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ENIWETOK AERIAL SURVEY TEST PLAN

Introduction

This test plan describes a technical aerial survey program of scientific photographic and gamma radiation measurements for selected islands in the Eniwetok atoll chain and priorities for carrying out these measurements. These surveys will be conducted in a time frame beginning 4 November 1972 and ending on or before 23 November 1972. Two CH-53 helicopters, flown by the 36th Marine Aviation Group, will provide the aerial platform for these measurements.

The following list of tasks is arranged in order of priority in the event that the helicopters are severely limited in operation or weather causes long delays.

Survey Tasks

Tasks in Descending Priority	Estimated Flying Hours
1. Quick-Look Photography	
Vertical aerial photographs will be taken of all islands in the entire atoll. Four Hasselblad cameras will be operated simultaneously; two with black and white film and two with infrared black and white film. Of the four films, two will be processed on island for immediate use. The remaining two will be returned to the mainland for controlled processing. The attached table indicates planned photographic coverage.	(4 hrs, 2 flights)

Tasks in Descending Priority (cont) — Estimated Flying Hours

2. Initial Gamma Radiation Survey

Gamma radiation survey of three islands, Eniwetok (Fred), Parry (Elmer), and Japtan (David). This survey will consist of a cross-hatched grid of flight lines spaced 150 feet apart. Sets of parallel flight lines will be flown perpendicular to each other. Two surveys will be flown for each island to record gamma energies consistent with cobalt (0 to 3.0 MeV) and americium (0 to 300 keV). (6 hrs, 2 flights)

3. Multispectral Photography

Four camera multispectral photographic survey of all islands in the entire atoll to include the following four wavelength bands:

a. Normal color (Kodak Aerocolor negative film)

b. Infrared color (Kodak Aerochrome positive film)

c. Black and white, red filter (Kodak Plus-X)

d. IR black and white (Kodak Infrared)

This survey will be flown as lighting and cloud cover permit. (8 hrs, 4 flights)

4. Complete Gamma Radiation Survey

Gamma radiation survey of remaining islands. Each island will be surveyed with a cross-hatched grid. Two grids will be flown for each island, 1) for cobalt and cesium (0 to 3.0 MeV), and 2) for americium

Tasks in Descending Priority (cont)

Estimated Flying Hours

(0 to 300 keV). The order in which islands will be surveyed is the following:

a. A contingency flight path to ring the entire atoll centered on each island
b. Janet
c. Irene
d. Yvonne
e. Ursula
f. Sally
g. Tilda
h. Ruby
i. Belle
j. Kate
k. Lucy
l. Mary
m. Nancy
n. Olive
o. Pearl
p. Vera
q. Wilma
r. Alice
s. Clara
t. Daisy
u. Edna
v. Leroy
w. Bruce
x. Clyde
y. Rex
z. Keith

Tasks in Descending Priority (cont)	Estimated Flying Hours
a[1] James	
b[1] Irwin	
c[1] Henry	
d[1] Glenn	(30 hrs, 10 flights)

5. Reef Gamma Radiation Survey

On a low priority basis, the reef below Alice will be surveyed at low tide.

6. Special Request and Documentary Photography

Includes search for underwater objects such as the MACK tower. (Photos may penetrate to depths of 20 feet.) Also includes oblique still photographs and 16mm color movies of the survey operation.

Presentation of Information

Photographic processing and printing capability and computer data processing capability for the gamma radiation data will be available on Eniwetok during the survey.

Photographic Processing

Six photo books will be prepared on the island for black and white quick-look records. These books will provide technical management personnel with an up-to-date aerial map of Eniwetok atoll. One set of photos will be used by the gamma radiation survey team for navigation purposes and overlay presentation of survey data.

Computer Processing

Gamma radiation data will be processed immediately after each flight. Total processing of data from any given flight may require one to two days to complete. Overlays will be prepared in a scale compatible with the photographs. Data will be displayed as exposure rates for an equivalent three foot above ground measurement (uR/hr or mR/hr as appropriate).

