STATEMENT OF WORK

for

Technical Services for Aerospace Systems Modeling and Simulation II
(SimLabs II)

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1.0 Background

This statement of work describes a requirement for contract services for the Simulation Laboratory Facilities located at the National Aeronautics and Space Administration's (NASA) Ames Research Center. The work to be performed is to provide operations, development, maintenance, and modification of the Simulation Laboratory Facilities. The contract consists of a Core Requirement, Contract Line Items (CLINs) 01A, 02A and 003A, Section 3.5 of the SOW. The contract also consists of an IDIQ requirement, CLINs 01B, 02B, and 003B, Sections 3.1 through 3.4 of the SOW as authorized by NASA through Task Orders.

Task Orders: Specific authorization or direction to perform work within the scope of the contract and as specified NFS 1852.216-80. Task Orders must clearly describe all services to be performed or supplies to be delivered so the full cost or price for the performance of the work can be established when the order is placed. Orders shall be within the scope, issued within the period of performance, and be within the maximum value of the contract.

Work Assignments: Technical direction given within the scope of a task order.

1.1 Mission Description

The Simulation Laboratory Facilities are unique national research and development facilities dedicated to providing researchers with high-fidelity environments in which to conduct simulated flight research and to advance the state-of-the-art of simulation technology. Researchers use the facilities to investigate a variety of topics ranging from the design of new aircraft guidance and control systems to the human factors implications of new or existing flight deck displays, airspace operations, air traffic control and automation. In-house projects and experiments are conducted to develop new simulator systems and subsystems, improve simulation systems, develop advanced engineering techniques to improve the fidelity and validity of simulation programs, and incorporate the latest technology into simulation systems. The Simulation Laboratory Facilities are primarily comprised of the Crew-Vehicle Systems Research Facility (CVSRF), the Vertical Motion Simulation Complex (VMSC) and FutureFlight Central (FFC).

The Simulation Laboratory Facilities are currently managed by the Aeronautics Directorate at NASA Ames. The Aeronautics Directorate manages these facilities through civil service line managers, who, in conjunction with the Contractor, are ultimately responsible for the successful performance of the mission of each facility.

The Contractor is responsible for the successful preparation and operation of the simulators, collection of research data and the continuing operation and upgrades of the facilities. It is not the responsibility of the Contractor to ensure that the data validate or invalidate any scientific theories, ideas, or designs.

The Contractor is also responsible for development, testing and validation of advanced air traffic management automation tools being developed at NASA Ames. These tools are anticipated to be integrated in the full simulation environment to support future research.

Together, the efforts of the NASA management and the contractor staff are required to accomplish the mission of each facility.

The simulation facilities are used by NASA programs, other NASA Centers, the Federal Aviation Administration, the Department of Defense, the National Transportation Safety Board, other government organizations, industry and universities.

1.2 Simulators/Facilities

The work in these facilities includes simulation of a wide variety of aircraft configurations including helicopters, advanced lift-fan aircraft, jet transports, modern concepts for Vertical/Short Take-Off and Landing (V/STOL) vehicles, Space Craft, Lunar Lander, UAS, and their guidance, control, and mission management systems, as well as air traffic management. The developmental nature of the work involves the continuous upgrading of capabilities, facilities and the advancement of the state-of-the-art of simulation technology.

The VMSC with its large amplitude motion system provides piloted, real-time flight simulation of proposed and existing vehicles. The dynamic and flexible research environment lends itself to simulation studies involving controls, guidance, displays, automation, handling qualities, flight deck systems, and accident/incident investigations. The facility is used to examine new guidance and control law algorithms and to evaluate handling qualities and characteristics. The VMSC, besides the large motion capability, has other laboratories for development, checkout and fixed base operations and five interchangeable cabs which are configured for a given simulation requirement. In addition, the facility includes the Distributed Simulation Research Laboratory (DSRL). The DSRL provides the infrastructure for distributed UAS in the NAS and Air Traffic Control (ATC) simulations.

The CVSRF is used to analyze performance characteristics of flight crews, formulate principles and design criteria for future aviation environments and evaluate new air traffic control procedures through the use of full-mission simulation. The CVSRF includes two full mission flight simulators - a Boeing 747-400 Flight Simulator and an Advanced Concepts Flight Simulator (ACFS). In addition, the facility includes an ATC Radar Lab which is used to simulate *enroute* and TRACON air traffic control facilities. The ATC Radar Lab can be interconnected with other simlab facilities to support cross-domain or air/ground integration research projects.

