all Federal departments and agencies. These graphics standards should be used for all computer graphics applications and programs that are either developed or acquired for government use.

9.1 The FIPS for PHIGS is intended for use in computer graphics applications that are either developed or acquired for government use. It is specifically designed to meet the performance requirements of such demanding applications as Computer Aided Design/Computer Aided Engineering/Computer Aided Manufacturing, command and control, molecular modelling, simulation and process control. It emphasizes the support of applications needing a highly dynamic, highly interactive operator interface and expecting rapid screen update of complex images to be performed by the display system. The PHIGS PLUS functionality is designed to support graphics applications requiring lighting and shading, curved lines, curved and facetted surfaces, and non-indexed color specification.

9.2 The use of this standard is compulsory and binding when one or more of the following situations exist:

- —The graphics application is very highly interactive, or contains hierarchically structured graphics data, or requires rapid modification of 2D or 3D graphics data and the relationships among the data.
- —It is anticipated that the life of the graphics program will be longer than the life of the presently utilized graphics equipment.
- —The graphics application or program is under constant review for updating of the specifications, and changes may result frequently.
- —The graphics application is being designed and programmed centrally for a decentralized system that employs computers of different makes and models and different graphics devices.
- —The graphics program will or might be run on equipment other than that for which the program is initially written.
- —The graphics program is to be understood and maintained by programmers other than the original ones.
- —The graphics program is or is likely to be used by organizations outside the Federal government (i.e., State and local governments, and others).

9.3 Nonstandard features of implementations of PHIGS should be used only when the needed operation or function cannot reasonably be implemented with the standard features alone. Although nonstandard features can be very useful, it should be recognized that the use of these or any other nonstandard elements may make the interchange of graphics programs and future conversion more difficult and costly.

10. Specifications. American National Standard Programmer's Hierarchical Interactive Graphics System, ANSI/ISO 9592.1–3:1989 and ANSI/ISO 9592.1a,2a,3a,4:1992, define the scope of the specifications, the syntax and semantics of the PHIGS elements and requirements for conforming implementations. All of these specifications apply to Federal Government implementations of this standard.

ANSI/ISO 9592.1–3:1989 and ANSI/ ISO 9592.1a,2a,3a,4:1992 define a language independent nucleus of a graphics system for integration into a programming language. Thus, it is embedded in a language layer obeying the particular conventions of the language. FIPS 153–1 is therefore divided into two parts. Part 1 represents the functional aspects of PHIGS. Part 1 consists of the following:

(1) Functional description (ANSI/ISO 9592.1:1989) and (ANSI/ISO 9592.1a:1992, Amendment 1)

The functional description of PHIGS provides a set of functions for the definition, display and modification of 2D or 3D graphical data. It also provides for the definition, display and manipulation of geometrically related objects, along with the modification of graphics data and the relationships between that graphical data.

(2) Archive file format (ANSI/ISO 9592.2:1989) and (ANSI/ISO 9592.2a:1992, Amendment 1)

The archive file provides a file format suitable for the storage and retrieval of PHIGS structures and structure network definitions. It allows structure definitions to be stored in an organized way on a graphical software system. And, facilitates transfer of structure definitions between different graphical software systems.

(3) Clear-text encoding (ANSI/ISO 9592.3:1989) and (ANSI/ISO 9592.3a:1992, Amendment 1)

The clear-text encoding provides a representative of the archive file syntax that is easy to type, edit and read. The file is human-readable (allows editing), human friendly (easy and natural to read) and machine readable (parsable by software).

(4) Plus Lumiere and Surfaces, PHIGS PLUS (ANSI/ISO 9592.4:1992)

The Programmer's Hierarchical Interactive Graphics System (PHIGS) Plus Lumiere and Surfaces (PHIGS PLUS) extends the basic PHIGS functionality by adding facilities for the specification of curved lines, curved and faceted surfaces, lighting and other effects such as depth modulation.

Part 2 of FIPS 153–1 consists of the bindings of PHIGS and PHIGS PLUS functions to actual programming languages, defined in ANSI/ISO 9593:1990. These bindings are developed in cooperation with the voluntary standards committees of the various languages. The following bindings currently exist, and form part 2 of FIPS 153–1:

- -The FORTRAN Language binding for PHIGS (ANSI/ISO 9593.1:1990);
- —The ADA Language binding for PHIGS (ANSI/ISO 9593.3:1990);
- –The C Language binding for PHIGS (ANSI/ISO 9593.4:1991).

Subsequent language bindings, including those for PHIGS PLUS, will be added periodically as they become available. As these bindings are approved by ANSI, each language binding will become part of this standard.

11. Implementation. Implementation of this standard involves four areas of consideration: the effective date, acquisition of PHIGS software system implementations, interpretations of PHIGS implementations, and validation of PHIGS implementations.

11.1 Effective Date. This revised standard is effective August 1, 1995. Requirements for the use of basic PHIGS functionality (defined in ANSI/ISO 9592.1–3:1989 and ANSI/ISO 9593.1:1990, 9593.3:1990, 9593.4:1991) are unchanged and continue in effect. Validation of PHIGS implementations is required after the effective date in accordance with Section 11.4.

11.2 Acquisition of Implementations. Conformance to FIPS for PHIGS is required whether PHIGS toolbox packages are developed internally, acquired as part of an ADP system procurement, acquired by separate procurement, used under an ADP leasing arrangement, or specified for use in contracts for programming services. Recommended terminology for procurement of FIPS for PHIGS is contained in the U.S. General Services Administration publication Federal ADP & Telecommunications Standard Index, Chapter 4 Part 1.

11.3 Interpretation of this FIPS. NIST provides for the resolution of questions regarding FIPS for PHIGS specifications and requirements, and issues official interpretations as needed. Procedures for interpretations are specified in FIPS PUB 29–3. All questions about the interpretation of FIPS for PHIGS should be addressed to: