

ANNEX 3.0

ENGINEERING SERVICES

TABLE OF CONTENTS

- 3.0 Engineering Services**
- 3.0.1 General Information**
- 3.1 Engineering Drafting Support Services & Documentation Maintenance**
- 3.1.1 Reserved**
- 3.1.2 Reserved**
- 3.1.3 Computer-Aided Drafting Information Services**
- 3.1.4 Central Engineering Files (CEF)**
- 3.2 Design**
- 3.2.1 Project Management Plan (PMP)**
- 3.2.2 Design Limits**
- 3.2.3 Environmental Design Certifications**
- 3.2.4 Engineering Studies**
- 3.2.5 As-Building**
- 3.2.6 Redline Verification Reviews**
- 3.2.7 Provide Test Complex Engineering**
- 3.2.8 Records, Reports, Submittals**
- 3.3 Construction Services**
- 3.3.1 Construction and Engineering Management**
- 3.3.2 Construction Surveillance and Engineering Services**

- 3.0 Engineering Services**
- 3.0.1 General Information**
- 3.0.1.1 Annex Description**

This annex identifies the facilities engineering services required by the Government. It should be understood that the engineering called for in this Annex is exclusive of all engineering necessary to meet other contract requirements as called for in other annexes.

3.0.1.2 Reserved

3.0.1.3 Restrictions, Limitations, and Special Conditions

The Contractor must take into account entry restrictions to secure facilities to accomplish the work called for in this Annex.

3.0.1.4 Professional and Non-Professional Engineering Services

Professional engineering services shall include, but not be limited to, civil, architectural, mechanical, electrical, structural, environmental, construction management and fire protection disciplines. Limited crane, instrumentation,

electronic control and chemical, specialties will be required. High pressure fluid system and cryogenic system specialties will require emphasis. The design of special equipment such as ground support and propulsion test equipment is also a requirement under this contract. Non-professional engineering services shall consist of, but not be limited to, drafting, detailing, AutoCAD Computer-Aided Drafting (CAD) operators, in-field testing and research, Central Engineering File (CEF) management, project control, Specsintact management, standards management and construction surveillance in support of SSC activities.

3.0.1.4.1 Design Discipline Supervisors or Leads

Leads shall be professional engineers registered in accordance with the National Society of Professional Engineers (NSPE), with a minimum of 5 years of experience working in their discipline.

3.0.1.4.2 Design Engineers

Engineers shall have an engineering degree in their technical discipline or must be a designer with 3 years minimum specialized experience in their technical discipline.

3.0.1.4.3 Drafting Personnel

Drafting personnel shall have knowledge of AutoCADD 14.0 or higher software or manual drafting expertise, personal computer operations, construction practices, the ability to accurately read construction drawings, and recognize building components and such disciplines as architectural, mechanical, electrical, and structural.

3.0.1.5 Design Overview

All designs and studies shall be prepared under the supervision of a professional engineer registered in the State of Mississippi. All designs and studies shall be in compliance with Federal, State, local, and Stennis Space Center (SSC) requirements and regulations. The Contractor shall coordinate with the site Safety, Pressure Systems, Environmental, Fire Safety and the plant Engineering offices to ensure

each design meets all applicable codes, regulations and Government requirements. The Contractor shall retain sole responsibility for ensuring all designs comply with applicable regulations and meet 10 Code of Federal Regulations (CFR) 435 and 436 and subsequent mandated legislation.

3.0.1.5.1 Design Reviews

The Government will request one final and a variable number of interim formal reviews of the design process and design deliverables. The specific personnel, requirements, scope and deliverables of the design effort and the design review processes will be addressed on a per project basis with the NASA project manager during the development of the Project Management Plan.

3.0.1.6 Updating Site-wide Oriented Repair Document (SORD) Drawing (As-Building)

At the start of this Contract the Government will have existing as-built work in backlog. (Approx. 1300 redlines.) As projects are as-built on this Contract, the Contractor shall review that existing backlog to determine: (1) if any of that backlog work can and should be integrated into the present work and (2) if it should be as-built. The site's SORD drawings shall be maintained and used by the Contractor and provided to others at the request of the Government as references for design, construction and operating efforts.

Once the SORD drawings have been updated, the final design drawings, the redlines, and the updated masters shall be delivered to Central Engineering Files (CEF) in Building 2104.

3.0.1.7 Computer-Aided Drafting

All CAD drafting called for by this Annex shall be performed using AutoCADD Version 14 or higher version software.

All updates shall be formatted per the **Facilities Engineering Documentation Instruction, SSC 66-500**, and the **Facilities Drafting Manual, SSC 66-600**.

3.0.1.8 Accuracy of Project Management Plans Construction Estimates

The Contractor shall include construction budget, design budget and design schedule data on a Project Management Plan (PMP) before a design begins per Paragraph 3.1.2. At each design review stage or when requirements change during the design, the Contractor shall review the PMP to determine that projected budget and schedule estimates are still correct. Informal proposals for adjustments to these and all PMP parameters are the responsibility of the Contractor as is notification of same to the Government's technical representative. All changes to these parameters agreed upon between the Contractor and Government's technical representative shall be formalized within 3 days in a revised PMP.

The degree of correlation required between the PMP construction budget and the construction cost-estimate produced as a deliverable of the design shall depend upon the construction budget and the design percent completion. The construction cost-estimate shall always be within the percentage as specified below of the construction budget detailed in the PMP:

For <\$25K Construction Projects:

If the design is < 50 percent – the new PMP construction cost-estimate shall be within 20 percent of the final negotiated construction estimate.

If the design is > 50 percent complete – the new PMP construction cost-estimate shall be within 15 percent of the final negotiated construction estimate.

For >\$25K and <\$75K Construction Projects:

If the design is < 50 percent complete – the new PMP construction cost-estimate shall be within 15 percent of the final negotiated construction estimate. If the design is > 50 percent complete – the new PMP construction cost-estimate shall be within 10 percent of the final negotiated construction estimate.

For >\$75K Construction Projects:

If the design is < 50 percent complete – the new PMP construction cost-estimate shall be within 10 percent of the final negotiated construction estimate. If the design is > 50 percent complete – the new PMP construction cost-estimate shall be within 5 percent of the final negotiated construction estimate.

3.0.1.9 Definitions

Sitewide Oriented Repair Documentation (SOR) Drawings: Master facility drawings, hardcopy or electronic, that act as the official record of the site's facilities.

