was passed and signed by the President. This Act requires the Director of the Office of Charting and Geodetic Services, NOAA, in consultation with the Director of the U.S. Geological Survey (USGS), to submit to the Congress a plan for preparing maps of the shoreline of the Great Lakes.

The plan will define the responsibilities of NOAA and USGS, set up a mapping schedule, with high-risk areas (erosion or flooding) given first priority, a completion date, and recommended funding. The committee set up by NOAA and USGS expects to complete their report to Congress during the next year. For further information, contact: Mr. Dennis Carroll at (301) 443-8742.
(C&GS Update, Winter 1989)

TOWARD A REDEFINITION OF CARTOGRAPHY

The International Cartographic Association (ICA) is soliciting views on a redefinition of "cartography" for its forthcoming Dictionary of Cartographic Terms. The British Cartographic Society offers the following:

"...in defining cartography we are speaking to more than just ICA but to many other interested parties. In the light of the recent BCS Council policy to broaden the appeal of cartography to both prospective members and the general public as a whole we have included two further definitions, one for professional cartographers and the other for the public at large.

"A definition for use in communication with the general public and prospective members not yet engaged in cartography:

Cartography is the art, science and technology of making maps.

A definition for practicing cartographers:

Cartography is the science and technology of analyzing and interpreting geographic relationships, and communicating the results by means of maps.

A definition suitable for the ICA Dictionary:

Cartography is the science and technology of analyzing, interpreting and communicating spatial relationships normally by means of maps."

(BCS Newsletter Number 1, 1989)

Editors note: One wonders why the BCS is willing to admit to the general public -- but not to "practicing cartographers" or the ICA -- that cartography is as much an art as a science or a set of technologies.

LETTER TO THE EDITOR

January 4, 1989
Professor Ruth A. Rowles, Editor
Cartographic Information

Dear Ruth:

I have just read with interest, and much profit, the issue No. 31, December, 1988. It is an informative and useful publication. There are three items on which I wish to comment.

First, Alan MacEachren's piece on "Renewed Interest in Map Projections" is very well done, and I hope he is right. One small item: he stated that the Robinson projection was patented in 1963. Devised then, yes; but patented, no. Van der Grinten's projection was patented in ca. 1903, but sometime later I believe the Patent Office declined to accept patent applications for projections. Also map *projections* cannot be copyrighted, but of course, maps can. In any case, the Robinson projection has been in the public domain ever since it was devised.

Second, I compliment you on your reply to Mr. Grigar of Texas. That leads into the third item. In that letter you list the prices for single copies of *Which Map Is Best?* and *Choosing a World Map*. But that reminded me of a fact less well-known, namely that *Choosing a World Map* is available at a discount when 10 or more copies are ordered, made possible by generous grants from several cartographic/geographic organizations. The prices are as follows:

Copies	Cost
10-19	$2.00
20-29	$1.50
30-39	$1.25
40-49	$1.10
50+	$1.00

Plus $2.00 shipping and handling for all orders. This was done with the hope that schools might find it a useful resource.

Very best regards,
Arthur H. Robinson

NEW VISUALIZATION CENTER

The State of California has given the San Diego Supercomputer Center $6 million to develop a scientific visualization facility that the state hopes will help attract high-technology business.

Scientific visualization uses graphics to express information -- particularly complex dynamic systems with complicated time scales, flow patterns, and spatial relationships -- with which scientists often work. It requires sophisticated software and powerful computers to manipulate the data, and specialists who understand how to represent numeric data using form, line, and color.

The supercomputer center, located at the University of California at San Diego, is supported by the National Science Foundation. (*Chronicle of Higher Education, 2/15/89*) *featured article*

Automated Radar Video Map Production at NOS

Ronald M. Bolton
and
Russell A. Hoover

The Aeronautical Charting Division (ACD), National Ocean Service (NOS), National Oceanic and Atmospheric Administration (NOAA) produces the Radar Video Maps (RVM's) used by air traffic controllers to monitor and control the Nation's airspace. These complex maps depict the local Federal Aviation Administration (FAA) airspace definition and show airways, intersections, holding patterns, selected navigational aids, special-use airspace boundaries, and other radar display elements critical to the traffic controller's radar scope displays. Previously produced by tedious manual methods, the ACD's Aeronautical Chart Automated Production (ACAP) system now provides the tools for automated production of this integral part of the FAA air traffic control system.

