

MEASUREMENT SYSTEM
IDENTIFICATION



NASA TECHNICAL STANDARD

National Aeronautics and Space Administration

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MINIMUM HARDWARE CONFIGURATIONS

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FOREWORD

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

The purpose of the material covered in this Standard is to define minimum hardware configurations necessary to support interoperability both between NASA end user computers and within the NASA operating environment. This Standard establishes minimum specifications for interoperable end-user hardware approved “to keep” in the NASA environment. Additionally, this Standard establishes minimum hardware specifications approved for procurement in the NASA environment. 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), Enterprise Technology Assessments and Digital Standards (ETADS) Office, MS 142-5, Cleveland, OH, 44135 or to desktop-standards@lists.nasa.gov.

/signature on file/

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Approval Date

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NASA-STD-2805 Spring 2016**1 SCOPE****1.1 Purpose**

NASA-STD-2805 is a NASA Technical Standard defining minimum Agency hardware specifications required for interoperability. 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 the appropriate table in Section 3 of this document to ensure mission, program, and Agency interoperability.

1.3 Authority

This technical standard is governed by the 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.

2 GENERAL REQUIREMENTS**2.1 Architectural Compliance Requirements**

NASA maintains a baselined and approved information technology architecture. The architecture is predicated upon:

- 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. This Standard, along with NASA-STD-2804 Minimum Interoperability Software Suite, defines the interoperable NASA end-user system.

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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.

2.2 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. External factors such as vendor roadmaps, product releases, and marketplace evolution are actively monitored for purposes of planning and incorporation. Additional information concerning the development process is available in the Concept of Operations located at:

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

2.2.1 Increased Mobility Focus

To better reflect user needs and marketplace trends, several mobility-focused and performance-focused adjustments have been made to the NASA-STD-2805 laptop HRCs.

- The PC Standard Laptop HRC now specifies a 256GB solid state drive (SSD) with a maximum weight of 3.5 pounds, which represents a reduction in both size and weight while enhancing both portability and performance. This Standard Laptop HRC specification now contains the SSD that was previously offered in the PC Lightweight Laptop HRC, and represents a weight decrease of roughly a pound from the previous PC Laptop HRC.
- The dimensions and performance characteristics specified as the PC Standard Laptop HRC have blurred the distinctions between what has historically defined a standard and a lightweight laptop, and so marginalized the current need for a Lightweight Laptop HRC. The Lightweight Laptop HRC will be suspended until marketplace evolution re-creates an appreciable distinction.
- To satisfy the requests and requirements of highly mobile end users, beginning in 2015 a PC Detachable 2-in-1 HRC has been specified, with the caveat that such systems necessarily run a touch-optimized Windows OS (Windows 8.1 or Windows 10). These systems may therefore sacrifice appreciable functionality, and in some instances enterprise interoperability, for specific form factor benefits.

2.2.2 Compute Platforms

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

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3 PERFORMANCE-BASED INTEROPERABILITY TABLES

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, which together define the interoperable NASA end-user system.

3.1 PC Desktop Systems

The PC Desktop class of system provides general office automation functions in a desktop form factor to meet the broadest set of organizational needs at the greatest level of interoperability and compliance with Agency services and emerging federal IT regulations. The abstract functions provided by the PC desktop include: electronic mail, office automation, web browsing and access to web applications, secure computing, multimedia, training, etc.

The desktop Engineering Workstation HRCs incorporate components targeted to meet the specific programmatic requirements of the scientific and engineering communities. The workstation reference configurations were each designed to offer increased performance and stability when fulfilling the above functions as well as others such as virtualization, software development, data analysis, multimedia authoring, and support for engineering and scientific applications.

