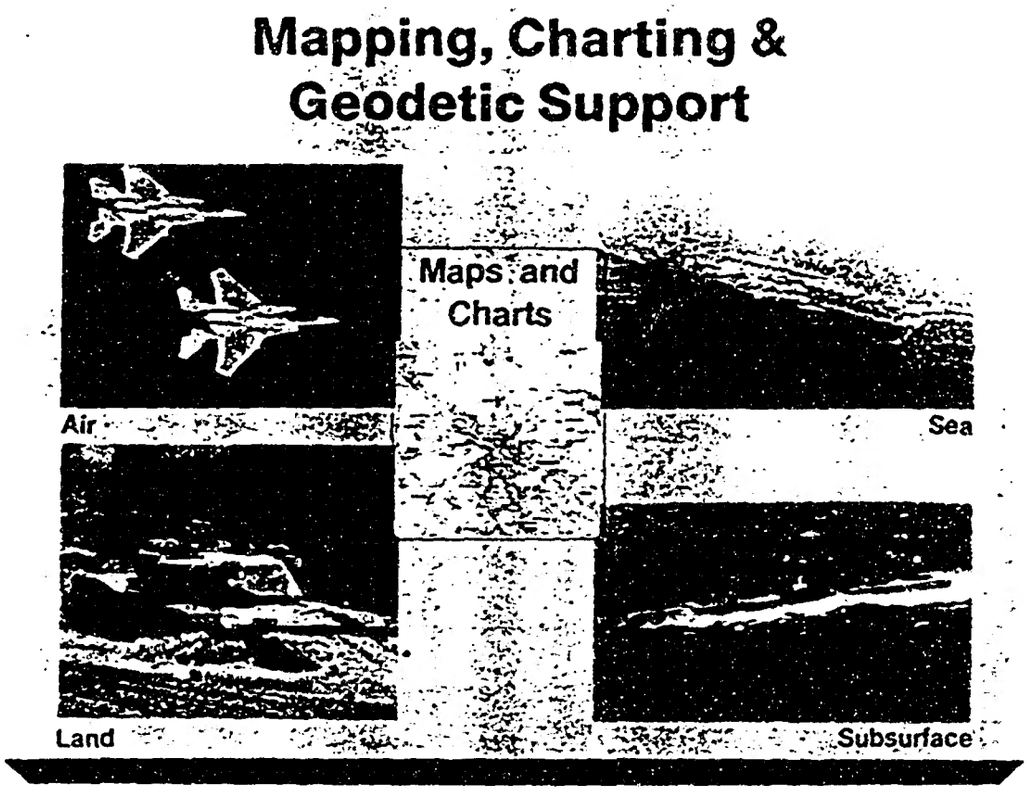

I am sure you realize we produce maps and charts. We produce them on a worldwide basis for all of our Armed Forces. Last year we produced over 40 million copies of maps and charts. I think it is safe to say that our Armed Forces could not operate without these products.

We are also very much in the digital business. In fact, as compared to maps and charts, our effort in the digital business now over 60 percent of our overall effort. We produce two digital data bases and these two digital bases are very important because most of our major weapon systems depend upon them to operate.

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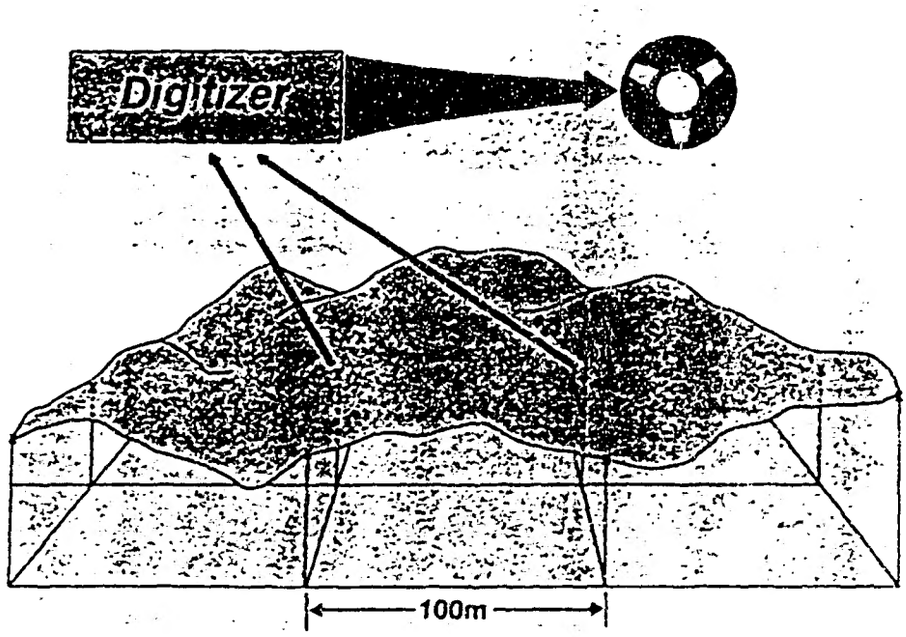
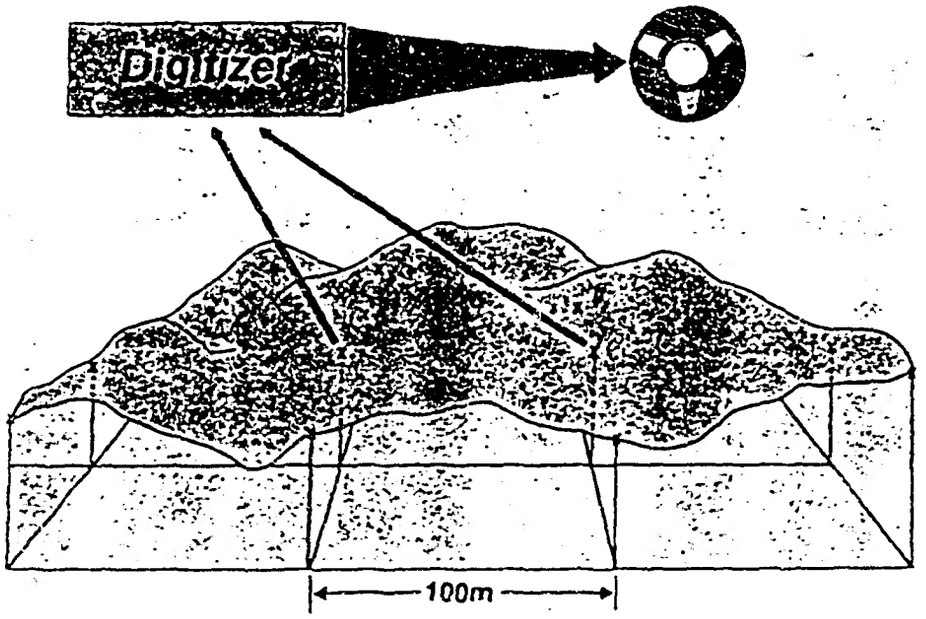
Digital Terrain Elevation Data (DTED)



