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Northeast Reconnaissance Test Area

Rome Air Development Center (RADC), Griffiss AFB, New York, is developing a reconnaissance sensor system test and evaluation facility in the Northeast United States which emphasizes development of a simulated European reconnaissance environment.

Abstract: *A reconnaissance sensor system test and evaluation facility is being developed in the Northeastern United States by the Rome Air Development Center (RADC), Griffiss AFB, New York. Emphasis is being placed upon development of a simulated European reconnaissance environment, with applications encompassing equipment, personnel and procedural aspects of reconnaissance cycle test and evaluations. Components of the test area include areas and targets representing several theaters of interest, a military equipment display area, resolution targets, and a reconnaissance operations center. An engineering resolution target, comprising a semi-circular Siemans Star, Mil Std/50 A bar groups and grey scale and edge analysis panels, has been developed. The Siemans Star provides for line scan system measurements both along and across track regardless of aircraft heading. These components are complemented by a full range of related RADC reconnaissance support functions.*

Introduction

Since the mid 1960's, reconnaissance research and development had concentrated mainly on new sensors and exploitation techniques for applications in Southeast Asia to improve intelligence capabilities. Limited attention was given to possible temperate zone applications. It was apparent that in order to evaluate the effectiveness of reconnaissance research and development, a test facility responsive to the requirement for conducting realistic reconnaissance evaluations in a temperate zone environment should be developed. In response to this requirement the Rome Air Development Center in 1970 started a study to determine the feasibility of developing a reconnaissance test area in the Northeastern United States. The study resulted in the initiation of work to develop such a test area.

RADC and HRB-Singer, under Air Force contract, have now completed the initial development of the Northeast Test Area (NETA). The geographic area comprising the NETA is illustrated in Figure 1. The NETA is designed for multiagency, multisensor reconnaissance applications in a temperate zone environment in general, and for Europe in particular. This new capability overcomes limitations to realistic in-theater evaluations and lack of suitable environmental theater parallels at existing Continental United States (CONUS) test facilities. Components include areas and targets representing several theaters, and scenarios for several activity levels for these theaters. Related RADC functions of flight test services, ground truth activities, a multisensor imagery data base, an imagery processing laboratory, and imagery/sensor evaluation services support these components. A reconnaissance operations center, providing procedures for sensor evaluation exercises, has also been developed.

* This work was sponsored by the Air Force Systems Command's Rome Air Development Center, Griffiss AFB, New York. Presented at the Annual Convention of the American Society of Photogrammetry, Washington, D.C., March 1973. Mr. Rochford is with Singer, Mr. Butters and Cpt. Schwab are with the Rome Air Dev. Ctr., Griffiss AFB, N.Y. 13441.

