Appendix 8
Current System Descriptions

For

Information Management and Communications Support (IMCS)

B.3.0 Technical Services

This appendix describes the current state of the systems used to provide the services listed in PWS Section 3, Technical Services. System locations are listed in Appendix 11 – System and Service Location Matrix.

B.3.1 Computer Services

B.3.1.1 Data Center Operations

The current Data Center environment encompasses several locations across KSC. The Data Center support approximately 300 servers and most of them are housed within 3 main locations: CIF room 243 with 233 servers including the KSC Internet System (KIS) and the KSC Applications System (KAS), HQ room 3470 with 50 servers, and LCC room 1P11 with 25 servers, of which 10 are Agency-owned and support NASA Agency applications. The remaining servers support a variety of KSC Government and contractor customers in various locations. These servers in remote locations are usually in close proximity to the users. The Data Center supports approximately 255 applications and websites. The majority of applications and web sites are used internally, but a limited number support users external to KSC. There are plans to consolidate these environments into a single central Data Center during the performance of this contract.

CIF 243 houses:

- A combination of Hewlett Packard and Dell servers. Windows Server 2003 is the primary server operating system; however, some servers use Windows Server 2000 and other operating systems. In some cases, hardware maintenance and operating system software licenses for systems are the responsibility of other organizations. These systems support the applications listed in Appendix 7 - Software Applications Listing.

- Peripherals supporting the Data Center include disc storage units, automated tape storage and backup units, RAID disc storage units, network switches, domain controllers, firewall, Fibre Channel Storage Area Network (SAN) switch, server monitoring systems, and uninterruptible power supplies (UPS).

- The KIS which hosts the KSC Internal and External home pages and provides web and streaming video services during launch and landing activities. The KIS utilizes high-end web/application servers, video streaming servers, and video encoding servers.

- The KAS is comprised of three environments - production, development/test, and evaluation. Production provides a secure environment for NASA-sensitive data. Development/Test provides a unique capability to develop, test, stage, and move applications to Production, all within an infrastructure that is configured and managed identical to Production. Evaluation provides the capability for NASA to evaluate and test new architectures and new technologies.

HQ 3470 houses:

- The CAD/CAE system supporting computer-related services to contractor and NASA Engineering communities. It uses MicroStation, with a 59-user concurrent license, and Pro Engineer, with a 41-user concurrent license center-wide. It also supports 204 Bentley MicroStation workstations: 142 contractor and 62 NASA users and 197 Bentley ProjectWise workstations: 194 contractor and 3 NASA users. The CAD/CAE support group is the primary licensing and support group for these systems at KSC and it directly

maintains 15 Windows NT Servers (for Domain Administration, as well as File Services). Most CAD/CAE servers are standalone Windows 2003 Server machines, while seven of the servers are Level-5 RAID Fault Tolerant file server. The CAD/CAE group is also responsible for providing help desk service for users of CAD/CAM and engineering analysis workstations (e.g. problems involving printing, network communication, Windows Admin Server access, workstation access, etc.)

- The STI support which includes the Shuttle Data Processing System (DPS). The Data Processing System consists of Loral Open Systems 90 equipment, one Penny and Giles 14-track recorder, a DEC 5000 ULTRIX Telemetry Front End (TFE) Workstation with Ingres database, two Loral Model IV 14-track tape recorders, one Loral 8470 Digital Discriminator, two Time Code Generator units, three sets of subcarrier discriminators, three oscillographs, one 429 Multiplexor encoder, one digital frequency discriminator, one analog to digital converter, two Wavetek signal filters and associated rack assemblies. The launch history data is stored in a 144 cartridge Alphatronix Inspire II magneto-optical jukebox.

Data Reduction services are provided to the Launch Vehicle such as:

- Launch, Launch Abort, Launch Scrub Measurement Data Reduction. Approximately 4,000 analog and digital measurements are extracted and processed in the engineering computer center for each launch flight readiness firing, launch, launch abort, or scrub. These measurements are recorded by sensors on the Shuttle orbiter and on ground support equipment and the many structures around the two launch pads. This data is used to accurately analyze and predict the environmental stresses that are imposed on instruments and structures around the launch pads. Each measurement is assigned a unique number that classifies the measurement location and type. The engineering computer center is capable of providing detailed analysis requiring high volume and high sample rates to exhibit conditions of anomaly or variations which may impact performance of ground support equipment or systems on the Orbiter. Specific ongoing launch measurements being provided to engineering include data from sensors on the External Tank GOX Vent Arm, LOX Pump Vibration, H2 Leak Detection, H2 Vent Arm, MLP Hold Down Post, air compressors, and several acoustic sensor locations. In addition to collecting, filtering, and sampling this data, the engineering computer systems offer services to present the data in formats capable of being processed by commercial analytical tools.

- Launch History STS-1 through STS-13, STS-26R through the latest STS mission. Engineers are able to interrogate a database of information pertaining to structures, locations, engineering units, measurement categories for telemetry data from past Shuttle launches, and display this data online at remote workstations in graphical format. The data from these launches includes a significant portion of the ground vibration, acoustics, pressure, strain, and heating rate data collected from STS launches to date. This data is launch-induced environment data is used to analyze existing and future ground launch structures and support equipment.

- Space Shuttle Main Engine (SSME) Data Reduction at High Volume, High Sample

Rates. Specific analysis of SSME vibrations and "pops" can be detected by sampling at 100KHz frequencies and filtering the data at lower frequencies. SSME refurbishment is extremely costly and this analysis is one of the ways in which SSME performance/wear is analyzed. This system provides a “waterfall” time frequency domain (FFT) plot of each of the measurements to main engine cutoff.

- Shuttle Landing Facility (SLF) Winds Return to Launch Site, SLF Shuttle Landing Data Acquisition. SLF telemetry data is acquired three hours prior to launch/landing through thirty minutes after launch/landing from three sites at the SLF. In addition to wind speed, the wind direction is required for the crosswinds vector calculation. This data is used for post launch analysis and is utilized in Return To Launch Site (RTLS) and Shuttle landing constraint analysis.

- Shuttle Launch Commit Criteria Data Acquisition Analysis. There is a requirement to archive meteorological data to support review of launch commit constraint criteria applicable to cloud electrification and "cloud to cloud" or "cloud to ground" lightning, crosswind speed and vector analysis for SLF landing and RTLS constraints, and basic Launch Pad Lightning Warning System (LPLWS) analysis to minimize disruption of launch support activities resulting from lightning and severe thunderstorm activity. Electric potential gradient data and Doppler radar data is processed 24/7 and archived from the Range Operations Control Center (ROCC) and Meteorological Interactive Data Display System (MIDDS). The data is made available for specific dates, locations, altitudes, and time periods from ground systems and Doppler radar systems to support this research to determine if launch constraints may be modified or relaxed.

- Shuttle Processing Operations Adverse Weather Warnings Data Acquisition - Data from the CCAFS ROCC and MIDDS is archived and provided to NASA and researchers in support of Government funded projects to pinpoint the origination of cloud electrification and predict cloud to cloud and cloud to ground lightning. These studies are coordinated by NASA and are used to dictate early warning conditions for Shuttle operations, especially for personnel working up to 200 feet above ground near the Orbiter and ELVs.

LCC 1P11 houses:

- The Agency system support for Electronic Security Surveillance-Access Control (ESS-AC) includes the Common Badging and Access Control System (CBACS) system. ESS-AC integrates each of the seven operator workstations in the 911 dispatch center using dedicated KVM switches, audio switches, and computers. CBACS administrators supporting this system are Lenel Master certified. KSC has administration responsibilities for only part of the CBACS system. The Agency provides the main support for the Regional servers as well the communications servers at KSC. KSC provides support for these servers when needed and when the permissions are granted by the agency. The Digital Video Recorders (DVR) and terminal servers are maintained by KSC. CBACS includes end devices such as card readers and intrusion detection devices which are installed and maintained by the facilities group. Programming of the Lenel system to accept and act on these devices and their maintenance is the responsibility of the IMCS contract. CBACS also includes the Agency Personnel Identity Verification

enrollment and badge issuance workstations. These computers are operated by the badging office in support of the Agency enrollment and badging functions. KSC provides the local support for these applications and performs local trouble resolution or coordinates resolution with the Agency CBACS team.

Server software used in the Data Center environments include:

- Juniper Networks NetScreen
- Cold Fusion MX Server
- Microsoft SQL Database Server
- Real Helix Video Streaming Software
- Symantec Antivirus
- Veritas Backup Exec
- NetIQ AppManager
- MoinMoin
- KSC System Change Log
- KSC Event Log Query System
- Unlimi-Tech Files2U
- Microsoft Monitoring Software
- List server software
- MicroStation-SE
- MicroStation-J

These systems support the services referenced in PWS 3.1.1.

B.3.1.2 Software Engineering

Applications developed, maintained, and/or sustained are included in Appendix 7 - Software Applications Listing.

Software engineering support is also provided to mainframe applications housed in the Marshall Space Flight Center (MSFC) NASA Data Center (NDC). The operation and maintenance of the mainframe is not part of this contract. The NDC Computer System is an IBM Z9 Processor as outlined in the Office of Space Flight (OSF) Automatic Data Processing (ADP) Consolidations Concepts Document and KSC's share is known as K14 LPAR (logical partition). Applications provided by the mainframe include: Human Resources, Financial Management, Equipment Management, Procurement Systems, etc. Email is sent every weekday indicating the status of backups for the systems identified by the Government. If the backup did not occur, an explanation is included documenting what is being done to resolve the issue.

An Associate Account Authorization Official (aAAO) for the NASA Account Management System (NAMS) provides help desk support for users with NAMS accounts. The aAAO will be responsible for users' local support, for entering the date the subscriber agreement is signed, the date when the IT Security Training was taken by the user, and for researching information on new account requests.

