

Military-USGS Mapping Cooperation

I VERY MUCH APPRECIATE the invitation to comment on the Department of Defense relationship with the U.S. Geological Survey on this occasion of its 100th anniversary. This has been a continuing and very important relationship since our military mapping and charting community is at once an ancestor, a collaborator, and a major customer of the Geological Survey.

As most of you here today probably know, topographic mapping began as a military science. Earliest mapping and charting grew out of the needs of explorers and the results of their explorations, most of which were mounted as military expeditions. The pattern of exploration followed by conquest, followed by settlement and development of the land, and then, eventually by scientific analysis, and then by national growth and security concerns, has through the centuries established the pattern for mapping and charting. The United States has pretty well followed this pattern. As the colonies and then the new nation moved through the wars of revolution, and through exploring, acquiring and protecting territory, the need for maps and charts was apparent. George Washington found his job as Commander of the Revolutionary forces sorely impeded by a lack of adequate maps. He therefore turned to Robert Erskine in 1777 to organize a topographic capability to support the Continental Army. Captain Erskine was a Scottish engineer, sent by the British owners to operate the Ringwood Iron Mines and Foundry in New Jersey. He established there his office as Geographer and Surveyor, going out with his carefully selected team of mappers to survey and map the areas where our Revolutionary forces would be in action.

Among his associates was Simon deWitt, the Surveyor General of the State of New Jersey, who later became a principal mover in the Erie Canal development. DeWitt succeeded Erskine at his untimely death in 1780. Thomas Hutchins, who was appointed Geographer of the Southern Army in 1781, later became the Surveyor General of the public lands and established the General Land Office.

Many of the officers who were involved in

this early mapping for the armies became key figures in exploring and mapping the developing country. Names such as Lewis and Clark, Fremont, Wheeler, Warren, Emory, McNeill, Whistler, and Pike are perhaps the best known among the many military surveyors who were actively engaged in exploration during the early days of our country. Other officers were active in the Coast Survey and in its emergence as the Coast and Geodetic Survey.

West Point was founded as an engineer school in 1802 and was the source for many of these topographers. One historian has pointed out that this fact probably established the tone for U.S. mapping. He called them "sophisticated intellectuals" and "unabashed romantics" who expanded the mechanics of surveying into collecting detailed information and commenting on the wonders of the new land. The Corps of Topographic Engineers, established under Colonel Abert in 1838, carried forward the traditions established by Erskine and deWitt, carrying out such monumental projects as the survey of the Great Lakes. When the Geological Survey was established in 1879, many of the topographers from that Corps moved to the new organization, particularly those who had been involved in the surveys of the west with Major Wheeler and Major Powell.

As the role of the Geological Survey was clarified to include the general topographic mapping of the United States, the Army began to look more to that agency for general map coverage, particularly since funds and manpower for such work dropped sharply in peacetime periods. Although the Corps of Topographic Engineers was phased out, a close cooperation has continued through the years between the USGS and the Army Corps of Engineers.

The modern concept for an orderly national series of maps based on trigonometric surveys probably began in France when in 1666 Colbert, the legendary adviser and minister to Louis XIV, established the Royal Academy and charged it with preparing such a new map of France which could meet both military and economic needs. This brought

about the work by the Cassini family, consummated in 1789 with the *Carte Geometrique*, the first of the standard national topographic series which all countries now attempt to produce and maintain.

Surprisingly, the early policies of the Geological Survey did not follow this concept of a national map series to support both military and civilian needs. Major John Wesley Powell, the second Director of the Geological Survey, and probably the individual who has had the greatest impact on its tradition and policies, provided the basis for this statement. It comes from a very interesting document which I've looked at in reviewing the history of our relationship with usgs. It records Major Powell's testimony in December 1884 before a Joint Senate-House Commission appointed to consider the organization of federal mapping and charting organizations to "secure greater efficiency and economy." (That has a familiar ring, doesn't it? I didn't realize that Wilkie Donelson went back that far!) This testimony and its accompanying statements for the records, published by the Government Printing Office in 1885, still make extremely interesting reading for mappers today. It provides not only Major Powell's views of U.S. mapping, but also a very comprehensive summary of the status of topographic survey organizations throughout the world.