Hardware Reference Configuration for PC Desktop Systems				
System Component	Standard Desktop	Single Socket Engineering Workstation	Dual Socket Engineering Workstation	CAD Workstation *as an ACES managed seat available by augmentation to Single Socket Workstation
Processor	Intel Core i5-6500 3.2 GHz Base, 3.6 GHz Max Turbo, 6M Cache (4 Cores-4 Threads) equivalent or higher performance	Intel Xeon E5-1650V3 3.5 GHz Base, 3.8 GHz Max Turbo, 15M Cache (6 Cores-12 Threads) equivalent or higher performance	2x Intel Xeon E5-2630V3 2.4 GHz Base, 3.2 GHz Max Turbo, 20M Cache (8 Cores-16 Threads each, total of 16 Cores-32 Threads) equivalent or higher performance	Intel Xeon E5-1630V3 3.7 GHz Base, 3.8 GHz Max Turbo, 10M Cache (4 Cores-8 Threads) equivalent or higher performance
Graphics Technology	≥ Intel HD Graphics 530 1 VGA ≥2 Display Port	≥ NVIDIA Quadro K2200 Graphics Memory ≥ 4GB GDDR5 128-bit ≥ 1 Dual Link DVI ≥ 2 Display Port ISV Certified	≥ NVIDIA Quadro M5000 Graphics Memory ≥ 8GB GDDR5 256-bit ECC RAM ≥ 1 Dual Link DVI ≥ 4 Display Port ISV Certified	≥NVIDIA Quadro M5000 Graphics Memory ≥8 GB GDDR5 256-bit ≥1 Dual Link DVI ≥4x Display Port ISV Certified
Display	≥ 24" Diagonal LED or equivalent, with a minimum vertical viewable area as afforded by the standard 24" monitor with an aspect ratio of 16:9	≥ 24" Diagonal LED or equivalent, with a minimum vertical viewable area as afforded by the standard 24" monitor with an aspect ratio of 16:9	≥ 24" Diagonal LED or equivalent, with a minimum vertical viewable area as afforded by the standard 24" monitor with an aspect ratio of 16:9	≥ 24" Diagonal LED or equivalent, with a minimum vertical viewable area as afforded by the standard 24" monitor with an aspect ratio of 16:9

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Hardware Reference Configuration for PC Desktop Systems				
System Component	Standard Desktop	Single Socket Engineering Workstation	Dual Socket Engineering Workstation	CAD Workstation *as an ACES managed seat available by augmentation to Single Socket Workstation
Display Resolution	≥ 1920 x 1080 resolution	≥ 1920 x 1080 resolution	≥ 1920 x 1080 resolution	≥ 1920 x 1080 resolution
RAM	≥ 8 GB DDR4-2133 SDRAM	≥ 32GB DDR4 2133 ECC Registered RAM	≥ 32GB DDR4 2133 ECC Registered RAM	≥ 32 GB DDR4 2133 ECC Registered RAM (4 GB x 8 DIMM)
Hard Disk Drive	≥ 500GB 7200 RPM SATA HDD	1-512GB SSD 1-500GB 7200 RPM SATA HDD	1-1TB SSD 1-1TB 7200 RPM SATA HDD	1 TB SSD PCIe based Z-Turbo Drive
Mouse	Optical USB w/ scroll	Optical USB w/ scroll	Optical USB w/ scroll	Optical USB w/ scroll
Keyboard	USB w/ Integrated Smartcard Reader	USB w/ Integrated Smartcard Reader	USB w/ Integrated Smartcard Reader	USB w/ Integrated Smartcard Reader
Sound	Analog Stereo Output	Analog Stereo Output	Analog Stereo Output	Analog Stereo Output
Speakers	Internal	Internal	Internal	Internal
Microphone	None	None	None	None
Peripherals Interface	≥ 8 USB with ≥ 4 of them USB 3.0	≥ 8 USB with ≥ 6 of them USB 3.0 or better	≥ 10 USB with ≥ 8 of them USB 3.0 or better	≥ 8 USB with ≥ 6 of them USB 3.0 or better
Network Interface	10/100/1000 Base-T Ethernet	10/100/1000 Base-T Ethernet	10/100/1000 Base-T Ethernet	10/100/1000 Base-T Ethernet
Wireless Network Interface	None	None	None	None
Bluetooth	None	None	None	None
Energy Savings	EPEAT Gold registered	EPEAT Gold registered	EPEAT Gold registered	EPEAT Gold registered
Camera	None	None	None	None
Optical Drive	≥ 16X DVD+/-RW	≥ 16X DVD+/-RW	≥ 16X DVD+/-RW	≥ 16X DVD+/-RW
Platform Integrity	Trusted Platform Module 1.2 upgradeable to 2.0	Trusted Platform Module 1.2 upgradeable to 2.0	Trusted Platform Module 1.2 upgradeable to 2.0	Trusted Platform Module 1.2 upgradeable to 2.0
Smart Card Reader	FIPS-201 Approved Transparent Reader (see keyboard)	FIPS-201 Approved Transparent Reader (see keyboard)	FIPS-201 Approved Transparent Reader (see keyboard)	FIPS-201 Approved Transparent Reader (see keyboard)

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3.2 PC Laptop Systems

The PC Standard and Ultra Lightweight Laptop class of system provides general office automation functions in a mobile form factor to meet the broadest set of organizational needs at the greatest level of interoperability and compliance with Agency services and emerging federal IT regulations. The abstract functions provided by the PC Laptop include electronic mail, office automation, web browsing and access to web applications, secure computing, multimedia, training, etc.

