"
- Earth berms
- Architectural features enhancing air flow
- Hot air rises, vent naturally
- Building terraces
- Recyclable containers located throughout
- Garbage disposal concepts
- Recycle landscaping
- Nursery to double as landscape populator
- Transportation management plan
- Energy efficient elevator
- "Cool roof"
- Low flow plumbing fixtures
- Under floor plenums
- Cost strategy
- Energy star appliances
- Photovoltaic lighting, covered parking
- Solar, thermal power
- Hybrid lighting systems
- Recycling systems
- Enhanced use lighting potential
    - External relations
- Water feature that provides microclimate through evaporation
    - Cooling tower?
- Low E windows
- Xeriscape
- Interior environment
- Geothermal energy for heating
- Parking structure
- Raised floors for ventilation and data/communications
- Plaza (green spaces)
- "Campus concept"
- Bike racks
- People movers
- Sustainability Education Center
- Cistern
- Energy control
- Building management
- Natural light control
- Green roof
- "Energy recovering"
- Co2 control
- Site orientation
- Pervious surfaces
- Building circulation (green roof)
- Local renewable resources
- Photovoltaic modules (different uses)
- Reuse materials (historic)

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