UNITED NATIONS
ECONOMIC AND SOCIAL COUNCIL

Dist.:
LIMITED

E/ECA/NRD/CART/208
09 February 1993

Original: ENGLISH

Economic Commission for Africa

Eighth United Nations Regional
Cartographic Conference for Africa

Addis Ababa, Ethiopia
22-27 February 1993

THE DIGITAL GEOGRPAHIC INFORMATION EXCHANGE STANDARD
(DIGEST) -- IMPLEMENTATION STATUS

UNITED   E
NATIONS
- -

                                                            Distr.

                                            ORIGINAL   IN   ENGLISH
===

EIGHTH UNITED NATIONS REGIONAL CARTOGRAPHIC
CONFERENCE FOR AFRICA
ADDIS ABABA, ETHIOPIA 22 - 27 FEBRUARY 1993

REVIEW OF THE LATEST TECHNOLOGY IN CARTOGRAPHIC DATA ACQUISITION,
     MANIPULATION, STORAGE AND PRESENTATION, WITH SPECIAL
  EMPHASIS ON POTENTIAL APPLICATIONS IN DEVELOPING COUNTRIES:

             LAND/GEOGRAPHIC INFORMATION SYSTEMS

      The Digital Geographic Information Exchange Standard
             (DIGEST) -- Implementation Status

         (Submitted by the United States of America)**

- - - - - -

*/   E/CONF.86/1/

**/   Prepared by Gary Hacker, Defense Mapping Agency

SUMMARY

The Digital Geographic Information Working Group (DGIWG) has been working since 1983 to develop an exchange standard for Digital Geographic Information (DGI). The result of this effort is the DGI Exchange Standard, or DIGEST, which specifies the exchange structure and feature attribute coding scheme for vector, raster, and matrix data. The paper provides background information on the DGIWG, current implementation of DIGEST-compliant datasets and future activities.

BACKGROUND

History of DGIWG

The Digital Geographic Information Working Group (DGIWG) currently consists of members from 11 North American and European countries and two observers from Supreme Headquarters Allied Powers Europe (SHAPE) and Australia. All members are also members of the North Atlantic Treaty Organization (NATO). DGIWG started in 1983 with representatives from France's Centre Géographique Interarmées, Germany's Amt fuer Militærisches Geowesen, the United Kingdom's Directorate General of Military Survey, and the United States' Defense Mapping Agency. Over the years, additional members have been added, including Belgium's Institut Géographique National, Denmark's Chief of Defense Geographic Office, Italy's Istituto Geografico Militare Italiano (IGMI) and Centro Informazioni Geotopografiche Aeronautiche (CIGA), Netherlands' Topografische Dienst, Norway's Forsvarets Karttjeneste, and the newest members, Canada's Directorate of Geographic Operations and Spain's Centro Cartográfico y Fotográfico del Ejército del Aire and Servicio Geográfico del Ejército. In some cases, the organizations represented above are also represented by their respective nations' Defense Ministries.

DESCRIPTION OF DIGEST

DIGEST is designed to handle exchange between participating nations of raster, matrix, and vector data (including the entire range of topological structures from no topology to full topology) using a standard feature and attribute coding scheme. Each is described below.

Raster Data

The DGIWG has developed exchange specifications for three different forms of raster data: ARC Standardized Raster Product (ASRP)[2], UTM/UPS Standardized Raster Product (USRP)[3], and Standardized Raster Graphics (SRG)[4]. All the types of raster data are digital replicas of paper maps. SRG consists of a scanned map including the border and margin areas. Parametric data are retained to allow users the option to rectify the image to satisfy their specific requirements. SRG allows either 24-bit Red, Green, Blue (RGB) or 8-bit Color Coding (CC). Pixel resolution for SRG is variable.

ASRP and USRP are 8-bit Extended Color Coded (ECC), 100 micron resolution replicas of maps in which the data has been rectified, placed on a common projection and datum, margin areas removed and finally merged with adjacent map sheets. The only difference between the two is that ASRP uses the Equal Arc-Second Raster Map/Chart (ARC) projection, while the USRP uses the Universal Transverse

Mercator and Universal Polar Stereographic Projections. Italy (IGMI) is custodian nation for SRG, UK for ASRP and France for USRP.

Matrix Data

Although DIGEST specifies guidelines for exchange of matrix data, the DGIWG nations have agreed to continue to exchange digital terrain elevation data in accordance with NATO Standardization Agreement (STANAG) 3809 [5]. Therefore, this matrix section will remain in DIGEST but its implementation is not expected in the near future.

