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MAPPING, CHARTING AND GEODESY
REQUIREMENTS FOR MILITARY
CONTINGENCY OPERATIONS

AN INDIVIDUAL STUDY PROJECT

by

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ABSTRACT

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The rapid development and application of digital technology is creating new methodologies in the field of cartography. The Defense Mapping Agency (DMA), which primarily serves the branches of the Department of Defense, is modernizing nearly all aspects of its operation in response to the technology-driven changes in military communications and weaponry. This paper will describe and analyze the planning and procedural changes that have occurred in the last decade at DMA, additional changes now being implemented, and the systems that will be installed before the turn of the century. Both problems and improvements in personnel productivity, training, intelligence gathering, communications, planning, and standardization are discussed and evaluated. Special emphasis is given to DMA's role as a crisis support agency, using three recent examples (Operations Just Cause, Urgent Fury, and Desert Shield/Storm). Finally, an assessment is offered of the likely affect of economic, political and social changes on DMA's mission, focusing on issues such as the U.N.'s expanded peacekeeping role and the use of cartographic digital data in counternarcotics efforts and Low Intensity Conflicts. Information used in this paper was obtained from a variety of unclassified documents (as noted in the bibliography), personal and telephone interviews, a survey of military officers, and fourteen years of experience at DMA.

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CHAPTER I

INTRODUCTION

Scope and Methodology

The Defense Mapping Agency (DMA) is a Combat Support Agency under the direction of the Assistant Secretary of Defense for Command, Control, Communications and Intelligence (ASD C3I). DMA's primary mission is:

"to provide support to the Office of the Secretary of Defense (OSD); the Military Departments; the Chairman, Joint Chiefs of Staff, and Joint Staff; the Unified and Specified Commands; and the Defense Agencies . . . and other Federal Government Departments and Agencies on matters concerning mapping, charting, and geodesy (MC&G)."

In addition to its military mission, however, today's DMA also must meet many non-military demands. These include participating in national and international MC&G activities, providing staff advice and assistance on MC&G matters to other Federal Government Agencies, and developing a Defense Department MC&G research, development, test, and evaluation (RDT&E) requirements plan.

The overall intent of this paper will be to explain how and why DMA is changing its current production systems so as to standardize, enhance, and automate its MC&G capabilities. In order

to achieve the planned changes, DMA is revising its current methodologies to accommodate changes in technology, and improve the exchange of MC&G data with the military departments and commands, other federal agencies, and the international community. DMA's role during contingency planning for crisis support will be analyzed, as will the MC&G requirements of regional and functional Commanders in Chief (CINCs) in the context of a changing international political environment. This paper also will address the myriad of complex requirements processes necessary to produce and distribute products during times of crisis.

The scope of this paper also includes DMA's relationship with United States Special Operations Command (USSOCOM) and the paramount requirements (both now and in the future) in providing crisis support. Future mapping requirements will be addressed both at the strategic and the operational level.

Methodologies currently in use at DMA will be analyzed and evaluated against perceived future requirements to improve production capabilities using its digital data base. This paper also will address the relationship between the Commands and DMA, and how together they will meet their crisis support mapping requirements by improving MC&G readiness.

The information contained in this paper was derived from many sources. These include interviews, surveys, and personal experience as a DMA physical scientist.

By way of illustration, this paper will review DMA's role in three specific crisis support operations: Urgent Fury in Grenada,

Just Cause in Panama, and Desert Storm in Kuwait and Iraq. In each of these crisis support operations, DMA's role was different and required the development of diverse products and production processes.

The Need for MC&G Products

"No longer merely the provider of the traditional paper maps and charts long familiar to generations of military people, today's Defense Mapping Agency is vitally involved in the basic functions of virtually every operational military element and generates massive amounts of highly sophisticated digital data for them and for most modern weapons systems."²

Among the items DMA generates are aeronautical products required for mission planning and inflight navigation, nautical products used during naval operations, topographic products needed for land operations, digital products for many military computer-based systems (e.g., the cruise missile), and geodetic products required for precise targeting.

Military leaders and planners are well aware of the crucial role of accurate MC&G data in the proper functioning of modern weapons. "Advanced weapon systems cannot function without proper MC&G data. The widely praised 'smart bomb' used during the Persian Gulf War, for example, would not have hit the targets without the MC&G data."³

The cruise missile also requires MC&G data to be launched from a ship. The position of a ship on the ocean is determined by the hydrographic chart and the Global Positioning System (GPS). "The

GPS is a satellite-based navigation system that provides position location and navigation information to soldiers equipped with a GPS receiver."⁴ Submarines, too, require the bottom contours on the hydrographic charts for navigational aids.

The soldier in the field needs a topographic map to identify his location in relation to recognizable terrain features, e.g., roads, mountains, and rivers. Critical locations on the ground cannot be identified for ground-air pickups or drops without the appropriate MC&G data.

"The pilot cannot operate certain equipment without the aeronautical chart for flight information. Also, ballistic missiles cannot be operated without the required MC&G data."⁵

In the training arena, mission planning and rehearsal systems cannot operate without meaningful data from DMA to support the MC&G functions.

The Planning Cycle

It is the intent of this paper to demonstrate and emphasize that planning is a critical element of crisis support. The planning process therefore must be explained before describing any crisis support operation.

The planning function originates with the Department of Defense (DoD) mandate to DMA to build products in accordance with the statement of requirements identified by the CINCs. This requirements process is the starting point of an elaborate planning cycle within DMA using sophisticated validation systems and

production management techniques.

The cycle begins with a simple but important assumption: that any given map or chart identified under the statement of requirements does not exist. Operating under this assumption, DMA personnel research the agency inventory for each mandated product to ascertain whether a map or chart does indeed exist for the specified area. If no product is on file, DMA must create a new product that meets the mission requirements of the user.

If a product for the specified area already exists, however, that product is compared to the new mission requirements to determine if changes must be made prior to final production. Such changes may include, for example, the scope of the specified area, the product scale, or simply the updating of topography.

This planning cycle is the normal system of procedures leading to the creation of DMA products. The non-crisis production environment is increasingly complicated, however, by the addition of significant non-military requirements to DMA's mission. Issues such as environmental degradation, civil wars, national boundary changes caused by the collapse of communism, and international cooperative efforts to halt the flow of illegal drugs are just a few of the increased non-military demands for MC&G products. It is important to understand that planning for crisis support in DMA is carried out within this programmed, though changeable, schedule for military and non-military production.

The various categories of crisis support provided by DMA are carefully defined to establish the appropriate level of response to

emergency requirements. The categories, ranked in order from most critical to least critical, help Agency decision-makers allocate the personnel, equipment, time, and resources needed to meet the crisis at hand. These categories are depicted in Figure 1.⁶

At the onset of a crisis, a complex series of events begins to unfold within DMA. Crisis support products are conjoined with the established methodology used by DMA for identifying routine resource priorities for product requirements. At this point, the most significant impact of the crisis on DMA is that previous production priorities in the pipeline are lowered, or completely dropped, in order to support the new crisis requirements.

DMA uses three key documents to guide its operations in peace, crisis, or war. These documents are an integral part of resource planning. They are: the Chairman, Joint Chiefs of Staff (CJCS) Memorandum of Policy (MOP) No. 31; the National Military Strategy Document (NMSD); and the DoD MC&G Area Requirements Document (known as the Gray Book).

The purpose of CJCS MOP No. 31 is to establish policy for assigning priorities to requirements for MC&G support from DMA. Requirements are identified and priorities are set based on operational support requirements.⁷ This document is used to provide MC&G priority guidance to the Commanders of the Unified and Specified (U&S) Commands, the chiefs of the Military Services, the Defense Agencies, the Joint Chiefs of Staff and other authorized government agencies.

FIGURE No. 1 - REQUIREMENT CATEGORIES

CODE	TITLE	DESCRIPTION
CASE-0	DIRECTOR'S EMERGENCY	Reserved for use as authorized by the Director.
CASE-1	CRISIS	The most intensive support is rapid response to JCS declared crisis. Production hours(PH): 24 hour/7 day
CASE-2	IMMEDIATE/HUMANITARIAN ASSISTANCE	Response to immediate requirements supporting committed forces in JCS directed operations. PH: 24 hour/7 day
CASE-3	MISSION ESSENTIAL	Response to requirements supporting forces to be committed imminently to an operation. PH: Overtime
CASE-4	VITAL PLANNING	Response to new development or significant revision of a plan requiring products to support key planning actions. PH: Overtime
CASE-5	EXERCISE/R&D CONTRACTOR SUPPORT	Response to requirements supporting JCS sponsored exercises. Response to requirements supporting specified contractor support meeting milestones in systems developments. Response to meet requirements for key training programs. PH: Normal
CASE-6	ROUTINE OUT-OF-CYCLE	Response to out-of-cycle changes to area requirements submissions. PH: Normal
CASE-7	ARAPS/POM [AREA REQ'T'S & PRODUCTS STATUS/ PROGRAM OBJECTIVE MEMORANDUM]	Programmed response to standard biennial submission of area requirements. Routine POM guidance. PH: Normal
CASE-8	OTHER	All other requirements.

