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USE OF SKYLAB S190B IMAGERY

by

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USE OF SKYLAB S190B IMAGERY

INTRODUCTION

Overall Objective

The overall objective of this series of investigations is to test two hypotheses:

1. That changes in the ecology of a river basin which take place during construction and long-term operation of a flood control reservoir can be measured by high-level aerial and satellite photography and other data; and

2. That post-project changes in areas having similar pre-project environments can be predicted with reasonable accuracy.

As part of this overall objective, a study was undertaken to develop a monitoring system with the objectives of:

a. Developing a simple information extraction technique based on optical process; and

b. Developing an interpretation system compatible with the products of optical processing.

This NASA-funded project was originally directed at the use of ERTS and high-altitude imagery. The results are presented in a technical report titled "Investigation of the Effects of Construction and Staged Filling of Reservoirs on the Environment and Ecology".[1]

Project Objective

The purpose of this phase of the project was to test the processing of SKYLAB S190B earth terrain camera imagery using optical processing techniques

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[1] Riggins, R. E. and Jain, R. K., "Investigation of the Effects of Construction and Stage Filling of Reservoirs on the Environment and Ecology", NASA Draft, June 1975.

and to determine the usefulness of such imagery in the environmental assessment of major construction projects.

SATELLITE - IMAGE OPTICAL PROCESSING TECHNIQUES

Introduction

The optical processing techniques used with space and high-altitude aircraft imagery include copying for enlargement, separating of spectral bands, combining spectral information and contrast enhancement. Of these four techniques, only copying will be discussed in detail. Separating of spectral bands and combining spectral information are described in detail in the previously referenced report. The techniques were demonstrated using ERTS imagery but would be similar when using SKYLAB S190A multispectral imagery. For S190B imagery, the technique of contrast enhancement was dismissed as ineffective due to the continuous tonal quality of the imagery.

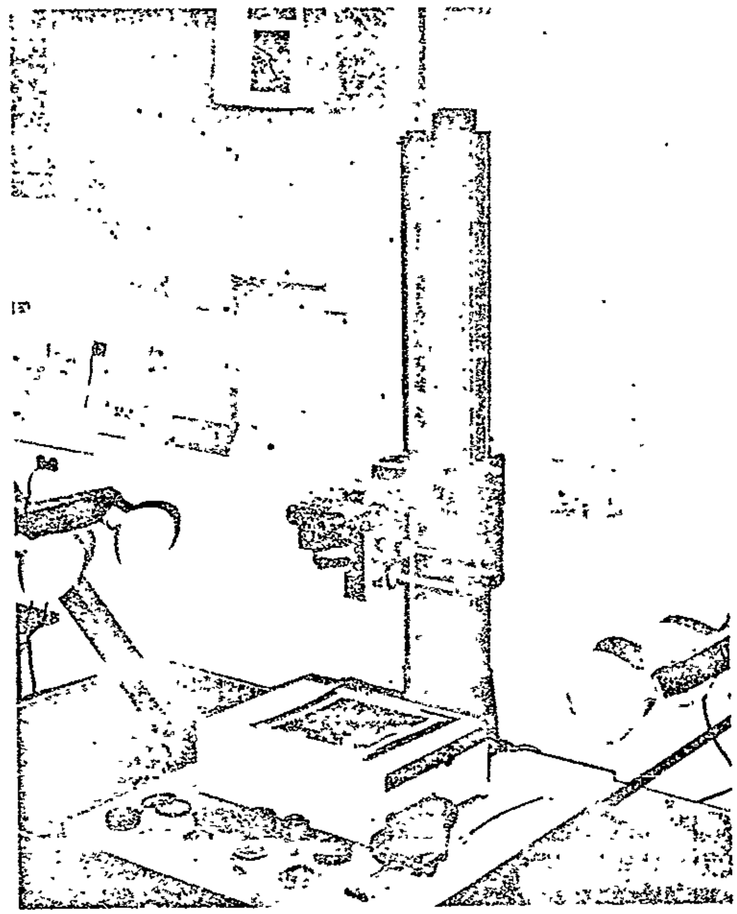
Copying

Often, information needed for a site from space imagery is contained in a small area of the image. A primary objective of copying is to obtain satisfactory enlargements of specific areas on the S190B frame. Three methods can be used:

1. Use of standard copying equipment built around 35 mm and 2-1/4 x 2-3/4 inch single lens reflex cameras. Figure 1 illustrates the system and its components.

2. Fabrication of a simple camera (see Figure 2) for obtaining a fixed 1:1 copy on 4 x 5 inch sheet film from transparent or opaque copy.

