

March 19, 1976

NORTHERN MARSHALLS AERIAL RADIOLOGICAL SURVEY

## Assumptions:

1. The aerial radiological survey must be supported by photo missions conducted prior to the radiological survey.

2. The aerial radiological survey will cover:

Eleven atolls and two islands in Table I or, BIKINI ATOLL Only.

3. For purposes of comparison, the survey will be conducted in one of two ways:

Logistics support obtained from commercial sources

or,

Logistics support provided by DOD.

4. For estimates of incremental and total costs for commercial logistics for the photo missions and radiological survey, see "COST ESTIMATES at end of report.

5. For DOD support:

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a. Personnel and equipment will use special air mission from Nellis AFB to KWAJALEIN ATOLL to arrive three days prior to D-day for the radiological survey of the eleven atolls and two islands.

b. Personnel and equipment will return to Nellis AFB by special air mission leaving KWAJALEIN ATOLL three days after the end of the radiological survey of the eleven atolls and two islands.

c. Personnel will use special air mission from Nellis AFB to BIKINI ATOLL to arrive three days prior to D-day for survey of BIKINI ATOLL Only.

d. Personnel will return to Nellis AFB by special air mission leaving BIKINI ATOLL three days after the end of the radiological survey of BIKINI ATOLL Only.

e. The radiological survey will be conducted by two helicopters and crews operating from a base camp established on ENYU ISLAND for the BIKINI ATOLL Only survey, or, from a ship anchored near each atoll for the eleven atoll survey.

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Requirements:

1. For the survey of eleven atolls and two islands

- a. Two helicopters that are operational, associated crews and support personnel, and a ship to operate out of KWAJALEIN ATOLL for a minimum period of 70 days. See Schedule I.
- b. Two small boats to put survey personnel ashore on selected islands to emplace ground based navigational aids, to collect samples of soil, fish, and vegetation, to make portable instrument measurements, and to collect samples of food on inhabited islands.
- c. For the radiological survey the following personnel will be the minimum to be used:

9-persons with aerial instruments and associated ground support crew.

11-persons performing ground survey and sample collection.

2. For the survey of BIKINI ATOLL Only:

- a. A base camp established on ENYU ISLAND or ship anchored nearby to support helicopter operations.
- b. Two helicopters and crews to operate at BIKINI ATOLL for 15 days. See Schedule II.
- c. Personnel requirements are the same as in part 1c above.

3. For either survey option, see Table II for atolls and areas to be covered and their priorities, and Table III for explanation of priorities assigned.

4. Table IV shows routes to be taken for the three part survey of eleven atolls and two islands (two crew changes and one resupply stop for the ship), and for BIKINI ATOLL ONLY. DOE ARCHIVES

5. For requirements for photo missions conducted separately, see "NORTHERN MARSHALLS PHOTO MISSIONS" and "SCHEDULE III." For requirements for photo missions for the BIKINI ATOLL Only survey, see "SCHEDULE II".

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TABLE I

NORTHERN MARSHALLS AERIAL SURVEY\* BASIC REQUIREMENTS

(Radiological and photo requirements)

<u>BIKAR ATOLL</u>	<u>GAMMA</u>	<u><sup>241</sup>Am</u>	<u>AREA MI<sup>2</sup></u>	<u>CHART</u>
				6024
BIKAR IS.	*	*	.09	
ARUMENIL IS.	*		.05	
JABOERUKKU IS.	*		.05	
			<u>.19</u>	
<u>TAKA ATOLL</u>				HO 6023
TOKA IS.	*	*	.12	
ELUK IS.	*		.04	
RAAJERUN IS.	*		.02	
			<u>.18</u>	
<u>UTIRIK ATOLL</u>				HO 6023
UTIRIK IS.	*	*	.92	
PIGOWAK IS.	*		.15	
AON IS.	*	*	.20	
			<u>1.27</u>	
<u>LIKIEP ATOLL</u>				HO 6020
LIKIEP IS.	*	*	.46	
AGONY IS.	*		.08	
ETOILE IS.	*		.05	
LUKUNOR IS.	*	*	.31	
KAPENOR IS.	*	*	.46	
MATO IS.	*	*	.55	
RIKURARN IS.	*		.31	
MERON IS.	*		.18	
JIEBARU IS.	*	*	.15	
KERE IS.	*		.06	
BIEBI IS.	*		.09	
MUKKURI IS.	*		.04	
LADO IS.	*	*	.28	
			<u>3.02</u>	DOE ARCHIVES

