SATCHEL TRAINING DEVELOPMENT ACTIVITIES: A STATUS REPORT

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ABSTRACT
Since satellites were first launched in 1960, research scientists have been working with operational meteorologists, oceanographers and others to ensure that satellite interpretation techniques were widely understood. In recent years, the arrival of satellite imagery display systems, and improved videorecorder and videodisk systems are forcing satellite training efforts into new waters.

This paper summarizes the state of satellite training within NESDIS, NWS, Air Weather Service and other Federal agencies. It also describes how these agencies individually or collectively are cooperating in training activities and in transferring interpretation technology to non-government and international organizations.

1. INTRODUCTION
Prior to 1985, the National Weather Service (NWS), the Air Weather Service (AWS), the National Environmental Satellite, Data and Information Service (NESDIS), and the Naval Oceanography Command (NAVOCEANCOMFAC) generally undertook applied weather/oceanography satellite training independently. In addition, NESDIS' international satellite training activities were largely addressed apart from those done domestically.

The situation was recognized by agency representatives at the Fall 1985 National Weather Association (NWA) Annual Meeting. At that time, two special training focus sessions opened new doors to multi-agency training development, particularly in the area of satellite imagery interpretation. Budgetary and personnel cutbacks, the imminent arrival of satellite imagery-in-motion display systems at both NWS and AWS sites, and a more realistic determination of training needs sparked the first Interagency Training Coordination Working Group (ITCWG) meeting at Scott Air Force Base (AFB), IL on February 24–25, 1986. Attendees included members of the operational meteorological community's work level trainers. Thus, instead of policy making, the attendees focused on actually making the training happen.

Subsequent meetings of the ITCWG were held in Kansas City, MO in 1986 and in Camp Springs, MD and Houston, TX in 1987. Each meeting further enhanced establishment and maintenance of a more fully coordinated training development program. Additionally, the AWS estimated training development savings of more than $20K and over an 18 month manpower savings due to initial training coordination activities alone (Guard, 2). Similar savings and/or creation of additional training materials resulted within NESDIS and NWS due to non-duplication of effort.

2. THE TRAINING UNIVERSE
Training, no matter how good, doesn’t just happen. It requires a multi-faceted approach (Fig. 1) and the involvement of large numbers of people, including agency management, operational forecasters, local weather office management, and training developers. Fortunately, such a team exists in the satellite training area.

NESDIS has assumed the leadership and coordination role in satellite training development activities. This has involved extensive discussions with the users of training materials, as well as the creation of a large, albeit ad hoc, force of training developers. Whereas in past years, NESDIS created its own training materials, there is now a coordinated program involving NWS, AWS, and Navy forecasters, contract support, and applied NESDIS research scientists.

The program relies heavily on ensuring that training development activities meet training needs and that duplicity of efforts is minimized. Further, NESDIS ensures that satellite training materials receive a critical, multi-agency evaluation prior to being released for use.

Training workshops, audio-cassette tape-slide programs, video tape and videodisk production, training laboratory exercises, and creation of a satellite technical reference handbook and correspondence course round out the overall satellite training program.

Once developed, distribution of training materials remains a problem. The materials are sent to remote sites where they are added to existing training aids. There may not be a person designated as a training coordinator. Hence, materials may not reach the people intended, they may not be used correctly, or they may be misplaced. Efforts are being made to overcome this. Within the NWS, serious consideration is being given to creating a training position at forecast offices as part of the proposed NWS reorganization. This person would create and administer training in a broad range of programs, not just satellite imagery interpretation.

There are other shortfalls in interagency training coordination activities, especially as personnel involved in the program change. Budgetary constraints have impacted training efforts, as well. International activities have been especially hard hit due to compounding of constraints by a larger number of organizations and nations.

