3	"Inspect Span Drive motors for alignment, coupling wear and for abnormal noise " during operation
4	Inspect gear box of roadway gates and lubricate with multipurpose grease
5	Inspect condition of electrical contacts in roadway gates and replace if necessary
6	Inspect Span Limit Switches and adjust if necessary
7	Lubricate Cam Limit Switches with light oil
8	"Inspect Plunger Limit Switches for dirt, moisture and oxidation"
9	Lubricate pin and trip pawl pin of the Plunger Limit Switch
10	"Inspect Plunger Limit Switch wiring, and fasteners"
11	Inspect Overspeed Switch main drive sprocket for wear and alignment
12	Inspect Overspeed Switch for excessive heat or moisture
13	Lubricate Overspeed Switch drive chain and check mounting bolts for tightness
14	"Test Signal Horn for signal strength and operation. Inspect wiring, fasteners" and air system
15	Grease Signal Horn grease cups
16	Verify operation of control room AC unit and heater. Clean/replace filters
17	Clean control room heater coils and area around heater
18	Clean internals of motor control center and area surrounding
19	Inspect Motor Control Center in accordance with Electrical PM item number 5.2.2.2.8.4.2
20	Wipe down Motor Control Center exterior.
21	Verify operation of strip heaters in MCC
22	Inspect lights in machinery rooms on North and South Spans and report for repair as per item no. 5.3.6.1
23	"Inspect light panels for moisture, proper switch operation, verify panel " directory labeling
24	Inspect AC unit in Span Motor Control cabinet and clean filters as necessary.
25	Record Ohm readings on following motors: "QTY 4 -- machinery brakes, N.E. Pier, N.W. Pier, S.E Pier and S.W. Pier" "QTY 4 -- span motors, N.E. Pier, N.W. Pier, S.E Pier and S.W. Pier " "QTY 4 -- draw bar motors, N.E. Pier, N.W. Pier, S.E Pier and S.W. Pier" "QTY 4 -- pumps, N.E., N.W., S.E., and S.W. (Counter Balance Pit)"
26	Inspect and record condition of structure paint condition throughout
27	Perform a complete functional check of bridge operation

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MAINTENANCE TASK SHEET # M-8

Marine Operations System

Pump

Task #1#1

Frequency- Quarterly (12 weeks)

Step	Description
1	Check pumps and components for excessive noise, vibration, overheating, etc.
2	Perform vibration analysis on pump and motor.
3	Based on vibration analysis results, lubricate, realign, etc, as required.
4	Provide a complete analysis evaluation of the vibration testing, and enter into the signature database.

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MAINTENANCE TASK SHEET #MO-9

Marine Operations System

Government Essential Equipment

Tugboat Clairemont II
Task # 1
Frequency: Weekly

Step	Description
1	"Inspect boat for signs of leakage of oil or water from hoses, stern tubes, fittings, valves" "tanks, hoses, piping and structure. "
2	Check all electronic equipment for proper operation
3	"Verify that all equipment operates in accordance with design limits. This includes but is not limited to: engines," "generators, HVAC system, steering system, starting air system, lighting and navigation aids," "winches, davits, instrumentation, fuel system, packing glands, valves and piping, watertight doors" "and windows, safety equipment, lubrication systems, thru hull fittings and valves, kitchen" "appliances, hydraulic oil systems, pumps and blowers, mooring lines, search light, markings and warning instructions," "personnel elevator, potable water system, and mooring system, shore power, ramp and dingy."
4	"Inspect for cleanliness, oil spillages, cleanliness of bilges, and proper stowing of material."
5	Inspect interior and exterior surfaces for signs of corrosion and deterioration. Spot paint exterior as required to eliminate corrosion areas.
6	"Maintain operating levels of oils, water and fuel to 90% of capacity or greater"

Task #2
Frequency: Quarterly

Step	Description
1	Inspect all equipment for tightness of nuts and foundation bolts and tighten as necessary.
2	Replace oil as necessary in accordance with manufacturer's instructions in all equipment.
3	"Lubricate gears on winches, bearings and check for cable fraying and

	corrosion"
4	Inspect condition of all hoses and replace if worn
5	"Inspect air compressor belts, air control lines, breather, tanks and change oil as required."
6	"Check shore power transfer panel for correct voltage, amps and grounding. Check for corrosion" and for secure connections. Repair as necessary.
7	"Perform megger check on all motors including: winch, fresh water pump, hydraulic pump," "air compressors, bilge pump elevator"
8	Maintain cleanliness of electrical cabinet internals and corrosion free.
9	Maintain all pumps seals free from leakage above manufacturer's standard
10	"Clean filters, AC filters, appliance screens and vents, Engine inlet filters, generator filters," "and replace as necessary oil, gas and hydraulic oil filters."
11	Perform maintenance painting on external surfaces to prevent the appearance of corrosion
12	Perform a thorough cleaning of internal compartments and clean and wax flooring
13	Inspect non-skid flooring and reapply non-skid coating as required by safety.
14	"Inspect and replace as necessary, safety equipment, throwing rings, etc."
15	Inspect transmission oil and replace filters
16	Inspect engine vibration dampeners and replace if rubber shows extrusion.
17	Inspect insulation including turbo-charger blankets to assure that no not surfaces are exposed.
18	Replace filter in AC unit
19	Inspect fire fighting equipment and replace if damaged.
20	Lubricate steering linkages
21	Check heat exchanger zinc plugs for corrosion and replace as required
22	Inspect gratings and other trip hazards and refasten if loose
23	Perform operational check of boat and certify that boat fulfills all conditions of Coast Guard regulations
24	Perform operational check of tug boat access ramp.

Task #3
Frequency: Annually

Step	Description
1	Perform annual maintenance painting to decks and other areas which show corrosion.

2	"Perform annual maintenance inspection to identify items needed for shipyard overhaul," "maintenance projects, and obsolescence replacement requirements."
3	Perform annual inspections on equipment internals to check for wear and deterioration
4	"Inspect electrical wiring, control wiring, panels and connections for deterioration"
5	"Inspect living quarters, perform annual cleanup and replace deteriorated or worn items."
6	Determine required date for next shipyard overhaul and identify maintenance items for this overhaul
7	Clean appliances interior and exterior
8	"Perform vibration analysis on propeller shafts, pumps, engines and generators"
9	"Perform oil analysis on main engines, generators and on hydraulic systems"

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MAINTENANCE TASK SHEET #NG-1

SSC Natural Gas System

Task #1
Frequency - Quarterly (13 weeks)

Step #	Step Description
1	Perform blow-down of pipeline at all positions to remove build-up of internal moisture.
2	Check Odorizer odorant level

Task #2
Frequency - Annually (52 weeks)

Step #	Step Description
1	Lubricate blowdown valves with plug grease.
2	Cycle all shutoff valves and lubricate with plug grease.
3	Perform "sniff" check of entire gas distribution system.

Task #3
Frequency - 5 years (260 weeks)

Step #	Step Description
1	Calibrate gas supply gauge
2	Calibrate building (user) pressure gauges on both sides of pressure regulator.

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MAINTENANCE TASK SHEET # PW-1

SSC Potable Water System

No. 1 Wellhouse Complex

Task #1
Frequency - Monthly (4 weeks)

Step #	Step Description
1	Perform Vibration Analysis on motor and pump assembly.

Task #2
Frequency - Semi-Annually (26 weeks)

Step #	Step Description
1	Lubricate water pump bearing with EP-2 grease.

Task #3
Frequency - Annually (52 weeks)

Step #	Step Description
1	Perform Motor Circuit Analysis on 30hp motor.
2	Lubricate motor with EP-2 grease.
3	Perform functional check of chlorine leak detection sensor.
4	Perform functional check of chlorine leak audible warning buzzer.

Task #4
Frequency - Biennial (104 weeks)

Step #	Step Description
1	Lubricate water meter register assembly with EP-2 grease.
2	Perform functional check of normally open gate valves by cycling closed, then open.
3	Perform functional check of normally closed gate valves by cycling open, then closed..

Task #5
Frequency - 5 years (260 weeks)

Step #	Step Description
1	Calibrate wellhead pressure gauge
2	Calibrate pump discharge pressure gauge

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MAINTENANCE TASK SHEET # PW-2

SSC Potable Water System

No. 2 Wellhouse Complex

Task #1
Frequency - Monthly (4 weeks)

Step #	Step Description
1	Perform Vibration Analysis on motor and pump assembly.

Task #2
Frequency -Semi-Annually (26 weeks)

Step #	Step Description
1	Lubricate water pump bearing with EP-2 grease.

Task #3
Frequency - Annually (52 weeks)

Step #	Step Description
1	Perform Motor Circuit Analysis on 30hp motor.
2	Lubricate motor with EP-2 grease.
3	Perform functional check of chlorine leak detection sensor.
4	Perform functional check of chlorine leak audible warning buzzer.

Task #4
Frequency - Biennial (104 weeks)

Step #	Step Description
1	Lubricate water meter register assembly with EP-2 grease.
2	Perform functional check of normally open gate valves by cycling closed, then open.
3	Perform functional check of normally closed gate valves by cycling open, then closed..

Task #5
Frequency - Five years (260 weeks)

Step #	Step Description
1	Calibrate wellhead pressure gauge.
2	Calibrate pump discharge pressure gauge.

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MAINTENANCE TASK SHEET # PW-3

SSC Potable Water System

No. 3 Wellhouse Complex

Task # 1
Frequency - Monthly (4weeks)

Step #	Step Description
1	Perform Vibration Analysis on motor and pump assemblies.

Task # 2
Frequency - Semi - Annually (26weeks)

Step #	Step Description
1	Lubricate water pump bearings with EP-2 grease.

Task # 3
Frequency - Annually (52 weeks)

Step #	Step Description
1	Perform Motor Circuit Analysis on 40hp motors.
2	Lubricate motors with EP-2 grease.
3	Perform functional check of chlorine leak detection sensor.
4	Perform functional check of chlorine leak audible warning buzzer.
5	Perform functional check of sump pump and float switch.

Task # 4
Frequency - Biennial (104 weeks)

Step #	Step Description
1	Lubricate water meter register assembly with EP-2 grease.
2	Perform functional check of normally open gate valves by cycling closed, then open.
3	Perform functional check of normally closed gate valves by cycling open, then closed..

Task # 5
Frequency - 5 Years (260 weeks)

Step #	Step Description
1	Calibrate all pressure gauges

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MAINTENANCE TASK SHEET # PW-4

SSC Potable Water System

No. 3 Elevated Tank Pumphouse Complex

Task # 1
Frequency - Monthly(4 weeks)

Step #	Step Description
1	Perform Vibration Analysis on motor and pump assemblies

Task # 2
Frequency - Semi - Annually (26 weeks)

Step #	Step Description
1	Lubricate pumps with EP-2 grease.

Task # 3
Frequency - Annually (52 weeks)

Step #	Step Description
1	Perform Motor Circuit Analysis on 15hp motors.
2	Lubricate motors with EP-2 grease.

Task # 4
Frequency - Biennial (104 weeks)

Step #	Step Description
1	Perform functional check of float switch.
2	Perform functional check of normally open gate valves by cycling closed, then open.
3	Perform functional check of normally closed gate valves by cycling open, then closed..

Task # 5
Frequency - 5 Years (260 weeks)

Step #	Step Description
1	Calibrate all pressure gauges

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MAINTENANCE TASK SHEET # SS-1

Domestic Wastewater System

Lift Station, Slide Mounted Pump Type

Task # 1
Frequency - Annually (52 weeks)

Step #	Step Description
1	Inspect open frame relay contacts for pitting or burning (if so equipped)
2	Inspect for effluent level decrease, after pump activated
3	Inspect for no backflow, after pump shutdown
4	Check "water in lubrication" warning light bulb
5	Check Lift Stations with non-corrosion resistant guide rails for corrosion

Task # 2
Frequency - Biennially (104 weeks)

Step #	Step Description
1	Verify gate valve operation by fully opening and closing each valve

Task # 3
Frequency - Quinquennially (260 weeks)

Step #	Step Description
1	Inspect and reverse impeller (grinder) blades, replace if necessary

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MAINTENANCE TASK SHEET # SS-2

Domestic Wastewater System

Lift Station, Secure Mounted Pump Type

Task # 1
Frequency - Weekly (1 week)

Step #	Step Description
1	Check for air leaks in air bubbler system
2	Blow down compressed air tank to remove accumulated water

Task # 2
Frequency -Monthly (4 weeks)

Step #	Step Description
1	Clean dehumidifier air intake, then adjust humidistat to verify unit operation
2	Verify no debris in sump pump inlet, then trip sump pump float switch to verify unit operation

Task # 3
Frequency - Semi-Annually (26 weeks)

Step #	Step Description
1	Lubricate pump bearings with multipurpose grease

Lift Station, Pump Type, continued

Task # 4

Frequency - Annually (52 weeks), continued

Step #	Step Description
1	Replace compressor(s) air filter and checkout operation of air system
2	Inspect open frame relay contacts for pitting or burning
3	Clean sediment out of wet well with fire hose, while pump system is activated
4	During wet well clean out, inspect for drop in wet well effluent level , with pump running
5	During wet well clean out, inspect wet well for no backflow, after pump turns off
6	Check operation of primary and backup pressure switches during wet well clean out
7	Trip alarm limit switch (if equipped) and verify alarm light operation
8	Verify manual operation by placing selector switch in manual position and verifying pump operation
9	Check operation of alternators, by activating manual switches several
	times

Task # 5

Frequency - Biennially (104 weeks)

Step #	Step Description
1	Inspect pump impeller blades for wear, shim as necessary
2	Functionally test gate valves by cycling open and closed

Task # 6

Frequency - Quinquennially (260 week)

Step #	Step Description
1	Perform motor circuit analysis on pump motor to determine motor health

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MAINTENANCE TASK SHEET # SS-3

Domestic Wastewater System

Lagoon System

Task # 1

Frequency - Weekly (1 week)

Step #	Step Description
1	Clear flow obstructions.
2	Remove trash & weeds
3	Monitor hyacinth & duckweed health

Task # 2

Frequency - Annually (52 weeks)

Step #	Step Description
1	Replace Ultra-Violet bulbs *
2	Analyze condition of sludge buildup and remove as necessary
3	Perform point-point functional checkout of control system

* Replacement UV bulbs shall be provided by the contractor.

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MAINTENANCE TASK SHEET # SS-4

Domestic Wastewater System

Septic Tank with Rockreed Filter

Task # 1

Frequency - Semi-Annually (26 weeks)

Step #	Step Description
1	Inspect rockreed filter and remove weeds and other contaminants from area

Task # 2

Frequency - Annually (52 weeks)

Step #	Step Description
1	Replace Ultra-Violet bulbs *

* Replacement UV bulbs shall be provided by the contractor.

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MAINTENANCE TASK SHEET # SS-5

Domestic Wastewater System

Septic Tank

Task # 1

Frequency - Quarterly (13 weeks)

Step #	Step Description
1	Inspect drain field for surfacing effluent. This is indicated by a spongy condition or the growth of green algae

Annex 5

Exhibit 3

Condition Monitoring Inservice Equipment and Acceptance Criteria: Centrifugal Chillers

CONDITION MONITORING
INSERVICE EQUIPMENT AND ACCEPTANCE CRITERIA
CENTRIFUGAL CHILLERS

GENERAL

These specifications provide performance requirements for vibration, oil analysis, current signature analysis, ultrasound and thermography technologies employed in the condition monitoring of centrifugal chiller machinery at Stennis Space Center. The requirements are intended to provide consistent and repeatable results, which can detect deterioration and schedule corrective maintenance action prior to catastrophic failure.

PART I MECHANICAL VIBRATION FOR CENTRIFUGAL CHILLERS ONLY

1.0 HISTORICAL INFORMATION

The current Centrifugal Chiller Program at Stennis Space Center is conducted as outlined in these specifications. Vibration Diagnostic envelopes have been designed to cover all the known forcing functions within the equipment. Alert and Alarm limits where developed based on statistical analysis of the running condition of the various makes and models of centrifugal chillers employed at Stennis and not on any general industry standards.

1.1 MEASUREMENT EQUIPMENT AND MEASUREMENT DATA

Where vibration measurements or surveys are required by contract clause, the Contractor shall adhere to the following criteria as outlined herein.

1.1.1 Consistent and repeatable high quality results are required in the collection of monitoring data, the analysis of the data, the storage and trending of the data, and the deliverable reports of the analysis results by the Contractor or Third Party Contractor.

1.1.2 The Contractor shall employ the use of the existing Centrifugal Chiller database that has been developed exclusively for Stennis Space Center.

1.1.3 The Contractor shall be required to use the existing software system. The software system employed is Computational Systems Inc. Master Trend Network System, latest version.

1.1.4 The Data Collectors employed at Stennis are Computational Systems Single Channel Machinery Analyzer 2115 and Dual Channel Machinery Analyzer 2120. If the Contractor chooses to use different equipment the Machinery Analyzer must be compatible with the present software and meet the requirements of Section 1.1.7.

1.1.5 The Machinery Analyzer employed shall have a calibration date and calibration certificate attached to the unit and supporting calibration firmware. The maximum allowable expiration date for calibration shall be two years from the date of the last calibration date or per the manufacturers recommendations, which ever is more stringent.

1.1.6 All equipment and software shall be maintained current and properly. This shall mean all latest upgrades to equipment and software.

