

NASA-STD-2805 Spring 2015 MINIMUM HARDWARE CONFIGURATIONS

May 6, 2015

NASA TECHNICAL STANDARD

Document History Log

Status	Document Revision	Approval Date	Description
Informal Draft	0.1		Draft Release
Formal Draft	0.2		Draft Release
Final Draft	0.3		Final Draft Release
Baseline		May 6, 2015	Approved Version

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FOREWORD

This Standard is approved for use by NASA Headquarters and all NASA Centers and is intended to provide a common framework for consistent practices across NASA programs.

The material covered in this Standard is governed and approved by the NASA Information Technology Management Board. Its purpose is to define minimum hardware configurations necessary to support interoperability both between NASA end user computers and within the NASA operating environment. The Standard establishes minimum "to keep" and minimum "to buy" hardware configurations. Adherence to this Standard ensures compliance with federal requirements for end user computing devices.

Requests for information, corrections, or additions to this Standard should be directed to the John H. Glenn Research Center at Lewis Field (GRC), Emerging Technology and Desktop Standards Group, MS 142-4, Cleveland, OH, 44135 or to desktop-standards@lists.nasa.gov.

/signature on file/

Larry N. Sweet

Chief Information Officer

1 SCOPE

1.1 Purpose

NASA-STD-2805 defines the minimum Agency hardware interoperability technical specifications. The specifications apply to all end user computing devices participating in the NASA environment.

1.2 Applicability

Center CIOs will ensure that all NASA employees at their respective centers have access to an interoperable system that is equipped with a minimum hardware configuration that meets the standards listed in Section 3 below. The Hardware Reference Configuration (HRC) establishes required functionality and required products necessary to meet that functionality. End user hardware specifications not meeting the defined minimum configuration may be used in areas where interoperability is not required. However, NASA-STD-2805 Mission systems such as end user workstations must meet the criteria specified in section 3.3 of this document to ensure mission, program and Agency interoperability.

1.3 Waivers

This technical Standard is governed by Enterprise Architecture Function as defined in Section 1.2.1.3 of NPR 2800.1B Managing Information Technology. Adherence to this Standard ensures compliance with the future state architecture as described in NPR 2830.1 NASA Enterprise Architecture Procedures.

The Emerging Technology and Desktop Standards group, in cooperation with the End User Services Service Executive and the Chief Enterprise Architect, will evaluate and process waivers to this Standard as appropriate. Waiver requests will include:

1. the reason the waiver is required
2. justification for the waiver
3. a proposed date by which compliance with the standard will be met

Waivers will be granted by the NASA CIO or at his/her discretion responsibility will be delegated to the Center or Mission Directorate CIO.

1.4 Sunsetting Technology and Streamlining of NASA-STD-2805 HRCs

1.4.1 Removable Storage

NASA-STD-2805 no longer specifies encrypted removable storage as a requirement for individual HRCs. End users with continuing removable storage requirements must use FIPS 140-2 validated media. FIPS 140-2 validated storage devices are available for procurement via the ACES Product Catalog at <http://aces.ndc.nasa.gov/order.html>. For HRC specification stability purposes, removable storage requirements are maintained in the Sunsetting and Legacy Technology section of NASA-STD-2805.

1.4.2 Optical Disk Drives

Cloud based software delivery and the increasing availability of share storage is quickly minimizing the need for optical disk drives as a discrete NASA-STD-2805 HRC specification. This trend is evident in the diminishing availability of optical disk drives across OEM product portfolios. As a result, optical disk drives are being moved to the Sunsetting and Legacy Technology section of NASA-STD-2805, and are no longer required for NASA-STD-2805 HRCs unless discretely specified within a NASA-STD-2805 HRC. Only the PC Desktop and Engineering HRCs specify an optical disk requirement in NASA-STD-2805 2015.

1.4.3 Deprecated NASA-STD-2805 HRCs

In response to end user feedback and marketplace evolution, several HRCs have been deprecated from NASA-STD-2805. The HRCs that have been removed from NASA-STD-2805 follow:

- Windows 8 PC Desktop
- Windows 8 PC Laptop
- Windows 8 Slate
- PC All-In-One
- High End PC Desktop
- High End PC Laptop

1.5 Increased Mobility Focus

To better reflect marketplace trends, several mobility-focused adjustments have been made to the NASA-STD-2805 laptop HRCs. The [PC Laptop HRC](#) no longer specifies a discrete optical drive requirement and has a maximum weight of 4.5 lb. In an effort to reduce size, weight, and increase portability, the [PC Lightweight Laptop HRC](#) weight has been reduced to a maximum of 3.5 lb. The [PC Ultra Lightweight HRC](#) is closely aligned with industry's UltraBook specification. The UltraBook specification states "UltraBook devices are 20mm or less in thickness for systems with displays smaller than 14 inches and 23mm or less for systems with displays 14 inches or larger; many systems are much thinner." To satisfy the requirements of highly mobile end users, a [Detachable 2-in-1 \(tablet\) HRC](#) has been added to the Standard.

2 ACRONYMS AND DEFINITIONS

2.1 Acronyms

CAD	Computer-Aided Design
CRT	Cathode Ray Tube
EPEAT	Electronic Product Environmental Assessment Tool
HDD	Hard Disk Drive
HRC	Hardware Reference Configuration
LCD	Liquid Crystal Display
LED	Light Emitting Diode
RPM	Revolutions Per Minute
SSD	Solid-State Drive

2.2 Definitions

2.2.1 End User Computing System

The term *End User Computing System* is used generically to refer to traditional desktop systems, as well as laptop computers, notebooks, engineering workstations, mobile form factors, and similar platforms that are utilized to provide basic interoperability.

2.2.2 Mobile Engineering Workstation

Mobile Engineering Workstation is used to describe high performance systems targeting the scientific, engineering and CAD community in a mobile form factor. Mobile Engineering Workstations are configured with high performance components and a wider array of ports than typical mainstream offerings. The resulting systems are portable yet typically heavier than their non-engineering peers. Mobile Engineering workstations align with the Mission category of systems and NASA-STD-2805 specifies three such configurations: The Apple Mobile Engineering Workstation, 15" Mobile Engineering Workstation and the 17" Mobile Engineering workstation.