3. NEEDS ASSESSMENT
3.1 Coordination
Besides formal ITCWG meetings, ITCWG members routinely discuss training needs and activities. In 1986, early in the ITCWG's history, the Navy and Air Force learned about the development of Forecasting Handbook No. 6—Satellite Imagery Interpretation for Forecasters. This compendium of selected operational articles, technical memoranda, and other publications provided an unparalleled technical reference resource for field forecasters. Many of the articles included in the Handbook would not have been available at remote weather sites. The handbook was organized by topics (e.g., tropical weather, convection, aviation)
Fig. 1. Conceptual model of the "training universe." All six areas must be successfully addressed to have an effective training program.

and was printed in loose-leaf format for later updating. The Air Force and Navy both joined in the initial and subsequent reprintings of the Handbook.

In addition, NESDIS’ Training and Information Services Branch (TISB) coordinates closely with two NOAA International Relations Offices (NWS and NESDIS). Recently NWS’ International Relations Office determined, through discussions with southeast Asian Nations, that there was a need for a specialized Satellite Interpretation Handbook on tropical meteorology (not just tropical cyclones). NESDIS and NWS have already begun exploring options for preparing such a Handbook.

NESDIS is also in touch with various international organizations. The World Meteorological Organization (WMO) is very interested in training, but lacks sufficient fiscal resources to implement a major worldwide training program throughout all meteorological, hydrological, and oceanographic disciplines. However, they do provide insight into international training needs, sponsor or co-sponsor numerous workshops and courses, and help distribute some training materials. Other groups, such as the International Civil Aviation Organization (ICAO), have training offices throughout the world and encourage training and/or distribute or market training materials.

NESDIS also undertakes a major training workshop program. In addition to effecting training, these workshops provide unparalleled opportunities for NESDIS instructors to interact with practicing meteorologists and oceanographers. Thus, training development, as well as applied projects, can be more tailored to meet operational needs.

Some of the topics for which satellite interpretation training materials were needed in late 1987 included:

- moisture channel imagery
- imagery-in-motion
- techniques for assessing numerical model initial analysis accuracy
- oceanic cyclogenesis
- mesoscale analysis
- sea surface temperature analysis techniques

Although training materials, once developed, could be used throughout the world, there is always the need to tailor materials, especially case study laboratory exercises, to specific geographical areas.

3.2 Professional Society Involvement

The NWA has been an active supporter of meteorological training activities. In 1986, they republished a satellite imagery interpretation handbook (NWS Forecasting Handbook No. 6—Satellite Imagery Interpretation For Forecasters), and made it available, at low cost, throughout the meteorological community (Fig. 2). At least three universities have used the reprinted handbook as a textbook (selected readings) as part of various courses in instruments and/or synoptic meteorology. The NWA has also included two training focus sessions at each of its last three annual meetings, and in 1987 hosted the annual ITCWG meeting. Due to this commitment to training, the ITCWG agreed to tie all of its future meetings to the NWA Annual Conference and invite the Executive Director of NWA to participate.

The American Meteorological Society (AMS) is also taking a more active role in training. As part of the 1987 Annual AMS Weathercasters Conference, a special full-day forecasting workshop was held. More than 100 weathercasters attended. And dozens of weathercasters, and others, have benefited from a videotape/workbook program derived from the workshop. The AMS plans another such weathercasters workshop in 1988 focusing on satellite and radar applications.
3.3 Training Workshops

NESDIS carries out an extensive training workshop program in support of both domestic and international users of satellite imagery. Internationally, NESDIS has provided instructors and/or training support to workshops on tropical cyclones, precipitation, and agricultural assessments. Numerous scientists from other Nations have visited NESDIS laboratories to learn firsthand about satellite research and operational applications. However, due to personnel cutbacks, the one-on-one visitation program is being downplayed as a viable training option.

Domestically, NESDIS instructors teach workshops at NWS Forecast Offices, NWS National Centers, Air Force and Navy Bases, and at other selected sites. They also participate in teaching the flash flood course at the NWS Training Center.

During the three-year period 1985-1987, NESDIS instructors conducted nearly 90 training workshops in the U.S. and abroad, training almost 2400 people (Fig. 3). These workshops have addressed severe weather, mesoscale and synoptic scale meteorology, aviation and oceanography applications, and heavy rainfall. Figure 4 shows some of the workshops conducted during the period October 1986—September 1987 (FY87).