1.1.7 If the Contractor chooses to use different Machinery Analyzers, the contractor shall obtain concurrence from the Contract Officer's Technical Representative (COTR). The equipment shall meet the following minimum criteria and shall be compatible with the existing software:

Single Channel Analyzer
LCD Display
Minimum 2mA constant Current power supply to power permanent mount accelerometers
Input signals: Dynamic and DC signals
Tachometer Input, Autoranging, and Communications
Dynamic Range greater than 70dB
Number of averages 1 to 9999
Analysis Resolution 100 to 3200 lines of resolution
Data Storage Capacity 832 kilobytes
A/D converter 12 bits of accuracy
Upper Frequency 10Hz to 30KHz
Harmonic Distortion less than 55dB

Dual Channel Analyzer
LCD Display
Minimum 2mA constant Current power supply to power permanent mount accelerometers
Input signals: Dynamic and DC signals
Tachometer Input
Dynamic Range greater than 90dB
Number of averages 1 to 9999
Analysis Resolution 100 to 6400 lines of resolution
Upper Frequency 10Hz to 40KHz
Low frequency vibrations down to 0.2Hz
Data Storage 512Kilobytes
Noise Floor 0.5μV for 400 lines resolution at 1000Hz

1.1.8 Historical Data Records, complete data records shall be maintained for a minimum period of five years within the Master Trend Database. After five years any records removed shall be committed to archive tape records and stored in Central Engineering Files. Historical records shall be available for customer review upon request.

1.2 PERSONNEL QUALIFICATIONS

Special personnel qualification is required for technicians and analysts employed in the vibration program

1.2.1 Technicians

The technician shall have a basic knowledge of machine vibration, be capable of routine data collection and periodic monitoring, and be able to perform basic fault diagnosis and condition evaluation. The technician shall have a minimum of one year of vibration experience in the field and a formal short course in basic vibrations or equivalent self-study. A proficiency in math that includes arithmetic and basic algebra is also necessary. The technician shall have a Vibration Specialist Level 1 Certification. An acceptable equivalence for the Level 1 Certification, the technician shall meet the above qualifications but must have a minimum of two years experience, and shall demonstrate his proficiency to the Lead Mechanical Engineer in understanding the basic practices and methods for vibration data collection, fault diagnostics and condition evaluation.

1.2.2 Vibration Analyst

The Analysts shall possess all the skills of the technician and shall be capable of carrying out fault diagnosis, condition evaluation, and acceptance testing. Analysts shall be capable of the following:

- Programming to set up periodic monitoring programs
- Perform minor and major corrective actions, and develop mechanical and electrical repair specifications
- Fundamental knowledge of signal processing, rotor dynamics, vibration control, cascade analysis, dual channel analysis and phase analysis
- Shall have a full programming knowledge of Master Trend with a minimum of five years experience
- Mechanical Engineering degree and a minimum of five years experience in the above listed fields
- Acceptable equivalence, the analyst shall be required to have a Specialist Level 1 and Specialists Level 2 Certification and a minimum of three years vibration experience in the above fields. A Mechanical Engineering degree shall be required plus proficiency in developing mechanical and electrical repair specifications and five years experience in rotating equipment maintenance.

1.3 SENSORS

To obtain consistent and repeatable data the Contractor shall use the type of accelerometers specified for portable data collection. Only one type of model and make of accelerometer shall be used consistently to collect data. The accelerometer shall not be changed out unless it fails. The accelerometer shall be stud mounted to a sound disk and shall be used in conjunction with the vibration data collector, which has the characteristics settings, listed below and sensor frequency response shall conform to the specifications listed below.

1.3.1 Machine Analyzer Settings

- Minimum of 800 lines of resolution for motors and 1600 lines for compressors
- Dynamic range greater than 70dB
- Frequency Response Range 5Hz to 30,000Hz
- Use of Hanning window
- Autoranging

1.3.2 Accelerometer Requirements

- Sensitivity ±5%, 25°C 100mV/g
- Noise at 2Hz 40Noise aPeak Amplitude (24V supply) 80g
  Frequency response ±5% 1.5 to 5,000 Hz
  ±10% 1.0 to 7,000 Hz
  ±3dB 0.5 to 15,000 Hz
- Resonance Frequency, nominal 25KHz

1.4 VIBRATION DATA

The Contractor shall employ the technique of Narrowband Spectral Alarm Envelope Analysis and Alarming for analysis and trending of Centrifugal Chillers.

1.4.1 Narrowband Spectral Alarm Envelope data shall be collected and examined in the following spectral areas:

- Sub-harmonic Frequencies
- Machine Imbalance problems
- Motor shaft rotational frequencies
- Compressor shaft rotational frequencies
- Coupling frequencies
- Gear Mesh frequencies
- Blade Pass frequencies
- Electrical Vibration Problems
  - Rotor Bar Pass frequencies
  - Stator Slot Pass frequencies
  - Line Current frequency

1.4.2 Severity Status Condition Indicator

Acceptable Operation – all narrowband spectra are below the Alert Limits
Unsatisfactory Operation – One-narrowband spectra has exceeded its Alert Limit on any one-measurement point for a period of two data collections.
Unacceptable Operation – Two narrowband spectra have exceeded the alert limit on any one measurement point for a period of two data collections or one narrowband spectra has exceeded the fault limit for a period of two data collections.

1.4.3 Measurement Points are defined under Measurement Points Information established in the software database.

1.4.4 Narrowband Spectra shall be defined in the Frequency Ranges established in the Analysis Parameter Sets.

1.4.5 Alert and Fault limits have been established in the Analysis Parameter Sets and as set forth in this contract.

1.4.6 Alteration on any programmed data outlined in Measurement Point Information, Analysis Parameter Sets, and Alert/Alarm Limits shall not be allowed.

1.4.7 Monitoring Schedule and Reporting

1.4.7.1 Machines whose operations are classed as unsatisfactory shall have the monitoring time schedule as listed in Measurement Point Information changed to half of the previous time limit until adjustments or repairs to the machine are made. The Systems Engineer shall be notified within 10 calendar days and analysis reports shall be filed every 90 days to the Contract Officer's Technical Representative (COTR). In addition, the COTR shall be notified of the time schedule change made to the Measurement Point Information.

1.4.7.2 Machines whose operations are classed as unacceptable shall have the monitoring time schedule changed to every fifteen days or less until repairs are made. The COTR and the Systems Engineer shall be notified immediately of the condition. Reports shall be filed very 30 days until the repairs are made.

1.4.7.3 Within one calendar week, after adjustments or repairs have been made new vibration data shall be collected baselining the results to determine if the unsatisfactory or unacceptable operation condition has been corrected. A report shall be filed within fifteen calendar days with the COTR and the systems engineer. After the machine has been repaired and is running in acceptable mode of operation, the monitor time schedule shall revert to the original programmed time schedule.

1.4.8 Additional Data and Programming Requirements for any Machines Running in Unsatisfactory or Unacceptable Operation

1.4.8.1 All machines regardless of operating speed, when operating in an unsatisfactory condition additional spectrum data of 5Hz to 500Hz spectrum shall be acquired with a minimum of 1600 lines of resolution to analyze balance and electrical line frequency faults.

1.4.8.2 All machines regardless of operating speed, when unsatisfactory conditions exist in one of the narrowband spectral envelopes additional data shall be acquired. The data shall be acquired encompassing the narrowband spectral envelope in which the fault occurs. Data shall be acquired with a minimum of 1600 lines of resolution.

1.4.8.3 The repeatability of the measured data is dependent on the number of averages collected to calculate the spectrum. Random noise patterns must be kept to a minimum. The number of averages shall be set at a minimum of 16 averages.

1.4.8.4 The use of UltraSound Technology shall also be employed for additional confirmation of any gear or bearing related faults. The sound waves shall be recorded stored and analyzed in comparison to established baseline sound waves for the particular machine.

1.4.9 Vibration Monitoring Sound Disc Locations

1.4.9.1 For all Centrifugal Chillers both new and existing provided under the contract, the Contractor shall be responsible for maintaining the

existing Stud Mounted Sound Discs and the placement of Stud Mounted Sound Discs on new equipment.

1.4.9.2 Stud Mounted Sound Discs shall be a minimum of 1" in diameter Manufactured from a 400 series magnetic stainless steel. Have a surface finish of 32 micro-inches RMS and be attached to the machine surface by a high-density molecular bonding agent. Bonding agent shall have a solidified density of 1.63 – 1.69g/cm³ and a tensile shear strength of 2,800 psi. The contractor has the option of machining the case in order to achieve a flat and smooth spot, which meets the same tolerances as the sound disc.

1.4.9.3 The Contractor shall insure monitoring locations are positioned on structural/casing members. The Contractor shall install sound discs radial to the input and output shafts in the horizontal and vertical planes. Additional sound discs shall be installed in the axial planes as close to the input and output shafts as possible.

1.5 VIBRATION CRITERIA FOR REPORTING

1.5.1 General - All vibration spectra and waveforms shall be analyzed at the following forcing frequencies:

- Sub-harmonic frequencies (0.2 to 0.8X running speed)
- 1x running speed
- 2x running speed
- All multiples of running speed that cover:
  - ✓ Looseness
  - ✓ Roller bearing defects
  - ✓ Resonance
  - ✓ Gear Mesh
  - ✓ Blade Pass
  - ✓ Couplings
  - ✓ Rotor Bar Pass
  - ✓ Stator Slot Pass
  - ✓ Electrical line frequency (60Hz and 120Hz) and sidebands thereof

1.6 DEVELOPING VIBRATION CRITERIA FOR NEW CENTRIFUGAL CHILLERS

1.6.1 Where the equipment manufacturer does not provide specific vibration criteria the following procedure shall be used in developing vibration criteria.

1.6.1.1 Obtain all nameplate data.
1.6.1.2 Obtain overall and envelop vibration spectra on similar machines. Difference in baseplate stiffness and mass shall be taken into account since this will effect the vibration signature.
1.6.1.3 Calculate all forcing frequencies, i.e. bearing defects, vane pass, gear mesh, electrical rotor bar and slot pass, baseplate resonance, coupling, etc.
1.6.1.4 Construct a mean vibration signature for similar machines.
1.6.1.5 Collect vibration data on the new equipment at all the listed positions.
1.6.1.6 Note any deviations from the guidelines and determine if the unknown frequencies are related to resonance frequency from the piping system, transmitted from other machinery, or baseplate resonance, etc.
1.6.1.7 Compare the vibration signature to the mean vibration signature of similar equipment as outlined above as well as with criteria and guidelines provided in this guide.
1.6.1.8 New equipment should have overall vibration and envelope signatures that are no worse than similar pieces of equipment that is operating in an satisfactory condition.

1.7 CENTRIFUGAL CHILLER VIBRATION STANDARDS

1.7.1 The following vibration standards as shown in Tables 1 through 8 shall be used to establish centrifugal chiller condition operating status for hermetic and non-hermetic motors and compressors.
1.7.2 All testing shall be conducted at 50% or higher load condition.
1.7.3 Hermetic and Non-hermetic centrifugal chillers shall be classified into three groups based on compressor speed.

- 3,000 to 4,999 RPM
- 5,000 to 19,999 RPM
- 20,000 and up RPM

TABLE 1
NON-HERMETIC
3,000 – 4,999 RPM

Frequency x RPM Motor Component	Maximum Amplitude Unacceptable Operation (in/sec Peak)	Maximum Amplitude Unsatisfactory Operation (in/sec Peak)
0.4 - 1.25	0.2	0.1
2X	0.15	0.1
3-4X	0.15	0.1
5-10X	0.15	0.1
11-20X	0.15	0.1
20-70X	0.08	0.05
Line Frequency 60Hz	Not detectable	Not detectable
2X Line Frequency (120Hz)	0.1	0.05
Overall Acceleration	3.0 G's	1.5 G's

TABLE 2
HIGH FREQUENCY DATA 0 to 120 ORDERS

Frequency x RPM Compressor Component	Maximum Amplitude Unacceptable Operation (in/sec Peak)	Maximum Amplitude Unsatisfactory Operation (in/sec Peak)
1X	0.2	0.1
2X	0.15	0.1
3-10X	0.15	0.1
11-20X	0.15	0.1
20-52X	0.15	0.1
52-70X	0.1	0.08
Rotor Bar/Stator	0.1	0.08
Gear Mesh (1X)	8.0 G's	5.0 G's
Overall Acceleration	8.0 G's	5.0 G's

TABLE 3
HERMETIC
3,000 – 4,999 RPM

LOW FREQUENCY 0 TO 70.5 ORDERS

Frequency xRPM Motor & Compressor Components	Maximum Amplitude Unacceptable Operation (in/sec Peak)	Maximum Amplitude Unsatisfactory Operation (in/sec Peak)
Sub-Harmonics	0.125	0.08
1X	0.15	0.1
2X	0.15	0.1
3-8X	0.15	0.1
9-24X	0.15	0.1
Line Frequency (60Hz)	Not detectable	Not detectable
2X Line Frequency (120Hz)	0.1	0.05
Acceleration Overall	3.0 G's	1.5 G's

TABLE 4
HIGH FREQUENCY 0 TO 101 ORDERS

Frequency xRPM Motor Component	Maximum Amplitude Unacceptable Operation (in/sec Peak)	Maximum Amplitude Unsatisfactory Operation (in/sec Peak)
Rotor Bars/Slots	0.1	0.05

TABLE 5
HERMETIC
5,000 – 19,999 RPM

Frequency x RPM Motor Component	Maximum Amplitude Unacceptable Operation (in/sec Peak)	Maximum Amplitude Unsatisfactory Operation (in/sec Peak)
Sub-Harmonics	0.1	0.07
1X	0.18	0.125
2X	0.15	0.1
3-4X	0.15	0.1
5-20X	0.15	0.1
Acceleration Overall	8.0 G's	4.0 G's
Rotor Bars/Slots	0.1	0.05

TABLE 6
HERMETIC
5,000 – 19,999 RPM

Frequency x RPM Compressor Component	Maximum Amplitude Unacceptable Operation (in/sec Peak)	Maximum Amplitude Unsatisfactory Operation (in/sec Peak)
Sub-Harmonics	0.1	0.07
1X	0.18	0.125
2X	0.15	0.1
3-4X	0.15	0.1
5-20X	0.15	0.1
Gear Mesh (1X)	10 G's	7.0 G's
Gear Mesh (2X)	4.0 G's	2.5 G's
Acceleration Overall	8.0 G's	5.0 G's

TABLE 7
HERMETIC
20,000 RPM and UP

Frequency x RPM Motor Component	Maximum Amplitude Unacceptable Operation (in/sec Peak)	Maximum Amplitude Unsatisfactory Operation (in/sec Peak)
Sub-Harmonics	0.13	0.08
1X	0.35	0.25
2X	0.30	0.225
3-4X	0.20	0.15
5-20X	0.15	0.10
Gear Mesh (1X)	10.0 G's	7.0 G's
Gear Mesh (2X)	2.0 G's	1.5 G's
Acceleration Overall	3.0 G's	1.5 G's
Rotor Bars/Slots	0.1	0.05

TABLE 8
HERMETIC
20,000 RPM and UP

Frequency x RPM Compressor Component	Maximum Amplitude Unacceptable Operation (in/sec Peak)	Maximum Amplitude Unsatisfactory Operation (in/sec Peak)
Sub-Harmonics	0.13	0.08
1X	0.35	0.25
2X	0.30	0.225
3-4X	0.20	0.15
5-20X	0.15	0.10
Gear Mesh (1X)	20.0 G's	14.0 G's
Gear Mesh (2X)	5.0 G's	3.5 G's
Acceleration Overall	20.0 G's	14.0 G's

PART II MOTOR CURRENT SIGNATURE ANALYSIS FOR CENTRIFUGAL CHILLERS AND RECIPROCATING CHILLERS

2.0 EQUIPMENT REQUIRING CURRENT SIGNATURE ANALYSIS

Centrifugal Chillers and Reciprocating Chillers shall have current signature analysis performed.

2.1 CONTRACTOR SHALL ADHERE TO THE FOLLOWING CRITERIA AS OUTLINED HEREIN

2.1.1 Consistent and repeatable high quality results are required in the collection of monitoring data, and storage and trending of the data, and deliverable reports of the analysis results by the Contractor or Third Party Contractor.

2.1.2 The contractor shall employ the use of the existing Centrifugal Chiller Electric Motor Analysis Database that has been developed for Stennis Space Center.

2.1.3 The Contractor shall be required to use the existing software system. The software system employed is Computational Systems Inc., Master Trend Network System MotorView, and the latest version.

2.1.4 The data collectors employed to collect this data are Computational Systems Inc., Single Channel Analyzer 2115 or the Dual Channel Analyzer 2115.

2.1.5 Calibration and maintenance service to the equipment and software shall be as outlined in Part I Mechanical Vibrations.

2.1.6 The data collection shall be performed with the motor loaded at 75% or greater.

2.1.7 The Contractor shall analyze the motor for the following:

- Stator Eccentricity, Shorted Laminations and Loose Iron
- Eccentric Rotor
- Rotor Bar problems
- Thermal Bow induced By Uneven Localized Heating of the Rotor
- Electrical Phasing Problems
- Torque Pulse Problems

2.1.8 The collected data shall be used in conjunction with the vibration data for full electrical and mechanical analysis of the Centrifugal Chillers.

2.1.9 Historical Data Records, complete data records shall be maintained for a minimum period of five years within the Master Trend Motor View database. After five years any records removed shall be committed to archive tapes and stored in Central Engineering files.

2.2 PERSONNEL QUALIFICATIONS

Personnel Qualifications shall be as outline in Part I Mechanical Vibrations.

2.3 CURRENT SIGNATURE ANALYSIS DATA

The Contractor shall employ the technique of Narrowband Spectral Alarm Envelope Analysis and Alarming for analysis and trending of the Centrifugal Chiller Motors for severity assessment of electrical motor problems.

2.3.1 Narrowband Spectral Alarm Envelope data shall be collected and examined in the following spectral areas:

- 1X Line Frequency including second and third harmonic frequency ranges
- Rotor Bar Pass Frequency
- Stator Slot Pass Frequency
- Air Gap Frequency
- Static Eccentricity
- Dynamic Eccentricity

2.3.2 Additional information as outlined in Part I Mechanical Vibration, Sections 1.4.2 through 1.4.7 shall apply to this portion of the contract. Section headings are as follows:

- Severity Status Condition
- Measurement Point
- Narrowband Spectra
- Alert and Fault Limits
- Program Alteration
- Monitoring Scheduling and Reporting

PART III LUBRICANT AND WEAR PARTICLE ANALYSIS

3.0 GENERAL

These specifications provide performance requirements for oil analysis employed in the condition monitoring of centrifugal and reciprocating chiller machinery at Stennis Space Center. The requirements are intended to provide consistent and repeatable results, which can detect deterioration and schedule corrective maintenance action prior to catastrophic failure.

