UNTIVERHIAL CODET

Mep duction of this document in whele in . rt is prehibited except with nurmisation of the office of erigin.

CUSTY CLA RDB PROJECT CARD TYPE OF REPORT REPORTE SONTROL SYMBOL DD-RDS(A)48 New Project 1. PROJECT TITLE (SECRET TITLE) INFRARED RECOMNAISSANCE SUB-2. SECURITY 3. PROJECT NUMBER SYSTEM FOR ARS, WS-117L (UNCLASSIFIED TITLE) SUBSYSTEM G, WS-117L SECRET 1761 4. INDEX NUMB S. REPORT DATE 6. BASIC FIELD OR SUBJECT 2-117L 2 April 1957 7. SUBMELD OR SUBJECT SUBDROUP 7A. TECH. OBJ. Strategic Air Warfare System 117L 37-Recon-Electronic Equipment SA-9A,9B 10,10-9 S. COGNIZANT AGENCY 12. CONTRACTOR AND/OR LABORATORY CONTRACT/W.O. NO. ARDC Lockheed Aircraft Corp. AF 04(647)-97 9. DIRECTING AGENCY HQ ARDC, WDD OFFICE SYMBOL WDTR Ext. 1343 10. REQUESTING AGENC HQ USAF 1959 11. PARTICIPATION, COORDINATION, INTEREST 1961 JET 1965 USAF/AMC-P ATC-I 14. DATE APPROVED SAC-I USN/CNO-I

This is the initial report on this project. 20. REQUIREMENT AND/OR JUSTIMCATION

USA/C/S-I

OTHER/CIA-I

APGC-I

ATIC-T

ADC 1

The Infrared Reconnaissance Subsystem is designed to fulfill, in part, the intelligence objectives outlined in System Requirement No. 5, dated 17 -October 1955. Development of an infrared sensing capability provides unique intelligence data for strategic warning purposes. Ultimately, with a system of satellites simultaneously on orbit, unfriendly territory will be placed under continuous and complete surveillance. The subsystem will automatically screen out unintelligible signals and respond only to highly emitting targets which rise out of the lower atmosphere. This fixes its response to large jet or rocket types of airborne vehicles and permits rapid interpretation of signals received.

15. PRICRITY

22. RD8 C.

DD . DOV NNGRADED AT 12 YEAR INTERVALS: NOT AUTOMATICALLY DECLASSIFIED DOD DIR 5200.10

Prev.

57

59

60

61-65

A (Missiles)

OM

191M

<u>1000m</u>

3000M

3000M

10000M

17191M

INFRARED RECONNAISSANCE SUBSYSTEM FOR ARS, WS-117L

Project: # 1761 2

2 April 1957

Brief and Military Characteristics: As visualized, the Infrared Subsystem in a satellite vehicle at 1000 miles altitude will detect and locate ICBM launchings ground receiving station within 2400 miles. The information is relayed directly to a at high latitude, and fifteen satellites in operation simultaneously, the entire region above latitude 55° North can be kept under continuous surveillance. When a data link is developed which will permit information to be relayed between vehicles can be achieved. From a 300 mile orbit, the Infrared Subsystem will since immediate transmission is not essential when air breathing vehicles are cycle.

21 b. Approach:

Target detection ranges and background effects will be studied to establish the performance to be expected of an infrared system. An optimized subsystem will be evolved, progressing from component and system breadboard studies to experimental and prototype models, with orbital flight tests of the prototype system. Suitable detector elements and scanning and cooling methods are critical features of the design. When the utility of infrared reconnaissance by a single satellite has been successfully demonstrated, multiple satellites and higher orbital altitudes will be attempted. Concurrently, development of an intersatellite data link and accurate tracking angle reference systems will be pursued at an appropriate pace.

21 c. Subsystem Tasks

(1) Task 39832: Background Effects

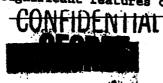
(a) Contractors:

Prime Contractor: Lockheed Aircraft Corporation, AF 04(647)-97

Subcontractors: Baird Associates
General Mills, Inc.