FFC is a full-scale Air Traffic Control (ATC) tower simulation facility used to test and evaluate airport design operational issues. The facility features a 360 degree out the window visual scene of a realistic airport environment. It is used to test procedural changes, enhance airport ramp procedures, optimize taxi routes and examine the implementation of new technologies to improve airport surface management and operations. In addition, FFC has been used as a real time visualization tool for remote science and remote robotics field testing.

In addition, the Simulation Laboratory Facilities support Simulation Development Stations used to design and develop models, scenarios and components in a workstation environment prior to integration into the full simulation environment including the ATC simulation laboratory in N-210.

Technical services are provided in support of air traffic management automation projects. These include the software design, implementation, and maintenance support for real-time Air Traffic Control simulation software and FAA/NASA systems interface software.

1.2.1 Location of Simulators/Facilities

The Simulation Laboratory Facilities are currently located in Buildings N-243, N-257, N-210 and N-262. These facilities are collectively referred to as SimLabs.

1.2.2 Simulators and Related Facilities

1.2.2.1 Crew-Vehicle Systems Research Facility (CVSRF) - Building N-257

- Advanced Concepts Flight Simulator (ACFS)
- Boeing 747-400 Flight Simulator
- Air Traffic Control (ATC) Simulation Laboratory

1.2.2.2 Vertical Motion Simulation Complex (VMSC) - Building N-243

- Vertical Motion Simulator (VMS)
- Interchangeable Cab 1 (I-Cab1) fixed-base area
- Interchangeable Cab 2 (I-Cab2) fixed-base area
- Distributed Simulation Research Laboratory (DSRL)

1.2.2.3 FutureFlight Central – Building N-262

FutureFlight Central is a single, integrated, air traffic control tower simulator capable of simulating all aspects of tower operation, tower ATM, ramp control, etc.

1.2.2.4 210 ATC Laboratory - Building N-210

The N-210 ATC Laboratory is a self contained development/ research facility that supports air traffic controllers, pseudo pilots and auxiliary systems for simulation of any airborne air traffic management domain. The facility can be interconnected with other Simlab facilities to support cross-domain or air/ground integration research projects.

2.0 Scope

Responsibility for NASA-Ames' SimLabs Flight Simulation Complex is shared between the Civil Service staff (hereafter referred to as NASA) and its prime contractor (hereafter referred to as contractor).
NASA is responsible for the:

- Management and performance of the Flight Simulation Facilities.
- Solicitation and acceptance of research customers.
- Scheduling and planning all simulation resources and labs for all simulation experiments and simulation technology projects in the SimLabs.
- Technology assessment, the definition of long-term requirements and new capabilities for simulation systems and technology, and the acceptance and integration of new technology.
- Safe operation of all facilities in compliance with Ames Research Center Human Occupancy requirements.

NASA also investigates simulation technology and conducts advanced simulations in support of its customer's research. In addition, NASA conducts simulation experiments and discrete projects to enhance the current capabilities of the simulation facilities. NASA supplies general and specific equipment, logistical services and plant engineering management of buildings and building systems so as to provide an efficient and reliable laboratory environment for experiment development and execution.

The Contractor is responsible for the:

- Technical development, integration, testing and execution of research experiments and discrete projects to meet the SimLabs mission. The Contractor is responsible for ensuring the fidelity, integrity and quality of experiments and projects as defined by work assignments and/or authorized task orders. Thus, it is not only important that the individual subsystems operate properly, but also, that when integrated together, all elements continue to perform properly and at maximum efficiency.
- Preparation and maintenance of plans for coordinating and minimizing the periods when the facility is unavailable for use. When problems occur it is the responsibility of the Contractor to ensure that the correct procedures are applied and that predetermined levels of downtime triggers the appropriate response.

The Contractor shall be responsible to plan the appropriate resources to support the design, development, integration, testing and execution of experiments, and produce required deliverables necessary to provide the researcher with the pilot evaluations and supporting data (and/or other deliverables, e.g., hardware), specified by research requirements. These include resources supplied by NASA, identified in the work assignments and/or authorized task orders, consistent with the high-level planning

conducted by NASA management. In addition, the Contractor shall conduct discrete projects or portions of projects, as defined by NASA through work assignments and/or authorized task orders. These projects are aimed at enhancing the capabilities of the simulation laboratories or facilities.