Vector Data

DIGEST allows the exchange of vector data in both feature-oriented data structure (DIGEST Annex A) and relational data structure (DIGEST Annex C). For exchange of neutral data DGIWG nations have generally agreed to use Annex A. Annex A uses ISO 8211 [6] to encode the information. For products, or datasets that are expected to be provided directly to users, it has been generally agreed that Annex C (also known as the Vector Relational Format (VRF)) will be specified. The United States has adopted DIGEST Annex C as MIL-STD-600006 Military Standard Vector Product Format [7]. DIGEST also includes Annex B, which specifies the use of ISO 8824 [8] and provides a specific implementation for exchange of digital geographic information via telecommunications devices. Canada is primarily responsible for the development of Annex B and is still testing some of the implementation aspects.

Feature and Attribute Coding Catalog (FACC) [9]

FACC is the result of nearly 5 years' effort to develop a comprehensive coding scheme for features, their attributes and attribute values that was acceptable by all member nations. FACC consists of three sections, section 1 containing the 5 character feature code, the feature's definition in English, and then the feature's name in English (both US and UK versions) Dutch, French, Italian, German, and Spanish. Section 2 contains the 3 character attribute code, the attribute's definition and a list of values that can be specified with the attribute. Section 3 contains a comprehensive example of appropriate feature and attribute combinations.

The DGIWG has also agreed to maintain reserved areas of FACC so nations can use those sections to satisfy their own national requirements. (e.g., Italy wishes to use FACC for cadastral information, a series of codes and attributes that use codes in the reserved areas of sections 1 and 2 is applied). Recognizing that not all features can be accommodated by the coding scheme, DIGEST allows for the exchange of data by including a complete data dictionary of those features and attributes unique to the dataset being exchanged. Several of the countries have adopted FACC as the basis for their internal coding schemes, and the United States Defense Mapping Agency and the United Kingdom Military Survey have adopted FACC for use as the coding scheme for all their future products [10].

4

NATO Digital Geographic Information Dataset Development

In 1990, the DGIWG was requested by the NATO Geographic Conference (NGC) to undertake development of standard digital geographic information datasets for data exchange to support combined use among NATO forces. The DGIWG Steering Committee accepted the NGC request and tasked the Technical Committee to develop dataset specifications and prototypes. NGC identified requirements for DGI to support 7 specific areas: Terrain Analysis, Transport and Logistics Planning, Background Display, Simulation, Air Information, Toponymy, and exchange of Neutral Data. Also, NGC specified that each dataset is required in one or more levels of detail, level 0 equal to the level of detail associated with a 1:1M scale map and smaller, level 1 equal to 1:250k to 1:500k, and level 2 equal to 1:100k and larger. DGIWG assigned lead nations to perform primary development of the datasets as follows:

- Terrain Analysis Dataset (TAD)   United States
- Transportation and
  Logistics Dataset (TLD)   Germany
- Background Display Dataset (BDD)   United Kingdom
- Air Information Dataset (AID)   Italy (CIGA)
- Toponymic Dataset   United Kingdom

No lead nations are assigned for Simulation and Neutral dataset specifications as the DGIWG Steering Committee and NGC agreed that the Simulation DGI requirements are currently satisfied by the use of internationally agreed specifications for Digital Terrain Elevation Data (DTED) and Digital Feature Analysis Data (DFAD). Also the DGIWG Technical Committee agreed that the specifications for Neutral Data would be a combination of all the features and attributes required for all the datasets.

Terrain Analysis Dataset (TAD)

The requirements for TAD are those features and attributes needed to perform traditional military terrain analysis, including cross-country movement, line of sight and range/bearing calculation. The US is lead development nation and is designing TAD using a layered approach, where the TAD is actually a combination of several layers used by other datasets--BDD/VMAP (discussed below), Digital Nautical Chart (DNC) (which is currently only a US requirement), and DTED. The top layer is Digital Terrain Analysis (DTA) and contains only that information uniquely required for performing terrain analysis. At the time of writing (early May 1992), DMA has a preliminary draft specification anticipated out in January 1993 and a prototype dataset out in Summer 1993.