The NMSD is the Defense Secretary's statement of major military objectives, resource recommendations, and issues. This document discusses major MC&G resource requirements to support the military strategy, identifies shortfalls, and evaluates any inherent risks in the programmed MC&G resources. The MC&G area requirements are developed by the U&S Commands, Military Services, National Security Agency (NSA), Defense Intelligence Agency (DIA), JCS and others in consonance with NMSD guidance. The NMSD is used as a basis for MC&G mid-range planning (three to five years) by the Military Services, the U&S Commands, DMA, and other defense agencies.

The Gray Book depicts validated MC&G area requirements at the highest appropriate MOP 31 priority submitted from among the DoD agencies, the intelligence community, and other authorized government agencies. Requirements of the Maritime Administration and the U.S. Coast Guard are also included. The Gray Book provides a consolidation of the priorities of required MC&G products. Together with a consideration for on-going programs, the Gray Book serves as the basis for developing the DMA Program Objective Memorandum (POM), and informs all DoD users of validated MC&G area requirements and priorities.

MC&G As An Intelligence Function

As a Defense Agency, DMA is involved in the gathering of intelligence data for military operations. The MC&G data therefore

serve an intelligence function; and the requirements and procedures for its accumulation, manipulation, and distribution are closely tied to the standards for DMA products. The exchange of MC&G data across defense agency lines follows standard formats and specifications for individual products.

The DMA Director can serve as an adjunct member of the Military Intelligence Board (MIB), further emphasizing DMA's intelligence function. Relationships with specific intelligence agencies and commands are maintained by liaison personnel employed by DMA. These intelligence organizations work with DMA in the planning process and cycle for crisis support. During Operation Desert Storm, for example, DMA and DIA exchanged MC&G technical data to meet the military's digital mapping requirements.

The Unified or Specified Command's " . . . staff focal point for MC&G data planning, requirements definition and coordination is usually the J-2."⁸ "The J-2 staff provide guidance and direction on MC&G matters to subordinate commands and coordinate with the DMA and supporting commands to ensure adequate and coherent MC&G support to all operations forces."⁹ DMA provides each unified and specified command with a liaison officer to advise staff members about MC&G matters.

CHAPTER II

CRISIS SUPPORT PROCESS

Definition

To understand the crisis support process, one must first understand the word "crisis" as defined by the Joint Staff. The Joint Staff defines crises as:

"incidents or situations involving a threat to the U.S., its territories and possessions that rapidly develop and create a condition of diplomatic, economic, political or military importance to the U.S. Government that the commitment of U.S. Military forces and resources is contemplated to achieve our national objective."¹⁰

Additionally, the Joint Staff takes the word "crisis" one step further and applies it specifically to "MC&G Crisis Support." This the Joint Staff defines as, "The rapid provision of MC&G products or services, including those not previously validated, needed on a one-time or first-time basis in support of a 'crisis'."¹¹

All crisis support requests going to the Joint Staff must follow the aforementioned definitions. "Requests for crisis support may vary but normally are made by message or by telephone, including secure telephone."¹²

Background

To ensure that critical planning needs are met during the initial phases of a crisis, the Office of the Secretary of Defense directed DMA to establish a proactive crisis management system; use

past lessons learned; specify standard procedures for crisis support; and consider simultaneous crisis support in different areas of requirements. In response to DoD, DMA established a Crisis Management Team (CMT), which is always active to provide immediate response in times of crisis. Further, DMA established CMT Duty Officers and Command Support Teams (CSTs). Internal HQ DMA divisions and the HQ DMA Intelligence Office also participate on the Crisis Management Teams.

"The DMA Crisis Management Team (CMT) comprises a coordinator and an alternate, who serve as action officers. The CMT is the focal point for all activities concerning MC&G requirements during crisis situations. The CMT reviews pre-crisis and crisis support procedures, monitors potential crisis situations, and provides day-to-day guidance for support. The CMT coordinator also selects a project officer, whose first action is to define potential critical elements so that a decision can be made about the quality level of the product to be furnished in the crisis response situation."¹³

Whenever it is determined that no suitable DMA product exists for a crisis support area, DMA is allowed by the JCS to turn to other alternatives in order to meet the requirements. For example, to provide military support in Grenada during Urgent Fury, DMA had to reproduce a (tourist map) product made by a co-producer because there was insufficient time to create a new product of the area. DMA met the mapping requirements by reproducing a map under international agreements for the military operation. The supply and distribution of the maps were completed within the timeframe allotted for the crisis and the mission was accomplished.

DMA received severe criticism, however, for the product it

produced for the Grenada operation. The primary limitation for this operation was "time." Many media and military personnel did not understand the constraints under which DMA was forced to perform. For example, turn-around time (or mission objective) for crisis support products was less than 48 hours. As events were to prove, "there was not sufficient intelligence to assure that an incursion there would be quick and painless. Nor was such a seemingly insignificant dot on the map - down at the very tail end of the Caribbean's long chain of Windward Islands."¹⁴

In 1989, DMA was asked to support military operations for Operation Just Cause in Panama. Although DMA worked with liaison teams in Panama, most mapping products were produced there using a local military and civilian mapping organization. The request for standard products over the specified area was the only requirement DMA had to fulfill. The maps and charts used in Operation Just Cause all had been updated within the last five years and therefore DMA was able to meet the mapping requirements in a timely fashion. Military plans were made, however, to rehearse and practice for a night invasion to take place in December, 1989. "All units rehearsed the plan several times. Some, including pilots of the 82nd Airborne Division, used simulators, and then all units practiced together in Panama on Thanksgiving night."¹⁵ Due to the rehearsals and detailed planning, long lead-time, and ready operations access to Panama, Operation Just Cause was a success.

In the summer of 1990, DMA changed its entire production pipeline to support Operation Desert Shield/Desert Storm with

maps, charts and geodetic data. DMA produced forty different types of products and twelve thousand individual products in all, including over six hundred digital products. The number of copies printed exceeded one hundred million, comprising fifty-five C-5 aircraft loads delivered for distribution to the troops.¹⁶

During the Gulf War, there were over 6,500 individual target positions identified for military operational tasks or maneuvers. In six months, DMA was able to manufacture products that exceeded a normal production output of two years. In fact, said Army Brig. Gen. Joseph Pratt, DMA's deputy director, "As a combat support agency, DMA provided the soldiers, sailors, Marines and airmen with a greater volume and with more accurate maps, charts, digital and precise positioning materials than in any previous U.S. military operation."¹⁷

DMA personnel were given great praise for their dedication to duty, and Joint Chiefs of Staff Chairman General Colin L. Powell made a point of visiting DMA to thank personally its men and women. During a speech he delivered while at DMA, General Powell remarked, "Each and every one of you should have a deep sense of pride in your personal accomplishments as well as the accomplishments of the Defense Mapping Agency."¹⁸ He went on to say, "You saved the lives of young men and women who went out to accomplish their mission for the nation."¹⁹

The obvious similarity between two of the three military operations was that DMA was involved from the beginning in the planning part of the crisis operations. In Operation Desert Storm,

DMA could change the production pipeline and produce the items requested. In Operation Just Cause, the basic set of 1:50,000 scale maps were updated prior to the crisis and other products were produced in Panama by organizations without DMA personnel. On the other hand, DMA was not brought into the planning process for Operation Urgent Fury in Grenada in time to do a proper job. As a result, with unnecessarily short lead-time, DMA was forced to reproduce a sub-standard and inadequate product from commercial sources. While DMA met the pro forma requirement, the result was less than satisfactory for military purposes.

The lessons learned by DMA regarding crisis support during these operations were twofold: there was a need to create a Crisis Response Team (CRT), and there was a need to develop response cells that could provide special emphasis on specific tasks. This required obtaining and identifying the necessary in-house expertise and/or personnel who would be brought in and become a part of the CRT. The lesson learned by the product users in Urgent Fury was that less strict compartmentation can improve the support they receive from agencies like DMA, while maintaining essential operational security.

The response cell monitors support of minor crises or other exceptional activities and performs specific tasks for meeting the coordination, production and distribution requirements. For example, an acquisition cell might be called in during a crisis support operation. The organization working with the response cell and the Crisis Response Team is the Product Requirements (PR)

organization at DMA. The responsibilities of the Crisis Response Team are to augment Unified and Specified Commands engaged in a crisis and to assist in the development of MC&G support. Further, this team serves as an ongoing liaison between the Command and HQ DMA.²⁰

Survey of Product Quality

A limited evaluation of the effectiveness of DMA's current crisis support capabilities may be made based on the results of a survey of eighteen Army War College (AWC) students conducted by the author of this paper on 25 November 1991. The primary purpose of the survey was to gather information from a selected sample of military personnel on their attitudes regarding the reliability of DMA products. The survey questionnaire is reproduced as Appendix A.