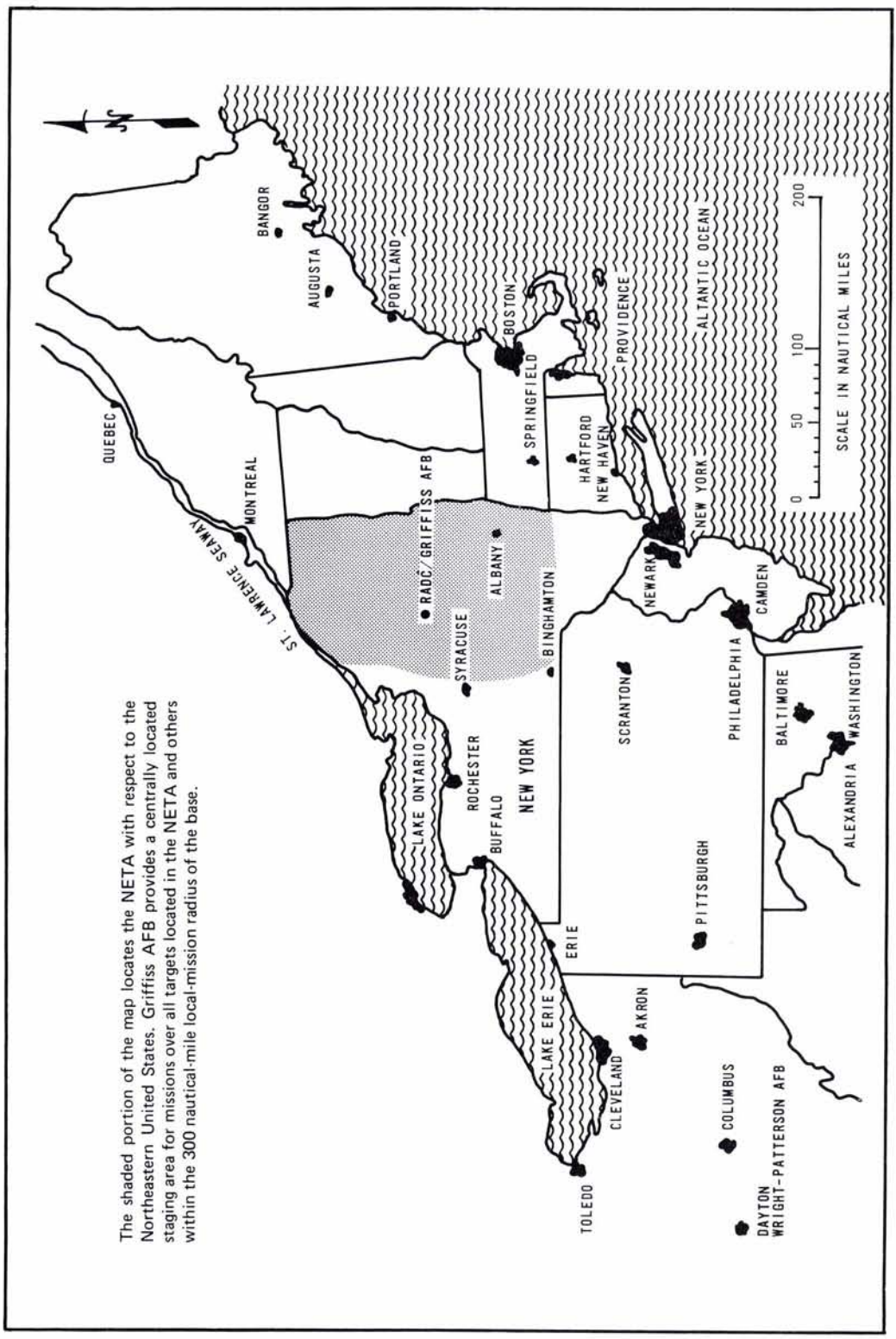


FIG. 1. Overall Northeast Test Area (NETA).

NETA-Europe Analogs

The establishment of a realistic test area included four areas of consideration: topography, climate, target types, and situations. Topographic and weather data on Central New York and Europe, obtained from several sources, was compared to determine if sufficient similarities existed. A detailed comparative map inspection was made to further compare topographic features. Closely matching topographic and climatic factors were discovered between Central New York and Central Europe.

Although not replicated on a one-for-one in-place basis, most significant military geography considerations, such as the major inland water transport system, plains and mountains, and soft and hardwood forests, are paralleled adequately in New York. There are dissimilarities in urban and rural cultural patterns but they are considered not to be detrimental. Comparison of weather data of interest to reconnaissance operations, i.e., cloud cover, precipitation and temperature, shows good agreement, with temperatures slightly more moderate in Europe, precipitation there being more in the form of rain than snow. For instance, average snow accumulation of 49″ per year in Albany, N.Y. contrasts with only 15.8″/year at Berlin. New York provides 6-7 good flying days per month while in Europe only three days per month can be counted on as acceptable for photo missions, on the average. Cloud ceilings in Central Europe are often about 2500-3000 feet, while in Central New York the average is about 5000 ft. Thus, sufficient analogies of European-like weather occur in Central New York, which has marginally better flying days and higher cloud ceilings.

Considering the potential applications of the NETA, required targets are conveniently grouped into industrial, communications, topographic, military, and engineering resolution categories.

Industrial targets abound in Central New York. Parallels are not met in all cases, however, with small plants located inside towns being characteristic of much European industry. Often in Europe parking facilities are lacking, raw materials are likely brought in via waterways, and cooling is by venturi towers rather than fan batteries. Differences as they effect sensor signatures can be significant.

Communications facilities in Europe range from archaic to ultra-modern. Examples of road, rail, inland water transport, bridge, and ferry sites are adequate in New York, as are electronic communications sites and facilities.

Topographic targets including beach landing areas, drop zones, helicopter and vertical/short take-off and landing (V/STOL) sites, bivouac areas and river crossing sites are all represented within Central New York. The simulation with Europe is adequate.

The lack of military targets was the most difficult to overcome. While some installations exist, there is a marked paucity of military units and equipments in Central New York. To overcome this deficiency, a military equipment display area (MEDA) was created.

Engineering resolution targets are considered an integral part of any reconnaissance test area and have been provided for photography, infrared, and side-looking radar systems.