End users requiring highly-mobile touch-enabled devices may consider the Detachable 2-in-1 HRC. This class of system necessarily runs a touch-enabled OS (Windows 8.1 or 10) and may therefore sacrifice appreciable functionality, and in some instances enterprise interoperability, for specific form factor benefits.

The PC Mobile Engineering Workstation HRCs incorporate components targeted to meet the specific programmatic requirements of the scientific and engineering communities. In addition to the functionality described above, these systems are appropriate for virtualization, software development, data analysis, multimedia authoring, and support for engineering and scientific applications. The higher performance processors, discrete graphics capabilities, increased screen real estate, and additional ports and bays necessitate a larger, heavier form factor.

Hardware Reference Configuration for PC Laptop Systems					
System Component	Standard Laptop	Ultra Lightweight Laptop	Detachable 2-in-1	15" Mobile Engineering Workstation	17" Mobile Engineering Workstation
Processor	Intel i5-6300U 2.4 GHz Base, 3 GHz Max Turbo, 3M Cache (2 Cores-4 Threads) equivalent or higher performance	Intel M7-6Y75 1.2 GHz Base, 3.1 GHz Max Turbo, 4M Cache or higher performance	Intel M5-6Y57 1.1 GHz Base, 2.80 GHz Max Turbo, 4M Cache or higher performance	i7-6820HQ 2.7GHz Base, 3.6 GHz Max Turbo, 8MB Cache (4 Cores-8 Threads) equivalent or higher performance	Intel Xeon E3-1535M V5 2.9 GHz Base, 3.8 GHz Max Turbo, 8MB Cache (4 Cores-8 Threads) equivalent or higher performance
Graphics Technology	≥ Intel HD Graphics 520 1 VGA 1 Display Port	≥ Intel HD Graphics 515 1 Micro HDMI 1 Thunderbolt	≥ Intel HD Graphics 515 1 Thunderbolt	≥ NVIDIA Quadro M1000M Graphics Memory ≥2GB GDDR5 128-bit ≥ Display Port 1.2 ISV Certified 1 Mini Display Port 1 HDMI 1 Thunderbolt	≥ NVIDIA Quadro M3000M Graphics Memory ≥4GB GDDR5 256-bit ≥Display Port 1.2 ISV Certified 1 Mini Display Port 1 HDMI 1 Thunderbolt
Display	≥ 14"	≥ 13"	≥ 12"	15" - 15.6"	≥ 17"
Display Resolution	≥ 1920 x 1080	≥ 1920 x 1080	≥ 1920 x 1080 Touch	≥ 1920 x 1080	≥ 1920 x 1080
RAM	≥ 8 GB DDR4 PC4-17000 2133 SDRAM	≥ 8GB LPDDR3 1600 MHz SDRAM	≥ 8GB 1866 MHz SDRAM	≥ 16GB DDR4 2133 MHz SDRAM	≥ 16GB DDR4 2133 MHz SDRAM, ECC