The Contractor shall ensure the safety, quality, integrity and maintenance of simulators, facilities and Installation-Provided Property (IPP). In the event that a modification to existing simulator facilities could impact the safety of the test subject, the Contractor shall provide support in developing any analyses required to satisfy NASA's Human Occupancy Review Board safety requirements. Additionally, if the facility modification could impact the safety of personnel operating or supporting the facility, the Contractor shall provide support in developing any analyses required to demonstrate to the SMA Organization that safety hazards and risk have been appropriately mitigated and that facility is safe to operate.

This Statement of Work (SOW) is organized to focus on the main purpose of the Simulation Facilities, namely the conduct of research experiments and discrete simulation technology projects. Section 3.1 is dedicated to specific phases in the experiment cycle. Section 3.2 addresses the requirements associated with the performance of discrete projects such as facility repair or simulation technology enhancements. Section 3.3 addresses the requirements of preventive and corrective maintenance. Section 3.4 addresses the functional capabilities necessary to meet the requirements in section 3.1, 3.2 and 3.3. Section 3.5 addresses core functions such as administration, procurement, documentation, configuration management, outreach, environmental compliance, Safety and Mission Assurance (SMA), and property management. While these supporting functions may not directly relate to the design, planning, preparation, conduct and data acquisition/reduction related to specific simulations or projects, each plays a vital role in facilitating the success of these activities.

3.0 Requirements

3.1 Experiments

The successful performance of aerospace simulation experiments is one of the primary functions of the facilities. The process cycle for a successful simulation includes planning, preparation, operations and post-operation activities. The Contractor shall use the functional capabilities defined in section 3.4, as necessary to achieve the goals of each experiment. The specific requirements which apply to each of these phases are given below.

3.1.1 Experiment Planning

Experiment planning focuses on the development of the technical and project management approaches, technical objectives, performance incentives, risk allocation, and performance metrics with a focus on identifying key actions/deliverables to be used to assess the success (or failure) of contractor performance. As necessary to meet the requirements defined in the work assignments and/or authorized task orders, the Contractor shall:

- Define, develop, operate and maintain an experiment resource control system, which will track the experiment schedule, finances and configuration for each specific project/simulation.
- Generate an Experiment Implementation Plan (EIP) which outlines the Contractor's approach to the technical objectives throughout the preparation, operations and post-operations phases. The EIP shall require Government approval. The EIP shall:
    - Define the tasks necessary to perform the experiment, the associated resources, schedule and budget.
    - Address special matters pertaining to Safety and Mission Assurance (SMA), environmental compliance, configuration management, maintenance, facilities integrity, and Installation-Provided Property (IPP).
    - Address any known technical and cost risks appendant to the Contractor's proposed approach.
    - Define the Contractor's approach in refining the simulation requirements necessary to meet the research objectives.

3.1.2 Experiment Preparation

With the planning phase complete, preparation for the experiment is required. The extent, complexity and duration of preparation activities will vary from experiment to experiment. For most experiments, hardware, systems software, applications programming, electrical, electronic and mechanical development will be required in order to prepare all facets of an experiment. This phase includes all activities from completion of project-specific planning to the beginning of the actual experiment.

Experiment preparation shall be implemented in accordance with the approved EIP. As part of the preparation for an experiment, the Contractor shall meet the following specific requirements:

3.1.2.1 The Contractor shall generate experiment operations plans and procedures, along with foreseeable contingencies, as described in the EIP.

3.1.2.2 The Contractor shall complete the design, development, fabrication, installation, integration and checkout of all mechanical, electrical and hardware systems necessary for the performance of the experiment.

3.1.2.3 The Contractor shall complete the development of specialized systems software necessary for the performance of the experiment.

3.1.2.4 The Contractor shall perform application programming, database modeling and graphics to complete the design, development, modification, installation, checkout and documentation necessary for the performance of the experiment.

3.1.2.5 The Contractor shall advise the experimenters on the development of realistic flight scenarios, including possible events, malfunctions, etc. and airspace operations needed for the performance of the experiment. This may include training on the use of simulators, ATC operations or airport procedures needed for the performance of the experiment.