These custom applications are developed and maintained using various programming languages and standard applications including:

- C, C++, C#
- FORTRAN
- Clipper
- Software AG “Natural”
- Software AG ADABAS
- Select Business Solutions: NOMAD
- Oracle PL/SQL
- Python
- MySQL
- Mercury Test Director
- ESRI ArcGIS
- CSS Flash
- Pro Engineer
- PTC Windchill
- Norton Antivirus Corporate Edition
- Nero
- Microsoft Project Version 2005 and higher
- Microsoft Office Professional *
- Microsoft Internet Information Server Version 6 and higher*
- Microsoft Windows Media Server*
- Microsoft Share Point Version 2 and higher*
- HTML*
- Visual Basic*
- JAVA, JAVA Script, JAVA SVG*
- Adobe Cold Fusion Version 5 and higher*
- Adobe Dreamweaver Version MX*
- Adobe Photoshop Version CS*
- Adobe Flash Version MX*
- Adobe Premiere Version CS*
- Microsoft SQL Server Version 2000 and higher*
- Real Media Helix Server*
- Sound Forge Version 8 and higher*
- ASP, ASP.NET, and .Net Frame work support*
- Backup Exec*
- Real Producer*
- 3D Studio MAX*
- Microsoft Windows Encoder*
- Microsoft WinBatch*
- SpotLight*
- Microsoft Operations Manager*

* These applications are currently used for the development of new applications.

These systems support the services referenced in PWS 3.1.2.

B.3.2 Cable Plant

KSC has both copper and fiber cable plants that provide transport for operational and institutional communications requirements at KSC and the NASA occupied facilities at the CCAFS. The cable plant traverses over 550 manholes, handholes, associated conduit systems, and facility cable trays. Some cables support unique systems at the Launch Complex (LC) 39 pads. Facility premise wiring is considered to be part of the cable plant.

Cable records are managed using the Circuit Assignment Management System (CAMS). CAMS was developed in-house. It automatically builds circuits between endpoints and provides information about which users will be affected when planning circuit outages.

B.3.2.1 Copper Cable Plant

The copper plant consists of over 3000 backbone and distribution coaxial cables and over 1,000 various gauge twin-axial cables. Within these cables there are over 500,000 19-, 22-, or 24-gauge copper twisted pair cables. The cables terminate at over 107 Main Distribution Frames and over 1700 Telephone Terminal Cabinets. There are over 42 cathodic protection rectifiers and over 22 air dryers with associated flow meter panels.

Frame Lights are used to display the frame access status (open, controlled, or closed). Typically, the frames are in controlled or closed status during launch and landing operations.

A Wire Test Board is located at the CD&SC.

B.3.2.2 Fiber Optic Cable Plant

The KSC fiber optic cable plant contains over 3000 multi-mode and single-mode fibers with FOTs for system connections. This includes the cable management system which provides the physical infrastructure for the fiber optic system. The systems supported include the Fiber Optic Wideband Transmission system, Orbiter S-Band uplink monitor, and external customers.

The fiber optic system consists of approximately 290 miles of fiber optic cable, 300 fiber optic cables, and 230 fiber optic terminals.

The single-mode fiber plant supports point to point and Coarse Wave Division Multiplexer (CWDM) technologies on 9/125 um single-mode fiber. This fiber plant supports the Digital Video Transmission System (DVTS), point to point, Kennedy Institutional Network (KNET), SONET, fire alarm, electronic security systems, and specialized program requirements.

The multi-mode fiber supports the 1300 and 1550 nanometer (nm) wavelength on 50/125 micrometer (um) multi-mode fiber. This fiber supports the legacy fiber optic wideband systems, NTSC video, Launch Processing System, 12 MHz analog interface, KNET, and

KSC fire alarm system. Systems currently supported by this fiber will migrate to the single-mode fiber plant.

A CWDM tool provides detail tracking and visual representation of the fiber plant utilization. Fiber records are also maintained for the intra-facility fiber and multi-mode fiber plant. Fiber records are coordinated with external customers such as CCAFS, NISN, and commercial companies who provide vehicle or payload processing to KSC, CCAFS, or other Federal agencies.

B.3.3 Transmission

B.3.3.1 Data Transmission

The Fiber Optic Transmission System (FOTS) transmits RS-170 or NTSC color video signals, analog signals within a 12-Megahertz (MHz) bandwidth, or asynchronous digital data up to 8 Mb/s No Return Zero-Level (NRZ-L), depending on the application. The system provides a balanced 124-ohm or unbalanced 75-ohm electrical interface for the optical transmission of video, analog, or digital data signals over a single fiber. The system processes a 1-volt input signal between 10 Hertz (Hz) and 12 MHz and transmits it optically at either 1300 or 1550 nm via Injection Laser Diodes (ILD) or Light Emitting Diodes (LED) to the receive location where the signal is restored to the original electrical input signal. ILD transmitters are used in conjunction with optical dividers to create multipoint circuits.

The frequency division data multiplexer can accommodate eight data channels (four channels from 0 to 128 Kilobit per Second [Kbps] and four channels from 0 to 512 Kbps). Asynchronous data, either balanced or unbalanced, can be transmitted at any data rate using RS-422 voltage levels or a one-volt peak-to-peak variant. The aggregate output of the multiplexer is transported via the fiber optic wideband transmission system.

The WDM equipment doubles the capacity of the existing fiber optics cable plant. WDMs are installed at facilities throughout KSC to enhance the optical fiber's capacity. The WDMs multiplex signals at 1300 and 1500 nm and are primarily used with the wideband fiber optic transmission system.

A 32 x 32 Sigma Electronics analog matrix at the CD&SC is used as the KSC off-site routing switch in support of Shuttle processing, launch, and landing video. The fiber optic wideband transmission system has more than 1300 transmitter/receiver pairs that service more than 35 facilities on KSC and CCAFS. At present, approximately eight facilities are equipped with frequency division data multiplexers. There are two full duplex 50-Mbps data links – one between the O&C building and Orbiter Processing Facilities (OPF) 1 and 2 and the other between the O&C building and OPF-3. The Orbiter S-Band Uplink Monitor transmits a 2 GHz analog signal between Pads A and B and the OPFs. The system utilizes single mode lasers and 2X2 optical couplers.

Fiber optic transmission for short distances includes RS-250-C short haul video, and Serial Data Interface (SDI) video. This also includes point-to-point variable rate telemetry circuits at KSC and CCAFS.

The Remote Monitoring and Alarm System (RMAS) consists of hardware and software to monitor the health of the Video Products Group Plessy Corning Optronics (PCO) 12 MHz analog transmission equipment located at KSC. RMAS can monitor any equipment generating discrete contact closures and/or analog voltages. The Sun Microsystems RMAS console uses Hewlett-Packard Open View Network Node Manager to provide the user interface and reporting mechanism. The RMAS Remote Terminal Unit (RTU) is

polled for alarm status utilizing a Simple Network Management Protocol (SNMP) proxy agent via a COTS Code Activated Switch (CAS). The RTU uses KSC designed hardware and software. The RTU software is written in the C language and is compiled to machine language in order to run on the RTU.

The fiber optic wideband (FOTS) system is being phased out and the circuits and functions are being transitioned to the Digital Video Transmission System (DVTS).

Standards Based Data Transmission systems include the ATM Transmission System (ATXS), T-Carrier/SONET, fiber optic end equipment, DVTS, and Voice Distribution Management System (VDMS). KSC has initiated a project to replace the existing systems functionality and add new capabilities with a common transport system. This system is expected to leverage technologies such as CWDM, optical switching, signal recognition, Next Generation SONET, emerging Ethernet technologies, innovative optical architectures, environmentally hardened equipment, Controlnet, Devicenet, Industrial Ethernet, and Fiber Optic RF Transmission.

ATXS

The ATXS is a commercial off the shelf, standards based switch network consisting of four 10 gigabyte per second (Gbps) Cisco 8600 and four 20 Gbps Cisco 8540 Multi-service Switch Routing (MSR) backbone switches, four 10 Gbps FORE ASX-1000 ATM switches, four 5 Gbps Light Stream 1010, two 20 Gbps Cisco 8540 MSR facility switches, and over 100 edge switches consisting of Cisco 2924, and Riverstone 3100. The ATXS is a mesh connected system integrated with the SONET transmission system to take advantage of the SONET ring physical layer protection. It serves as the KSC operational data transport system, integrating separate operational LANs over virtual circuits. These virtual circuits utilize RFC-1483, Classical IP over ATM, or direct OC-3c ATM connections.

ATXS network management is accomplished by an in-band SNMP based platform running Hewlett Packard Open View Network Node Manager software and vendor specific management software. An out-of-band system utilizing point-to-point modems provides security and maintenance alarms.

T-Carrier/SONET

The T-Carrier/SONET backbone supports both administrative and operational customers at KSC and CCAFS. The backbone utilizes SONET OC-48, SONET OC-3, and M-13 multiplexers. The system provides OC-12, OC-3, DS-3, and DS-1 connectivity between major facilities at KSC and CCAFS.

The T-carrier system consists of fiber optic multiplexers at twenty-one locations at KSC and one location at CCAFS. Office repeaters are installed at all multiplexer locations to improve signal quality at the multiplexer. Customer Service Unit (CSU)/Data Service Units (DSU) and Smart Jacks are supplied at customer demarcation points for data

conversion for V.35, RS-422, and RS-530 interfaces. The T-carrier system utilizes High-bit-rate Digital Subscriber Line (HDSL) equipment to reach selected customers in some of the outlying areas of KSC.

The SONET system consists of 16 OC-48 multiplexers and 17 OC-3 multiplexers at major facilities at KSC.

All M-13 and SONET multiplexer locations have UPS or battery back up.

The T-Carrier/SONET management system consists of SNMP control devices and proprietary control devices.

DVTS

DVTS consists of CWDM, video transmitter (TX) and receiver (RX) cards, data TX and RX cards, and audio TX and RX cards. It supports Orbiter processing and launch operations, payload test and checkout, Electronic Security Surveillance (ESS)-Access Control (AC), Ground Camera Acquisition Imaging Project, Electronic Hold Fire, shoreline intrusion detection, and Digital Broadband Communications Distribution System (BCDS).

