CALGARY TRIP REPORT/

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FROM: Harold E. Lefevre, Geologist
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SUBJECT: TRIP REPORT - SEVENTH THEMATIC CONFERENCE ON REMOTE SENSING FOR EXPLORATION GEOLOGY AT CALGARY, ALBERTA, CANADA ON OCTOBER 2-6, 1989

PURPOSE: To acquire knowledge of the potential application of remote sensing techniques as a reconnaissance exploration tool in several specific areas on interest - mineral and hydrocarbon exploration and structural geology - for possible application at the proposed high level radioactive waste site at Yucca Mountain, Nevada.

SUMMARY OF PERTINENT POINTS:

Theme

The primary focus of the 7th Thematic Conference on Remote Sensing was on the use of remote sensing as a reconnaissance exploration tool applied to mineral and hydrocarbon exploration.

Among others, remote sensing techniques include satellite imagery, aerial photography and a myriad of airborne geophysical methodologies including ground penetrating radar and aeromagnetics.

The conference table of contents identifying the titles of the invited papers/poster sessions as well as their authors is appended as Attachment A. The proceedings summary for each of the presentations is available for reference in the Geosciences and Systems Performance Branch files.

Attendance

The recognition of the usefulness of remote sensing as an aid to exploration was illustrated by the fact that more than twenty countries were represented at the conference with approximately 1,100 attendees. Presentations consisted of forty nine invited papers delivered at eleven plenary sessions, while some 200 papers were presented at the six poster sessions.

Summaries of Conference Papers

Summaries of papers and poster sessions that had been scheduled for presentation at the conference have been assembled by the conference organizer, Environmental Research Institute of Michigan (ERIM) of Ann Arbor and have been made available to the conference attendees. Those summaries considered particularly relevant (with special reference to the arid environment of the Yucca Mountain site) to the high-level radioactive waste program are appended. For convenience of reference, the summaries have been separated into those dealing with (1) geologic structure (see Attachment B), (2) hydrocarbon exploration (see Attachment C), (3) minerals exploration (see Attachment D), (4) integrated studies (see Attachment E), and (5) lithologic identification (see Attachment F.) Several of the attached summaries are specifically referenced in the following paragraphs. For further insight into any of the previously-indicated five subjects, the reader is encouraged to refer to the other summaries included as attachments.

Application To The High-Level Radioactive Waste Program

a. Applications

*Remote sensing is used to prepare:

1. Structural maps for the analysis of lineaments for faults and folds and other geologic features.

2. Lithologic maps showing general rock units and alteration zones.

3. Geobotanical surveys which highlight anomalous vegetation patterns that may indicate hydrocarbon microseepage or high mineral content.

NOTE: Geologists interpret enhanced remote sensing images to provide a better geologic mapping base to support exploration. Remote sensing data are interpreted and integrated with other data to develop improved geologic models and exploration data bases. The identification of anomalous areas, which may be associated with oil or mineral accumulations, can greatly benefit exploration.

* Extracted from Environmental Research Institute of Michigan (ERIM) Brochure, 1985, entitled "Efficient Exploration Through Remote Sensing").

b. Non-Destructive Testing

Remote sensing techniques, as a non-destructive exploration tool, have particular application to the site characterization aspects of the high level radioactive waste program where regulatory constraints (10 CFR Part 60.11(d)(1-4) inhibit the full utilization of conventional exploration techniques such as drill holes, shafts and trenches.

c. Penetration Of Ground Cover*

Vegetative stress, which can be quantified and mapped from the air, can be caused by excessive minerals or hydrocarbons in the soil. Remote sensing allows surface minerals to be located despite vegetative cover.

* Extracted from undated MONITEQ, Ltd. (630 Rivermede Road, Concord, Ontario, Canada) Brochure entitled "Applications of Airborne Multispectral Imagery."

d. Penetration Of Soil Cover

Ground penetrating radars are a class of remote sensing radars operating at sufficiently low frequency that energy can be transmitted through many meters of earth (one to ten meters), thereby permitting, in principle, the imaging of subsurface features. Subsurface reflections are obtained from discontinuities in the electrical properties of the soil, including those often associated with the water table and with geologic features (see Attachment D, p. 26).

e. Identification Of Previously-Unrecognized Faults

Using spectral contrasting enhancement techniques, previously-undocumented strike-slip and normal faults up to 25 miles in length have been located in the central and eastern Mojave Desert. These faults are not obvious on either aerial photography or on radar imagery, but field investigations have subsequently confirmed their presence. The newly-identified faults provide important insights to the late Cenozoic tectonics of the Mojave Desert Block (see Attachment B, p. 190).

f. Identification Of Hydrothermally-Altered Areas

A study of numerous sites near Virginia City, Nevada where volcanic rocks are associated with gold and silver mineralization has provided evidence that thermal-infrared laboratory and aircraft multispectral scanner data are effective in identifying and mapping hydrothermal alteration that may be associated with mineralization in volcanic terrains (see Attachment D, p. 262).

CONCLUSION:

It was made abundantly clear in a number of talks that remote sensing should be considered an essential part of the site exploration/characterization program. Since regulatory constraints [10CFR60.11(d)(1-4)] inhibit the full utilization of conventional exploration techniques such as drill holes, shafts and trenching, the non-destructive attributes inherent to remote sensing are ideally suited to accommodate this regulatory requirement. Specific examples of the potential application of remote sensing at the proposed Yucca Mountain site were demonstrated in several of the presented papers and include (1)

the ability, in some cases, to locate surface minerals despite the presence of heavy vegetative cover, (2) the potential for the imaging of subsurface features through meters of soil cover and (3) the identification (using spectral contrasting enhancement techniques) of faults, up to 25 miles in length, that were not obvious on either aerial photography or on radar imagery.

HL

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Enclosures: As stated (5)

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