2.2.3 Slate Computer

A slate is a touch oriented computing device whose design omits a permanently attached physical keyboard, to achieve a much lighter weight than other form factors. NASA-STD-2805 includes two slate HRCs: the Apple iPad Air 2, the Apple iPad Mini 3, and the Detachable 2-In-1 systems.

2.2.4 Tablet Computer

A tablet computer is defined as a computing device with a *physically attached keyboard* and a touch screen. Tablets are noteworthy for their light weight, attached keyboard, and generally smaller display sizes. Hardware innovations such as slates and ultra lightweight laptops with touch screens have encroached on, and minimized the prominence of PC Tablets with attached keyboards. These marketing pressures have relegating PC Tablets (as defined here) to the category of sunseting technology.

2.2.5 Minimum Workstation to Support Basic Interoperability

Workstations that support basic interoperability are defined by being networked, and by having users who exchange information electronically, including those users that perform any or all of the activities encompassed in the minimum office automation software suite defined below.

2.2.6 Minimum "To Keep" Workstation Hardware Configuration

This category defines the minimum interoperable workstation hardware configuration that may be retained by a NASA organization.

2.2.7 Minimum "To Buy" Workstation Hardware Configuration

This category defines the minimum interoperable workstation hardware configuration that may be procured by a NASA organization. The CIO at each Center is empowered and accountable for determining the performance/cost assessment for configurations that exceed the minimum hardware configuration and its associated cost. The Center CIO will also ensure that obsolete workstations are excessed on a one-for-one basis as new workstations are introduced.

2.2.8 Minimum Interoperability Software Suite

The Minimum Interoperability Software Suite is defined in NASA-STD-2804, "Minimum Interoperability Software Suite."

2.2.9 HRC Business Functions

General Purpose Office Automation Systems General Purpose Office Automation Systems provide the general office automation functions and highest degree of enterprise interoperability to meet the broadest organizational needs. Example HRCs include the PC Desktop, PC Laptops including ultra lightweights, Apple OS X Desktop and Apple OS X Laptops including ultra lightweights.

Mobile Computing Systems Mobile Computing Systems may sacrifice appreciable functionality for specific form factor benefits and in some instances enterprise interoperability. Example HRCs include smartphones, slates devices such as the iPad and tablets.

Mission Systems Mission Systems are computing systems defined by NASA Program specifications to meet broad mission needs and include engineering HRCs, mobile engineering and CAD HRCs.

Legacy and Sunsetting Technology This category represents formerly mainstream technology that persists in the Standards for specification stability reasons, until no longer required within the NASA environment. Current examples include optical drives and USB thumb drives.

3 GENERAL REQUIREMENTS

3.1 Architectural Compliance Requirements

NASA maintains a base-lined and approved Information Technology Architecture. The architecture is predicated on:

- The selection of Standards for a broad and cost-effective infrastructure using commercial off-the-shelf and well-supported open source products to the greatest extent practical – Interoperability both within and external to NASA
- Flexibility for future growth
- Consistency with generally accepted consensus standards as much as feasible
- Among these objectives, ensuring interoperability is one of NASA's most critical issues related to information technology

At times, it is in NASA's best interest to specify commercial products as standards for an interoperable implementation of a particular set of related and integrated functions. The products themselves often include additional functionality or proprietary extensions not specified by this standard. While these products can be used to create higher-level interoperability solutions, these solutions may not be recognized within the context of the NASA interoperability environment and may be deprecated without warning by future revisions to this standard. Users of this standard are advised to apply appropriate caution when implementing proprietary or non-standard extensions, features and functions that go beyond the explicitly stated standard functionality.

3.2 Computing Platforms

This standard recognizes that NASA is a diverse agency with independent computing requirements. NASA will continue to support three desktop computing platforms: Windows, OS X, and Linux/UNIX.

3.3 Performance-Based Interoperability

The following tables establish the minimum desktop system hardware configurations that will support the Agency-wide interoperability software suite as defined in NASA-STD-2804.

3.3.1 Minimum Hardware Requirements for PC and Apple Systems

Minimum "To Keep" Requirements for PC Systems Running Windows 7		
System Component	Component Characteristics	Comments and/or Component Specification(s)
Processor	32-bit or 64-bit x86 Minimum Base Processor Frequency 1.0 GHz	Windows 7 Requirement
Memory (RAM)	1 GB	Windows 7 Requirement
Hard Disk Capacity	16 GB	Windows 7 Requirement
Graphics Technology	32 Bit Color Support	Windows 7 Requirement
Display Type	LCD	CRT displays shall be retired as of June 2013
Display Resolution	1024 x 768 Pixels	MS Office 2007 Requirement
Optical Drive	4x or greater	
Sound	Analog Stereo Output	
Speaker(s)		Internal
Interfaces	USB, PCI, Parallel or Serial	
Network Interface	10 Base-T Ethernet	
Smart Card Reader	Required FIPS-201 Approved Transparent Reader	See 3.3.4 below
Energy Savings	EPEAT Registered	See 3.3.6 below

Minimum "To Keep" Requirements for Systems Running OS X 10.10		
System Component	Component Characteristics	Comments and/or Component Specification(s)
Supported Models:	iMac (Mid 2007 or newer)	These models are required for Mountain Lion
	MacBook (Late 2008 Aluminum, or Early 2009 or newer)	
	MacBook Pro (Mid/Late 2007 or newer)	
	MacBook Air (Late 2008 or newer)	
	Mac mini (Early 2009 or newer)	
	Mac Pro (Early 2008 or newer)	
	Xserve (Early 2009)	
Memory (RAM)	2 GB	Required for Mountain Lion and above
Smart Card Reader	Required FIPS-201 Approved Transparent Reader	See 3.3.5 below
Energy Savings	EPEAT Registered	See 3.3.6 below

3.3.2 NASA-STD-2805 HRC Development Process

The development and formulation of the NASA-STD-2805 Hardware Reference Configuration takes into account many factors including system lifecycle expectations, the evolution of NASA-STD-2804, future

OCIO portfolio offerings, and emerging Federal and NASA regulations. Additional information concerning the development process is available in the Concept of Operations located at:

