

SURFACE VEHICLE RECOMMENDED PRACTICE

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Recommended Practice for the Selection of Engineering Workstations

Foreword—The development of cost effective engineering workstations has resulted in a marketplace with many vendors, each offering a myriad of options or configurations. This proliferation has created confusion for the potential user who is seeking common workstation configurations for particular applications. The user needs a better definition of standard functions that should be expected from the workstation vendors. A functionality definition is required that describes performance and capacity ranges, and sets specific standards in the following areas:

Hardware
System Software
Communications
Graphics Display

This document defines a range of functional requirements to be met by a family of workstations. The resulting engineering workstation specifications are based on the commitment to existing and emerging industry standards. This commitment facilitates the following:

Portability of application software from one vendor's workstation to another.
Interoperability between vendor workstation families.
A "single point of access" to compute resources.
A consistent "user interface."
"Seamless" communications across local and wide area networks serving a diverse hardware environment.
Full support for a diverse application environment.

1. **Scope**—This SAE Recommended Practice defines a guideline to help engineering users select workstations by specifying vendor supported functionality with several levels of performance and capacity. These workstations will satisfy different engineering applications while maintaining interoperability. The objective is to specify a set of standards, not a single workstation, which must be addressed by vendors to meet the hardware and operating environment needs of engineers in their CAD, CAM, CAE and other activities.

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2. References

2.1 Applicable Publications—The following publications form a part of this specification to the extent specified herein.

2.1.1 ISO DOCUMENTS—Available from ANSI, 11 West 42nd Street, New York, NY 10036-8002.

- ISO 1539: 1980—ISO Standard "Programming Languages—FORTRAN" (Also known as ANSI X3.9-1978)
- ISO 8652—Current ISO standard "Programming Languages—Ada"
- ISO 8802-3—Current ISO standard "Information Processing systems—Local Area Networks—Part 3: Carrier sense multiple access with collision detection (CSMA/CD) access method and physical layer specifications" (Also known as IEEE 802.3)
- ISO 8802-4—Current ISO standard "Information Processing systems—Local Area Networks—Part 4: Token-passing bus access method and physical layer specifications" (Also known as IEEE 802.4)
- ISO 8802-5—Current ISO standard "Information Processing systems—Local Area Networks—Part 5: Token ring access method and physical layer specifications" (Also known as IEEE 802.5)
- ISO 9314—Current ISO standard for Fibre Data Distributed Interface (FDDI) (Also known as ANSI X3.166)
- ISO 9592—Current ISO standard "Information processing systems—Computer graphics—Programmer's hierarchical interactive graphics system (PHIGS)" (Also known as ANSI X3.144)
- ISO 9594—Current ISO standard "Information processing systems—Open Systems Interconnection—The Directory—Parts 1–7 (Also known as CCITT X.500 series)
- ISO 9945-1—Current ISO/IEC standard "Information technology—Portable Operating System Interface (POSIX)—Part 1: System Application Programming Interface (API) [C Language]" (Also known as IEEE 1003.1)
- ISO 10021—Current ISO/IEC standard "Information processing systems—Text Communication—Message oriented text interchange system—Parts 1–7" (Also known as CCITT X.400)

2.1.2 ANSI DOCUMENTS—Available from ANSI, 11 West 42nd Street, New York, NY 10036-8002.

- ANSI X3.64—Current ANSI standard "Additional Controls for Use with American National Standard Code for Information Interchange"
- ANSI X3.113—Current ANSI standard "Information systems—Programming Language—FULL BASIC"
- ANSI X3.159—Current ANSI standard "Programming Language C"
- ANSI 770X3.97—Current ANSI/IEEE "Standard Pascal Computer Programming Language"

2.1.3 OTHER DOCUMENTS

- CCITT X.25—CCITT Recommendation "Interface Between DTE and DCE for Terminals Operating in the Packet Mode on Public Data Networks"
- CCITT V.35—CCITT Recommendation "Data Transmission at 48 KBPS Using 60–108 KHz Group Band Circuits" for data communication over the telephone network
- EIA-232-D—Current ANSI/EIA standard "Interface Between Data Terminal Equipment and Data Circuit-Terminating Equipment Employing Serial Binary Data Interchange" (revision of standard RS-232-C)
- EIA-343-A—Current EIA standard "Electrical Performance Standards for High Resolution Monochrome Closed Circuit Television Camera"
- EIA-449—Current ANSI/EIA standard "General Purpose 37-Position and 9-Position Interface for Data Terminal Equipment and Data Circuit-Terminating Equipment Employing Serial Binary Data Interchange"
- IEEE 488.1—Current ANSI/IEEE standard "IEEE Standard Digital Interface for Programmable Instrumentation"
- IEEE 488.2—Current ANSI/IEEE standard "IEEE Standard Codes, Formats, Protocols, and Common Commands" (For Use with ANSI/IEEE Standard 488.1-1987 IEEE Standard Digital Interface for Programmable Instrumentation)

IEEE 770X3.97—Current ANSI/IEEE standard "Pascal Programming Language"