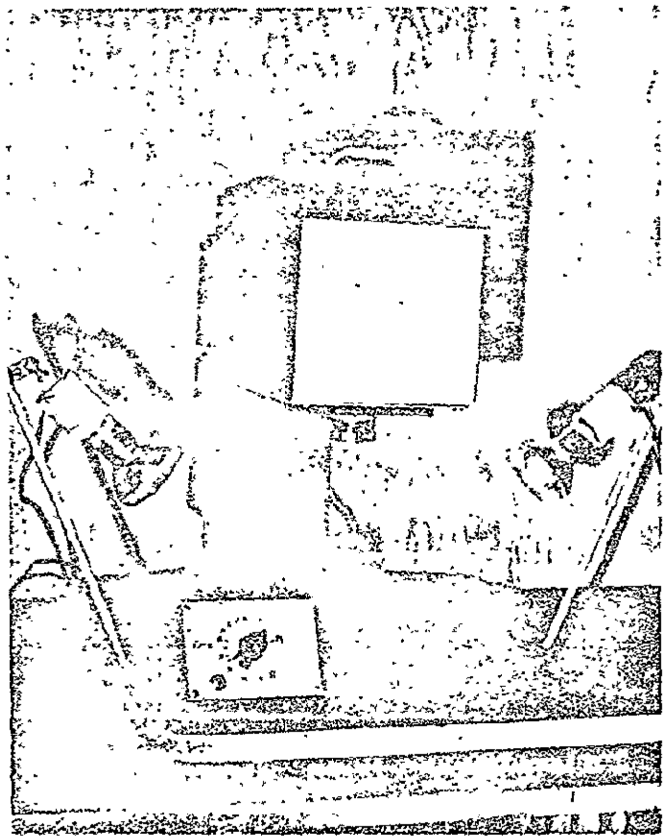
3. Use of an enlarger to project portions of a color transparency or enhanced Diazo transparency. This system produces the sharpest results at extreme magnification.



CLOSE-UP PHOTOGRAPHY SYSTEM

1. Saturn Copy Stand
2. 3400 K Photo Floods
3. Aristo DA-10 Light Unit
4. Nikon F 35mm Camera
5. Micro-Nikkor-P.C. Auto 1:3.5 f55mm lens
6. Bellows, Spiratone Macrotel 1:45, f150 lens
7. Extension Tubes
8. +1, +2, +3 Close-Up Lenses
9. Spiratone Macrostigmat +20 Diopter Lens
10. Critical Focuser
11. Miranda FVT 35mm Camera
12. Focusing Rail