<http://etads.nasa.gov/downloads/NASA-STD-2805ClientDeviceHardwareConOps.pdf>

3.3.2.1 Universal Technical Specifications

Universal Hardware Reference Configuration Technical Requirements		
Business Function	The following technical specifications are required for all hardware references configurations unless superseded by an explicitly listed specification.	
System Component	Component Characteristics	Component Specification(s)
Processor	4th Generation Intel Haswell Refresh-or-5th Generation Intel Broadwell	Unless otherwise specified, all applicable HRCs require fourth generation (Haswell Refresh) or fifth generation Broadwell Intel iCore processors, when available in the marketplace. In instances where these processors are not available, NASA-STD-2805 FY 2014 (amended September 22nd, 2014) defines the minimum performance required Intel iCore processor for the HRC. is available at: https://etads.nasa.gov/downloads/NASA-STD-2805-FY-2014-Rev-2.pdf
Graphics Technology		Intel HD graphics or higher
External Display	Required for all NASA-STD-2805 HRCs (Excludes Mobile HRCs)	24" or greater 1920 x 1080 or higher resolution LED or equivalentExternal display adaptor(s) is required if the system lacks compatible inputs.
Laptop Display Resolution		1920 x 1080 or higher
Memory (RAM)	8GB	1600 MHz
Hard Disk Drive	SATA Interface	500GB or larger 7200 RPM
Mouse		Optical USB w/ scroll
Keyboard		USB
Sound	Analog Stereo Output	
Speaker(s)		Internal
Headphones	Over the ear	
Peripherals Interface	USB 3.0	2 or more
Network Interface	10/100/1000 Base-T Ethernet (Excludes Mobile Systems)	Wired LAN connectivity is required for laptops. In instances where the system lacks an integrated LAN port an external adaptor must be provided with the system.
Wireless Network Interface	Laptops and Mobile HRCs only	802.11n or greater
Bluetooth	Laptops and Mobile HRCs Only	Bluetooth Low Energy 4.0
Smart Card Reader		- FIPS-201 Approved Transparent Reader
Energy Savings	Excludes Mobile HRCs	EPEAT Gold registered
Webcam	Excludes Desktop and Tower Engineering HRCs	
Microphone	Excludes Desktop and Tower Engineering HRCs	

3.3.2.2 PC Desktop Systems

PC Desktop Minimum Hardware Requirements		
General Purpose / Office Automation		
Business Function	The PC Desktop provides general office automation functions in a desktop form factor to meet the broadest set of organizational needs at the greatest level of interoperability with Agency services and compliance with emerging federal IT regulations. The abstract functions provided by this seat include: electronic mail, office automation, web browsing and access to web applications, secure computing, multimedia, training, etc.	
Seat Delivery Mechanism	ACES Seat Delivery Candidate or other procurement mechanisms as required by individual program needs	
System Component	Component Characteristics	Component Specification(s)
Processor	4th Generation Intel Haswell Refresh Core i5	i5-4590 equivalent or higher performance
Optical Drive	Required	16X DVD+/-RW
Platform Integrity	Trusted Platform Module 1.2	
Other Components	As listed in the NASA-STD-2805 HRC Universal Specifications	As listed in the NASA-STD-2805 HRC Universal Specifications

3.3.2.3 Apple Desktop Systems

Apple Desktop Minimum Hardware Requirements		
General Purpose / Office Automation		
Business Function	The Apple Desktop provides general office automation functions to meet the broadest set of organizational needs at the greatest level of interoperability with Agency services and compliance with emerging federal IT regulations. The abstract functions provided by this seat include: electronic mail, office automation, web browsing and access to web applications, secure computing, multimedia, training, etc.	
Seat Delivery Mechanism	ACES Seat Delivery Candidate or other procurement mechanisms as required by individual program needs	
System Component	Component Characteristics	Component Specification(s)
Model	27" Apple iMac	
Processor	4th Generation Intel Core i5	3.2GHz quad core or higher performing
Display	27" LCD	
Hard Disk Drive	PCIe	256GB Solid State
Graphics Technology		NVIDIA GeForce GT 755M with 1GB video memory
Other Components	As listed in the NASA-STD-2805 HRC Universal Specifications	As listed in the NASA-STD-2805 HRC Universal Specifications

3.3.2.4 PC Laptop Systems

PC Laptop Minimum Hardware Requirements	
General Purpose / Office Automation	
Business Function	The PC Laptop provides general office automation functions in a mobile form factor to meet the broadest set of organizational needs at the greatest level of interoperability with

	Agency services and compliance with emerging federal IT regulations. The abstract functions provided by this seat include: electronic mail, office automation, web browsing and access to web applications, secure computing, multimedia, training, etc. To meet the broadest set of needs, the PC laptop includes a 14+” display, higher clock frequency, larger internal storage, and more ports. Highly mobile end users requiring lighter weight systems may want to consider the NASA-STD-2805 Lightweight or Ultra Lightweight HRCs.	
Seat Delivery Mechanism	ACES Seat Delivery Candidate or other procurement mechanisms as required by individual program needs	
System Component	Component Characteristics	Component Specification(s)
Processor	4th Generation Intel Haswell Refresh Core i5	i5-4200M equivalent or higher performance
Display	14+”	
WiDi Support	Required	Integrated
Platform Integrity	Trusted Platform Module 1.2	
Weight	4.5 lb. maximum	
Other Components	As listed in the NASA-STD-2805 HRC Universal Specifications	As listed in the NASA-STD-2805 HRC Universal Specifications

3.3.2.5 Apple Laptop Systems

Apple Laptop Minimum Hardware Requirements (15.4" MacBook Pro)		
General Purpose / Office Automation		
Business Function	The Apple Laptop provides enhanced computational capabilities in a mobile form factor to meet the broadest set of organizational needs, at the greatest level of interoperability with Agency services and compliance with emerging federal IT regulations. The Apple Laptop's 15" display and Core i7 processor provides increased performance above its lightweight counterpart the Apple Lightweight Laptop. The abstract functionality of this system include messaging, office automation, secure computing, web application usage, virtualization, software development and moderate multimedia development.	
Seat Delivery Mechanism	ACES Seat Delivery Candidate or other procurement mechanisms as required by individual program needs	
System Component	Component Characteristics	Component Specification(s)
Model	15" MacBook Pro	
Processor	4th Generation Intel Core i7	2.5GHz quad core or higher performance
Display Size	15.4" Widescreen LCD	Retina LED-backlit glossy widescreen
RAM	16GB	
Disk Drive	Solid State	512GB Solid State or higher
Other Components	As listed in the NASA-STD-2805 HRC Universal Specifications	As listed in the NASA-STD-2805 HRC Universal Specifications