Technical Advisor: Mr. L. H. Meuser WCLR, WADC

- (b) Objective: Determine the extent to which background radiation imposes limitations on the infrared detection system and determine the choice of system parameters which will minimize it. This will contribute to early evaluation of the target detection capabilities of a satellite-borne infrared-sensing system.
- (c) Approach: Balloon flight tests will be conducted using elements of the system as initially conceived, with suitable spectral sensitivity, filtering, field of view, scan speed, chopping rate, etc., and provisions for variations thereto. A limited number of day and night balloon flights will be conducted at maximum attainable altitude, in the vicinity of 100,000 feet, under representative and extreme terrain and cloud conditions. Measurements of background radiation will be correlated with significant features of observed areas.



PAGE 2 OF 14

(2) Task 39833: Target Characteristics Viewed from High Altitude

(a) Contractors:

Prime Contractor: Lockheed Aircraft Corporation, AF 04(647)-97

Subcontractors: Eastman Kodak Company (Proposed)

Technical Advisor: Mr. L. H. Meuser

WCLR, WADC

(b) Objective: Measure infrared radiation intensity emanating from appropriate types of missiles and aircraft as a function of their altitude. Make these measurements from as high an altitude as possible to minimize the very great effect of the lower atmosphere. Together with background effects investigated under Task 39832, these measurements are essential to evaluating operational performance expectations.

(c) Approach: An instrumented aircraft will be flown at 45,000 feet or higher. Equipment will have in-flight calibration features to measure intensity in important spectral regions, placing particular emphasis on the 2-3 and 4-5 micron regions. Measurements will be performed on two-target types as follows:

1. Air-breathing turbo-jet or turbo-prop aircraft with high horse-power engines, such as the B-47, B-52, C-130, F-102 and F-104. The target aircraft altitude will be varied from sea level to 45,000 feet with particular emphasis on altitudes above 20,000 feet. The target aspect will be varied sufficiently to allow construction of approximate polar intensity plots.

2. Burning rocket engines of the ICBM type. Radiation intensity will be measured during ascent from sea level to burnout, and beyond if

Pursuit of this task is contingent upon obtaining a suitable USAF aircraft with crew and such operational support as is necessary. A request for test aircraft and support from AFFTC, Edwards Air Force Base, has been initiated and resources annexes are in preparation.

(3) Task 39834: Prototype Infrared Subsystem

(a) Contractors:

Prime Contractor: Lockheed Aircraft Corporation AF 04(647)-97

Subcontractors: Aerojet-General Corporation

Eastman Kodak Company

Technical Advisor: Mr. L. H. Meuser WCLR, WADC

(b) Objective: Develop a prototype Infrared Subsystem with detection capabilities as outlined in the General Design Specification.



PAGE 3 OF 14 IND-57-01252 INFRARED RECONNAISSANCE SUBSYSTEM FOR ARS WS-11/L Project: # 1761 2 April 1957

The prototype will have no tracking capability nor will it be equipped for intersatellite communication.

(c) Approach: The feasibility of various technical approaches will be studied. Scanning methods for locating small targets in a large field of view will be investigated. These include techniques such as rotating a fan of pencil beams in conjunction with an electronically scanned linear array of detecting elements, utilizing a solid angle of pencil beams emanating from an electronically scanned stationary mosaic of detectors, or utilizing a single element with an optical scanning device. Promising detector elements such as lead sulphide, lead telluride, lead sellenide, indium antimonide, gold doped germanium, etc. will be evaluated. Relative suitability of such detectors will be determined in terms of spectral response, sensitivity, time constant, cooling requirements, physical properties, nuclear radiation damage, and environmental compatibility. Airborne data processing equipment similar to utilized, with and without, data storage features.

Breadboard component studies will be conducted and an experimental model built. The experimental model will be tested exhaustively on the ground and in aircraft. Test results will lead to prototype design specifications. Power requirements, heat generation, weight, and size of the prototype will be reduced to an absolute minimum by miniaturization and transisturization wherever possible. A very substantial effort will be exerted to achieve an extreme degree of reliability for the entire system. Redundant as well as improved components will be considered. After extensive ground and aircraft tests, the prototype will be given erbital flight tests.

(4) Task 39835: Feasibility of Advanced Applications

(a) Contractors:

Prime Contractor: Lockheed Aircraft Corporation, AF 04(647)-97

Subcontractor: Undetermined

- (b) Objective: Study the feasibility of more difficult and advanced applications of satellite-borne infrared-sensing equipment.
- (c) Approach: Practicable operational concepts and equipments will be studied to extend the performance of the Infrared Subsystem beyond that of the proportion orbital altitude, number of vehicles on orbit, and data transmission methods will be investigated. The operational utility of a satellite system in an AICBM role will be considered, including the feasibility of tracking the requirements of a reliable intersatellite communication. Characteristics and area under prompt surveillance will be established. Methods for obtaining an accurate angle reference system will be studied, including line-of-sight between satellites and celestial references.