\*Names and spelling of names are not necessarily those currently accepted but rather are taken from indicated charts:

<u>RONGELAP ATOLL</u>	<u>GAMMA</u>	<u>241 Am</u>	<u>AREA MI<sup>2</sup></u>	<u>CHART</u>
				HO 6029
RONGELAP IS.	*	*	.21	
ARBAR IS.	*		.04	
ENIRAN IS.	*		.01	
TUFA IS.	*		.02	
BUROKKU IS.	*	*	.02	
NAEN IS.	*	*	.03	
AERIK IS.	*		.01	
YUGUI IS.	*		.01	
LOMUFLEL IS.	*		.02	
GENJEN IS.	*	*	.01	
LUKNEN IS.	*		.01	
ANTELAP IS.	*		.01	
KABELLE IS.	*	*	.02	
GABELLE IS.	*		.01	
MULLE IS.	*		.04	
ENTAETOK IS.	*	*	.05	
			<u>.52</u>	

RONGERIK ATOLL

HO 6026

RONGERIK IS.	*	*	.23
TARROWATT IS.	*		.04
ENEWETAK IS.	*	*	.17
BOCK IS.	*	*	.14
JEDIBBERDIB IS.	*		.01
LATOBACK IS.	*		.09
MORTLOCK IS.	*		.01
BIGONATTAM IS.	*		.12
			<u>.81</u>

AILINGINAE ATOLL

HO 6026

BOKOR YUREN IS.	*		.05
MAJOKORYAAN IS.	*		.12
BOKOEN IS.	*		.06
KNOX IS.	*	*	.12
KUNGEEKAN IS.	*		.03
UCCHUWANEN IS.	*		.08
KUOBUEN IS.	*		.05
RIBINOURI IS.	*	*	.11
ENIBUK IS.	*		.07
MOGIRI IS.	*	*	.12
MANCHINIKON IS.	*		.05
SIFO IS.	*	*	.06
NAJIBUEN IS.	*		.01
			<u>.93</u>

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<u>WOTHO ATOLL</u>	<u>GAMMA</u>	<u>241 Am</u>	<u>AREA</u> <u>MI<sup>2</sup></u>	<u>CHART</u> HO 5429
WOTHO IS.	*	*	.96	
YELDO IS.	*		.04	
KABBEN IS.	*	*	.19	
MEDYERON IS.	*		.19	
			<u>1.38</u>	
<u>AILUK ATOLL</u>				HO 6022
AILUK IS.	*	*	.32	
AGULUE IS.	*	*	.14	
KAPEN IS.	*	*	.23	
ENIJABRO IS.	*		.17	
ENEJELAR IS.	*		.18	
BIGEN IS.	*		.23	
ENENEMAN IS.	*		.08	
ENEARUMICHI IS.	*		.08	
ALJET IS.	*	*	.12	
BERERJAN IS.	*		.06	
MARUPPN IS.	*		.08	
ENOA IS.	*		.03	
			<u>1.72</u>	
<u>UJELANG ATOLL</u>				HO 6035
UJELANG IS.	*	*	.35	
BURLE IS.	*		.03	
EIMNLAPP IS.	*	*	.06	
ENNIMENETTO IS.	*		.03	
KIRINIYAN IS.	*		.01	
KALO IS.	*	*	.05	
POKON IS.	*		.01	
KILAGEN IS.	*		.02	
DAISU IS.	*		.04	
			<u>.60</u>	
<u>JEMO ISLAND</u>	*	*	.08	DOE ARCHIVES
<u>MEJIT ISLAND</u>	*	*	1.26	Sheet 8152 111 SW Series W 861
				Sheet 8352 1 NE Series W 861

