

*John
Teuber*

August 30, 1962

Miss Mary L. Koval
Directorate of Chemical Sciences
Office of Aerospace Research
United States Air Force
Washington 25, D. C.

Dear Miss Koval:

In answer to your letter of August 28 regarding information on the recent Newsletter item on new techniques in archaeology, I am enclosing a copy of a paper which was delivered by Miss Ralph at Fort Belvoir last spring. I hope this will give you the information you desire.

Sincerely yours,

Mrs. John Dellevigne, Jr.
Secretary to Dr. Rainey

HEADQUARTERS
AIR FORCE OFFICE OF SCIENTIFIC RESEARCH
OFFICE OF AEROSPACE RESEARCH
UNITED STATES AIR FORCE
WASHINGTON 25, D. C.



28 August 1962

REPLY TO
ATTN OF:

SUBJECT:

TO:
University of Pennsylvania
University Museum
33rd and Spruce Street,
Philadelphia 4, Pa.

*send copy
of paper*

Dear Sir:

Reference news item published in August issue of Newsletter,
titled "Modern Instruments Help Archaeologists." Please send
additional information on this article.

Sincerely

A handwritten signature in cursive script that reads "Mary L. Koval".

Mary L. Koval
Directorate of Chemical Sciences

DEPARTMENT OF THE AIR FORCE
HEADQUARTERS AIR FORCE CAMBRIDGE RESEARCH LABORATORIES (OAR)
LAURENCE G. HANSCOM FIELD, BEDFORD, MASSACHUSETTS 01730



REPLY TO
ATTN OF: CR/FT

23 December 1956

SUBJECT: Information on Different Film-Filter Combinations

TO: Mr. Julian W. Whittlesey, FAIA
31 Union Square
New York, New York 10003

W Williams
617-274-6100
ext 3670

Dear Mr. Whittlesey:

Branch Chief
861-4441
3670

Here is the information on various film-filter combinations that will be useful to you. I have also enclosed some Kodak information on emulsion-type film.

Since the first use of such film-filter combinations for the Greek site will probably be by a U.S. Air Force officer (Capt. Bryant), a standard press camera (4"X5" back), utilizing cut film, would probably be the best camera to use.

<u>FILM TYPE</u>	<u>FILTERS AND COMMENTS</u>
Pan black & white	Up to 5,000' use a WRATTEN K-1 or K-2 filter. Above 5,000' use a minus blue filter (WRATTEN 12).
Tri-X black & white	Same as above.
IR black & white (5424)	Use a WRATTEN 25 filter.
UV (IR black & white - 5424)	Use a WRATTEN 13A filter.
CD (Color IR - 8443)	Use a WRATTEN 12 filter plus any emulsion balance filters that may come in film package.
Color (8442)	Use Kodak HF-3 haze filter.
Color (80-282)	Use a WRATTEN 1A (Skylight filter).

I trust this information will prove helpful. If you need any additional information or advice please don't hesitate to contact me. Best wishes on the continued success of your project(s).

Very warmest regards,

Richard S. Williams Jr.

1st Lt. (Dr.) Richard S. Williams, Jr., USAF
Geologist
Geotechnics Branch, Terrestrial Sciences Laboratory

1 Atch

DEPARTMENT OF THE AIR FORCE
HEADQUARTERS AIR FORCE CAMBRIDGE RESEARCH LABORATORIES (OAR)
LAURENCE G. HANSCOM FIELD, BEDFORD, MASSACHUSETTS 01730



REPLY TO
ATTN OF: CRJT

15 February 1967

SUBJECT: Aerial Survey of the Crati and Sirii Areas, Italy

TO: Prof. Froelich Rainey
The University Museum
University of Pennsylvania
Thirty-Third and Spruce Streets
Philadelphia, Pennsylvania 19104

Dear Prof. Rainey

I am delighted to receive news of the planned aerial resurvey of the Crati River Plain and the aerial survey of the Sirii area. I trust that this letter will answer the several questions set forth in your letter of 11 February 1967.