First of all, using available source material we produce a digital terrain elevation data base in which we extract the [deleted] elevations at specific intervals, normally 100 meters, along the Earth's surface. We then digitize and put them on tape.

Digital Terrain Elevation Data (DTED)



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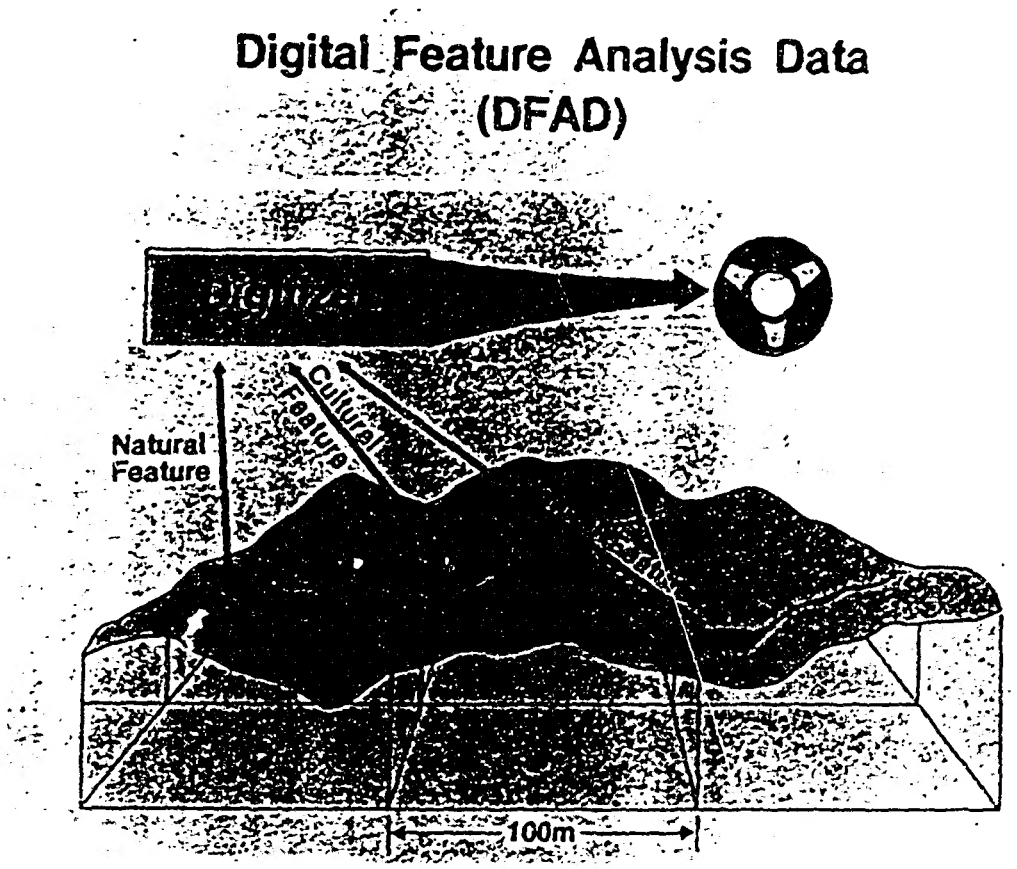
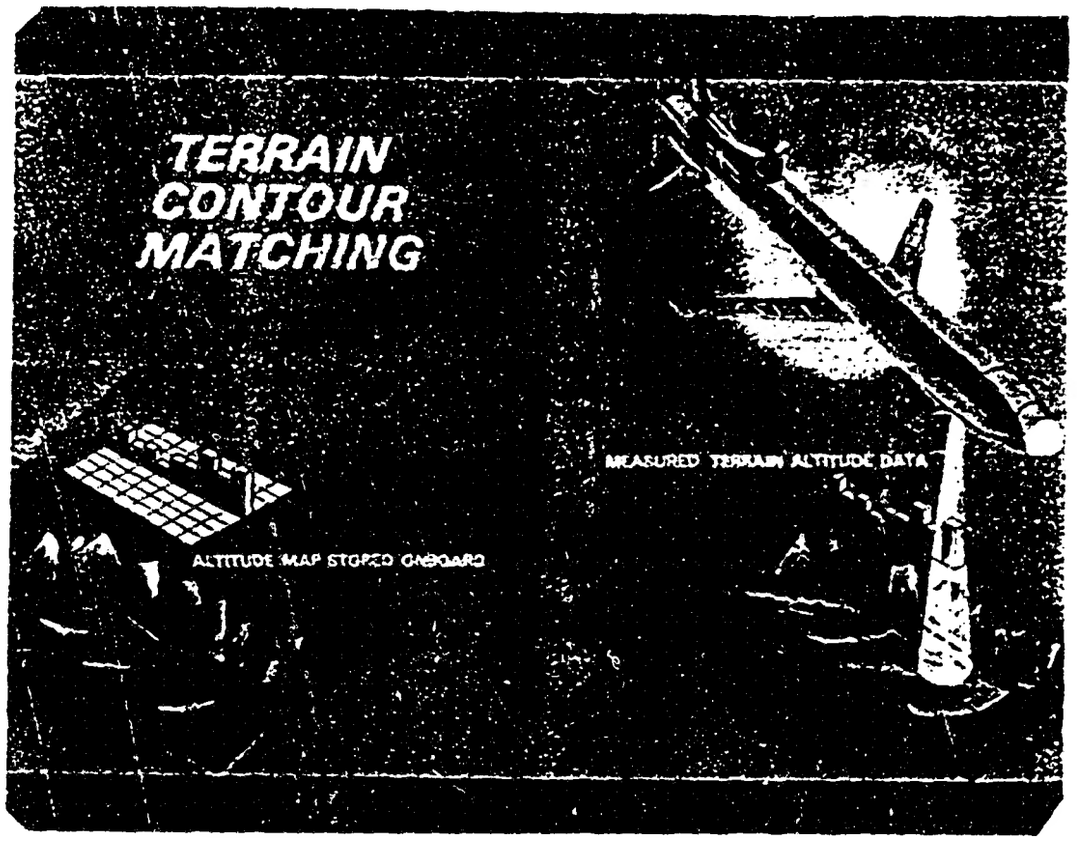


