

1. INTRODUCTION

The Defense Mapping Agency (DMA) produces numerous mapping, charting, geodetic, gravimetric, and digital products in support of the Department of Defense (DoD). It is advantageous to refer these products to a single geocentric coordinate system for many reasons other than an improved facility for working with a large number and variety of products. Such a system is needed due to accuracy and user interface considerations, the need for a product to support the widest possible range of applications (local, worldwide), the need to relate information from one product to data obtained from another source (e.g., map/chart positions to coordinates obtained from inertial navigation systems in real time), and the need to ensure a smooth transition in product use from one part of the world to another.

In accomplishing the preceding, such a geocentric system, termed a world geodetic system, provides the basic reference frame and geometric figure for the earth, models the earth gravimetrically, and provides the means for relating positions on various local geodetic systems to an earth-centered, earth-fixed (ECEF) coordinate system. In brief, a world geodetic system serves as the framework for DMA products and worldwide DoD operations.

To date, three such systems, World Geodetic System 1960 (WGS 60), WGS 66, and WGS 72, each successively more accurate, have supported DoD activities. Although WGS 72 has aged gracefully and is still adequate for some DoD applications, it has several shortcomings which negate its continued use. For example, the WGS 72 Earth Gravitational Model (EGM) and Geoid are obsolete and local geodetic system-to-WGS datum shifts of improved accuracy and greater geographic coverage are needed than are available from WGS 72. In addition, relatively minor orientation and scale errors also affect WGS 72. Other factors contributing to the desirability of replacing WGS 72 with an improved system are:

- Such an update and replacement occurs at a time when other

geodetic system changes are either underway or contemplated; e.g., the up-dating, readjustment, and replacement of North American Datum 1927 (NAD 27) by NAD 83 [1.1] [1.2], the readjustment and analysis activities involving European Datum 1950 (ED 50) [1.3] [1.4], and the availability of the new Australian Geodetic Datum 1984 (AGD 84) [1.5].

- An extensive increase in the data and types of data needed to develop an improved WGS.
- The availability of new theory and techniques to support a WGS improvement effort.

The purpose of this publication is to report on a new more accurate system, WGS 84, which has been developed as a replacement for WGS 72. The new system represents DMA's modeling of the earth from a geometric, geodetic, and gravitational standpoint using data, techniques, and technology available through early 1984. It is an improvement over WGS 72 in several respects. New and more extensive data sets and improved computer software were used in the development. A more extensive file of Doppler-derived station coordinates was available, and for many more local geodetic systems; improved sets of ground-based Doppler and laser satellite tracking data and surface gravity were available; and, geoid heights deduced from satellite radar altimetry (a new data type) were available for oceanic regions between 70 degrees north and south latitude (approximately).

REFERENCES

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