3.3.2.6 PC Lightweight Laptop Systems

PC Lightweight Laptop Minimum Hardware Requirements	
General Purpose / Office Automation	
Business Function	The PC Lightweight Laptop provides general office automation functions in a lightweight mobile form factor to meet the broadest set of organizational needs, at a

	high level of interoperability with Agency services and compliance with emerging federal IT regulations. The technical specifications of this system attempt to specify a feature rich system that strikes a balance between performance, battery life, and light weight while providing a moderate sized keyboard and display. The abstract functions provided by this seat includes: electronic mail, office automation, web browsing and access to web applications, secure computing, multimedia, training, etc.	
Seat Delivery Mechanism	ACES Seat Delivery Candidate or other procurement mechanisms as required by individual program	
System Component	Component Characteristics	Component Specification(s)
Processor	5th Generation Intel Core i5	i5-52xxU equivalent or higher performance
Display	13+" display size form factor	
Hard Disk Drive	Solid State	256GB Solid State or higher
Weight		3.5 lb. maximum
Platform Integrity	Trusted Platform Module 1.2	
Other Components	As listed in the NASA-STD-2805 HRC Universal Specifications	As listed in the NASA-STD-2805 HRC Universal Specifications

3.3.2.7 Apple Lightweight Laptop Systems

Apple Lightweight Laptop Minimum Hardware Requirements		
General Purpose / Office Automation		
Business Function	The Apple Lightweight Laptop provides general office automation functions in a lightweight mobile form factor to meet the broadest set of organizational needs, at a high level of interoperability with Agency services and compliance with emerging federal IT regulations. The technical specifications of this system balance performance objectives with lightweight portability at moderate prices. The abstract functions provided by this seat include: electronic mail, office automation, web browsing access to web applications, secure computing, multimedia, training, etc.	
Seat Delivery Mechanism	ACES Seat Delivery Candidate or other procurement mechanisms as required by individual program needs	
System Component	Component Characteristics	Component Specification(s)
Model	13" MacBook Pro	
Processor	5th Generation Intel Core i5	2.7GHz dual core equivalent or higher performance
Hard Disk Drive	Solid State	256GB Solid State or higher
Display	13.3" Widescreen LCD	Retina LED-backlit glossy widescreen,
Other Components	As listed in the NASA-STD-2805 HRC Universal Specifications	As listed in the NASA-STD-2805 HRC Universal Specifications

3.3.2.8 PC Ultra Lightweight Laptop Systems

PC Ultra Lightweight Laptop Minimum Hardware Requirements		
Mobile Computing		
Business Function	The PC Ultra Lightweight Laptop provides general office automation functions in an extremely lightweight mobile form factor to meet the broadest set of organizational needs at a high level of interoperability with Agency services and compliance with emerging federal IT regulations. The technical specifications of this system support	

	highly mobile end users requiring maximum portability and light weight. The abstract functions provided by this seat include: electronic mail, office automation, web browsing and access to web applications, secure computing, multimedia, training, etc. The omission of an internal optical drive, smaller keyboard and smaller display are significant factors contributing to this HRC's overall weight and portability. At time of publication, the 2015 Dell XPS 13 represents the purest marketplace form factor expression of the Ultra Lightweight Laptop HRC.	
Seat Delivery Mechanism	ACES Seat Delivery Candidate or other procurement mechanisms as required by individual program needs.	
System Component	Component Characteristics	Component Specification(s)
Form Factor	UltraBook	
Processor	5th Generation Intel Core i5	i5-52xxU equivalent or higher performance
Display	13" display size	1920 x 1080 or higher
Memory (RAM)	8GB or greater	
Graphics Technology		Intel HD Graphics 5500 or higher
Hard Drive	SSD	256GB or higher
Weight	3 lb. maximum	
Other Components	As listed in the NASA-STD-2805 HRC Universal Specifications	

3.3.2.9 Apple Ultra Lightweight Laptop Systems

Apple Ultra Lightweight Laptop Minimum Hardware Requirements		
General Purpose / Office Automation		
Business Function	The Apple Ultra Lightweight Laptop provides general office automation functions in an extremely lightweight mobile form factor to meet the broadest set of organizational needs at a high level of interoperability with Agency services and compliance with emerging federal IT regulations. The technical specifications of this system support highly mobile end users requiring portability and light weight. The abstract functions provided by this seat include: electronic mail, office automation, web browsing and access to web applications, secure computing, multimedia, training, etc.	
Seat Delivery Mechanism	ACES Seat Delivery Candidate or other procurement mechanisms as required by individual program needs	
System Component	Component Characteristics	Component Specification(s)
Model	13.3" MacBook Air	
Processor	5th Generation Intel Core i7	2.2GHz dual core equivalent or higher performance
Hard Disk Drive	Solid State	256GB or higher
Display	13.3" Widescreen LCD	LED-backlit glossy widescreen
Other Components	As listed in the NASA-STD-2805 HRC Universal Specifications	As listed in the NASA-STD-2805 HRC Universal Specifications

3.3.2.10 Single Socket Engineering Workstation

Single Socket Engineering Workstation Minimum Hardware Requirements	
Mission Computing	
Business Function	The Single Socket Engineering Workstation hardware reference configuration is targeted to meet specific programmatic requirements of the scientific and engineering

	communities. The Single Socket Engineering Workstation HRC includes Xeon processor architecture, increased RAM, high-performance graphics capabilities, a larger display and a wide range of ports and expansion options in a workstation form factor.	
Seat Delivery Mechanism	ACES Seat Delivery Candidate or other procurement mechanisms as required by individual program needs	
System Component	Component Characteristics	Component Specification(s)
Display	27" LED or greater	1920x1080 or higher resolution
Processor	Intel Haswell Xeon E5	E5-1650V3 equivalent or higher performance
Memory (RAM):	32GB	DDR4 2133 MHz or higher
Hard Disk Drive:	SATA Interface	1 x 512GB SSD
		1 x 500GB @ 7200 RPM
Graphics Technology	Memory Size	4 GB or higher
	Memory Type	GDDR5
	Memory Interface	128-bit
	Dual Display Connectors	- DL-DVI
		- Dual Display Port
	Application Support	ISV Certified
Platform Integrity	Trusted Platform Module 1.2	
Other Components	As listed in the NASA-STD-2805 HRC Universal Specifications	As listed in the NASA-STD-2805 HRC Universal Specifications