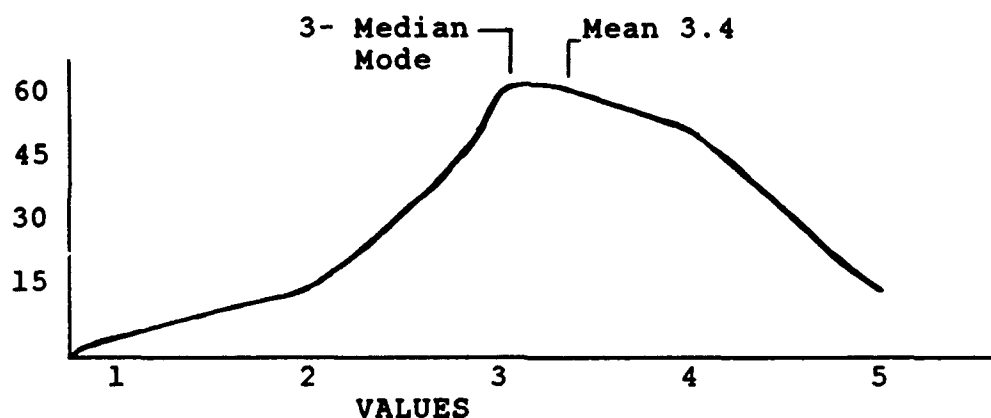
The survey was composed of two parts. The first part concentrated on demographic questions that were open-ended to obtain generic information on military rank, branch, and years of service of the respondents. Part two was intended to obtain data about attitudes of users toward DMA products, and to find out whether they found these products to be reliable and timely.

The survey results reveal that Army personnel generally have a favorable, though not highly favorable, opinion of the quality and timeliness of DMA products, based on their personal experiences. Survey results are displayed in a Bimodal Distribution Curve, shown in Figure 2 below. This chart suggests

that between "sometimes" (or numeric value 3) and "most of the time" (or numeric value 4), the survey respondents found DMA's products to be reliable.

In Figure 2, the median and mode are identified as the same value and the distribution curve has its highest frequency of 54 at the "sometimes" level. The arithmetic mean is 3.4, which shows that opinion is skewed toward the "always" value. This mean score, 3.4, reveals a favorable attitude about the products.

FIGURE No. 2 - BIMODAL DISTRIBUTION CURVE



The survey did reveal, however, that DMA could improve its crisis support performance in terms of product quality, timeliness of delivery, and accuracy of communications. This survey could serve as a model for a comprehensive study of military opinions of DMA products to improve crisis support planning within the Agency for future military operations.

Requirements Statement

DMA receives crisis support requirements in two ways: (a) by message, or (b) by telephone. Generally, the procedures that the Unified and Specified Commands must follow during a crisis are to consolidate their requirements prior to submission, and to establish a point of contact for MC&G crisis support requirements within the Headquarters DMA Crisis Management Team. Commands will sometimes have requirements for existing DMA standard products and can order specific products using a DMA stock number.

DMA also receives requests for nonstandard products. In such instances, Commands can specify the type of product required, geographic area of coverage required, preferred scale, type of grid required, marginal data, intended use, and maximum acceptable security classification. All requests must specify a realistic "required by" date for both standard and nonstandard products, and an agreement must be coordinated with the CMT. The time scales for nonstandard products assume that DMA has the appropriate source material from which to make the product.

All requests must include desired transportation mode, coordination details, and special instructions. Since time scales for nonstandard products do not include shipping time, requests for nonstandard products should include an allowance for transportation by the required delivery date. DMA is responsible for getting all products to the point of embarkation for air- and sea-lift, with shipping costs assumed by the military. During Operation Desert Shield/Storm, with the huge volume of maps and charts that were

requested, DMA personnel were assigned to the theater to help coordinate distribution of MC&G products.

CHAPTER III

PROCESS MANAGEMENT

The Role of the Users

It is said that the most valuable resources in any organization are its people. This maxim certainly applies to DMA and the organizations it serves in their fulfillment of the objectives of process management. This chapter will concentrate on the interface between the military commands and DMA in meeting user requirements.

All Unified and Specified Commands submit MC&G requirements to DMA. In times of crisis, particularly when use of military force is anticipated, requirements typically are submitted by the supported regional CINCs.²¹ The MC&G Officer at the Unified Command is an essential player interfacing with DMA during the process management phase of the operation. It is the responsibility of this staff officer to gather and identify all requirements within the Command (including service and sub-unified components) and work with DMA on the consolidation and prioritization of those MC&G requirements. The organization with which the MC&G Officer interfaces in DMA is the Headquarter's Plans and Requirements Command Support Division (PRC).

During periods of crisis, DMA's normal production pipeline must be adjusted to accommodate the needs of the crisis. The requirements of the crisis are known as "out-of-cycle

requirements," because they have not been programmed into DMA's normal MC&G cycle.

The key to DMA's success in meeting crisis support requirements is having proactive liaison officers in the commands, military departments, Joint Chiefs of Staff, and other DoD agencies such as DIA. Key personnel involved in crisis support operations are the CMTs, CRT Duty Officers, Command Support Teams, and other internal DMA organizations.

Requirements Management

DMA's input to the Planning, Programming and Budgeting System (PPBS) is known as the DMA Program Objective Memorandum (POM). The POM supports normal production operations in DMA and covers six years of planning and programming requirements; however, there is great flexibility in the POM when it comes to meeting crisis support production requirements. If the JCS submits crisis production requirements to DMA, the POM can be adjusted to accommodate any new production requirements for crisis support. Resources, manpower, money, and equipment are reallocated at times of crisis from within existing production programs. Once the crisis is over, managers make the necessary resource adjustments to return to a normal production schedule. The result is that some scheduled products are deferred to a later date.

While soft-copy digital product requirements continue to grow, traditional requirements for maps, charts, and digital products in paper form have not decreased. Additionally, the

requirements for new non-military products mentioned earlier have added substantial pressure to DMA's ability to meet its requirements.

DMA data collection, production, and distribution is prioritized according to the guidance provided by the JCS as submitted by the Unified and Specified Commands, the military departments, and certain Federal agencies. Adding a further burden to a system that is already overloaded with requirements, the JCS continues to demand strategic products, while DMA's other customers prefer tactical products.²²

There are five MC&G levels of prioritization (see Appendix B). This paper will address only Priority One, which is directly tied to crisis support. Priority One is specifically reserved for meeting crisis support requirements and is identified as "essential in the area of operation of primary or secondary missions where the operational risk is unacceptable."²³

In the planning phase of PPBS, DMA begins the requirements cycle by forwarding to each submitting organization its previous standard baseline requirements. Nine months later, the user organizations return their requirements to DMA for input, review and validation. At this point in the cycle, senior DMA leadership must accommodate changes from previous submissions, as well as any new product requirements.

In mid-September, the DMA Headquarters Directorate, which is responsible for plans and requirements consolidation, validates requirements to the Director of DMA for POM submission. At the

same time that user requirements are transmitted to DMA, the agency receives the submission of the Unified and Specified Command requirements in support of their assigned missions. This ties into the overall DoD Joint Strategic Planning System, as shown in Figure 3.