Situations have to be created artificially through scenarios. Development of situations has started on a building block basis, permitting flexible application depending on such constraints as to the amount of detail required for an evaluation, the portion of a system being tested (sensor only or entire airborne platform), length of exercise, and number of supporting activities required.

The following discussion presents additional detail on the development of test area components.

Test Area Component Development

MAJOR TARGET GROUPS. Four major target groups have been developed and documented in the NETA for use in sensor evaluations. These comprise tactical, strategic, military equipment and engineering resolution arrays.

TACTICAL TARGETS. Seventy New York State target sites, representative of tactical target categories, have been selected and documented. These were chosen out of hundreds of examples which exist in New York, over 200 of which were surveyed in detail prior to final selection. Figure 2 illustrates but six of these target types.

STRATEGIC TARGETS. Many of these tactical targets used in NETA reconnaissance evaluations are also useable within a strategic target study context. In addition to those targets which may serve both roles, many others of a purely strategic nature exist in the NETA. These include:

- INDUSTRIAL
- MILITARY
- TRANSPORTATION
- RESEARCH AND DEVELOPMENT

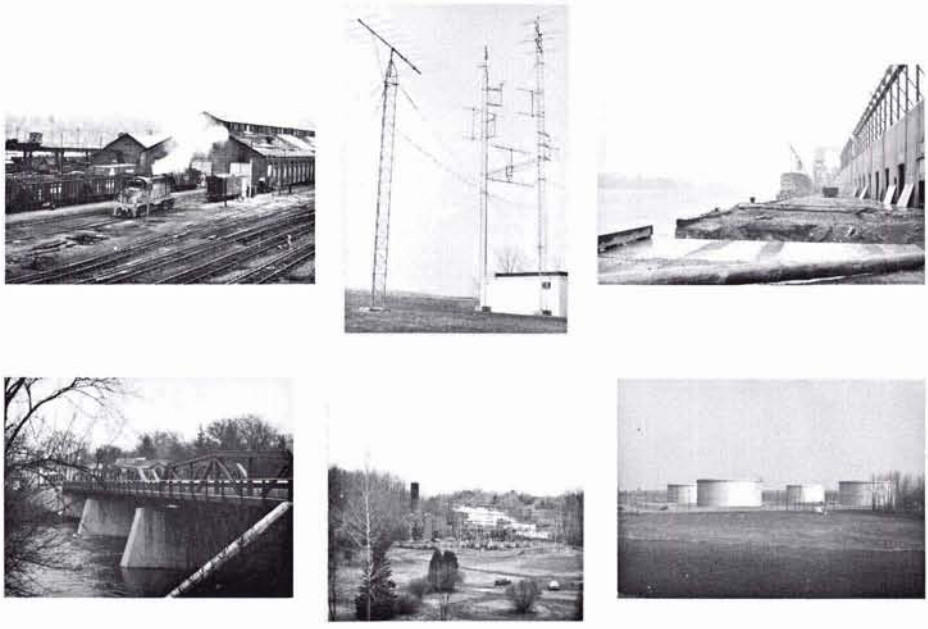


FIG. 2. Representative NETA tactical target category analogs: (*top left*) rail repair facility, (*top center*) communications site, (*top right*) river port, (*bottom left*) bridge, (*bottom center*) hydroelectric power, (*bottom right*) POL storage.

Figure 3 is representative of the strategic target types within the NETA available for reconnaissance related evaluations. Some of these also serve as tactical targets and are fully documented, while others are simply cataloged for future use.

MILITARY EQUIPMENT TARGETS. To complement the existing tactical and strategic target types within the NETA, a military equipment display area (MEDA) has been developed. Using an RADC test annex to provide a tactical setting, realistic military family groups have been deployed at a 500 acre site 25 miles southwest of Griffiss AFB. The groups currently deployed include the following:

- Surface-to-air Missile Site
- Surface-to-surface Missile Site
- Anti-aircraft Artillery
- Heavy Artillery Battery
- Mortar Platoon
- Armored Group
- Assault Engineer Group
- Ground Defensive Position—Minefield, barbed wire, trench system
- Tactical Headquarters
- Motor Convoy
- Supply Point

These groups include demilitarized but functional guns, vehicles and tanks which can be maneuvered to represent the activities of operational tactical units. Each group is composed of only key equipments, the identification of which would serve to identify the unit function. Two portable resolution panel groups are included. A V/STOL site is scheduled as a future addition to these target groups.