Raster Master Drawings: Master facility drawings that have been scanned into electronic format.

As-Building: Updating the master facility drawings to accurately depict existing conditions in the field.

Project Management Plan (PMP): Detail of a specific scope of work relating to design and study services and deliverables.

Specification Control Drawings (SCD): Detailed drawings showing parts and specifications of individual elements of a component or system such as valve, controllers, expansion joints and pipe fittings.

Construction: Any and all field work for the purpose of constructing new facilities, and modifying, rehabilitating, or repairing existing facilities. This construction is not limited to Davis-Bacon definitions and includes the installation of special equipment.

Certificate of Completion (COC): Document used to close construction project verifying completion.

Redline Drawing: A drawing which has had approved modifications/changes not incorporated in the controlled official archives.

**ANNEX 3.0
ENGINEERING SERVICES**

<u>ITEM NO.</u>	<u>PERFORMANCE REQUIREMENT</u>	<u>RELATED DOCUMENTS OR INFORMATION</u>	<u>WORKLOAD DATA</u>	<u>MINIMUM STANDARDS</u>
3.1	Engineering Drafting Support Services and Documentation Maintenance			
3.1.1	Reserved			
3.1.2	Reserved			
3.1.3	Engineering Drafting Support Services and Documentation Maintenance			
3.1.3.1	Sitewide Oriented Repair Documentation (SORD), Documentation Update	<p>The contractor shall revise, create and update all SORD drawings to accurately reflect the field conditions upon completion of any facility modification or new construction work performed by this contract and as built changes from NASA and Resident Agencies. This service shall be performed when a facility modification or new construction results in a change to government property, facilities, electrical and climate control systems, plumbing, utilities, roads and grounds. The contractor shall incorporate as-built details to the level of detail presently found on the SORD drawings.</p> <p>The Government shall be given electronic accessibility to the database maintaining these records.</p>	Update drawings for 100 COCs per year.	<p>No deviation from Facilities Engineering Documentation Instruction, SSC 66-500, and the Facilities Drafting Manual, SSC66-600.</p> <p>The Contractor shall maintain records to show a project's receipt from construction and the percent completion of incorporating as-built details into the SORD System. The records shall cover all as-built work.</p>

ANNEX 3.0
ENGINEERING SERVICES

<u>ITEM NO.</u>	<u>PERFORMANCE REQUIREMENT</u>	<u>RELATED DOCUMENTS OR INFORMATION</u>	<u>WORKLOAD DATA</u>	<u>MINIMUM STANDARDS</u>
3.1.3.2	Specification Control Drawing (SCD's) SORD Update	The contractor shall revise, create and update Specification Control Drawings (SCD's).	Update 400 "B" size drawings per year	<p>Review and use all available sources, including redlines, shop drawings, submittals and field investigations to determine the information to be transferred to the affected SORD drawings. Perform all drafting, CAD and manual, to update all SORD drawings affected by a project.</p> <p>Delivery of final as-builts to CEF shall be within 5 days of job completion or NASA review and approval.</p> <p>Update per redline mark-ups per Facilities Engineering Documentation Instruction, SSC 66-500 the Facilities Drafting Manual, SSC66-600 and SSC Work Instruction</p>

**ANNEX 3.0
ENGINEERING SERVICES**

<u>ITEM NO.</u>	<u>PERFORMANCE REQUIREMENT</u>	<u>RELATED DOCUMENTS OR INFORMATION</u>	<u>WORKLOAD DATA</u>	<u>MINIMUM STANDARDS</u>
				99-011.
3.1.3.4	Master Plan Updates	The contractor shall revise, create and update all master plan drawings and make available to the government on electronic database. Frequency will be as directed by the Government's designated Master Planner.	Minimum 1 Maximum 30 pages per year.	Update per redlines, mark-ups and information furnished by the government.
3.1.3.5	Design Drafting and Miscellaneous CADD Support	The contractor shall perform CADD drafting services as requested by the government. The contractor shall revise or create projects, signs, graphs, and charts.	100 requests per year. As ordered	The Contractor shall complete these tasks within 14 days of Government providing information. The exact schedule for each task shall be given when the task is assigned. Update or create per redline, mark-ups or information given by the government.
3.1.3.6	Issue Digging Permits	The Contractor shall review construction drawings created by other contractors to ensure installation, re-routing, or removal of cables, and conduits of the site's underground/buried utility systems meets SSC's facility criteria. Contractor will ensure that all potential hazards and position conflicts resulting from such installation are identified visually in the field with paint or tape and conveyed verbally to the	50 Digging permits issued per year.	All requests for permits and their disposition, whether approved or disapproved, are documented by the Contractor. Within 7 days the

ANNEX 3.0
ENGINEERING SERVICES

<u>ITEM NO.</u>	<u>PERFORMANCE REQUIREMENT</u>	<u>RELATED DOCUMENTS OR INFORMATION</u>	<u>WORKLOAD DATA</u>	<u>MINIMUM STANDARDS</u>
		Government or construction project manager and to the team physically handling the installation.		Contractor shall review the submitted construction drawings and respond to the customer with a new permit or a written notice explaining the reason for the request being rejected.

ANNEX 3.0
ENGINEERING SERVICES

<u>ITEM NO.</u>	<u>PERFORMANCE REQUIREMENT</u>	<u>RELATED DOCUMENTS OR INFORMATION</u>	<u>WORKLOAD DATA</u>	<u>MINIMUM STANDARDS</u>
3.1.3.7	Configuration Management and Project Control	<p>The Contractor shall maintain and make available to the Government current project information for all facility projects the contractor has a requirement to perform as requested by the Government. This includes facility designs, studies, locally approved construction and modifications, planned maintenance projects, and construction surveillance.</p> <p>(See DR 1-CM01)</p>	52 written updates per year.	<p>Cost and current status information maintained in the NASA approved system and PC spreadsheet software as required for NASA and Tenant efforts in the COF and local construction programs. Data will include start and completion date, current completion status, point of contact and project cost.</p>
3.1.3.8	Building Plans (1/8" Floor Plans) DR 3-FA01	<p>Use and build upon the existing Building Plan Drawings and maintain in CADD format.</p> <p>The updated Building Plan drawings shall reflect current room number, and location of walls and partitions within Government and Government-leased buildings. The Contractor shall perform field inspections of the onsite facilities to verify all Building Plan drawings are accurate. The Contractor shall update Building Plans per redlined drawings provided by the Government from bid construction work and from construction performed by this contract.</p>	150 updates per year	<p>Each Building Plan shall represent the current architectural configuration of the area including room numbers and layouts, room type, gross square footage and net usable square footage total. The format of each update shall be according to the SSC 66-600 and all room numbers shall be legible, when just photocopied.</p> <p>All onsite buildings shall</p>