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Hardware Reference Configuration for PC Laptop Systems					
System Component	Standard Laptop	Ultra Lightweight Laptop	Detachable 2-in-1	15" Mobile Engineering Workstation	17" Mobile Engineering Workstation
Hard Disk Drive	≥ 256 GB SSD	≥ 256GB SSD	≥ 256GB SSD	≥ 512GB SSD	≥ 512GB SSD
Sound	Analog Stereo Output	Analog Stereo Output	Analog Stereo Output	Analog Stereo Output	Analog Stereo Output
Speakers	Internal	Internal	Internal	Internal	Internal
Microphone	Internal	Internal	Internal	Internal	Internal
Peripherals Interface	≥ 2 USB 3.0, ≥ 1 USB C, Display Port, VGA Port	≥ 1 USB 3.0, ≥ 2 Thunderbolt 3	≥ 1 USB 3.0, ≥ 1 USB C	≥ 4 USB Ports, ≥ 2 of them 3.0 and ≥ 1 Thunderbolt 3	≥ 4 USB Ports, ≥ 3 of them 3.0 and ≥ 1 Thunderbolt 3
Network Interface	Wired LAN connectivity	Wired LAN connectivity via docking station or Gigabit Ethernet Dongle	Wired LAN connectivity via docking station or Gigabit Ethernet Dongle	Wired LAN connectivity	Wired LAN connectivity
Wireless Network Interface	≥ 802.11 a/b/g/n/ac	≥ 802.11 a/b/g/n/ac	≥ 802.11 a/b/g/n/ac	≥ 802.11 a/b/g/n/ac	≥ 802.11 a/b/g/n/ac
Bluetooth	≥ Bluetooth Low Energy 4.0	≥ Bluetooth Low Energy 4.0	≥ Bluetooth Low Energy 4.0	≥ Bluetooth Low Energy 4.0	≥ Bluetooth Low Energy 4.0
Energy Savings	EPEAT Gold registered	EPEAT Gold registered	EPEAT Gold registered	EPEAT Silver registered	EPEAT Gold registered
Camera	Yes	Yes	Yes	Yes	Yes
Weight	3.5 lb. maximum	2.5 lb. maximum	2.0 lb. or less (without keyboard), 3.0 lb. or less (with attached keyboard)	6.2 lb. maximum	7.6 lb. maximum
Platform	Trusted Platform Module 1.2 upgradeable to 2.0	Trusted Platform Module 1.2 upgradeable to 2.0	Trusted Platform Module 2.0	Trusted Platform Module 1.2 upgradeable to 2.0	Trusted Platform Module 1.2 upgradeable to 2.0
Smart Card Reader	FIPS-201 Approved Transparent Reader integrated	FIPS-201 Approved Transparent Reader integrated	FIPS-201 Approved Transparent Reader integrated, and USB reader for use with detached tablet	FIPS-201 Approved Transparent Reader integrated	FIPS-201 Approved Transparent Reader integrated

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3.3 Apple Desktop Systems

The Apple Desktop provides general office automation functions to meet the broadest set of organizational needs at the greatest level of interoperability and compliance with Agency services and emerging federal IT regulations. The abstract functions provided by the Apple desktop include: electronic mail, office automation, web browsing and access to web applications, secure computing, multimedia, training, etc.

The Apple Engineering Workstation HRC 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 to include the above capabilities and add others such as virtualization, software development, data analysis, multimedia authoring, and support for engineering and scientific applications.

Hardware Reference Configuration for Apple Desktop Systems		
System Component	Apple Desktop	Apple Engineering Workstation
Model	27" Apple iMac	Apple Mac Pro
Processor	3.2GHz quad-core Intel Core i5 processor (Turbo Boost up to 3.6GHz)	6-Core Intel Xeon E5 with 12MB L3 cache and Turbo Boost up to 3.9GHz
Graphics Technology	AMD Radeon R9 M380 with 2GB video memory	Dual AMD FirePro D500 graphics processors with 3GB of GDDR5 VRAM each
Display	27" Retina 5K	≥ 24" Diagonal LED or equivalent, with a minimum vertical viewable area as afforded by the standard 24" monitor with an aspect ratio of 16:9
Display Resolution	5120 x 2880	≥ 1920 x 1080
RAM	≥ 8GB 1600MHz DDR3	≥ 32GB DDR3 ECC memory
Hard Disk Drive	≥ 256GB Solid State Drive, PCIe-based flash storage	1TB Solid State Drive, PCIe-based flash storage
Mouse	Apple Magic Mouse	Apple Magic Mouse
Keyboard	Apple Wireless Keyboard	Apple USB Keyboard with Numeric Keypad
Sound	Headphone/optical digital audio output (minijack)	Combined optical digital audio output/analog line out (minijack)
Speakers	Internal Stereo	Internal
Microphone	Internal Dual microphones	None
Peripherals Interface	Four USB 3 ports	Four USB 3 ports, 6 Thunderbolt 2, 1 HDMI 1.4 UltraHD
Network Interface	Gigabit Ethernet	Dual Gigabit Ethernet ports
Wireless Network Interface	802.11ac Wi-Fi	802.11ac Wi-Fi
Bluetooth	Bluetooth 4.0 wireless technology	Bluetooth 4.0 wireless technology
Energy Savings	Rated EPEAT Gold	Rated EPEAT Gold
Camera	Internal FaceTime HD camera	None
Optical Drive	None	None

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Hardware Reference Configuration for Apple Desktop Systems		
System Component	Apple Desktop	Apple Engineering Workstation
Smart Card Reader	FIPS-201 Approved USB Smart Card Reader	FIPS-201 Approved USB Smart Card Reader

3.4 Apple Laptop Systems

The Apple Laptop class of HRCs encompasses three distinct form factors. End users requiring portable, lightweight systems running the OS X operating system can consider the 13" MacBook Air or the 13" MacBook Pro models. The abstract functions provided by these systems include: electronic mail, office automation, web browsing and access to web applications, secure computing, multimedia, training, etc.