3.3.2.11 Dual Socket Engineering Workstation

Dual Socket Engineering Workstation Minimum Hardware Requirements		
Mission Computing		
Business Function	The Dual Socket Engineering Workstation hardware reference configuration is targeted to meet specific programmatic requirements of the scientific and engineering communities. Like its Single Socket peer, the Dual Socket Engineering Workstation HRC includes Xeon processor architecture, increased RAM, a high-performance graphics capabilities and a larger display. As its name suggests, the HRC includes a second Xeon processor and port density and expansion exceeding its single socket peer.	
Seat Delivery Mechanism	ACES Seat Delivery Candidate or other procurement mechanisms as required by individual program needs	
System Component	Component Characteristics	Component Specification(s)
Display	27" LED or greater	1920x1080 or higher resolution
Processor	Intel Haswell Xeon E5 x 2	E5-2630 V3 equivalent or higher performance
Memory (RAM)	32 GB	DDR4 1866 MHz or higher
Hard Disk Drive:		1 x 1TB Solid State Drive - and - 1 x 1TB @ 7200 RPM
Internal Hard Disks Bays		Support four (4) hard disk bays.
Graphics Technology	Memory Size	4 GB or higher
	Memory Type	GDDR5
	Memory Interface	256-bit or higher

	Dual Display Connectors	- One or more Dual Link DVI
		- One or more Display Port
	Application Support	ISV Certified
Optical Drive:	Required	16X DVD+/-RW
Platform Integrity	Trusted Platform Module 1.2	
Other Components	As listed in the NASA-STD-2805 HRC Universal Specifications	As listed in the NASA-STD-2805 HRC Universal Specifications

3.3.2.12 Apple Engineering Workstation

Apple Engineering Workstation Minimum Hardware Requirements		
Mission Computing		
Business Function	The Apple Engineering Workstation hardware reference configuration is targeted to meet specific programmatic requirements of the scientific and engineering communities. The technical specifications of this system attempt to serve the broadest base of high end Apple users by striking a balance between processor clock speed and core count. The HRC also incorporates dual high performance GPUs, solid state storage architecture, additional RAM and a larger display. The abstract functions provided by this seat include: messaging, office automation, secure computing, web application usage, virtualization, software development, data analysis, multimedia authoring and support for engineering and scientific applications.	
Seat Delivery Mechanism	ACES Seat Delivery Candidate or other procurement mechanisms as required by individual program needs	
System Component	Component Characteristics	Component Specification(s)
Model	Late 2013 Mac Pro Edition	
Display	27" LED or greater	1920x1080 or higher resolution
Processor	Intel Xeon E5 Processor	3.5GHz 6-core with 12MB of L3 cache equivalent or higher
Memory (RAM)	32 GB or higher	1866MHz DDR3 ECC
Hard Disk Drive	PCIe Interface	1TB or higher Solid State
Graphics Technology		Dual AMD FirePro D500 GPUs with 3GB of GDDR5 VRAM each
Other Components	As listed in the NASA-STD-2805 HRC Universal Specifications	As listed in the NASA-STD-2805 HRC Universal Specifications

3.3.2.13 CAD Workstation

CAD Workstation Minimum Hardware Requirements	
Mission Computing	
Business Function	The CAD hardware reference configuration is structured specifically to meet the programmatic needs of the CAD community and other organizations requiring system with high frequency, moderate core count processors and additional memory. The CAD HRC includes discrete, high-performance graphics capabilities and ISV certified components to ensure compatibility with Agency programs, projects and missions.

Seat Delivery Mechanism	ACES Seat Delivery Candidate or other procurement mechanisms as required by individual program needs	
System Component	Component Characteristics	Component Specification(s)
Display	27" LED or greater	1920x1080 or higher resolution
Processor	Intel Haswell Xeon E5	E5-2643v3 equivalent or higher performance
Memory (RAM)	32 GB	ECC 1600 MHz or higher
Hard Disk Drive:	SATA Interface	1 x 1TB Solid State Drive & 1 x 1TB @ 7200 RPM
Graphics Technology	Memory Size: Memory Type: Memory Interface: Display Connectors:Application Support	4GB or higher GDDR5 256-bit or higher One or more each of Dual link DVI & Display Port ISV Certified
Optical Drive:	Required	16X DVD+/-RW
Platform Integrity	Trusted Platform Module 1.2	
Other Components	As listed in the NASA-STD-2805 HRC Universal Specifications	As listed in the NASA-STD-2805 HRC Universal Specifications

3.3.2.14 15" PC Mobile Engineering Workstation

15" Mobile Engineering Workstation Minimum Hardware Requirements		
Mission Computing		
Business Function	The 15" Mobile Engineering Workstation is targeted to meet specific programmatic requirements of the scientific and engineering communities. The hardware reference configuration is designed with additional RAM, high frequency, high core count processors and increased storage. The 15" Mobile Engineering Workstation includes discrete, high-performance graphics capabilities to enhance overall system performance. The 15" Mobile Engineering Workstation is lighter than its 17" peer and lacks its expansion bay, larger display and may have few expansion options.	
Seat Delivery Mechanism	ACES Seat Delivery Candidate or other procurement mechanisms as required by individual program needs	
System Component	Component Characteristics	Component Specification(s)
Processor	4th Generation Intel Haswell Refresh Core i7	i7-4810MQ equivalent or higher performance
Memory (RAM)	16GB or greater	1600MHz or higher
Hard Disk Drive:	SATA Interface	256 GB or higher Solid State Drive
Upgrade Bay Populated With	2nd Hard Disk	500 GB or higher 7200 RPM or faster
Display	15" - 15.6" LED	1920 x 1080 or higher
Graphics Technology	Memory Size: Memory Type: Memory Interface: Display Connectors:ISV Certifications:	2 GB GDDR5 128-bit 1 VGA & 1 Display Port OpenGL Version 3.3 ProE WildFire 5 Creo 1 Siemens UG NX 7.5 Ansys Workbench 13.0 MSC.Software Patran 2010.12
Battery		8 Cell or higher
Platform Integrity	Trusted Platform Module 1.2	
Other Components	As listed in the NASA-STD-2805 HRC Universal Specifications	As listed in the NASA-STD-2805 HRC Universal Specifications