Transport and Logistics Dataset (TLD)

The requirements for TLD are those features and attributes to support logistics planning and movement of personnel and materiel. It is intended to provide detailed information on transportation routes (e.g., roads, railroads, canals and navigable waterways, air facilities, maritime ports, etc.) and may be combined with user supplied data to support additional logistics planning requirements. Germany is lead development nation of TLD and is designing the dataset to contain only the features and attributes required to support these very specific requirements. Draft TLD specifications are available and a prototype is expected in 1993.

Background Display Dataset (BDD)

The requirements for BDD are those features and attributes needed for display of geographic information as a background for overlay of other typically non-geographic information in command and control systems, mission planning systems, etc. The UK is lead development nation and is designing BDD as a simple map background with limited attribution and topology. There was concern by the US that the original UK design was too limited to support the requirements of many geographic information systems, so US began development of Vector Smart Maps (VMAP), working closely with UK to ensure the datasets are fully compatible. At the time of writing (November 1992), US and UK are convinced that a consolidation of the BDD and VMAP is possible such that only be one dataset specification can be produced to satisfy both requirements. As it is agreed the Digital Chart of the World fulfills the requirements for BDD level 0, UK and US are only developing dataset specification for levels 1 and 2.

Air Information Dataset (AID)

The requirements for AID are to provide a graphic database of airspace structures and vertical obstructions on the terrain for low to very low altitude, Visual Flight Rules (VFR), and Instrument Flight Rules (IFR) flight operation and planning use. Italy (CIGA) is lead development nation and is designing AID which comprises two subsets distributed separately, the AID-Aeronautical Information Subset (AID-Aero) and the AID-Obstruction Information Subset (AID-Obs). AID-Aero will contain all aeronautical information portrayed both on NATO designated aeronautical charts and on ICAO charts, particularly Enroute Charts. AID-Aero will be a single level dataset. AID-Obs will contain selected geo-features required for safety and reference in low-very low air navigation. Italy (CIGA) has a draft specification and prototype completed and is working on refining the database design.

Toponymic Dataset

The requirements for the Toponymic Dataset are to provide a digital database of geographic place names and associated support information to be used both as a stand-alone dataset and in conjunction with other datasets. Early in the development phase, UK identified two possible design choices, one a complex

6

dataset that included over 20 separate entries per place name, the other a simple dataset that includes 11 entries per name. NGC's guidance was to develop the simple dataset. DMA used the UK specification as the basis for the development of the Digital Gazetteer prototype that was issued in May 1992 for evaluation. Work is continuing to determine if the toponymic dataset should consist of a simple text file or if it should be a spatially referenced graphic file, with a decision expected by Spring 1993.

DIGEST IMPLEMENTATION STATUS

At the time of this writing, there has been two significant implementations of DIGEST-compliant dataset types. The UK began producing ASRP data during the Gulf War and continues to produce ASRP to satisfy national requirements. The second is the US/UK/Canada/Australia Digital Chart of the World (issued in July 1992) which satisfies the NATO requirement for Background Display Dataset level 0.

STANDARDS CONSOLIDATION ACTIVITIES

There has been a desire by all of the bodies currently developing standards for exchange of digital geographic and hydrographic information to try and consolidate the standards as much as possible. Along those lines, there have been several high level bilateral discussions and correspondence between DGIWG and the International Hydrographic Organization (IHO) (promoters of DX-90), the Spatial Data Transfer Standard (SDTS) committee, the UK Ordinance Survey (promoters of the National Transfer Format (NTF)), and the Canadian General Standards Board (promoters of Spatial Archive and Interchange Format (SAIF)). Following is a status report on efforts to consolidate DIGEST with those standards.

DIGEST/DX-90

At a meeting in November 1990, representatives from DGIWG and IHO met to discuss consolidation of DIGEST and DX-90. It was agreed that interested nations would thoroughly research the differences between the standards and agree to attempt consolidation in a future edition of both DIGEST and DX-90. To that end, Canada, United States, and United Kingdom have all funded studies on identifying the differences between DIGEST and DX-90. UK and Canada's reports are available and indicate that there is a possiblility for a consolidation, although there will have to be concessions made, most likely by both DIGEST and DX-90.

DIGEST/SDTS

Representatives from DMA and USGS have met in March and April 1992 to discuss establishment of a federal vector profile in SDTS that is also DIGEST compliant. Also in April 1992, DMA formally proposed to the FGDC Standards Subcommittee that the FGDC consider adopting FACC as the feature and attribute coding system of choice for SDTS. A formal committee was established in July 1992 to (a) determine the feasibility of preparing a DIGEST profile in SDTS and (b) if feasible, preparing

7

formal recommendations for changes/modifications to DIGEST and/or SDTS to create the DIGEST profile as part of the SDTS Topological Vector Profile. Final results of the committee's work are expected in November 1992.