Infrared (IR), Black and White film (Type 5424) should be ordered from Kodak in Rochester, New York. 24x24 cm. film produces the same size prints as the conventional aerial photographs that we took over the Crati River Plain last June. The size is the standard 9½" x 9½" aerial photograph used in geologic and other mapping programs. The film should be used with a Wratten No. 25 filter, also available from Kodak.

IR film can be developed prematurely (fogged) by exposure to high temperatures. It should normally be stored at temperatures less than 55°F. Above this temperature the film may get fogged -- the higher the temperature the worse the problem gets. It should be o.k. even at 70°F., however, so I don't think you'll have any problem during the Spring when it is shipped to Italy. Make certain it is kept in a cool, dry environment wherever possible; i.e., don't leave next to a radiator, etc.

I am enclosing a map of the Crati River Plain, Italy, with information necessary to accomplish the aerial survey of this area. (If you have a replacement map, please send one to me as I need another for our project work). Our aerial photographer, S/Sgt. Roland E. Hudson assisted me in plotting the survey information.

I am assuming that a standard aerial cartographic camera will be used, judging from the film size requested. The following information pertains to such a camera with a 6 in. (152.6 mm.) focal length, using 9½" x 9½" (24 cm. x 24 cm.) film.

*Altogether
10 A.M.
2 P.M.
4 hours
Crati*

*250
500*

*At 10
more higher
F 16*

*rather
25
filter*

The aircraft should be flown at 5,550 feet (1,700 meters) above mean sea level. The 20 flight lines will give the standard 40% side lap for complete coverage at this altitude, hence the flight lines are approximately 5,000 feet (1,500 meters) apart. To achieve stereoscopic coverage, which is strongly recommended, a picture should be taken every 3,330 feet (1,015 meters) along the flight lines. This will give 60% overlap of successive pictures. For the area delineated and the length of the flight line this would require 575 exposures. Adding 2 blanks before and after each flight line would add 40 more exposures for a total of 615 exposures.

Aerial photographic film (9½ in. width) can be obtained in 370 foot rolls, thus 430 exposures can be recorded on each roll. Counting film threading and missed flight lines, 2 rolls of 370 feet long, IR, Black and White, 5424 film would be required to do the Crati River Plain. As you suggested, twice this amount (if the Sirii area is of comparable size) -- or 4 rolls -- would be sufficient.

TOTAL
7
Rolls

The above information should be all Adamesteanu needs for mission planning purposes. If you need any additional assistance please don't hesitate to give me a call.

Very warmest regards

Richie

1st Lt. (Dr.) Richard S. Williams, Jr., USAF
Geologist, Geotechnics Branch
Terrestrial Sciences Laboratory

Atch
1 Map

Cost ~ \$180.00 per roll (3/14/67)

UNITED STATES
AIR FORCE

5 October 1967

Me
Techniques

1st Lt. (Dr.) Richard S. Williams, USAF
Geologist
Geotechnics Branch, Terrestrial Sciences Laboratory
AFCL
Hanscom Field
Bedford, Massachusetts

Dear Richie:

I greatly appreciate your note of this summer regarding the Camouflage Detection etc. report for which I have written to Naval Reconnaissance as per the enclosed. I also appreciate the feature release of your flight over Surtsey in Iceland.

This letter is to report on our infrared attempts in Greece on an archaeological site. They were fraught with difficulties. I enclose the films and prints for all but one exposure.

We chose two areas to cover. On discovering that the exposure time for IR 135 film with Wratten 18A filter was likely to be of some duration, we could not use the balloon or air-foil suspension because of movement. Consequently the Nikon was suspended from the Bipod which held the camera some 5 m. above the ground. The available coverage accordingly was but about 6 x 4 m. This is shown on the enclosed print marked A. This was a record photo of the area taken with +X film 2½ x 3½, exposure 1 (film enclosed).

The foregoing photo was taken for reference purposes to compare results on +X film with those on IR 135 over the same area with Wratten 18A filter.