3.3.2.15 15" Apple Mobile Engineering Workstation

Apple Mobile Engineering Workstation Minimum Hardware Requirements		
Mission Computing		
Business Function	The Apple Mobile Engineering Workstation hardware reference configuration is targeted to meet specific programmatic requirements of the scientific and engineering communities. The technical specifications of this system attempt to balance high performance computing objectives with portability. The HRC satisfies this condition by incorporating Core i7 processor technology, a discrete high-end GPU, solid-state storage architecture, 16GB RAM and a 15" Retina display. The abstract functions provided by this seat include: messaging, office automation, secure computing, web application usage, virtualization, software development, data analysis, multimedia authoring and support for engineering and scientific applications.	
Seat Delivery Mechanism	ACES Seat Delivery Candidate or other procurement mechanisms as required by individual program needs	
System Component	Component Characteristics	Component Specification(s)
Model	15" Retina MacBook Pro	
Processor	4th Generation Intel Core i7	2.8GHz quad equivalent or higher performance
Memory (RAM)	16GB	16GB 1600MHz DDR3L SDRAM
Hard Disk Drive	Solid State	512GB or larger
		SSD, PCIe
Graphics Technology		NVIDIA GeForce GT 750M with 2GB GDDR5 memory or higher
Display	15.4"	Retina LED-backlit display with IPS technology; 2880-by-1800 resolution at 220 pixels per inch with support for millions of colors
Other Components	As listed in the NASA-STD-2805 HRC Universal Specifications	As listed in the NASA-STD-2805 HRC Universal Specifications

3.3.2.16 17" PC Mobile Engineering Workstation

17" PC Mobile Engineering Workstation Minimum Hardware Requirements		
Mission Computing		
Business Function	The 17" Mobile Engineering Workstation provides engineering and mission functionality in a mobile form factor. The 17" Mobile Engineering Workstation is designed with a wide array of ports, additional RAM, high frequency, high core count processors and enhanced storage. In addition to a larger display, the HRC includes graphics capabilities exceeding its 15" counterpart and a second bay for missions or projects requiring additional solid-state storage or a second battery. The larger display and bay add weight well in excess of the 15" Mobile Engineering Workstation.	
Seat Delivery Mechanism	ACES Seat Delivery Candidate or other procurement mechanisms as required by individual program needs	
System Component	Component Characteristics	Component Specification(s)
Display	27" LED or greater	1920x1080 or higher resolution

Processor	4th Generation Intel Haswell Refresh Core i7	i7-4910MQ equivalent or higher
Memory (RAM)	16GB or greater	1600MHz or higher
Hard Disk Drive	SATA Interface and Solid State Drive	500 GB 7200 RPM (or higher) and 256 GB SSD
Display	17" LED	1920 x 1080 or higher
Graphics Technology	Memory Size: Memory Type: Memory Interface: Display Connectors:ISV Certifications:	4 GB GDDR5 256-bit 1 VGA & 1 Display PortOpenGL Version 3.3 ProE WildFire 5 Creo 1 Siemens UG NX 7.5 Ansys Workbench 13.0 MSC.Software Patran 2010.12
Optical Disk	Required	8X DVD+/-RW
Docking Station		
Battery	Long life battery	8 Cell or higher
Platform Integrity	Trusted Platform Module 1.2	
Other Components	As listed in the NASA-STD-2805 HRC Universal Specifications	As listed in the NASA-STD-2805 HRC Universal Specifications

3.3.2.17 Apple iOS Slate

Apple iOS Slate Minimum Hardware Requirements		
Mobile Computing		
Business Function	The iOS Slate (i.e. iPad Air) aligns with the Mobile Computing HRCs; a logical grouping that sacrifices appreciable functionality for specific form factor benefits in order to meet targeted mission needs and requirements. The abstract functions provided by this seat include: electronic mail, office automation, web browsing and access to web applications in highly portable, lightweight form factor. This HRC may also compliment and/or enhance tasks performed on flight lines, test cells or other areas requiring lightweight, portable devices with long battery life.	
Seat Delivery Mechanism	ACES Seat Delivery Candidate or other procurement mechanisms as required by individual program needs	
System Component	Component Characteristics	Component Specification(s)
Model	128GB iPad Air 2 with Retina Display	
Processor	A8X	64-bit
Hard Disk Drive	Solid State Drive	128GB
Display	9.7"	Retina MultiTouch 2048 x 1536
Additional iOS Slate Specifications:	All other standard vendor features as found at: http://www.apple.com/ipad-air-2/	

3.3.2.18 Apple iOS Mini Slate

Apple iOS Mini Slate Minimum Hardware Requirements		
Mobile Computing		
Business Function	The iOS Mini Slate (i.e. iPad Mini with Retina Display) aligns with the Mobile Computing HRCs; a logical grouping that sacrifices appreciable functionality for specific form factor benefits in order to meet targeted mission needs and requirements. The abstract functions provided by this seat include: electronic mail, office automation, web browsing and access to web applications in highly portable, lightweight form	

	factor. This HRC may also compliment and/or enhance tasks performed on flight lines, test cells or other areas requiring lightweight, portable devices with long battery life.	
Seat Delivery Mechanism	ACES Seat Delivery Candidate or other procurement mechanisms as required by individual program needs	
System Component	Component Characteristics	Component Specification(s)
Model	64GB iPad Mini 3 with Retina Display	
Processor	A7	Dual-core
Hard Drive Capacity	Solid State Drive	64GB
Display	7.9"	MultiTouch Retina 2048 x 1536
Height	7.87 inches	
Width	5.3 inches	
Additional iOS Slate Specifications:	All other standard vendor features as found at: http://www.apple.com/ipad-mini-3/	