ANNEX 3.0
ENGINEERING SERVICES

<u>ITEM NO.</u>	<u>PERFORMANCE REQUIREMENT</u>	<u>RELATED DOCUMENTS OR INFORMATION</u>	<u>WORKLOAD DATA</u>	<u>MINIMUM STANDARDS</u>
				<p>be field checked at least once a year.</p> <p>All updates shall be completed within requirements set by the COC procedures.</p> <p>Full size drawings shall be plotted to scale: 1/8" = 1'-0" for 28" x 40."</p>
		<p>The Contractor shall distribute updated Building Plan drawings to an established distribution list. **Building Plan Distribution List**. Building Plan Drawings shall be available to the Government thru electronic means – (Auto Manager is the current software utilized for this requirement).</p>	<p>20 copies per year, requested as and when required.</p>	<p>Updated Building Plans with wall modifications or room number changes will be distributed with a redlined Building Plans showing the location of the changes.</p> <p>Customer requests shall be met within 8 hours.</p>
		<p>The Contractor shall provide a hardcopy of the Building Plan's Document to the Government and other site customers upon request.</p> <p>Maintain one original copy and 5 stock copies in CEF.</p>	<p>5 per year</p>	<p>Customer requests shall be met within 72 hours.</p> <p>Available for inspection by the Government.</p>

ANNEX 3.0
ENGINEERING SERVICES

<u>ITEM NO.</u>	<u>PERFORMANCE REQUIREMENT</u>	<u>RELATED DOCUMENTS OR INFORMATION</u>	<u>WORKLOAD DATA</u>	<u>MINIMUM STANDARDS</u>
3.1.3.9	Fire Evacuation Plans	<p>The Contractor shall create, update, and maintain Fire Evacuation Plans (FEP) when requested by the Government.</p> <p>The Contractor shall maintain and update **FEP**. The Contractor shall work with Facilities Engineering Division to identify location and placement of key evacuation and safety features in all facilities located at SSC, EF, and SCTF. The Contractor shall also perform field inspections to verify locations of fire hose cabinets, pull stations, and fire extinguishers. The Contractor shall modify existing FEP drawings based on the Building Plan's to include key evacuation symbols.</p> <p>The Contractor shall create and maintain a progress list to document current FEP's.</p> <p>The Contractor shall plot the updated FEP drawings to an appropriate scale to fit the existing 18" x 24" black wood frames located in the facilities. Provide Facility Manager with finished plot.</p>	<p>As Ordered</p> <p>Minimum 1</p> <p>Maximum 1</p>	<p>(See SPG 8715.1)</p> <p>Update and distribute to Facilities Engineering Division within 21 days of request. Fire Safety items properly located on FEP's. FEP data shall be consistent with Building Plan data.</p> <p>List kept current and available for inspection by the Government.</p> <p>Full plot fits within existing frames.</p>
3.1.3.10	Asbestos Abatement Plans	<p>The Contractor shall update Asbestos Abatement Plans (AAP) based on redlined drawings provided by the Government.</p> <p>The Contractor shall post AAP's on SSC web page.</p>	<p>As Ordered</p> <p>Minimum 1</p> <p>Nothing additional.</p>	<p>Produce and distribute within 21 days.</p>

ANNEX 3.0
ENGINEERING SERVICES

<u>ITEM NO.</u>	<u>PERFORMANCE REQUIREMENT</u>	<u>RELATED DOCUMENTS OR INFORMATION</u>	<u>WORKLOAD DATA</u>	<u>MINIMUM STANDARDS</u>
		The Contractor shall maintain the AAP's List and provide updated lists to the NASA Facilities Engineering Division. The Contractor shall also maintain a log for status purposes. **AAP's Listing** .		Updated list available for inspection by the Government. Respond to inquiries concerning requested dates and delivery dates within 8 hours.
3.1.3.11	Drafting and Central Engineering Demand Services	Provide drafting services for SSC programs and Resident Agencies.	As Ordered Minimum 20 Requests	See Paragraph 3.1.3.1
		Provide document retrieval and filing services for SSC programs and Resident Agencies.	As Ordered Minimum 50 Requests	
3.1.3.12	Space Utilization and Real Property	The Contractor shall provide up-to-date 1/8" floor plans. Data to be reflected: net square footage per room, type of space per room, gross square footage for building, wall type, and tenant occupying room or building. Submit in accordance with DR's 3-FA01 and 3-FA03. Periodic walkthrough inspections of space will be conducted to verify accuracy of plans. See Paragraph 3.1.3.8	100 requests per year.	See Paragraph 3.1.3.8 Support shall be provided within 2-4 hours of the request. The exact schedule for each task shall be given when the task is assigned.
		Provide annual listing of Real Property collateral equipment; values over \$5000, per DR 3-FA02.	1 list per year	No instances of unreported property
3.1.3.13	SPECSINTACT System Maintenance	The Contractor shall maintain and update the NASA's SPECSINTACT Software System to produce project	4 updates per year. **SPECSINTACT **	Updates shall be completed within 30 days of receiving

ANNEX 3.0
ENGINEERING SERVICES

<u>ITEM NO.</u>	<u>PERFORMANCE REQUIREMENT</u>	<u>RELATED DOCUMENTS OR INFORMATION</u>	<u>WORKLOAD DATA</u>	<u>MINIMUM STANDARDS</u>
		<p>specifications for Government bid projects. The SSC Submasters shall be updated twice a year per the latest SPECSINTACT text updates and format changes, and the software shall be updated twice a year per the latest SPECSINTACT software updates. The Government shall be given 5 days to review and approve the Submaster changes before they are made available for project design use. A copy of the latest master text and Submasters shall be kept on the shelf for use by the Government.</p>	<p>Submaster Index.</p>	<p>the latest SPECSINTACT software or text updates. Master text updates and approved Submasters shall be on the shelf within 30 days.</p>
3.1.3.14	<p>Management of Engineering Guidelines and Work Instructions</p>	<p>The Contractor shall maintain and update SSC engineering guidelines and work instructions. The contractor will update these documents when changes are request by the government and incorporate updated industry consensus standards as they occur. There are 110 engineering guidelines and work instruction to be maintained.</p>	<p>20 Document updates per year</p>	<p>Accurate updates shall be completed within 30 days of received change data. Documents will be grammatically correct and the a consistent format.</p>
3.1.4	<p>Computer-Aided Drafting Information System Maintenance and management of Data Bases</p>	<p>The Contractor shall provide programming support for AutoCAD 14 and other government furnished engineering software, which includes providing functional enhancements, response to questions, trouble shooting of problems, and assistance in printing.</p> <p>The contractor shall maintain/create all engineering and drafting electronic databases to SORD, EMI,</p>	<p>Support required throughout normal working hours weekly, 200 hours.</p>	<p>Support shall be provided within 2-4 hours of the request. The exact schedule for each task shall be given when the task is assigned. All databases shall be maintained current.</p>