IEEE 1003.4—Current IEEE standard "Portable Operating System Interface for Computer Environments,"
Real Time Extensions

SPEC—Systems Performance Evaluation Cooperative, "SPEC Release 1.0 Benchmark Run Rules and
Reporting Rules"

XPG3—X/OPEN Company Limited, Portability Guide Issue 3, December 1988

3. **Definitions**

3.1 Ada—High level computer programming language named after Lady Ada Lovelace, Charles Babbage's computer programmer.

3.2 ANSI—American National Standards Institute.

3.3 ANSI X3.9-1978—1978 ANSI standard "Programming Language FORTRAN" (see ISO 1539: 1980)

3.4 ANSI X3.144—Current ANSI standard "Information Systems—Computer Graphics—Programmer's Hierarchical Interactive Graphics System (PHIGS) Functional Description, Archive File Format, Clear-Text Encoding of Archive File" (see ISO 9592)

3.5 ANSI X3.166—Current ANSI standard for Fibre Data Distributed Interface (FDDI) (see ISO 9314)

3.6 Anti-Aliasing—A technique used to provide a greater apparent resolution on the screen of a graphics display without the cost of a higher resolution display.

3.7 BSD 4.3—Berkeley Software Distribution (version 4.3).

3.8 C—A high level programming language (see ANSI X3.159).

3.9 CCITT—Comite Consultatif International de Telegraphique et Telephonique (an international consultative committee that sets international communications usage standards).

3.10 CCITT X.400—CCITT Recommendation "Message Handling Systems: System Model—Service Elements" (see ISO 10021)

3.11 CCITT X.500—CCITT Recommendation "Information processing systems—Open Systems Interconnection—The Directory—Parts 1–7" (also known as ISO 9594)

3.12 CPU—Central Processing Unit.

3.13 Cray Station—CRAY Research, Inc.'s proprietary remote job scheduling products.

3.14 CSMA/CD—Carrier Sense Multiple Access with Collision Detection.

3.15 DCE—Data Communications Equipment.

3.16 DEC VT-100—Digital Equipment Corporation proprietary ASCII text terminal emulation products.

3.17 DEC VT-2xx—Digital Equipment Corporation proprietary graphics terminal emulation products.

3.18 Depth Queuing—Graphics display technique in which an object being displayed that is farther from the viewer is darker; the closer an object, the brighter it is.

- 3.19 Double Buffering**—The concept of using two buffer registers between a computer's central processing unit and an input/output device in which one buffer is being refreshed while the other is being used for the input (or output) operation thereby resulting in increased performance and reduced flicker between screen updates.
- 3.20 DTE**—Data Terminal Equipment.
- 3.21 EIA**—Electronics Industries Association.
- 3.22 FDDI**—Fibre Data Distributed Interface (see ISO 9314 also ANSI X3.166)
- 3.23 FORTRAN-77**—High level computer programming language for FORMula TRANslation—1977 version; (see ISO 1539: 1980 also ANSI X3.9-1978).
- 3.24 GB**—Gigabyte; billions of bytes.
- 3.25 Gouraud Shading**—A shading technique used for the display of objects in which varying degrees of light intensity are calculated across each polygonal surface making up the object. This technique provides a more realistic image than constant shading but a somewhat less realistic image than provided by Phong shading.
- 3.26 IBM LU 6.2**—International Business Machines Corporation's Logical Unit type 6.2 proprietary format operating under SNA for application to application program communications across a network.
- 3.27 IBM 3179/3279G**—International Business Machines Corporation's proprietary SNA terminal with vector data stream products.
- 3.28 IBM 3279**—International Business Machines Corporation's proprietary SNA vector graphics terminal products.
- 3.29 IBM 5080**—International Business Machines Corporation's proprietary high performance graphics terminal products.
- 3.30 IEEE**—The Institute of Electrical and Electronic Engineers, Inc.
- 3.31 IEEE 802.3**—Current ANSI/IEEE standard for Local Area Networks "CSMA/CD Media Access Method" (see ISO 8802-3)
- 3.32 IEEE 802.4**—Current ANSI/IEEE standard for Local Area Networks "Token-Passing Bus Access Method and Physical Layer Specifications" (see ISO 8802-4)
- 3.33 IEEE 802.5**—Current ANSI/IEEE standard for Local Area Networks "Token Ring Access Method and Physical Layer Specifications" (see ISO 8802-5)
- 3.34 IEEE 1003**—See ISO 9945 "POSIX" standard
- 3.35 I/O**—Input/output.
- 3.36 ISO**—International Organization for Standardization
- 3.37 ISO/OSI**—International Organization for Standardization/Open Systems Interconnection.
- 3.38 LAN**—Local area network.
- 3.39 LISP**—LISt Processing programming language widely used in artificial intelligence applications.
- 3.40 MAP/TOP**—Manufacturing Automation Protocol/Technical Office Protocol.