<u>BIKINI ATOLL</u>	<u>GAMMA</u>	<u>241 Am</u>	<u>AREA MI<sup>2</sup></u>	<u>CHART</u>
				81544
BIKINI <sup>1, 2/</sup>	*	*	1.0	
ENYU <sup>1, 2/</sup>	*	*	.5	
AIRUKIJI-ENINMAN <sup>2/</sup>	*	*	.45	
ENIRIK <sup>2/</sup>	*	*	.3	
RUKOJI	*		.06	
CHIEERETE	*		.06	
ARRIKAN	*		.01	
OURUKAEN	*		.02	
BOKOAETOKUTOKU	*		.01	
BOKORORYURU	*		.01	
BOKOBYAADAA <sup>2/</sup>	*	*	.08	
BOKONEJIEN <sup>2/</sup>	*	*	.01	
NAMU <sup>2/</sup>	*	*	.2	
YUROCHI	*	*	.06	
UORIKKU-AOMOEN <sup>2/</sup>	*	*	.23	
			<u>3.00</u>	

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1. As a screening measure, one flight track will be flown along the reef between Bikini and Enyu Islands passing over the center of BOKONFUAAKU, YOMYARAN, ENLAIRO, ROCHIKARAI. and IONCHEBI ISLANDS.
2. To the extent practicable, modest extensions should be made of flight tracks over these islands to cover portions of adjacent shallow water areas on the reef.

TABLE II  
TOTAL AREA TO BE COVERED

<u>ATOLL</u>	<u>GAMMA</u>	<u>AM-241</u>	<u>TOTAL</u>	<u>PRIORITY</u> *	<u>NUMBER**</u> <u>PEOPLE</u>	<u>SURVEY</u> <u>DA YS***</u>
BIKAR	.19	.09	.28(4)	4	-	2
TAKA	.18	.12	.3(4)	3	-	1
UTIRIK	1.27	1.12	2.39(5)	2	217	3
LIKIEP	3.02	2.21	5.23(19)	2	406	8
RONGELAP	.52	.34	.86(22)	2	165	6
RONGERIK	.81	.54	1.35(11)	3	-	3
AILINGINAE	.93	.41	1.34(17)	3	-	4
WOTHO	1.38	1.15	2.53(6)	2	61	4
AILUK	1.72	.81	2.53(16)	3	-	5
UJELANG	.60	.46	1.06(12)	2	342	3
JEMO ISLAND	.08	.08	.16(2)	3	-	1
MEJIT ISLAND	1.26	1.26	2.52(2)	2	271	1
BIKINI	3.00	2.83	5.83(24)	1	< 100	10

\*See Table III.

\*\*1973 Census.

\*\*\*Roughly derived from time required for aerial survey of ENEWETAK ATOLL.  
( ) Number of islands to be flown plus those reflown.

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TABLE III  
NORTHERN MARSHALLS AERIAL SURVEY  
PRIORITIES

<u>Priority</u>	<u>Description*</u>
1.	Atolls where nuclear tests were conducted.
2.	Atolls or islands currently inhabited.
3.	Uninhabited atolls or islands near inhabited atolls or islands that are visited frequently and used for food collection.
4.	Uninhabited atolls or islands remotely located from inhabited atolls or islands.

\*The term "atoll" is used to denote a group of islands along a reef surrounding a shallow lagoon such as BIKINI ATOLL. The term "island" is used to denote an isolated island that is not a part of an atoll such as JEMO ISLAND.

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TABLE IV  
RADIOLOGICAL SURVEY ROUTES  
Eleven Atolls + Two Islands

Survey A

KWAJALEIN - WOTHO - UJELANG - BIKINI (See Map I)

Survey B

BIKINI - AILINGINAE - RONGELAP - RONGERIK - LIKIEP -  
KWAJALEIN (See Map II)

Survey C

KWAJALEIN - TAKA/UTIRIK - BIKAR - MEJIT - AILUK - JEMO -  
KWAJALEIN (See Map III)

BIKINI ATOLL ONLY

KWAJALEIN - BIKINI - KWAJALEIN  
(See Map IV)