INTRODUCTION AND BACKGROUND

Prior to 1967, Radar Video Maps (RVM's) were constructed individually by cartographers at FAA Air Route Traffic Control Centers (ARTCC's) and towers. The cartographers prepared inked compilations (drawings) on various media, using several different projections and scales. These compilations were taken to local contractors for reduction and processing into negatives which were then trimmed to the required sizes and placed between two pieces of glass or plastic. The composite plates were then oriented to the traffic controller's radar scope.

There were many problems with these early plates. Some scales and projections used were not suitable for the map areas covered. The compilations were prepared on paper rather than dimensionally stable mylar. The symbology varied and line weights were not uniform. Overlapping areas did not match and frequently revisions were not received when needed. As a result of these and other problems, the FAA, realizing the need for establishing a program for Radar Video Maps, assigned the U.S. Coast and Geodetic Survey (U.S.C&GS, the predecessor of NOAA) the task of Radar Video Map production in 1967.

The current Radar Video Map final product is in the form of a negative map image (Fiure 1) depicted on either 2.3 or 3.0 inch square plastic plates, depending upon the type of Airport Surveillance Radar (ASR) equipment. As many as five slides can be mounted in the ASR equipment at one time, and projected on the video screen through multichannel display. The plates cover 10 to 60 nautical miles in range and are depicted at scales from 1:100,000 to 1:400,000. The choice of data to be depicted on each map is left to the discretion of the FAA requesting facility. These data might consist of obstructions, landmark features, control zones, vectoring altitudes, geographic boundaries, or any other features that the traffic controller feels might assist in the traffic control for that particular ARTCC.

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MANUAL PROCEDURES

Currently, 95 percent of all compilation is being performed using the automated procedures. Special or unusual requests are still being handled by manual operating procedures. Under the manual operating procedures, the production process is initiated when a request Form 7910-1 for a new RVM is submitted by the FAA. This request specifies the type of video display, plate size, quantity, map range, radar site coordinates, and data to be depicted on the map. All requested data are verified and obtained either directly from support units within the Aeronautical Chart Branch (ACB), or through terminal queries of the

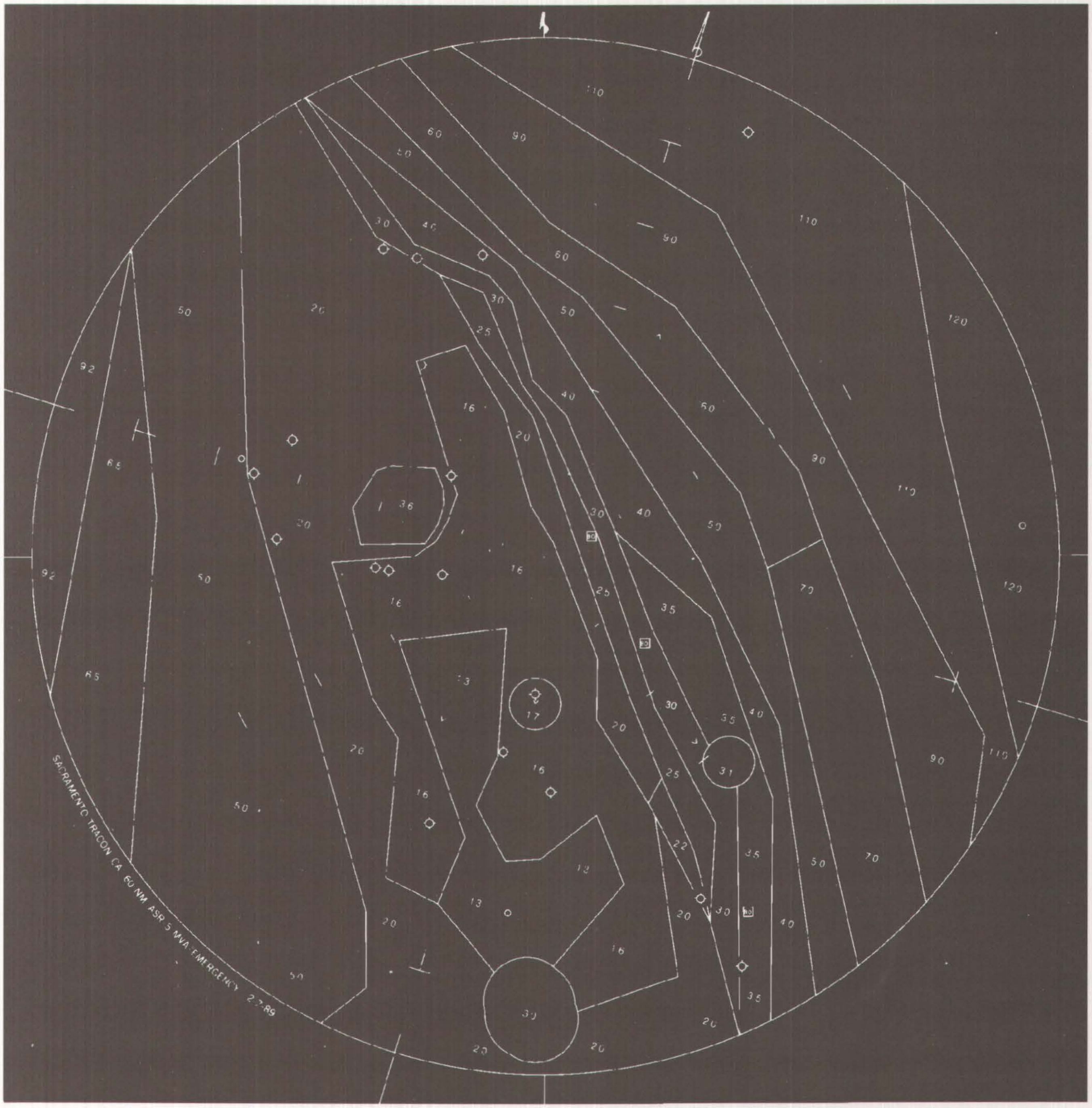
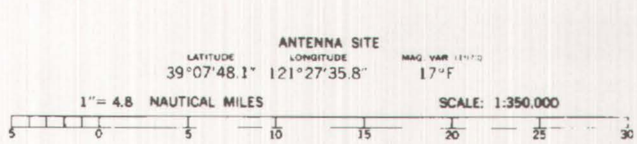