3.1 MEASUREMENT EQUIPMENT AND MEASUREMENT DATA

3.1.1. Where oil analysis is required by contract clause, the Contractor shall adhere to the following criteria as outlined herein.

3.1.1.1.Consistent and repeatable high quality results are required in the collection and handling of oil samples, the storage and trending of the data, and the deliverable reports of the analysis results by the Contractor or Third Party Contractor.
3.1.1.2.The Contractor shall employ the use of the existing Centrifugal Chiller Oil Analysis Database that has been developed exclusively for Stennis Space Center.
3.1.1.3.The Contractor shall be required to use the existing software system. The software system employed is Computational Systems, inc., Master Trend Oilview Oil Analysis, and the latest version.
3.1.1.4.The contractor shall select whether to test the samples with the existing 5100 Oil Analyzer equipment from Computational Systems, Inc. or send the samples to an independent lab provided all of the previous requirements are satisfied.
3.1.1.5.The oil grids shall be calibrated per the manufacturers recommendations or as described below, which ever is more stringent. Calibration shall be done on semi-annual basis. Grids shall be calibrated with calibration fluid Parts B510001 and B510003 from Computational Systems, Inc.

3.2 PERSONNEL QUALIFICATIONS

Special personnel qualification is required for technicians and analysts employed in the oil analysis program.

3.2.1. Technicians

The technician shall have basic oil analysis knowledge and be able to perform basic fault diagnosis and condition testing. The technician shall have a minimum of one year of oil analysis and data collection experience in the field and a formal oil analysis short course or equivalent self-study.

3.2.2. Oil Analyst

The analysts shall possess all the skills of the technician and shall be capable of carrying out fault diagnosis, condition evaluation, and acceptance testing. Analysts shall be capable of the following:

- Set up of periodic monitoring programs
- Perform minor and major corrective actions
- Fundamental knowledge of centrifugal chiller internal construction and Lubricants
- Engineering degree and a minimum of two years oil analysis experience in the above listed fields.

3.3 TESTING PROCEDURES

3.3.1 Sampling Point Locations

3.3.1.1 Oil samples shall be collected as follows:

- Collect from established labeled ports at either the sump tank or the oil supply line before the filter
- Samples must be taken while the centrifugal chiller is in operation
- Extreme care shall be taken to avoid oil contamination
- Only new factory clean bottles shall be used
- Minimum volume oil sample size shall be 4oz

3.3.2. Monitoring Schedule

3.3.2.1 Samples shall be collected and tested on prescribed cycles. When a testing parameter falls into an unsatisfactory condition, sampling time shall be reduced to once every three months until the oil is changed or a repair has been made to the machine correcting a problem cause.

3.3.3. Sample Handling

3.3.3.1 Refrigerant shall be removed from all oil samples prior to testing. This shall apply to samples tested in-house or at an independent laboratory.

3.3.4 Oil Criteria Readings Required

3.3.4.1 The following 5100 Oil Analyzer Test (or approved equal) shall be performed on each sample.

5100 OIL ANALYZER LUBRICANT TESTS

TEST	TESTING FOR	INDICATES
OIL LIFE INDEX	Lube degradation, Lube System Contamination	Overall, condition of the lubricant.
CHEMICAL INDEX	Lube Degradation, Lube system Contamination	Oil degradation
CONTAMINANT INDEX	Lube system Contamination, Mechanical Wear, Water	Presence water and/or solids. Contamination or degradation
FERROUS INDEX	Presence of iron	Mechanical wear
LARGE CONTAMINANT INDICATOR	Ferrous particles	Mechanical wear
WATER CONTENT	Water	Degradation, leak, Oxidation, emulsion
VISCOSITY	Lubricating quality	Presence of refrigerant, Contamination, degradation

Table 1 – 5100 OIL ANALYZER LUBRICANT TESTS

3.3.5 Oil Criteria Status for Reporting

3.3.5.1 The following Oil Analysis Standards as shown in Table 2 shall be used to establish centrifugal chiller oil conditions:

5100 OIL ANALYZER RESULTS AND INTERPRETATIONS

TEST	ACCEPTABLE CONDITION	UNSATISFACTORY CONDITION	UNACCEPTABLE CONDITION
OIL LIFE INDEX	<13	13 TO 18	>18
CHEMICAL INDEX	<5	5 TO 7	>7
CONTAMINANT INDEX	<12	12 TO 18	>18
FERROUS INDEX	<10	10 TO 20	>20
LARGE CONTAMINANT INDICATOR	"NO LARGE INDICATIONS"	"LARGE FERROUS" "LARGE NON-FERROUS" "DROPLETS"	N/A
WATER CONTENT	<300 PPM	300 TO 500 PPM	>500 PPM
VISCOSITY CHANGE FROM BASELINE	<20%	20 TO 30%	>30%

Table 2 - 5100 OIL ANALYZER RESULTS AND INTERPRETATIONS

3.3.5.2 When analysis is performed by an independent lab, a complete spectro-chemical analysis shall be required. The following minimum information shall be supplied:

Total Acid Number -TAN
Water (PPM)
Viscosity (cSt at 40 Deg C)
Wear Metals (Fe, Cr, Pb, Cu, Sn, Al, Ni, and Ag in PPM)
Additives (Mg, Ca, Ba, P, Zn, and Mo in PPM)
Contamination (>2, 5, 15, 25 , 50, and 100 μm ; ISO 2, 5, and 15)

Including overall condition status of the sample as described in Table 3.

STATUS RANKING TYPICALLY USED BY INDEPENDENT LABS

STATUS	MEANING	
1	Normal	Acceptable Condition
2	Closer Observation	Acceptable Condition
3	Start of a Problem	Unsatisfactory Condition
4	Take Immediate Action	Unacceptable Condition
5	Critical, Immediate Failure	Unacceptable Condition

TABLE 3 - STATUS RANKING TYPICALLY USED BY INDEPENDENT LABS

3.3.6 Lab Analysis and Follow-up Analysis

3.3.6.1 When an oil sample has been analyzed by an independent lab and reaches a status level of 3 the monitoring period shall be reduced to once every three months. The accelerated time schedule shall remain in effect until the oil is changed.
3.3.6.2 When an oil sample is analyzed using the in-house analysis equipment (Oil View 5100), and anyone of the tests indicated in Table 2 produces an unsatisfactory condition the monitoring time schedule shall be reduced to once every three months. The accelerated time schedule shall remain in effect until the oil is changed.
3.3.6.3 When an oil sample is analyzed using the in-house analysis equipment (Oil View 5100), and anyone of the tests indicated in Table 2 produces an unacceptable condition a second oil sample must be taken. The second oil sample shall be re-tested the same as the first oil sample. If the results are repeatable than a third oil sample shall be taken and sent to an independent oil analysis lab. A full spectrochemical analysis shall be performed examining for contents as outlined in Section 3.3.5.2. If the sample results returned have an unacceptable status, the time scheduling period shall be reduced to once every three months. All future oil samples taken shall be sent to an independent lab for analysis until the oil is changed.
3.3.6.4 When an oil sample is analyzed using the in-house analysis equipment (Oil View 5100), and anyone of the tests indicated in Table 2 produces an unsatisfactory condition a second oil sample must be taken. The second oil sample shall be re-tested the same as the first oil sample. If the results are repeatable than a third oil sample shall be taken and sent to an independent oil analysis lab. A full spectrochemical analysis shall be performed examining for contents as outlined in Section 3.3.5.2. When the sample results returned have an unsatisfactory status, the following procedure shall apply:

- If a failing part is causing the oil contamination, corrective action shall be taken immediately. Oil shall be changed out after corrective action. Interaction with other technologies shall be used to locate the failing part.
- If the oil has degraded, than the oil shall be changed out immediately.

- The oil-monitoring schedule shall be reduced to once a month until the oil is changed.

3.3.6.6 When water is present in quantities between 300 and 500 PPM, a new filter dryer shall be installed within 30 days. Monitoring time schedules shall not be changed unless the repair is not effected within 30 days.
3.3.6.7 When the oil is changed the filters shall be changed.

3.3.7 Oil Change Criteria

3.3.7.1 When an oil sample has been analyzed by an independent lab the oil shall be changed when the status reaches the unacceptable, level 4 or higher (refer to Table 3).

3.3.8 New and Existing Centrifugal Chiller Oils

3.3.8.1.Only OEM recommended oils shall be added to the machines. No substitutes shall be allowed.

3.3.8.2 All centrifugal chillers site-wide must have labels specifying the required OEM Oil.

3.3.9 Testing New Oil for Product Acceptance and Baseline

3.3.9.1 All new shipments of OEM Oil shall be tested. A sample from each container must be collected and analyzed for acceptance. Viscosity readings are to be taken and compared with their respective data sheets. If the oil analysis does not met the manufacturers data sheets criteria it shall be rejected and returned to the manufacturer/ distributor.
3.3.9.2 Whenever oil is changed in a machine, the new accepted oil becomes the baseline oil for that machine. Baseline testing will determine changes that occur to the oil while in operation. The 5100 Oil Analysis program requires the testing of baseline oil and uses this information to calculate the oil life and chemical indexes of the oil sample from the machine.

3.3.10 Time-Frame to Collect and Analyze Sample from Machines After Oil Has Been Changed

3.3.10.1Within one week after the oil has been changed, a sample shall be collected and analyzed. Samples will be taken every six months thereafter.

3.3.11 Reports

3.3.11.1 The Contractor shall issue Individual Oil Status Reports once a year on the status of each individual chiller. Reports shall be issued between October and December so those repairs can be effected during the winter months.
3.3.11.2 Oil Reports shall include, but not be limited to, Trivector Plots indicating wear, contamination and chemistry index.
3.3.11.3 Notification Reports shall be issued within ten calendar days on oil analysis that is rated as unacceptable. Notification reports shall be issued to the COTR and the Systems Engineer. The report shall be issued every thirty days until the problem has been corrected.

PART IV THERMOGRAPHY

The Contractor shall perform a Thermographic Survey on all electrical distribution equipment for the centrifugal chillers.

4.0 GENERAL

These specifications provide performance requirements for Thermal Imaging work employed in the condition monitoring of centrifugal chiller machinery at Stennis Space Center. The requirements are intended to provide consistent and repeatable results, which can detect deterioration and schedule corrective maintenance action prior to catastrophic failure.

4.1 THERMAL IMAGING EQUIPMENT AND MEASUREMENT DATA

4.1.1 Thermal Imaging Surveys can be conducted in the 3 to 5 micron ranges or the 8 to 15 micron ranges.
4.1.2 Adjustments shall be made for the objects Emissivity.
4.1.3 Thermal camera employed shall have a minimum spectral resolution of 1.8 milli-radians horizontal and vertical for 20° minimum horizontal field of view.
4.1.4 Thermal Camera shall be capable of processing and storing thermal image data produced by the thermal camera.
4.1.5 The contractor shall be required to use the existing software system to analyze thermal data. The software system employed is Inframetrics TherMonitor 95
4.1.6 Thermal data collection equipment employed at Stennis is Inframterics Model 760 Long Wave High performance Radiometer. If the contractor chooses to use, an equivalent Radiometer the equipment must be compatible with the present software.
4.1.7 The Thermal Imaging Camera employed shall have a calibration date and calibration certificate attached to the unit and supporting calibration firmware. The maximum allowable expiration date for calibration shall be two years from the previous date. The contractor shall be responsible for all costs in maintaining the equipment calibration.
4.1.8 Historical Data Records, complete data records shall be maintained for a minimum period of 10 years of thermal imaging pictures taken as required by this contract. The thermal images shall be stored in the Thermal Imaging Database.

4.2 PERSONNEL QUALIFICATIONS

Special personnel qualification is required for technicians and analysts employed in the thermal imaging program.

4.2.1 The technician shall have a basic knowledge of thermographic techniques. The techniques shall include:

- Basic theory of thermography and its application
- Hands-on use of thermal imaging equipment
- Concepts of infrared imaging that apply to predictive maintenance
- Elements of proper image acquisition and documentation
- Documenting findings
- The technician shall have a minimum of two years thermographic experience in the field and a formal thermographic short course or equivalent self-study

In lieu of the above, an acceptable equivalence shall be a Level 1 Certification certified by ANST Thermographer at Level III. Technician shall also have a minimum of one-year experience prior to taking the Level 1 exam.

4.2.2 The Analysts shall possess the skills of the technician and shall be capable of carrying out a fault diagnosis, condition evaluation and acceptance testing. Analysts shall be capable of the following:

- Database work to maintain the thermal imaging files
- Processing of the thermal images with existing in-house Thermonitor 95 software
- Fundamental knowledge of electrical component construction, radiating surfaces, transmission media, radiometer accuracy and response, and surface emissive power
- Develop electrical repair specifications
- Mechanical or Electrical Engineering Degree and a minimum of three years experience in Thermography and five years experience in maintenance.

In lieu of the above, an acceptable equivalence shall be a Level 1 Certification certified by ANST Thermographer at Level III, a Mechanical or Electrical Engineering Degree, two years thermographic experience and five years experience in maintenance.

4.3 ELECTRICAL THERMOGRAPHIC SURVEY REQUIREMENTS

4.3.1 The survey shall start from the chiller main breaker and follow all wiring and components to the control cabinets and through to the pot head connections on the chillers. The thermographic survey must be conducted

once a year before the start of the major cooling season, between 15 March and 15 May.

4.4 MECHANICAL THERMOGRAPHIC SURVEY REQUIREMENTS

4.4.1 The Contractor shall perform a yearly Thermographic Survey on all insulated piping and ductwork within the Centrifugal Chiller Mechanical Equipment rooms. The contractor shall correct any voids in the piping insulation either existing or created by any maintenance work crews at no additional cost to the procuring agency. The contractor shall resurvey repaired areas to assure proper corrective action has been taken.

4.5 EQUIPMENT OPERATING REQUIREMENTS

4.5.1 Centrifugal compressor loading shall be 50% or greater. No thermographic surveys will be allowed for loading less than 50%.
4.5.2 Equipment must be running for a minimum time of one hour before any thermographic surveys can be performed.

4.6 STANDARDS AND CONDUCTOR FAULT LIMITS

4.6.1 For all major electrical components (breakers, starters, disconnects, etc.) conductors temperatures shall be surveyed and the image recorded and stored in the Thermal Imaging database. Any conductor temperature differences between phases on an individual component in excess of 10°F shall be classified as unacceptable operation and shall be corrected by the contractor at no expense to the procuring agency.
4.6.2 Power Cable derating shall be a part of cable protection Thermal Imaging Program as described ANSI/IEEE Standard 242-1986 Chapter 8 or later. The above shall apply to all power conductor cables surveyed. Sections in particular relating to Temperature Derating Factor, Normal Loading Temperature and Cable Current and Temperature shall apply. The contractor shall resurvey repaired areas to assure proper corrective action has been taken.
4.6.3 Absolute Temperature Criteria and Temperature Derating Factors based on ANSI/IEEE and NEMA shall be applied to all electrical system components surveyed. The contractor shall resurvey repaired areas to assure proper corrective action has been taken.

PART V ULTRASOUND

The Contractor shall perform ultrasonic electrical and mechanical inspection of the Centrifugal Chillers.

5.0 GENERAL

These specifications provide performance requirements for Ultrasonic work employed in the condition monitoring of centrifugal chiller machinery at Stennis Space Center. The requirements are intended to provide consistent and repeatable results, which can detect deterioration and schedule corrective maintenance action prior to catastrophic failure.

5.1 ELECTRICAL ULTRASOUND SURVEY REQUIREMENTS

5.1.1 The survey shall start from the chiller main breaker through the control cabinet and to the chiller pothead connection. The survey must be conducted once a year before the start of the major cooling season, between 15 March and 15 May.
5.1.2 The contractor shall inspect any molded case breakers and bus bars employed with any of the chiller electrical systems.
5.1.3 Electrical scanning shall be performed at 40KHz band range on a Log scale.
5.1.4 Inspection shall be performed for corona arcing with sound quality and sound level comparisons made to similar equipment.
5.1.5 All acoustical problems shall be recorded. Data shall be transferred to FFT Spectral analysis software. Data shall be measured and compared to similar existing equipment.
5.1.6 Data shall be stored and a report filed with the COTR.

5.2 MECHANICAL ULTRASOUND SURVEY REQUIREMENTS

5.2.1 An ultra sound survey shall be performed on all Centrifugal Chiller refrigerant piping. Leakage shall be reported and repaired immediately. The contractor shall resurvey any repaired areas to assure proper corrective action has been taken.

5.3 ULTRASONIC EQUIPMENT AND MEASUREMENT DATA

5.3.1 The ultrasonic equipment employed at Stennis is UE Systems UltraProbe 2000 and FFT Spectral Analysis software is Sound Technology SpectraPro.
5.3.2 The contractor shall be required to use the existing ultrasonic equipment and software system.
5.3.3 Historical Data Records, complete data record shall be maintained for a minimum period of 10 years of sound spectrums. All spectrum data shall be stored within the audio file database.

5.4 PERSONNEL

Special personnel qualification is required for the personnel employed in the ultrasound program.

5.4.1 Personnel shall have a strong working knowledge of Audio Spectrum Analysis, Fast Fourier Transformation and signal processing.
5.4.2 A minimum of two years experience working with audio sound software programs shall be required.

PART VI DELIVERABLE REPORTS

6.0 INDIVIDUAL STATUS REPORTS

The Contractor shall issue Individual Status Reports once a year on the status of each individual chiller. Reports shall be issued between October and December so those repairs can be effected during the winter months.