DVTS provides all of the services listed under the FOWB analog system and includes the additional digital services:

- HD digital video
- SDI digital video
- Asynchronous serial interface (ASI) streaming video
- Digital video multiplexing (8 SDI/ASI channels on one wavelength)
- Digital audio (including analog audio)
- Increased bandwidth RS422 data (up to 2 Mbps)
- Bi-phase L data
- 10/100 Mbit Ethernet
- Gigabit Ethernet
- Analog to Digital converters and Digital to Analog converters

The DVTS system has an integrated SNMP for system monitoring and alarms.

DVTS also incorporates the CWDM Optical Remultiplexer and Regenerating System (CORRS), which provides both passive CWDM optical patching and active regeneration patching.

CORRS will integrate with the future system deployment of the Optical to Electrical to Optical (OEO) switch which will provide point-to-point and point-to-multi-point optical switching of the CWDM wavelengths. Point-to-point provides redirection of the wideband services to different facilities through major hub points such as the VABR and CD&SC. Point-to-multi-point provides multi-casting of select wideband services to multiple facilities through major hub points.

VDMS

VDMS is a COTS multi-nodal, multi-aggregate multiplexer system for local routing of communication signals in the KSC vicinity. The system routes approximately 300 operational voice and data circuits at KSC and CCAFS. The VDMS is the primary interface between the KSC OIS-D system and the NISN interface which routes KSC circuits to other NASA Centers.

VDMS is comprised of 37 General DataComm (GDC) Megamux Transmission Management System (TMS) multiplexers and 23 ADC Fibermux Magnum 100 Mbps fiber optic multiplexers on five100 Mbps backbone rings. The System utilizes computer automated performance monitoring and control. The TMS and Magnum systems are designed to be highly reliable and will automatically reroute circuits around system failures to the full extent possible. This auto routing feature is essential due to the critical nature of the VDMS function.

The system is located at the CD&SC with multiplexers throughout the primary communications locations at KSC and CCAFS.

These systems support the services referenced in the PWS 3.3.1.

B.3.3.2 KFRL

The KFRL consists of communication systems and functions provided by the Ground Networks for support of space flight operations, testing, and simulations. This includes data and voice combined to form the telemetry and command stream transmission.

The Forward Link function utilizes the KFRL system to process commands and A/G voice (V1 and V2) and then transmits the Forward Link Pulse Code Modulation (PCM) stream to the uplink site. The two AstroComm analog voice channels and the LPS-generated Forward Link command stream (with voice fill) are sent into the KFRL system where the voice is digitized and multiplexed into the Forward Link stream. The Forward Link stream (32 Kbps/72Kbps) is then encrypted, if required, and blocked for transmission through the NISN mission network(s) to the ground station at MILA, JSC, Dryden Flight Research Center (DFRC), or White Sands Complex (WSC). Additionally,

the KFRL system can route both Forward Link and Forward Link Echo streams from any uplink site to RPS for recording purposes. These data streams are de-blocked and decrypted prior to transmission to RPS.

The KFRL system will process the Return Link PCM stream (192/96 Kbps) by first de-blocking the data, decrypting it if necessary, demultiplexing the data and two voice channels (V1 and V2), generating the output Operational Downlink PCM stream (128/64 Kbps), and finally distributing the data and analog voice channels to the appropriate LPS Firing Room, RPS, and AstroComm. Nominally, when the source is either MILA/PDL, JSC, DFRC, or WSC, the Return Link (or direct Operational Downlink from DFRC) will be decrypted, as required, then routed directly to the appropriate LPS Firing Room and RPS without any further processing.

KFRL is in the installation phase with completion anticipated by the end of CY 2007.

These systems support the services referenced in the PWS 3.3.2.

B.3.4 Networks, Telephones and Network Security Perimeter

B.3.4.1 Network

KNET provides approximately 20,000 network connections. KNET currently supports IP based protocols and is controlled using approximately 30 routers, 600 switches/hubs and 150 access points to provide networking to over 240 buildings and trailers throughout KSC and NASA occupied facilities on CCAFS. KNET also supports various offsite facilities. For the NASA facilities located on VAFB, the following is required:

- Provide and remotely manage the point of presence in Building 836. Incidental touch labor is provided through an ACA with the Launch Services Program (LSP) managed contractor.
- Provide and remotely manage wireless equipment
- Assign a block of IP addresses for use by NASA and NASA contractors
- Provide (as required) equipment and installation drawings for incidental system changes. Touch labor will be provided through an ACA with the LSP managed contractor.
- Manage the NISN T-1 extension between KSC and VAFB for administrative networking on both the OPEN and PRIVATE networks including provisioning routers on both ends, including troubleshooting with NISN on the T-1.
- Perform on-site installation of major upgrades. Subsequent incidental changes may be accomplished via an ACA with the LSP managed contractor.

The current network consists of 10/100/1000 Mbps Ethernet and associated cable for data transmission to desktop, servers, VoIP phones, IP cameras, and other end user devices. KNET is built upon and utilizes cabling and capabilities discussed in section 3.2 Cable Plant. KNET sustaining engineering efforts for the wired network include upgrading bandwidth limiting 10Base2/Category 3 cabling to Category 6A premises wiring and 10 Mbps switches/hubs to 10/100/1000 Mbps switched Ethernet. Several remote locations where fiber optic cable is not available are served by Digital Subscriber Line (DSL) equipment at lower speeds. KNET also provides wireless LAN service. Wireless LAN sustaining efforts include upgrading autonomous wireless access points to a centralized management wireless system.

KNET interconnects geographically dispersed facilities with a redundant Kennedy Metropolitan Area Network (KMAN) 100/1000 Mbps Ethernet switched backbone. KNET connects to external providers such as NISN through KMAN and the Network Security Perimeter.

KNET uses policy based routing and virtual LAN's to provide three segmented/logically isolated networks referred to as internal (private), public, and open (three islands) across KSC and NASA occupied facilities on CCAFS.

KNET operates and maintains many network services. These include:

- DNS – Sun/Solaris Server and BIND

- DHCP – Intel/WIN Server and Cisco Network Registrar Service
- Network Time Protocol (NTP) – Truetime and Symmetricom Appliances
- Authorization, Authentication, and Accounting Service – Cisco Secure Control Server and Juniper Steel-Belted Radius Server

Note: The Government expects to deploy an Agency-wide tool(s) for DNS and DHCP management during the base period of the contract. The contractor shall be responsible for transitioning to and using the new tool(s).

KNET's Network Control Center (NCC) operates from a primary location at the CIF and a limited functional backup NCC located at the O&C. Network management uses software and protocols including, but not limited to:

- Network Management Application – 3COM Transcend, CiscoWorks, Cisco Wireless Control Server, Spectrum, and What's Up Gold
- Network Operations Database Servers – Microsoft SQL Server
- Network Web Servers – Microsoft IIS and Apache
- Network Troubleshooting Tools – Sniffer, F-Secure, and Solarwinds

New or revitalized facilities are typically premises wired with a minimum of one Customer Faceplate Plate per 100 square feet of area each delivering 2 Category 6 augmented cabling. Additional CFP can be installed per user requirements.

The majority of the KNET routers, gateways, switches, and hubs are manufactured by Cisco Systems. However, there many 3COM and Cabletron hubs and switches still operating within the network. The bulk of the wireless devices are manufactured by Cisco Systems. The DSL devices are manufactured by Tut Systems, Pairgain, and Cisco Systems.

These systems support the services referenced in PWS 3.4.1.

B.3.4.2 Network Security Perimeter

The KSC NSP system is comprised of a series of interrelated/interconnected networking, security, and monitoring subsystems that provide a variety of functional services that are both protective and service delivery oriented.

The NSP functions as the primary KSC Wide Area Network (WAN) ingress/egress point to the outside world (including the other NASA Centers, partners, contractors, and the Internet). Via NISN, the NSP delivers primary, first level Center perimeter access control services and provides remote access services, intrusion detection, ingress/egress monitoring, network troubleshooting access, and performance measurement capabilities

at the Center's network edge. The primary locations of this system are in the CD&SC and CIF facilities with secondary monitoring locations in the HQ building and a small lab facility in the Engineering Development Lab (EDL) building.

The connectivity architecture is a basic three layer external router-firewall-internal router configuration with passive monitoring points located throughout the layers and subsystems to permit the completion of transparent system management, traffic monitoring, and network troubleshooting. Firewall filtering and other forms of traffic intervention are performed in some capacity at every layer of this architecture using "stateful" network firewalls, router access control lists, and route filtering. Direct interface to a number of "near-site" contractor/partner facilities (e.g. Boeing "Bldg 100," the Astrotech spacecraft processing facility, and the 45 SW network at CCAFS and PAFB) is completed via a dedicated set of partner switches connected at KSC and remote locations. Additionally, the two major network environments (internal and open/guest) at KSC are defined and delivered to the Center LAN through a variety of logical and physical means.

The routers and switches that interconnect the various system components and functions are a combination of Cisco Catalyst 6xxx, Catalyst 4xxx chassis based switches, Cisco 72xx and 26xx based Ethernet routers, and a number of non-modular Cisco Catalyst 35xx and 29xx switches. These switches and routers are interconnected through a mix of 1 Gbps primary network paths and 100 Mbps secondary network paths. The two primary sets of KSC firewalls (for the internal and guest networks) are redundant Checkpoint Firewall NGX-based Intel server platform clusters with a smaller number of Juniper Netscreen firewalls performing internal system protective functions.

Two redundant instances of the RADIUS and SecurID services are functional in different facilities with one in the CD&SC and one in the CIF KNET Control Center on separate "Center services" network segments and adjacent to other key network services nodes. The Center services network segment in the CD&SC includes an open source SQUID proxy server cluster running on generic Intel server platforms providing external http/https connectivity for a limited number of on-site networks/hosts that would not otherwise be routed off-site as a NASA managed network.

Within the NSP management and monitoring subsystem, there are a number of sub-functions that are performed by multiple components within this logical grouping.