Figure 1: Radar Video Map and legend detail.



ACAP aeronautical database. Once all the necessary data have been defined and collected, they are manually key-entered through remote terminals to create Map Definition Language (MDL) sets for creating rough computer generated pen plots of the map. A typical RVM plate may require one hundred to two hundred manual data entries. Some requests may take up to one thousand data entries. Cultural features such as rivers, shorelines, or major roads must be drawn manually.

The main problem was developing a database

Two compilation plots are produced on dimensionally stable mylar. The first plot depicts only data requested by the FAA facility, the second plot contains all data generated to produce the final map such as projection, extra obstructions, and other miscellaneous data. After the compilation plots are reviewed, they are sent to the NOS Reproduction Branch where they are transferred to scribing material which is engraved with lines of between .012 to .018 inches in width. A contact-type paper proof of the final engraved artwork is sent to the RVM Unit for review where it is checked for accuracy. Errors are identified and the marked proof is returned to the Reproduction Branch for correction to the final engraving. Another paper proof of the corrected linework is sent back to the RVM Unit for review. This cycle continues until a final proof is certified to be correct. An Ozalid copy of the final map is sent to the FAA requestor for final approval, and upon acceptance by the FAA, the engraved image is reduced six to ten times on a high precision Deacon III micro camera designed and constructed especially for Radar Video Maps (Figure 2). This sophisticated camera assures repeatability and eliminates distortion between the original engraved copy and the final RVM negative plate. Two plates, five Ozalid paper prints at compilation scale, and one 8.5 by 10 inch film positive are then sent to the FAA requestor.

AUTOMATION CONCEPT AND OPERATION DATABASE

As early as 1973 (Boger, 1973), it was realized that automation of RVM production could result in considerable cost savings over manual methods. A feasibility study performed in June 1975 (Bolton, 1974) revealed that automation would result in an annual savings of $100,000.

The main problem of implementing an automated RVM system, even during the mid-seventies, was not the interactive graphic editing, nor was it the production of the final graphic output. The main problem was developing a database to depict the necessary aeronautical data (Pendleton, 1974). The RVM depicts over eighteen unique types of aeronautical data, much of which may or may not be employed, depending upon the individual traffic controller's needs. There was no simple algorithmic approach to access these data in a purely automated mode. Also, development of an appropriate database for a single product such as the RVM would be cost-prohibitive. Such a database would require on-line storage of all data elements describing the National Airspace System, even though only a small fraction of these elements would ever be used for any given RVM.

It was not until 1985-86 when the ACAP chart-independent, dictionary-driven aeronautical database was implemented, that automation of the RVM could become a reality. The ACAP database contains 12 active files consisting of over 240,000 records. This database was implemented to support the 8,180 aeronautical charts and 26 publications produced by the NOS for recreational, military, and commercial aviation.