INFRARED RECONNAISSANCE SUBSYSTEM FOR ARS, WS-117L

Project: # 1761

2 April 1957

21 d. Other Information:

The satellite platform furnishes a unique vantage point for viewing infrared targets in that it provides a very large horizon distance and minimum intervening atmosphere. Technical problems involved in the subsystem development are also unique, considering the environment and the long duration of unattended operation. Duplication of other efforts is therefore not believed to exist. Equipment and techniques are under development which have similar operational applications, but which have more limited coverage. In particular, development work undertaken by AFOIN-4 is clesely related to this effort and coordination between the two programs

THE HILL

21 e. Background History

During early design study of the WS-117L, the Missile Systems Division, Lockheed Aircraft Corporation, recognized the possibility of accomplishing useful reconnaissance with satellite-borne infrared-sensing equipment. A proposal to this effect was included in MSD-1726, 30 June 1956, "Pied Piper First Annual Report" on Contract AF 33(616)-3105. Feasibility was further pursued by Lockheed, results being given in periodic reports and being summarized in MSD 1929, 6 September 1956, "Preliminary Study of WS-117L Warning System Against ICBM Attack." Lockheed was also engaged in a separate AICBH study on Contract AF 33(616)-3284, reporting potential AICBM applications of a satellite infrared system in MSD 1844, 31 August 1956, "Third Quarterly Report - AlCBM Study Program." A related program initiated by AFOIN-4 contributed to the feasibility and desirability of this approach.

21 f. Future Plans:

During the next reporting period feasibility studies will be extended. Measurements of background effects on an elementary system and of target characteristics as viewed from high altitude will establish range and performance capabilities. Preliminary design of the subsystem will be conducted leading to specifications for an experimental model.

21 g. References

- (1) General Operational Requirements (80) SA-2C, 11 March 1955
- (2) System Requirement 5, 17 October 1955
- (3) MSD 1726, 30 June 1956, "Pied Piper First Annual Report"
- (4) MSD 1844, 31 August 1956, "Third Quarterly Report-AICEM Study Program"
- (5) MSD 1929, 6 September 1956, "Preliminary Study of WS-117L Warning System
- (6) Confract AF 33 (616)-3105
- (7) Contract AF 33(616)-3284



PAGE 5 OF 14 1111 E7. A12 ED



INFRARED RECONNAISSANCE SUBSYSTEM FOR ARS, WS-117L

Project: # 1761 2 April 1957

(8) Contract AF 04(647)-97

21 h. Coordination and Signature Block

GEORGE E. AUSTIN

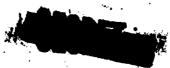
Major, USAF

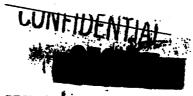
Project Engineer

FREDERIC C. E. ODER Colonel, USAF

Assistant for WS-117L

CK)





GENERAL DESIGN SPECIFICATION

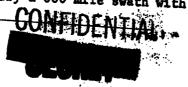
I. General

- a. Statement of the Problem: The Infrared Subsystem will partially fulfill the objectives outlined in System Requirement No. 5, 17 October 1955, by providing the following capabilities for the WS 117L:
- (1) Detection of ICBM launchings whenever and wherever they occur, giving immediate and unambiguous warning of ICBM attack.
- (2) Detection of large jet aircraft and missiles for early warning of attack by such vehicles, and for surveillance of air traffic patterns as an indicator of the imminence of hostilities.
- (3) Tracking of ballistic missiles during their burning stages with sufficient accuracy for trajectory and impact prediction in AICBM applications. This represents a very advanced capability.
- b. Approach: The Infrared Subsystem will passively receive infrared signals in selected portions of the 1-12 micron region, process these signals, and feed them to the Ground Space Communication Subsystem for transmission to the ground in suitable form for immediately locating the emmitting sources. Hopefully, these sources will be limited to large rocket or jet engines at altitude, with ground targets blanked out by the lower atmosphere.