6.1 INDIVIDUAL STATUS REPORT REQUIREMENTS

6.1.1 Individual status reports shall include information on:

- Oil Analysis
- Vibration Analysis
- Current Signature Analysis
- Thermographic Analysis
- Ultrasound Analysis

6.1.2 Oil Reports shall include, but not be limited to, Trivector Plots indicating wear, contamination and chemistry index.
6.1.3 Vibration Analysis Reports shall include vibration spectrums and or trend charts for a minimum of one point on the motor and one point on the compressor. The report shall also contain a summary on the overall condition of the individual centrifugal chiller. In addition to the above, notification reports shall be issued as outlined in Part I Mechanical Vibration when a centrifugal chiller is operating in an unsatisfactory or unacceptable mode.
6.1.4 Current Signature Analysis Report shall be included in the overall summary report on the centrifugal chiller.
6.1.5 Thermographic Analysis Report shall state any electrical and mechanical repairs that where performed due to thermal imaging finds.
6.1.6 Ultrasound Analysis Report shall state any repairs or confirmations to problems found using other technologies due to survey work performed with the ultrasonic detector.

GENERAL

These specifications to provide performance requirements for vibration, oil analysis, and current signature analysis, technologies employed in the condition monitoring of rotating machinery at Stennis Space Center. The requirements are intended to provide consistent and repeatable results, which can detect deterioration and schedule corrective maintenance action prior to catastrophic failure.

PART VII MECHANICAL VIBRATION FOR ROTATING EQUIPMENT

7.0 HISTORICAL INFORMATION

The Rotating Equipment Program at Stennis Space Center is conducted as outlined in these specifications. Vibration Diagnostic envelopes have been designed to cover all the known forcing functions within the equipment. Alert and Alarm limits where developed based on statistical analysis of the running condition of the various makes and models of rotating equipment employed at Stennis and not on any general industry standards.

7.1 MEASUREMENT EQUIPMENT AND MEASUREMENT DATA

Vibration measurement equipment and measurement data needed to provide consistent and repeatable results.

7.1.1 Consistent and repeatable high quality results are required in the collection of monitoring data, the analysis of the data, the storage and trending of the data, and the deliverable reports of the analysis results.
7.1.2 Existing rotating equipment databases have been developed exclusively for Stennis Space Center.
7.1.3 The software system employed at Stennis Space Center is Computational Systems Inc. Master Trend Network System, latest version.
7.1.4 The Data Collectors employed at Stennis are Computational Systems Single Channel Machinery Analyzer 2115 and Dual Channel Machinery Analyzer 2120. If Any third party Contractor chooses to use different equipment the Machinery Analyzer must be compatible with the present software and meet the requirements of Section 7.1.7.
7.1.5 All Machinery Analyzers shall have a calibration date and calibration certificate attached to the unit and supporting calibration firmware. The maximum allowable expiration date for calibration is two years from the date of the last calibration date or per the manufacturer recommendations, which ever is less stringent.

7.1.6 Maintain all equipment and software to current issues and proper condition. This means all the latest upgrades to equipment and software.
7.1.7 If any third party contractor chooses to use different Machinery Analyzers, obtain concurrence from the Contract Officer's Technical Representative (COTR). The following minimum criteria is employed at Stennis Space Center and meets compatible requirements with the existing software:

Single Channel Analyzer
LCD Display
Minimum 2mA constant Current power supply to power permanent mount accelerometers
Input signals: Dynamic and DC signals
Tachometer Input, Autoranging, and Communications
Dynamic Range greater than 70dB
Number of averages 1 to 9999
Analysis Resolution 100 to 3200 lines of resolution
Data Storage Capacity 832 kilobytes
A/D converter 12 bits of accuracy
Upper Frequency 10Hz to 30KHz
Harmonic Distortion less than 55dB

Dual Channel Analyzer
LCD Display
Minimum 2mA constant Current power supply to power permanent mount accelerometers
Input signals: Dynamic and DC signals
Tachometer Input
Dynamic Range greater than 90dB
Number of averages 1 to 9999
Analysis Resolution 100 to 6400 lines of resolution
Upper Frequency 10Hz to 40KHz
Low frequency vibrations down to 0.2Hz
Data Storage 512Kilobytes
Noise Floor 0.5μV for 400 lines resolution at 1000Hz

7.1.8 Historical Data Records, complete data records are maintained for a minimum period of five years within the Master Trend Database. After five years any records removed are committed to archive tape records and stored in Central Engineering Files. All historical records are available for customer review upon request.

PERSONNEL QUALIFICATIONS

Special personnel qualification is required for technicians and analysts employed in the vibration program

7.2.1 Technicians

The technicians are required to have a basic knowledge of machine vibration, are capable of routine data collection and periodic monitoring, and able to perform basic fault diagnosis and condition evaluation. The technicians have a minimum of one year of vibration experience in the field and a formal short course in basic vibrations or equivalent self-study. A proficiency in math that includes arithmetic and basic algebra is also necessary. An acceptable alternate to the above is the technician can have a Vibration Specialist Level 1 Certification. An acceptable equivalence for the Level 1 Certification, the technician meets the above qualifications but has a minimum of two years experience, and can demonstrate his proficiency to the Lead Mechanical Engineer in understanding the basic practices and methods for vibration data collection, fault diagnostics and condition evaluation.

Vibration Analyst

The Analysts possess all the skills of the technician and is capable of carrying out fault diagnosis, condition evaluation, and acceptance testing. Analysts are capable of the following:

Programming to set up periodic monitoring programs
Perform minor and major corrective actions, and develop mechanical and electrical repair specifications
Fundamental knowledge of signal processing, rotor dynamics, vibration control, cascade analysis, dual channel analysis and phase analysis
Has full programming knowledge of Master Trend with a minimum of five years experience
Mechanical Engineering degree and a minimum of five years experience in the above listed fields
Acceptable equivalence, the analyst can have a Specialist Level 1 and Specialists Level 2 Certification and a minimum of three years vibration experience in the above fields. A Mechanical Engineering degree is required plus proficiency in developing mechanical and electrical repair specifications and five years experience in rotating equipment maintenance.

SENSORS

Consistent and repeatable data is obtained by using the following type of accelerometers specified for portable data collection. Only one type of model and make of accelerometer must be used consistently to collect data. The accelerometer can not be changed out unless it fails. The accelerometer uses a rare earth type magnet to mount to the sound disk and is used in conjunction with the vibration data collector who has the characteristics settings listed. Sensor frequency response conform to the specifications listed below.

7.3.1 Machine Analyzer Settings

Minimum of 800 lines of resolution for all rotating equipment
Dynamic range greater than 70dB
Frequency Response Range 5Hz to 30,000Hz
Use of Hanning window
Autoranging

7.3.2 Accelerometer Requirements

Sensitivity ±5%, 25°C 100mV/g
Noise at 2Hz 40υg/√Hz
Peak Amplitude (24V Supply) 80g
Frequency response ±5% 1.5 to 5,000Hz
±10% 1.0 to 7,000Hz
±3dB 0.5 to 15,000Hz
Resonance Frequency, nominal 25KHz

VIBRATION DATA

The technique of Envelope-band Spectral Alarm Analysis, Alarming and Trending of rotating equipment is employed at Stennis Space Center.

7.4.1 Envelope-band Spectral Alarm Envelope data is collected and examined in the following spectral areas applicable to the type of rotating equipment being examined:

Sub-harmonic Frequencies
Machine Imbalance problems
Motor shaft rotational frequencies
Alignment and Soft Foot Condition frequencies
Coupling frequencies
Belt Frequencies
Gear Mesh frequencies
Blade Pass frequencies
Electrical Vibration Problems
Rotor Bar Pass frequencies
Stator Slot Pass frequencies
Line Current frequency
Lubrication Problems

Severity Status Condition Indicator

Acceptable Operation – all envelope-band spectra are below the Alert Limits
Unsatisfactory Operation – Alert Limits are exceeded in one or more of the envelope-bands.
Unacceptable Operation – Fault Limits are exceeded in one or more of the envelope-bands.

7.4.3 Measurement Points are defined under Measurement Points Information established in the software database.

1.4.4 Envelope-band Spectra is defined in the Frequency Ranges established in the Analysis Parameter Sets.

7.4.5 Alert and Fault limits have been established in the Analysis Parameter Sets.

7.4.6 Alteration on any programmed data outlined in Measurement Point Information, Analysis Parameter Sets, and Alert/Alarm Limits is not allowed.

7.4.7 Monitoring Schedule and Reporting

7.4.7.1 Rotating equipment classified as Level 1 (Safety, Environmental and Quality Critical) and Level 2 (Safety and Environmental Critical) Environmental, whose operations are classed as unsatisfactory have the monitoring time schedule as listed in Measurement Point Information changed to every 30 days until adjustments or repairs to the machine are made.
7.4.7.2 Rotating equipment classified as Level 1 and Level 2, whose operations are classed as unacceptable shall have the monitoring time schedule changed to every twenty days or less until adjustments or repairs are made. The Systems Engineer is notified within 10 calendar days of the condition. Reports are filed very 30 days until repairs or adjustments are made.
Within one calendar week, after adjustments or repairs have been made new vibration data is collected base-lining the results to determine if the unsatisfactory or unacceptable operation condition has been corrected. A report is filed within fifteen calendar days with the systems engineer. Monitor time schedule than revert to the contract time schedule after the machine has been repaired.

Additional Data and Programming Requirements for any Rotating Equipment running in Unsatisfactory or Unacceptable Operation

7.4.8.1 Rotating equipment operating in an unsatisfactory condition. Additional spectrum data of 5Hz to 500Hz spectrums is acquired with a minimum of 1600 lines of resolution to analyze balance and electrical line frequency faults. Phase data is also collected.
7.4.8.2 Rotating equipment, when unsatisfactory conditions exist in one of the envelope-band spectral envelopes additional data is acquired. The data acquired encompasses the envelope-band spectral envelope in which the fault occurs. Data is acquired with a minimum of 1600 lines of resolution.
The repeatability of the measured data is dependent on the number of averages collected to calculate the spectrum. Random noise patterns are kept to a minimum by setting the number of averages to 16 averages.

7.4.9 Vibration Monitoring Sound Discs

For all new and existing Rotating Equipment installed, Johnson Controls is responsible for maintaining the existing Stud and Magnetic Mounted Sound Discs and the placement of Stud and Magnetic Mounted Sound Discs on new equipment.
New sound discs are installed using the following guidelines:
Sound Discs have a minimum of 1" diameter, manufactured from 400 series magnetic stainless steel material, have a surface finish of 32 micro-inches RMS, and be a minimum of 1/4 inch thick.
Sound Discs are attached by bonding the disc to the casing. Bonding agent have a solidified density of 1.63 – 1.69g/cm^3 and a tensile shear strength of 2,800 psi. An option of machining the case in order to achieve a flat and smooth spot, which meets the same tolerances as the sound disc can be applied.
Monitoring locations are positioned as close to bearing locations as possible. Discs are mounted on structural members of the rotating equipment. Installation of sound discs on bolted cover plates is not be allowed.

Vibration Monitoring Sound Disc Locations

Centrifugal Pumps Horizontally Mounted. Sound discs are mounted in the radial, vertical and axial planes as close to the bearings as possible. Mounting locations are always inline with each other, perpendicular to the surfaces. Axial locations are at the coupled ends of the pump and motor when possible.
Centrifugal Pumps Vertically Mounted. Sound discs are mounted in the horizontal planes at both ends of the motor and pump. Mounting locations are always inline with each other, perpendicular to the pump discharge and located at the free end and coupled end of the motor and pump and in the axial direction on the motor and pump if possible.
Positive Displacement Pumps. Sound discs are mounted in the horizontal and vertical planes radial to the shaft at the free and coupled ends of the motor and pump as close to the bearings as possible. Mounting locations are always inline with each other, perpendicular to the surfaces.
Generators. Sound discs are mounted in the horizontal and vertical planes on the free ends of the motor and generator bearing assemblies. Pedestal bearing between the motor and generator are monitored in the vertical direction radial to the shaft. Thrust bearing are monitored in the axial direction.
Gear Boxes. Sound disc are mounted radial to the input and output shafts in the horizontal and vertical planes. Additional discs are installed in the radial direction as close to the input and output shafts as possible.

Gear Boxes for Cooling Towers. Sound discs are mounted radial to the input and output shafts in the horizontal plane. Additional discs are mounted in the axial plane as close to the input shaft as possible.
Reciprocating Refrigeration Compressors. Sound disc are to be installed radial to the input and output shafts in the horizontal and vertical planes. Additional sound discs are installed in the axial direction as close to the input and output shafts as possible.
Air Handlers with Internal Mounted Motors. The motor have sound discs mounted radial at each bearing and in the axial direction at the output shaft. The fan have sound discs mounted radial on each pillow block bearing.
Air Handlers with External Mounted Motors. The motor have sound discs mounted radial and vertically at each bearing and in the axial direction at the output shaft. The fan have sound discs mounted radial on each pillow block bearing.

VIBRATION CRITERIA FOR REPORTING

7.5.1 General - All vibration spectra and waveforms are analyzed at the following forcing frequencies:

Sub-harmonic frequencies (0.2 to 0.8X running speed)
1x running speed
2x running speed
All multiples of running speed that cover:
- Looseness
- Roller bearing defects
- Resonance
- Gear Mesh
- Blade Pass
- Couplings
- Rotor Bar Pass
- Stator Slot Pass
- Electrical line frequency (60Hz and 120Hz) and sidebands thereof

VIBRATION CRITERIA FOR NEW ROTATING EQUIPMENT

When condition monitoring or acceptance surveys are performed, obtain the following information from the procuring organization concerning the rotating equipment that will be part of the Condition Monitoring program or have survey work performed.

Fans. The procuring organization is requested to provide the following information on all fans supplied.

Fan Design
Fan Mounting
Air Inlet Design
Volume Flow Rate
Number of Guide Vanes, Outlet Vanes, & Primary Fan Blades
Fan Wheel Diameter
Rotating Speed
Number of Belts
Center to Center distance of Shafts
Pitch Diameter of Drive Sheave
Pitch Diameter of Driven Sheave

Pumps. The procuring organization is requested to provide the following information on all pumps supplied.

Pump Design
Pump Mounting
Number of Stages
Impeller Diameter
Number of Impeller Vanes
Number of Diffuser Vanes
Design GPM
Manufacturers required NSPH
Shaft Critical Speed

Cooling Towers. The procuring organization is requested to provide the following information on all cooling towers supplied.

Number of Fan blades
Fan Speed
Gear Ratio

Motors. The procuring organization is requested to provide the following information on all motors supplied.

All nameplate data
Shaft lubrication
Bearing housing support
Number of rotor bars and stator slots
Shaft critical speed
Enclosure type

VIBRATION ACCEPTANCE CRITERIA FOR NEW ROTATING EQUIPMENT

7.6.1 GENERAL
These specifications provide performance requirements for the acceptance of new rotating equipment to prevent premature machine failure.

7.6.1.1 Coupled Shaft Alignment Requirements. Coupled shaft alignment is the positioning of two or more machines so that the rotational centerlines of the shafts are collinear at the coupling center under operating conditions. Laser Alignment equipment is used. Either combined laser emitter and laser target detector can be used or separate units for the laser emitter and the laser target. The tolerances specified in Table 1 are the maximum allowable deviations from Zero-Zero Specifications (intended targeted offset and/or angularity).

TABLE 1 COUPLED SHAFT ALIGNMENT TOLERANCE VALUES

	RPM	TOLERANCE SPECIFICATIONS
SOFT FOOT	ALL	**< 0.002 Inch at each foot**

SHORT COUPLINGS	RPM	HORIZONTAL & VERTICAL PARALLEL OFFSET	ANGULIARITY/GAP **Inch/10 inch Coupling Diameter**
	600	**0.005 in.**	**0.010 in.**
	900	**0.003 in.**	**0.007 in.**
	1200	**0.0025 in.**	**0.005 in.**
	1800	**0.002 in.**	**0.003 in.**
	3600	**0.001 in.**	**0.002 in.**

COUPLINGS WITH SPACERS	RPM	HORIZONTAL & VERTICAL PARALLEL OFFSET PER INCH OF SPACER LENGTH
	600	**0.0018 in.**
	900	**0.0012 in.**
	1200	**0.0009 in.**
	1800	**0.0006 in.**
	3600	**0.0003 in.**

7.6.1.2 Horizontal Motor and Pump Vibration Requirements. A rotating machine's condition when purchased and installed must be evaluated to assure the real condition of the "new" machine and if it was installed adequately. Machinery vibration diagnostic analysis and established standards are used to evaluate rotating equipment. Vibration tolerances specified in Table 2 are established standards employed at Stennis for the acceptance of new rotating equipment. Velocity Amplitude (inch/sec peak) Limits shall not exceed the band-envelope limits in any direction. The use of overall readings are not acceptable.

TABLE 2 MAXIMUM ALLOWABLE ENVELOPE-BAND AMPLITUDE LIMITS
HORIZONTAL MOTOR AND PUMP

Table 2 Maximum Allowable Vibration Amplitude Limits **Fractional and Integral Horsepower AC/DC Motors < 500HP**		
	Velocity Line-Amplitude Band Limits	
Band	**Frequency Range (CPM)**	**Inch/Sec - Peak**
1	0.3 **x RPM** 0.4 **x RPM**	**0.04**
2	0.5 **x RPM** **1.2 x RPM**	**0.075**
3	1.2 **x RPM** **3.5 x RPM**	**0.04**
4	3.5 **x RPM** **8.5 x RPM**	**0.03**
5	8.5 **x RPM** **70.5 x RPM**	**0.03**

Acceleration Envelope-Band Amplitude Limits	
Frequency Range (CPM)	**G's**
0.3 **x RPM** **120K**	**0.5**

7.6.1.3 Vertical Mounted Motor and Pump Vibration Requirements . Vertical mounted heights greater than 5'0" will have an allowance factor increase in Velocity amplitude in Envelope-Bands 1, 2, & 3 of 5% for every 3'3" in height above 5'0". Maximum Acceleration Amplitude Envelope-Band values are 1.0G's regardless of height.