Print B from 35 mm film #14 (filmstrip enclosed) is the IR exposure which showed least movement of the camera. It covers but a small portion of the area as marked on print A in black grease crayon. The reason for such small IR area is that the Wratten 18A filter had been shattered.

Print C, taken from IR 35 mm film IA (filmstrip enclosed) covers a slightly larger area by having assembled two pieces of the shattered filter and mounting same over the lens. The area covered may be identified on print A by reference to the boulder lying more or less centrally on the ground.

Print D from IR 35 mm film 4A (filmstrip enclosed) covers an area comparable in size to that of print C east of the above mentioned boulder which may be seen at the top edge of this print.

The best IR exposures were gotten with exposures of one or two minutes with f/16 aperture. I chose to print not necessarily the best exposure depending upon whether there was evidence of camera movement. This is apparent by the double images in print D.

To our untutored eyes we see little or no difference between the IR films and the +X films in the same area. The area does contain limestone conglomerate stone blocks protruding from the surface and without question other blocks or fragments of blocks lying below it. Such a protruding wall block may be seen in the upper right hand corner of print A near the south foot of the Bipod. The Bipod lies across the axis of what is undoubtedly a buried ancient wall remains of conglomerate limestone blocks. The ground here has lain undisturbed for centuries, being in an old olive grove. Shadows of the nearby olive tree are apparent.

To our eye the IR exposure on the naked limestone above and protruding from the ground seemed quite the same as those on the +X film. Nor do we discern meaningful differences elsewhere between the films. Perhaps interpretation such as you may provide will show some significance. It is true that we cannot guarantee remains lying below and close to the surface. However there is every likelihood that they are there. This is why we chose this particular spot.

We also took an IR exposure through the shattered filter over an area certainly having no remains below it. I do not have the film for this area as I dictate this letter but hope to find an enclose it on mailing, in which case it will be referred to in a handwritten PS. I have, however, examined that film carefully and it too provides a normal image of all features on the ground such as leaves, twigs, pebbles and their shadows and the bare earth itself.

I trust that you find some significance to this coverage. Certainly you will recommend trying again. We were unable to secure an IR exposure with the Wratten 25 filter at a time when the ground had dew upon it. There were many such opportunities early in the season of which we were not prepared to take advantage at that time. This must follow next year.

I trust the questions raised in this letter will not burden you too much and that I may have a reply in due course by letter or phone. I would be glad to call you at any time you suggest.

Finally, Professor Jameson and Dr. Rainey ask me whether we should renew our attempts to make a coverage with the IR Scanner. The question here is whether this is sufficiently promising to warrant the considerable effort required to

secure the use of the Scanner from the Air Force and muster and pay for the cooperation required from a research firm such as Texas Instruments Inc. Perhaps you would care to comment on that. As of last spring you were inclined to put more hopes on the relatively simple IR coverage to reveal limestone traces with the Wratten 18A filter or reveal radiation effects upon ground dew with the Wratten 25. I wonder how you stand on this matter now and whether you consider this summer's fragmentary attempts of any significance.

Sincerely,

Julian H. Whittlesey

JHW:AH

cc: Dr. Froelich Rainey
Dr. Michael Jameson

P.S. We developed the films at the site in Greece according to Kodak instructions for that film.

The fragments of the filter were matched and masked and mounted flat over the lens in the normal filter plane. The sun's image sighted through the filter fragments appeared exactly the same as the sun's image when seen through the filter prior to fracture.

Techniques

December 15, 1967

Office O. C. R. D.
Attn: C. R. D. P. E. S.
Attn: Dr. J. I. Bryant
Department of the Army
Washington, D. C. 20310

Dear Dr. Bryant:

Following our telephone conversation, I am enclosing a set of our newsletters on archaeological techniques, which I am sure will show you what we are doing here.