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NORTHERN MARSHALLS AERIAL RADIOLOGICAL SURVEY

SCHEDULE\* I

Eleven Atolls + 2 Islands

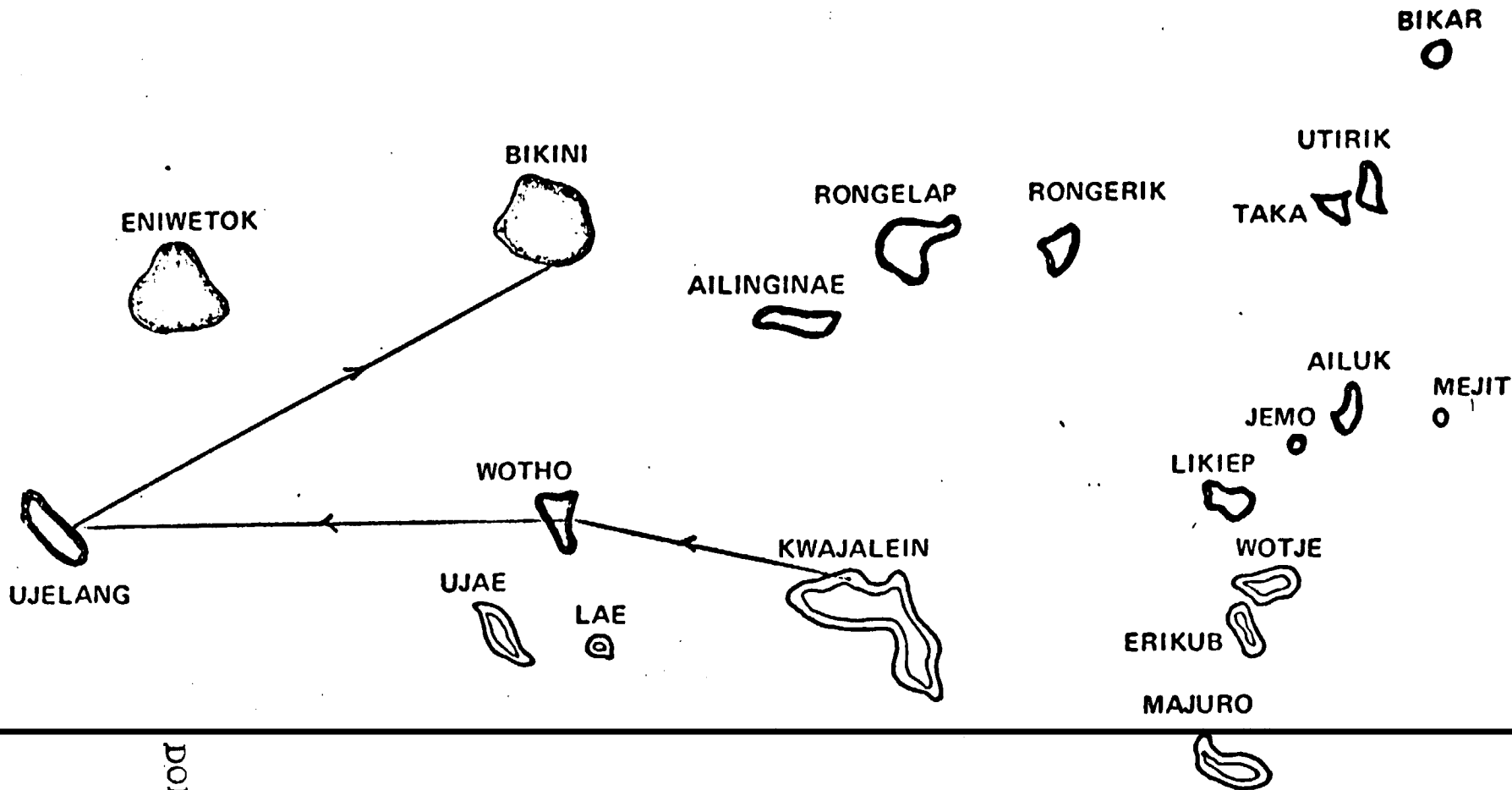
- D-day KWAJALEIN to WOTHO
- D+1 Survey WOTHO
- D+5 WOTHO to UJELANG
- D+6 Survey UJELANG
- A D+10 UJELANG to BIKINI
- D+11 Survey BIKINI  
(Crew change at end of Bikini survey.)
- 
- D+23 BIKINI to AILINGINAE
- D+24 Survey AILINGINAE
- D+28 AILINGINAE to RONGELAP
- D+29 Survey RONGELAP
- D+35 RONGELAP to RONGERIK
- D+36 Survey RONGERIK
- B D+39 RONGERIK to LIKIEP
- D+40 Survey LIKIEP
- D+47 LIKIEP to KWAJALEIN  
(Resupply, check equipment and repair, and crew change)
- 
- D+52 KWAJALEIN to TAKA/UTIRIK  
(treat these two atolls as one survey location)
- D+53 Survey TAKA/UTIRIK
- D+57 TAKA/UTIRIK to BIKAR
- D+59 Survey BIKAR
- D+60 BIKAR to MEJIT
- D+61 Survey MEJIT
- C D+62 MEJIT to AILUIK
- D+63 Survey AILUIK
- D+68 AILUIK to JEMO
- D+69 Survey JEMO
- D+70 JEMO to KWAJALEIN