ANNEX 3.0
ENGINEERING SERVICES

<u>ITEM NO.</u>	<u>PERFORMANCE REQUIREMENT</u>	<u>RELATED DOCUMENTS OR INFORMATION</u>	<u>WORKLOAD DATA</u>	<u>MINIMUM STANDARDS</u>
		<p>SCD, 1/8" floor plans (Building Plan Drawings). The contractor will devise a fast response retrieval system and provide the government network access to the databases. The databases consist of Raster, Vector and Raster/Vector AutoCAD and AutoCAD compatible drawings. The contractor shall maintain a back-up and security system to prevent the loss of information.</p>		
3.1.5	Central Engineering Files (CEF)	<p>The contractor shall operate the government's Central Engineering Files addressing customer requests, research, document distribution, document pick-up and delivery, document archive and retrieval, control of Engineering Modification Instructions, control of vendor data, control of engineering work instructions, and maintaining current engineering/industry consensus standards.</p>	<p>Operate weekly during normal working hours, 40 hours/week.</p>	<p>Comply with SSC work instructions 66-500, 66-600, NPG 8820.2 and the Standard Operating Procedure 1500 for CEF.</p>
3.1.5.1	Documentation Research	<p>The contractor shall provide information to the government by researching the databases and files in CEF. The request would be for drawings, specifications, technical reports, standards, vendor data and space utilization and real property information.</p>	<p>3000 requests per year</p>	<p>Information is complete based on customer request</p>
3.1.5.2	Pick-Up and Delivery	<p>The contractor shall provide pick-up and delivery</p>	<p>100 per year</p>	<p>Respond within three days</p>

ANNEX 3.0
ENGINEERING SERVICES

<u>ITEM NO.</u>	<u>PERFORMANCE REQUIREMENT</u>	<u>RELATED DOCUMENTS OR INFORMATION</u>	<u>WORKLOAD DATA</u>	<u>MINIMUM STANDARDS</u>
		services to and from CEF.		of the request.
3.1.5.3	CEF Filing and Maintenance of Hard Copies	The contractor shall file and maintain hard copies of drawings, manuals, and technical papers.	1200 documents to file per year	All documents, drawings used shall be filed on a weekly basis.
3.1.5.4	CEF Control of Engineering Modification Instructions (EMI) Packages	The contractor shall receive, check, have signed, print and release all EMI packages.	150 EMI's per year	At the government's request CEF will release and maintain all EMI packages.
3.1.5.5	CEF Support to Documentation Updates	The contractor shall supply CEF support to the drafting staff for documentation updates such as Certificate of Completions (COC's), SORD #'s, pulling EMI packages, research, Engineering Orders(EO's), Field Change Requests (FCR's) and filing. Research all existing SORD facility drawings to determine those affected by each modification.	Update 500 drawings per year	Support within 5 days of request.
3.1.5.6	Input and Maintenance of CEF Computer Data Base	The contractor shall update databases in CEF to control documentation files. The database will consist of the vendor cross reference index, EMI/SWR cross reference indexes, CADD/EMI indexes, Technical reports and Studies indexes, SSC standards index, SSC technical procedures index, SSC maintenance	100,000 entries per year	All databases shall be maintained current. All documentation, such as drawings, manuals, technical papers, pertinent to SSC facilities, systems,

ANNEX 3.0
ENGINEERING SERVICES

<u>ITEM NO.</u>	<u>PERFORMANCE REQUIREMENT</u>	<u>RELATED DOCUMENTS OR INFORMATION</u>	<u>WORKLOAD DATA</u>	<u>MINIMUM STANDARDS</u>
		instructions index, government standards and specifications index, Industry standards and specifications index, Construction SPECSINTACT index, CADD/SCD index, SORD Drawing index, CR/CCBD index and component database (CDB to parts list).		and equipment will be controlled by CEF.
3.2	DESIGN			
3.2.1	Project Management Plan (PMP)	<p>A. For each design and study effort of a value >\$1000, the Contractor shall develop the Project Management Plan (PMP) for Government review and approval. The PMP initiates each design process and details the following:</p> <p>Objectives Necessary Personnel Activities, Deliverables and Schedule Construction Funding Constraints Total Proposed Cost of Implementing the PMP Schedule of Values Detailing the Schedule and Level of Compensation to the Contractor</p> <p>B. In the event that changes in the Government's requirements or resources occur, the efforts stipulated</p>	<p>Minimum: 75 PMP's per year. Maximum: 105 PMP's per year.</p>	<p>Completed PMP delivered for approval on the following schedule:</p> <p>Within 7 days of receipt of the design request when the tasks estimated construction value is between \$10,000 and \$50,000.</p> <p>Within 14 days of receipt of the design request when the task estimated construction value is >\$50,000</p>

ANNEX 3.0
ENGINEERING SERVICES

<u>ITEM NO.</u>	<u>PERFORMANCE REQUIREMENT</u>	<u>RELATED DOCUMENTS OR INFORMATION</u>	<u>WORKLOAD DATA</u>	<u>MINIMUM STANDARDS</u>
		in the PMP can be expanded, reduced or terminated. Contractor shall develop and provide a revised PMP within 7 days of Government notice.		
		C. The Contractor shall be represented at NASA's Facilities Engineering Division weekly meetings.	52 meetings per year.	Background information necessary to provide status is ready for distribution and discussion.
		D. In the event the contractor requests revision to PMP to accommodate management of workforce, data shall be provided to Government validating request.		Maintain workload data available for Government review.