In addition, instructors at the Chanute AFB Weather School conduct workshops at many overseas sites in various weather topics, including satellite imagery interpretation. NESDIS has begun providing videotapes, slides, and transparencies to Chanute in support of these efforts. Recently, Air Weather Service Headquarters provided individual instructor copies of Forecasting Handbook No. 6 to Chanute Weather School. Workshops taught by Chanute Weather School instructors were not included in the workshop totals listed above.

4. CREATION AND PRODUCTION

The creation process involves coordinating with governmental developers, monitoring non-government contractor development, and pooling scarce governmental finances for training resources.
contracts. NESDIS' Training and Information Services Branch (TISB) has taken the lead in this area during the past two years.

Internal NESDIS coordination is primarily with the Physical Sciences and Regional and Mesoscale Meteorology Branches (both within the Office of Research and Applications). Additionally, there is close cooperation between TISB and the Satellite Services Division, part of the operational arm of NESDIS. Scientists and forecasters in these offices develop satellite interpretation applications, conduct training workshops and develop training materials or courseware.

TISB routinely coordinates with NWS National and Regional Headquarters, as well as with the National Meteorological Center (Hurricane, Severe Storms, and Operations Divisions), and the NWS Training Center. There is also frequent coordination with AWS Headquarters, The Air Force's Training Center at Chanute AFB, IL, and with various Air Force sites (e.g., Kennedy Space Center). Navy coordination is done primarily through the Naval Oceanography Command Facility at Bay St. Louis, MS.

There is also coordination, albeit limited, between TISB and the FAA Academy in Oklahoma City and with the Canadian Atmospheric Environment Service. These groups are being brought into the training effort more fully due to their growing involvement in the ITCWG.

While government employees and contractors create the training materials, it is primarily government personnel who are preparing the final products at this time. NWS and NESDIS worked together to organize, reconstruct, and publish NWS Forecasting Handbook No. 6 and its associated correspondence course. NESDIS rewrote and reorganized several contractor-developed training packages and laboratory exercises and is preparing final photography and layout/design. NESDIS has begun working with the AWS to transform audio-cassette tape-slide and videotape programs to videodisk. NWS and AWS are both exploring videodisk systems for use in remote site, self-study training.

The training development effort is being directed to ensure that materials will be suited for videodisk use in future years (Fig. 5). Step one currently involves creation of a script-slide program because it is the easiest to produce and modify, and because instructors can more easily use materials in slide format. Once completed, the program will be transformed into videotape, with addition of imagery in motion, where appropriate. From this step, interactive videodisk production follows, "relatively" easily.

Wherever possible, training, regardless of which step is being used, will be interactive and/or will involve hands-on laboratory experiences, and Handbook No. 6 as a reference source and correspondence course. This is based on extensive workshop evaluations and discussions with forecasters.

5. REVIEW PROCESS

It's one thing to produce a training package; it's quite another to complete it. During the development phase, several reviews
of a training package are often undertaken. In addition to verifying technical content and training effectiveness, reviews center on ensuring proper annotating, satellite image clarity and photographic contrast, and other audiovisual aspects.

Once the product is completed, a more formal review, involving as many as a dozen different groups, is in order. For example, a recently completed training program on basic polar orbiter image interpretation was sent to NWS and AWS Headquarters, the Navy, the NWS Alaska Region Headquarters, Chanute AFB, the FAA Academy, Johnson Space Center’s Space Flight Meteorology Group, and at least three NESDIS Branches not involved in the program’s original development. The goal is to ensure the most complete, most accurate training package possible. This will speed transformation to videotape/videodisk formats.

6. COORDINATION

Coordination never really ceases. There are always opportunities to reassess training needs, formats, and courseware content. ITCWG members discuss these and other topics routinely. Again, workshops provide opportunities for courseware to be "field-tested." Based on this feedback, materials may be changed prior to final production or they may be updated once in use.