We also produce a feature data base. Once again from available source material [deleted] extracting features, man made and natural, digitizing them and putting them on tape.

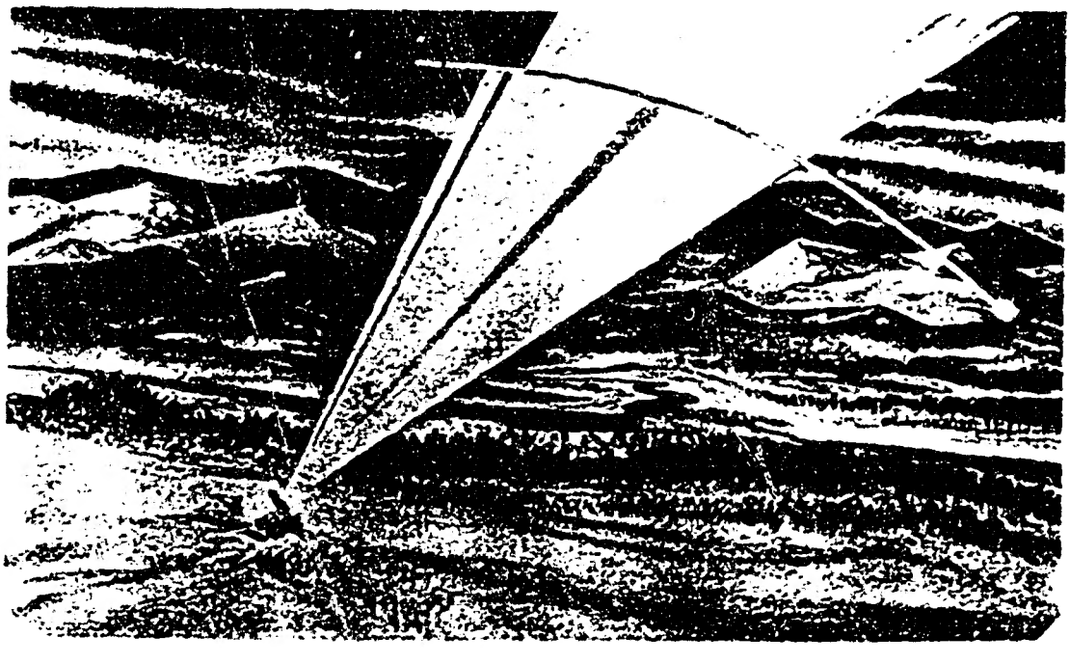
Last year, we produced more than 1.5 billion elevations I would like to show you some of the systems that these digital data bases are used on.