- 3.41 **MB**—Megabyte; millions of bytes.
- 3.42 **Megapixel**—Millions of graphics display picture elements.
- 3.43 **MS DOS**—Microsoft Corporation's Disk Operating System for personal computers.
- 3.44 **NFS**—SUN Microsystems, Inc.'s Network File System specification.
- 3.45 **Non-Interlaced**—In raster graphics display tubes, every scanning line is refreshed for each sweep down the display as opposed to the interlace method used in standard television in which every other scanning line is refreshed during each sweep thereby requiring two sweeps to completely refresh the display.
- 3.46 **NTSC**—National Television Standards Committee.
- 3.47 **NURBS**—Non-Uniform Rational B-spline Surfaces.
- 3.48 **OSF/Motif**—Open Software Foundation X-Window based user interface product.
- 3.49 **Pascal**—High level computer programming language named after Blaise Pascal (see IEEE 770X3. 97).
- 3.50 **PC-DOS**—IBM Personal Computer Disk Operating System.
- 3.51 **PEX**—PHIGS+ Extensions to X-window.
- 3.52 **PHIGS**—Programmer's Hierarchical Interactive Graphics System (see ISO 9592, also known as ANSI X3.144).
- 3.53 **Phong Shading**—A compute-intensive shading technique used in the display of objects whereby the light intensity for every point on the object is calculated to obtain a very realistic image.
- 3.54 **Pixel**—The smallest addressable picture element of a graphics display.
- 3.55 **POSIX**—Portable Operating System Interface (see ISO 9945 also IEEE 1003).
- 3.56 **Postscript**—Adobe Systems Incorporated's proprietary device-independent, high-level, interpretive programming language with extensive graphics capabilities. It is primarily used to describe the appearance of text, geometric shapes and sampled images on printed pages.
- 3.57 **PU**—Physical Unit.
- 3.58 **QWERTY**—A standard keyboard named because the letters 'qwerty' appear in order in the row of keys directly above the keyboard left hand home row.
- 3.59 **RGB Output**—An output model for specifying a color, or a gray-scale, as a combination of the three primary colors of light (red, green, and blue) in particular concentrations. The intensity of each primary color is specified by a number in the range of 0 to 1. If all three colors have equal intensity, the perceived result is a pure gray on the scale from black to white (see EIA-343-A).
- 3.60 **RJE**—Remote Job Entry.
- 3.61 **RS-232**—Serial interface specification (see EIA-232-D).
- 3.62 **RS-449**—Serial interface specification (see EIA-449).
- 3.63 **Spec**—Systems Performance Evaluation Cooperative

- 3.64 **SPECfp**—SPEC floating point performance measure
- 3.65 **SPECmark**—SPEC overall performance measure
- 3.66 **SPEC Thruput**—SPEC Thruput performance measure
- 3.67 **TCP/IP**—Transmission Control Protocol/Internet Protocol.
- 3.68 **Tektronix 4XXX**—Tektronix Inc.'s proprietary graphics terminal products.
- 3.69 **Unix System V**—Current version of the portable computer operating system developed by Bell Laboratories of AT&T.
- 3.70 **WAN**—Wide area network.
- 3.71 **X/Open GUI**—X/OPEN Corporation specification for a graphical user interface (future).
- 3.72 **X-Window System**—Massachusetts Institute of Technology's defacto standard portable distributed windowing system.
- 3.73 **X.25**—CCITT Recommendation "Interface Between DTE and DCE for Terminals Operating in the Packet Mode on Public Data Networks" (see CCITT X.25).
- 3.74 **V.35**—CCITT Recommendation "Data Transmission at 48 KBPS Using 60—108 KHz Group Band Circuits" for data communication over the telephone network (see CCITT V.35).
- 3.75 **X.400**—CCITT Recommendation "Message Handling Systems: System Model - Service Elements" (see ISO 10021).
- 3.76 **X.500**—CCITT Recommendation "Information processing systems—Open Systems Interconnection—The Directory—Parts 1–7 (see ISO 9594).
- 3.77 **Z Buffering**—Technique used in hidden-surface algorithms in which the z-depth value of each pixel being examined is compared against the value stored in the buffer to see which pixel is closer to the viewer. The pixel closest to the viewer is then displayed. High depth z buffering is accomplished by using additional bits in the z-buffer (24 bit).

4. **Trademarks**

Ethernet—Trademark of Xerox Corporation
 Motif—Trademark of Open Software Foundation
 Network File System—Trademark of Sun Microsystems, Inc.
 NFS—Trademark of Sun Microsystems, Inc.
 OSF—Trademark of Open Software Foundation
 Postscript—Registered trademark of Adobe Systems, Inc.
 SPEC—Trademark of the Standard Performance Evaluation Corporation
 SPECmark—Trademark of the Systems Performance Evaluation Cooperative
 Unix—Registered trademark of AT&T
 X/Open—Registered trademark of X/Open Company, Ltd.
 X Window System—Trademark of Massachusetts Institute of Technology

- 5. **Technical Compliance Matrix**—The workstation specifications are contained in the Technical Compliance Matrix, which is divided into two sections: (1) Standard Workstation Characteristics (See Figure 1A, Figure 1B; and (2) Minimum Performance and Capacity Ranges (See Figure 2.) These two sections are described below.