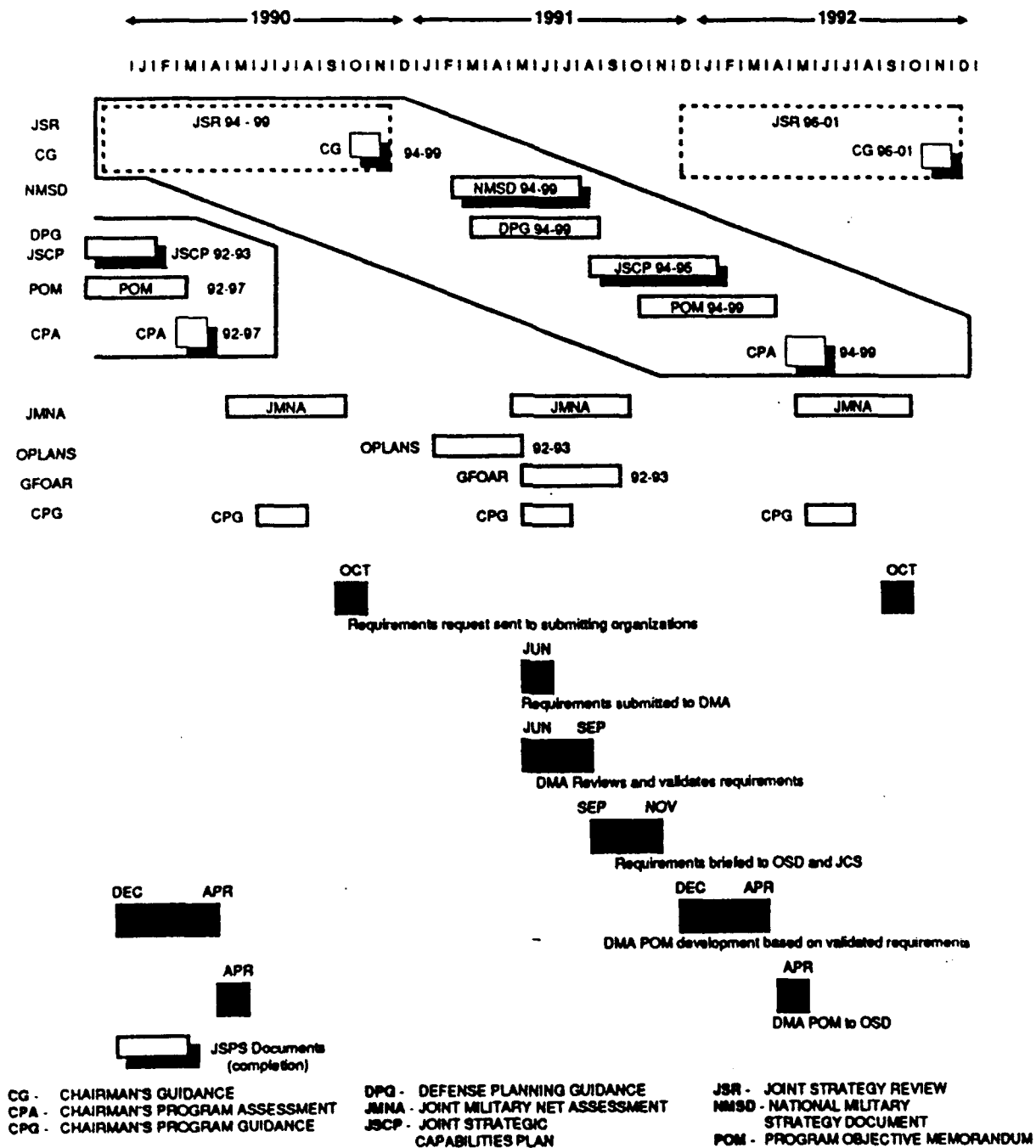
In the second quarter of the same fiscal year, DMA develops its POM based on JCS-validated and -approved requirements. The POM is then submitted to the Office of the Secretary of Defense (OSD) in April.

After going through the approval cycle at OSD, the POM is integrated into the DoD budget. Execution of the requirements then begins in DMA's production programs.

DMA's current requirements are primarily based on standard operations that have been identified to DMA by the Commands during the aforementioned biennial requirements cycle. The real challenge to the senior leadership of DoD comes into play when they must respond to unexpected challenges or meet crisis requirements for contingency operations.

A recent example of meeting current product requirements for CINCs occurred during Operation Desert Shield/Desert Storm. DMA's production output, as decided by the JCS during the crisis, reflected a change from established normal non-crisis requirements to crisis support.

**Figure No. 3 - MC&G REQUIREMENT CYCLE
AND THE
JOINT STRATEGIC PLANNING SYSTEM**



SOURCE: ADAPTED FROM FIGURE 10-1, ARMY COMMAND AND MANAGEMENT: THEORY AND PRACTICE

The Secretary of Defense (SECDEF) has instituted plans to reduce the total DoD budget by closing bases and reducing troops in Europe and elsewhere. The SECDEF's plan, however, will not reduce DMA's requirements, because the mission factors for DMA involve mapping and charting areas of coverage geared to operational requirements. Size of forces is irrelevant to this process.

Training

Army Chief of Staff Gordon R. Sullivan has described clearly the enhanced importance the Army attaches to training in achieving peacetime objectives. Military Review described General Sullivan's views this way: "His message is simple and clear: training is the peacetime Army's first priority. He emphasizes that training is the link between peacetime readiness and performance in combat and challenges Army leaders to make training the 'glue' that holds the Army together in this period of change."²⁴

In undergoing its own "period of change," the Defense Mapping Agency is clearly emulating the Army's ardor for training. DMA is investing an enormous share of its resources to upgrade capability and performance through superior training.

The Defense Mapping School (DMS), a component of DMA, provides for the necessary training of selected military and civilian personnel both from DMA and from its consumer organizations. All DMS training is met, documented, and funded by ASD C3I.

There are two primary types of training required at DMA to insure effective communication between DMA and the Commands: (a)

training for the producers, and (b) training for the consumers. As the Armed Forces reduces its manpower levels, concentrated training in specified areas will become critical to ensuring that military personnel in the future will be adequately trained about DMA products and mission.

Many courses offered at DMS are targeted at both the military consumers and the predominantly civilian producers. A clear, concise, and well-defined understanding of the roles each person must play in the DoD environment is essential to achieving mission requirements. Three specialized courses offered at DMS are the MC&G Staff Duty Officer course, Introduction to Digital Data (IDMCGD), and the Mobile Training Team (MTT) course. These three courses are taught to help personnel translate operational and tactical requirements into products that can be planned and generated within the MC&G cycle.

Today, the pressure to shorten the learning curve within the Commands is intensifying because of an increase in personnel changeovers and a reduction in the number of available MC&G Officer training slots. Given the current cost for training and the additional reductions anticipated in both military and civilian personnel, it seems imperative that personnel be required to remain in the areas for which they were trained until other personnel can be trained to replace them.

Training for the generation of DMA products is accomplished internally at DMA. Training is system- and product-specific. "Proper training is essential to the transition of the work force

to a digital production system. To that end, an extensive training program, affecting the majority of the work force, is being designed."²⁵ Cartographers within DMA must acquire the skills, knowledge and ability necessary to operate high technology computer workstations. They must know and understand the specifications that pertain to each product. They also must understand how the product is ultimately used by the military organizations.

Cartographers once had to work at a drafting table with other mapping products, surveys, and imagery to develop a required map or chart. In today's work environment, the cartographer sits at a computer workstation, and works with digital data that can generate a softcopy or hardcopy product. Cartographers are also required to have many diversified areas of expertise. For example, they have to be knowledgeable about several regional areas, digital data, feature data, terrain data, source collection and specific product types.

DMA has taken on a new challenge in the 1990s with its installation of the Digital Production System (DPS). DMA personnel will undergo extensive training and revamping in the early 1990s to achieve full production system capability. Each cartographer will be given hours of both applied and structured on-the-job training specifically related to the DPS. Classroom sessions will be primarily directed at producing future digital products in support of military needs.

In the near term, both the consumer and the producer need for training will increase immensely. Both parties must be prepared to

understand that the current standard product specifications being used to meet MC&G requirements and to support the interoperability of digital data for DMA and military systems in the field are changing.

In response to this challenge, DMA has instituted training efforts that encompass six specific areas - preparatory training, prerequisite training, system level training, cadre training, segment specific training and full production training.²⁶ The key to process management in the future will be training toward an all-digital environment and passing data via diskette or CD ROM. DMA is providing the tools its work force will require by "changing today to meet tomorrow."²⁷

Systems Acquisition

In times of crisis support operations, communications and computer equipment become critical to completing the mission. The movement of digital and intelligence data could ultimately make or break the operation. The main system employed by the military is the network of communications established by ASD C3I.

The requirements necessary to directly link MC&G data to the soldier in the field are the key to the future of joint military operations. In crisis support, good planning will assume an increasingly important role. The future goal during crisis support operations will be the use of digital data that will allow military leaders in the theater to make decisions and plan operational maneuvers for troops in the field. An important factor in assuring

link capacity will be the compatibility of the intelligence, MC&G information, and computer equipment located in one area, with other information and equipment located in another area.

CHAPTER IV

TECHNOLOGY

To maintain its value to the American military during the 1980s, DMA had to upgrade its employee skill levels, improve its accountability, and completely rebuild its existing production system. The agency developed ambitious goals to reduce dramatically both production costs and throughput time, the former by 50 percent and the latter by 75 percent. To achieve these aims, DMA would have to build a digital system that could produce a set of standard products representing 90 percent of DMA's total production.²⁸

Also in the 1980s, requirements for digital MC&G data jumped dramatically, although at that point DMA's digital products consisted of relatively small subsets of information contained on paper maps. As the applications for digital MC&G data became broader and the specifications became more stringent, the demand for the products in terms of data content, resolution, and accuracy rose abruptly. Complicating the efforts of DMA to meet these expanded requirements were the deficit-driven reductions in the agency's budget.

Responding to these enormous challenges, DMA "decided to put more effort into standardizing MC&G products users would require in the coming decade. There is now an MC&G Technology Area within the Defense Standards Program, and a Departmental/Agency Standardization Office within DMA. Current DMA product specifications are being converted to Military Specifications

(MILSPEC), and efforts are being made to develop Military Standards (MILSTD) and MILSPEC's for new digital products."²⁹ With the sudden changes in the nature of its source material, DMA would have to speed up its conversion to the digital production system.