The firewall clusters are supported by a pair of Checkpoint firewall management and logging servers that manage the individual firewall clusters and perform flow-level logging of all network traffic crossing the Center's network perimeter.

Intrusion detection and anomalous traffic identification functions are delivered using a mix of intrusion detection sensor servers running the open source SNORT Intrusion Detection System (IDS) applications/sensors, TCPDump raw packet capture systems, and the legacy ISS Real Secure COTS IDS application. The raw data delivered by these systems is post-capture processed by a series of internally developed Perl scripts and

other open source reporting tools. These sensors are located both at the Center's perimeter, as well as spread across the KSC campus backbone networks at key monitoring/transit locations.

This system also houses Agency remotely supported intrusion detection and monitoring capabilities based on a variety of COTS software products using Intel-based server platforms that are supported as part of the local NSP infrastructure.

These systems support the services referenced in the PWS 3.4.2

B.3.4.3 Telephones

The KSC telephone system is primarily a Siemens EWSD Class 5 Central Office Host Switch (located in CD&SC, Room 128) with six Smart Remotes (RSU) and eight remote Digital Line Remote Control Units (RCU) located in major KSC facilities. The switch has all of the features and functionality of a Class 5 Central Office (CO) including Custom Local Area Signaling Service (CLASS), SS7, and Integrated Switched Digital Network (ISDN). The system has an integrated Centigram voice mail system, two conference bridges (Latitude and Polycom), a SecureLogix telephone firewall, and a multi-port conferencing unit for ISDN video. The system integrates with an E-911 switch to provide Public Safety Answering Point (PSAP) services to KSC. The switch provides outside KSC connectivity through Primary Rate Interface (PRI) trunking to the local calling area and between NASA Centers and long distance through Federal Telecommunications System (FTS) General Services Administration (GSA). The LCC Firing Rooms are served by a Siemens HiPath PBX.

The phone system provides point-to-point links for launch critical operations. The majority of KSC phones are single line display phones with Caller ID, speakerphone, voice mail, and CLASS features. Additionally, there are a large number of ISDN multi-line speakerphones with display. VoIP has been deployed in select KSC locations and has been designated as the future configuration for the Center. The VoIP system consists of Call Managers, Unity Voice Mail, Emergency Responders (E-911 location information), and gateways. There are approximately 18,500 instruments and ports in approximately 275 buildings. There are several PRI spans servicing video, gateways, Reports and Information Distribution (RAID,) and other data requirements.

These systems support the services referenced in PWS 3.4.3.

B.3.4.4 Secure Remote Access

The KSC Secure Remote Access Services (SRAS) subsystem is a collection of remote access services that permit access to the KSC/NASA IT infrastructure from locations external to the Center. These remote access services include basic dial-in modem access service via analog Plain Old Telephone Service (POTS)/ISDN digital lines and redundant dial-in servers (Cisco 37xx class routers with single PRI interfaces), a limited services functionality Secure Sockets Layer (SSL) based Virtual Private Networking (VPN)

solution using the Agency standard web browsers as access clients (using redundant Juniper Networks Access 6000 series SSL VPN gateways), and an Internet Protocol Security (IPSEC) client based VPN gateway services using a set of redundant Cisco 3000 series VPN concentrators. This IPSEC client based service provides both full remote host connectivity, as well as a subset of that connectivity to certain remote user groups, based on group access profiles, and ultimately will perform full remote client configuration auditing via network admission control agents. This full VPN client is supported in Windows, MacOS X, and Linux environments.

A redundant Remote Authentication Dial In User Service (RADIUS) system, based on the Juniper/Funk Global Enterprise Edition RADIUS software application running on Intel based server platforms, provides basic DHCP, account logging, and pass-through authentication functions for these SRAS components. Secondary support servers providing Microsoft (MS) Windows Internet Naming Services (WINS) and Domain Name Services are also functional within this subsystem.

A two-factor authentication system based on the COTS RSA Security SecurID hardware tokens and redundant ACE servers running on Solaris based servers provides two factor authentication for the SRAS servers. Although this system primarily provides authentication for the SRAS components, it also provides strong authentication for selected systems across the Center, such as the KSC “TechDoc” document management system. Ultimately, this system will be passing the authentication requests to either the NASA Consolidated Active Directory (NCAD) or Agency Enterprise Authentication systems for final user authentications/authorization.

These two-factor strong authentication services are also utilized with the on-board ACE Server TACACS+ server daemon built into the redundant ACE Servers to provide centralized strong network authentication to the individual components of the Network Security Perimeter. A server reporting application provides a more user friendly reporting function over the built in reporting functions of the servers. A SRAS support web server that provides some user self service token management functions and an SRAS client download repository is also operational.

These systems support the services referenced in the PWS 3.4.4

B.3.5 Imaging

B.3.5.1 Surveillance Television

Operational Television (OTV)

The OTV system provides closed circuit television support to NASA operations at KSC. The system includes visual surveillance support to spacecraft, payload, and security operations and has equipment located in the LC-39 and Industrial Areas.

In the LC-39 area, video cameras are mounted in protective housings on pan and tilt units throughout the LC-39 Pad sites, Vehicle Assembly Building (VAB), and OPFs and are remotely operated from the Television Control Center (TCC) in the Launch Control Complex (LCC). An analog video switch and control system in the TCC allows for the input of 192 cameras to be sent to 512 output destinations. The switch may also be controlled from individual console locations located in Firing Rooms 1 through 4 and associated management areas. Additionally, remote controls for the video switch assigned outputs are located in the KSC Industrial Area, JSC, and MSFC. Also in the TCC is the video recording system for original recordings, duplication, and dubbing. The OTV system provides recording formats in both digital broadcast quality and commercial analog quality depending on the identified requirement. Timing equipment for time registration on the live and recorded video is also located in the TCC.

Approximately 75 video cameras and their associated pan and tilt apparatus at each pad are connected to the Pad Terminal Connection Room (PTCR) via the NASA designed TV-39 cables. In the PTCR, the Camera Control Unit separates the TV-39 signals, separating control from video. Baseband video signals are multiplexed (WDM) for transmission back to the TCC on fiber optic cables. In the TCC, the video is demodulated from the carrier frequencies, amplified, fed into a 192 X 512 Grass Valley video switch, and directly transmitted to over 500 monitors and test locations. Approximately five channels of the switcher output are fed to Broadband Cable Distribution System (BCDS) for general distribution.

Additional surveillance cameras include nine color cameras located in the transfer aisle of the VAB and three color cameras in each of the three OPF Highbays.

The existing LC-39 OTV system consists of three standalone routing switches, the analog switch is used to route existing color and black and white NTSC analog camera signals, the Standard Definition switch is used to route both existing analog and standard definition video camera signals, and the High Definition switch is used to route the recently installed high definition camera signals. The system is currently being upgraded to a digital system through the OTV-Digital (OTV-D) project. This project will transition the current analog camera, routing, and control system to permit the implementation of a SDI closed circuit surveillance system. The digital transition schedule requires that the new digital system and the current analog system co-exist for a number of years. The analog routing switch will be de-commissioned at the completion of the OTV-D

transition. The OTV-D project will also implement a new digital control system which will unify the control capability for all OTV camera formats and provide control of all video routing switchers from digital control panels. Currently, the OTV-D Digital Switch and the Video Processing and Distribution system are installed and operational.

The Industrial Area OTV System provides visual information distribution between several payload handling facilities including the O&C Building, the Payload Hazardous Servicing Facility (PHSF), Vertical Processing Facility (VPF), and the Space Station Processing Facility (SSPF).

The Industrial Area system has a central routing center which distributes video information from the payload handling facilities to various user groups, safety, and security personnel located throughout KSC. The Industrial Area system is comprised of approximately 150 black and white or color cameras and remote controlled pan and tilt units; 500 monitors; routing switches; and distribution, synchronization, video recording, duplication, and dubbing equipment.

The O&C Television Control Center is the operations center for the Industrial Area OTV system. A 128 x 400, XY routing switch at this location interfaces directly with outputs from the SSPF switch (96 x 200) and the LC-39 OTV switch (192 x 512).

ESS Access Control (AC) Cameras

The ESS AC cameras are Pan, Tilt, Zoom (PTZ) configured video camera systems that support visual surveillance around the perimeter of most major facilities at KSC. The camera systems are remotely controlled from the KSC Security Control Center. There is decentralized recording of video that is made available to security personnel at operational consoles.

Web Cameras

Web cameras provide digital video over standard KSC networks from remote locations to customer monitoring computers. The webcam capability provides an alternative to traditional video surveillance methods through the use of IP addressable video cameras. Currently, webcams are used at the SLF, the Railroad Depot area, and the Child Care Facility.

These systems support the services referenced in the PWS 3.5.1.

B.3.5.2 Multimedia Production and Distribution

KSC TV

During NASA missions, KSC TV produces live, continuous, broadcast quality audio and high definition video coverage of launch and landing, Shuttle downlink video, news conferences, and other events in response to customer requirements. The system at the

Press Site provides technical operations for both broadcast quality audio and video programming. The Press Site television system creates original programming in both the NTSC and ATSC HD 720p/59.94fps formats.

During launch and landing, Engineering News Gathering (ENG) teams are sent to sites at KSC to provide primary video sources used to create NASA TV programming. These isolated video feeds are individually distributed live to the media for creating independent programming. Unedited tracking views from each camera are replayed on NASA TV shortly after the event. For major mission milestones and special events, NASA TV events originating at KSC are transmitted to other NASA Centers, and disseminated to the public through the use of the KSC video inter-center digital video capability, either as real time or near real time delayed broadcasts.

KSC TV provides original multi-camera program development, post-production editing, and original broadcast quality NTSC and ATSC HD recordings of NASA Media Services Division requirements. KSC TV also produces both broadcast and commercial quality videotape and DVD format duplications and dubs.

News briefings are conducted before, during, and after missions to inform the news media and public of mission status. Most briefings are moderated by a NASA Public Information Officer and may include graphics, videotape, animation, and multipoint two-way audio for media participation from remote locations such as other NASA Centers and, when applicable, international venues.