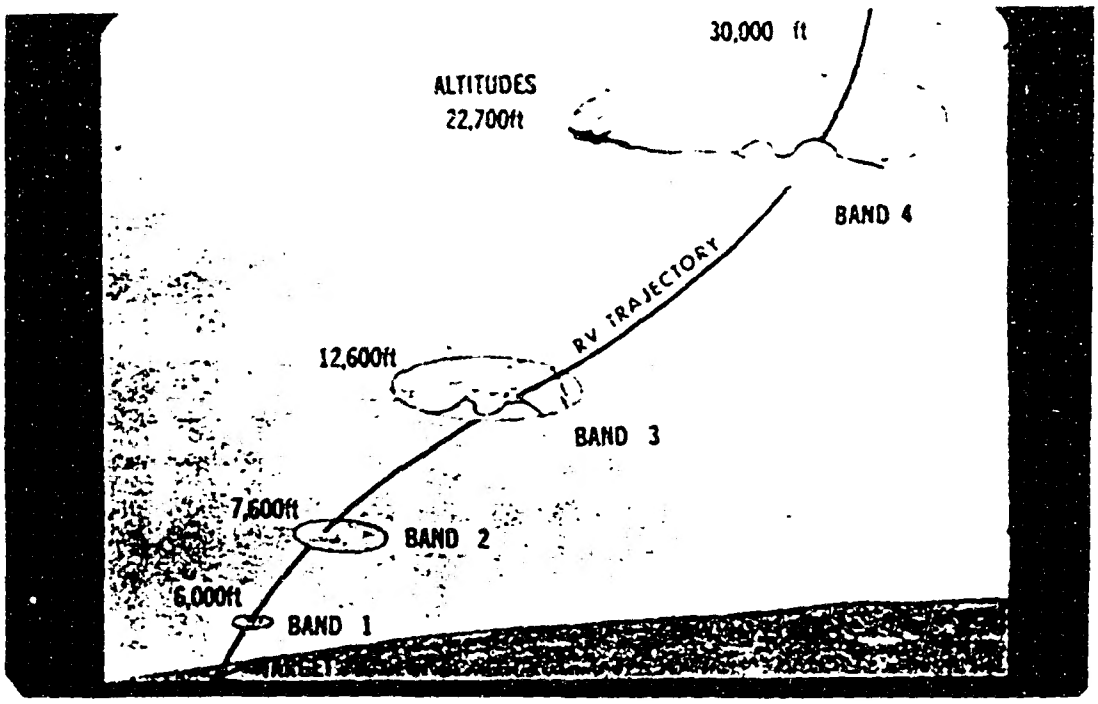
First of all, for the cruise missile, we produce a terrain contour matching map which is stored in the on board computer of the missile, and is used by using the radar altimeter to compared it to the actual terrain on the ground. The precise position is obtained in this way and incorporated in corrected by the inertial navigation system on the cruise missile.

We also produce vertical obstruction data and elevation data along the missile path allowing the missile to fly close to the ground.

Firefinder

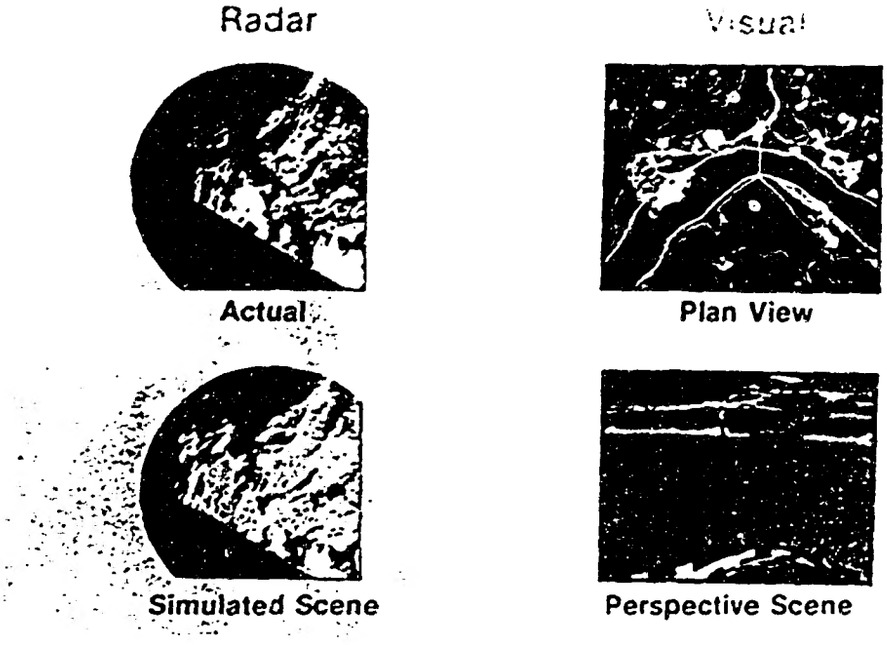


Firefinder is a counterfire weapon successfully used in Lebanon. This vugraph depicts the enemy battery with an incoming round. The trajectory of the round as derived from radar is combined with our digital terrain elevation data to give the exact location of the enemy weapon: then that is instantly sent back to our counterfire weapon system.



For the Pershing II, the Army uses our two data bases to produce a target reference scene. This scene is compared with the actual radar scene generated by the missile and this comparison forms a basis for correcting the missile path.

Digital Simulations



We also produce simulator data. Manufacturers use our two data bases to produce scenes for simulators using both radar and visual scenes for a number of aircraft and other weapon systems.