You mentioned some Army center involved in geophysical and other prospecting techniques, and I would be very happy to get in touch with them if you could let me know to whom I should write. Our cesium magnetometer has been utilized by the Army; our two-man submarine, the "Asherah" has been used by the Navy; and we have been carrying on some research in remote sensing with the Air Force. So, I feel sure it would be mutually useful to get in touch with the Army, where these prospecting devices are being explored. Our main business here, is to adapt new techniques in the archaeological field. But our experience for the last five or six years shows that our experiments and adaptations are useful to others. For example, investigations with side-scanning sonar, carried out off the coast of Turkey in one of our undersea operations, are certainly going to be useful to the Navy.

We look forward to keeping in touch with you,

Most sincerely,

Froelich Rainey
Director

FGR/vg

Techniques

April 17, 1969

Dear Richard:

Attached is a letter from Emil Haury which as you will see, explains that some photos of the Snaketown site are missing. Perhaps they were not taken, but if they were taken, do you think that you could find them and send them on to Haury?

John Corbett at the National Park Service tells me that he has found somebody in Washington interested in working on the interpretation of films taken over Snaketown and Casa Grande--and so, if you can get the rest of these pictures to us (that is, the camouflage, infrared, and so forth) I will see what John can do about them. Perhaps we can get his interpreters together with you and also with Emil, who knows those sites better than anybody else. I am most anxious to see if we can get some results from these experiments we have carried out so that we can plan further experiments in this line.

All the best,

Froelich Rainey
Director

Lt. Richard S. Williams
Geologist, USAF
Geotechnics Branch, Terrestrial Sciences Lab.
AFCRL, Hanscom Field
New Bedford, Massachusetts

FR/j
Encl

April 11, 1969

Dear John:

Thanks for yours of March 28 regarding our experiment with aerial photography. Certainly I remember the Itek firm, because we used their 9-lense camera in our first Sybaris experiment. By all means, if you can get them to study the material from Arizona, we should go ahead because I don't think we have yet hit upon a good method for interpreting such experiments. Richard Williams, as you remember, assured me he would have prints of the far-out stuff within about a month, so if you can set this business up with Itek after July 1st I would be all for it.

FGR
Reamides → I have just heard from Emil also, and he agrees that your Itek possibility should be pursued. In the meantime, I will write Richard again and urge him to get the color infrared and the other material to you as soon as possible.

Sincerely,

Froelich Rainey
Director

Mr. John M. Corbett
Chief Archaeologist
National Park Service
Office of Archaeology and Historic Preservation
801 19th Street, N. W.
Washington, D. C. 20006

FR/j



UNITED STATES
DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE
OFFICE OF ARCHEOLOGY AND HISTORIC PRESERVATION

IN REPLY REFER TO:

801 19TH STREET, N. W.
WASHINGTON, D. C. 20006

MAR 28 1969

Dr. Froelich Rainey, Director
The University Museum
University of Pennsylvania
Thirty-Third and Spruce Streets
Philadelphia, Pennsylvania 19104

Dear Fro:

Thank you for your letter of March 20th to Mr. Bradley, my assistant who had written you on my behalf during my recent absence. I am glad the pictures turned up after all and had not disappeared somewhere into outer space with NASA.

You may remember the firm called ITEK which did an aerial recon for us on part of the Missouri Basin plus a photo-interpretation of the sites. I think you borrowed the study for a while. They are located across the river in Alexandria. After I get the pictures, I thought I might show them to ITEK and ask them for an estimate of a photo-interpretive study.

We do not have funds available for such a study, the rest of this fiscal year (through June 30) but might have some after July 1, or we might be able to raise a grant outside the Government. Would you be willing for me to pursue this thought?

I could also explore the possibility of the Geological Survey doing such a study - maybe on a reimbursable basis. They have a photo-interpretive division here in Washington.

I am anxious to see the pictures since I firmly believe that someday, somebody will develop a sensor, or sensors which will be of great help to archeology.