KSC TV provides technical support to operational requirements at the KSC Press Site. The Press Site provides a central location for media personnel to assemble and interface with the KSC TV system. The Press Site has provisions for direct video feed distribution of the NASA remote cameras to the news media. NTSC distribution includes approximately 20 distribution boxes located around the Press Site with 24 isolated video outputs and one RF feed which includes the local broadcast channels. ATSC HD (HD-SDI) distribution includes approximately 12 distribution boxes with 24 isolated video outputs, located at the Press Site Annex Building.

In addition to these feeds, there are also four small stump boxes each providing five NASA TV baseband NTSC feeds and five RF feeds. A total of 52 RF cable drops are provided in the stump boxes. Three additional ATSC HD (HD-SDI) distribution boxes exist with approximately 20 each NASA TV program and approximately 20 each KSCTV program, located at the Press Site Annex Building and as portable enclosures in the parking lot for media satellite trucks distribution.

BCDS

BCDS is a hybrid fiber/coaxial cable television distribution system. The system provides digital high definition, standard definition, and analog channels. The system is designed to provide television distribution in several tiers. The first tier is basic analog television programming. This includes off-air commercial television channels as well as operational

views of various KSC locations. The second tier is MPEG Annex B digital formatted video programming. This tier is used to distribute digital programming for receivers and set-top boxes that use the American standard encoding format. This tier includes off-air channels that have transitioned from analog to digital for their satellite delivery service. The third tier of programming is MPEG Annex A. This tier is based on the European standard digital encoding format and has conditional access restriction capabilities. This tier allows for secure distribution of sensitive video programming to select customers using the broadband cable infrastructure. The basic function of the broadband system is to provide both programming originated at KSC and off-air television channels to users at KSC and CCAFS.

The KSC BCDS is a mid-split cable television broadband system that provides distribution of television to most of the major KSC facilities and acts as a headend feed for cable television distribution at CCAFS. The BCDS is comprised of a consolidated headend that delivers signals to the cable distribution system in the Industrial Area, LC-39 Area, and to CCAFS. The system is capable of providing 63, 6 MHz cable television channels. Program sources include local KSC operational video from spacecraft and payload operational areas, off-air commercial television, C-band and Ku-band satellite feeds, and video taped material. The system currently services approximately 12,000 television drops.

Origination sources include local off-air antennas, satellite dishes, and outputs from Grass Valley and Sony HD video switches located in the LCC and the Payloads/SSPF switches located in the O&C and SSPF. Baseband signals from the video sources are encoded, modulated, processed, and distributed using COTS television equipment.

The NASA Training and Information Channel is distributed on BCDS. This is a dedicated channel that broadcasts training and informational programming twenty-four hours per day. A COTS system stores program video as MPEG files on a hard drive. Playback is controlled by a PC based scheduling system. Operator intervention is required only if a new program must be added or a schedule change is required.

Webcast Studio

The webcast studios are located at the KSC Press Site and CCAFS Building 1605. The Press Site system consists of six racks, approximately five servers, and, 10 video editing workstations, and a TV studio. The CCAFS system consists of six racks, three video editing suites, a TV studio, video switch, and video dubbing areas. The webcast studios are part of the Kennedy Internet System and are used to develop multimedia products to be hosted on the KIS for distribution. Webcast studios also perform live webcast programming and podcasting to support NASA activities such as Shuttle and ELV launches from Kennedy Space Center and Vandenberg Air Force Base. These products are delivered through the KSC Internal/External home pages, organizational web applications, and the NASA portal web site. The webcast studios are connected to the KIS through the KSC networks and require special permission to access the KIS. The webcast studios utilize high-end Axio HD video editing workstations, file servers, tape

backup units, uninterruptible power supplies, RAID disc storage units, video streaming encoders, GlobeCaster video switching technology, 3D Studio MAX animation software, and Adobe Premiere Pro video capture and editing software.

These systems support the services referenced in the PWS 3.5.2.

B.3.5.3 Processing, Launch, and Landing

The Processing, Launch, and Landing Imaging systems provide tracking, motion picture, still photographic, digital, and video products and services. This includes support to institutional and engineering requirements.

Program Engineering Photographic Imagery

Program Engineering Photographic Imagery acquisition provides motion picture, photographic still, and digital still images for major milestones of NASA programs. A mixed media solution is used to provide a high degree of spatial and temporal resolution. Camera types used include Photosonic 16mm, 35mm and 70mm motion picture cameras, various 35mm and large format photographic still cameras, professional digital still cameras, and high definition video cameras operating at 720P lines of resolution, 60 frames per second (fps). Currently the Photosonic motion picture cameras provide our highest temporal capability for operations at up to 400 fps. Investigations into high-speed digital cameras are currently underway for potential future as a replacement to or augmentation of high-speed motion picture film.

A large supply of lenses and telescopes is maintained in house. Lenses range from macro to long telephoto types for both film and video. Both fixed and active zoom lenses are available. Telescopes are both fixed and actively focused with a focal length range from 50” to 180”.

The system also includes the tracking mounts and associated support vehicles such as trucks for towing and mobile control rooms for control of video cameras and recording equipment. There are two major classes of tracking mounts. The first mount is the remotely controlled Kineto Tracking Mount (KTM). This unit uses a remote control system that allows the tracker to be used in Blast Danger Areas such as short range sites around the Pads. There are approximately 14 of these units in inventory. The second type of tracker is the Intermediate Focal Length Optical Tracking Mount (IFLOT). This tracker is a manned unit that has been recently refurbished to include digital tracking technology to improve performance and reliability. There are approximately six of these units in inventory.

Photo Optical Control Systems (POCS)

The POCS supports LC-39 engineering and NASA Media Services Division documentary requirements. The POCS is a motion picture, photographic still, and digital

still remote control system that is capable of camera start/stop, lens control, and performance data logging.

A POCS Control and Acquisition Module (CAM) is located at the cameras. The CAM interfaces directly with a camera and controls and monitors the camera functions and parameters at remote camera sites. Also housed at these sites are the FOT along with the multiplexers/demultiplexers required for remote operations. The CAM to FOT interface is serial RS-422 with a base function rate of 9600 baud. The FOT links between remote locations and the central control area operate at 1550 nm and 1300 nm. The central control area for POCS is located in the LCC room 2P10.

There are two NASA custom designed Communications Control Systems (CCS) with redundant connections to the FOTs in the Payload Control Center. The CCS can be controlled and monitored from a number of workstations via Ethernet connections.

The POCS software has the capability to support 512 CAM units each at Pad A and Pad B. There are 300 operational CAM units.

HD/SDTV Image Acquisition

HD/SDTV Image Acquisition assets include HD cameras and lenses, SD cameras and lenses, camera control hardware and software, and HD and SD recorders.

Ground camera imagery is acquired by operation of camera tracker mounts and camera controls using a mix of both locally and remotely operated devices. The image acquisition system includes transmission equipment to move HD and SD signals from the cameras to recorders and live viewing locations. A 64 x 64 HD video routing switcher is used to configure live feeds for a variety of locations. SD signals are routed through the OTV switch.

For remote camera sites with fiber-optic connectivity, HDTV imagery files are moved from on-site recorders to the OTV area post event. For remote camera sites without fiber-optic connectivity, HDTV imagery files are moved from on-site recorders to the OTV area on removable media by couriers.

For remotely controlled devices, signals are multiplexed over fiber optics using data transmission equipment. Universal Time Code (UTC)/IRIG-B timing information is inserted just prior to the image being recorded.

Mission Support Imagery

Mission Support Imagery is acquired from sources outside of KSC and the Eastern Range (ER). The acquisition of these types of images is achieved by sources that are outside of the scope of this contract. These sources include cameras mounted on the launch vehicle and images acquired during on-orbit operations and down linked to JSC. Additionally, the KIIS will support radar imagery as provided from various sites on KSC and the ER.

Image Distribution

The image distribution system consists of two major elements:

- NISN Dedicated Network with constant allocation of 200Mbps with burst rates of up to 400 Mbps.

- KSC, JSC, and MSFC Image Analysis Facility hardware and software platforms for imagery data access.

Imagery data is distributed to the image analysis facilities using a configuration of "mirrored servers" located at JSC, MSFC, and KSC. The mirrored servers are identical in storage capacity and computing power. Imagery placed on a mirrored server at one center is automatically replicated on the mirrored servers at the other two centers. Firewalls are used to protect the data and the system components. Communications between the centers is via a dedicated NISN link.

Imagery content is placed on the mirrored servers from the Image Archival Server in support of mission requirements. User areas are also utilized for the users at each center to place content on their mirrored server for distribution to the other Centers.

Image Archival Server

The Image Archive Server is located at KSC and supports archiving the following types of imagery:

- **External Tank Camera Video** – This imagery is transferred to the Archive Server from the MILA, Ponce DeLeon (PDL), Wallops Flight Facility (WFF), and Jonathon Dickinson Missile Tracking Annex (JDMTA) tracking stations.

- **Solid Rocket Boosters (SRB) Camera Imagery**– This imagery is acquired from cameras mounted on the SRBs and is delivered to the KSC for archiving and distribution after SRB retrieval.

- **WB- 57 Camera Video** – This imagery is captured from the NASA WB-57 aircraft and delivered to the KIIS post ascent for archiving and distribution.

- **Baseline Configuration Imagery** – This imagery is a set of high-resolution digital still images in TIFF format of pre-launch Shuttle elements for comparison with on-orbit views of similar sets.

- **Engineering playback views (as defined in NSTS 08244)** – This imagery includes engineering and NASA Media Services Division sources as defined.

- **NASA Media Services Division Video** – This imagery includes other NASA Media Services Division select feeds.

- **Radar Data Imagery** – This imagery is provided to the KIIS for archival and distribution from radar sites at KSC and the ER.

- **Other Sources** – These imagery formats include standard NTSC analog, Super-Video Home System (S-VHS), Digital Video (DV), DVD - ROM, Institute of Electrical and Electronic Engineers (IEEE) 1394 “firewire”, USB, SDI, HD-SDI, and other digital imagery files.