VIBRATION CRITERIA FOR EXISTING ROTATING EQUIPMENT

7.7 GENERAL

Operating performance specifications for existing rotating equipment have been developed specifically for Stennis Space Center to prevent premature machine failure. The information is defined within the existing computer Vibration Program. All data can be found under Database Setup Management - Alarm Setup Information. The Alarm Setup Information is fixed and can not be altered without the written approval of the Contractor Officers Technical Representative (COTR). The Alarm Information defines a machine's operating status as Good, Unsatisfactory or Unacceptable operation.

Annex 5

Exhibit 4

Special Purpose Mobile Equipment (SPME)

Discipline	Equip#	Description	Bldg	Priority	Install Date	CM/PM	CM ONLY
SPME	00962172	AIR CONDITIONER, PORTABLE (SPOT COOLER)	2201	3	1/1/87		X
SPME	00962173	AIR CONDITIONER, PORTABLE (SPOT COOLER)	2201	3	1/1/87		X
SPME	0132870	AIR CONDITIONER, PORTABLE (SPOT COOLER)	2201	3			X
SPME	0132871	AIR CONDITIONER, PORTABLE (SPOT COOLER)	2201	3	1/1/87		X
SPME	031006	NL 31-06 - AMBULANCE	2201	1	12/15/89	X	
SPME	031007	NL 31-07 - AMBULANCE	2201	1	12/15/89	X	
SPME	034014	NL 34-14 - FOUR-WHEELER (NASA #0824552)	2403		4/4/88		X
SPME	034015	NL 34-15 - FOUR WHEEL SCOOTER (GASOLINE)	2204		6/27/88	X	
SPME	034017	NL 34-17 - VEHICLE- OFFROAD UTILITY (NASA#G033820)	2105		4/25/89	X	
SPME	034018	NL 34-18 - VEHICLE- OFF ROAD	2201		5/30/90	X	
SPME	034019	NL 34-19 - VEHICLE- OFF ROAD	2403		5/30/90		X
SPME	034020	NL 34-20 - VEHICLE- OFF ROAD	2201		5/30/90	X	
SPME	034021	NL 34-21 - VEHICLE- OFF ROAD	2201		5/30/90	X	
SPME	034022	NL 34-22 - VEHICLE- OFF ROAD UTILITY	8100		9/11/92	X	
SPME	034023	NL 34-23 - VEHICLE- OFF ROAD UTILITY	8100		9/11/92	X	
SPME	034024	NL 34-24 - NRL - DELIVERY VAN	1100			X	
SPME	034025	NL 34-25 - FOUR WHEELER, HONDA	2403		3/15/94		X
SPME	034E11	NL 34-E11 - GOLF CART	2201		10/14/80	X	
SPME	034E13	NL 34E-13 - GOLF CART EZ-GO	2204		6/10/88	X	
SPME	034E14	NL 34E-14 - GOLF CART EZ-GO	2204		6/10/88	X	
SPME	034E18	NL 34E-18 - GOLF CART- EZ-GO	2204		6/28/89	X	
SPME	034E19	NL 34E-19 - GOLF CART	2204		10/23/91	X	
SPME	034E20	NL 34E-20 - GOLF CART	2204		10/23/91	X	
SPME	034E21	NL 34E-21 - GOLF CART- EZ-GO	2201		6/11/92	X	
SPME	034E22	NL 34E- 22 - GOLF CART	2205		8/2/93	X	
SPME	034E24	NL 34E-24 - GOLF CART EZ-GO	2204		8/17/94	X	
SPME	034E3	NL 34-E3 - GOLF CART	2204		10/3/80	X	
SPME	034E5	NL 34-E5 - GOLF CART	2105		10/14/80	X	
SPME	034E6	NL 34-E6 - GOLF CART	2205		10/14/80	X	
SPME	051003	NL 51-03 - TRUCK, FIRE	2201		3/7/66		X
SPME	051006	NL 51-06 - TRUCK- FIRE (ECN 0289804)	2201	1	10/16/85	X	
SPME	051007	NL 51-07 FIRE TRUCK	2201	1		X	
SPME	051008	NL 51-08 - TRUCK- MAINTENANCE	2201		10/16/89	X	
SPME	051009	NL 51-09 - VISITORS CENTER TOUR BUS	1200	3	7/29/90	X	
SPME	051010	NL 51-10 - TRUCK, FIRE	2201				X
SPME	051011	NL 51-11 - BUS, TOUR SUPREME	1200	3	6/2/92	X	

SPME	051012	NL 51-12 - TRUCK, FIRE	2201	1	1/26/93	X	
SPME	051013	NL 51-13 - TRUCK FIRE	2201	1	3/24/93	X	
SPME	051014	NL 51-14 - TRUCK, SERVICE	2201	3	8/19/97	X	
SPME	071075	NL 71-75 - TRUCK REFUSE	2201		1/1/86	X	
SPME	071076	NL 71-76 - TRUCK AERIAL LIFT W/BUCKET	2201	2	4/9/86	X	
SPME	071079	NL 71-79 - TRUCK- PICKUP DODGE (NASA#0396975)	2205		10/28/86		X
SPME	071082	NL 71-82 - CHEVY STEP VAN (NASA#0016134)	2205		9/30/88		X
SPME	071086	NL 71-86 - TRUCK- FOOD SERVICE (NASA#1012054)	1100		1/22/91	X	
SPME	071087	NL 71-87 TRUCK, FORD PICKUP	2207		2/7/92	X	
SPME	071088	NL 71-88 TRUCK, FORD PICKUP	2207		2/7/92	X	
SPME	071090	NL 71-90 - TRUCK, 1 1/4 TON 4X4	4302		3/28/91	X	
SPME	071092	NL 71-92 - TRUCK, REFUSE (NASA#1224950)	2105		10/25/92	X	
SPME	071095	NL 71-95 - TRUCK- PICKUP DODGE	2204			X	
SPME	071096	NL 71-96 - TRUCK, GAS DISPENSING - NASA # 1540153	2105		4/8/96	X	
SPME	071097	NL 71-97 - TRUCK- 4 X 4 JIMMY (NASA#1542246)	2104			X	
SPME	071098	NL 71-98 - TRUCK- TOW (NASA#1911182)	S4302				X
SPME	081011	NL 81-11 - TRUCK + CHASIS	2201		8/11/66		X
SPME	081021	NL 81-21 - TANKER- FUEL JP4 AND TRUCK	2105		10/30/85		X
SPME	081023	NL 81-23 TRUCK- DUMP	2105		2/9/90	X	
SPME	081024	NL 81-24 - TRUCK- POLE	2201	2	1/16/90	X	
SPME	081028	NL 81-28 - WRECKER(NASA#1224232)	2105		1/15/93	X	
SPME	081030	NL 81-30 - TRUCK-SERVICE(NASA#1323186)	2105		8/18/93	X	
SPME	081031	NL 81-31 TRUCK- DUMP	2105		11/16/94	X	
SPME	081032	NL 81-32 - TRUCK- DUMP	2105		11/16/94	X	
SPME	081033	NL 81- 33- 1 1/2 TON FLATBED TRUCK-NASA# 1540902	2105	4		X	
SPME	081034	NL 81-34 - 2 TON FLATBED TRUCK-NASA#1541594	5005		7/19/88	X	
SPME	081035	NL 81-35 - 2 TON FLATBED TRUCK-NASA#1541626	2105		7/19/88	X	
SPME	081036	NL 81-36 - TRUCK, STAKE BODY	2105		5/18/98	X	
SPME	091001	NL 91-01 TUBE BANK TRL (NA131454)	3305	2		X	
SPME	091002	NL 91-02 - TRAILER SEMI HYD	3202				X
SPME	091003	NL 91-03 - TRAILER, SEMI HYD	2205	2	11/19/65	X	
SPME	091004	NL 91-04 - TUBE BANK TRAILER(NASA# 0131420)	3305	2			X
SPME	091008	NL 91-08 - TRAILER 7' X 34'	2201		5/14/86		X
SPME	091015	NL 91-15 - TRAILER-SEMI TANK 4000 GAL	2107		10/14/65		X
SPME	091030	NL 91-30 - TRAILER PIPE-POLE	3110		9/14/64	X	
SPME	091031	NL 91-31 - TRAILER FOLD GOOSENECK 50 TON	2105		9/9/65	X	
SPME	091064	NL 91-64 - TRAILER 4-WHEEL TANDEM	2205		6/30/67	X	

SPME	091068	NL 91-68 - TRAILER- W/TANK	2105		12/10/85		X
SPME	091069	NL 91-069 - TRAILER- W/TANK	2105		12/10/85		X
SPME	091070	NL 91-70 - TRAILER W/ANTENNA(NASA#0133461)	2105				X
SPME	091073	NL 91-73 - TRAILER 10'X30' (SMART TRA)	2201		8/29/88		X
SPME	091074	NL 91-74 - TRAILER- SEMI VAN- 20 TON	2105		2/6/90	X	
SPME	091075	NL 91-75 TRAILER, LOWBOY(NASA# L06007)	2105			X	
SPME	091076	NL 91-76 TRAILER, LOWBOY(NASA# L06008)	2105			X	
SPME	091077	NL 91-77 - TRAILER- TRUCK TILTING	2105		11/1/91	X	
SPME	091078	NL 91-78 - TRAILER- ENCLOSED(MCI LOAN)-ECN:1011199	3201		11/13/91	X	
SPME	091079	NL 91-79 - TRAILER, LOWBOY(NASA #1223798)	2105		5/28/92	X	
SPME	091080	NL 91-80 TRAILER	2105		6/3/90	X	
SPME	091082	NL 91-82- TRAILER, TUBE BANK (LOX D-ROAD)	8888	2	11/4/93		X
SPME	091083	NL 91-83- TRAILER, TUBE BANK (LOX D-ROAD)	8888	2	11/4/93		X
SPME	091084	NL 91-84- TRAILER, TUBE BANK (LOX D-ROAD)	8888	2	11/4/93		X
SPME	091085	NL 91-85- TRAILER, TUBE BANK (LOX D-ROAD)	8888	2	11/4/93		X
SPME	091086	NL 91-86- TRAILER, TUBE BANK (LOX D-ROAD)	8888	2	11/4/93		X
SPME	091087	NL 91-87- TRAILER, TUBE BANK (CTF)	8888	2	11/4/93		X
SPME	091088	NL 91-88 - TRAILER, TUBE BANK (CTF)	8888	2	11/4/93		X
SPME	091089	NL 91-89 - TRAILER, TUBE BANK(HIGH HEAT FLUX)	8888	2	11/4/93		X
SPME	091090	NL 91-90 - TRAILER, TUBE BANK(HIGH HEAT FLUX)	8888	2	11/4/93		X
SPME	091091	NL 91-91 - TRAILER, TUBE BANK	3305	2	11/4/93		X
SPME	091092	NL 91-92 - TRAILER, TUBE BANK	3305	2	11/4/93		X
SPME	091093	NL 91-93 - TRAILER, TUBE BANK	3305	2	11/4/93		X
SPME	091094	NL 91- 94 - TRAILER LOWBED - NASA # 1539314	2105		7/14/95	X	
SPME	091095	NL 91-95-TRAILER-SEMI TANK 5000 GAL(NASA#0034627)	2105		4/2/97	X	
SPME	091097	NL 91-97 - TRAILER, SEMI GOOSENECK, 30 TON, 40 FT	2105		1/1/81	X	
SPME	091098	NL 91-98 - TRAILER, WELLS CARGO INC (ECN:0034722)	2201	3	3/9/98	X	
SPME	091099	NL 91-99 - TRAILER, WELLS CARGO INC (ECN:1541319)	2201	3	3/9/98	X	
SPME	091100	NL 91-100 TRAILER, DROP DECK (NASA#1912664)	2105		4/14/98	X	
SPME	091102	NL 91-102 TRAILER, PLATFORM (NASA#1939418)	2105		10/20/98	X	
SPME	110017	NL110-17 - SPRAYER HI-PRESS	2201				X
SPME	110019	NL110-19 - SPRAYER- INSECT	2201				X
SPME	110097	NL110-97 - SEWERODER RODER COIL	2201		8/1/67	X	
SPME	110100	NL110-100 - MIXER CONCRETE TILE SIDE EISCH	2201		6/13/75	X	
SPME	110109	NL110-109 - WELDING MACHINE ARC TWO WHEEL	4302		9/14/76		X
SPME	110110	NL110-110 - WELDING MACHINE ARC TWO WHEEL	2201		9/14/76		X
SPME	110115	NL110-115 - GENERATOR (NASA#0752865)	2201				X

SPME	110126	NL110-126 - GENERATOR (NASA#0824549)	2105	2	9/30/81	X	
SPME	110132	NL110-132 - CENTRIFUGAL PUMP (NASA#0593198)	2201		1/13/82	X	
SPME	110133	NL110-133 - PUMP TRASH PORTABLE (NASA#0593203)	2201		1/13/82	X	
SPME	110134	NL110-134 POWER PLANT GENERATOR	2201			X	
SPME	110136	NL110-136 - CENTRIFUGAL PUMP	T2423				X
SPME	110137	NL110-137 - LINCOLN WELDING MACHINE	2205		3/1/84		X
SPME	110138	NL110-138 - LINCOLN WELDING MACHINE	4302		3/1/84		X
SPME	110139	NL110-139 - WELDING MACHINE	2205		10/1/84	X	
SPME	110147	NL110-147 - PORTABLE AIR COMP SN 30066	2201		12/6/84	X	
SPME	110148	NL110-148 - PORT. PRESSURE PUMP(NASA#0753702)	2201		6/18/85		X
SPME	110149	NL110-149 - PORT. PRESSURE PUMP(NASA#0753703)	2201		6/18/85	X	
SPME	110153	NL110-153 - WELDING ARC MACHINE	4301				X
SPME	110156	NL110-156 - WELDER, TRAILBLAZER, GAS(ECN1910808)	4301		2/26/86	X	
SPME	110157	NL110-157 - WELDER, TRAILBLAZER, GAS(ECN: 0396294)	4120		1/1/86	X	
SPME	110160	NL110-160 - GENERATOR ONAN (#0396801)	2201				X
SPME	110161	NL110-161 - GENERATOR 5000 WATT	2201		6/16/86		X
SPME	110163	NL110-163 - AIR COMPRESSOR	2201		5/27/87		X
SPME	110166	NL110166 GEN.(#59413 A83)G32951	4302				X
SPME	110167	NL110-167 - GENERATOR (#G843805510)	4302				X
SPME	110174	NL110-174 - COMPRESSOR	5005		10/9/87	X	
SPME	110178	NL110-178 - HOMELITE PORT. GENERATOR	2201		6/20/88	X	
SPME	110180	NL110-180 - GENERATOR (NASA#0015702)	2201		9/15/88	X	
SPME	110181	NL110-181 - GENERATOR (NASA#0015703)	2201		9/15/88	X	
SPME	110182	NL110-182 - GENERATOR (NASA#0015704)	2201		9/15/88	X	
SPME	110183	NL110-183 - GENERATOR (NASA#0015705)	2201		9/15/88	X	
SPME	110185	NL110-185 - GENERATOR- PORTABLE (GAS)	8305		3/7/89		X
SPME	110187	NL110-187 - SPRAYER, INSECTICIDE(NASA#G033532)	2105		3/21/89	X	
SPME	110189	NL110-189 - COMPRESSOR- AIR	8305		5/16/89	X	
SPME	110193	NL110-193 - WELDER- LINCOLN TRL MTD (NASA#G034298)	2205		8/7/89	X	
SPME	110194	NL110-194 - WELDER- LINCOLN TRAILER MTD	2205		8/7/89	X	
SPME	110195	NL110-195 - WELDING MACHINE	2205		8/11/89	X	
SPME	110196	NL110-196 - WELDING MACHINE (NASA#G034342)	2205		8/11/89	X	
SPME	110197	NL110-197 - WELDER- LINCOLN TRL MTD(NASA#G034451)	2205		8/18/89	X	
SPME	110198	NL110-198 - GENERATOR (NASA#G034369)	2201		8/14/89	X	
SPME	110200	NL110-200 - ARC WELDING SYSTEM	2205				X
SPME	110205	NL110-205 - PUMP, GASOLINE NASA#1011066)	2201		7/5/90	X	
SPME	110206	NL110-206 - PUMP ((NASA#1012137)	2201		3/1/91	X	