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\*Schedule does not include any time for photo missions.

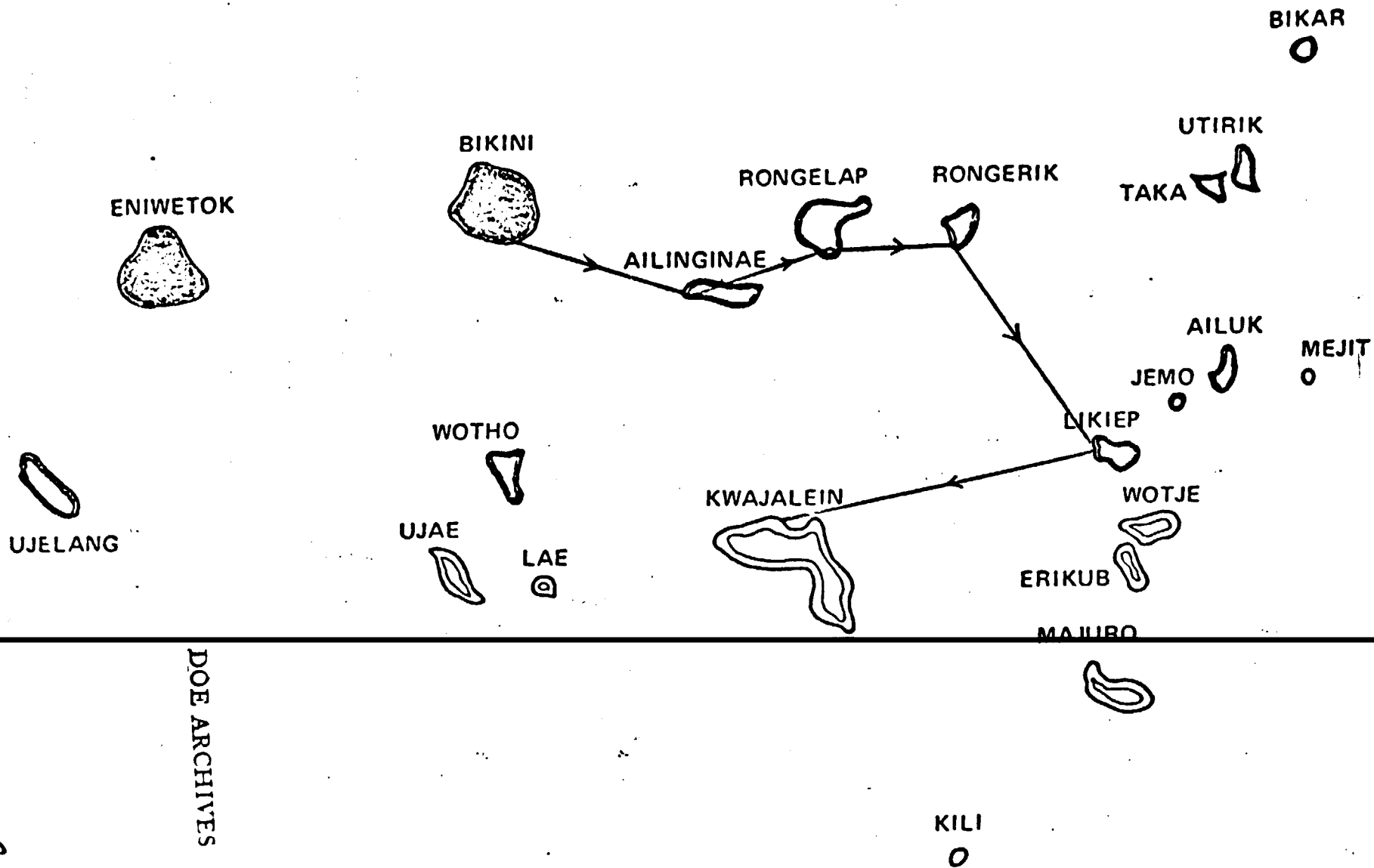