PLANNED PHOTOGRAPHIC COVERAGE OF
ISLANDS IN ENIWETOK ATOLL
QUICK-LOOK AND 4-BAND MULTISPECTRAL COVERAGE

Name	Island Size (Ft.)	Aircraft Altitude (Ft.)	No. Of Passes	No. Of Pictures	Photographic Coverage On Ground (Ft.)
CLARA	300 x 1,200	2,000	1	1	1,374 x 1,374
SAM	150 x 300	"	1	1	"
TOM	300 x 450	"	1	1	"
URIAH	300 x 1,200	"	1	1	"
ALVIN	150 x 600	"	1	1	"
CLYDE	300 x 600	"	1	1	"
WALT	600 x 900	"	1	1	"
LEROY	600 x 1,200	"	1	1	"
DAISY	900 x 1,500	3,000	1	1	2,061 x 2,061
EDNA	1,200 x 1,500	"	1	1	"
KATE	600 x 1,200	"	1	1	"
LUCY	750 x 1,500	"	1	1	"
PERCY	300 x 1,200	"	1	1	"
MARY	300 x 1,200	"	1	1	"
URSULA	1,500 x 1,500	"	1	1	"
WILMA	750 x 1,500	"	1	1	"
JAMES	600 x 1,500	"	1	1	"
BELLE	1,200 x 2,100	4,000	1	1	2,748 x 2,748
VAN	300 x 1,800	"	1	1	"
KEITH	600 x 2,400	"	1	1	"
ALICE	600 x 2,700	5,000	1	1	3,435 x 3,435
IRENE	1,800 x 3,000	"	1	1	"
NANCY	300 x 3,000	"	1	1	"
OLIVE	1,200 x 2,100	"	1	1	"
PEARL	1,200 x 3,000	"	1	1	"
TILDA	1,800 x 2,400	"	1	1	"
VERA	900 x 2,100	"	1	1	"
YVONNE	1,200 x 9,000	"	1	4	3,435 x 10,000
BRUCE	900 x 3,000	"	1	1	3,435 x 3,435
DAVID	2,100 x 2,400	"	1	1	"
ELMER	2,100 x 8,100	"	1	4	3,435 x 10,000
FRED	2,400 x 13,800	"	1	5	3,435 x 15,000
IRWIN	600 x 2,400	"	1	1	3,435 x 3,435
HENRY	600 x 3,900	6,000	1	1	4,122 x 4,122
SALLY	3,000 x 4,500	8,000	1	1	5,496 x 5,496
GLENN	600 x 5,400	9,000	1	1	6,183 x 6,183
JANET	3,900 x 5,700	10,000	1	1	6,875 x 6,875
ZONA	Connected to Yvonne				

APPENDIX
TECHNICAL CONSIDERATIONS

Spatial Resolution

Spatial resolution is controlled by altitude, flight speed, data accumulation time and gamma-ray energy. The detectors exhibit a cosine angular response for low energy gamma-rays such as the 60 keV line from Am 241. Inherent spatial resolution is approximately 125 ft at 100 ft altitude for this energy. Inherent spatial resolution is degraded for higher energy gamma-rays due to the decrease in air attenuation and the transmission of gamma-rays by the shielding around the sides of the crystals. The assumption of isotopic angular response and no air attenuation for high energy gamma-rays gives a spatial resolution of 200 ft at an altitude of 100 ft.

Data accumulation time can be adjusted to be consistent with inherent spatial resolution and flight speed.

Sensitivity

Sensitivity is controlled by survey rate, spatial resolution and background count rates under the photopeaks of interest. Sensitivities can be estimated by assuming background spectra in the region of interest to be identical to that taken over typical U. S. Soil with an array of 4- by 4-inch crystals. Amplitude of the spectra are scaled according to crystal surface area and radiation levels three feet above the ground. The following sensitivities are estimated with these assumptions and the additional assumptions of 100 ft/sec flight speed, spatial resolution of 150 ft, survey speed 15000 ft^2 /sec, and cosine angular response for the detector system

Cs 137 ~ .3 uR/hr at 3 ft above the ground

Co 60 ~ 1 μR/hr at 3 ft above the ground

Am 241 ~ .5 μCi/m^2