SPME	110208	NL110-208 - WELDING MACHINE- MILLER ELEC	2205		12/19/91		X
SPME	110209	NL110-209 - WELDING MACHINE- MILLER ELEC	2205		12/19/91		X
SPME	110210	NL110-210 - WELDING MACHINE- MILLER ELEC	2205		12/19/91		X
SPME	110211	NL110-211 - WELDING MACHINE- MILLER ELEC	2205		12/19/91		X
SPME	110220	NL110-220 - WELDING MACHINE	2205		10/13/92	X	
SPME	110221	NL110-221 - WELDING MACHINE	2205		10/13/92	X	
SPME	110222	NL110-222 - GENERATOR (NASA#1322534)	2201		3/23/93	X	
SPME	110223	NL110-223 - GENERATOR (NASA#1322588)	2201		4/9/93	X	
SPME	110224	NL110-224 - GENERATOR (NASA#1323234)	2201		9/7/93	X	
SPME	110226	NL110-226 - WELDER- DIESEL	2205		4/13/94	X	
SPME	110229	NL110-229 - GENERATOR (NASA#1323365)	4400				X
SPME	110230	NL110-230 - PORTABLE AIR-COOLED CHILLER	2201				X
SPME	110231	NL110-231 - GENERATOR, EMERGENCY, 120/208 VAC	3203			X	
SPME	110234	NL110-234 - MILLER TRAILBLAZER	2205		8/12/96	X	
SPME	110235	NL110-235 - MILLER TRAILBLAZER	2205		8/12/96	X	
SPME	110236	NL110-236 - WELDING MACHINE, ARC (NASA#1541600)	2205		1/27/97	X	
SPME	110237	NL110-237 - WELDING MACHINE, ARC	2205		1/27/97	X	
SPME	110239	NL110-239 - WELDING MACHINE (NASA#1910143)	2205			X	
SPME	110240	NL110-240 - WELDING MACHINE (NASA#1910144)	2205			X	
SPME	110241	NL110-241 - PORTABLE AC UNIT#1 /100 TON TRL MTD	2201	2	10/1/87		X
SPME	110242	NL110-242 - PORTABLE AC UNIT#3 /5 TON - TRL MTD	2201	3			X
SPME	110244	NL110-244 - PORTABLE 15-TON UNITARY UNIT	2201	3			X
SPME	110245	NL110-245 - PUMP, CENTRIFUGAL (NASA#1910166)	2201		6/16/97	X	
SPME	110246	NL110-246 - WELDING MACHINE (NASA#1912393)	S4301		1/1/97	X	
SPME	110247	NL110-247 - GENERATOR, 100KW	2105	4	9/21/93	X	
SPME	110248	NL110-248 - GENERATOR, EMERGENCY(ECN 1912807)	2201		5/21/98	X	
SPME	110249	NL110-248 - GENERATOR, PORTABLE (ECN 0034872)	2201		1/1/97		X
SPME	1172707	TRAILER, SINGLE AXLE	2204		6/17/91		X
SPME	120002	NL120-02 - TRUCK LIFT FORK	8100		6/18/65	X	
SPME	120042	NL120-42 - TRUCK LIFT FORK	2203				X
SPME	120051	NL120-51 - TRUCK LIFT FORK	2105	3	5/19/71		X
SPME	120075	NL120-75 - TRUCK LIFT FORK	4120		5/25/79	X	
SPME	120077	NL120-77 - TRUCK FORKLIFT	3202		1/5/81	X	
SPME	120084	NL120-84 - FORKLIFT UPRIGHT 4000LB	2204		9/27/83	X	
SPME	120085	NL120-85 FORKLIFT - DEMAND SERVICES	8100			X	
SPME	120086	NL120-86 FORKLIFT	3203			X	
SPME	120087	NL120-87 - FORKLIFT, DIESEL	2105			X	

SPME	120088	NL120-88 FORKLIFT	3203			X	
SPME	120089	NL120-89 - TRUCK LIFT FORK	2203		8/1/84	X	
SPME	120091	NL120-91 - TRUCK LIFT FORK W/SIDE SHIFTER	3202		6/20/85	X	
SPME	120092	NL120-92 - TRUCK FORK LIFT	4122		6/20/85	X	
SPME	120094	NL120-94 - TRUCK WALKIE REACH	2105		7/8/85	X	
SPME	120099	NL120-99 - TRUCK- LIFT FORK	3202		12/3/85	X	
SPME	120103	NL120-103 - FORKLIFT GAS - DEMAND SERVICES	9134			X	
SPME	120104	NL120-104 - FORKLIFT, RAYMOND - DEMAND SERVICES	9134			X	
SPME	120105	NL120-105 - FORKLIFT, RAYMOND - DEMAND SERVICES	9134				X
SPME	120107	NL120-107 FORKLIFT 1500 LB R123	8100			X	
SPME	120108	NL120-108 FORKLIFT 1000 LB R123	8100			X	
SPME	120110	NL120-110 - FORKLIFT 36 VOLT ELEC	2204		9/15/87	X	
SPME	120111	NL120-111 - FORKLIFT 36 VOLT ELEC	2204		9/15/87	X	
SPME	120112	NL120-112 - FORKLIFT- CATERPILLAR	2204		9/16/87	X	
SPME	120113	NL120-113 - FORKLIFT, YALE (PALLET STACKER)	2204		10/16/87	X	
SPME	120115	NL120-115 - FORKLIFT , YALE	8888				X
SPME	120116	NL120-116 - FORKLIFT SWL 30-000 LB	2105	3	3/9/88	X	
SPME	120118	NL120-118 - CLARK ELEC FORKLIFT	2204		6/17/88	X	
SPME	120119	NL120-119 - YALE ELEC FORKLIFT	2204		7/19/88	X	
SPME	120120	NL120-120 - DIESEL FORKLIFT 4000LB	2205		10/31/88	X	
SPME	120121	NL120-121 - 6000LB DIESEL FORKLIFT	4301		11/10/88	X	
SPME	120122	NL120-122 - FORKLIFT- 8000 LB.	2105		12/28/88	X	
SPME	120123	NL120-123 - FORKLIFT- 6000 LB DIESEL	4302		3/21/89	X	
SPME	120124	NL120-124 - FORKLIFT- 4-000 LB GASOLINE	4220		10/30/89	X	
SPME	120125	NL120-125 - FORKLIFT- 4-000 LB GASOLINE	3202		10/30/89	X	
SPME	120126	NL120-126 - FORKLIFT- 6000 LB	2204		12/20/89	X	
SPME	120127	NL120 - 127 FORKLIFT EXTENDER	2205			X	
SPME	120129	NL120-129 - FORKLIFT- DIESEL	2205		8/3/90	X	
SPME	120130	NL120-130 - FORKLIFT, HYSTER	2204		8/3/90	X	
SPME	120131	NL120-131 - FORKLIFT- UPRIGHT- YALE	2204		1/9/91	X	
SPME	120132	NL120-132 FORKLIFT,ELE(S#MA0100243 NDBC	3203			X	
SPME	120133	NL120-133 - FORKLIFT- ELECTRIC (HYSTER)	2204		10/1/91	X	
SPME	120134	NL120-134 - FORKLIFT, ELECTRIC (HYSTER)	2204		10/24/91	X	
SPME	120135	NL120-135 - FORKLIFT, ELECTRIC (HYSTER)	2204		10/30/91	X	
SPME	120136	NL120-136 - FORKLIFT, GAS - DEMAND SERVICES	9165			X	
SPME	120139	NL120-139 - FORKLIFT- 6000 LBS - DEMAND SERVICES	1106			X	
SPME	120140	NL120-140 - FORKLIFT, 6000# DIESEL - DEMAND SERV	2406			X	

SPME	120141	NL120-141 - FORKLIFT, DIESEL - DEMAND SERVICES	1005			X	
SPME	120143	NL120-143 - FORKLIFT, 6000# DIESEL - DEMAND SERV	1005			X	
SPME	120144	NL120-144 - FORKLIFT- DIESEL	2105		6/2/93	X	
SPME	120145	NL120-145 - FORKLIFT, ELECTRIC - DEMAND SERVICES	2408			X	
SPME	120146	NL120-146 - FORKLIFT, ELECTRIC - DEMAND SERVICES	9165			X	
SPME	120147	NL120-147 - FORKLIFT, ELECTRIC, STANDUP	2205		1/24/94	X	
SPME	120150	NL120-150 FORKLIFT, DIESEL - DEMAND SERVICES	9134			X	
SPME	120151	NL 120-151 - WESCO DRUM LIFTER-MODEL DL55	2205			X	
SPME	120152	NL 120-152 - WESCO BARREL LIFTER-FORKLIFT MOUNTED	2205			X	
SPME	120153	NL120-153 FORKLIFT, ELECTRIC - DEMAND SERVICES	9134				X
SPME	120154	NL120-154 - FORKLIFT, HYSTER, ELECTRIC, 3000LB	9134			X	
SPME	120155	NL120-155 - FORKLIFT, HYSTER, ELECTRIC, 3000LB	9134			X	
SPME	120159	NL120-159 FORKLIFT, 10,000LB DIESEL	3203			X	
SPME	120160	NL120-160 FORKLIFT, 6,000LB DIESEL (NASA#0034631)	2205		4/2/97	X	
SPME	120161	NL120-161 FORKLIFT, 6,000LB DIESEL (NASA#1542249)	2105		4/2/97	X	
SPME	120162	NL120-162 FORKLIFT, CROWN (NASA#1910696)	3202		8/8/97	X	
SPME	120163	NL120-163 FORKLIFT, CROWN (NASA#1910695)	3202		8/8/97	X	
SPME	120164	NL120-164 FORKLIFT , CASE, 6,000 LB.(ECN:1910825)	4010		9/18/97	X	
SPME	120165	NL120-165 FORKLIFT ELECTRIC - DEMAND SERVICES	9134			X	
SPME	120166	NL120-166 FORKLIFT, STACKER (NASA#0824850)	8304		5/5/88	X	
SPME	120167	NL120-167 - FORKLIFT, YALE, DIESEL (5,000 LB)	3203		8/13/98	X	
SPME	120168	NL120-168 - FORKLIFT, CLARK, DIESEL (ECN 1939898)	2105		11/9/98		X
SPME	1223926	PORTABLE BOILER	2201	2			X
SPME	130005	NL130-05 - DRAGLINE	3201		5/27/65		X
SPME	130006	NL130-06 - CRANE HYDRAULIC W/CAB ASSY	3201				X
SPME	130018	NL130-18 - TRACTOR FRONT END LOADER	2105		6/11/76	X	
SPME	130023	NL130-23 - TRACTOR LOADER/BACKHOE	2105		6/3/76	X	
SPME	130045	NL130-45 - CRANE TRUCK	2105	3	10/26/77		X
SPME	130046	NL130-46 - ROLLER MOTORIZED	2202				X
SPME	130048	NL130-48 - LIFT A LOFT	2201		2/25/80	X	
SPME	130050	NL130-50 - SWEEPER, TENNANT 92	2403		9/2/80		X
SPME	130051	NL130-51 - TRENCHER SELF PROPELLED	2105		9/3/81	X	
SPME	130053	NL130-53 - MOBILE AERIAL LIFT	2201		3/1/84	X	
SPME	130069	NL130-69 - GRADER	2105		4/10/86	X	
SPME	130072	NL130-72 - SWEEPER	S2126		8/1/86	X	
SPME	130073	NL130-73 - PERSONNEL LIFT- GENIE	4110		9/25/87	X	
SPME	130074	NL130-74 - HT SWEEPER S/N 124672	2403		10/21/87		X

SPME	130075	NL130-75 - SISSOR LIFT MOD SLI-44896-E	4120		3/16/87		X
SPME	130077	NL130-77 - GENIE BOOM LIFT Z-30/20(NASA#0144843)	2201		12/30/87	X	
SPME	130079	NL130-79 - LIFT-A-LOFT	2201		10/19/89	X	
SPME	130080	NL130-80 - CRANE, MOBILE, BRODERSON(NASA#1011954)	2105		12/4/90	X	
SPME	130085	NL130-85 GENIE LIFT, HAND OPERATE HVAC	2201			X	
SPME	130086	NL130-86 - TRACTOR- CATERPILLAR(NASA# 0819064)	2105	3	11/8/91	X	
SPME	130087	NL130-87 - J.L.G. PERSONNEL LIFT	4302	3	4/29/92	X	
SPME	130088	NL130-88 - CRANE, P & H	2105			X	
SPME	130089	NL130-89 - EXCAVATOR- HYDRAULIC(NASA#1224492)	2105	3	9/15/92	X	
SPME	130090	NL130-90 - DOZER- BULL(NASA# 1224932)	2105		10/21/92	X	
SPME	130091	NL130-91 - COMPACTOR- GARBAGE(NASA#1322510)	2105		3/23/93	X	
SPME	130092	NL130-92 - SCRUBBER- FLOOR	2403		4/2/93		X
SPME	130093	NL130-93 - CRANE, 55 TON GROVE(NASA# 1323530)	2105	3	11/8/93	X	
SPME	130094	NL130-94 - LIFT, PERSONNEL	2201		3/28/94	X	
SPME	130095	NL130-95 - J. L. G. LIFT	4302	3	5/3/94	X	
SPME	130096	NL130-96 - END LOADER	2105	3	6/20/94	X	
SPME	130097	NL130-97 - BACKHOE, CATEPILLAR	2105		7/14/94	X	
SPME	130098	NL130-98 - LIFT-A-LOFT	2201		9/29/94	X	
SPME	130099	NL130-99 - CRANE, 50 TON AMERICAN (NASA# 1540739)	2105		7/10/96	X	
SPME	130100	NL130-100 - COMPACTOR- LANDFILL (NASA#1542245)	2105	3	2/25/93	X	
SPME	130101	NL130-101 - CRANE, GROVE (NASA#0034684)	2105	3	4/2/97	X	
SPME	130102	NL130-102 - SCRAPER (NASA#1912185)	2105		2/24/98	X	
SPME	130103	NL130-103 - MANLIFT (NASA#1912751)	2201		5/7/98	X	
SPME	130104	NL130-104 - MANLIFT (NASA#1912819)	2201		6/3/98	X	
SPME	130105	NL130-105 - CRANE, TEREX 8.5 TON	2105		6/9/98	X	
SPME	130106	NL130-106 - CRANE, TEREX 75 TON	2105		6/9/98	X	
SPME	140022	NL140-22 - MOWER THREE GANG REEL TYPE	2201				X
SPME	140043	NL140-43 - CUTTER-SOD-RYAN-JR.	2403		8/7/79		X
SPME	140065	NL140-65 - TRACTOR AGRICULTURE 35 HP ENG	2105		11/24/75	X	
SPME	140082	NL140-82 - TRACTOR	2403		2/28/78		X
SPME	140091	NL140-91 - TRACTOR	2403		3/9/79		X
SPME	140097	NL140-97 - TRACTOR JOHN DEERE	2403		3/20/80		X
SPME	140120	NL140-120 - SELF PROP. VACUUM (BILLY GOAT)	2201		4/5/85		X
SPME	140121	NL140-121 - TRACTOR- FOR	2403		6/22/87		X
SPME	140129	NL140-129 ROTO HOE	2403		1/15/89		X
SPME	140134	NL140-134 - FORD TRACTOR	2201		5/17/88		X
SPME	140137	NL140-137 - MOWER- RIDING TORO	2403		3/30/89		X

SPME	140138	NL140-138 - MOWER- TORO	2403		8/1/90		X
SPME	140139	NL140-139 - MOWER- RIDING- TORO	2403		8/20/90		X
SPME	140140	NL140-140 - NL140-140 MOWER- FLAIL (GROUNDSKEEPER)	2403		7/31/91		X
SPME	140141	NL140-141 - CUTTER- SOD- OMC LINCOLN	2403		5/10/91		X
SPME	140142	NL140-142 - CHIPPER- LANDSCAPE	2403		9/3/91		X
SPME	140143	NL140-143 - MOWER- BATWING	2403		9/5/91		X
SPME	140144	NL140-144 - MOWER- BATWING	2403		9/5/91		X
SPME	140146	NL140-146 - MOWER- RIDING TORO	2403		5/14/92		X
SPME	140147	NL140-147 - MOWER- RIDING TORO	2403		5/14/92		X
SPME	140148	NL140-148 - MOWER- RIDING WOODS	2403		9/21/92		X
SPME	140149	NL140-149 - MOWER, RIDING	2403		9/21/92		X
SPME	140150	NL140-150 - MOWER, BATWING	2403		4/13/94		X
SPME	140151	NL140-151 - MOWER, BATWING	2403		4/13/94		X
SPME	140152	NL140-152 - MOWER- RIDING TORO(NASA#1539531)	2403		9/14/95		X
SPME	140153	NL140-153 - MOWER- RIDING TORO(NASA#1539532)	2403		9/14/95		X
SPME	150003	NL150-03 - TANK, LIQUID STORAGE (NASA#0405908)	2105				X
SPME	150004	NL150-04 - CAMPER- TOW	2201		1/29/86		X
SPME	150005	NL150-05 - DARKROOM- TRAILER MNTED	4102		10/28/85		X
SPME	150006	NL150-06 - MOBILE DARK ROOM	4102		4/8/88		X
SPME	160001	NL160-01 TUG CLERMONT II NA146104	3201			X	
SPME	160002	NL160-02 WATER TANK	4220			X	

Annex 5

Exhibit 5

Inventory of Vertical Transportation Equipment List

INVENTORY OF VERTICAL TRANSPORTATION EQUIPMENT

EQUIP. NO.	BLDG.	**(1) TYPE	CAP (LBS)	MFR	MFR NO.	YEAR INST.	LAST INSP. DATE	DATE TESTED	SPEED (FPM)	NO. FLRS.	**(2) DOORS
96A09993	1000 ANNEX	PHE	6000	MONTGOMERY	CP-55824	1986	2/98	N/A *	100	3	PD
96A09998	1002	PHE	4000	DOVER	E50479	1978	2/98	N/A *	150	2	PD
96A10018	1100	PHE	2100	DOVER	EC6526 (West) #1	1992	2/98	N/A *	125	3	PD
96A10023	1100	PHE	2100	DOVER	EC6525 (East) #2	1992	2/98	N/A *	125	3	PD
96A10008	1100	PCE	3500	WESTINGHOUSE	36294E-1	1965	2/98	11/97	250	3	PD
96A10003	1100	PCE	3500	WESTINGHOUSE	36294E-2	1965	2/98	11/97	250	3	PD
96A10013	1100	FHE	4000	WESTINGHOUSE	8432	1965	2/98	N/A *	60	3	MD
96A10028	1103	PHE	3500	DOVER	E87029 (East) #1	1987	2/98	N/A *	150	2	PD
96A10033	1103	PHE	3500	DOVER	E87030 (West) #2	1987	2/98	N/A *	150	2	PD
96A10038	1200	PCE	2500	MONTGOMERY	C-17321	1965	2/98	11/97	200	4	PD
00962193	2204	PHE	2100	AMERICAN CRESCENT	901-1571	1997	2/98	N/A *	100	2	PD
96A10043	3203	PHE	2000	DOVER	E65437	1981	2/98	N/A *	125	3	PD
96A10048	3203	FCE	5000	OTIS	341668	1965	2/98	11/97	150	6	PD
96A10067	4120	FCE	9000	TURNBULL	301425	1965	2/98	11/97	300	12	PD
96A10069	4122	FCE	9000	OTIS	341344	1965	2/98	11/97	300	12	PD
96A10074	4220	PCE	9000	OTIS	341537 (East)	1965	2/98	11/97	300	19	PD
96A10080	4220	PCE	9000	OTIS	341538 (West)	1965	2/98	11/97	300	19	PD
96A10054	8100	PHE	3500	U.S. ELECTRIC	E16969	1982	2/98	N/A *	125	3	PD
96A10059	1000	DW	400	MONTGOMERY	C-17322	1966			50	3	MD
96A10086	4995	DW	500	OTIS	341888	1965			50	2	MD
00962194	2205	DW	400	MONTGOMERY	C-17532	1966	DOWNMODED	DOWNMODED	50	2	MD