Sincerely yours,

John M. Corbett
Chief Archeologist

Techniques

DEPARTMENT OF THE AIR FORCE
HEADQUARTERS AIR FORCE CAMBRIDGE RESEARCH LABORATORIES (OAR)
LAURENCE G. HANSCOM FIELD, BEDFORD, MASSACHUSETTS 01730



REPLY TO
ATTN OF:

CRJT/Dr. Williams

15 September 1969

SUBJECT:

Color, Color Infrared, Plus-X, and Infrared Aerial Photography
of Snaketown and Casa Grande, Arizona

TO:

Prof. Froelich Rainey, Director
The University Museum
University of Pennsylvania
Thirty-Third and Spruce Streets
Philadelphia, Pennsylvania 19104

Dear Prof. Rainey

Under separate cover I have forwarded to you today eight (8) rolls of ektachrome aero (Kodak 8442), ektachrome infrared aero (Kodak 8443), Plus-X aerographic (Kodak 5401), and infrared aerographic (Kodak 5424) aerial photography of Casa Grande and Snaketown, Arizona. This aerial photography represents two (2) sets (4 rolls to a set) of the Casa Grande and Snaketown sites. The Plus-X and infrared aerial photography is in the form of negatives; the color and color IR is in the form of positive transparencies. Adjacent frames provide for stereoscopic viewing on a 9 in. x 9 in. format.

I regret the delay in forwarding this aerial photography to you, but trust it will be of use to you and Prof. Haury at the University of Arizona. As you know, if you need any further information about or require assistance in the analysis of the aerial photography I would be glad to lend a hand. I have also forwarded a duplicate set to my colleague on the U.S. Geological Survey, Dr. Jules D. Friedman. It is likely that he will contact the National Park Service about the coverage of the Casa Grande site.

I trust your various expeditions have been as successful as the quest for Sybaris. I would enjoy hearing about your latest adventures upon your return.

By the way, if any of the aerial data is used in subsequent publications I would appreciate an acknowledgement as to the source of the data: Terrestrial Sciences Laboratory of Air Force Cambridge Research Laboratories. I would also like at least two copies of any reports for our records.

Very warmest regards

Richee

RICHARD S. WILLIAMS, JR.
Chief, Geotechnics Branch
Terrestrial Sciences Laboratory

Cy to: J. D. Friedman

No record of receipt

WILLIAMS (U.S.A.F.)

October 24, 1969

Dear Richie:

I had your letter of September 15 upon my return from the Mediterranean and now am just checking up to find that those eight rolls of film on the Casa Grande and Snaketown jobs just does not seem to have arrived here. ~~Will~~ you actually send them around the 15th, because if so, we are going to have to run them down somewhere.

Also, I have a letter from John Hampton in England who is inquiring about various kinds of aerial photography for archaeology and since they have a regular aerial photographic service for archaeology in England, I am proposing to him that we try an experiment in England with him, where we have a lot of known sites and a good deal of experience interpreting aerial photographs. If this sounds interesting to him, then I shall make some more proposals to you and to the Eros people at the Department of Interior about trying such an experiment with multispectral photography. Fischer at the Interior Department had urged me to do some more experimental work in this line, but I have never hit upon a very good proposition. This English thing might serve the purpose, and I will certainly let you know if it works out.

After all, we did find Sybaris primarily with the cesium magnetometer and the drills, and I am sending you my final report written for the American Journal of Archaeology. Orville Bullitt has also written a popular book about this search, called The Search for Sybaris published by Lippincott, and I am sure that would amuse you.

By all means, any reports we get out on this aerial experiment business will be acknowledged to the Terrestrial Sciences Laboratory, and you will certainly get copies of the reports. I am not sure just how to handle the Casa Grande and Snaketown material. When I get those films, I

Lt. Richard S. Williams, Jr.
Page 2
October 24, 1969

will immediately send a copy to Emil Haury and ask him to make some sort of study of this, perhaps with you. Emil is certainly the one to go over that material because he is the only one who thoroughly knows the site of Snaketown and we should get someone else to look at the Casa Grande material.

All the best.