He makes a strong defense for keeping topographic mapping in the U.S. Geological Survey (apparently there had been some sentiment in the Congress for transferring it to the Coast and Geodetic Survey). He states, "Topography kept under the control of geologists will be executed better and at less expense." While this may be true and indeed the idea has continued in the United States for 100 years, it hasn't caught on in the rest of the world. Few, if any, other national mapping programs are under the control of the geologists. (In those days geologists were paid \$4,000 per year—topographers \$2,000.)

Major Powell established as the purpose of the topographic map program the preparation of a base for geologic mapping and other scientific classification of the Earth's natural features. It was his policy to avoid showing details of the works of man which tend to make maps obsolete rapidly. He was concerned that these details might obscure the terrain information. While he recognized that such detail was important for military purposes, he believed that it should not be included in a "scientific" map. The impact of this policy on the U.S. National

Topographic Series has been evident when these were compared with the national series of other countries. However, since World War II, there has been an increasing "U.S." user interest in more complete map information, which has brought closer together military and civilian concepts for map design. There is also increasing recognition of the need to more rapidly revise the national series to keep up to date those details which "obsolesce rapidly." As Paul Alexander of the old Army Map Service once pointed out, "cartography's closest occupational relative is journalism; the map becomes outdated almost before it's printed; the topographer, like the reporter, works largely in terms of the next edition." Today, we are working closely with the U.S. Geological Survey to assure that the "next editions" of the maps of areas of the U.S. where our military forces train, and where they develop and test weapons systems, are maintained on schedule.

Through the years, the close relationship that has been maintained between our defense organizations and the usgs has been demonstrated each time the nation faced a military emergency and had to develop quickly an expanded surveying and mapping capability to support the armed forces. Many professionals and technicians of the U.S. Geological Survey were commissioned in the military mapping organizations. At the same time facilities of the usgs undertook work in support of the military mapping and charting organizations. The survey history of the usgs by Mrs. Rabbit notes that the usgs was almost entirely on a war footing in World War I. As World War II approached, national concern about the relatively incomplete or obsolete status of the topographic maps for the defense of U.S. national territory led in 1940 to a major effort to upgrade "maps of strategic areas," particularly along the coastal valley and lake areas of the U.S. Military requirements again became a major force driving the usgs for most of the years between 1940 and 1946.

The technology for topographic mapping was changing rapidly in that period with the advent of photogrammetry in the U.S. Significant progress was made through the joint efforts of the Army and usgs along with other federal mapping and charting agencies and industry. The work of Russ Bean at Wright Field and the contributions of Harry Kelsh are well-remembered highlights.

Again, many usgs personnel put on their uniforms and joined the military mapping agencies and field units. Colonels Bob

Moravetz, Dan Kennedy, Bob Altenhofen, and Bill Davies were key figures in the wartime development and operation of the Army Map Service (AMS). Bill Radlinski, Bill Overstreet, and many others were in the Engineer topo units. USGS professionals continue to participate today in Army Engineer Reserve units to assure a rapid mobilization potential. Steve Pousardien of the Topographic Division, USGS, now is Commander of the 368th Engineer Detachment (Geodetic Survey) headquartered at Fort Belvoir, Virginia.

USGS also had a major wartime impact on military air charting. While air navigation charts for the 48 states were generally available, the Army Air Corps recognized the need for charts of Alaska. Colonel Kay, who headed the charting activity in the Air Corps at that time, approached the USGS in July 1941 to see what could be done. Dr. Smith, the Chief Geologist of Alaskan Branch and Gerald FitzGerald, his Chief Topographer, tackled the problem, agreeing to try out the tri-metrogon camera system developed by the Air Corps at Wright Field. The USGS Wilson Photoalidade was to be used as the principal tool. Colonel Kay arranged for the Air Corps to fly the tri-met photography and a joint military-USGS operation for production of air charts of Alaska was begun in December 1941. Colonel FitzGerald donned his uniform and moved to the Air Corps accompanied by Jack Davidson, and Charlie Fuechsel took over the Alaskan Branch which expanded to more than 400 people producing air charts over the globe to meet military needs. More than four million square miles of charting was produced and maintained. The unit continued to operate after the war to exploit tri-metrogon and other reconnaissance materials brought back from overseas areas by U.S. forces to improve the quality of charting as a major contribution to national security readiness. With the development of Air Force production facilities in St. Louis, the USGS Special Maps Unit direct support of the foreign air charting program was discontinued in 1958.