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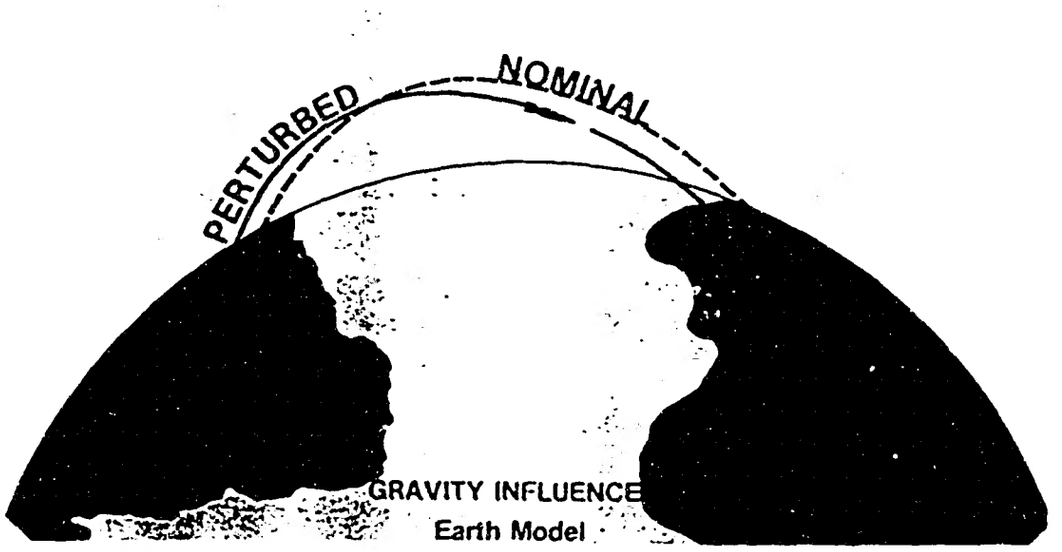
Effect of Gravity



We also produce gravity data used by our strategic systems along with precise target positioning. These two, gravity and precise target positions, account for over 25 percent of the accuracy error budget for our strategic systems.

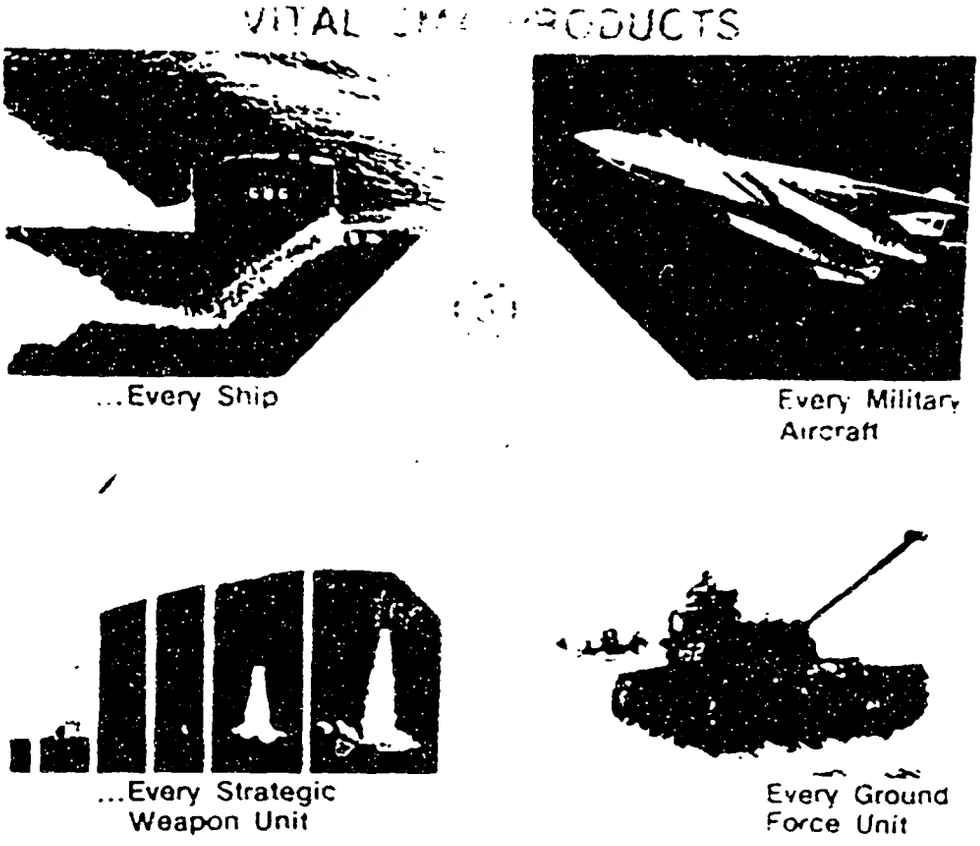
FY 83 Production

- 52,000 Line Items
- 3,312 New or Revised Maps and Charts
- 40 Million Copies of Maps and Charts
- 4.4 Million Square Nautical Miles of Digital Data
- 11,320 Strategic Points
- 32,000 Gravity Point Measurements

Mr. Chairman, this gives you a look at what we produced last year. This 4.4 million square nautical miles of digital data represents over one-tenth of the Earth's land surface. This is our propaganda slide. We are required to show it at all DMA presentations, but I think it does point out very clearly that we are part of every weapon system.

ESSENTIALITY OF DMA SUPPORT

First of all, we are essential because our forces could not operate without our maps and charts; and second, all of our major weapon systems depend upon these two digital data bases to operate, to actually work.



SYSTEM DEFICIENCIES

We are, however, running into problems in producing quantities of these vital products needed in the timeframe required by our Armed Forces. This is further compounded by the fact that the more complex digital requirements are increasing rapidly in number.

Now, our present system is the best in the world, certainly the most modern in the world, but it has some very serious deficiencies when compared to our requirements. First, it is too slow. It takes 6 to 24 months to produce a map or chart. We simply cannot respond fast enough to the requirements.

Second, of course, its lengthy process affects the quantities of products that we can make.

Third, it is too costly. This is because it is a very labor intensive system, and fourth, it is inflexible. We don't have the flexibility we require. Our present system does not respond well to changes in either new products or revisions to existing products, nor to changes in the production line.