FIGURE 1. CLOSEUP PHOTOGRAPHY SYSTEM



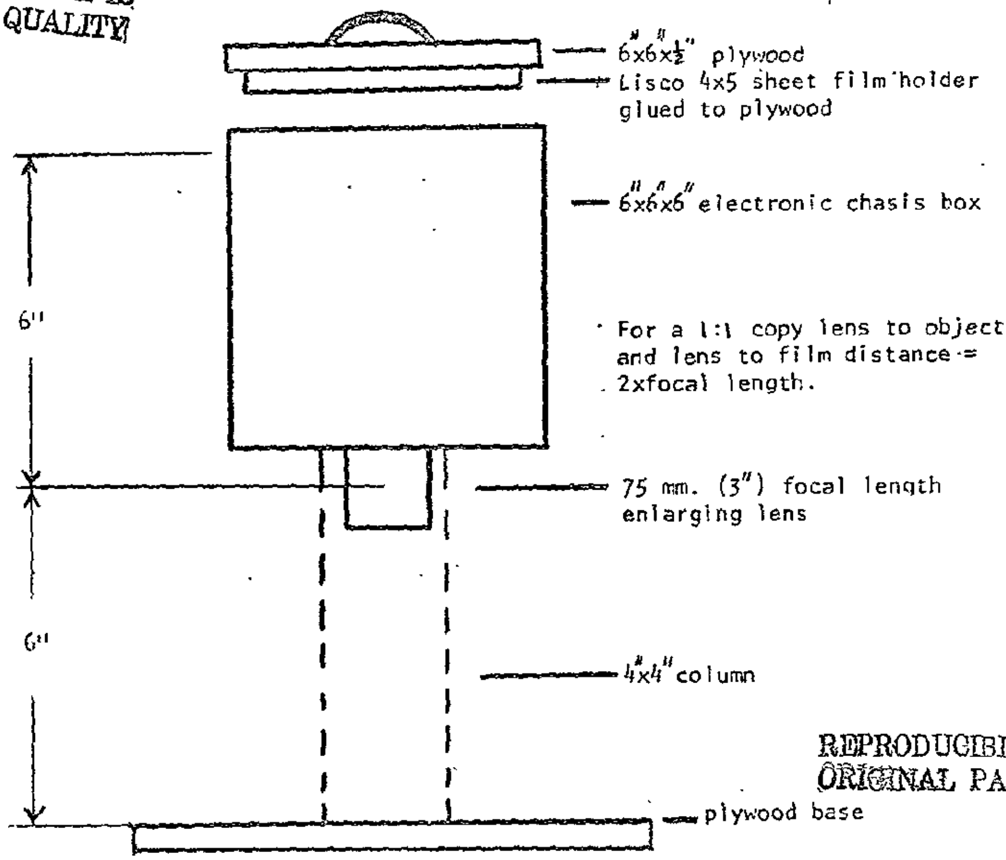


FIGURE 2. SIMPLE 1:1 COPYING CAMERA

Table 1 outlines the steps for copying with the enlarger, and Table 2 outlines the necessary filtration for other enlarger bulbs and daylight-balanced films.

The first copying method was used to enlarge the S190B imagery and was found to be quite successful. Contrast was increased by using a standard film, such as Ektacolor or Ektachrome, rather than copy films which reduced contrast gain in the copying reseau. Figures 3a and 3b illustrate the use of standard film.

TABLE 1. ENLARGER COPYING SKYLAB IMAGERY

FILM

EKTACOLOR-L, 4 x 5 inch sheet for exposure of 1-10 second, balanced for 3200°K lighting or daylight balanced films such as Kodacolor or Ektachrome

ENLARGER BULB

See Table 2.

CORRECTION FILTER

(2950°K → 3200°K): 82B

FILM HOLDER

4 x 5 inch Lisco sheet film holder. A white piece of paper is inserted on one side of the film holder to act as a focusing panel. The dark slide for this side is permanently removed.

STEPS

1. Put transparency in enlarger, *flipped over once from correct viewing*.

2. Focus image at desired enlargement on white focusing panel.

3. Turn film holder over; position holder with image on dark slide (DO NOT REFOCUS).

4. Turn off enlarger; remove dark slide and expose (nominal exlosure 1 second at f32 with 150 mm lens).

5. Replace dark slide.

TABLE 2. ENLARGER BULBS AND COLOR CORRECTING FILTERS FOR BALANCING TUNGSTEN AND DAYLIGHT FILMS

Enlarger Bulb	Color Temperature	Color Correction Filters	
		Daylight Films	Tungsten Films (3200°K)
211 (75 watts)	2950°K	80B and 82C	82B
212 (150 watts)	2950°K		
300 (150 watts)	3100°K	80B and 82B	82