3.3.2.19 Detachable 2-in-1 (tablet)

Detachable 2-in-1 (tablet) Minimum Hardware Requirements		
General Purpose / Office Automation		
Business Function	The Detachable 2-in-1 (tablet) provides general office automation functions in an extremely lightweight mobile form factor to meet the broadest set of organizational needs at a high level of interoperability with Agency services and compliance with emerging federal IT regulations. The technical specifications of this system support highly mobile end users requiring maximum portability and light weight. The abstract functions provided by this seat include: electronic mail, office automation, web browsing and access to web applications, secure computing, multimedia, training, etc. The omission of an internal optical drive, physically attached keyboard and smaller display are significant factors contributing to this HRC's overall weight and portability. The detachable form factor best represents the objectives of the Detachable 2-in-1 (tablet) business function.	
Seat Delivery Mechanism	ACES Seat Delivery Candidate or other procurement mechanisms as required by individual program needs.	
System Component	Component Characteristics	Component Specification(s)
Form Factor	Detachable	
Processor	4th Generation Intel Core i5	i5-43xxX equivalent or higher performance
Memory (RAM)	8GB or greater	System based (not split across system and peripherals)
Hard Drive	Solid State Drive	256GB or higher
Display	10.8" - 13"	1920 x 1080 or higher resolution
Graphics Technology		Intel HD Graphics 4000 or higher
Additional Keyboard	Physical	Attachable / Detachable
Weight		2.3 lb. or less (without keyboard)
		3.71 lb. or less (with attached keyboard)
Other Components	As listed in the NASA-STD-2805 HRC Universal Specifications	

3.3.2.20 Smartphones

Smartphone Minimum Hardware Requirements
Mobile Computing

Business Function	Smartphones fall within the Mobile Computing Systems Logical Grouping of NASA-STD-2805. A category that may sacrifice appreciable functionality for specific form factor benefits and in some instances enterprise interoperability.	
System Component	Component Characteristics	Component Specification(s)
Cellular Connectivity	Domestic US	CDMA, GSM, or 4G
Wireless Connectivity	Bluetooth	
Geographical/Location Services	Assisted GPS and/or cellular triangulation	
Messaging and Calendaring Mail	Native support for NASA-STD-2804 defined messaging and calendaring standards	
Device Security	See Section 3.3.3	

3.3.3 Minimum Mobile Device Requirements

Mobile devices entering NASA's IT environment are required to meet the minimum hardware requirements identified in section 3.3.2 as well as the following minimum mobile device requirements:

- Native support for Microsoft Exchange.
- Centralized management via Microsoft Exchange ActiveSync Policies with specific support for remote wipe capability, password locking, and wipe after predetermined number of bad password attempts.
- Devices connecting to the NASA IT landscape require device encryption.
- Corporate cellular phone licensing and billing agreements.
- Require OEM support on devices.

All new devices and any existing devices that undergo a significant platform revision (i.e. noteworthy operating system upgrade, hardware redesign, etc.) as part of their normal technology evolution are subject to an enterprise interoperability assessment performed by ETADS as well as an Agency-sanctioned Risk Assessment prior to being approved for use.

3.3.4 Smart Card Reader

All HRCs excluding Mobile Systems must include a FIPS-201 Approved Transparent Reader that meets the requirements of NIST SP 800-96, and appears on the GSA's FIPS 201 Approved Product List at:

<http://www.idmanagement.gov/approved-products-list>

In the "Filter by Category" drop down, select "LACS Transparent Reader"

Additionally, the NASA ICAM Device Integration project validates smartcard readers of various interface types for use on NASA computing systems. For more information, see the ICAM Device Integration site:

<https://etads.nasa.gov/IDI>




3.3.5 Energy Savings

Newly procured systems must be EPEAT Gold. See the EPEAT website for the list of registered systems at:

<http://www.epeat.net>

EPEAT evaluates electronic products in relation to 51 total environmental criteria, identified in the Criteria Table below and contained in IEEE 1680 -â€ 23 required criteria and 28 optional criteria. To qualify for registration as an EPEAT product, the product must conform to all the required criteria.

Products are also ranked in EPEAT according to three tiers of environmental performance: Bronze, Silver, and Gold. All registered products must meet the required criteria, and achieve Bronze status. Manufacturers may then achieve a higher level EPEAT "rating" for products by meeting additional optional criteria as follows:

EPEAT Criteria Table		
Bronze	Silver	Gold
 BRONZE	 SILVER	 GOLD
Meets all 23 required criteria	Meets all 23 required criteria plus at least 50% of the optional criteria	Meets all 23 required criteria plus at least 75% of the optional criteria

The IEEE 1680 Standard, which forms the basis of EPEAT, requires that every EPEAT registered product meet the current version of the applicable ENERGY STAR standard.

Please refer to [NASA-STD-2804](http://www.nasa.gov/standards/2804) for requirements on how energy-saving features should be configured.

3.3.6 Printers

All printers shall be configured for duplex printing by default. Only printers capable of supporting duplex printing shall be procured.

3.4 Section 508 Compliance Requirements

Hardware products procured after June 21, 2001 must be in conformance with Section 508 of the Rehabilitation Act. Complete information and guidance on addressing Section 508 requirements is available at www.section508.nasa.gov

4 LEGACY AND SUNSETTING HARDWARE REFERENCE CONFIGURATIONS

4.1 Legacy PC Tablet

Legacy PC Tablet Minimum Hardware Requirements		
Legacy and Sunsetting Technology		
Business Function	The Business Function of the PC Tablet is being marginalized by the encroachment of capabilities of the Slate and Ultra Lightweight systems, along with the PC Tablet's diminishing marketplace presence, motivates the removal of this hybrid form factor Hardware Reference Configuration. However, for specification stability purposes a final PC Tablet Reference Configuration is provided in this Standard prior to its removal during the semi-annual Standards update process.	
System Component	Component Characteristics	Component Specification(s)
Processor	3rd Generation Intel Core i5	i5-3437U equivalent or higher performance
Hard Disk Drive	SATA Interface	256 GB or larger SSD

Display	10" - 13.3"	MultiTouch Capacitive
Keyboard	Physical	Attached
Weight	4.5 Lbs. or less	
Platform Integrity	Trusted Platform Module 1.2	
Other Components	As listed in the NASA-STD-2805 HRC Universal Specifications	As listed in the NASA-STD-2805 HRC Universal Specifications