For example, if we have to produce a new product from scratch, we have to interupt the production process, pull the partially completed product out and put in the new product perturbing the system. It is very inefficient and also expensive

Our RDT&E program is designed to correct these deficiencies. This is or objective and I will just leave the vugraph up there for a moment.

Mr. Chairman, this is what we are emphasizing. First, conversion to an all digital production system.

Second, developing a gravity gradient sensor to produce data to support our stratehgic weapons systems.

Third, to develop techniques and equipment to use remote sensing for determining the ocean floor topography which is very important for our naval forces.

And fourth, to develop a system capable of transmitting data to our field units so that maps, charts and digital products may be produced in the field.

FY85 RDT&E Funding Requirements

($ in millions)

Program	Requirement
Exploitation Modernization Program	$165.4
Continuing Research and Engineering Development	23.7
Acquisition System Development	18.3
Total RDT&E Requirements for DMA	$207.4

This is our budget as submitted. We are requesting $207.4 million. One hundred sixty-five point four million dollars is requested for the Exploitation Modernization Program. This is a virtual rebuilding of our production system. It is a congressionally endorsed program which will ultimately give us an all digital system throughout the production process. Our goal is to reduce our production time requirements by 75 percent and our costs by 50 percent.

Without this program, we will not be able to meet our strategic commitments in the outyears and into the early nineties.

In our continuing research and engineering development program we are requesting $23.7 million. First, this request is to find ways to improve our data collection and analysis methods.

Second, to improve our labor intensive system by incorporating artifical intelligence into production operations.

Third, to introduce special data bases and fourth, to improve the way we now generate and produce products.

Last, we are requesting $18.3 million for our acquisition systems development program, which is designed to insure that the source data we receive [deleted] is compatible with our production system requirements.

Mr. Chairman, what we have attempted to do is show that the products we produce are essential to the effectiveness of our Armed Forces and that our capability to continue producing these products is dependent upon our R&D program. Finally we respectfully request the committee's support for our budget as submitted.

Thank you, sir.

The CHAIRMAN. Thank you.

Mr. Hutto.

Mr. HUTTO. No questions.

The CHAIRMAN. Mr. Coleman.

Mr. COLEMAN. No questions.

The CHAIRMAN. Does the staff have any questions?

Mr. BAYER. The Air Force claims that they are spending about $25 million a year reformating the data that you provided them for the cruise missile program and they have asked for about $11 million to set up a system to do that on their own. I wonder why DMA wouldn't do that for them? They claim they have three-fourths of the requirement for data. It would seem like it would be better for you all to get the data in the right format for the Air Force and that we really shouldn't put the money in the Air Force to do that.

Admiral WILKINSON. This is a very complicated process as it stands right now. We produce two digital data bases and the type of formats needed from the digital data base depends upon the specific products that we needed. There may be a missile simulator that needs a different formating. The Pershing needs a different formating. We do some of this, but not all of it for everybody. We simply would not have the time, computer time, to do that or the money to do it.

Let me ask Mr. Ayers. He may want to elaborate on that a little bit.

Mr. AYERS. First, was your question related to the cruise missile or the simulators?

Admiral WILKINSON. If it was the simulator, it is an easy question to——

Mr. AYERS. In particular, you might want to go back to the Air Force, it is their program element. They are only asking for about $1 million this year and another $10 million to reformat DMA data. They claim they are the primary user of the data. I would think it would be better if you gave them data in the right format.

Admiral WILKINSON. We have 165 users of this digital data in all. Nine different simulators use it, in addition to all the weapons systems I went through up here. Everybody requires it in a different format. I don't understand it for the cruise missile. We will get a better answer for that; we produced the Tercoms, as we call the terrain contour matching system matrices, for the cruise missile.

Let me see if Mr. Ayers wants to elaborate.

Mr. AYERS. I think we can check into it but to my knowledge, they are not reformating the data for the cruise missile.

Mr. BAYER. They claim here on page 165 of their backup they are spending about $25 million a year doing that.

Mr. AYERS. We are delivering the data and they are using it for testing.

Admiral WILKINSON. We will provide you an answer for the record on that.

[The following information was received for the record:]

CARTOGRAPHIC APPLICATIONS FOR TACTICAL AND STRATEGIC SYSTEMS [CATSS]

DMA is cognizant of Air Force's proposed Cartographic Applications for Tactical and Strategic Systems (CATSS) program (P.E. 63259) and supports the concept. It is our understanding this program is intended to optimize DMA cultural, physical and symbolic cartographic data in a digital format for the specific needs of a wide range of developing weapon systems. In most cases, some form of transformation of standard DMA products is required before they can be employed on a given system. In the case of the cruise missile, the Terrain Contour Matching (TERCOM) map and Vertical Obstruction Data are produced specifically for that system and require no additional processing. The large Digital Terrain Elevation data base used to plan the route of the missile, however, is a standard DMA product used for many other applications. A simple reformatting routine is applied to make the data more efficient for that specific task. This operation is currently performed by the Air Force and is independent of the CATSS effort. Advanced versions of the cruise missile currently under development may employ more sophisticated and complex transformation programs which will incur greater levels of post-production data processing.

We perceive the CATSS program as the necessary interface between DMA and the Air Force user community. CATSS will provide system developers with the technical expertise to develop the software needed to employ DMA standard products for their needs. Beyond the cruise missile, a whole family of systems requiring DMA digital data are either entering operation or are under active development. Missile and aircraft guidance systems, simulators, avionics suites and C^{3}I systems are just a few of the applications requiring digital map support. DMA cannot afford to build specialized products for each of these requirements. It is DMA policy to concentrate our resources on production of a limited number of flexible data bases which, with appropriate transformation, can be utilized by a wide variety of systems. It is not within our purview as a data producer to develop this transformation software. It should be the responsibility of applications oriented programs such as CATSS to provide this support. We see no conflict or duplication between our role and that of the CATSS program.