The archive server can store online at least three missions of the imagery described above. All other missions are stored in either online tape storage or offline tape storage. Images are stored with metadata to facilitate retrieval. An automation system is used to manage all images in storage.

BCI

BCI is visual data captured in the form of high resolution digital images of the Space Shuttle vehicle, external tank, and solid rocket booster surfaces prior to launch for engineering evaluation of the Space Shuttle vehicle Thermal Protection System (TPS) performance. The baseline imagery will be compared with imagery captured on-orbit to assist NASA image analysis facilities in determining if there are problems that require corrective action.

BCI system consists of four major elements:

a. Acquisition and validation: The contractor currently uses digital imaging equipment consisting of Kodak Pro SLR/n cameras, Better Light 4x5 Scanning Backs, Altman Proline 1200 SE lights, and Quantum Flash Units. Images are validated by personnel to ensure captured images meet both qualitative and quantitative data requirements and that the required geographic coverage of the TPS surface is achieved.

b. BCI file management - Validated images are assigned a file name and associated image metadata is imported, created, and entered into the archiving system

c. BCI distribution - Image data is distributed through manual and internet access mechanisms to KSC, JSC, and MSFC image analysis facilities.

d. BCI archiving - Image data is archived in accordance with Space Shuttle Program requirements, NASA Records Retention Schedules, and requirements established by NARA.

Institutional Computerized Archival System (ICAS)

ICAS provides for efficient image data searches and retrieval from various collections using a graphical and text based search tool through the convenience and accessibility of a web-browser interface.

Major collections of data managed by ICAS include, BCI, NASA engineering video, institutional stills, institutional videos, and operational documents.

The ICAS system is made up three major server operations: the Web server, the database server, and the image server.

These systems support the services referenced in the PWS 3.5.3.

B.3.5.4 Non-Engineering Imaging

Imaging services provides motion picture, still photographic, digital, and video products and services for customers at both KSC and CCAFS. This includes support to institutional and engineering requirements.

Institutional products include processing of negative film, 8x10, 11x14, and 16x20 inch color prints; digital still hardcopy; video products including broadcast and commercial formatted video tape recordings; duplication; dubbing; film to tape transfer; multimedia presentations; and digital video CD and DVD archiving and duplication. The services include on-call photographers and videographers, media customer service interface, digital video production programming development, distribution, duplication, dubbing, archiving, optics and photo equipment repair and maintenance, broadcast and HD video productions, and digital still image services including scanning, digital image manipulation, and CD/DVD archiving. Official KSC motion picture and still film photographic and digital products are archived in the KSC HQ building. The NASA Media Services Division photo, video, and digital products archives are located at the Press Site.

These systems support the services referenced in the PWS 3.5.4.

B.3.5.5 DOD Technical Multi-Media Support

Systems described in B.3.5.3 are used to support services referenced in PWS 3.5.5

B.3.6 Graphics

Software applications include Adobe Creative Suite 2, Carrara 4, Corel Bryce 5, and Microsoft Office 2004. Both Mac and Personal Computer (PC) platforms are used with peripherals including Epson Stylus Pro 10000 P260A plotters, an HP 7300DN 2400 dot per inch (dpi) laser printer, scanners, and external hard drives. Other hardware includes mat cutters, laminating equipment, and digital cameras.

These systems support the services referenced in the PWS 3.6.

B-3.7 A/V and Presentation Support Services

There are approximately 20 conference facilities ranging from 15 seat rooms to a 280 seat auditorium. Depending on user requirements and facility size, a variety of A/V equipment is available in each conference facility.

- Audience and presenter microphones, mixers, amplifiers, and loudspeakers
- Teleconferencing system
- Motion picture and slide projectors
- Video projection equipment
- VHS video recorder/player
- Audio recorder/player
- DVD player
- Viewgraph projector
- Electrically operated projection screen
- Ceiling mounted video projector
- Network connected PC
- Audio, video, network, and power "pop-ups" on the conference table
- Universal, programmable remote control for audio/video equipment
- Motion-activated *Meeting in Progress* sign outside the main door
- Touch screen system controller
- High Definition television set

There are multiple dedicated video teleconferencing (ViTS) rooms. The typical room has two video cameras, two video projection screens, audio conferencing equipment, an interactive graphics and document sharing workstation, associated system hardware and software, and a ViTS room operator console. Dedicated ViTS are in HQ 3125, 3201, and 3210; LCC 4P10; 16 in OSB II, OSB I, O&C; and two in SSPF. There are also portable ViTS units.

The A/V equipment loan pool consists of:

- Microphones, mixers, amplifiers, and loudspeakers
- Lecterns
- Slide projectors and screens
- Overhead video camera for documents
- VHS video recorder/players
- DVD players
- Television receiver/monitors
- Video projectors
- Camcorders
- Equipment stands

B.3.8 Timing

Timing, countdown, and frequency signals are generated and distributed from Central Timing Stations in the LCC and Central Instrumentation Facility (CIF) buildings. These signals are distributed to all areas of KSC and to KSC communication systems as needed including LPS, OTV, photo, transmission systems, calibration labs, and network servers. Timing and frequency reference signals are distributed on a continuous basis while countdown signals are provided as needed for launch, landing, and testing including payload checkout.

Each Central Timing Station consists of more than 15 equipment racks, operational consoles with timing management computers, test equipment, and bench repair stations. Additional distribution/signal conditioning equipment is found throughout KSC in communication rooms and user controlled areas. Also, over 400 timing and countdown displays are distributed throughout KSC.

The core of a KSC timing station centers on multiple GPS clocks with Cesium Standard frequency reference. Voting logic is used to determine which system is used as the primary source in the event of a failure. From the primary timing source, multiple signal generators are used to provide the various time and countdown formats required. The Cesium standard also provides precise frequency signals which are provided to customers throughout KSC. Most signals are carried on copper lines between facilities with remote amplification and signal conditioning at distant sites. A few signals are routed between the Timing Stations over fiber-optics for redundancy.

These systems support the services referenced in the PWS 3.8.

B.3.9 Voice Systems

B.3.9.1 Paging and Area Warning System (PAWS)

The KSC PAWS is a center wide system designed to provide emergency, operational and administrative announcements to KSC personnel. The system also provides a series of warning signals for various emergency conditions. The Area Warning signal is used to precede evacuation instructions and/or emergency directives. The Weather Warning Signal precedes weather status announcements. Along with the audio announcements, the PAWS provides flashing beacon and strobe lights in high noise areas.

The PAWS is controlled from two identical control systems, one located in the LCC and the other in the CD&SC. Each serves its respective area. Paging panels are located throughout the LCC and other control areas throughout KSC. All panels are wired to their associated control system. Each control system feeds the paging zones in its respective area. The LCC system feeds all of the LC-39 area, while the CD&SC System feeds the KSC Industrial Area. The two systems are linked together to facilitate all area paging. PAWS has one Bytex matrix switch to deliver T-1's to VDMS.

Each paging area (building/facility) has a subsystem for its own audio distribution and warning lights (if equipped). The associated PAWS Control System interfaces to these local audio distribution subsystems through a standardized PAWS interface called a control tray. The audio distribution system takes audio and control signals from the control tray and distributes them to the speaker networks with one or more power amplifiers. The control tray offers audio feedback and control status back to the control system.

The hazardous operational areas of KSC are required to have redundant PAWS systems. Such areas will have identical redundant paging networks. Some of these areas have reserve power systems as well. The system consists of 50 warning beacons, over 300 power amplifiers, and over 3000 speakers located throughout KSC. PAWS is a KSC designed system utilizing both custom and COTS hardware. Software for the system was written in a mixture of 'C' and Assembly language.

PAWS includes a test-bed where limited troubleshooting by skilled operators supports repairs of in-house developed electronics.

These systems support the services referenced in the PWS 3.9.1.

B.3.9.2 Radio Systems

The KSC radio systems are composed of handheld and mobile transceivers with associated fixed base stations and remote control units. There are both conventional and trunked land mobile radio systems.

The following describes the conventional system: Direct Radio System (DRS), MedComm, Cranes, Administrative Radio System (ARS) and Aircraft Radios.

DRS - DRS consists of three conventional base station radios which provide one-for-one voice connectivity between Operational Intercommunications System Digital (OIS-D) channels and radio nets. DRS frequencies are programmed into a controlled set of radios, 55 of which are closely managed by the crewed-vehicle program, and dispensed from a loan pool area which this contractor operates. DRS communications are recorded.

Medcomm - Medcomm consists of three base station transceivers and one repeater connected to OIS-D, two base stations remotely controlled from the Occupational Health Facility (OHF), radios in emergency response vehicles (such as ambulances and helicopters), handheld radios (which are trunking capable and may contain talkgroups). Medcomm base station transceivers are supported by backup power sources.

ARS - ARS consists of unrecorded radio channels which are not available via a wired communication system such as OIS-D or tone-remotes. ARS consists of narrowband VHF conventional radios and is in use at the Space Life Sciences Lab (SLSL), but is not restricted to the facility.

Fixed and mobile cranes - Fixed and mobile cranes on KSC rely upon conventional radio communications between the operator and ground crew. Radio communication associated with fixed cranes is recorded via receivers and comparators. Audio networks support centralized receiver comparison, recording, and playback. A network of transmitters, which simulate handheld crane radios in key facilities, facilitate regular health monitoring of the crane recording system. Base station aircraft radios exist at the SLF, some of which are operated via the Solacomm system. Aircraft radios also exist in automobiles, including the Convoy Command Vehicle.

Helipad Light Activation – A Radio control system which activates the helicopter landing pads lights at the Occupational Health Facility and north of the Press Site

The following describes the trunked system:

Smartzone - The system is a Motorola Smartzone 3.0 system with both a simulcast site and four non-simulcast sites. The simulcast site consists of two transceivers locations, one on the 500 foot weather tower in the LC-39 area, and one on the radio shop tower (M6-791) in the Industrial Area. The non-simulcast sites are at Malibar, Shilo, PAFB, and CCAFS. The Air Force also operates consoles, radios, base stations, and audio interfaces. This system provides support for such functions as security, fire, medical, safety, base support, and maintenance operations.