Other elements of the USGS also undertook significant foreign area map production throughout World War II to assist the Army Map Service. USGS geologists supported military forces by providing geologic information essential for providing "movement maps" of foreign strategic areas and for identifying mineral resources critical to military operations and war production. The "Military Geology Branch" established in World War II continued to provide direct

support until the mid-1960's. Professional consultation continues today on an "as needed" basis.

The Korean War emergency brought another surge in military cartography workload and again the USGS responded with its characteristic high enthusiasm and effectiveness.

In the years immediately following World War II, as the mapping and charting agencies greatly expanded during the war and then reshaped their programs to peacetime needs, there were often differences of view about peacetime roles. I can remember some stormy sessions between Colonel FitzGerald, who had by then returned as USGS Chief Topographic Engineer, and Colonel Dan Kennedy, the AMS Chief of Operations, concerning an AMS decision to go to commercial contractors to produce quadrangle maps for the military posts and camps which would house our forces returning from the war. There were also disagreements about the need for a national map series at the 1:250,000 scale, which AMS finally produced as a military series.

In some instances Bob Randall, Chief Examiner for Maps of the Bureau of the Budget, had to intercede to settle things down a bit. But out of this grew an era of understanding and cooperation which improves each year. George Whitmore, Bob Lyddan, Earle Fennell, Bill Radlinski, and Rupe Southard have all contributed much to building an effective coordination between USGS and military interests and operations.

The Department of Defense does not operate a separate domestic mapping and charting program. We provide statements of our needs for U.S. topographic maps to the USGS, and for air and sea navigation charts of U.S. airspace and U.S. coastal waters to the National Ocean Survey (NOS). If they cannot provide any of them to meet an urgent defense need, the Defense Manning Agency (DMA), the successor agency to AMS, may look for some way to assist, but does not initiate such work without full coordination and consultation. We operate joint committees and working groups to assure that map and chart specifications meet all users' needs to the maximum extent possible. (Since military maps and charts are standardized internationally, the coordination process is sometimes slow and difficult but we've made great progress in the last few years.)

The 1:250,000 scale map of the U.S., produced by AMS in the 1950's when no civilian need was established, was transferred to the USGS in 1965 and will be maintained and republished by USGS to service all national

requirements. We have worked out agreements to simplify the conversion of these to special military training editions and conversely to apply to the national map any DMA revisions made in these special editions.

At one time after World War II, the Army planned to produce a separate large-scale military map series for the United States by changing the scale and overprinting the military grid and other detail on the standard U.S. topographic quadrangles. Just the cost for storage of all these additional items would have been a huge figure. Today, the standard 1:24,000 scale quadrangle is used to service almost all Defense needs and the separate military version is produced only for limited training areas where troops learn to use metric-style maps like those they'll encounter overseas. As USGS moves to the metric contours and the 1:25,000 scale of the future, even these duplicate maps will no longer be needed.

With the rapid advances in surveying and mapping technology, USGS and DMA have established strong coordination ties to assure effective exchange and introduction of new ideas and the results of research and development work. USGS, NOS, and DMA have recently taken steps toward formalizing the exchange of technical personnel, and of coordination of acquisition of technical production equipment and systems. We have also taken note of the large volume of digital terrain data and other Earth science related

information being generated by the three agencies and will move toward standardizing formats and the development of a national data base.

Views have been expressed from time to time supporting the consolidation of all federal mapping, charting, and geodesy activities into a single national agency. Because of the management problems that widely differing priorities would bring, such an integration is not considered desirable today by most of the members of the communities concerned. We believe that coordination and cooperation is generally going so well that little, if any, additional efficiency would be realized. Our relative roles are now well understood and our joint interface with the rest of the world appears to be sound. Perhaps the most important problem that we face is the same one we've always had: inadequate resources. Even with improvements in production techniques and facilities, we find ourselves hard-pressed to meet fully the three challenges that continually stare us in the face: to keep products up to date, to satisfy requirements for new products, and to have in hand map and chart coverage of the United States essential for national security. Together, the 100-year-old USGS and the military mapping community are doing more than even before, and doing it better. It's just that our customers' needs seem to keep running ahead of us. In other words, "Hang in there, USGS!"