DIGITAL PRODUCTION SYSTEM (DPS)

The 1980s and early 1990s have witnessed both a marked decrease in the size and cost of computers and a steady increase in their use by DMA customers. To meet its changing requirements, DMA has placed into operation new systems and procedures designed to generate output containing geographic references that transmit to other systems.³⁰

The effort to achieve total MC&G interoperability between systems is a mammoth undertaking. Interoperability includes inter-system compatibility and consistency in terms of accuracy, data structure, feature coding, georeferencing systems, datums, spatial resolutions, and precision.

Both data and software must be standardized to achieve complete compatibility. "There must be a commonality of MC&G functions present in order to achieve diverse operational end user applications."³¹

An example of a major MC&G project currently under way at DMA is the Digital Chart of the World (DCW). It is described in the DMA publication Digitizing the Future as:

"...a 1:1,000,000 scale vector geographic information data base developed as the initial product implementation of a multi-nation R&D project with Australia, Canada, and the United

Kingdom, designed to develop a set of vector product standards oriented towards the Geographic Information System environment. The 1:1,000,000 scale Operational Navigation Chart series provides the source information to produce the major portion of the database. Six 1:2,000,000 scale Jet Navigation Charts provide source coverage of Antarctica.

"This system is a backdrop for national databases, global and theater plans and assessments, briefing and decision graphics, index for spational retrieval of other data, and global physical modeling. The database can be accessed by PC or larger computer regardless of make."³²

It was thus the adoption of the Digital Production System by the Agency that brought a project of the scope and complexity of DCW into the realm of possibility. It is the effort to achieve total interoperability that makes possible international efforts to complete a system such as DCW to further mutual goals of military readiness and capability. The DCW system received its first practical application during Operation Desert Shield/Storm, providing the military with the latest technology in digital data.

One of the greatest obstacles to international system compatibility is the variety of datums in use around the world. All maps and charts are defined on the basis of geodetic reference systems, or datums, that tie all coordinates in a geographical area to a common origin. The location of a target is dependent on coordinates and the known datum.

Accurate coordinates combined with the known datums will help military personnel in the field successfully complete their mission; however, "bad coordinates equal combat mission failure."³³ In 1988, DMA formed a Coordinates Working Group with the Defense

Intelligence Agency (DIA) to support the operational commander. Both DMA and DIA recognize that misuse of coordinates and products, or misunderstanding of the relationship between targeting and charting can jeopardize mission success.

Digital MC&G data must clearly define the datum used in extraction so the accuracy of the database is complete. The importance of controlling datums for digital intelligence and MC&G data was a point emphatically stressed by each Director and staff officer interviewed at USSOCOM.³⁴

The main datums used in worldwide mapping are the World Geodetic System (WGS) and the European Datum. The development of the all-Digital Production System at DMA incorporates a datum known as WGS 84, which represents DMA's modeling of the Earth from a geometric, geodetic, and gravitational standpoint.

The DMA Digital Production System is composed of five segments, each of which interacts with all others to generate a product. Though it is a single production system, it is geographically dispersed to three Production Centers -- St. Louis, Missouri; Brookmont, Maryland; and Reston, Virginia.

The system can achieve a start-to-finish production of MC&G items in a completely digital environment. Thus, the DPS can extract terrain elevation and feature data, primarily from imagery on a multi-product basis; store that data in a global database organized by data type and levels within data type; and then use that data to generate a variety of graphic and digital MC&G products.

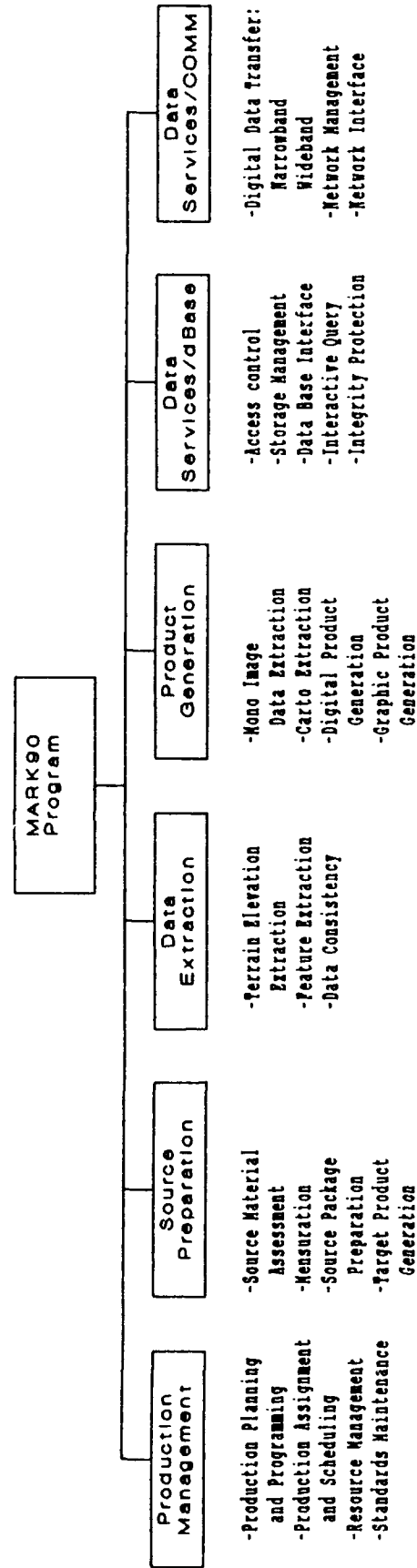
DMA has set a number of goals to be achieved in bringing the DPS on line. These include an increase in the agency's total production capacity, greater efficiency in system and tactical operations, and improved flexibility gained by the decrease in production time.³⁵ By the time it is fully operational in the mid-1990s, the DPS will provide completely state-of-the-art cartographic production capability and revolutionize map making in DMA.

It must be pointed out, however, that the DPS will not serve as the entire DMA production system; rather, it will be a significant part of a Modernized Production System (MPS). The MPS will encompass the entire DMA product line, providing production capability for the full DMA family of products, not just the 28 selected items to be created under the DPS.

It will be the task of the MPS to integrate two fundamentally different production systems. Both the Digital Production System and the older, hardcopy-based production operation will be accommodated under the functioning of the MPS."³⁶

The DPS is a \$2.6 billion, 10-year program, implemented in two distinct phases. The first, MARK 85, has already been delivered and is fully operational. The follow-on phase, MARK 90, has been delivered and is scheduled to come on-line by the mid-1990s. Together, the MARK 85 and MARK 90 programs will enable DMA to reach the time, production, and budget goals outlined.³⁷ (See Figure 4).

FIGURE No. 4 - DIGITAL PRODUCTION SYSTEM



The Production Management Segment of the DPS encompasses the activities "supporting the definition of customer MC&G requirements, translating them into DMA program guidance and development, determining preliminary programs and source material requirements, formulating DMA's Program Objective Memorandum (POM), DMA's production program, and developing DMA's budget."³⁸

The schedule for the DPS is controlled and monitored by the Production Management Segment. The system manages the details of the production schedule and is the key ingredient in crisis support management. This system segment also can handle crisis support requests and change the production schedule within two hours. The requirement comes in as an ad hoc request, and the users receive a product within the time allotted for crisis support. When a crisis support requirement is received, the system automatically reschedules the next eight-hour shift and begins to work on the crisis within 24 hours. It also can track the production and the progress of the crisis support product over the same period. This part of the DPS system will be the future for planning and operating against requirements submitted by the Unified and Specified Commands.

Mapping Support for Intelligence and Operations

DMA exchanges digital data with all of the military commands and other federal agencies. USSOCOM was made the focus of research because of its future abilities regarding computer applications for planning and mapping support data. "Today, the

Special Operation Command Research Analysis and Threat Evaluation System (SOCRATES) is a real success story. SOCRATES encompasses the total intelligence support needed for SOF mission activities, to include computer, communications and map and imagery-handling equipment."³⁹ This technology provides a significant capability for providing intelligence support for Special Operations mission planning and execution.

Future technology being developed for Special Operations Forces is the Special Operations Forces Planning and Rehearsal System (SOFPARS). "The SOFPARS will provide planning capabilities for SOF aviation, ground and maritime operations."⁴⁰ This system will provide essential information for mission planning and operational support requirements, and is heavily reliant on digitized terrain data.

DMA will provide the MC&G digital data in specified formats to support the SOFPARS system. Among these products are Digital Terrain Elevation Data (DTED), Digital Feature Analysis Data (DFAD), ARC Digitized Raster Graphics (ADRG), Interim Terrain Data (IDT), and Probablistic Vertical Obstruction Data (PVOD). Using its growing array of digital products, DMA will supply the military with all the resources required to accomplish the mission.

In the planning phase for crisis support, it is crucial to analyze the differences between "high-tech" and "low-tech" applications to enhance decision-making regarding the types of products that can meet the mission requirements. This is especially important given the growing requirement for digital data

products in the high-tech world to support advanced weapons systems.