Interfaces - In addition to the equipment associated with a typical trunked system, KSC has 16 interfaces to allow audio cross-patching between conventional radio nets and trunked talk groups (using Base Interface Modules [BIM]), and 56 interfaces to allow audio cross patching between OIS channels and trunked talk groups. Each OIS-to-talk

group interface is achieved in part via a Radio Control Panel (RCP). This arrangement appears to the trunked radio system as if there is a console for every OIS-to-talk group patch, and makes KSC very atypical among users of trunked radio systems.

Consoles - Three locations on KSC contain consoles: the LCC contains 7 consoles; the CD&SC contains one, and the Center Operations Facility (COF) in the LCC contains one.

Base Stations - Three base stations are dedicated to providing communication between OIS-D and three key safety talkgroups in the event of a trunking radio system failure, such as site trunking or failsoft. These three are constantly available. One base station transceiver is located in each rack of RCPs to be available to serve as an alternative communication path between OIS-D and a selectable talkgroup, after manual patching, in the event of a trunking radio system failure.

Radios - There are approximately 1600 portables, 500 mobiles, and 25 base station radios. Trunking radios are installed in helicopters, trains, automobiles, desktops ("base mobiles"), ambulances (with multiple heads), fire trucks, armored vehicles, and other modes of conveyance.

Trunked Radio Monitoring System –This system monitors the health, status, and history of the trunked radio system and its subscribers using the over-the-air control channel data streams. Through radio receivers, this system demodulates the control channel data streams of the Simulcast, Shilo, and CCAFS trunked radio sites. Through computers connected to the receivers, this system displays the real-time system health, status, radio affiliations, repeater assignments, and call types as well as log this information. The particular system which is being used at KSC is Treport (http://www.thebriarpatch.org/treport/). The Government is pursuing the purchase of GenSZAI (http://www.genesisworld.com/GZ/default.asp). The system is also monitored by Motorola on a 24X7 basis.

These systems support the services referenced in the PWS 3.9.2.

B.3.9.3 OIS

OIS-D

The OIS-D is a fully digital, multi-channel, voice conferencing communication system. It consists of two system centers, one in the LC-39 area and one in the Industrial Area, with a common channel interface to allow intercommunication. It supports all KSC test and launch operations facilities. The major hardware components are the Group Processor Assembly (GPA), Data Transmission Equipment (DTE), Central Summing Network (CSN), End Instrument (EI), Technical Control (TC) and Offnet Processor Subsystem (OPS).

Brief descriptions of all hardware components follow:

GPA Rack - The GPA is the principle rack assembly, providing the interface between the user EI and the CSN. Each GPA can support up to 119 EIs, they are installed at each major operational KSC facility, and they provide the first level of audio summation.

DTE Rack - The DTE racks are used to support transmission on fiber between the GPA and CSN for distances over 50 feet. The equipment converts an electrical T3 to an optical signal and back to an electrical T3.

CSN - The CSN performs the second level voice conferencing, summing all voice contributions from the GPAs. Each system center has its own CSN. The CSN creates a global sum of digital audio traffic by successively adding pairs of 512 channel DS3 inputs until a 512 channel global sum is produced.

EI - The EI is an operator controlled, multi-channel, microprocessor-based device that provides the interface to the GPA. They communicate with the GPA over 19- American Wire Gage (AWG) twisted pair at 130 kbps bipolar bit stream. Descriptions of the six types of instruments are provided below.

a. 51D - The 51D EI is a multi-monitor, 19-inch rack mounted, single user-8 channel/dual user-4 channel unit for controlled environment (indoor) use.

b. 52D - The 52D EI is a multi-monitor, 19-inch rack mounted, single user-4 channel/dual user-2 channel unit for controlled environment (indoor) use.

c. 53D - The 53D EI is functionally equivalent to the 52D; however, it is contained in a sealed, able to be purged, deep-drawn aluminum housing for use in hazardous environments. The unit is designed to be wall mounted or mounted on a portable cart.

d. 55D - The 55D is a desktop unit with 4 channels and a speaker for controlled environment (indoor) use.

e. 57D - The 57D is a rack mounted speaker monitor that can be used with a 51D or 52D unit. The unit is muted when the EI user is transmitting.

f. 58D - The 58D is a wall mounted speaker monitor that can be used with a 53D unit, but not in outdoor locations or hazardous environments.

g. 59D - The 59D is a desk-mounted speaker monitor for use in office areas.

Technical Control Workstations (Tech Control) - Tech Control provides overall monitoring and control capability for the OIS-D system operators. The Intel-based workstations are running UNIX System V with X Windows as the windowing environment. The machines are linked together over an ethernet to the CSNs and Offnet Processor Subsystem (OPS).

RPS - RPS provides continuous recording of all channels in OIS-D by combining inputs from both the LC-39 and Industrial Area CSN. Three digital recording units with two digital recorders in each unit will allow for recording of 1000 channels with 100% redundancy. Analog tape dubbing is provided through a separate playback recorder and analog cassette decks.

OPS - OPS is a redundant T1/T3 conferencing voice switch that provides both T1 interfaces out of OIS-D and individual audio channel interfaces through channel banks. This provides for off-center communications through both NISN and TMS. The interface is also used to bring radio-nets into OIS-D. OPS has a T3 interface with the two system center CSNs and has an input and output capability of 92 T1 links. Currently, 26 channels banks and 38 T1s are being used to provide the off-site and audio interfaces.

OIS-D consists of approximately 3500 EIs, 57 GPAs, 49 DTE racks, 19 racks of CSN, 10 racks of OPS, 8 racks of RPS, 14 channel banks, 65 chargers, 72 battery banks, and 3 UPS systems.

Test facilities - OIS-D has two test facilities. The Off-line Test Set located in the shops (M6-791, room 110B) and the CIF lab system (M6-342, room 247). Each test site is equipped with GPA's, CSN and OPS racks used for testing new software and recreating and trouble shooting field problems.

OIS-D is a KSC designed system utilizing both custom and COTS hardware. Software for the system was written in a mixture of 'C' and multiple assembly languages, and is in excess of a million lines of code.

Operational Intercommunication System Quintron (OIS-Q)

The OIS-Q is a commercial off the shelf provided by Quintron Systems Incorporated using their DICES III equipment. OIS-Q is used in locations that have minimal or unique communication requirements. Each system consists of a centrally located redundant microprocessor controlled digital switch and the user instruments are fed by twisted pair cable or multi-mode fiber optic cable at T1 data rates. OIS-Q has the ability to integrate telephones, both conventional and point-to-point, paging, radio nets, and voice conferences.

There are three systems in place at KSC located at the KSC SLF, Crawler Transporter I and II, and two sub mux's with 10 units on the Convoy Command Vehicle. The systems consist of 3 system controllers, five 40-channel communication units, thirty-five 10-channel communication units, and eight T1 channel bank assemblies. A test equipment rack for Quintron is located in the CD&SC (M6-138, room 131). A Quintron system is located at the DFRC Shuttle Processing Area (SPA).

Astrocomm System

The Shuttle Astrocomm system provides interconnection of five Orbiter on-board voice circuits to the LCC control room consoles and OIS-D. Two independent intercommunication circuits are tied directly from the LCC to the Orbiter via umbilical cables. Two independent A/G full-duplex, S-band radio circuits are via the MILA USB STDN Station, and one A/G half-duplex, ultra-high frequency (UHF) radio circuit is via the MILA USB STDN Station.

Solacomm

The Solacomm system resides in the Aircraft Control Tower at the SLF and is used for aircraft operations. Solacomm has the ability to integrate telephones, both conventional and point-to-point, paging, radio nets, aircraft radio nets and voice conferences.

These systems support the services referenced in the PWS 3.9.3.

B.3.9.4 Audio Distribution System

This system consists of a mixture of 4-wire / 2-wire Kentrox and Tellabs audio bridges used to distribute mostly non-OIS-D circuits to required operator locations

These systems support the services referenced in the PWS 3.9.4

B.3.9.5 Voice Recording System

A Dictaphone Freedom system (located in the CD&SC) with 36 T-1 recorders and five 16-channel analog recorders provides digital and analog format record and playback capability of most of the 1024 OIS-D channels, all radio nets, most direct frequency radios, certain paging circuits, and certain specified telephones including HiPath digital instruments in the LCC. This service provides voice duplications made on cassette tapes, sound files (such as .ogg) DVD or CD for operational analysis. In addition, there are three 20-channel recorders and one 20-channel recorder to support the two crawler transporters and the TCS. A de-trunking interface supports recording and playback of trunking radio talkgroups. A local recording system exists on each crawler transporter. A call-check record and playback system exists at the 911 dispatch center. Recording equipment exists at the SLF.

These systems support the services referenced in the PWS 3.9.5.

B.3.9.6 Fixed Audio Systems

Audio support, consisting of audio signal amplification, transmission, conditioning, switching, and distribution is provided by fixed systems. Equipment exists at various sites including viewing sites at Saturn V and Banana River. Audio support is provided

for events such as Shuttle launches, landings, and rollouts; astronaut arrivals; unmanned launches; Air Force launches; press briefings; NASA briefings; and other special events.

These systems support the services referenced in the PWS 3.9.6

B.3.10 Electromagnetic Measurement and Analysis

(Electromagnetic measurement and analysis services will be incorporated into the IMCS contract at the start of FY 2013.)