**ANNEX 3.0
ENGINEERING SERVICES**

<u>ITEM NO.</u>	<u>PERFORMANCE REQUIREMENT</u>	<u>RELATED DOCUMENTS OR INFORMATION</u>	<u>WORKLOAD DATA</u>	<u>MINIMUM STANDARDS</u>
3.2.2	Design Limits			
3.2.2.1	Engineering Designs for Bid Work Construction Value <\$10K or <\$1000 Design Cost	Contractor pricing shall include design and implementation estimate in the SWR for construction.	Nothing Additional	
3.2.2.2	Engineering Designs for Bid Work Construction Value \$10K - \$200K or Greater than \$1000 Design Cost	The Contractor shall produce designs for open competitive bid by the Government to accomplish construction. The Contractor shall produce final engineering design package drawings and specifications necessary to make the correct facility modifications to meet the requirements determined in the project scope of work. The designs shall accommodate the modification, repair of existing, and the construction of new facilities.	Nothing Additional	<p>Design shall meet the PMP requirements. All design construction drawings are formatted per the Facilities Engineering Documentation Instruction, SSC 66-500, and the Facilities Drafting Manual, SSC66-600.</p> <p>All designs address and resolve specific requirements detailed in approved PMP.</p> <p>All designs created require the following:</p> <p>Specifications and the design drawings define the construction work to be accomplished.</p>

ANNEX 3.0
ENGINEERING SERVICES

<u>ITEM NO.</u>	<u>PERFORMANCE REQUIREMENT</u>	<u>RELATED DOCUMENTS OR INFORMATION</u>	<u>WORKLOAD DATA</u>	<u>MINIMUM STANDARDS</u>
				<p>All engineering designs reference the specifications developed for the construction project.</p> <p>Latest and most applicable specifications are edited and tailored to meet specific project requirements.</p> <p>The final design includes all the required materials and is delivered per schedule.</p> <p>Designs are in compliance with the **National Resource Protection Act when modifications are made in a secure area.</p> <p>The specifications are produced using the NASA SPECSINTACT Submasters, and the CCB NASA SPECSINTACT Mastertext, whichever is the latest and most applicable.</p>

**ANNEX 3.0
ENGINEERING SERVICES**

<u>ITEM NO.</u>	<u>PERFORMANCE REQUIREMENT</u>	<u>RELATED DOCUMENTS OR INFORMATION</u>	<u>WORKLOAD DATA</u>	<u>MINIMUM STANDARDS</u>
3.2.2.3	Accomplish Design for Construction Category	See Paragraph 3.2.2.2	As Ordered.	See Paragraph 3.2.2.2

Design prepared under the supervision of a registered professional engineer.

The Contractor shall provide an itemized construction cost estimate with each design review package. A final construction cost estimate, based upon the final Government approved design, shall be provided with the final design.

An itemized construction cost estimate is provided with each design review package. Final cost estimate, based upon the final Government approved design, is delivered with the final design.

Final cost estimate is within plus or minus 12% of the average competitive bids received by the Government.

The format of the estimates shall be per PMP as a deliverable.

Construction change requests due to design error as compared to total original construction cost shall be less the 5% cost.

**ANNEX 3.0
ENGINEERING SERVICES**

<u>ITEM NO.</u>	<u>PERFORMANCE REQUIREMENT</u>	<u>RELATED DOCUMENTS OR INFORMATION</u>	<u>WORKLOAD DATA</u>	<u>MINIMUM STANDARDS</u>
	\$10K - \$200K		Maximum 90	
3.2.2.4	Engineering Designs Construction Value > \$200,000	<p>The Contractor shall produce final design engineering drawings and specifications necessary to make the correct facility construction modifications to meet the requirements determined in the project scope of work. The designs shall accommodate the modification, repair of existing, and the construction of new facilities. The Contractor shall produce designs for its own construction personnel or open competitive bid by the Government.</p> <p>For Construction projects greater than \$200,000, the Contractor shall create new project specifications using CCB NASA SPECSINTACT software and text. Each new or edited project specification shall be based upon marked-up specifications at various stages of design. The specification edits shall occur at 60%, 90% and 100% design.</p> <p>The marked-up specifications shall be proofread before editing begins to ensure an understanding of what and how the specification is to be edited. The edited product shall be reviewed for, spelling, sentence structure, punctuation, clarity, and accuracy.</p>	<p>As Ordered.</p> <p>Maximum 15</p>	<p>See Paragraph 3.2.2.2</p> <p>The new or edited project specification shall accurately reflect the marked-up specifications.</p> <p>The edited product shall have no spelling, sentence structure, or punctuation errors.</p>
3.2.3	Environmental Design Certifications, Permits, and Permit Applications	For all applicable environmental designs, the Contractor shall prepare design and construction	As Ordered.	Certifications are prepared in accordance with 40 CFR

ANNEX 3.0
ENGINEERING SERVICES

<u>ITEM NO.</u>	<u>PERFORMANCE REQUIREMENT</u>	<u>RELATED DOCUMENTS OR INFORMATION</u>	<u>WORKLOAD DATA</u>	<u>MINIMUM STANDARDS</u>
3.2.4	Engineering Studies	<p>certifications signed by an independent, registered, professional engineer. The Contractor shall not use staff personnel to provide the design or construction certification if the corresponding design or construction work will be performed by the Contractor.</p> <p>The Contractor shall prepare permits, permit applications, modifications, renewals and certification forms and applicable documentation and calculations per local, State, and Federal environmental regulations. The permit applications will be reviewed and approved by the Government before submission to the State. The Government shall be given a minimum of one week for review.</p> <p>The Contractor shall perform feasibility studies, special engineering investigations and analysis, environmental studies, existing condition studies, analysis of future requirements, cost and design feasibility studies, conceptual project design studies, energy conservation studies.</p>	<p>Minimum 1</p> <p>As Ordered.</p> <p>Minimum 1</p>	<p>270 and 40 CFR Part 60. Certifications are submitted in accordance with regulation in time to support construction schedules.</p> <p>All documentation is submitted to the Government and the State within a schedule that will not impede construction activities.</p> <p>Permits, permit applications, modifications, are prepared and submitted per Mississippi Environmental Administrative Code.</p> <p>Study report shall: Describe all data used for the final conclusion.</p>