* 3 YR. HYDROSTATIC TEST NON-APPLICABLE (NO PRESSURE VESSEL IN SYSTEM)

Notes:

** (1) Indicates one of the following:

DW - Dumbwaiter
FCE - Freight Cable Elevator
FHE - Freight Hydraulic Elevator
PCE - Passenger Cable Elevator
PHE - Passenger Hydraulic Elevator

**(2) Indicates one of the following:

PD - Power Doors
MD - Manual Doors

Annex 5

Exhibit 6

Inventory of Backflow Preventors

Inventory of Backflow Preventers

Location	Quantity	Size
Bldg. 3209	1	3" RPV
Bldg. 4110	2	1" RPV
Bldg. 8100	1 1	¾" RPV 1 ½" RPV
Bldg. 5002 Breakroom Rm 118	1 1	¾" RPV 1" RPV
Bldg. 8201	1	¾"
Bldg. 2105	1	1 ½" RPV
Bldg. 2105	1	1" RPV
Bldg. 8130	1	1 ½"
Bldg. 3305	1	¾" RPV
Bldg. 8301	1	¾" RPV
Bldg. 8105	1	¾" RPV
Bldg. 8110, Rm 111 Blr RM	1 2	3" RPV ¾" RPV
Bldg. 2206	2	¾" RPV
Bldg. 2203	1	¾" Double Check
Bldg. 2201, Mechanical Rm 23	1	¾" RPV
Bldg. 2101	1 1	¾" Double Check ¾" RPV
Bldg. 1105	2 2	¾" RPV 2" RPV

Bldg. 1103	3	¾" RPV
Bldg. 1100, Rm 195	2 1	¾" RPV 2" RPV
Bldg. 1210	1	¾" Double Check
Bldg. 1006	1	1" BFP
Bldg. 1005	1	1" RPV
Bldg. 1201, Blr Rm	2 1	¾" RPV ¾" RPV
Bldg. 1200	1	1" RPV
Bldg. 1020	1	¾" RPV
Bldg. 1002	1	¾" RPV
Bldg. 1003	1 1 1	¾" RPV 2" RPV 1" RPV
Bldg. 1000	1	¾" RPV
ZONE 99	1	1" RPV
Bldg. 1002	1 1	2" RPV 1" RPV
Bldg. 3202	2 1	1" RPV ¾" RPV
Bldg. 3203	1 1	1" RPV ¾" RPV
Bldg. 2110	1	1" RPV

Annex 5

Exhibit 7

Description of BMAR Database

Description of Backlog of Maintenance and Repair Databases (BMAR)

The BMAR databases, Test Complex and Base, is a summary of deficiencies noted during the annual facility inspections. In addition, structures, facilities, utilities, systems and subsystems that are no longer economical to repair or are within 5 years of expected service life are included in the databases. Each record in the database is called a project, regardless of the estimated cost.

FIELD NAME	DESCRIPTION
Rank	Required; Contractor determined
Approval	Contractor determined
Status	Contractor determined
Inspection Year	Required; Fiscal year the project was identified
Item Number	Required; A sequential number starting at 1 each fiscal year. The item number along with the fiscal year, create a unique identifier for each project.
Inspector	Contractor determined
Facility ID	Required; Real property number for the specific structure, facility or utility
Work Element	Required; Restricted to the following values: (see definitions in NHB 8831.2A) A – Preventive Maintenance B – Predictive Testing and Inspection C – Grounds Maintenance D – Programmed Maintenance E – Corrective Maintenance (Repair) F – Trouble Calls (there should not be any trouble calls in the BMAR) G – Replacement of Obsolete Items (ROI) H – Service Requests
Equipment Number	Required for numbered equipment; A unique number assigned to equipment and maintained in the CMMS
System	Required; restricted to the following values:

HVAC	All equipment and components associated with Heating, Ventilation and Air Conditioning
EMCS	All equipment and components associated with the Energy Management and Control System
ELEC HIVOLT	All electrical equipment and components except High Voltage, includes Distribution 600 volts and greater
M/S	Except HVAC and equipment associated with sanitary and storm sewer systems, includes fire protection systems
ROAD	All road repair projects including signage
PKLOT	Parking lots including striping, wheel stops, etc
ROOF	All roofing related projects
EXPAINT	All components of the Exterior Waterproofing System, such as exterior painting, caulking, sealing, etc
SWALK	Sidewalks
NG	All equipment and components associated with the natural gas system
FENCE	Perimeter and security fencing
ARCH	Architectural systems excluding exterior paint. Includes interior paint, floor covering, and ceiling tile in common use areas, windows, doors, interior and exterior stairs, etc.

SEWER	All equipment and components associated with the sanitary and storm sewer systems

Description of Backlog of Maintenance and Repair Databases (BMAR)

FIELD NAME	DESCRIPTION
Subsystem /Location	Required; Contractor determined
Priority	Required; Restricted to the following values
	1 Emergency; Safety of life or property threatened; immediate mission impact; loss of utilities
	2 Urgent; Maintenance or repair work required for continued facility operation; should be completed to ensure continuous operation of the facility and to restore healthful environment. Not a life-threatening emergency. Respond upon completion of current work but within a specified period of time.
	3 Priority; Work that is to support the mission on a priority basis or to meet project deadlines. Complete before starting new Priority 4 (routine) work.
	4 Routine; Facilities maintenance work that can be routinely scheduled within the capability of the facilities maintenance organization. Complete in order of receipt and consolidate by facility or zone to obtain efficiency of operation.
	5 Discretionary; Work that is desired but not essential to protect, preserve, or restore facilities and equipment. Typically, new work that is not tied to a specific mission milestone.
	6 Deferred; Work that may be safely, operationally, and economically postponed; the work should be done, but cannot be scheduled because of funds shortage, work site access, or conditions outside the control of the maintenance organization.
Project Title	Required; Contractor determined
FY Required	Required; Contractor determined – once established this value cannot change unless the priority changes
Fund Source	Government determined (primarily used to identify projects that are the Responsibility of a resident agency, Construction of Facilities, Local Construction funds) – when known the Contractor should fill in this field. Restricted to the following values: RES – Resident Agency COF – Construction of Facilities LC – Local Construction
ROM cost	Required; Contractor determined - Rough Order Magnitude cost estimate
Comments	Contractor determined

Annex 5

Exhibit 8

Specified Structures & Facilities

Specified Structures and Facilities List

SSC Tenants

Property #	Name	Status	Class	Capacity
1000	DATA HANDLING CENTER	Active	310-15	51,229 SF
1002	OCEANOGRAPHY BLDG.	Active	610-10	101,389 SF
1003	NAVY COMPUTER PROGRAM OPS	Active	310-10	68,851 SF
1005	OCEAN SCIENCE LAB BLDG.	Active	310-10	60,002 SF
1006	OCEAN TECH. STAGING FACILITY	Active	442-10	4,836 SF
1007	NAVAL OCEANOGRAPHIC PROGRAM BLDG.	Active	610-10	7,004 SF
1008	AIR DEFENSE INITIATIVE	Active	610-10	7,475 SF
1020	CNOC ADMINISTRATION FACILITY	Active	610-10	13,840 SF
1103	MISS. TECH. TRANSFER CENTER	Active	610-10	48,013 SF
1106	CORE STORAGE FAC. FOR NAVY	Active	310-10	2,849 SF
1107	CHEMICAL STORAGE BUILDING	Active	442-90	640 SF
1206	CNOC ADMINISTRATION BLDG.	Active	610-10	4,630 SF
2040	U.S. CUSTOMS BUILDING	Active	610-10	8,271 SF
2101	SSC HYDROSCIENCE CENTER	Active	310-10	41,199 SF
2406	ELECTRONIC & FURNITURE WAREHOUSE	Active	442-10	2,255 SF
2408	PRE-FAB METAL WAREHOUSE	Active	442-10	7,000 SF
2420	EPA/GMPO Conference Building	Active	610-10	1,570 SF
2437	MAGNETIC OBSERVATORY BLDG	Active	310-10	2,255 SF
2438	AIRBORNE ELECTRO-MAG. LAB.	Active	310-10	2,414 SF
2510	NEW RANGE RECREATION BLDG	Active	740-54	723 SF
3200	MARINE LOGISTICS FACILITY	Active	442-10	8,144 SF
3203	OCEANOGRAPHIC BUILDING	Active	610-90	85,207 SF
3203A	NDBC METAL STORAGE BUILDING	Active	442-10	3,000 SF
3204	CENTRAL HEATING PLANT	Active	821-30	10,445 MB
3205	SYSTEM TEST & DEVELOP BLDG.	Active	310-60	9,316 SF
3206	NDBC METAL OFFICE BUILDING	Active	610-10	1,296 SF
3209	PAINT & SAND BLAST FACILITY	Active	350-20	1,410 SF
8130	REFRIGERATION BUILDING	Active	310-20	960 SF
S-1001	NAVY OCEANOGRAPHY BLDG.	Active	310-10	14,326 SF
S-1205	CNOC HEADQUARTERS BUILDING	Active	310-10	6,674 SF

T-2111	NORDA CONTRACTS & FINANCE	Active	630-10	4,890	SF

Stennis Space Center

Property #	Name	Status	Class	Capacity	
0	PERIMETER FENCING	Active	872-10	119,739	LF
6	HARBOR	Active	164-90	5,500	LF
7	RAILROAD TRACKS	In-Active	860-10	44,928	LF
8	CRYOGENIC DOCKS	Active	154-90	780	LF
9	ROADS (OTHER)	Active	851-12	0	SY
10	ELECTRICAL DISTRIBUTION SYSTEM	Active	812-30	189,650	LF
11	NATURAL GAS SYSTEM	Active	824-10	24,079	LF
12	AREA LIGHTING	Active	812-50	11,978	LF
13	POTABLE WATER SYSTEM	Active	842-10	25,281	LF
14	NON-POTABLE WATER SYSTEM	Active	842-30	2,105	LF
15	COMMUNICATION DUCT SYSTEM	Active	132-90	1	EA
16	PARKING AREAS- BITUMINOUS	Active	852-11	116,301	SY
17	PARKING AREAS- CONCRETE	Active	852-10	31,538	SY
18	SIDEWALKS (CONCRETE)	Active	852-20	6,716	SY
20	HTHW DISTRIBUTION SYSTEM	In-Active	822-20	2,084	LF
22	SANITARY SEWER SYSTEM	Active	832-10	127,296	LF
23	PAVEMENT (OTHER)	Active	852-91	46,115	SY
24	GROUND IMPROVEMENTS	Active	871-90	95,124	LF
26	MOORING DOLPHINS	Active	163-10	86	EA
27	FIRE PROTECTION PIPELINE	Active	843-10	4,550	LF
28	SEWAGE DISPOSAL SYSTEM	Active	831-90	125,000	GA
29	ROADS (BITUMINOUS)	Active	851-11	26,881	SY
30	CURBS (CONCRETE)	Active	851-90	36,628	LF
32	ROAD BARRICADES & TRAFFIC SIGNS	Active	851-92	155	LF
33	ROADS (CONCRETE)	Active	851-10	1,320	SY
34	ADMINISTRATIVE ENTRANCE STRUCTURES	Active	690-90	2	EA
35	PARKING AREAS (OTHER)	Active	852-12	168,203	SY
36	CANAL & DOCK FACILITIES	Active	163-90	3	EA
39	FIRE ALARM SYSTEM	Active	880-10	225	BX
40	HPIW DISTRIBUTION SYSTEM	Active	355-40	1	EA
41	HPG SYSTEM	Active	355-50	1	EA

42	PROPELLANT TRANSFER & STORAGE	Active	355-20	1 EA
43	FACILITIES MIDFIELD SONIC	In-Active	132-90	1 EA
44	FLOW BASIN/FLOOD PLAIN	Active	164-90	3,900 LF
45	MARINA(INCLUDES T-2426)	Active	163-90	1 EA
48	SURFACE WATER IMPOUNDMENT RESERVOIR	Active	841-55	1 KG
50	HAZARDOUS MATERIALS STORAGE	In-Active	422-90	96 SF
53	LAGOON SYSTEM, BLDG 1105	Active	831-90	500 GA
54	CONTROLLED STREAM SYSTEM	In-Active	320-10	5,000 SF
55	NPS EXPERIMENTAL NURSERY WELL	In-Active	841-55	0 KG
56	RIVER COMPLEX SEWAGE DISPOSAL SYST.	In-Active	831-10	500 GA
57	SEVERE WEATHER WARNING SIREN SYS	In-Active	880-90	1 EA
58	UTILITY CONTROL SYSTEM	Active	812-90	8,700 LF
59	MONITORING WELLS,BUFFER ZONE LANDF.	Active	841-55	10 KG
302	BOOSTER TRANSFER DOCK	Active	152-90	65 FB
1000B	BOILER ROOM BUILDING	Active	821-30	600 MB
1100	ADMINISTRATION BUILDING	Active	610-10	208,059 SF
1105	ENVIRONMENTAL LABORATORY	Active	310-10	74,614 SF
1110	DATA ENGINEERING SUPPORT BUILDING	Active	310-10	23,450 SF
1200	AUDITORIUM BUILDING	Active	350-20	30,246 SF
1201	COMMUNICATION BUILDING	Active	131-40	18,254 SF
1207	VENDING ROOM/REST ROOMS @EX. PARK	Active	740-90	1,152 SF
1208	STAGE OUTDOOR	Active	750-50	75 SE
1210	EARTH RESOURCES APPLICATION BLDG.	Active	310-10	20,799 SF
2104	ENGINEERING SERVICES BLDG	Active	610-10	16,001 SF
2105	ENGR.& LOGISTICS BUILDING	Active	219-11	36,119 SF
2106	PAINT STORAGE BUILDING	Active	442-30	150 SF
2107	FUEL STORAGE TANK AREA	In-Active	411-40	40,000 GA
2108	TECH SUPPORT/ENGINEERING BLDG.	Active	610-10	7,373 SF
2110	NASA/NSTL BIO. ASSEMBLY LAB.	Active	610-10	1,568 SF
2119	HEALTH AND FITNESS CENTER	Active	740-43	6,715 SF
2120	CHILD CARE FACILITY	Active	740-90	4,028 SF
2126	CUSTODIAL BUILDING	Active	610-10	1,329 SF
2201	REPAIR & FABRICATION SHOP	Active	219-10	58,616 SF
2202	WAREHOUSE COMPRESSED GAS CYL. STO.	Active	442-90	5,945 SF
2203	WAREHOUSE FLAMMABLE MAT. STO. BLDG.	Active	442-30	8,902 SF

2204	WAREHOUSE BUILDING	Active	442-10	179,539 SF
2205	REPAIR & FABRICATION SHOP	Active	219-11	48,675 SF
2206	PAINT SHOP, REP. & FABRICATION SHOP	Active	219-11	1,365 SF
2207	(WHSE COMPLEX) SALVAGE MAT/STO.BLDG	Active	442-10	4,262 SF
2209	BOILER ROOM BLDG @2203	Active	821-30	52 MB
2210	HAZARDOUS WASTE HANDLING FACILITY	Active	831-40	251 GA
2310	LOCK & BRIDGE EQUIPMENT BLDG.	Active	610-90	961 SF
2311	LOCK WATER SUPPLY PUMP STATION	Active	841-55	565 KG
2312	WATER WELL & PUMP HSE. No. 2	Active	841-50	179 KG
2317	LOCK AND BASCULE BRIDGE	Active	163-90	1 EA
2401	CONSTRUCTION MATERIAL DOCK	Active	152-60	275 FB
2402	SANDBLAST SHELTER	Active	350-20	850 SF
2403	CONSTRUCTION SERVICE DOCK	Active	610-10	392 SF
2404	ELEVATED WATER TANK No. 1	Active	841-30	45,000 GA
2405	ELEVATED WATER TANK No. 2	Active	841-30	45,000 GA
2407	RDS. & GRDS. EQUIPMENT STORAGE	Active	452-12	3,720 SY
2409	OLD GAINSVILLE SCHOOL BLDG.	Active	610-10	1,676 SF
2410	BLOCK HOUSE.(GAINSVILLE RD)	In-Active	610-10	566 SF
2411	CYPRESS HOUSE	Active	740-54	2,447 SF
2412	TENNIS COURTS	Active	750-10	4 EA
2413	PAVILLION No. 1	Active	740-54	4,125 SF
2414	PAVILLION No. 2	Active	740-54	1,240 SF
2415	ACOUSTICAL VELOCITY TRAINING FAC.	Active	690-90	1 EA
2421	GREENHOUSE	In-Active	320-10	2,588 SF
2422	ECOLOGICAL HABITAT SYSTEM	Active	310-10	718 SF
2423	ENVIRONMENTAL RESEARCH LAB.	In-Active	310-10	5,808 SF
2425	ROUCHON HOUSE	Active	610-10	5,253 SF
2427	STREAMSIDE SENSING FACILITY	Active	610-10	346 SF
2435	SSC FACILITY OPERATING CONTR. HQ.	Active	610-10	1,407 SF
2436	SSC FACILITY OPERATING CONTR. HQS.	Active	610-10	13,110 SF
2501	BLOCK HOUSE	In-Active	610-10	924 SF
2502	PESTICIDE OPERATION BUILDING	In-Active	442-10	1,400 SF
3101	SECURITY CONTROL CENTER SOUTH	Active	730-20	6,620 SF
3102	GUARD HOUSE (SOUTH)	Active	730-25	66 SF
3201	MARINE OPERATIONS BUILDING	Active	610-90	3,246 SF

