

73 30 0101

0

March 6, 1973

MEMORANDUM

TO: B. Robinson and L. Silva

FROM: Luis A. Bartolucci

SUBJECT: Water Resources EXOTECH Experiment

The Water Resources Research Group is planning to conduct a series of experiments with the EXOTECH spectroradiometer (reflective and thermal units) during the summer of 1973, preferably during the months of July, August, and if possible September.

A complete description of the experiments will be ready in the near future after discussing the kinds of data needed for water quality analysis with Dr. Hoffer and Dr. John Bell of Environmental Engineering.

Thank you for your consideration of this matter.

Luis A. Bartolucci
Luis A. Bartolucci *HH*

LAB:sdh

CC: R. Hoffer

1 2

Ecosystems Research Project Description

Water Resources Project # 5

Project Title: Water Resources EXOTECH Experiment

- Objectives:
- (1) to determine the effects of the bottom characteristics upon the spectral response of streams and water bodies.
 - (2) to study the influence of water depth on the spectral characteristics of streams and water bodies.
 - (3) to correlate the spectral response of water bodies to the amount of suspended solids (turbidity).

Background:

Water Resources Research to date has indicated that differences in water depth, amount of suspended solids (turbidity) and bottom characteristics will cause distinct spectral differences in scanner data. It is the intent of this project to determine the influence of these parameters, in a more accurate manner and under more carefully controlled conditions on the spectral characteristics of water bodies.

It is believed, that the results of this experiment will help in the interpretation of the classifications of water from aircraft scanner data.

Equipment and Support Required: The EXOTECH field spectroradiometer with the short wavelength unit, supporting hi-ranger and recording van will be required. Exotech software for the reduction of the spectral data will also be required.

Supporting items needed;

- a) 2 x 2 foot white-painted metal panel.

- b) 2 x 2 foot black-painted metal panel.
- c) meter-stick for depth measurements
- d) 24 bottles for water samples
- e) **T**hermistor thermometer for water-surface and ambient temperature measurements.

Personnel Involved:

Principal Investigators: L. A. Bartolucci, B. Robinson, and R. M. Hoffer

Supporting Personnel: (*Exotech crew, 2*)
(2 undergraduate students)

Program Support: Project funded by the Office of University Affairs for Water Resources.

Time Required: Three days for data collection in the field will be required. One day on the Wabash River, one day on the Tippecanoe and one day at Lake Freeman.

Anticipated Completion Date: This project should be completed by the end of August, 1973.

Approach and Procedures: Measurements will be taken at three test sites where there is easy access for the equipment:

- 1) Launching ramp at the River Junction (Wabash site)
- 2) Hog Point Bridge (Tippecanoe site)
- 3) Lake Freeman

At the Wabash and Tippecanoe sites, nine (9) runs will be needed for each site and repeating one time every run. At Lake Freeman, twelve (12) runs will be needed and duplicating one time every run. The total number of runs needed is sixty (60).

Site	Freeman			Wabash			Tippecanoe		
Bottom	white	black	normal	white	black	normal	white	black	normal
Depth 1									
Depth 2									
Depth 3									
Depth 4									

6 cm
2 cm
5 cm
10 cm
20 cm
50

The data should be taken at comparable altitudes at all three test sites, about 40 feet between the instrument and the water surface.

All the spectral data will be gathered using the 3/4° field of view. The spectral data should be collected on a clear day and at low sun angles, that is, between 11:00 AM and 1:00 PM local time, and the measurements should be normal to the target surface in order to minimize the effects of background radiation.

Ecosystems Research Project Description

Water Resources Project #6

Project Title: EXOTECH Thermal Experiment

Objectives:

- (1) to study the emissive characteristics of water bodies in the thermal infrared wavelengths.
- (2) to determine the effects of the areal size of the target upon the emissive characteristics of water.
- (3) to study the influence of turbidity (suspended solids) on the emissivity of water in the thermal infrared region of the spectrum.

Background:

Work to date on thermal mapping of water from scanner data has been quite satisfactorily, especially in 8.0 - 13.5 μm spectral band and for low flight altitudes (2000 or 3000 ft.). It is believed that besides the atmospheric effect on the radiant temperatures, the area size viewed by the scanner has also to be considered where measuring radiant temperatures at different altitudes. (Areal averaging effect).

It is also expected that this experiment will help in understanding the observed fact that radiant temperatures as measured from the scanner data in the 4.5-5.5 μm band are always lower than the radiant temperatures obtained from the 8.0-13.5 μm band and lower than the Kinetic Temperatures of the targets (Bucket temperatures). This observed phenomenon might be due to a lower emissivity

of the target (water) in the 4.5-5.5 μm band than in the 8.0-13.5 μm atmospheric window. It could also be due to stronger atmospheric attenuation in the 4.5-5.5 μm channel than in the 8.0-13.5 μm band, that is, assuming that the 8.0-13.5 μm window is more transparent than the 4.5-5.5 μm band.

Equipment and Support Required:

The EXOTECH field spectroradiometer with the long wavelength unit, the hi-ranger and the recording van will be required. Exotech software for the reduction of the spectral data will also be required.

Supporting items needed:

- (a) A thermistor thermometer and a precision mercury thermometer for the measurement of the water-surface and ambient temperatures.
- (b) 10 bottles for water samples.

Personnel Involved:

Principal Investigators: L. A. Bartolucci, B. Robinson and R. M. Hoffer.

Supporting personnel: the Exotech crew (2) and 2 undergraduate students.

Program Support: Project funded by the Office of University Affairs for Water Resources.

Time Required: One to two days for data collection in the field will be required. One day to gather the thermal spectral data of clear (clean) water and another day over turbid water.

Anticipated Completion Date; This project should be completed by the middle of September, 1973.

Approach and Procedures:

Two test sites will be used in this experiment, one in turbid water (for example the Wabash River) and the other in clean water (Tippecanoe). Three runs (with one duplication) will be needed in each test site at 3 different altitudes. The total number of runs needed is 12.

	Tippecanoe	Wabash
Altitude 20 ft. (5 ft. F.O.V.)		
Altitude 30 ft. (8 ft. F.O.V.)		
Altitude 40 ft. (10 ft. F.O.V.)		

The 15° F.O.V. will be used in all the runs and the weather should not be a problem, that is, it does not have to be a clear day and the local time should not influence the measurements.

Water samples will be collected for analysis of turbidity and careful measurements of surface water temperatures will be taken.

Date Data Collected:

7/11/73

<u>Scene</u>	<u>Number of Observations</u>
River Water	17

Photos Taken