As ever,

Froelich Rainey
Director

Lt. Richard S. Williams, Jr.
Chief, Geotechnics Branch
Terrestrial Sciences Laboratory
Hanscom Field
Bedford, Massachusetts 01730

FR/j

AseA

Ramenbeck

January 9, 1962

Mr. Stephen E. Dwornik
Mine Detection Branch
U. S. Army Engineer Research and
Development Laboratories
Fort Belvoir, Virginia

Dear Mr. Dwornik:

Sorry about the delay in getting in my abstract on the paper for the meetings on March 19 and 20 in Fort Belvoir, but I have been away from the office. I hope it is not too late.

Most sincerely,

Froelich G. Rainey
Director

FR:ad

Abstract of Paper to B. Crow at Fort Belvoir
Mar-19-20-62

NEW INSTRUMENTATION TECHNIQUES IN ARCHAEOLOGY

The University Museum in Philadelphia has recently established the Applied Science Center for Archaeology and one task of this Center is to develop new instruments for underground exploration in Archaeology. Four types of instruments are now being used in field tests in Central America, the Southwest, Iran, Turkey, and Italy. The most extensive testing of these instruments was carried out in Italy during the Fall of 1961.

Three instruments, a German manufactured resistance apparatus, a Proton-Magnetometer produced in Oxford, and an American-made seismic instrument, were utilized to locate Etruscan tombs north of Rome at Tarquinia and Chervetri. Also the same instruments were used to locate a long buried wall on the plain of Sybaris in Calabria in the South of Italy. The most successful ^{were} ~~was~~ the German resistance equipment and the Proton-Magnetometer. The seismic equipment was successful, but slow and cumbersome.

A new high-frequency sonic device is now being developed by the Center in Philadelphia. The principle has been proven but the instrument needs much more development. However the results of the field explorations indicate that such electronic equipment makes possible much more rapid archaeological ^{surveys} ~~advances~~ and probably the discovery of sites which could be found in no other way.

EM

29 November 1961

Dr. Froelich G. Rainey
Director of the University Museum
Department of Physics
University of Pennsylvania
Philadelphia 4, Pennsylvania

Dear Dr. Rainey:

Your paper titled "New Instrumentation Techniques in Archaeology" has been accepted for presentation at the symposium on "Detection of Underground Objects, Materials and Properties". This symposium will be held at the auditorium of the Motion Picture Laboratory, U. S. Army Engineer Research and Development Laboratories, Ft. Belvoir, Virginia, on 19-20 March 1962.

A 250-300 word abstract of your paper should be submitted prior to 1 January 1962. This will be included in the program bulletin and information on transportation and hotel accommodations to be mailed to you as soon as scheduling permits. It is pointed out that this symposium will be unclassified and that adherence to this requirement is the responsibility of the author.

Attached is a list of tentative papers to be presented at the symposium.

Very truly yours,

1 Incl
as

STEPHEN E. DWORNIK
Program Chairman
Mine Detection Branch

TENTATIVE PROGRAM FOR SYMPOSIUM ON DETECTION
OF UNDERGROUND OBJECTS, MATERIALS AND PROPERTIES

I. Welcome - Director of US Army Engineer Research and Development

Laboratories, Ft. Belvoir, Virginia

II. Keynote Speaker.

III. Problem Areas and Objectives.

1. Problems of Detecting Minefields: Mr. Benjamin Goldberg, Chief, Mine Detection Branch, USAERDL, Ft. Belvoir, Virginia
2. Objectives of Project Vela/Uniform: Dr. Charles Bates, ARPA, DOD
3. Requirements for Explosive Ordnance Disposal Locater Equipment: author not stated, R&D Div, Inf and Aircraft Weapons Systems Branch, Office Chief of Ord., Wash. 25, D. C.

IV Detection Theory and Techniques.