3.1.2.6 The Contractor shall develop the data collection process to support the experiment, including, but not limited to, the definition of the parameters, data rate and volume, and data format.

3.1.2.7 The Contractor shall integrate the laboratory control system to the motion simulator, cab and associated hardware, as required.

3.1.3 Experiment Operations

The operations phase is the period of activities which occur from the start of the actual simulation experiment through its completion. This is the period where pilots evaluate the aircraft and/or scenario; ATC personnel evaluate the ATC simulation; or, where airport design personnel evaluate the characteristics of the tower simulation and data is collected and stored.

Simulation experiment operations shall be implemented in accordance with the approved EIP. As part of the operations of a simulation experiment, the Contractor shall meet the following specific requirements:

3.1.3.1 The Contractor shall operate simulation experiments in accordance with written plans/procedures, and shall provide the flexibility to modify experiment parameters contingent upon interim experiment results.

3.1.3.2 The Contractor shall ensure integrity of the simulators prior to each day's experiment runs. The contractor shall be responsible for documenting the setup, operation, and performance of each simulation in a consistent format.

3.1.3.3 The Contractor shall train the crews/experimenters on operations needed for the performance of the experiment, including, but not limited to, the conduct of safety briefings, and the conduct of system familiarization briefings.

3.1.3.4 The Contractor shall conduct data collection, verification and any post-processing required for each experiment.

3.1.3.5 The Contractor shall record all system discrepancies that impact simulation experiments and ensure that they are resolved in compliance with NASA guidelines. The Contractor shall also log changes in systems status for each simulation conducted (e.g., electrical/electronic, mechanical, hardware/software, spares, etc.)

3.1.4 Post-Experiment Operations

Subsequent to experiment completion, all documentation, post-experiment briefings and other deliverables shall be completed and delivered to the appropriate NASA Lab Manager.

Simulation post-experiment operations shall be implemented in accordance with the approved EIP. As part of the post-experiment operations of a simulation experiment, the Contractor shall meet the following specific requirements.

3.1.4.1 The Contractor shall provide required outputs in accordance with simulation requirements, which may include but are not limited to:

- Data distribution and analysis per the EIP
- Project summary report including documentation of all modifications made to equipment to support the experiment.

3.1.4.2 The Contractor shall recommend what simulation hardware/software/data to retain for future use/reference and shall capture the configuration to ensure that the simulation can be repeated at a future time.

3.1.4.3 The Contractor shall record lessons learned and update the current project book or work file, a copy of which goes in the SimLabs libraries.

3.1.4.4 The Contractor shall support the NASA post-experiment briefing to review the conduct and results of the experiment.

3.2 Discrete Projects

Work assignments will be generated by NASA for discrete projects outside the bounds of simulation experiments, maintenance, and routine support functions. Discrete projects may also take the form of authorized Task Orders. Such projects may include proof of concept, demonstrations, facility refurbishment or upgrade, or other facility tasks. As with the experiment activities of section 3.1, discrete projects are expected to follow the standard process cycle including planning, preparation, implementation and post-implementation activities, meeting the same requirements delineated in section 3.1. The Contractor shall use the functional capabilities defined in section 3.4, as necessary, to achieve the goals of each discrete projects or project.

Discrete projects encompass analyses, design, acquisition, modification, installation, and checkout of electronic laboratory equipment, system software, graphics, flight hardware systems, structural modifications to simulation systems and facilities; and development and fabrication of simulation mechanical systems.

The contractor shall be responsible to NASA for analysis and recommendation of solutions in the above-mentioned areas which may lead to acquisition of off-the-shelf solutions or in-house development and modifications. Follow-on activities shall include appropriate system level installation and checkout of these solutions.

3.3 Maintenance

The maintenance of each facility is significantly more complex than that for standard training simulators. The unique nature of the equipment and the research and development environment requires specialized maintenance unlike in commercial training simulator environments. The Contractor shall use the functional capabilities defined in section 3.4 to accomplish the maintenance requirements.

3.3.1 Preventive Maintenance

As necessary to meet the requirements of work assignments and/or authorized task orders:

3.3.1.1 The Contractor shall provide all services necessary to maintain the simulation facilities and to maximize simulation systems uptime.

3.3.1.2 The Contractor shall provide spare parts sufficient to support routine maintenance/anticipated failures, and tools required to maintain simulator equipment, unless provided by NASA.