ENGINEERING RESOLUTION TARGET ARRAYS. Three distinct resolution target arrays are available to provide NETA users with a capability to accurately determine photo, IR and SLR system performance. These include a combination photo and IR target, a functional jeep array for radar signature analysis, and groups of radar corner reflectors and Lunenberg lenses. The jeeps and the reflectors are currently deployed at RADC test sites and can be configured in any required pattern. In addition to the principal photo/IR target mentioned above, two sets of portable panels are available for deployment at the MEDA site. These comprise a series of grey scales and a series of bar groups, both painted on metal sheets.

The photo/IR target is painted on a 100

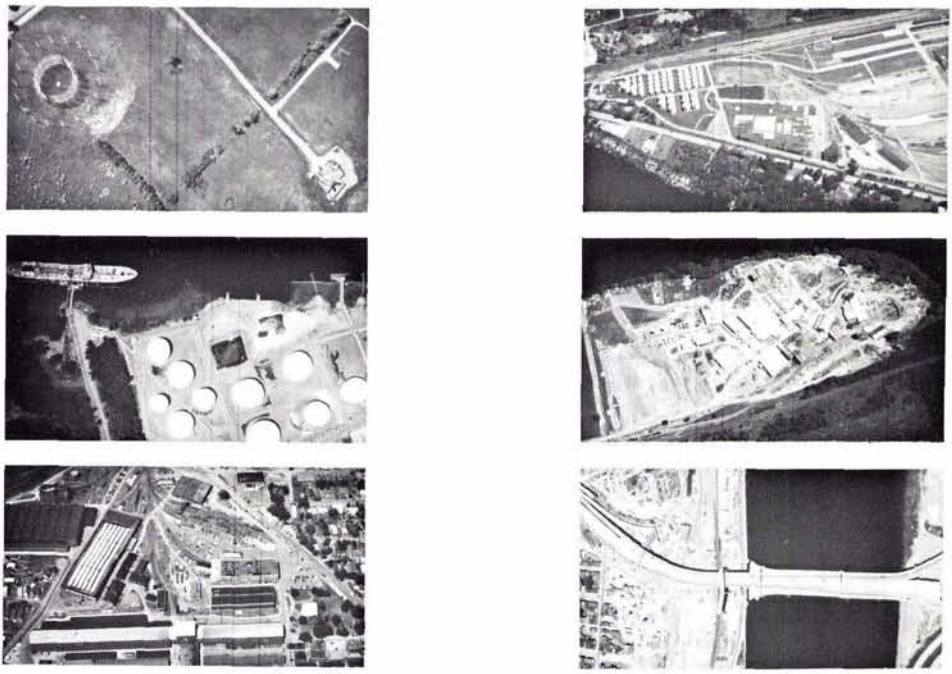


FIG. 3. Representative NETA strategic target types: (*top left*) electronics, (*top right*) material storage, (*center left*) inland river/sea port, (*center right*) chemical plant, (*bottom left*) arsenal, (*bottom right*) major bridge.

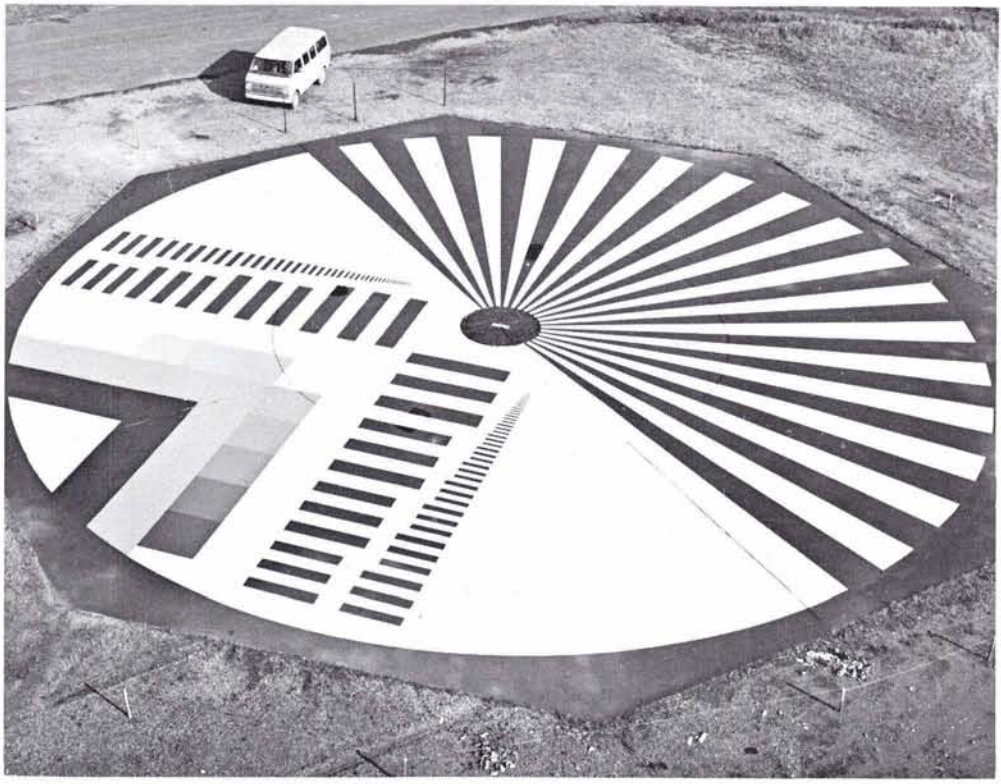
ft. diameter concrete slab at the RADC Floyd test annex, approximately five miles southeast of Griffiss AFB. Figure 4 shows a view of this target and pertinent specifications. Originally developed as a study aid, the target has been used operationally to check system performance for many months.