Mr. AYERS. One other item is important in regard to simulators. We have encouraged through the Under Secretary of Defense for R&D, the need to get standardization in the data so that the cost to translate our digital data into every different type of computer that a manufacturer of weapons systems comes up with is minimized. You can rapidly see that each manufacturer or each software developer could come up with a different approach to writing the software. There is an active effort toward getting some standardization in that area so as to minimize the costs of transformation. And this is an area that we have been working on with Dr. DeLauer's office very diligently.

The CHAIRMAN. Thank you very much, gentlemen.

Admiral WILKINSON. Thank you.

PREPARED STATEMENT OF REAR ADM. EDWARD A. WILKINSON, JR.

Mr. Chairman and members of the committee: I welcome the opportunity to appear before you today to discuss the Defense Mapping Agency's fiscal year 1985 research, development, test and evaluation (RDT&E) appropriation requirements. Our RDT&E program is divided into three distinct but interrelated areas: One, the activities of the exploitation modernization program (EMP); two, the continuing re-

search and development program for mapping, charting, and geodesy (MC&G); and three, the acquisition systems development porogram. All of these programs are a part of the department of defense (DOD) tactical intelligence and related activities (TIARA) aggregation. I will now discuss briefly, DMA's mission, RDT&E program objectives, and the fiscal year 1985 request for the three segments of our program.

DMA MISSION

DMA's mission is directly and almost exclusively related to readiness activities. We provide mapping, charting, and geodesy (MC&G) support and services to the Armed Forces through the production and worldwide distribution of maps, charts, precise positioning data, and digital data for strategic and tactical military operations and weapons systems. In fact, DMA products that are accurate, current, and timely are needed for every conceivable type of military operation, including air and marine navigational safety. Those products that become an integral part of the weapons systems are crucial to their effectiveness and the accuracies of missiles depend upon our precise positioning of launch and target areas by geodetic and geophysical means. DMA also has a statutory responsibility to support the merchant marine worldwide except for United States territorial waters.

MAJOR OBJECTIVES

DMA strives to provide timely support of the validaterd, global needs of the Armed Forces for MC&G products, data, and services by pursuing our major objectives which are to:

Meet the minimum, validated requirements of the military users for MC&G products; assure the availability of current products required for safety of flight and navigation at sea; meet, to the extent resources and source materials permit, the need for completion of products and data required by the initial operating capability dates established for new weapons, navigation systems, etc.

Continue to work closely with the military users to assure that no new product line is developed if an existing product will satisfy the mission need. If a new product line is required, we produce the most economical product that will satisfy the requirement.

Continue efforts to increase productivity through research and development, equipment acquisition, and improved production processes, principally through the exploitation modernization program, to better meet product requirements of the Armed Forces.

Achieve production in the most economically feasible manner including a proper balance between in-house and contractual effort.

Continue working closely with the 80 some foreign countries with which we have cooperative agreements and with U.S. civil mapping agencies in order to maximize our ability to use, whenever possible, their products in lieu of direct DMA production to meet military requirements.

MC&G PRODUCTION ACCOMPLISHMENTS

Significant MC&G production accomplishments in fiscal year 1983 were:

All products required to support the IOC's of Pershing II and ground launched cruise missile (GLCM) were produced and delivered on time.

All requirements for the cruise missile program support were met.

Support to the U.S. Central Command (CENTCOM) in Southwest Asia remained on schedule and accelerated production in Central America in support of the U.S. Southern Command (SOUTHCOM) was initiated.

Peacekeeper development,· test, and evaluation gravity requirements were met and surveys to meet similar requirements for Trident II were initiated.

All high priority aeronautical, nautical, and topographic mapping and charting commitments were met as scheduled.

A total of seven JCS-directed crisis actions were responded to on time, including major support efforts for Lebanon and Grenada.

PRODUCTS AND PRIORITIES

Our production priorities continue to be directed toward satisfying, first, those requirements of the strategic forces such as the cruise missile and the Trident II, and to providing products that are essential to safety of flight and navigation at sea. Our secondary emphasis is directed toward the needs of the U.S. European Command (EUCOM), U.S. Cental Command (CENTCOM), U.S. Pacific Command (PACOM), and U.S. Southern Command (SOUTHCOM). Two of the tactical systems receiving

special attention are the Pershing II and Firefinder. To suppport urgent and high priority needs in these categories, requirements in lower priority areas must be deferred. This precludes supporting many requirements in third world areas with the execution of CENTCOM'S and SOUTHCOM's higher priority requirements. Unfortunately, recent history indicated that the third world is the most likely area for uprisings and incursions.

PERSHING II

One example of DMA's support of tactical systems is the Pershing II whose strike plan we support by producing point positioning data bases (PPDBS) for in-field targeting. We also produce digital terrain elevation data (DTED) and digital feature analysis data (DFAD) for the in-field generation of reference scenes used with this land based missile's terminal guidance system. Production to meet Pershing II deployment dates is a DMA effort with some allied coproducer support.

U.S. CENTRAL COMMAND REQUIREMENTS

With respect to tactical forces, a major portion of our production effort continues to be devoted to satisfying priority requirements of the USCENTCOM. Small and medium scale coverage for USCENTCOM areas are now generally available. Therefore, we are concentrating both in-house and contractural effort on the production of large scale maps and charts and PPDBS.