ANNEX 3.0
ENGINEERING SERVICES

<u>ITEM NO.</u>	<u>PERFORMANCE REQUIREMENT</u>	<u>RELATED DOCUMENTS OR INFORMATION</u>	<u>WORKLOAD DATA</u>	<u>MINIMUM STANDARDS</u>
		<p>The Contractor shall perform field investigation, engineering analysis, research of master facility drawings, and all engineering necessary to produce reports, studies and planning documents relative to:</p> <p>a. Investigate, analyze, and evaluate existing facility operations anomalies to make remedial (non-repair) recommendations.</p> <p>b. Modification of existing facility structures and systems.</p> <p>c. Design of new facilities and systems.</p>		<p>Provide analysis of problem or issue, and sound engineering recommendations.</p> <p>Address project feasibility, constructability, cost effectiveness, schedule, energy efficiency as applicable.</p> <p>Design prepared under the supervision of a registered professional engineer.</p>
3.2.5	As-Building			
3.2.5.1	Master Facility Drawing Updates (Construction Projects <\$200,000)	See Paragraph 3.1.3.1.	Nothing Additional	See Paragraph 3.1.3.1.
3.2.5.2	Master Facility Drawing Updates (Construction Projects >\$200,000)	A. The Contractor shall revise, create and update all NASA master facility drawings to accurately reflect the field conditions upon completion of any facility modification work performed by this contract. This service shall be performed when a facility modification results in a change to Government property, including but not limited to facilities,	As Ordered. Minimum 2 Maximum 15	The Contractor shall: Research all existing master facility drawings, CAD or hardcopies, to determine those affected by each facility modification.

ANNEX 3.0
ENGINEERING SERVICES

<u>ITEM NO.</u>	<u>PERFORMANCE REQUIREMENT</u>	<u>RELATED DOCUMENTS OR INFORMATION</u>	<u>WORKLOAD DATA</u>	<u>MINIMUM STANDARDS</u>
		<p>systems, utilities, roads and grounds.</p> <p>The Contractor shall as-build to the level of detail presently found on the master facility drawings.</p> <p>** Master Facility Drawing Examples.</p>		<p>Review and use all available sources, including redlines, shop drawings, submittals, and field checks to determine the information to be transferred to the effected master facility drawings.</p> <p>Perform all drafting necessary, CAD and manual, to update all master facility drawings effected by a project.</p> <p>Deliver final as-builts to CEF within 5 days of job completion or NASA review and approval.</p> <p>Complete all backlog work within the same room, system, or functional area has been as-built at the same time as the current as-building job.</p>
		<p>For this line item, the Contractor shall preprice each bare cost craft hour by engineering discipline.</p>		

ANNEX 3.0
ENGINEERING SERVICES

<u>ITEM NO.</u>	<u>PERFORMANCE REQUIREMENT</u>	<u>RELATED DOCUMENTS OR INFORMATION</u>	<u>WORKLOAD DATA</u>	<u>MINIMUM STANDARDS</u>
3.2.6	Redline Verification Reviews (Construction Projects >\$200K)	For open, competitive bid construction projects by the Government >\$200,000, the Contractor shall participate with the Government in three redline verification reviews to ensure the construction redlines are clear and complete as the project progresses. The Contractor shall note discrepancies and shall indicate where clarification is required to produce accurate redlines.	As Ordered Minimum 3 Maximum 8	The Contractor shall note and document problems with redline discrepancies.
3.2.7	Provide Test Complex Engineering	<p>There are special requirements for engineering work for test programs and for test complex facility maintenance. These requirements are divided into two areas: Component Engineering and Area Engineering. The special requirements for each of these requirements are listed in the sub-annexes below:</p> <p>Historical Work Load Data:</p> <p>Component Engineering: Test Complex – 6-1/2 my/yr Base – 1/2 my/yr</p> <p>Area Engineering: Area Engineering – 1-1/2 my/yr Rapid Designs – 3-1/2 my/yr PVR Program – 1-1/2 my/yr Drafting Support – 2 my/yr</p>	See Below	

ANNEX 3.0
ENGINEERING SERVICES

<u>ITEM NO.</u>	<u>PERFORMANCE REQUIREMENT</u>	<u>RELATED DOCUMENTS OR INFORMATION</u>	<u>WORKLOAD DATA</u>	<u>MINIMUM STANDARDS</u>
3.2.7.1	Provide Component Engineering Capability	<p>The requirements are:</p> <ol style="list-style-type: none"> 1. Maintain, update and write specifications for components. These standards are called **Standardized Control Drawings (SCD's or commonly called B00-Specs.)**. The responsibility for selection of components for the correct application and maintenance of all component site standards and procurement specifications falls within this organization. 2. This includes engineering in the FCPF and, as such, makes all engineering decisions regarding repair techniques, application of components and piece parts, and disposition of Discrepancy and Corrective Action reports for components. Close interface with shop and quality personnel is required along with good customer relations. 3. This function coordinates the procurement of spare parts for various programs and base side. As part of this effort, maintain a data base on all backlog of spares requirements, canvas customers annually on their requirements for the next year, and provide a prioritized listing of requirements for spares prior to the start of each fiscal year. The requirements for spares shall be segregated by program. Synergy and commonality between programs shall be cost reduction emphasis. This function shall serve as the advocate for spares procurement and coordinate all annual requirements with the various NASA Program 	<p>Maximum 430 tasks/yr for SCD's</p> <p>Maximum 215 tasks/yr in FCPF</p> <p>1 annual task for spares requirements document</p>	<p>SCD's will be current and changes will be input within 3 months of requirement. Engineering decisions will be completed within 1 day for shop work. Customer coordination will be timely and technically in accordance with SSC standards.</p>

ANNEX 3.0
ENGINEERING SERVICES

<u>ITEM NO.</u>	<u>PERFORMANCE REQUIREMENT</u>	<u>RELATED DOCUMENTS OR INFORMATION</u>	<u>WORKLOAD DATA</u>	<u>MINIMUM STANDARDS</u>
3.2.7.2	Provide Area Engineering Capability	<p>Offices and Construction Group. Construction and maintenance activities shall develop spare parts lists which are divided into: large dollar spares, operating spares and consumable startup items.</p> <ol style="list-style-type: none"> 4. This function coordinates spares procurements to meet customer need dates, maintain a data base on the status of each item and provides the customer with weekly or monthly updates in delivery information. (Depending on the criticality of the customer requirements, this update procedure may be required daily but no less often than monthly.) 5. Review shop bench stock and assure that quantities and type of material are adequate to meet customer needs. 6. Provide cost estimates for repairs. 	<p>Write Shop Packages for: 160 Planned Maintenance Projects/year Studies: 2/yr Pressure Vessel initial certifications: 15/yr. Recertifications: 10/yr. Periodic inspections of pressure vessels: 80/yr.</p>	<p>Designs shall meet standards in 3.2.2.2</p>