Since warning of ICBM attack requires instantaneous reporting of targets detected by the Infrared Subsystem, data storage and subsequent readout during passage over a ground receiving station cannot be considered for this capability. Using multiple satellites simultaneously on orbit, but with no intersatellite data link, direct transmission from each satellite to ground must be utilized. The geographical area under surveillance at any Each of these ranges is expected to be approximately 2500 miles for an orbital altitude of 1000 miles.

Preliminary analysis indicates that with one high latitude ground receiving station and fifteen satellites equally spaced on an 83 degree, 1000 mile orbit, all launching sites within the USSR for missiles with a 5500 nautical mile range can be kept under constant surveillance. The coverage of total Soviet territory will be no less than 50% at any time and will average approximately 80%. With intersatellite communication, greater coverage can be obtained with half as many satellites.

For operation against manned aircraft and other airbreathing vehicles, storage and later transmission of detection data is feasible. Whereas, the ICBM detection range is line-of-sight limited and can be increased by increasing orbital altitude, the less intense emissions from airbreathing targets are not likely to be detected from a 1000 mile orbit. A 300 mile orbital altitude must therefore be utilized for this application. A single satellite will provide useful surveillance of USSR aircraft patterns and activity. Cutting approximately a 600 mile swath with each passage, the





the satellite brings a very large percentage of Soviet territory under observation at some time during each day. The type of intelligence data so obtained is an activity indicator, providing an alert whenever significant deviations from normal patterns occur.

c. Solution:

The infrared Subsystem must detect and locate emitters of minute size in a large field of view. A conceptual but non-optimized design to accomplish this employs a line array of approximately 150 cooled lead telluride detecting elements. These are placed in the focal plane of a 56 inch diameter corrected reflector system, creating a fan-shaped field of view comprised of 150 vertical axis, 150 concentric annular rings are swept out. Simultaneously with mechanical rotation, each of the detecting elements in the line array is crientation of the optical system together with the identity of the detecting element in the line array.

Target radiation falling upon a detecting element changes its conductivity and produces a voltage signal which is amplified by an individual pre-amplifier mounted on the rotating scanner. A commutator system receives azimuthal potentiometer produces a voltage indicative of the scanner's position. The electronic scanning voltage, which is used to scan the elements, is fed signals out of the target amplifier with the appropriate and correlates all target target position data, together with a timing code signal are passed through relayed to ground by the satellite-to-ground transmitter.