PERSPECTIVES ON MC&G SUPPORT

DMA's efforts, and consequently its resource needs, are sensitive to accuracy requirements and planned areas of application of individual weapon systems and contingency plans rather than troop and force levels. Accordingly, our production of terrain contour matching (TERCOM) matrices and other digital data for the various cruise missiles is dependent upon the areas of deployment and accuracy requirements of each system rather than the actual numbers deployed. Also, much of the data such as PPDBS, DTED, and DFAD produced for a given geographic area will support more than one weapon system; for example, intercontinental ballistic missiles, cruise missiles, and the Pershing II. Thus, a reduction in the numbers of missiles or even the elimination of a system does not necessarily affect the need for a given DMA product.

DMA RDT&E PROGRAM OBJECTIVES

The objective of the DMA RDT&E program is to improve MC&G capabilities in all phases of our operations from source collection through the distribution of finished MC&G products. Our current program emphasizes first, expanding the digital processes in the DMA production system to support current and future weapons (cruise missile, Pershing II, simulators, etc.); second, developing a gravity gradient sensor in support of the Trident weapon system; third, developing equipment and exploitation techniques using remote sensors for hydrographic data to define the topography of the ocean floor in support of current and future surface and sub-surface military operations; and fourth, developing means for remote production of maps and charts using transmitted data in support of rapidly deployed forces world wide.

TOTAL FISCAL YEAR 1985 RDT&E FUNDING REQUIREMENTS

For fiscal year 1985, DMA is requesting a total of $207.4 million. Of this amount, $165.4 million is for the exploitation modernization program; $23.7 million is required for continuing research and development activities including $500 thousand for the initiation of an exploratory development activity within DMA; and $18.3 million is for our acquisition systems development program. The request of $207.4 million represents a $77.3 million increase over our fiscal year 1984 authorization and is directly associated with the Secretary of Defense mandated, congressionally endorsed, EMP development effort.

EXPLOITATION MODERNIZATION PROGRAM (EMP)

In fiscal year 1985, $165.4 million is being requested for the EMP. The committee was advised last year of the establishment of a new component, the DMA special program office for exploitation modernization (DMASPOEM) whose mission would be to develop the all-digital production capability needed for the 1990s. This capabil-

ity also will provide DMA the flexibility to adapt its production line for use of all available source materials.

Compared to current capabilities, the all-digital system is expected to increase DMA's production capacity to support current and new weapon systems and tactical operations, and provide the flexibility for greatly improved responsiveness through a decrease in production time. The EMP objectives are a 50 percent reduction in production costs and a 75 percent reduction in pipeline time as compared to current DMA capabilities.

CONTINUING RDT&E DEVELOPMENT PROGRAM

As I have also stated previously, $23.7 million of the fiscal year 1935 request will provide for the continuing advanced and engineering development efforts for mapping, charting, and geodesy and the initiation of an exploratory development activity. These efforts are directed toward maintaining a broad-based RDT&E program which supports the current DMA production system as well as the emerging digital production system in both the near term and long range timeframes. During fiscal year 1985, the thrust of this program will be to continue with those efforts required to enhance MC&G data collection and analysis activities, to more fully automate processes for MC&G data extraction and development and management of spatial data bases, and to provide more efficient product generation capabilities.

To accomplish this segment of our R&D program, the requested funds for fiscal year 1985 will be divided among the following four functional areas.

MC&G DATA COLLECTION AND ANALYSIS ACTIVITIES

For developments in the MC&G areas of geodesy, geophysics, hydrography and related data collection and analysis activities, $7.3 million will be required. Hardware and software techniques will be developed to exploit and collect geodetic and geophysical data used to enhance the capabilities of current and future DOD weapons systems. Specifically, DMA is required to collect MC&G data using advanced sensors and technology; produce launch and target positions, including astro-geodetic deflection of the vertical; produce navigation checkpoints; and provide precise measurements of the earth's gravitational field and other geodetic and geophysical data. In the area of hydrography, developments will be directed towards satisfying DOD and statutory requirements associated with safety of navigation at sea and hydrographic charting. This will be accomplished through improved hydrographic data collection and processing related to coastal bathymetry, detection of navigation hazards, sonar surveying, and remote sensing techniques.

MC&G DATA PROCESSING

There is a requirement of $9.1 million to be used for improvements in MC&G data processing capabilities. These R&D development efforts will be concentrated in the areas of data extraction, data base management, and computer science. In the data extraction and data base management areas, efforts are designed to further increase automation in our MC&G production system by the use of expert systems for feature identification and extraction and for management of spatial data bases which are three-dimensional representations of the earth's surface, including the ocean bottom. MC&G user requirements have made it necessary for DMA to develop these new methods which will permit the use of more efficient automated techniques for extracting, structuring, storing and retrieving a high volume of source data required in both DMA's current and emerging digital production systems. In the computer science area, developments will include the establishment of a modern programming environment within DMA, integrated simulations of production subsystems, and application of telecommunication technology and related computer engineering techniques. These efforts are designed to eliminate excessive manual data handling, inefficient software developments and maintenance difficulties and to incorporate modern software engineering methodology into the DMA production environment.

MC&G PRODUCT GENERATION

To increase MC&G product generation efficiency and support, $6.8 million will be required. This will be accomplished through advanced developments in the areas of automated cartography, graphic arts and the use of radar and other sensor scene simulations and remote sensing techniques. Automated cartographic efforts will be directed at developing near-term equipment that will be further enhanced by the exploitation modernization program (EMP) and developing techniques and software that automate DMA's labor intensive cartographic production processes, including