3.3.1.3 The Contractor shall prepare and implement preventive maintenance plans for the equipment listed in Attachment J.1(a) 4.

3.3.1.4 The Contractor shall maintain, implement and update the preventative maintenance plan schedule for the Simulation Laboratory Facilities to minimize system downtime. The Simulation Laboratory Facilities are comprised of the equipment listed in Attachment J.1(a) 4.

3.3.1.5 The Contractor shall perform functions to ensure proper maintenance of facility systems, including but not limited to:

- Provide mechanical maintenance in accordance with Simulation Facility Operations Manuals, Manufacturer’s service information and standard industry practices.
- Clean, lubricate, service, adjust, and tune the simulators, to support simulation schedules.
- Maintain analog and digital systems with associated peripherals, networks and interfaces.
- Maintain simulation lab hardware, such as simulation engineers control station/workstations, strip-chart recorders, and audio/video recording equipment for data collection purposes.
- Maintain visual and graphics generation systems such as computer-generated out-the-window imagery equipment, special symbology generators, and graphics workstations.
- Maintain visual and graphics presentation systems, such as high resolution display systems, projectors, head-up-displays (HUDs), and video switching systems.
- Maintain control loaders and hydraulic power units.
- Maintain communications and audio systems such as aircraft sound systems, and voice input/output systems.
- Maintain aircraft instruments.

3.3.1.6 The Contractor shall perform the following functions to ensure proper maintenance of systems software:

- Maintain, integrate, test and install software for each computer system, including upgrades.
- Licenses to software purchased under this contract shall be issued in the name of the Government.
- Maintain documentation for these systems.
- Coordinate with operational SimLabs groups to achieve required system performance.
- Incorporate modifications to solve reported problems/incorporate and document approved design changes.
- Perform system backups as necessary.
- Test and report on all new/modified systems software (accept/reject).
- Archive software and associated documentation.
- Perform system/subsystem testing, diagnostics, and reporting on new hardware.
- Provide programming and software capabilities assistance to systems users.

3.3.2 Corrective Maintenance

Individual work assignments and/or authorized task orders will be generated for corrective maintenance outside the bounds of simulation experiments, discrete projects, or routine support functions. As with the experiment activities and discrete projects of sections 3.1 and 3.2, corrective maintenance tasks are expected to follow the standard process cycle. This includes planning, preparation, implementation and post-implementation activities, meeting the same requirements delineated in section 3.1, although in an expedited fashion in that corrective maintenance work assignments and/or authorized task orders are likely to be time critical.

3.3.3 747-400 Flight Simulator Certification

The Contractor shall perform the following functions to ensure FAA Level D equivalent certification is maintained on the 747-400 flight simulator as determined by FAA on-site verification:

- Maintain all systems performance within FAA Level-D regulatory tolerances.
- Maintain all required certification documentation.
- Maintain test procedure manuals.
- Maintain test driver software.
- Acquire, set-up and operate certified test equipment.
- Conduct tests of simulator.

3.4 Functional Capabilities

The Contractor shall provide the following functional capabilities in order to meet the requirements in section 3.1, 3.2 and 3.3 of this SOW. The degree to which each of these capabilities will be called upon will be dependent upon the specific work assignments and/or authorized task orders generated.

3.4.1 Systems Engineering

As necessary to meet the requirements of the work assignments and/or authorized task orders, the Contractor shall provide system engineering services to ensure the continuing operation and evolutionary improvement of the simulation facilities which may include, but is not limited to:

- Definition and development of facilities upgrades and capabilities, including development of new simulators. This may include providing structural modifications to existing systems and facilities, performing systems analyses and conceiving designs for simulator systems/subsystems, and providing the implementation planning, integration and testing for new simulation systems.
- Design, development, and integration of advanced technology into simulation systems (i.e., advanced controls/displays). This may also include developing advanced engineering techniques to improve fidelity/validity of simulations.
- Performance of systems analyses and provision of recommendations for redesign of software and hardware systems including networks.