4. Airborne Geoscience Research: Mr. Carlton Molineux and Lt. James T. Neal, Terrestrial Sciences Lab., Air Force Cambridge Research Laboratories, Bedford, Massachusetts
5. Detection of Undersnow Structures and Features: Messrs. B. Lyle Hansen, J. N. Rinker, R. D. Leighly, US Army Cold Regions Research and Engineering Laboratories, Hanover, N. H.
6. Problems of Interpreting Element Content of Plants in Relation to Underlying Deposits: Mr. Hansford T. Shacklette, USGS, Denver, Colorado
7. Underground Detection Methods of Exploration Geophysics: Mr. Frederick E. Romberg, Texas Instruments, Geosciences Dept, P. O. Box 35084, Airlawn Station, Dallas 35, Texas
8. Geochemical and Other "Auras" of Influence Surrounding Buried Inhomogeneities: Dr. John C. Cook, SWRI, 8500 Calebra Road, San Antonio, Texas

9. Technique of Mapping and Analyzing Photogeologic Fracture Traces:
Dr. Laurence H. Lattman, Pennsylvania State Univ, Univ Park, Pa.
10. Ring Core Flux-Gate Magnetometer: Dr. W. A. Geyger, US Naval
Ordnance Laboratory.
11. Range Calculation for the Active Magnetic Object Locator:
Dr. Angelo J. Campanella, HRB-Singer, Inc.
12. Airborne Electro-Magnetic Detection: Speaker Unknown,
Aero Service Corporation, Philadelphia, Pa.
13. Aerial Photographic Interpretation of Vegetation as an Aid in the
Detection of Underground Objects; Materials and Properties:
Dr. Robert N. Colwell, Univ of California.
14. Photo-Interpretation-Its Place in Detection of Underground Objects,
Materials and Properties: Mr. Robin I. Welch, Airview Specialists,
Corporation.
15. Infrared Reconnaissance Equipment for Terrain Thermal Mapping:
Messrs. W. A. Eliot, G. L. Woodbridge, HRB-Singer Inc., P.O. Box 60,
Science Park, State University, Pa.
16. Mapping at Sub-Surface Structure from Infrared Photography:
Mr. William A. Fisher, USGS, Washington, D. C.
17. Variation in Reflectance Properties of Soils and Vegetation
Manifested by Sub-Surface Causes: Mr. Donald Orr and SP-4 Leonard
Young, USAERDL.
18. Detection of Certain Underground Deposits by Differential Radiation
of Surface Vegetation: Mr. Arthur Cosler, Geonautics Inc.,
1346 Connecticut Ave., N. W., Washington, D. C.

19. Microwave Radiometry: David Jaffe, American Machine and Foundry, Alexandria, Va.
20. Detection of Buried Objects and Measurement of Soil Moisture by Thermal Imaging: Mr. Stanley Carts and SP-4 Charles Hodges, USAERDL.
21. Effect of Sub-Surface Anomalies Upon Soil Moisture Properties: Dr. D. Anderson and Stanley Buol, University of Arizona, Tucson, Arizona.
22. Feasibility of Mine Detection Using Backscattered Radiation: Mr. C. H. Dyer, US Naval Ordnance Lab, White Oak, Silver Spring, Md.
23. Hydrodynamics of Underground Nuclear Explosions: Dr. D. C. Anderson, Armour Research Foundation, Chicago, Illinois.
24. Detection of Transient Stresses and Displacements in Soil: Mr. E. Selig, Armour Research Foundation, Chicago, Illinois.
25. Thermoluminescence Characteristics of Rocks Adjacent to Underground Nuclear Explosions: Mr. Carl H. Roach, US Geological Survey, Denver, Colorado.

V. Data Reduction and Analysis.

26. Resolution Improvement Techniques: Mr. Chandler Stewart, USAERDL.
27. Digital Recording of Spectro Radiometric Information: Dr. F. S. Brackett, American Machine and Foundry, Alexandria, Va.
28. Computer Analysis of Spectrophotometric Data as an Aid in Optimizing Photographic Tone Contrast: Mr. Phillip Langley, Airview Specialists Corporation, Pleasant Hill, California.

VI. Closing Remarks - Critique.