ANNEX 3.0
ENGINEERING SERVICES

<u>ITEM NO.</u>	<u>PERFORMANCE REQUIREMENT</u>	<u>RELATED DOCUMENTS OR INFORMATION</u>	<u>WORKLOAD DATA</u>	<u>MINIMUM STANDARDS</u>
		develop the maintenance five-year plan. Attendance is required at weekly status meetings. Engineering evaluations, work coordination, and quick response problem solving are functions performed by area engineering.		
3.2.8	Records, Reports, and Submittals	None.		
3.3	Construction Services			
3.3.1	Provide Construction and Engineering Management of Contractor Administrated Construction Contracts		As Ordered. Minimum 20 Construction Projects	
3.3.1.1	Pre-solicitation Activities	The Contractor shall manage Government Furnished Equipment (GFE) issues related to the construction contract. This effort will include placing orders, confirming funding and acquisition of the Facility Review Board (FRB) and other relevant approvals.		Manage GFE issues to effect minimum project schedule impact.
		The Contractor may be responsible for checking documentation for accuracy, appropriate approvals, proper issuance by CEF and for the reproduction of contract and design documents as required.		Checking and reproduction are to be completed prior to the pre-bid distribution of documents.

ANNEX 3.0
ENGINEERING SERVICES

<u>ITEM NO.</u>	<u>PERFORMANCE REQUIREMENT</u>	<u>RELATED DOCUMENTS OR INFORMATION</u>	<u>WORKLOAD DATA</u>	<u>MINIMUM STANDARDS</u>
		<p>The Contractor shall be responsible for the development, approval acquisition and implementation of the project Statement of Work, NASA forms 1509 and 1510, Material Requests (MR's) and Stennis Work Requests (SWR's) for construction support.</p>		<p>Development and approval of required documentation to be completed prior to the pre-solicitation conference.</p>
		<p>The Contractor shall be responsible for consideration of legal, labor, FRB and funding requirements.</p>		<p>Consideration and resolution of issues to be implemented prior to pre-solicitation conference.</p>
3.3.1.2	Solicitation Activities	<p>The Contractor shall be responsible for technical review of the solicitation package for accuracy and for development of the anticipated construction schedule.</p>		<p>Completion is required prior to the pre-solicitation conference.</p>
		<p>The Contractor shall be responsible for the planning and management of the pre-bid conference and for the documentation and resolution of amendments and GFE issues that arise at that time.</p>		
3.3.1.3	Award Activities	<p>The Contractor shall be responsible for the management and documentation of the Bid opening process.</p>		<p>All documentation is to be collected, registered and reported upon within five days.</p>
		<p>The Contractor shall be responsible for the development of the Implementation Cost Worksheet (which details design costs, construction cost estimates and available funds), Bid Summary, Technical</p>		<p>All items, excepting the Construction Report, to be developed and presented to the Government within five</p>

ANNEX 3.0
ENGINEERING SERVICES

<u>ITEM NO.</u>	<u>PERFORMANCE REQUIREMENT</u>	<u>RELATED DOCUMENTS OR INFORMATION</u>	<u>WORKLOAD DATA</u>	<u>MINIMUM STANDARDS</u>
3.3.1.4	Construction Activities	<p>Evaluation and updates to the Construction Report.</p> <p>The Contractor shall be responsible for the management of remaining GFE issues and for the coordination of the Post-Award conference.</p> <p>The Contractor shall be responsible for the processing and delivery to the Government of all subcontractor submittals.</p> <p>The Contractor shall review and approve the subcontractor's Proposed Construction Schedule and shall evaluate and remain apprised of the degree of construction completion.</p> <p>The Contractor shall conduct daily inspections of the project site keeping records of progress and issues in a daily construction log.</p> <p>The Contractor shall ensure the approval of all necessary permits and coordinate all elements of construction activities. These include updating construction reports, management of construction costs, Facility Change Requests (FCR), Material Safety Data Sheets (MSDS) issues, utility outages, subcontractor access to restricted areas and all related documentation including "AS BUILT" drawings.</p>		<p>days of the bid opening.</p> <p>GFE issues shall be managed to resolution.</p> <p>The submittal review process shall be managed with the goal of minimal impact on the construction effort.</p> <p>This requirement shall be addressed daily.</p> <p>This requirement shall be addressed daily.</p> <p>Related issues shall be managed with the goal of minimal impact on the construction effort.</p>

**ANNEX 3.0
ENGINEERING SERVICES**

<u>ITEM NO.</u>	<u>PERFORMANCE REQUIREMENT</u>	<u>RELATED DOCUMENTS OR INFORMATION</u>	<u>WORKLOAD DATA</u>	<u>MINIMUM STANDARDS</u>
3.3.1.5	Contract Closeout Activities	<p>The Contractor shall meet with the NASA Project Engineer regularly for briefing on the current project status.</p> <p>The Contractor shall collect and distribute, as and to whom appropriate, all documentation related to the construction effort including required NASA forms, "AS BUILT" drawings, Certificate of Completion (COC), parts lists, warranties, equipment operations and maintenance manuals, submittals and construction logs.</p> <p>The Contractor shall conduct a walk-through inspection of the completed work ensuring the completion, as specified, of all components of the subcontract.</p> <p>The Contractor shall conduct a facilities maintenance assessment of all facilities and equipment installed under the contract.</p>		<p>This requirement shall be addressed at a minimum effort of once weekly. FCR shall be processed in accordance with Facilities Construction Configuration Management Manual RA-97-02.</p> <p>Document collection and distribution shall be complete prior to COC approval.</p> <p>Walk-through shall be completed prior to final invoice and COC approval.</p> <p>Written invitation shall be distributed upon completion of walk-through and resolution of all punch-list items.</p>