			& D										•										2.	R	EP0	RT	s cc	XXTI	ROL	SYM	BOL
(SECRET TITLE) INFRA-RED	SYSTEM DE PROJECT TASK OTHER RECONNAISSANCE SUBSYSTEM FOR ARS, WS 117L CHANGE CHANGE CALENDAR YEARS														-	2	A	pr:	<u>_</u>	19	 57										
(UNCLASSIFIED TITLE) SUBS	YSTEM G, W	1	17L	JB2	¥51	TEM.	FO	R A	ARS	, W	8 1	1.77	L					7					•	NI	JMB	ER				_	
SCHEDULE		T		_					 -					Ц,									ı		:	176	51				
TITLE	PROJECT OR TASK NR	<u>_</u>		57		L		_		• 5	8	_			_		_	-	_	7	30	60		_	18 (_				
		╫	4	P	ᄥ	빝	<u> </u>	14	<u>"</u>	11.	凸	۰۱۰	N	ь	٦,		٨	٠,	1.		11.	T.	1.			1	╄				134F
ıbsystem G	1761	Ц	土		\pm	Н	+	╁	H	+	Н	+	F	П	Ŧ	П	7	1	Ц	Ì	Ϊ		П	I	#	土	屵	H	* 4	+	£465
Background Effects	39832	╁	+	H	Ŧ	П	Τ,		H	丰	П	#			土	Н	1	+	Н	+	╁	Н	c ,	9	Ŧ	Ŧ	P	П	1	-	E
Target Characteristics	39833	I	\Box	#	士		Ľ			+	H	+	Н	4	+	Н	Ŧ	\mp	П	7	1	П	T,	1	土	土	Ħ		<u> </u>	i. I	J
<u> </u>	72033	H	╁┤	+	+	-	4-	П	R.	L	П	I		ユ	土		1	+	Н	+	+-	Н	+-	+	4-	+	-	-	.]		
IR Equipment Components	39834	II.	\Box	\downarrow	\Box			Н	\pm	$\dagger \dagger$	+	+	Н	+	\perp	H	, T	П		٦.			1.	+		Ϊ.					╁┤.
		+	H	+	H	+	+	\Box	Ŧ	П	1	T	口	1	上	ď	1	Н	+	+	Н			4.	╀	 -;	P		1		E
Feasibility of Adv. App			П	土	\Box	\perp	$\dagger \dagger$	+	十	H	+	+-	H	+	+	4	+	П	7	I		1	I	上	1	1.	•	-	1-1	\dashv	J
OI ACV. App	. 39835	+	₩	+	H	Ŧ	Π	7	Ţ	П	4			土		+	+	Н	-+	+-	Н	-	+-	+	ļ	1		T	П	-1	
Key - A - Contract				土	Ш	士	+	+	+	╁	+	H	+	╀	Н	Ŧ	F	П	7	T	П	コ	土	İ		L	Í	÷	╁		++
Rey - A - Contract Award B - Fabrication of C - Development M. D - End of Contact	Develope	119	54)	4	H	\perp	\Box	T	I	П	I		1	1	H	十	+-	Н	+	+	Н	+	╄	╂-	Н	Ļį	Ţ	T	П	ユ	廿
C - Development No.	el Pabrica	1			H	Τ.		于	dto	ᆄ	4_	**	gh.	4	-	द्वा	4)	П	I			Ì	<u>†</u> -	†	\vdash			+	₩	+	1-1-
E • Completion of	T	_		-		ч.	he.	'n			M	Li	7	À	t () Ces	:Je	} 	+	+	H	4	4	$oxed{\Box}$	Е			I	Ì	广	\pm	1
J - Preparation of	Procure	,,,,	7	4.5	4	Dev	ÞΙÞ	طع	41	1	40		راه			LET.	1.1	T		t.	+	+	+-	Н	┞┽	-4.	+	4_'	П	T	口
	101 maami I	7.	7	19	7	ጕ	╁	╁	+	+	╀	Н	+	-	_		Ц	I	Ϊ		7	ተ	H	Н	H	+	+	╁┤	+	+-	├-}-
VECOUNG Teet Ct.		7	7	П	工			士	† †	+	+	╁	+	+	<u>.</u>		i÷	+	L	Ц	Ţ	Į				土	1	H	+	+	┝╂┙
P - Integration w t	h First Fi	44	= (4	9	p de	44	9	œ.	Gu	oup	L				İ	f	1	+	╁	Н	┿	╀	Н	Н	+	+	+	П	工	口	
		Ц	士	H	+	Н	+	+	╁┥	+	+	4	+	\Box	Ţ	1.	П	I		口	土	İ	ㅂ	7	+	十	+	∺	+	++	-+-
		\Box	Ŧ	П	Ţ	П	I	İ	口		Ħ	\perp	士	Н	+	+-	+	+	H	H	+	#	П	4	Ţ	I	工	口	土	廿	丗
		Ħ	\pm	H	+	╁	+	╀	Н	+	П	Ŧ	F	П	1		#	土	Ħ	士	士	\pm		+	+	+	+	Н	+	+-	刊
	$$ \bot	П	Ţ	口	I	Ħ	土		廿	\pm	H	\pm	+	H	+		+	+	Н	\mp	Ŧ	П	7	7	T	丰	Ħ	口	土	廿	廾
	· ·	H	+	╁	+	H	+		Ц	Ţ	П	Ţ		\Box	1	П	士	\perp	H	士	+	Н	+	+	+	+	H	\dashv	\vdash	\prod	口
FORM 103 PREVIOUS EDITIO		т	_	\vdash	┿	╆╌╋	+-	Н	⊢∔	4-4	Н		L	$\sqcup \mathbb{L}$		ıΙ	Т		П	T	7	77	+	+	+	+-	₩	+	+	++	+