DIGEST/NTF [11]

In 1991 a technical evaluation between NTF and DIGEST was undertaken. This resulted in a number of recommended changes to NTF of which most were included in the draft NTF version 1.2. UK reports that for raster and matrix data the two standards are essentially compatible. For unstructured vector data, DIGEST spaghetti is generally compatible with NTF level 2, although to ensure proper translation between DIGEST and NTF it may be appropriate to translate into the NTF level 3 complex spaghetti subset. For structured vector data, DIGEST specifies a full topological model which has no corresponding NTF level or subset. To perform a translation from full topological DIGEST to NTF the data dictionary must be defined using FACC as the coding scheme and using the user-defined standard option of NTF available in the unstructured Level 4.

DIGEST/SAIF

The Canadian General Standards Board has adopted a national implementation strategy of a harmonization of DIGEST and SAIF by including a DIGEST profile within SAIF. They have proposed that their new national standard containing the harmonization be called Canadian Geomatics Interchange Standard (CGIS) 1.0.

FORMAL STANDARDIZATION ACTIVITIES

Submission of DIGEST as a NATO Standardization Agreement (STANAG)

Canada, on behalf the the DGIWG, has formally proposed DIGEST for consideration as a NATO STANAG. If there are no objections, it is possible that DIGEST could become a STANAG as early as February 1993.

Submission of DIGEST for Consideration as an ISO Standard

The DGIWG formally proposed the formation of an ISO committee for consideration of standards for Geomatics. Along with this proposal, DGIWG proposed several existing NATO STANAGs for paper MC&G products and aDIGEST for exchange of digital data.

FUTURE ACTIVITIES

The initial goal of the DGIWG, to establish a comprehensive exchange standard for DGI, is complete with the issuance of DIGEST edition 1.1. The immediate future activities of the DGIWG are to complete the development and prototyping of the NGC datasets (Spring 1993). Over the years, DGIWG has become a unique international forum for other organizations (such as NATO) to accomplish detailed

technical work in less time than normally required for NATO standardization activities. It is anticipated that NATO or other groups may take advantage of DGIWG to develop and test other dataset types. The issuance of the Digital Chart of the World is the first major dataset published in compliance with DIGEST. As users become familiar with the data and DIGEST it is certain that improvements will be recommended. DGIWG expects to review and act on modifications to DIGEST and FACC as required. Also, it is expected that needs will arise for additional datasets which will need to be developed and tested to support NATO requirements. If so, DGIWG may be tasked to develop and test such datasets.

Note: Special thanks to the members of the 15th DGIWG Panel of Experts for their input and assistance in preparing this paper

BIBLIOGRAPHY

1. Digital Geographic Information Working Group (DGIWG), Digital Geographic Information Exchange Standard (DIGEST), Edition 1.1, August 1992.

2. _____, Specifications for Exchange of ARC Standardized Raster Product, Edition 1.1, June 1992

3. _____, Specifications for Exchange of UTM/UPS Standardized Raster Product, Edition 1.1, June 1992

4. _____, Specifications for Exchange of Standardized Raster Graphics, Edition 1.1, June 1992

5. North Atlantic Treaty Organization (NATO) Military Agency for Standardization, Standardization Agreement (STANAG) 3809 IGEO, Edition 2 Amendment 1, Digital Terrain Elevation Data Exchange Format, 1 August 1988.

6. ISO 8211-"Information processing systems-Specification for a data descriptive file for information interchange", 1985

7. US Department of Defense, MIL-STD-600006 Military Standard Vector Product Format, 13 April 1992.

8. ISO 8824-"Information processing systems-Open Systems Intercon-nection Specifications of Abstract Syntax Notation One (ASN 1)", 1987 (CCITT X.208)

9. Digital Geographic Information Working Group, Feature and Attribute Coding Catalog (FACC), Edition 1.1, June 1992.

10. Defense Mapping Agency Letter, 6 March 1992, Subject: DMA Policy for Feature and Attribute Coding of Digital Products

11. Ley, R.G. (UK Military Survey), "The Digital Geographic Information Exchange Standard–DIGEST" (unpublished)