The standard 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 Core i7 processor and increased RAM provide enhanced performance above its lighter weight counterparts. In addition to the functionality described above, this HRC is appropriate for light virtualization, software development, and moderate multimedia development.

The Apple Mobile Engineering Workstation hardware reference configuration is targeted to meet specific programmatic requirements of the scientific and engineering communities in a mobile form factor. This HRC incorporates a higher clock Core i7 processor and a discrete GPU to provide the above functions as well as support higher performance virtualization, software development, data analysis, multimedia authoring and support for engineering and scientific applications.

Hardware Reference Configuration for Apple Laptop Systems				
System Component	Laptop	Lightweight Laptop	Ultra Lightweight Laptop	Mobile Engineering Workstation *as an ACES managed seat available by augmentation to Apple Laptop
Model	Apple MacBook Pro 15" Retina	Apple MacBook Pro 13" Retina	Apple MacBook Air 13"	Apple MacBook Pro 15" Retina
Processor	≥ 2.5GHz quad-core Intel Core i7 processor (Turbo Boost up to 3.7GHz)	≥ 2.7GHz dual-core Intel Core i5 processor (Turbo Boost up to 3.1GHz)	2.2GHz Dual-Core Intel Core i7, Turbo Boost up to 3.2GHz	2.8GHz Quad-core Intel Core i7, Turbo Boost up to 4.0GHz
Graphics Technology	Intel Iris Pro Graphics	Intel Iris Graphics 6100	Intel HD Graphics 6000	Intel Iris Pro Graphics + AMD Radeon R9 M370X

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Hardware Reference Configuration for Apple Laptop Systems				
System Component	Laptop	Lightweight Laptop	Ultra Lightweight Laptop	Mobile Engineering Workstation *as an ACES managed seat available by augmentation to Apple Laptop
Display	15.4" Retina LED-backlit display	13.3" Retina LED backlit display	13.3" LED-backlit glossy widescreen display with support for millions of colors	15.4" LED-backlit display
Display Resolution	2880 x 1800 resolution at 220 ppi	2560 x 1600 resolution at 227 ppi	1440 x 900	2880 x 1800 resolution at 220 ppi
RAM	16GB 1600MHz DDR3L	≥ 8GB 1866MHz LPDDR3	8GB 1600MHz LPDDR3 SDRAM	16GB 1600MHz DDR3L
Hard Disk Drive	Solid State Drive, PCIe-based flash storage ≥ 512GB	Solid State Drive, PCIe-based flash storage ≥ 256GB	Solid State Drive, PCIe-based Flash Storage ≥ 256GB	Solid State Drive, PCIe-based Flash Storage ≥ 512GB
Sound	Headphone port	Headphone port	Headphone port	Headphone port
Speakers	Internal Stereo Speakers	Internal Stereo Speakers	Internal Stereo Speakers	Internal Stereo Speakers
Microphone	Dual Internal microphones	Dual Internal microphones	Dual Internal microphones	Dual Internal microphones
Peripherals Interface	MagSafe 2 power port, two Thunderbolt 2 ports, two USB 3 ports, HDMI port, SDXC card slot	MagSafe 2 power port, two Thunderbolt 2 ports, two USB 3 ports, HDMI port, SDXC card slot	MagSafe 2 power port, Thunderbolt 2 port, two USB 3 ports, SDXC card slot	MagSafe 2 power port, two Thunderbolt 2 ports, two USB 3 ports, HDMI port, SDXC card slot
Network Interface	Apple Thunderbolt to Gigabit Ethernet Adapter	Apple Thunderbolt to Gigabit Ethernet Adapter	Apple Thunderbolt to Gigabit Ethernet Adapter	Apple Thunderbolt to Gigabit Ethernet Adapter
Wireless Network Interface	802.11ac Wi-Fi	802.11ac Wi-Fi	802.11ac Wi-Fi	802.11ac Wi-Fi
Bluetooth	Bluetooth 4.0 wireless technology	Bluetooth 4.0 wireless technology	Bluetooth 4.0 wireless technology	Bluetooth 4.0 wireless technology
Energy Savings	Rated EPEAT Gold	Rated EPEAT Gold	Rated EPEAT Gold	Rated EPEAT Gold
Camera	720p FaceTime HD camera	720p FaceTime HD camera	720p FaceTime HD camera	720p FaceTime HD camera
Weight	≤ 4.49 pounds	≤ 3.48 pounds	≤ 2.96 pounds	≤ 4.49 pounds
Smart Card Reader	FIPS-201 Approved USB Smart Card Reader	FIPS-201 Approved USB Smart Card Reader	FIPS-201 Approved USB Smart Card Reader	FIPS-201 Approved USB Smart Card Reader