The Siemans Star semicircle permits direct line scan system spatial resolution measurement, both along and across track, regardless of aircraft heading. The necessity of correcting data read from a bar group if scanned at other than right angles is thus avoided. The bar groups themselves are aligned parallel and perpendicular to the main runway at Griffiss AFB to facilitate overflight orientation during target checks. The bars are based on the fourth root of two in a modified Mil Std 150A configuration.

That the Siemans Star provides greater sensitivity than the bar groups was demonstrated during a recent IR system check. Imagery analysis showed a 1.0 mil resolution according to Siemans Star readings while even the largest 10 ft. × 2 ft. bar group spaces were not discernible, due primarily to aircraft heading. Future additions to the target will include an IR target panel group of various materials and a color test panel group. Contrast values and reflectance values of the existing target elements continue to change with time. Current readings can be provided upon request.

TARGET FILES. Detailed information about each NETA and MEDA target has been collected and placed in a target folder. Each folder contains a Base Pack and a Sensor Pack. The Base Pack contains large and small scale annotated maps, photographic and textual ground truth, and large and small scale photography including annotated prints and stereograms. Often blueprints, sketches, or diagrams of the target are also available. For the MEDA targets, survey locational data for each item of equipment is available to an accuracy of 0.1 ft. The Sensor Pack contains photo, IR, SLR, and, when available, other sensor imagery of the target. New information, including aerial and ground photography, is added to the folders as it becomes available. In addition to this information, RADC maintains a comprehensive data base of multisensor imagery, reports, and other information relative to the NETA targets.

Most of the materials are mounted on heavy stock and can accompany the user in



Dimensional Data

Octagon (overall)
- Flat side length: 41 ft.
- Inner circle radius: 4 ft.
- Outer circle radius: 47 ft.

Siemans Star (semicircle)
- 5-degree spokes/18 per quadrant, alternating black and white.
- Length from inner circle to black periphery: 43 ft.
- Inner chord: 4.18 in. at 4 ft. radius
- Outer chord: 4 ft. 1.18 in. at 47 ft. radius

Three-bar groups
- Spacing between groups is equal to next larger group bar width
- Largest group: 10 ft. × 2 ft.
- Smallest group: 7.5 in. × 1.5 in.

Grey scale chevron
- Ten panels in 2 groups of 5 at right angles
- Each panel: 5 ft. square

Reflectance Data°

Grey scale chevron: 6,8,10,12,14/18,20,24,32, and 48%
Grey neutral density chevron: 16%
Black edge analysis chevron: 4%
Three-bar target group: black 4%, white: 64%

°Nominal values; current data available upon request

FIG. 4. NETA photo and IR resolution array.

the aircraft or on the ground. The folders can be used in preparing briefings, catalogs, or reports after the mission. They serve as useful tools in imagery evaluation, and for target signature studies.

Related Support Capabilities

In addressing the overall NETA development plan, a principal consideration addressed was that of resources currently available versus resources which would have to be acquired or developed.

The feasibility of establishing the NETA in Central New York was considered within the context of the total resources required to evaluate all elements of a reconnaissance cycle, from the user requirement, through an operations center, to the flying organization, through photo processing, image interpretation and finally receipt of the interpretation report by the user.