4.2 Cellular Phones

Cellular Phone Minimum Hardware Requirements		
Legacy and Sunsetting Technology		
Business Function	Cellular phones, which fall within the Legacy and Sunsetting Technology Logical Grouping of NASA-STD-2805 are maintained within the Standards for specification stability purposes to ensure symmetric communication interoperability for end users requiring this functionality.	
System Component	Component Characteristics	Component Specification(s)
Cellular Connectivity	Domestic	CDMA, GSM, or 4G
Data Storage	2 GB card (MicroSD or Mini SD)	
Battery	1000 mAh or higher	
Device Navigation	Built-in pointing device (4-way, trackball, scroll pad)	
Voice Input/output	Integrated earpiece/ microphone/speakerphone, 3.5mm stereo headset capable, Bluetooth headset capable	
Productivity	Calendar, Tasks, Phone Book	
Multimedia	Audio, Video, Images	
Internet Browsing	HTML	
Connectivity	Bluetooth	

4.3 Pager

Pager Minimum Hardware Requirements		
Legacy and Sunsetting Technology		
Business Function	Pagers, which fall within the Legacy and Sunsetting Technology Logical Grouping of NASA-STD-2805 are maintained within the Standards for specification stability purposes to ensure asymmetric communication interoperability for end users requiring this functionality.	
System Component	Component Characteristics	Component Specification(s)
Cellular Connectivity	Domestic	
Cellular Mode	Single Band	
Message Storage	10 messages minimum	
Display	Date and Time	
Backlight	Yes	

Indicator/Alerts	Alarm/Low battery/Messages	
Service Notification	Ringtone/Vibrate/Silent	
Messaging Display	Time Stamp/# of Messages/Indicator	
Device Navigation	Button(s)	

4.4 Network Printer

Network Printer Minimum Hardware Requirements		
Legacy and Sunsetting Technology		
Business Function	Network printers, which fall within the Legacy and Sunsetting Technology Logical Grouping of NASA-STD-2805 are maintained within the Standards for specification stability purposes to ensure hard copy output interoperability for end users requiring this functionality.	
System Component	Component Characteristics	Component Specification(s)
Connectivity	10Base-T/100Base-T, 1 Gb Ethernet	
Printing	30 ppm or higher B&W, 600 DPI or higher, Auto Duplex	
Paper	50-sheet Auto Feed, Letter & Legal	
Paper Capacity	Two (2) adjustable paper trays with a minimum of 250-sheet capacity each	Minimum of letter and legal size
Output Tray	Integrated	
Page Description Language	PCL6, PCL5e, Adobe Postscript 3	
Security		Compliance with NIST SP 800-88 and NIST SP 800-36

4.5 Multi-Functional Devices

Multi-Function Device Minimum Hardware Requirements		
Legacy and Sunsetting Technology		
Business Function	Multifunction devices, which fall within the Legacy and Sunsetting Technology Logical Grouping of NASA-STD-2805 are maintained within the Standards for specification stability purposes to ensure hard copy, scanning and facsimile interoperability for end users requiring this functionality.	
System Component	Component Characteristics	Component Specification(s)
Paper Sizes	Letter, legal, and ledger size	
Paper Capacity	Two (2) adjustable paper trays with a minimum of 250-sheet capacity each	Minimum of letter and legal size
Scan	Scan to e-mail, Scan to Network	
Scan File Formats	PDF, JPEG, TIFF, and Multi-page TIFF	
Copy	Copy Options: 1-1, 1-2, 2-2, and 2-1	
Fax	G3 33.6 Kbps Modem with auto fallback	
Input Resolution	Minimum 600 dpi	For Scan and Copy
Security	Enabled card reader for PIV-compliant Smartcards	Meets NIST SP 800-96

4.6 Optical Disk Drives

Optical Disk Drive Minimum Hardware Requirements		
Legacy and Sunsetting Technology		
Business Function	Optical Disk Drives fall within the Legacy and Sunsetting Technology Logical Grouping of NASA-STD-2805. Optical Drives are maintained within the Standards for specification stability purposes to ensure a minimum level of capability and interoperability for end users requiring this functionality. Optical drives are no longer required for NASA-STD-2805 HRCs unless discretely specified within a NASA-STD-2805 HRC.	
System Component	Component Characteristics	Component Specification(s)
Optical Disk Drive	Laptop HRCs & Portable Drives	8X DVD+/-RW
Optical Disk Drive	Desktop HRCs	16X DVD+/-RW

4.7 Removable Storage (e.g. Thumb drives)

Removable Storage Minimum Hardware Requirements		
Legacy and Sunsetting Technology		
Business Function	Removable storage (e.g. thumb drives) fall within the Legacy and Sunsetting Technology Logical Grouping of NASA-STD-2805. Removable storage is maintained within the Standards for specification stability purposes to ensure a minimum level of capability, interoperability, and regulatory compliance for end users requiring this functionality. End users with continuing removable storage requirements must use FIPS 140-2 validated media.	
System Component	Component Characteristics	Component Specification(s)
Removable Storage		2GB or larger FIPS 140-2 validated

5 REVIEW AND REPORTING REQUIREMENTS

5.1 INTEROPERABILITY REPORTING

Each Center CIO will establish the necessary processes and tools, both manual and automated, to report on an annual basis to the NASA CIO the hardware and software configuration of all workstations at their respective centers. These data will contain sufficient information to ascertain if the workstation supports NASA employees or is Government-furnished equipment to a contractor, whether the equipment is required to be interoperable, and a description of the hardware architecture/environment. The report will specify the number of NASA employees that do not have access to interoperable workstations.

5.2 Basic Interoperability Standards Maintenance

This standard, and its companion, NASA-STD-2804 Minimum Interoperability Software Suite, are maintained on behalf of the NASA CIO by the Emerging Technology and Desktop Standards group. Together, these standards define the software, hardware, and configurations necessary to ensure basic interoperability within the NASA information technology computing infrastructure.

This standard will be reviewed and updated on an as-required basis, not to exceed 12-month intervals. Participation in the revision process is open to all NASA employees. Details on how to be alerted to changes in the standards and/or comment on proposed updates can be found at

<https://etads.nasa.gov/dcs/>

This site also maintains interim guidance, position papers, software and hardware reviews, recommendations and other documentation intended to promote standardized basic interoperability.

6 DURATION

6.1 Duration

This standard will remain in effect until canceled or modified by the NASA CIO.

7 SUPPORTING DOCUMENTS

7.1 Supporting Documents

Supporting documents and additional information related to this standard may be found at

<https://etads.nasa.gov/dcs/>

<https://etads.nasa.gov/idi/>