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4 Minimum “To Keep” Hardware Requirements

This section states the minimum system specifications for interoperable end-user hardware approved “to keep” in the NASA environment. Systems no longer meeting these minimum requirements are not considered interoperable and shall be removed from the NASA end user infrastructure. These specifications are largely driven by operating system or software package minimum requirements, and should not be interpreted as describing an end-user system with satisfactory performance.

4.1 Minimum “To Keep” Requirements for Systems Running Windows 7/8.1/10

Minimum “To Keep” Requirements for PC Systems Running Windows 7/8.1/10		
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 7/8/10 requirement. See next line if 6 th generation Intel processor
Skylake Processor - additional information for Windows 7 & 8.1	Intel 6 th generation (Skylake) processors have a specific support cycle for Windows 7 and 8.1	Microsoft plans to drop full support for Windows 7 and 8.1 running on Skylake processors after July 17, 2018. Hardware with this generation processor must be updated to Windows 10 prior to this date. http://windows.microsoft.com/en-us/windows/skylake-support Additional guidance and timeline information is available in NASA-STD-2804
Memory (RAM)	<ul style="list-style-type: none"> 1 GB 2 GB 	<ul style="list-style-type: none"> Windows 7/8.1 requirement 64-bit Windows 10 requirement
Hard Disk Capacity	<ul style="list-style-type: none"> 16 GB 20 GB 	<ul style="list-style-type: none"> Windows 7/8.1 requirement, 32-bit Windows 10 requirement 64-bit Windows 10 requirement
Graphics Technology	<ul style="list-style-type: none"> 32 Bit Color Support DirectX 9 or later with WDDM 1.0 driver 	<ul style="list-style-type: none"> Windows 7/8.1 requirement Windows 10 requirement
Display Type	≥ LCD, LED Backlit LCD, or OLED	CRT displays shall be retired as of June 2013
Display Resolution	1024 x 768 Pixels	MS Office Lync 2013 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	Integrated where possible. See Smart Card Reader requirements section
Energy Savings	EPEAT Registered	EPEAT Gold Registered where possible. See EPEAT requirements section

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4.2 Minimum “To Keep” Requirements for Systems Running OS X

Minimum “To Keep” Requirements for Systems Running OS X 10.10 and 10.11		
System Component	Component Characteristics	Comments and/or Component Specification(s)
Supported Models:	iMac (Mid 2007 or newer)	These models are required for OS X 10.10 Yosemite and above
	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 Yosemite and above
Smart Card Reader	Required FIPS-201 Approved Transparent Reader	See Smart Card Reader info under Additional Requirements
Energy Savings	EPEAT Registered	See Energy Savings under Additional Requirements

4.3 Minimum “To Keep” Requirements for Devices Running Mobile Operating Systems

Minimum “To Keep” Requirements for Systems Running Mobile Operating Systems		
System Component	Component Characteristics	Component Specification(s)
OS (iOS)	Fully patched and updated iOS 8 or above	Apple does not explicitly state EOL information for iOS; however, with the iOS 8 release they began to prohibit legacy hardware including the iPhone 4 from updating to the newest, most secure iOS version.
OS (Android)	Fully patched and updated Android 4.4 or above	Google does not specifically state patching support for Android OSs prior to this. Additionally, 4.0.4 is a minimum requirement for Maas360.
OS (Windows Phone)	Fully patched and updated WP 8.1 or Windows 10 Mobile	Support for Windows Phone is not currently planned for implementation in MDM; therefore, Windows Phone OS and Windows 10 Mobile will lie outside of the Standard upon implementation of MDM.
Cellular Connectivity (when applicable)	Domestic US	CDMA, UMTS, GSM, LTE

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Wireless Connectivity	802.11 a/b/g/n/ac Wi-Fi & Bluetooth	
Geographical/Location Services (when applicable)	Assisted GPS and/or cellular triangulation	
Messaging and Calendaring Mail	Support for minimum mobile device requirements as defined above, and for NASA-STD-2804 defined messaging and calendaring standards	
Device Security	See minimum mobile device requirements	

5 Mobile Devices

Mobile Devices constitute a category of devices that run a mobile operating system as opposed to a full-featured desktop/laptop operating system. Examples include iOS, Android, and Windows 10 mobile. Devices in this category may sacrifice appreciable functionality, and in some instances enterprise interoperability, for specific form factor benefits.