High-tech possibilities in the mapping industry are growing because of the increased use of computers and the amount of data they can store and manipulate. The increased reliance on the Global Positioning System (GPS) in the Persian Gulf War has only enlarged the mapping industry requirements for more digital data. The GPS satellite-based navigation system did an excellent job in helping military personnel pinpoint their locations, thereby improving targeting effectiveness. The requirement for better communication lines in the field will become critical in future military operations to allow digital data to be transferred over long distances in short periods of time.

Low-tech applications include paper products that are still required for military operations throughout the world. These applications are still considered low-tech because they display multispectral imagery (i.e., landsat imagery) on paper. Copies are then made of the gridded photo.

Commercial image data such as that from US LANDSAT, Russian SOYUZHKARTA, Russian ALMAZ Radar, and French SPOT were used by the U.S. Army Space Command (USARSPACE) to enhance DMA Topographic Line Maps in the Persian Gulf War during tactical operations. These systems are unclassified photoreconnaissance satellites, the products of which are available on the open market by any customer. As one DMA official has observed, "advanced delivery of some of our new digital production system gave us the opportunity to rapidly

exploit LANDSAT data and create 1:100,000 scale image maps as an interim product."⁴¹

Multispectral imagery is the key to map making for tactical military operations. Imagery currently exists for over 90 percent of the earth. Much of this existing imagery, however, is outdated, of varying resolution quality (often because of cloud cover), and is not digitized. Rapid urbanization in many parts of the world has rendered some data unusable for military purposes, because imagery collection does not keep pace with the development of cultural geographic features.

In places where existing multispectral imagery is useful, it is unclassified, and can be used to generate hardcopy imagery maps for a current crisis. Software is commercially available, and it is accessible on a desktop PC. Low-tech applications, however, likely will always exist for the soldier or tactical commander in the field.

CHAPTER V

FUTURE APPLICATIONS

New Issues

The military must change with the times to ensure that it progresses rather than regresses in its MC&G capability, especially as the military redefines its role in the changing geopolitical environment. DoD's ability to continue to progress, however, is threatened by the substantial reallocations of funds now being implemented. These funding decisions may ultimately affect the future of military operations and the further development of MC&G technology.

The time has come when the military must drastically change the way it conducts business. During this period of diminished superpower threat, the focus and direction of military planning and operations is undergoing a radical shift. Although the perceived threat posed by the nuclear and conventional capabilities of the former Soviet Union has diminished greatly, the United States, as the world's strongest military power, will continue to play a major role in affairs throughout the world. Planning for military operations likely will concentrate on possible Low Intensity Conflicts (LICs) rather than large-scale nuclear or conventional warfare.

Rather than direct, unilateral intervention, the U.S. may confine its role more often to peacemaking and peacekeeping, often

under the auspices of the United Nations or in conjunction with other international organizations. Unfortunately, "the United Nations peacekeeping apparatus is in need of significant reform."⁴²

"There is a wide divergence of opinion as to what type of military missions legitimately constitute peacekeeping, as opposed to interventions or peacetime contingency operations."⁴³ The terms interventions and peacetime contingency operations, however, apply more to peacemaking than peacekeeping. This paper will first address peacekeeping.

In the future, DMA's role in supporting peacekeeping operations will depend largely upon the nature and extent of U.S. military involvement. Historically, DMA has not played a significant part in supporting the peacekeeping activities of the Security Council of the United Nations (U.N.). Its role has been restricted to supporting OSD, the military departments, and the JCS on matters concerning mapping, charting, and geodesy. Since all expenditures incurred by DMA in supporting peacekeeping activities are reimbursable and are not programmed in the POM, the main constraint on DMA's support for the military's peacekeeping role would be its manpower limitations.

With the growing involvement of the U.N. in mediating conflicts around the globe, and in the absence of superpower competition, peacekeeping is becoming a major multi-national operation in which the U.S. military might become more actively involved. This is one area where requirements for U.S. military forces could increase greatly in the 1990s. With the U.N.'s

funding crisis worsening as its peacekeeping costs grow, a major change in member countries' peacekeeping responsibilities and military support requirements could become inevitable.

President Bush recently met with leaders of the 14 other members of the Security Council. "These members are expected to call on the United Nations to play a growing role in preserving peace in trouble spots around the globe."⁴⁴ Many of the member nations that are involved, however, have not paid their obligations for the operations being planned. "The United States and other leading members already owe the United Nations hundreds of millions of dollars in unpaid peacekeeping dues."⁴⁵

By the end of 1991, the United States was in arrears by \$140.9 million. This year, U.N. peacekeeping operations are being planned for Cambodia and Yugoslavia involving some 36,000 troops and observers plus civil administrators. "The United Nations could find itself spending \$600 million to \$700 million during the remainder of this year in Cambodia alone."⁴⁶ Additionally, costs involved in sending over 22,000 troops into Yugoslavia to oversee the cease-fire could exceed \$350 million. Costs to the United States for these two missions could exceed \$300 million.

One possible solution to reducing such costs would be for each participating member country to pay for its troop, support, and administrative contributions. This scenario would likely place additional MC&G responsibilities on DMA.

Another new issue for the military of the future is the environment. While DMA does not have a clear environmental

mission, its support to the military has already concentrated on safety of sea and air navigation that involves the environment. Future requirements for MC&G products that will enhance the military's role in cleaning up the environment will greatly depend on achieving the goal of changing from a reactive to proactive position. "The relief for all environmental problems depends on similar needs - money, commitment and leadership."⁴⁷

While it is obvious that environmental issues involving clean-up have remained a secondary concern of military leaders, the military has not totally ignored environmental subjects. For example, the Army and the Air Force are working with the Environmental Protection Agency (EPA) and the US Geological Survey (USGS) in sharing and communicating information on Global Positioning Systems (GPS) technology, which could become a first step toward monitoring the environment of the future.

At the strategic level, "space systems (like GPS) and forces will be absolutely essential to meeting our national security interests in this period. . ."⁴⁸ There is reason to believe that, with continued popular and political pressures, in time, the environment will become more of an issue and less of a problem for DoD.

Other issues include support for insurgency and counterinsurgency, combatting terrorism, and peacetime contingency operations. These low intensity conflict (LIC) missions will require the MC&G and intelligence communities to alter focus and priorities in order to provide the type of intelligence we require

to support the challenges of the future. These missions are of primary interest to USSOCOM.

"USSOCOM assesses and catalogs countries with LIC potential by comparing United States strategic threats and policy concerns with worldwide social, political and economic trends and technological capabilities (trans-regional issues) against the roles and missions of special operations, civil affairs, and psychological operations forces. Special attention is also given to the proliferations of high-tech weaponry, terrorism, narcotic trafficking and insurgencies in key Third World countries."

From DMA's perspective, the key to accurate and timely provision of MC&G data and materials during insurgency and counterinsurgency operations is good intelligence. With attention now focused on many different "hot spots" in the Third World, DMA's objective is to establish a proactive process to improve MC&G readiness worldwide.

This process consists of four components: Country List, Country Books, Starter Sets, and Current Operations Packs Sets (COPS). All these components are interlinked to ensure responsive support to the commands when required.

The purpose of the Country List component is to provide a prioritized list of countries for collection of MC&G source material. Countries are initially grouped by OSD regional precedences; within a region, countries are grouped by priorities from national intelligence and command documents.

Country Books provide for DMA personnel a ready reference of MC&G data available in a particular country. It consists of U.S. MC&G requirements in the country, a menu of all MC&G sources

available, the host nation MC&G production capability, MC&G agreement strategies and goals, and the starter set contents (if required).

The Starter Sets provide timely support for operations in Third World countries by establishing minimal country data bases. These data bases consist of either finished products or sources to build products for low priority requirements. Though they vary by country, the Sets typically contain large or medium scale maps and charts, city graphics, harbor and approach or coastal charts, and terrain matrix data. Though mapping requirements for Third World countries normally have a low priority, Starter Sets are being implemented to improve responsiveness when crises occur in such areas.

COPS is the operational component of DMA's effort to improve its MC&G readiness. It consists of products essential for a specific mission area to support mission planning, mission rehearsal, and initial stages of execution if necessary. The COPS component includes standard, starter set, and non-standard products.

DMA's role in supporting the military in any operations against terrorism would be to meet the contingency operations for crisis support by supplying intelligence and MC&G data on an *ad hoc* basis. Terrorist often strike with little or no warning; therefore, it is difficult to incorporate required MC&G data into the planning pipeline. With the creation of Starter Sets and COPS, DMA can do some pre-planning and limited production in support of

the Defense Intelligence Agency, the Central Intelligence Agency, and the Counterterrorism Joint Task Force planning priorities.