# ATOLLS CONTAMINATED BY FALLOUT



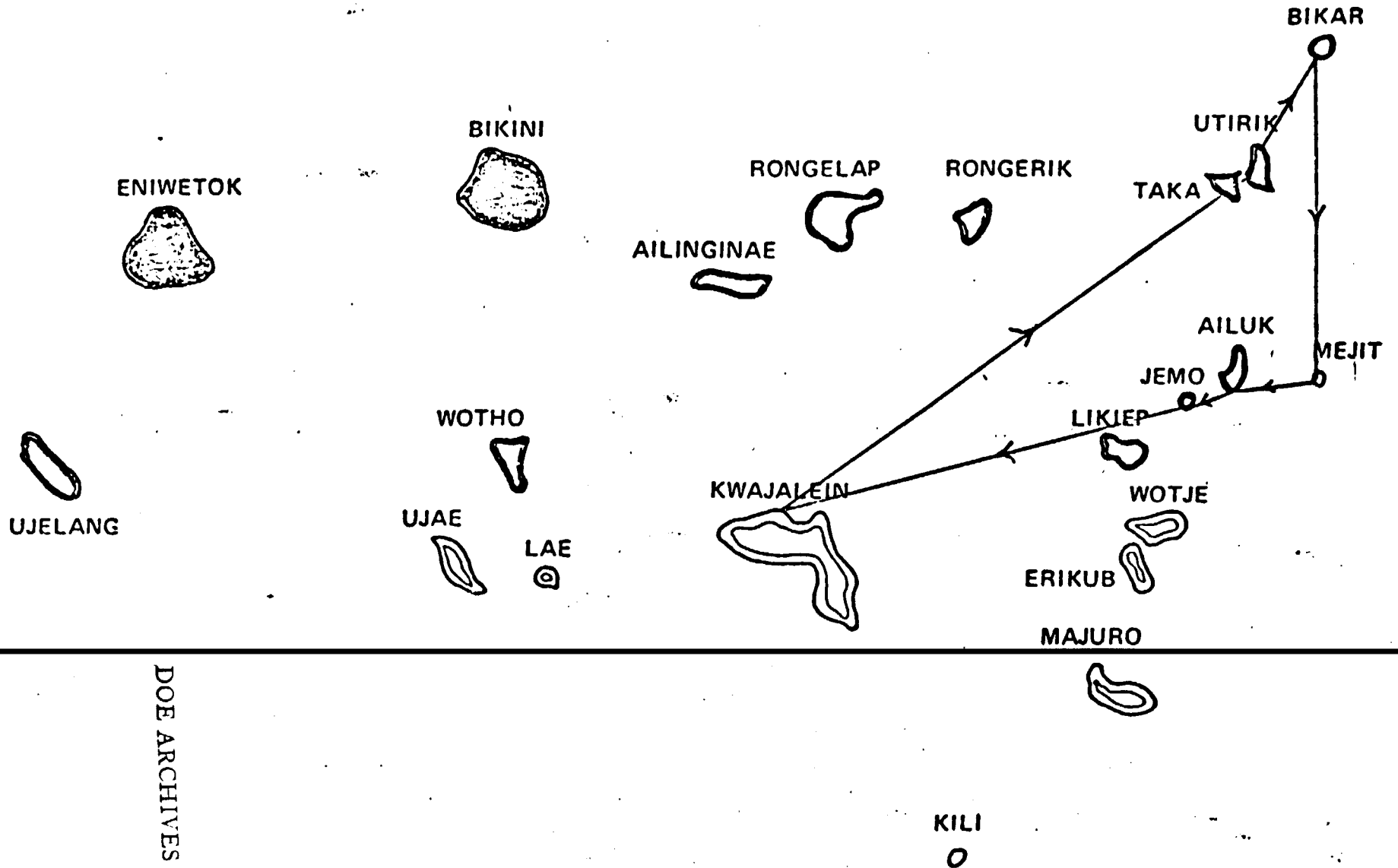
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# ATOLLS CONTAMINATED BY FALLOUT