Due to the availability of resources at RADC, acquisition, development, and implementation problems were simplified. Already in existence were extensive related support capabilities. RADC has an established reconnaissance R & D laboratory. The reconnaissance imagery data base has available for comparison purposes approximately 370,000 ft. of reconnaissance imagery from more than 100 different sensors. The data base also has approximately 3400 reconnaissance related documents available. The reconnaissance imagery processing laboratory has a complete aerial reconnaissance capability including specialized equipment such as color Versamats. A reconnaissance operations center coordinates mission requests with available resources. Experienced imagery and systems evaluation personnel are available, as well as elaborate exploitation equipment. A ground truth capability is also available for collection of required collateral information. Radar tracking and guidance capabilities for reconnaissance aircraft can be provided RADC also has a flight test capability of four C-131 aircraft with varied reconnaissance capabilities. In addition, Griffiss Air Force Base is capable of handling most reconnaissance aircraft in terms of routine aircraft support.

The availability of these resources at RADC and Griffiss AFB strongly influenced the choice of Central New York as the NETA location. Close proximity to Griffiss was considered a prime advantage.

NETA Applications

The utility of the NETA is limited only to the imagination of its users. Developed, however, for sensor evaluations in a temperate climate, this application remains primary. A reconnaissance sensor must function at the optimum in its designed use environment, ideally also functioning at optimum or near optimum in other or diverse environments. Prior to the NETA, however, no concerted effort existed for temperate climate sensor evaluation. The paramount demands of Southeast Asia in recent years had been justifiably of primary concern in sensor evaluations. For such evaluations, the Underbrush Test Range at Eglin AFB, Florida, designed to simulate that environment, was extensively utilized and proved to be of immeasurable value. Temperate climate target analogs, specifically European theater targets, by their very nature are far more complex than those of Southeast Asia. With four distinct seasonal variations, highly developed industrial complexes and extensive lines of communication, the NETA complex represents a natural choice for a wide variety of applications.

Sensor evaluation programs can be designed and developed as desired by the user. Such programs can be as simple as target coverage with a particular sensor at a given time, heading and altitude, to complex long term sensor or target studies incorporating comprehensive statistical analyses. Individual target types or target families may be studied in detail for particular signatures, i.e., key returns to analyze when interpreting infrared imagery of specific targets.

With the available support facilities previously detailed, comprehensive reconnaissance cycle evaluations also can be easily performed. Such studies become particularly appropriate when dealing with sensors having unique characteristics, i.e., the long image formats of the newer panoramic sensors.

Aircrew and navigation training can be effectively carried out in the NETA. With relatively unrestricted air space and preplanned routes, many navigational situations can be developed. The MEDA also provides a unique opportunity for the extremely important aircrew visual reconnaissance training. These target display areas have been designed to incorporate those subtle, but all-important, signature changes which are key elements in visual reconnaissance.

At the present time there are a significant number of studies being conducted within the military community on the value of color vs. black-and-white imagery. The extensive

ground truth data on NETA targets, coupled with natural climatic and weather variations suggest that the NETA should further serve as an operational test bed for these all important studies.

The MEDA also allows for such varied applications as minefield detection, intrusion detection, and ground photogrammetry studies.

While NETA developments have not been directed toward nonmilitary uses of the test area, some rather timely and appropriate applications, such as pollution, transportation and urban analysis studies, could be undertaken. Military applications of LOC (line of communication) monitoring have already been accomplished in the NETA with encouraging results.

Notice to Contributors

1. Manuscripts should be typed, double-spaced on $8\frac{1}{2} \times 11$ or $8 \times 10\frac{1}{2}$ white bond, on *one* side only. References, footnotes, captions—everything should be double-spaced. Margins should be $1\frac{1}{2}$ inches.
2. Ordinarily *two* copies of the manuscript and two sets of illustrations should be submitted where the second set of illustrations need not be prime quality; EXCEPT that *five* copies of papers on Remote Sensing and Photointerpretation are needed, all with prime quality illustrations to facilitate the review process.
3. Each article should include an abstract, which is a *digest* of the article. An abstract should be 100 to 150 words in length.
4. Tables should be designed to fit into a width no more than five inches.
5. Illustrations should not be more than twice the final print size: *glossy* prints of photos should be submitted. Lettering should be neat, and designed for the reduction anticipated. Please include a separate list of captions.
6. Formulas should be expressed as simply as possible, keeping in mind the difficulties and limitations encountered in setting type.