3201A	MARINE OPS ANNEX	Active	630-10	448	SF
3202	SPACE SHUTTLE BUILDING	Active	350-20	55,151	SF
3208	SSME LOGISTICS ANNEX	Active	442-10	3,200	SF
3210	HYACINTH DRYER FACILITY	In-Active	310-10	2,156	SF
3212	BOILER ROOM @3203	Active	821-30	50	MB
3220	SCALE BUILDING	Active	860-90	1	EA
3300	DIAGNOSTIC TEST FACILITY	Active	310-20	1,326	SF
3304	AIR COMPRESSOR SHELTER	Active	350-20	1,821	SF
3305	CENTRAL COMPRESSOR BLDG.	Active	350-20	11,512	SF
3306	HYDROGEN COMPRESSOR BLDG.	Active	423-90	3,500	GA
3307	RP-1 CONTROL BUILDING	In-Active	350-20	493	SF
3308	RP-1 STORAGE TANK	In-Active	411-30	10,000	GA
3309	LIQ.NITROGEN TANK (WEST)	Active	423-90	1,000	GA
3310	GASEOUS HELIUM TANK CENTER	Active	424-10	1,000	GA
3311	GASEOUS HELIUM TANK EAST	Active	424-10	1,000	GA
3312	WATER WELL & PUMP HSE. No. 1	Active	841-50	179	KG
3320	HYDROGEN FLARE STACK AT 3306	Active	423-10	200	GA
3406	STORAGE BUILDING	Active	442-10	490	SF
3407	LIQ. HYDROGEN CONTROL BLDG.	Active	423-90	1,850	GA
3410	LOX STORAGE TANK	Active	423-10	2,500	GA
3414	LOX STORAGE FACILITY	Active	423-10	2,500	GA
3415	HYDROGEN TRANSFER FACILITY	Active	423-20	1,500	GM
3416	WASHROOM (LOX STOR.AREA)	Active	610-90	126	SF
4001	HIGH HEAT FLUX FACILITY	Active	320-50	450	SF
4010	TEST OPERATIONS BUILDING - CTF	Active	340-10	15,826	SF
4040	ELECTRICAL BUILDING CTF	Active	811-90	612	KW
4050	CTF TEST STAND	Active	345-10	1	EA
4060	TANK FARM CTF	Active	423-10	4,500	GA
4100	POTABLE WATER TANK	Active	841-30	250,000	GA
4101	PUMP HOUSE AT ASRM FACILITY	Active	842-15	200	LF
4102	SSME GUARD HOUSE	Active	730-25	337	SF
4103	SSME INERT GAS STORAGE AREA	Active	345-20	1	EA
4110	SSME TEST CONTROL CENTER	Active	350-10	20,664	SF
4115	LIQUID HYDROGEN CATCH TANK	In-Active	345-20	1	EA
4120	SSME TEST STAND A-1	Active	345-10	1	EA

4122	SSME TEST STAND A-2	Active	345-10	1 EA
4125	SSME OBSERVATION BUNKER A-1	Active	355-10	333 SF
4126	SSME OBSERVATION BUNKER A-2	Active	355-10	333 SF
4202	SHUTTLE ORBITER GUARD HOUSE	Active	730-25	337 SF
4210	SHUTTLE ORBITOR TEST CONTROL CENTER	Active	350-10	26,329 SF
4220	SHUTTLE ORBITOR TEST STAND B1	Active	345-10	1 EA
4221	B-2 TEST STAND SSME	Active	345-10	1 EA
4225	SHUTTLE ORBITOR OBS. BUNKER B1	Active	355-10	360 SF
4226	SHUTTLE ORBITOR OBS. BUNKER B2	Active	355-10	360 SF
4230	SHUTTLE ORBITOR INST. TOWER CENTER	Active	345-10	1 EA
4231	SHUTTLE ORBITOR INST.TOWER EAST	Active	345-10	1 EA
4240	SHUTTLE ORBITOR INERT GAS STORAGE	Active	345-20	1 EA
4301	SSME OFFICE BLDG	Active	610-10	3,629 SF
4302	FURNITURE WAREHOUSE	Active	442-10	4,120 SF
4312	SHUTTLE ORB POT. W. WELL PUMPHSE 3	Active	345-40	1 EA
4320	INDUSTRIAL WELL No. 1	Active	345-40	1 EA
4321	INDUSTRIAL WELL No. 2	Active	345-40	1 EA
4322	INDUSTRIAL WELL No. 3 & PUMPHOUSE	Active	345-40	1 EA
4324	SEWAGE LAGOON No. 3	In-Active	831-90	15,000 GA
4325	INDUSTRIAL WATER RESERVOIR	Active	345-40	1 EA
4400	HPIW EMERG. POWER & HEATING PLANT	Active	345-40	1 EA
4500	RP-1 STORAGE TANK AREA	In-Active	411-30	1,000 GA
4505	RP-1 READY STORAGE TANK AREA	In-Active	411-30	1,000 GA
4995	DATA ACQUISITION FACILITY	Active	350-20	43,190 SF
7001	SECURITY CONTROL CENTER (N)	Active	730-20	2,951 SF
7002	GUARD HOUSE (NORTH)	Active	730-20	66 SF
7020	LANDFILL BUILDING	Active	833-40	0 SF
8100	INSTRUMENTATION LABORATORY	Active	310-20	81,500 SF
8101	RADIOGRAPHIC FACILITY	Active	219-11	0 SF
8105	BOILER ROOM BUILDING	Active	821-30	1,200 MB
8110	CRYOGENICS BUILDING	Active	350-20	22,989 SF
8120	ATMOSPHERIC CALIBRATION EQ. BLDG.	Active	330-30	3,000 SF
8201	METEOROLOGY BUILDING	Active	350-20	8,614 SF
8202	REMOTE SENSING STORAGE FACILITY	Active	442-20	720 SF
8210	HORN TOWER	In-Active	320-10	100 SF

8212	HORN CONTROL BUILDING	In-Active	350-20	216 SF
8301	TEST SUPPORT OFFICE	Active	610-10	8,916 SF
8304	TEST SUPPORT OPERATIONS BUILDING	Active	219-11	6,799 SF
8305	TEST OPERATIONS SUPPORT BUILDING	Active	350-20	3,386 SF
9800	PYROTECHNICS OPERATION BLDG.	In-Active	310-50	1,800 SF
9801	LAB & MAINTENANCE SHOP	In-Active	219-11	1,800 SF
9810	IGLOO STORAGE	In-Active	421-90	500 SF
9811	IGLOO STORAGE	In-Active	421-90	500 SF
TRL-110	TRAILER 110	Active	630-30	434 SF
TRL-117	TRAILER 117	Active	630-30	200 SF
TRL-134	TRAILER 134	Active	630-30	840 SF
TRL-137	TRAILER 137	Active	630-30	840 SF
TRL-232	TRAILER 232	In-Active	630-30	1,160 SF
TRL-234	TRAILER 234	In-Active	630-30	680 SF
TRL-235	TRAILER 235	Active	630-30	680 SF
TRL-236	TRAILER 236	In-Active	630-30	680 SF
TRL-237	TRAILER 237	Active	630-30	1,116 SF
TRL-238	TRAILER 238	In-Active	630-30	1,790 SF
TRL-247	TRAILER 247	Active	630-30	1,440 SF
TRL-248	TRAILER 248	Active	630-30	1,440 SF
TRL-249	TRAILER 249	Active	630-30	1,440 SF
TRL-250	TRAILER 250	Active	630-30	1,440 SF
TRL-261	TRAILER 261	Active	630-30	1,680 SF

Annex 5

Exhibit 9

Refuse Pickup Schedule

REFUSE PICK-UP SCHEDULE

LOCATION	QUANTITY		FREQUENCY/TIME				
	DUMPSTER	BARRELL	M	T	W	TH	F
BUTLER COMPLEX	1				AM		
T 2409	1		AM				
S 2425	1		AM				
S 2423	1						AM
2411	2		AM		AM		AM
2411		12	AM		AM		AM
NMBT2	1		AM				
2108	1				AM		
2204 S. SIDE	2		AM		AM		
2204 RECEIVING DOCK	1				AM		AM
2105	2				AM		AM
2104	2						AM
2201, 2205, 2206	8				AM		AM
2201		2	PM		PM		PM
2101	4		AM		AM		
3204	1						AM
SERVICE STATION	1		AM		AM		
1110, 1105	2		AM		AM		
1105 N. SIDE	1		AM		AM		
1103	2				AM		AM
1005	3		AM		AM		
1002 N. SIDE	3		AM		AM		AM
1002 S. SIDE	1		AM		AM		AM
1002 SHREDDER	1			PM		PM	
1100	3		AM/PM		AM/PM		AM/PM
1100 CAFETERIA	3		PM	PM	PM	PM	PM
1210	1		PM		PM		
1201	1		PM		PM		
1200	3		PM		PM		PM
1200		8	PM	PM	PM	PM	PM
8100, 8110	4				PM		PM
7001	1		PM				
7001		1		PM			
3202	2		PM		PM		PM
3200	1		PM		PM		
2316	1		AM				
2120	1		PM		PM		PM
2126	1				AM		
3300	1						PM
3305	1		PM				
8201	2				PM		

REFUSE PIC UP SCHE' 'LE

LOCATION	QUANTITY		FREQUENCY/TIME				
	DUMPSTER	BARRELL	M	T	W	TH	F
4210		1			PM		PM
4301	1						PM
4995	2				PM		PM
4995		1			PM		PM
4120	3				PM		PM
4120		1			PM		PM
4110	1						PM
4110		1					PM
4220 (EAST PIER)	1				PM		PM
4220		1			PM		PM
4400	1				PM		
4302	2				PM		PM
3101	1		AM				
3101		1	AM				
3407	1		PM				
2501	2		ON	CALL			
2406	2				AM		
2040	1		AM				
1020	2				PM		
3203	3		PM		PM		PM
4010	1				PM		PM
SOFTBALL FIELDS (SEASONAL)		4			PM		PM
VOLLEYBALL COURTS (SEASONAL		2	PM				
2019	1				PM		
3201	1		PM		PM		
3205	2		PM		PM		PM
4122	1				PM		PM
4122		1			PM		
ASRM	2		PM				PM
E-1 STAND	3		PM		PM		PM
8306	1				PM		
8301	2		PM		PM		
4220 (WEST PIER)	3				PM		PM
4210	1				PM		

Annex 5

Exhibit 10

List of Government-Furnished PT&I Equipment & Software

GOVERNMENT-FURNISHED PT&I EQUIPMENT

EQUIPMENT

CSI 2115 Single Channel Machinery Analyzer	NASA #1322971
CSI 2120 Dual Channel Machinery Analyzer	NASA #1910698
Accessory Equipment: Accelerometers, Current Probes, & Tachometers	
CSI 444 Strobe Light	NASA #1540236
CSI 5100 Oil Analyzer	NASA #1322940
Accessory Equipment: Portable Oven, Vacuum Pump & Viscosity Comparator	
AVO Ebrite Battery Impedance Tester	NASA #1541103
Inframetrics 760 Infrared Camera	NASA #1322955
Inframetrics 760 Control Module	NASA #1322954
Sonny Video Recorder and Screen	NASA #1322953
Cyclops Radiometer	NASA #1223547
EDP Technology Laser Radiometer	NASA #1541255
Fluke Meter	NASA #036670
Megger	NASA #1223783
Ludeca Optalign Laser Alignment	NASA #1324545
Corrosion Meter	NASA #1223562
UE 2000 Ultrasonic Meter	NASA #1910217
Digital Camera	NASA #1622467

GOVERNMENT-FURNISHED PT&I SOFTWARE

COMPUTER EQUIPMENT and PRINTERS

Microsoft Windows NT Server - Gateway 2000	
CPU	NASA #1541718
Monitor	NASA #1541716
Microsoft Windows NT Workstation - Gateway 2000	
CPU	NASA #1541717
Monitor	NASA #1541715
Microsoft Windows NT Workstation - Bay State	
CPU	NASA #1540279
Monitor	NASA #1540271
Sharp Color Video Printer	NASA #1322952
Hewlett Packard Color Paint Jet XL300 Printer	NASA #041901

SOFTWARE

CSI Master Trend Vibration Analysis	Network
CSI Oil View Analysis	Network
CSI Electric Motor Analysis	Network
CSI Four Run Balancing	Network
CSI Multi-Plane Balancing	Network

Inframetrics Thermonitor 95 - Infrared Processing
Inframetrics Data Manager Infrared Processing

Ultrasonic FFT SpectraPro Spectral Analysis Acoustical Analysis Software

Olympus 95 Digital Software
Photodeluxe Digital Processing Software

Annex 5.0

PERFORMANCE REQUIREMENTS SUMMARY

CONTRACTS REQUIREMENTS			PERFORMANCE REQUIREMENTS				
(1) ITEM NO.	(2) CONTRACTS REQUIREMENT	(3) WEIGHT (%)	(4) SURVEILLANCE METHOD	(5) WORK REQUIREMENT	(6) WEIGHT (%)	(7) STANDARD OF PERFORMANCE	(8) MAD
ANNEX 5 (OPERATIONS AND MAINTENANCE SERVICES)							
1	Develop and Accomplish Preventive Maintenance Program. (Annex 5.2)	15	RR, PI, UPI, VCC	Complete and Implement PM Plan	35	Use available resources to accomplish PM requirements effectively	5%
			RR, VCC, PI, UPI	Accomplish PM on Schedule	10	Accomplish per Table 5.2-1	20%
				Accomplish Minor Repairs	20	Complete all minor repairs at job site, with available resources	10%
			RR	Provide PM Report (DR 5-FA02)	15	Submit reports timely and accurately	3%
			PI, UPI, VCC	Quality of Accomplished Work	20	Work quality complies with specified standards	10%

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(1) ITEM NO.	(2) CONTRACTS REQUIREMENT	(3) WEIGHT (%)	(4) SURVEILLANCE METHOD	(5) WORK REQUIREMENT	(6) WEIGHT (%)	(7) STANDARD OF PERFORMANCE	(8) MAD
ANNEX 5 (OPERATIONS AND MAINTENANCE SERVICES)							
2	Accomplish Corrective Maintenance (Annex 5.3)	10	PI, UPI, VCC, RR	Accomplish Other Tasks	10	Accomplish Minimum Standards of Annex 5.3 not listed below	15%
			VCC, PI, UPI	Quality of Accomplished Work	35	Work quality complies with specified standards.	10%
			PI, UPI, VCC	CM accomplished in accordance with Table 5.3-1	30	CM completed within specified response time requirements	20%
			RR	Completed CM Documented In CMMS	10	Report covers all specified reporting requirements	5%
			RR	Prioritize CM	15	Assign work priority in accordance with definition in Annex 5.1	10%

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(1) ITEM NO.	(2) CONTRACTS REQUIREMENT	(3) WEIGHT (%)	(4) SURVEILLANCE METHOD	(5) WORK REQUIREMENT	(6) WEIGHT (%)	(7) STANDARD OF PERFORMANCE	(8) MAD
ANNEX 5 (OPERATIONS AND MAINTENANCE SERVICES)							
3	Perform Operations (Annex 5.4)	5	PI, UPI, VCC, RR	Accomplish Other Tasks	10	Accomplish Minimum Standards of Annex 5.4 not listed below	15%
			RR, PI, UPI	Provide Qualified System Operators	20	Operator staffing within specified "watchstanding" requirement; operators are properly equipped and qualified	5%
			PI, UPI, VCC	Provide Proper System Operation	40	Systems are operating to specified output ranges, capacities, and efficiency	20%
			RR	Document System Operation	15	Operating logs are complete, data is entered within specified time requirements and plans, procedures are submitted	10%
				Maintenance Management	15	Use resources and manage effectively	15%

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ANNEX 5 (OPERATIONS AND MAINTENANCE SERVICES)							
4	Assure Availability (Annex 5.5)	50	RR	Document Results	10	Document covers all specified reporting requirements	See Tables Annex 5.5
			PI, UPI, VCC	Provide Availability	90	Perform intended function and deliver the intended output	

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ANNEX 5 (OPERATIONS AND MAINTENANCE SERVICES)							
5	Provide management, Engineering and Craft Support for Test Complex Work (Annex 5.6)	10	PI, UPI, VCC, RR	Perform all work per customer requirement, maintain bench stock, provide timely reports and notifications to NASA, control costs	100	Complete all work on time, in accordance with engineering standards, provide adequate staffing for work load and maintain bench stock to satisfy historical and current work requirements. Provide all notifications and reports on time. Keep equipment in operating condition to meet work load.	15%

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CONTRACTS REQUIREMENTS			PERFORMANCE REQUIREMENTS				
(1) ITEM NO.	(2) CONTRACTS REQUIREMENT	(3) WEIGHT (%)	(4) SURVEILLANCE METHOD	(5) WORK REQUIREMENT	(6) WEIGHT (%)	(7) STANDARD OF PERFORMANCE	(8) MAD
ANNEX 5 (OPERATIONS AND MAINTENANCE SERVICES)							
6	Accomplish Facility Inspection and Planned Maintenance Program (Annex 5.7)	5	PI, UPI, RR	Perform inspection of all structures, facilities, utilities, systems, and subsystems as SSC	5	Inspection covers all required facility components and systems	15%
			PI, UPI, RR	Prioritize, plan, estimate annual planned maintenance projects	15	Plan is timely/priority reflects maintenance requirements estimates and budget.	15%
			PI, UPI, VCC, RR	Implement planned/program maintenance projects	75	Quality workmanship within cost and on schedule.	15%
			RR	Documentation	5	Documentation complete and accurately indicate facility/systems condition and repair requirements.	10%

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ANNEX 5 (OPERATIONS AND MAINTENANCE SERVICES)							
7	Perform grounds Maintenance Integrated Management (Annex 5.8)	5	PI, UPI, VCC	Provide Quality Work	60	Work Quality complies with specified standards	20%
			PI, UPI, VCC	Accomplish Scheduled Grounds Maintenance in accordance with Work Plan	30	Grounds Maintenance is completed within specified time requirements	15%
			RR	Provide Grounds Maintenance History Report	10	Report covers all specified reporting requirements	10%

ANNEX 6.0

SAFETY, QUALITY AND ENVIRONMENTAL SERVICES

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