# ATOLLS CONTAMINATED BY FALLOUT



NORTHERN MARSHALLS AERIAL RADIOLOGICAL SURVEY  
SCHEDULE\* II  
BIKINI ATOLL ONLY

D-3	Arrive BIKINI ATOLL
D-day	Survey BIKINI ATOLL
D+9	Complete survey flights
D+12	Depart BIKINI ATOLL

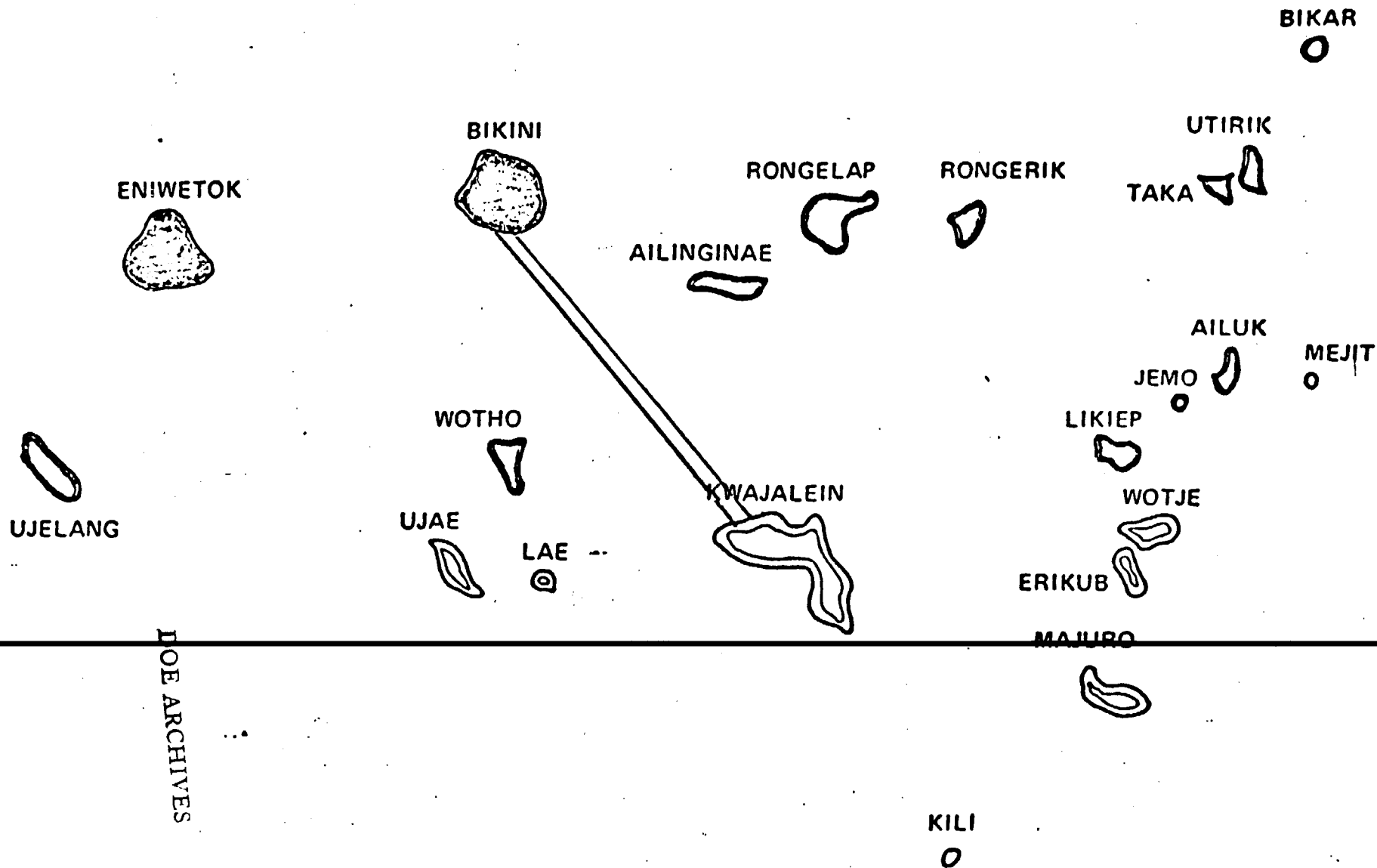
\*If photo missions are made a part of the BIKINI ATOLL ONLY survey, these missions must begin at D-5 and 9 more personnel must be added to the survey team for a total of 29. See item 2c, Requirements, for the radiological survey. A photo processing laboratory capability must be established in the base camp or ship.