Both fixed and mobile assets are available to provide electromagnetic measurement and analysis services. The Electromagnetic Laboratory (EML) houses administrative and engineering offices and technical workspace. Equipment available at the EML includes screen rooms, reference antennas, signal generators, spectrum analyzers, and associated test equipment. The contractor maintains and operates a test console located in the EML building. The console is manned during major tests and is the focal point for coordinating Frequency Control and Analysis (FCA) activities. A "Quick Response Vehicle" contains similar test equipment for making electromagnetic measurements in the field. The contractor operates two FCA vans. These vans contain equipment for monitoring and locating environmental RF signal sources. The vans contain radar interrogators which are used to measure the characteristics of radar beacons located on launch vehicles. Maintenance of the vans drive trains are provided by others. Both the vans and a fixed system at the EML have receivers and motorized directional antennas covering a broad frequency range that are used to locate signal sources.

The RAS is a network of antennas distributed throughout KSC and CCAFS that relay payload communications and telemetry signals between processing facilities and remote Payload Operations Control Centers (POCC). The RAS antenna network is comprised of approximately 100 dish antennas, 700 cables, 60 antenna masts, antenna rotating mechanisms, and GN2 purge systems.

The contactor operates an automated RF monitoring system. There are seven remote sites. Each site consists of an antenna connected to a programmable Hewlett Packard (HP) spectrum analyzer. The spectrum analyzer is programmed to sweep over a band of interest and the frequency and power level of the signals detected is reported back to the central controller at the EML over wire lines. The central controller logs the reports from each site and emails a daily summary of the data to authorized personnel. The data is also archived locally for future reference.

These systems support the services referenced in the PWS 3.10.

B.3.11 Publications Services

There are no unique systems or software applications associated with Publications Services.

B.3.12 Printing, Reproduction, and Microimaging

The web-based KSC Online Print Request System allows customers to submit their job requests directly from their desktop PCs. This system links to the Printing and Microimaging Information System (PAMIS), which is work control system that tracks production units against accounting cost codes for funding and metric purposes.

Production equipment used for printing, reproduction, and microimaging includes:

- Document scanners
- Docutech printers
- Digital color press
- Microfilm laser plotter
- Microfiche reader
- Aperture card scanners
- CD/DVD recorders, duplicators, and labeling machines
- Drilling, folding, stitching, "perfect binding," and tying machines.

There are two document storage facilities. One facility is located in the Headquarters building. The other facility is standalone and is climate controlled to National Archives and Records Administration (NARA) standards for documents and film. Aperture cards, which are the accepted media and method for long term storage of drawings, are stored in this facility.

Systems described in B.3.12 are used to support services referenced in PWS 3.12.

B.3.13 Engineering Data Center (EDC)

The EDC utilizes the KSC Engineering Documentation System (KEDS), a web-based application that provides the KSC engineering community with easy access to electronic images of facility and ground support engineering equipment drawings and associated documents. The system allows for paperless distribution of engineering drawings, reducing user trips to document centers and minimizing on-site support. Over 200,000 engineering documents are currently available online. KEDS drawings can be accessed by all on-site U.S. persons at KSC.

The Configuration Management Data System (CMDS) supports contractors and NASA in Engineering Document Release, Engineering Change Processing, and equipment/system Configuration Identification Documents (CID). Those recorded on the system are indexed to specific equipment and systems that are identified in the document itself. All document revisions are maintained as well as Engineering Orders (modifications) and Engineering Instructions to support the Engineering Orders. There are three major subsystems. Document Release Subsystem: All new or revised engineering documentation is authorized and released officially by a signed Document Release Authorization (DRA). Some typical documents indexed and identified are electrical schematics, cable assemblies, deviation waivers, operation and maintenance manuals, etc. Some of the elements recorded when a new document or revision is released are the authorizing engineer, authorizing organization, document location, total sheets, sheet size, and equipment item. Configuration Identification Subsystem: Three files of equipment system relationships are maintained. Baseline System Codes identify systems such as Launch Operations Area (LOA), Vehicle Assembly Area (VAA), and Hypergol Maintenance Area (HMA), but this level of identification does not specify equipment items. Subordinate to the baselines are Work Unit Codes (WUC) and Program Model Numbers (PMN) which identify equipment types and specific equipment items. All of these files are indexed to documents. Change Processing Subsystem: Permits tracking of Engineering Support Requests (ESR) for design engineering activities and Configuration Control Board actions. Engineering assessments, CCB directives, and Support Requests are also indexed to the other subsystems.

The EDC customer service area contains a customer service counter, four desks for staff, three computer stations for customer to access drawings, and an aperture card reader for drawings that have been scanned to that media.

Systems described in B.3.13 are used to support services referenced in PWS 3.13.

B.3.14 Library Services

NASA GALAXIE is an online catalog and bibliographic listing of all NASA holdings. The software is licensed to Langley Research Center (LARC) and the maintenance contract and systems administrator is funded jointly by LARC and the NASA HQ STI Program Office which is located at LARC.

The SirsiDynix Unicorn Integrated Library System is used to manage library content. This integrated library system has two main components - the public side and the staff side. The public side consists of a web based search interface to the library's collection. The staff side is used to catalog and update bibliographic records for all types of library materials. Additionally, it is used to track all material orders and related information. A serials function includes check in of received issues, routing the issues to the requesters, and claiming missing issues from the publisher. It also provides the library's circulation system to check out and check in materials that have been loaned and produces overdue notices. It has a reports feature which is used extensively to produce many different types of information based on the data stored on the system. This system is hosted at LARC and the other Centers have clients.

InMagic DBTextworks is commercial database software. The library Archives has been using DBTextworks since 1993 to catalog unique one of a kind items that make up the Archives collections. DBTextworks allows customization of the database structure rather than the typical generic one size fits all. Databases created using this product include: Master shelf list (listing of every box and location within the Archives); Photograph database (includes prints, transparencies, electronic images); Documents Database (includes correspondence, books, documents, manuscripts, institutional materials, and electronic files); Exhibits (topics and items used for display); and the Trivia Database which contains reference questions the Archives have received and answered. This database includes the question and the location within the Archives of the source material used to answer the question. A new database, the Employee Database, contains the work history of those individuals who entered data in the original KSC Employee Hall of Honor web site. This database was removed from the web and a database was created to preserve the data. Each of these databases requires different types of metadata. DBTextworks allows the users to customize the cataloging information in each unique database. Due to the simplicity of keyword searching, customers can search any field within a database.

The main library is located in the Headquarters building. The various library functions (Archives; Documents/Specifications and Standards; Books – circulating and reference, and Serials) occupy approximately 9000 square feet.

Main Library Collection Information: (these numbers are approximate)

Collection	Number of Items
Archives	over 1,000,000 sheets of paper and other items
Documents, specs & standards	91,610
Books – Circulating	18,171
Books including bound serials – Reference	18,585
Serials	1,479

There is a small law library located in the Headquarters building. It contains approximately 350 titles though many of these titles have multiple books. The Law Library has one electronic product, Lexis/Nexis, which is licensed by NASA HQ Chief Counsel. Additionally, there is a small legal collection in the O&C building.

The Media Reference Library is located at the Press Sites. It occupies approximately 700 square feet and contains over 20,000 books, vertical files, publications and other historical documents.

B.3.15 Maximo

The Government provided Maximo work control system includes the hardware, system software and software licenses as described below:

Asset Management	300 Licenses
Field Control	300 Licenses
Project Adapter	20 Licenses
Service Desk	20 Licenses
Inventory Manager	15 Licenses
Self Service Requestor	300 Licenses

B.3.16 Forms Services

Currently, there are approximately 1800 KSC and Government forms in hardcopy or electronic format.

Software applications associated with the forms services include COTS products such as Adobe Acrobat Creative Suite, Adobe InDesign, and Adobe PageMaker and in-house applications listed in Appendix 7

The NASA Electronic Forms System (NEFS) is comprised of FileNet Forms Manager to create and deploy electronic forms, KSC Forms web site interface to FileNet Forms Manager, and the FileNet Desktop client for electronic forms

Systems described in B.3.16 are used to support services referenced in PWS 3.16.

B.3.17 IT Security

The KSC IT Security utilizes various tools to help perform vulnerability scanning, incident response and IT Security system review and assessment, including the required documentation.

Vulnerability scanning is performed throughout the month across the entire KSC network environment (including the related remote KSC locations), based on a list of potential vulnerabilities developed by the NASA Competency Center for IT Security. Once the scanning is completed using an Agency standard set of software tools. A series of largely automated reports are compiled, generated, and reviewed prior to dissemination for each organization on the type and severity of the vulnerabilities that were detected on the hosts for which they are responsible. These organizations then report back on the status of vulnerabilities that were identified during the scans and this IT Security function tracks the progress of fully mitigating these vulnerabilities. Initial system scans are required prior to the connection of a new system being to the center's network environment or whenever substantial changes to the IT Security posture are made to existing IT systems.

Incident Response & Computer Security Forensics are often required in support of IT Security event investigations. This function provides technical support to the KSC IT Security Manager is the detection, isolation and remediation of IT Security Incidents and issues.

The practice of wireless "war driving" IT security vulnerability scanning is completed periodically to identify unauthorized or insecure wireless networks connected to the KSC networking environment, using a special wireless scanning system. Subsequent IT security investigations are completed to locate the owner of the unauthorized wireless network and to correct the identified security issues.

IT Security plans are submitted to the Government for technical review and assessment. This process follows the approved Agency requirements and procedures for these functions. The IT Security Office reviews every security plan for the required basic content. After this has been completed, IT Security will document, track, and perform the initial levels of assessment of the system security plan before starting the formal Agency certification and accreditation process.

KSC utilizes both the McAfee Foundstone IT security vulnerability scanning/reporting tool as well as the Nessus (open source) tool for the detection and identification of IT Security vulnerabilities. Both the Foundstone and Nessus scanners are Government Furnished Equipment and are configured specifically for this activity. Incident response and computer security forensics capabilities utilize the Encase Forensics disk imaging tool. In the future, a standard Agency Incident Response/Forensics toolkit will be deployed, using mostly open source software tools & Agency developed scripts. In the future, there will also be a center standard IT Security Event Management system that will house the raw investigation data, notes, and analysis results for each of the center's potential events and actual IT Security incidents over the course of the investigation and for historical purposes.

B.3.18 Center Managed Services

There are no unique systems or software applications associated with Center Managed Services.