7. FOLLOW-UP ACTIVITIES

Operational forecasters (meteorologists and oceanographers) eventually define the success of the training materials. They may alert their agency and/or ITCWG member about a newly developed technique or procedure, or a modification to an existing one. Perhaps, they’ll experience a significant weather event which provides valuable training information. In the case of NWS Forecasting Handbook No. 6, routine updating is planned, with removal of certain papers and addition of others. This will require changes to the satellite interpretation correspondence course. Regardless, the ITCWG members fully support updating to ensure the latest, most accurate information is available. It is recognized that updating is far superior to re-creation.

8. PRODUCTION AND DISTRIBUTION

Once developed, training materials must be produced and distributed by the various agencies. To date, each agency has paid for its own materials. However, through coordinated purchasing, agencies have saved large amounts of money over what individual printing costs would have been.

Distribution of training materials must also be considered. In some cases, it may be desirable to house copies of materials at a central site(s) and loan them to interested users, as needed. NESDIS’ Training and Information Services Branch (5200 Auth Road, Room 601, Camp Springs, MD 20746-301-763-8204) does this for intra-governmental loan of films and videotapes. NESDIS’ Satellite Data Services Division (5200 Auth Road, Room 101, Camp Springs, MD 20746-301-763-8111) provides film rental service for non-governmental users. The Air Force and Navy also have central distribution sites for videotape loan within their respective agencies. However, the preferred approach is to have copies of training materials resident at each forecast site for use by operational staff whenever they can find the time to use them.
Each agency currently maintains its own distribution lists and basically prints and/or reproduces its own training materials. However, due to coordination efforts, it is becoming rarer for one agency to produce and/or distribute a training program without others knowing about and being involved in it.

Distribution of technical reports and technical memoranda is needed to ensure proper interagency development of training materials. The ITCWG recently agreed to undertake a review of the present distribution lists for its technical and scientific publications. Each agency has agreed to update these lists.

9. OTHER TRAINING ASPECTS

There are still a great number of unsolved training issues before the ITCWG. These include:
- determining methods for purging old and outdated training materials,
- ensuring compatibility of training systems (e.g., videotape, videodisk, computer),
- providing the needed staffing and fiscal resources to keep developing and improving training materials,
- administering training programs at remote sites to ensure accomplishment of training,
- assessing the training requirements associated with new technology well before implementation, and ensuring that training is available prior to operational use of the systems,
- determining ways to publish and provide government developed training materials to non-government users at a time when "give-aways" are no longer permitted.

How these and similar issues are addressed will define the state of training in years to come.

Finally, let me restate that training doesn't just happen. It requires involvement, commitment and resources. Although the emphasis in this paper was on the governmental sector's involvement, Mark Shulman, past National Weather Association president, put it this way in his outgoing presidential address (3):

"... it is through education and training at the university and elsewhere that we (the meteorological, hydrological, and oceanographic community) will be able to meet the challenge of service to the public. The rigor of a thorough ... education ... must be maintained ... with an indepth comprehension of the physical principles underlying the profession ... the forecaster must be retrained to understand the capabilities and limitations of new observing systems and ... be able to use the (new and growing) wealth of data ..."

Through the ITCWG and its own agency's representatives, NESDIS, NWS, the Air Weather Service, the Navy, and the FAA have begun to realize this training goal. Further involvement and cooperation of others, such as the universities, professional societies, and other agencies, will certainly keep training in the spotlight and ensure that it serves the operational needs of forecasters throughout the world.

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NOTES AND REFERENCES

1. H. Michael Mogil serves as the Chief of the Training and Information Services Branch, Satellite Applications Laboratory, NOAA/NESDIS. Mr. Mogil has previously served within the National Weather Service in the Scientific Services Divisions for the NWS Southern and Eastern Region Headquarters. He has also served as the Deputy Meteorologist-in-Charge at the Weather Service Forecast Office in Fort Worth, Texas and as lead forecaster at San Francisco, California. Other experience includes the Warnings and Community Preparedness Branch at NWS headquarters, the National Meteorological Center, and the Severe Storms Forecast Center. He has been an on-air meteorologist for AM Weather. He has served on several AMS and NWA Committees, the Interagency Training Coordination Working Group and is a consulting editor of Weatherwise Magazine.