Access to this database is based upon single point, polygon, or circle searches of the particular data elements. The data elements are those items needed to describe the National Airspace System, such as airports, navigation aids, obstacles, air routes, fixes, etc., and they are the lowest level in the data structure. Each record contains record identifiers peculiar to that item or record. For example, an obstacle record contains such identifiers as State, height above mean sea level, and number code. Retrieval is conducted using remote terminals and consists of keying-in the search commands for each category or particular items falling within the RVM boundaries. Once the necessary data elements for the RVM have been retrieved, they are stored in separate files for input to the Map Definition Language (MDL) set that will be used to generate the digital design file. This digital design file produces the graphic.

The ACAP aeronautical databases and the graphics software (OMNIPLOT) is resident on both a Digital Equipment Corporation (DEC) VAX 751, and a VAX 785. The interactive graphics system utilizes the in-house OMNIPLOT software as well as Intergraph Corporation Interact and WMS software. The workstations are Intergraph 6800 dual-screen CRT with 60-inch format, high resolution (+/-.0025 inches) digitizing tables.

CONSTRUCTING A VIDEO MAP

The first step in automated RVM construction begins with receipt of the FAA Form 7910-1 from the requesting facility. The cartographer accesses the ACAP FIND system resident on the VAX through either on-site or remote alpha-numeric terminals. All of the essential data elements for the particular RVM are retrieved and stored in separate "plot" files. A Map Definition Language (MDL) set that defines the cartographic parameters of the map is generated. This MDL set contains such things as projection, scale, standard parallels, radar site coordinates, neatline, and legend notes. The MDL set also contains the filenames of the previously retrieved data elements.

The MDL set is then processed by the OMNIPLOT graphics system to generate the vector formatted graphics file. This graphics file is processed through the Intergraph translator software (UNPLOT) to create a master format design file. From the design file, an exact depiction of the RVM and the complete set of unedited data elements is displayed on the CRT screen for editing. The cartographer performs the edit, eliminating unnecessary obstructions, moving landmark features, resolving clutter problems, and performing any cosmetic operations necessary to create an accurate, legible product.

Once the CRT image "compilation" has been reviewed by a senior cartographer, a pen proof is generated and sent immediately to the FAA region for acceptance, additions, deletions, or comments. Further editing is performed if necessary, and another proof is delivered to the FAA. This cycle continues as often as necessary. Upon acceptance of the proof copy, the final design file is used as input to drive a high precision Gerber photo-scribing plotter. A photo-scribed negative possessing the exact .012 to .018 inch line widths is produced and after thorough inspection and review, it is sent to the Reproduction Branch for photo-processing on the Deacon III micro camera. The final Radar Video Plates are then sent to the requesting FAA Region.

The design files are archived on system disc and backed-up on tape, resulting in a permanent record of each RVM. Update or revision of existing RVMs is a simple task of retrieving the design file and performing interactive editing to produce a new RVM. Both the new RVM and the old RVM will be maintained in order to keep a historical record.

UPDATE OF EXISTING RVMs

As of fiscal year 1989, approximately two thousand Radar Video Maps are in use by the FAA Regions. In order for the NOS to keep the full economic benefits of the automated RVM system, it will be essential to digitize all existing manually generated maps. Once design files have been created, upkeep and revision of the existing maps will take only hours as compared to days. In-house digitizing efforts have shown that the average time per RVM is four to eight staff hours. The number of staff hours estimated to construct a complete RVM database of the existing maps is twelve thousand hours. Efforts are currently underway to begin this digitization, either through private contracting or inter-agency cooperative agreement.

ADVANTAGES OF AUTOMATION

During fiscal year 1987 there were 3,100 RVM revisions, and 100 original RVM compilations. The cost savings based upon this annual production rate and implementation of the automated procedures would be well over $300,000 per year. However, the real benefit to NOAA will be customer satisfaction. The elapsed time for the production of a new video plate will drop from four to six weeks to one to two weeks. The customer -- FAA --will be able to get proof copies within a week for revision and approval.

In addition, the automated procedures will provide the digital data in support of the FAA's Advanced Automation System (AAS) which is cur-rently being developed by the IBM Corpora-tion. This $3.6 billion effort will upgrade the current air traffic control automation system to handle traffic loads well into the next century. The NOS will supply the digital data for the 2,340 Tower Control Position consoles and the 7,500 Terminal/ Enroute consoles. These systems will be implemented in the field beginning in 1991 and should be com-pletely installed by 2001. The digital data requirements of the FAA's AAS will be massive and will require the NOS to supply high quality digital data on a rigid fifty-six day cycle.