**ANNEX 3.0
ENGINEERING SERVICES**

<u>ITEM NO.</u>	<u>PERFORMANCE REQUIREMENT</u>	<u>RELATED DOCUMENTS OR INFORMATION</u>	<u>WORKLOAD DATA</u>	<u>MINIMUM STANDARDS</u>
3.3.2	Provide Construction Surveillance and Engineering Services for NASA Direct Construction Contracts		As Ordered Minimum 2 Construction Projects Maximum 8 Construction Projects	
3.3.2.1	Pre-Solicitation Activities	<p>At the discretion of the Government, the following requirements may be contracted for on an as needed basis.</p> <p>The Contractor shall implement and resolve all GFE related issues.</p> <p>The Contractor shall check documentation for completeness and for appropriate approvals and issuance by CEF.</p> <p>The Contractor shall be responsible for the reproduction of contract and design documents as necessary.</p> <p>The Contractor shall develop a complete Statement of Work.</p> <p>The Contractor shall develop and implement the</p>		<p>Manage GFE issues to effect minimum project schedule impact.</p> <p>Checking is to be completed prior to the pre-bid distribution of documents.</p> <p>Reproduction is to be completed prior to the pre-bid distribution of documents.</p> <p>Development shall be completed prior to solicitation.</p> <p>Development shall be</p>

ANNEX 3.0
ENGINEERING SERVICES

<u>ITEM NO.</u>	<u>PERFORMANCE REQUIREMENT</u>	<u>RELATED DOCUMENTS OR INFORMATION</u>	<u>WORKLOAD DATA</u>	<u>MINIMUM STANDARDS</u>
		construction management SWR's as required.		completed prior to solicitation.
3.3.2.2	Solicitation Activities	<p>At the discretion of the Government, the following requirements may be contracted for on an as needed basis</p> <p>The Contractor shall review technical portions of the solicitation package for accuracy and return any relevant comments to the NASA Project Engineer.</p> <p>The Contractor shall attend the pre-bid conference and document the details of the meeting, any proposed amendments and details of GFE issues.</p> <p>The Contractor shall attend the post-award conference and assist in the orientation of the accepted bidder.</p>		<p>Review shall be completed prior to solicitation.</p> <p>Resolution of issues shall be managed to resolution.</p> <p>Attend the meeting as scheduled.</p>
3.3.2.3	Construction Activities	<p>At the discretion of the Government, the following requirements may be contracted for on an as needed basis.</p> <p>The Contractor shall be responsible for the continued management of GFE issues.</p> <p>The Contractor shall coordinate the processing of all contractor submittals.</p>		<p>GFE issues shall be managed to resolution.</p> <p>The submittal review process shall be managed with the goal of minimal impact on the construction</p>

**ANNEX 3.0
ENGINEERING SERVICES**

<u>ITEM NO.</u>	<u>PERFORMANCE REQUIREMENT</u>	<u>RELATED DOCUMENTS OR INFORMATION</u>	<u>WORKLOAD DATA</u>	<u>MINIMUM STANDARDS</u>
3.3.2.4	Contract Closeout Activities	<p>The Contractor shall ensure the approval of all necessary permits.</p>		<p>effort.</p> <p>Related issues shall be managed with the goal of minimal impact on the construction effort.</p>
		<p>The Contractor shall conduct daily inspections of the project site keeping records of progress and issues in a daily construction log.</p>		<p>This requirement shall be addressed daily.</p>
		<p>The Contractor shall perform quality control surveillance and document discrepancies. The Contractor shall coordinate elements of construction activities including updating construction reports, FCR and MSDS issues, utility outages, permits, contractor access to restricted areas and all related documentation including current "AS BUILT" drawings.</p>		<p>Related issues shall be managed with the goal of minimum impact on the construction effort. FCR's shall be processed in accordance with Facilities Construction Configuration Management Manual RA-97-02.</p>
		<p>The Contractor shall meet with the NASA Project Engineer regularly for briefing on the current project status.</p>		<p>This requirement shall be addressed at a minimum of once weekly.</p>
		<p>At the discretion of the Government, the following requirements may be contracted for on an as needed basis.</p>		

ANNEX 3.0
ENGINEERING SERVICES

<u>ITEM NO.</u>	<u>PERFORMANCE REQUIREMENT</u>	<u>RELATED DOCUMENTS OR INFORMATION</u>	<u>WORKLOAD DATA</u>	<u>MINIMUM STANDARDS</u>
		<p>The Contractor shall collect and distribute, as and to whom appropriate, all documentation related to the construction effort including required NASA forms, "AS BUILT" drawings, COC, parts lists, warranties, equipment operations and maintenance manuals, submittals and construction logs.</p> <p>The Contractor shall conduct a walk-through inspection of the completed work ensuring the completion, as specified, of all components of the contract.</p>		<p>Document collection and distribution shall be completed prior to COC approval.</p> <p>Walk-through shall be completed prior to final invoice and COC approval.</p>

ANNEX 3.0
ENGINEERING SERVICES

Table 3-1

FOSC Work Load Data Designs

	Construction Range	Design Range	Number of Projects 1995	Number of Projects 1996	Number of Projects 1997	Number of Projects 2000	Yearly Average
Base	0-10000	0-1000	0	23	27	28	25
	10000-25000	1000-2500	5	9	12	42	8
	25000-50000	2500-5000	1	6	16	6	7
	50000-100000	5000-10000	7	3	6	4	5
	100000-150000	10000-15000	0	4	2	2	2
	150000-200000	15000-20000	0	0	0	1	0
	200000>	>20000	0	1	3	1	1
Test Complex	0-10000	0-1000	5	1	10	10	4
	10000-25000	1000-2500	2	1	2	15	5
	25000-50000	2500-5000	11	2	8	16	9
	50000-100000	5000-10000	1	4	4	10	5
	100000-150000	10000-15000	1	1	2	3	2
	150000-200000	15000-20000	0	0	2	1	1
	200000>	>20000	3	3	3	5	4
Demand	0-10000	0-1000	0	63	79	90	36
	10000-25000	1000-2500	3	14	4		5
	25000-50000	2500-5000	4	3	9	3	5
	50000-100000	5000-10000	5	4	5	6	5
	100000-150000	10000-15000	1	2	3	6	3
	150000-200000	15000-20000	2	2	1	1	2
	200000>	>20000	8	11	10	12	10
				157	208	224	196
	Design Range			70	92	96	78
Totals	0-1000						
	1000-2500	PMP Threshold					18

ANNEX 3.0
ENGINEERING SERVICES

2500-5000	75 PMP's			21
5000-10000				15
10000-15000				7
15000-20000				3
>20000				15
				78