3.4.2 Systems Software & Systems Administration

As necessary to meet the requirements of individual work assignments and/or authorized task orders, the Contractor shall:

- Provide and execute specialized systems software including real-time schedulers, debug packages, program development tools, input/output routines, special device handlers, networks, and hardware diagnostics.
- Provide and execute data reduction software.
- Perform systems analysis and provide recommendations for redesign of systems software.
- Perform coordination of all systems software development with simulation engineering including proprietary software (see Section 5.0).
- Train and consult with system users regarding new hardware/software.
- Provide requirements and specification studies.
- Maintain current system configuration control library, including subcontractor supplied software and equipment.

- Implement a system of programming standards, design, coding, and documentation methods.
- Perform system backups as necessary.
- Provide manuals and other documents, including those for training.

3.4.3 Aerospace Engineering and Applications Programming

The Contractor shall perform aerospace engineering and applications programming to complete the design, development, modification, installation, checkout and documentation of all real-time models (e.g., models of advanced and existing aircraft for real-time computation) necessary to meet work assignments and/or authorized task orders, which may include, but is not limited to:

- Ground reactions and ground handling models
- Primary and secondary flight control systems
- Auto flight systems
- Avionics systems
- Propulsion systems
- Fuel system
- Hydraulic systems
- On-board auxiliary systems
- Air conditioning/pressurization systems
- Navigation systems programs
- Detection/communication systems
- Maintenance or creation of new navigational data bases (terrain profiles, radio facilities, etc.)
- Development and modification of advanced aircraft models and air traffic control management for real-time computation
- Determination of methods to provide effective visual/motion cues to simulator pilots
- Scenario development

3.4.4 Graphics Programming

As necessary to meet the requirements of the individual work assignments and/or authorized task orders, the Contractor shall complete or modify the design, development, installation, checkout and documentation of all graphics, text and display software, which may include, but is not limited to:

- Creation and maintenance of real-time graphics software based on simulation requirements. This may include the integration of advanced controls/display technology into simulation systems or the modification or creation of new air traffic control simulation displays.
- Creation and maintenance of text and graphic displays for simulation heads-down and heads-up displays, and experimenter/researcher control pages.

3.4.5 Real-time Visual Displays/Visual Scene Models

As necessary to meet the requirements of individual work assignments and/or authorized task orders, the Contractor shall create and maintain real-time visual scene databases and visual scene models. Visual scene models are either vendor supplied, modified from a previous model or developed in-house. The programs that create or modify the databases have also been provided by vendors or have been developed in-house.

3.4.6 Hardware and Mechanical Systems Engineering

Hardware and mechanical systems can be separate systems or several sub-systems interconnected as a larger system. The Contractor shall:

- Design, fabricate, modify, assemble, and integrate hardware and equipment for simulation research operations and discrete projects. Tasks may include fabrication of original equipment from design drawings or sketches and/or modification or changes to existing hardware and systems including but not limited to cab instrument panels and consoles, floor panels, seats, visual display support structures, sheet metal assemblies, pilot control devices such as sticks, grips, surface controls, and power management mechanisms.
- Design, develop, maintain, operate, and modify simulation mechanical, hydraulic, electrical/electronic, and servo systems.
- Provide structural modifications to systems and facilities.
- Design, fabricate or modify electronic chassis, assemblies and subassemblies, and cables using wire wrap, termi-point, soldering, and potting techniques.
- Support hardware-in-the-loop simulation by integrating customer provided hardware into the simulation system.
- Develop/maintain equipment operations and maintenance logs for usage/configuration and availability, including discrepancy reports.
- Understand/manage diverse hardware/software environment.
- Provide integration of new hardware systems.

3.4.7 Aviation System Operations

As necessary to meet the requirements of individual work assignments and/or authorized task orders, the Contractor shall operate and evaluate the performance of the facility, including providing subject matter expertise to help develop and test experiment scenarios and conduct flight system operations training.

3.5 Core Functions

The successful long-term performance of the simulation facilities is dependent on efficient and effective on-going additional functions. These additional functions, further defined below, provide the logistics and infrastructure necessary to keep the facilities operating.

3.5.1 Management/Administration

The Contractor shall provide an overall management and administrative function to ensure that the proper resources are available and allocated, that adequate reports and documentation are prepared, and that the overall environment supports the experiment requirements. The Contractor shall provide for overall management and administrative functions to meet the requirements.

3.5.1.1 The Contractor shall manage the contract in a fiscally responsible manner. The contractor shall seek, and recommend to NASA, opportunities to operate more efficiently or at lower cost while meeting all other requirements.