5.1 Minimum Mobile Device Requirements

Mobile devices entering NASA's IT environment are required to meet the minimum “to keep” mobile hardware requirements identified in the table above, as well as meet the device capability requirements stated here:

- Native support for Microsoft Exchange
- Centralized management via Microsoft Exchange ActiveSync with the ability to accept all configured ActiveSync policies, including specific support for remote wipe capability, password locking, and wipe after a 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

***Expected Updates** – upon implementation, the Mobile Device Management (MDM) Project will require the following additional requirements to supersede their current counterparts listed above:

- MaaS360 secure container support for Microsoft Exchange
- Centralized management via MaaS360 policies with specific support for remote wipe capability, certificate management, and secure container locking after predetermined number of bad passcode attempts

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5.2 Apple Tablet Systems

The Apple iPad aligns with the Mobile Devices class of systems as defined above. The abstract functions provided by this HRC include electronic mail, light office automation, web browsing and access to web applications in a touch-enabled, portable, lightweight form factor.

Hardware Reference Configuration for Apple Tablet Systems		
System Component	iOS Slate	iOS Mini Slate
Model	iPad Pro	iPad Mini 4
Operating System Type	iOS	iOS
Processor	A9X chip with 64-bit architecture and M9 motion coprocessor	A8 chip with 64-bit architecture and M8 motion coprocessor
Display	9.7" Retina LED-backlit Multi-Touch display	7.9" LED-backlit Multi-Touch display
Display Resolution	2048-by-1536 at 264 pixels per inch	2048-by-1536 resolution at 326 pixels per inch
Hard Disk Drive Type	Solid State Drive	Solid State Drive
Hard Disk Drive Size	128 GB	64 GB
Speakers	Internal	Internal
Wireless Network Interface	Wi-Fi (802.11a/b/g/n/ac); dual channel (2.4GHz and 5GHz); HT80 with MIMO	Wi-Fi (802.11a/b/g/n/ac); dual channel (2.4GHz and 5GHz); HT80 with MIMO
Bluetooth	Bluetooth 4.2 technology	Bluetooth 4.2 technology
Camera	FaceTime HD camera and iSight camera	FaceTime HD camera and iSight camera
Microphone	Dual microphones	Dual microphones
Connector	Lightning	Lightning
Weight	< 1 pound	.65 pounds
Height	9.4 inches	8 inches
Width	6.6 inches	5.3 inches
Depth	.24 inch	.24 inch

5.3 Smartphones

Smartphones fall within the Mobile Devices class of system as defined above, and must meet the minimum hardware requirements defined in section 4.3. The abstract functions provided by this HRC include electronic mail, light office automation, web browsing and access to web applications in a touch-enabled, highly portable, lightweight form factor. Due to the broad spectrum of hardware choices in the marketplace, and the rapid pace of vendor releases/updates/end of sales to hardware in this category, this Standard does not currently define specific Smartphone HRCs.

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6 Additional Requirements

6.1 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 <https://www.idmanagement.gov/IDM/IDMFicamProductSearchPage>

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

6.2 Energy Savings

Newly procured systems must be EPEAT Gold where possible. 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 as 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
		
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](#) for requirements on how energy-saving features should be configured.

6.3 Printers

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

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6.4 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

7 LEGACY AND SUNSETTING HARDWARE

7.1 Removable Storage

Beginning with the 05/06/2015 NASA-STD-2805 revision, the Standard 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 and drives shall be cross-platform compatible. FIPS 140-2 validated storage devices are available for procurement via the ACES Product Catalog – further information is available at <https://aces.ndc.nasa.gov>.