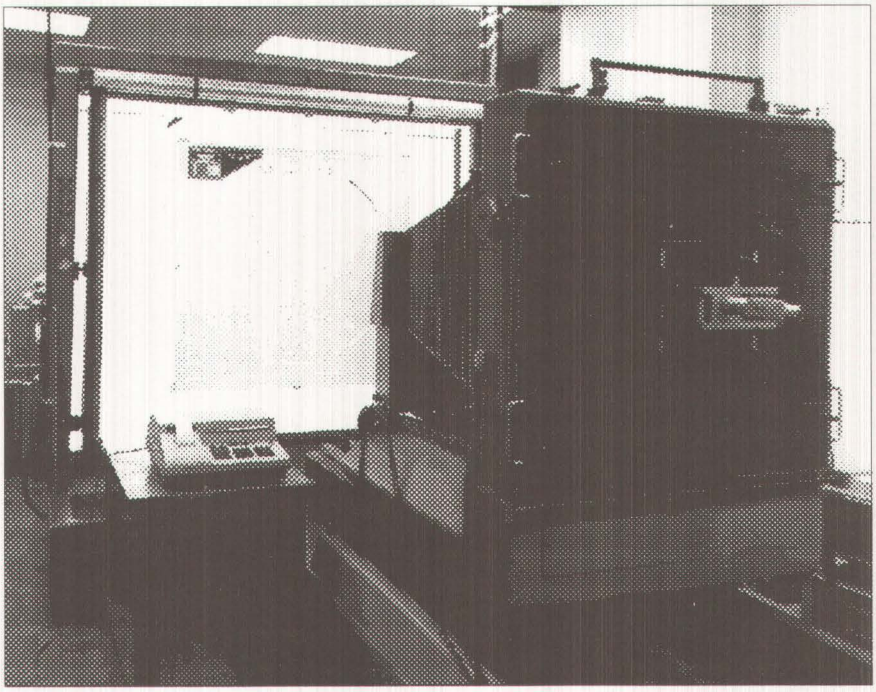


Figure 2: Deacon III micro camera.

In summary, the RVM automation effort has not only cut production costs, it will reduce elapsed time for deliveries of the RVM's to the air traffic controller, thus resulting in a more up-to-date product. This re-duction in elapsed time between receipt of new information and applica-tion to the air traffic control system will result in increased safety for the air traveler. The automation capability will also enable NOS to provide the FAA and other users with the digital data essential to operate the sophisticated air traffic control systems that will be in use through the next century.

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Produccion de Mapas Automatizados por RadarVideo en la NOS

Extracto

La Divisíon de Carta Aeronáutica (ACD), del Servicio Océano Nacional (NOS), de la Administración Atmosférica y Oceánica Nacional (NOAA) de los Estados Unidos de America produce los Mapas por el Radar Video (RVM) usado por los contralores de tráfico aéreo. Estos compuestos de mapas retratan la definición local de la Administración de Aviación Federal (FAA) y definen vías aéreas, interseccióndes aéreas, separasiónes de vías aéreas, selecciones de auxiliares de navegación, limites de espacio aéreo para usos específicos, y otros elementos de presentacíon radar en las pantallas usadas por los contralores. Previamente producido por métodos manual tedioso, el systema de Producción de Carta Aeronáutica Automatizada de la ACD ahora proveé los instrumentos para la producción de mapas automatizados y forma una parte integral del systema de control de trafico aéreo de la FAA.

criteria for featured papers

All featured papers will be *solicited* by the NACIS Publications Committee. The goals of the solicitation procedure will be to select high quality papers that provide a balanced representration of the divers interests of the membership. The primary mechanism for soliciting featured papers will be a paper competition held in conjuction with the Annual Meeting. All papers prepared for the meeting and submitted in written and / or digital form will be considered. Three of these will be selected to appear in *Cartographic Perspectives* during the next year.

In addition to the competition winners, the Publications Committee (in consultation with the editors) will solicit one or more papers each year from other sources. The goal here is to ensure that all aspects of the membership are served and to attract some thought-provoking ideas from authors who may not be able to attend the Annual Meeting.

Authors of selected papers will be given an opportunity to respond to suggestions of the Publications Committee or meeting participants before submitting as final version. The writing quality must adhere to high professional standards. Due to the interdisciplinary nature of the organization, it is particularly important that papers are carefully structured with ideas presented succinctly. The editors reserve the right to make editorial changes to ensure clarity and consistency of style.

Papers ranging from the theoretical / philosophical to methodological / applied topics will be considered providing that ideas are presented in a manner that will interest more than a narrow spectrum of members.

To be considered for the paper competition, papers should be prepared exclusively for NACIS, with no major portion previously published elsewhere.

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