3.5.1.2 The Contractor shall provide a well-defined, stable organizational structure with clear lines of authority and clearly identified Government interfaces.

3.5.1.3 The Contractor shall ensure the facilities are available for scheduled simulation experiments. All work areas will work shifts depending upon facility, simulation, maintenance, and development schedules and/or availability of laboratory and facility equipment.

3.5.1.4 The Contractor shall manage the contract resources allocated by NASA for specific projects in a manner to ensure experiments are performed in accordance with published schedules.

3.5.1.5 The Contractor shall identify and advise NASA on critical skills needed to maintain existing capabilities and enhance future capabilities

3.5.1.6 The Contractor shall provide supply and service acquisition for system requirements in accordance with its own purchasing procedures, as approved by the Government.

3.5.1.7 The Contractor shall prepare and implement a discrepancy reporting and tracking system.

3.5.1.8 The Contractor shall provide a monthly report of the state of the facilities, identifying risks and critical issues.

3.5.1.9 The Contractor shall maintain and update current plans and procedures to ensure the facilities consistently meet requirements. Plans and procedures that currently exist will be made available to the contractor and may be used to assist in the fulfillment of this requirement.

3.5.1.10 The Contractor shall document and obtain approval from the Contracting Officer and of the NASA Contracting Officer's Technical Representative (COTR) for all deviations, waivers and non-compliance to the requirements of individual work assignments and/or authorized task orders.

3.5.1.11 The Contractor shall have the ability to quickly obtain necessary resources to perform specialized, short duration, discrete work to be conducted for SimLabs as needed.

3.5.2 Outreach

SimLabs primarily exists to support NASA programs. SimLabs' mission is to research, advance and transfer scientific simulation knowledge and understanding. In addition, as NASA programmatic commitments will allow, facility time can be made available for other Government agencies, Academia and Private Industry to perform simulation-based projects that will enhance facility operations and/or exploit the unique capabilities of the SimLabs' facilities.

3.5.2.1 The Contractor shall support the Government's analysis of program requirements and shall support the outreach efforts of the Government to provide information regarding SimLabs' mission to potential users. This support shall include the maintenance of a contact database of current and potential SimLabs customers, support in developing Government proposals to potential users, tours of the SimLabs facilities, development of communication materials (including posters and brochures), maintenance of the SimLabs website, support of educational outreach and support in sharing SimLabs facility capabilities at professional conferences.

3.5.3 Procurement

The Contractor shall provide procurement services for materials, equipment and services required for the ongoing SimLabs operations. In addition to purchasing materials and equipment for day-to-day operations, the contractor shall also purchase materials and equipment for discrete projects, quick turnaround maintenance purchases and expertise when necessary to ensure success of a project or enhance facility performance. All procurement activity shall be in accordance with all Federal Acquisition Regulations (FAR) and NASA regulations.

3.5.4 Property Management

To ensure accountability for equipment and facilities, as provided and through any upgrades or repairs, the Contractor shall meet the requirements listed below:

3.5.4.1 The Contractor shall prepare, maintain, and implement a Property Management Plan which, at a minimum, will:

- Identify the objectives of the plan and how they will be fulfilled.
- Define the property management tasks that will be performed and their inter-relationships.
- Identify where Government-furnished logistics, forms and procedures will be used.

3.5.4.2 The Contractor shall develop and implement procedures for maintaining within-facility stock of materials/spares, maintain current database inventory documentation and integrate with NASA property management system.

3.5.5 Environmental, Safety and Mission Assurance (SMA)

The Contractor shall develop, maintain, and implement a comprehensive Risk Management Plan addressing at least Technical, Cost, Schedule, Safety, and Security risks.

To ensure the facilities are operated in a safe and reliable manner, with adequate quality controls, the Contractor shall meet the SMA requirements listed below, as well as relevant NASA SMA Policies, procedures and guidelines.

3.5.5.1 Environmental Compliance

The Contractor shall identify and maintain records for all hazardous materials and obtain permits through the Ames Environmental Office in accordance with the Ames Environmental Handbook Procedural Requirements (APR 8800.3) and in coordination with the COTR. The Contractor shall comply with the applicable regulations included in Chapter 1 of the APR and the other applicable procedures and guidelines specified in the APR.

3.5.5.2 System Safety

The Contractor shall provide copies of valid certifications from vendors providing DOD or FAA parts or services.