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MAP IV

# ATOLLS CONTAMINATED BY FALLOUT



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NORTHERN MARSHALLS PHOTO MISSIONS  
Eleven Atolls + Two Islands  
(Conducted separately)

Assumptions:

1. Personnel and equipment will use commercial air to KWAJALEIN ATOLL.
2. Photo missions will be flown by fixed winged aircraft from KWAJALEIN ATOLL beginning at least three weeks before the beginning of the radiological survey.\*
3. Aerial photos are to be obtained for those atolls and islands listed in Table I.
4. Film will be processed at both KWAJALEIN ATOLL and Las Vegas, Nevada.
5. For commercial logistics of photo missions see "COST ESTIMATES."

Requirements:

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1. One C-54 aircraft plus crew, or, an aircraft with equivalent range to fly photo missions to those atolls and islands shown in Table I. See Schedule III showing a period of 30-day to complete photo missions.
2. Finished photos suitable for planning each of the three parts of the aerial radiological survey must be available prior to the beginning of each part.
3. For photo missions, the following personnel are the minimum to be used:

3-persons flying with cameras.

1-person at KWAJALEIN ATOLL processing  
"tails" to insure good results.

\*This assumption rests on the additional assumption that a C-54 aircraft is used since hardware for mounting cameras is available. For any aircraft where mounting hardware must be fabricated, this fabrication will take two to four weeks.

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NORTHERN MARSHALLS PHOTO MISSIONS

SCHEDULE\* III

D-day	Photo mission to BIKINI ATOLL
D+1	Second mission to BIKINI ATOLL
D+3	Photo mission to UJELANE ATOLL
D+5	Photo mission to WOTHO ATOLL
D+7	Photo mission to RONGELAP ATOLL
D+8	Second mission to RONGELAP ATOLL
D+10	Photo mission to LIKIEP ATOLL
D+11	Second mission to LIKIEP ATOLL
D+13	Photo mission to AILINGINAÉ ATOLL
D+14	Second mission to AILINGINAE ATOLL
D+16	Photo mission to RONGERIK ATOLL
D+18	Photo mission to TAKA/UTIRIK ATOLLS
D+20	Photo mission to MEJIT ISLAND
D+22	Photo mission to AILUK ATOLL
D+23	Second mission to AILUK ATOLL & JEMO ISLAND
D+25	Photo mission to BIKAR ATOLL

\*Plus 5 days to allow for weather and cloud cover interference.

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MARSHALL ISLANDS AERIAL RADIOLOGICAL SURVEY AND  
PHOTO MISSIONS

COST ESTIMATES

COMMERCIAL LOGISTICS SUPPORT

	<u>11 Atolls + 2 Islands</u>	<u>BIKINI ATOLL ONLY</u>
Survey Time - days	70	15
Photo time-days	30	2
LST	\$2,000,000	\$1,250,000
Helicopters (2)	200,000	135,000
Air Transport (2 trips)	210,000	210,000
Separate photo missions (fixed wing A/C)	100,000	23,000
Combined photo missions (helicopter)	NA*	32,000
Total (separate photo)	2,510,000	1,618,000
Total (Combined photo)	NA	1,627,000

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\*NA is "not applicable."

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