7.2 Optical Disk Drives

Cloud based software delivery and the increasing availability of shared storage is quickly minimizing the need for optical disk drives as a discrete NASA-STD-2805 HRC specification. This trend accelerated in the consumer space beginning in 2013 and has now progressed through the commercial lines as demonstrated by the diminishing availability of optical disk drives across OEM product portfolios. As a result, optical disk drives have been moved to the Sunsetting and Legacy Technology section of NASA-STD-2805 and are no longer required unless explicitly specified in the HRC. Only the PC Desktop and PC Engineering HRCs specify an optical disk drive requirement in NASA-STD-2805 Spring 2016.

7.3 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 or suspended include:

- Windows 8 PC Desktop
- Windows 8 PC Laptop
- Windows 8 Slate
- PC All-In-One
- High End PC Desktop
- High End PC Laptop
- PC Lightweight Laptop – this HRC has been suspended but not fully deprecated. See “Increased Mobility Focus” in section 2 for more information.

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7.4 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	

7.5 Pagers

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)	

7.6 Wireless Aircard Service for Mobile Broadband Internet

USB and card style devices to connect to mobile broadband Internet fall within the Legacy and Sunsetting Technology grouping. These capabilities are being replaced by standalone mobile

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broadband hotspots, or by mobile smartphone devices that include hotspot capabilities for connectivity sharing.

8 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 Enterprise Technology Assessments and Digital Standards Office. 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, enterprise assessments, position papers, software and hardware reviews, recommendations and other documentation intended to promote standardized basic interoperability.

8.1 Coming Attractions

- Likely release of new Apple hardware in June
- Likely release of next generation Intel Chips in late 2016 which will force the move to Windows 10 on systems utilizing this technology.
- Likely dropping of VGA port as a vendor supplied option on laptop systems by next round of hardware
- Imminent completion of transition from snap-in-dock type port replicator solution to Thunderbolt (single cabled type dock) with next round of hardware
- Potential for continued shift toward Intel M-type processor in non-workstation laptop hardware

9 DURATION

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

10 SUPPORTING DOCUMENTS

Supporting documents and additional information related to this standard may be found at <https://etads.nasa.gov/dcs/> and <https://etads.nasa.gov/idi/>

11 COMMENTS

NASA-STD-2805, Minimum Hardware Configurations, includes information from teams and projects across the Agency. If information from your team or project is referenced in the Standard, please review and provide updated information to your Center's Chief Information Office.

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12 ACRONYMS AND DEFINITIONS**12.1 Acronyms and Abbreviations**

CAD	Computer-Aided Design
CRT	Cathode Ray Tube
EPEAT	Electronic Product Environmental Assessment Tool
ETADS	Enterprise Technology Assessments and Digital Standards
GB	Gigabyte
HDD	Hard Disk Drive
HRC	Hardware Reference Configuration
LCD	Liquid Crystal Display
LED	Light Emitting Diode
OLED	Organic Light Emitting Diode
RPM	Revolutions Per Minute
SSD	Solid State Drive
TB	Terabyte

12.2 Definitions

Term	Definition
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.
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, the 15” Mobile Engineering Workstation, and the 17” Mobile Engineering Workstation.
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 three slate HRCs: the Apple iPad Air, the Apple iPad Mini, and Detachable 2-In-1 systems.

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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 relegated PC Tablets (as defined here) to the category of sunseting technology.
Minimum “To Keep” Hardware Configuration	This category defines the minimum interoperable hardware configuration that may be retained by a NASA organization.
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.
Minimum Interoperability Software Suite	The Minimum Interoperability Software Suite is defined in NASA-STD-2804, “Minimum Interoperability Software Suite.”
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, Apple OS X Desktop and Apple OS X Laptops including lightweight and ultra-lightweights.
Mobile Computing Systems	Mobile computing systems may sacrifice appreciable functionality, and in some instances enterprise interoperability, for specific form factor benefits. Example HRCs include smartphones and slate devices such as the iPad.
Mission Systems	Mission Systems are computing systems defined by NASA program specifications to meet broad mission needs and include engineering HRCs, mobile engineering HRCs, and CAD HRCs.
Legacy and Sunseting 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.

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APPENDIX A – Proposed Augmentation Matrix

A.1 This appendix is included for informational purposes. These configurations of proposed augmentations to the ACES managed seat offerings are not part of the Standard; however, they can serve to inform end-users with non-managed compute needs what pre-defined configurations were chosen using test results and feedback from the target audience for the specific augmentation.

A.2 Spring 2016 Aces Seat Augmentation Matrix

Document Number	Document Title
1.1	Proposed ACES Compute Seat Augmentation Matrix
https://etads.nasa.gov/downloads/AugmentMatrix_05_02_16_Appendix.pdf	