While peacetime contingency operations may necessitate changes in DMA's production schedule, MC&G requirements can often be met with existing products. Peacetime contingency operations include

"...such diverse actions as disaster relief, certain types of counter-drug operations, and land, sea and air strikes. The unifying feature of these actions is the rapid mobilization of effort to focus on a specific problem, usually in a crisis . . . Peacetime contingency operations may require the exercise of restraint and the selective use of force or concentrated violent actions."⁵⁰

Special Operations Forces, relying on DMA's MC&G data, are typically employed to conduct peacetime contingency operations.⁵¹ The close working relationship between DMA and USSOCOM is vital to providing proper support during the onset and execution of such operations.

Counternarcotics efforts fall under the purview of several Federal and military agencies. DoD involvement in counternarcotics supports the Drug Enforcement Agency (DEA) under Title X of the National Defense Authorization Act of 1990.

A major obstacle in the ability to plan and project military support requirements for a long-term counter-narcotics strategy is the lack of a complete government plan. If a master plan existed, the CINCs of the Unified and Specified Commands could develop and write a military campaign plan. This is an area where SOF can be employed to assist DEA on drug trafficking and counternarcotics. DMA can assist with supporting the intelligence and MC&G data

needed for the military to undertake its mission, although such assistance will directly increase DMA's product requirements for the Unified and Specified commands.

Joint military operations and SOF operations will increase to satisfy the demands of Low Intensity Conflicts. With the downsizing in military forces, the requirement for increased emphasis on joint operations is imperative. DMA's requirement and role will be to have the most current maps and charts available that cover Low Intensity Conflict areas. Without proper planning and source materials, DMA will have difficulty in meeting the military demands for products. The regional and functional CINCs can prioritize their mapping requirements and gain the approval required at the strategic level of the JCS. The commanders in the field will still have tactical requirements that will increase area mapping requirements due to operational need.

Changing Priorities

The national security requirements for the United States in the 1990s are uncertain with the ending of the Cold War and the disaggregation of the Soviet Union. President Bush, addressing the nation on September 27, 1991, stated that the dramatic changes in the Soviet Union and Eastern Europe had allowed the United States to vastly reduce its strategic and tactical nuclear arsenals. The President announced his intention to: withdraw and eliminate short-range tactical nuclear weapons, take U.S. strategic bombers off alert status, negotiate new weapons agreements, and implement

the scheduled reductions mandated by the START treaty. According to U.S. military and diplomatic officials, "President Bush's new arms plan will reshape U.S. nuclear forces created during the Cold War by destroying or pulling back some of the least useful and least controllable weapons from the front lines of the former East-West confrontation."⁵²

After President Bush announced his broad-based reduction of nuclear weapons, the Soviets reacted quickly and positively. As reported in the New York Times, "In responding to President Bush's arms control initiative, the Soviet President, Mikhail S. Gorbachev, said he would match the American move to destroy or withdraw from service most tactical nuclear weapons on land and at sea."⁵³ Though the control of Soviet nuclear weapons subsequently was taken from Gorbachev's hands, the United States has pressed forcefully for the adoption of adequate safeguards by the newly independent republics.

Because of the instability and uncertainty created by these mostly welcome changes, their implications for the national security of the United States are as yet little understood. We therefore must reassess completely our strategic military planning, our budgetary priorities, and our international relationships. The end of the Cold War confronts the United States with unexpected political and economic challenges, but also provides opportunities to promote democratic and capitalist principles.

In the New World Order proclaimed by President Bush, the likelihood of a superpower confrontation is sharply diminished.

The disintegration of the USSR and the weakening of Iraq both militarily and economically through the Persian Gulf War point toward a lessening of the threat of a worldwide nuclear or regional conventional conflict. At the same time, with communist ideology all but abandoned around the world, even lesser threats to stability, such as Cuba and North Korea, must feel cautious and vulnerable, remembering the unified resistance to Iraq's attempt to overwhelm a small and defenseless neighbor. Yet, in this era of successful international cooperation, Low Intensity Conflicts are perhaps more likely and cannot be undertaken without substantial risk.

In an article in Military Review, Steven Metz states, "The post-Cold War environment offers many challenges to US interests. These certainly compound the tasks facing our strategic thinkers and planners." The author sees the need for a new strategy for the US role in low-intensity conflict and recognizes the dramatic changes occurring in the Third World and in the US-Soviet (now Russian) relationship.⁵⁴

Though the potential for wars over ideology may have diminished, the overall potential for conflict may yet be growing. Skirmishes, revolutions, and civil wars are likely to arise over a number of issues: economics, narcotics-trafficking, environment, religion, nationalism, irredentism.

DMA's support and requirements for contingency operations around the world have been reviewed, and DMA's new concept is to have a core set of strategic products to meet military requirements

globally. DMA's set of strategic products, as noted earlier, is known as Current Operation Packs Sets (COPS). They will "provide minimum essential products to support current operations that are planned for high probability, low intensity conflict areas."⁵⁵

COPS are divided into two distinct categories: primary and secondary resources. These categories reflect DoD's redefinition of the priorities for MC&G products. The key questions for each area of the world will be: How important is the mission? How important is the product? Can DMA provide the product in a timely manner? The core sheets will serve as a minimum set of DMA products for COPS.

CHAPTER VI

CONCLUSION

As an agency of the DoD, the Defense Mapping Agency's changing role in supporting contingency operations, including crisis support, is necessarily shaped by the military's own rapidly changing function within our society and in the international arena. The collapse of communist regimes in the Soviet Union and Eastern Europe, domestic economic turmoil and budget crises, and the continued rapid development of technological modes of warfare, all are serving to redefine American military goals, strategies, and deployment.

The Defense Mapping Agency is widely regarded as the finest military mapping and charting service in the world. If it is to continue to fulfill this role, however, it must accelerate its modernization programs and technical development to keep up with the demands of the departments it serves. The Agency must strive toward these goals in spite of the burden of growing budgetary constraints.

An accurate assessment of future military needs and priorities is crucial to clarifying DMA's role in future contingency operations. However, even the most experienced students of foreign service, military planning, and political science must confess to uncertainty about the shape of the New World Order now being formed.

Even this, however, does not fully describe the task ahead. Greater efficiency will be required to satisfy the growing demands for products and services while, simultaneously, meeting reduced spending goals. The lower manpower allocations will require a far more skilled and well-rounded workforce. The likely consolidation of physical plants will challenge the ingenuity of planners, managers, and technicians alike.

The new or increased roles now being assumed by the military in counternarcotics, environmental renewal, insurgency and counterinsurgency, counterterrorism, and peacekeeping/peacemaking will require careful planning and coordination to enable DoD to achieve realistic goals within expected tight budgetary guidelines. DMA will need to take a more active role in the planning stage of these endeavors to ensure that its own activities can adequately support the military involvement.

All that being said, it is also important to note that President Bush's announcement of a large-scale reduction in U.S. tactical nuclear weapons was a wise and timely change in our nuclear containment strategy. It should result in long-term fiscal savings for the United States without harming our basic defense capabilities.

Although the threat of a superpower confrontation has lessened, the proliferation of nuclear weapons among Third World countries is becoming an increasing concern for the U.S. Even after its lopsided defeat in the Persian Gulf War, for example, Iraq has pursued its plans for nuclear capability. With so many

small countries seeking to develop, buy, or steal nuclear arms or technology, the need for current, accurate intelligence, and for reliable MC&G data on such countries, is growing rapidly. DMA must pursue its goals for improved readiness in order to help meet this growing threat to U.S. national security and interests.

Technological superiority, good intelligence, and excellent conventional forces seem to be the best assets for the United States as we head toward the twenty-first century. Keeping our tactical nuclear weapons waiting in the wings, however, adds to our general sense of security and confidence.

The makers of the future are many, and many must come together to make the future work. Just as DMA and SOF are jointly planning for the future to meet operational requirements, so too, must other military organizations. How the JCS will ultimately decide DMA's fate, will largely depend on the future mapping requirements of the world.

Today's strategic decisions are tomorrow's military realities.

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APPENDIX A

SURVEY QUESTIONNAIRE

SURVEY RESEARCH PROJECT

Memorandum for: Selected students in the USAWC class of 1992

Subject: Pretest Survey of "Mapping Support Requirements".

Purpose: To gather information from a selected sample of military personnel on their recognition and use of the Defense Mapping Agency products.

The information that is obtained and analyzed will be used to further refine the scope of research being conducted in conjunction with the Shippensburg University graduate program. This data will be used without reference to any individual and therefore names are not desired.

The survey utilizes both closed and open-ended questions to provide you an opportunity to expand upon questions.

Please answer the following questionnaire concerning the Defense Mapping Agency products you have used during your military career.

Susan Riley

1. Current service, rank and branch ?

1. Current service, rank and branch ?

2. Years of service ?

1. Have you ever used Defense Mapping Agency maps or charts in fulfilling a operation or task ?

 Yes

 No

2. If yes, please select the category of products that you most often have used:

Select one

____ Topographic maps

 Aeronautical Charts

___ Hydrographic Charts

 Digital data

3. For the category checked above please answer the following questions by circling the number in the right hand column according to the scale.