The Contractor shall perform all tasks so as to provide for the Protection of Human Research Subjects (NPR 7100.1).

The Contractor shall provide for Human Research Planning and Approval Guidelines in accordance with APR 7170.1. The Contractor shall be an active participant in the Government Industry Data Exchange Program (GIDEP). As necessary, projects including significant design, fabrication or modification to motion simulators and/or their equipment shall require review and approval through the Human Occupancy Review Board.

3.5.5.3 Occupational Safety

The Contractor shall be an active participant of Voluntary Protection Program (VPP) and comply with safety standards consistent with Management of Basic and Applied Research APR 1700.1 for all tasks under this contract.

The Contractor shall furnish appropriate safety equipment (safety glasses, shoes, ear protection, etc.) as required to protect personnel.

3.5.5.4 Reliability

The Contractor shall preserve and ensure facility (VMSC, FFC, CVSRF and 210 ATC Lab) integrity in terms of availability, reliability and maintainability such that facilities including all development systems and support equipment are operational and perform to requirements during scheduled operations.

3.5.5.5 Quality Assurance

The Aerospace Systems Division (Code AF) is required to maintain current up-to-date operational, safety, maintenance, quality etc. policies and procedures in accordance with the Ames Management System. The contractor shall be responsible for complying with and supporting all Ames Management policies and procedures, including AF Division policies and procedures, and provide for the integration of all policies and procedures into the Ames Management System. The contractor software development processes shall comply with NASA requirements such as NASA Software Engineering Requirements NPR 7150.2.

3.5.6 Configuration Management

To ensure the facilities are operated in a regular, consistent and known manner, that their performance levels are measured and recorded, that a historical record of activities are maintained, the Contractor shall meet the requirements listed below:

3.5.6.1 The Contractor shall establish, maintain and implement a configuration management plan in accordance with the Ames Management System, including AF Division policies.

3.5.6.2 The Contractor shall maintain the facilities' documentation libraries and ensure that they are current, accurate and complete, including but not limited to:

- All operating procedures and reference manuals.
- Records of measured system performance parameters.
- Documentation recording the performance of experiments including project notebooks/work files, significant repairs/ upgrades and preventative maintenance records.
- Manufacturer's manuals, bulletins, parts lists, and vendor source lists.
- Facility configuration.

3.5.7 Phase-In / Phase-Out

3.5.7.1 Phase-In: The phase-in process shall be accomplished as expeditiously as possible, with a maximum phase-in period of 30 days. The phase-in process shall not adversely impact the work being done by the outgoing contractor. It shall be conducted in a manner consistent with safe operation requirements. The incoming contractor is responsible for providing a qualified contractor staff by the end of the phase-in period.

3.5.7.2 Phase-Out: Upon completion of this contract, the outgoing contractor is responsible for the orderly transfer of duties and records to the incoming contractor. This should be accomplished in an expeditious manner, consistent with any contract phase-in schedule, while minimally impacting ongoing task orders. The contractor shall submit a phase-out plan no later than 60 days before the end of the contract for Government review and approval.

4.0 Abbreviations and Acronyms

ACFS	Advanced Concepts Flight Simulator
AF	Aviation Systems Division
AHB	Ames Handbook
APD	Ames Policy Directive
APR	Ames Procedural Requirements
ARC	Ames Research Center
ATC	Air Traffic Control
COTR	Contracting Officer's Technical Representative
CVSRF	Crew-Vehicle Systems Research Facility
DOD	Department of Defense
DSRL	Distributed Simulation and Research Laboratory
EIP	Experiment Implementation Plan
FAA	Federal Aviation Administration
FAR	Federal Acquisition Regulations
FFC	FutureFlight Central
HUD	heads-up-display
ICAB	Interchangeable Cab Simulator (Fixed Base Area)
IPP	Installation-Provided Property
NASA	National Aeronautics and Space Administration
NMI	NASA Management Instruction
NPR	NASA Procedural Requirements
QA	Quality Assurance
SOW	Statement of Work
SMA	Safety and Mission Assurance
V/STOL	Vertical/Short Takeoff and Landing
VMS	Vertical Motion Simulator
VMSC	Vertical Motion Simulator Complex

5.0 Proprietary Software

The Contractor will be required to utilize and support all software included in Attachment J.1(a) 5.