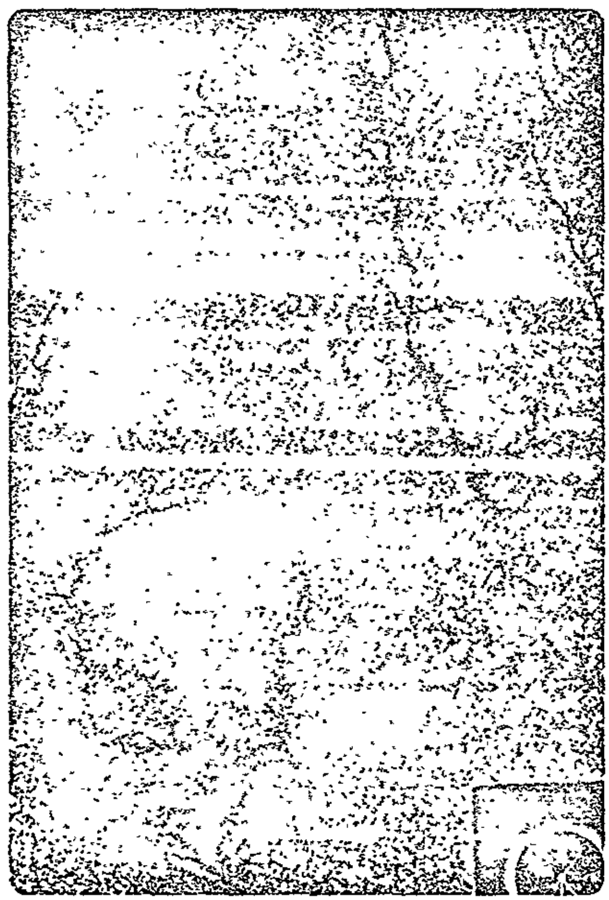


FIGURE 3a. PART OF THE SANGAMON BASIN STUDY AREA FROM SKYLAB ETC FRAME COPIED USING EKTACOLOR-S

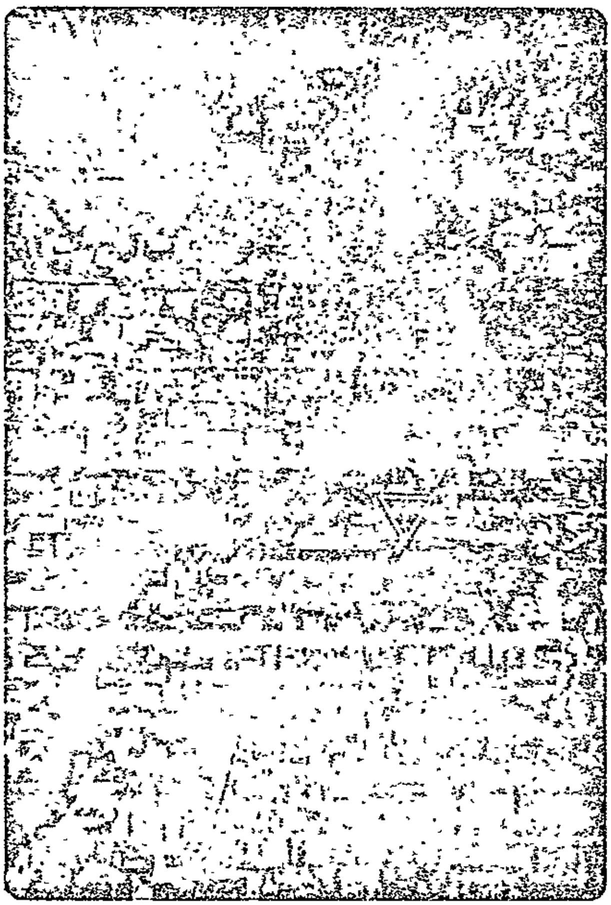


FIGURE 3b. CLOSEUP OF THE CITY OF DECATUR AND LAKE DECATUR FROM SKYLAB ETC FRAME COPIED USING EKTACOLOR-S

USE OF SKYLAB IMAGERY

Imagery Obtained

Two sets of S190B imagery were received: the first in August 1973 and the second in March 1974. The second set of imagery was not useful due to approximately 80 percent cloud cover.

Use of the Imagery

A subjective evaluation of the enlarged S190B frame indicated two primary roles for this imagery in the optical processing system. The first role is as a base map. This imagery has a decided advantage over the ERTS products because its superior resolution enabled it to be enlarged without significant loss of clarity.

Analysis of optically-processed enlarged imagery (ERTS or S190A multispectral) can be performed through the use of manual interpretation techniques employing the throwback projection system (see Figure 4). Projected images are interpreted and coded for use in a digital mapping routine.* The S190B imagery provides an efficient means to produce a base map for display of interpreted results. The map may be produced digitally or manually from a projected image.

A comparison between Figure 3a and Figure 5 indicates the potential usefulness of enlarged S190B imagery for defining cultural features within the region of a proposed reservoir. Although statistical evidence has not been obtained, it is expected that S190B imagery can provide most of the