SCALE Never 1 2 3 4 5 Always

Questions	Scale
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a. How well were your product requirements met ? 1 2 3 4 5

- b. Were the products accurate ? 1 2 3 4 5
- c. Were the products provided on time ? 1 2 3 4 5
- d. Did the products provide current information ? 1 2 3 4 5
- e. Did the product physically withstand everyday use ? 1 2 3 4 5
- f. Were a sufficient number of copies usually delivered ? 1 2 3 4 5
- g. Was the correct datum used ? 1 2 3 4 5
- h. Was the ordering sufficient for the operation ? 1 2 3 4 5
- i. Was the product sufficiently detailed ? 1 2 3 4 5
- j. Was the scale of the product appropriate for your use? 1 2 3 4 5

4. Do you know how to order the different products from the Defense Mapping Agency ?

___ Yes
___ No

5. Did the products have a positive or negative impact on the operations ?

___ Positive
___ Negative
___ Neither

6. Any other comments to make about Defense Mapping Agency products?

7. Any comments or recommendations about the survey questions?

APPENDIX B

**CJCS MOP31
ASSIGNING PRIORITIES TO REQUIRMENTS FOR
MAPPING, CHARTING AND GEODESY SUPPORT**

ASSIGNING PRIORITIES TO REQUIREMENTS FOR
MAPPING, CHARTING, AND GEODESY SUPPORT

1. Purpose. To establish policy for assigning priorities to requirements for standard Defense Mapping Agency (DMA) mapping, charting, and geodesy (MC&G) products. This MOP supersedes policy previously established in Annex E (MC&G) to the Joint Strategic Planning Document FY 1990-1997.
2. Applicability. This MOP applies to the unified and specified commands, Services, Defense agencies, and the Joint Staff (hereafter referred to as DOD components), and to the US Maritime Administration.
3. General. DMA produces and distributes standard MC&G products over specific geographic areas based on the prioritized MC&G support requirements determined by DOD components and other authorized Government agencies. DOD components and other authorized Government agencies prioritize MC&G support requirements for standard DMA products in accordance with this MOP and submit the requirements to DMA in accordance with DMA Instruction (DMAI) 8050.4.* MC&G requirements are prioritized

* DMAI 8050.4, 17 June 1987, "Submission and Validation of Area Requirements for MC&G Products and Services"

based on operational need. In support of the Chairman, Joint Chiefs of Staff, and in accordance with DOD Directive 5105.4,* the Director, DMA, reviews and validates the MC&G requirements and priorities of the DOD components and other authorized Government agencies and develops a consolidated list of MC&G requirements and priorities. At the conclusion of the biennial MC&G requirements process, DMA briefs the Deputy Operations Deputies on significant changes to the consolidated list of MC&G requirements and priorities and solicits their concurrence. From the consolidated list, DMA develops its fiscal year production programs within resource constraints. During crisis situations confirmed by the Director for Operations, J-3, Joint Staff, the MC&G priorities assigned in accordance with this MOP are waived, as necessary, to allow DMA to apply sufficient production resources to ensure responsive crisis MC&G support to operational commanders.

4. Assigning Priorities. DOD components and other authorized Government agencies assign a CJCS MC&G priority to their requirement for each standard DMA product over specific geographic areas by assigning a basic priority and applying

* DOD Directive 5105.40, 12 December 1988, "Defense Mapping Agency"

additional priority qualifiers (APQs), as appropriate, to obtain a final CJCS MC&G priority. APQs are necessary to apply practical and fiscal constraints in determining a final CJCS MC&G priority. Additionally, a numerical precedence may be assigned to MC&G requirements with the same CJCS MC&G priority, in order to assist DMA production programming. Strategic nuclear forces assigned a Single Integrated Operational Plan (SIOP) mission have the highest precedence for DMA MC&G support within CJCS MC&G priority 1.

5. Basic Priority. DOD components and other authorized Government agencies assign a basic priority 1 through 5 to a requirement for a standard DMA product over a specific geographic area, according to the following definitions and criteria:

a. Definitions

(1) Primary Mission Area of Operations. The geographic area in which operations are planned for the command's assigned primary mission.

(2) Secondary Mission Area of Operations. The geographic area in which operations are planned for the command's contingency or secondary missions.

- (3) Forward-Deployed Forces. Forces that are currently positioned in their primary mission area of operations.
- (4) Rapidly Deployable Forces. Forces that can be deployed and are required by the theater CINC to be in their primary mission area of operations by D+10.
- (5) Self-Deployable Forces. Forces that can self-deploy and are required to be in their primary mission area of operations by D+10.
- (6) Strategic Nuclear Forces. Forces that are assigned a SIOP mission.

b. Basic Priority Criteria

(1) Basic Priority 1

(a) Operations. MC&G products required for primary mission operations by the following operational forces: strategic nuclear forces assigned a SIOP mission, forward-deployed forces, and rapidly deployable or self-deployable forces operating in their primary mission area of operations.

(b) Safety of Navigation. MC&G products essential for safety of navigation and required for forces

conducting normal operations in primary operating areas.

(c) Intelligence. MC&G products required for US intelligence operations involving vital support to SIOP forces and theater CINC primary mission area of operations or that are of critical importance to primary US national security interests.

(d) Training. MC&G products required for training in primary training areas by strategic nuclear forces that support the SIOP and deployed operational forces currently positioned in their primary mission area of operations.

(e) Merchant Marine. Does not apply to merchant marine requirements.

(2) Basic Priority 2

(a) Operations. MC&G products required by follow-on operational forces that can be deployed and are required to be in their primary mission area of operations after D+10.

(b) Safety of Navigation. MC&G products essential for safety of navigation and required for forces

conducting normal operations in secondary operating areas.

(c) Intelligence. MC&G products of major importance to US intelligence operations supporting primary US national security interests.

(d) Training. MC&G products required for training by rapidly deployable and self-deployable forces required by the theater CINC to be in their primary mission area of operations by D+10 and covering primary, mission-indispensable training areas

(e) Merchant Marine. MC&G products required by oceanborne commerce over sea lines of communication (SLOCs) connecting the United States and its allies with (1) the primary mission area of operations or (2) areas or countries the United States and its allies depend on for import of petroleum (including liquid natural gas) or for 50 percent or more of their requirements for other strategic and critical materials and goods.

(3) Basic Priority 3

(a) Operations. MC&G products required by forces conducting secondary mission area operations outside their primary mission area of operation.

(b) Safety of Navigation. MC&G products essential for safety of navigation and required for forces conducting normal operations outside their primary or secondary mission area of operations.

(c) Intelligence. MC&G products important to US intelligence operations supporting US national security interests.

(d) Training. MC&G products required for general orientation training and covering primary training areas.

(e) Merchant Marine. MC&G products required by oceanborne commerce over SLOCs connecting the United States and its allies with (1) contingency mission areas of operations or (2) areas or countries the United States and its allies depend on for import of 25 percent or more (but less than 50 percent) of their requirements for nonpetroleum strategic and critical materials and goods.

(4) Basic Priority 4

(a) Operations. MC&G products required for forces conducting normal operations in areas peripheral to their primary or secondary mission area of operations.

(b) Intelligence. MC&G products of interest to US intelligence operations.

(c) Training. MC&G products required for general orientation training and covering secondary training areas.

(d) Merchant Marine. MC&G products required by oceanborne commerce over SLOCs connecting the United States and its allies with (1) peripheral areas or (2) areas or countries the United States and its allies depend on for import of 10 percent or more (but less than 25 percent) of their requirements for nonpetroleum strategic and critical materials and goods.

(5) Basic Priority 5. All merchant marine requirements except those defined under basic priorities 2 through 4.

6. Additional Priority Qualifier. DOD components and other authorized Government agencies apply APQs to modify the basic

priority assigned to each requirement for a DMA standard product to arrive at a final CJCS MC&G priority for that requirement. Application of one APQ modifier lowers the basic priority by one to obtain the final CJCS MC&G priority. Application of both APQs lowers the basic priority by two to obtain the final CJCS MC&G priority. The following criteria apply:

a. APQ-1. The MC&G product is required to support a CONPLAN rather than an OPLAN, as defined by the Joint Operation Planning System. APQ-1 does not apply to basic priority 4 or 5, MC&G requirements for safety of navigation, national-level intelligence, merchant marine, or to general orientation training.

b. APQ-2. The MC&G product requirement is satisfied by coverage of an existing product that is determined by the requirement submitter as useable (i.e., the requirement (need) is to maintain or update an existing product, not to produce it for the first time). APQ-2 does not apply to basic priority 5, or to MC&G requirements for safety of navigation.

7. Exceptions and Adjudication. Requests for exceptions to this policy or adjudication of conflicting priorities for DMA support must be submitted to the Director for Operations, J-3, Joint Staff.