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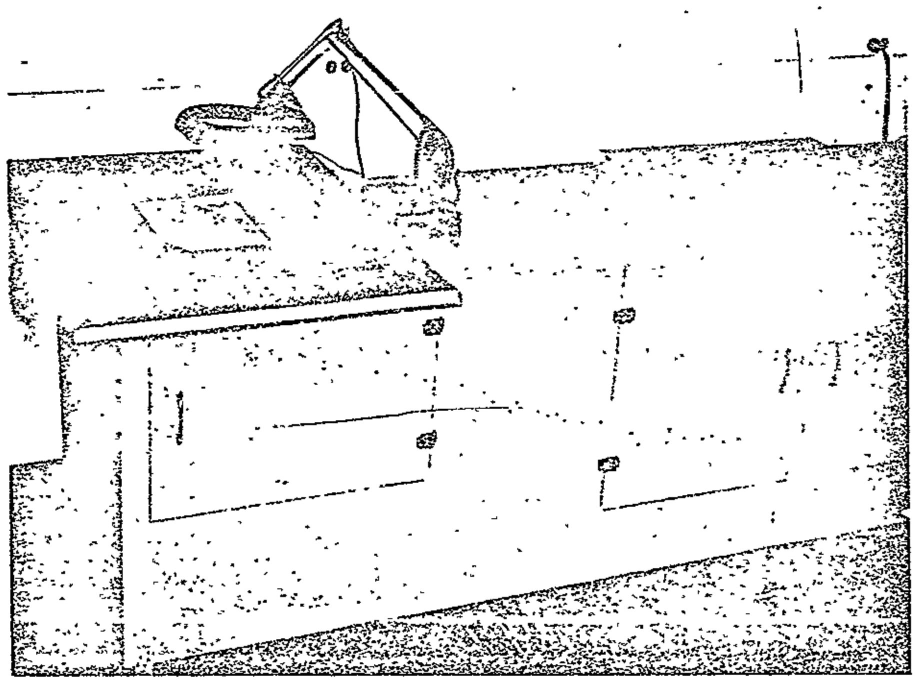
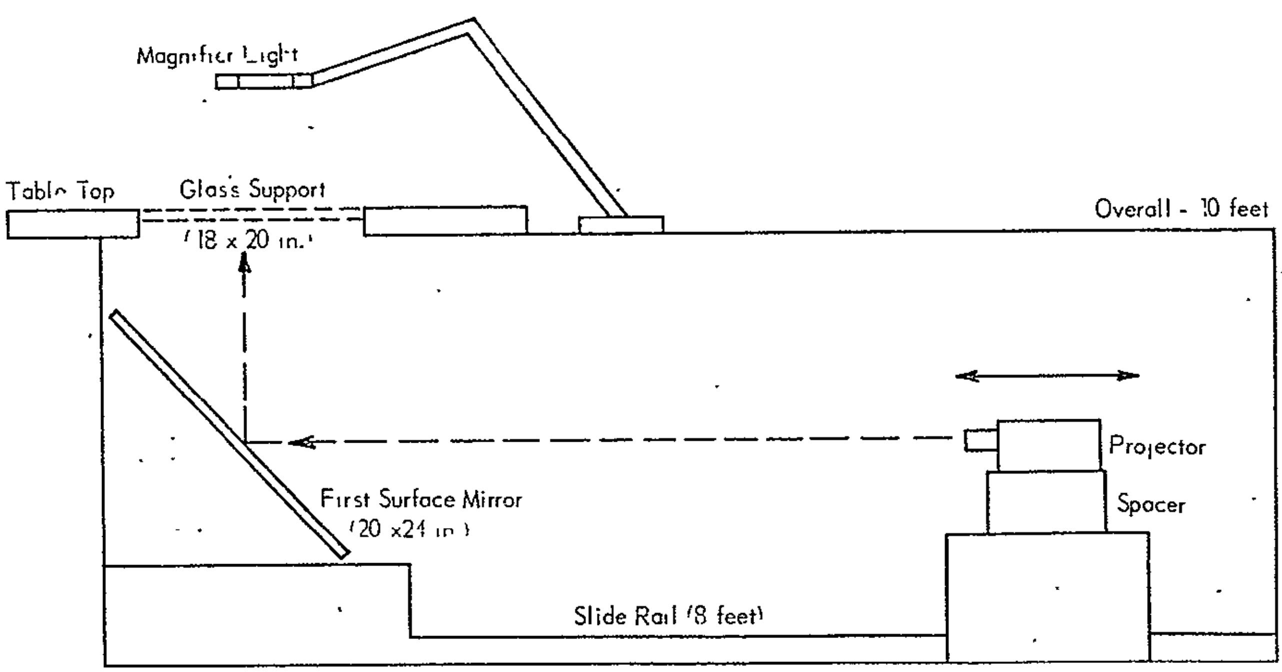
* See previously cited reference for elaboration of these techniques.





Throwback Projector

FIGURE 4. THROWBACK PROJECTION SYSTEM

FIGURE 5. UNDERFLIGHT IMAGE OF THE DECATUR AREA

required cultural information (for environmental analysis of major construction) that could be obtained from high-altitude aerial coverage and do so in a more efficient and economical manner.

CONCLUSIONS

SKYLAB S190B imagery has a definite role within an optical processing system when employed in the environmental analyses of major construction projects. Most equipment required for optical processing techniques can be built at a modest cost (less than $3,000) and requires only minimal technical competence. For those whose investigations require limited or infrequent information extractions, it appears that the use of S190B imagery and optical techniques could be cost-effective and practical.

Further, beyond the scope of the original project, we feel that SKYLAB quality imagery could be of invaluable assistance in a wide variety of environmental management applications if it were to become available on an operational basis.