PAGE 9. OF 14



			& D TEST AIMEX PROJECT TASK			<u> </u>	ONTROL SYMBOL
	•		I IASK	OTHER		PAGE S. DATE	OF PAGE
4. TITLE (SECE (UNCL	ET TITI ASSIFIE	E) INFRA-RED RECONNAISSA ED TITLE) SUBSYSTEM G, WS	NCE SUBSYSTEM FOR	ARS, WS 117L CM	TIAL X	2 April	1957
7. RESP CE	TER .	A. PROJECT OFFICER	44/1			1761	
WDD ((DTR)	Major G. E. Austin	9. SUPPORTS (Sye or Proj	1 '	1 AT 04 1	1761	13. SECURITY
II. ITEM NUMBER	16.	TEST ITEM	WS 117L	Lockheed Acft.Co	1 111 -	1A, 1-6	SECRET
1.	Info			SCRIPTION	TEST AGENCY AND SIT	E TEST ITEM	19. ROD TEST
	18T1C		One A/C with IR s will measure the intensity in sele regions from burn and jet aircraft in power engines. He capability in excepted is necessary mented A/C in order effects of the low variations in targuith altitude and determined. Data used to evaluate p IR detection system very high altitude	radiation cted spectral ing ICMM rockets with high horse- igh altitude less of 40,000 for the instru- er to subordinate wer atmosphere. get radiation aspect will be obtained will be erformance of an momentum.	(1) Agency to be determined. AFFIC OF AFAI under consideration. (2) Site - Some flights necessary in vicinity of Patrick AFB. Site of other flights optional.	strumentati avail 30 er Aug 57 (2) A/C to be instrume desired 30 Aug 57 (3) ICEM ta	nted rgets t
. NAME	·		TEST CENTE		<u> </u>		
			REANIZATION	* AFFRUYAL		·	
. NAME			PREAMIZATION			DATE	
						DATE	
. NAME			RESPONSIBLE CEN	TER APPROVAL	<u> </u>		, the second
RDC FORM	105	PREVIOUS EDITIONS OF THIS FORM	CONT.	C. K. C. C. C. C. C. C. C. C. C. C. C. C. C.	·	DATE	

1''									
		R & D TES	T AND TEST S	UPPO	RT A	ircraft an	NEX.	2. REPORTS CONT	ROL SYMBOL
		SYS	TEM IN PROJE	ECT I	T 1	ASK 🗆 OTH		PAGE OF	PAG
4. TIT	LE (SK	ARKAT MANAGARA			•		EK.	P. DATE 2 April 1	057
SUBS	YSTE	CRET TITLE) II M FOR ARS, WS	TRAKED RECOR	NIVALS:	SANC	S. INITIAL	1	6. NUMBER	337
(UNCI	AȘSI.	FIED TITLE) S	BUBSYSTEM G.	WS 11	l 71.	CHANGE			
ITEM	-	AIRCRAFT RI	EQUIRED	٠.	10.	11.	12.;	1761	
NUMBE	QTY	TYPE, MODEL AND SERIES	SERIAL NUMBER	CODE	8 8	DATE REQU AND LOCATION	ESTIMATED RELEASE DATE	RECOMMENDED DISPOSITION	14. 18. 2 U L
1. 2.	1	B-47 (or eq			L	30 Aug 57	31 Mar 5	8	** *: 110 110
2. 3.	1	B-47 (or eq	1		A	*	*	•	12 12
4.	1	F-100 (or e	1		A	* *	*		4 3
5.	1	C-130 (or e			A	*	*		15 12
		(rragienc)	·	A	*	*	TOTAL	12 <u>24</u>
	.					•			
	l			·				.	
							. [
				.		-			
•	LOCE	tion and Dat	es to be det	ermin	ed b	y Center.	Center is	expected to	
		WO UL PRETIAU	A 1970 4 1					CUMUMUTAN ENGLI	-u- 000
	L	CUITE SOA ALL	h				arre refille	71 TO 6 The	ilitional
	aud	places of commated hours	mraniana, d.	1			lug 57 to 3	3 to be flown	at times
**	1.	· · I		. [,			
45	Hour	s and costs	re totallei	for	peri	od 30 Aug 5	7 through	31 Mar 58.	
				- 1					
İ		Ţ		- 1	-].		
	1			-					
							1		
	ſ		İ						
		1			.				
.	1].	1	
									.
	j								
-				-			ŀ		
			1	1				.	
l							l		

ARDC | FORM 106

PREVIOUS EDITIONS OF THE TREE DESCRIPTE!

PAGE 11 OF 14 WD-57-01352

		D MANPOWE						2. REPORT	CONTROL	5776BOL
	Catalen C	PROJECT	TASK [OTHER				PARE	OF	PAGE
MCLASS	FIED TITLE						•	3. DATE		
					S. INITIAL	_ (T)		4 ADI	11 1957	
Sub	System G, WS-117L				CHANG					
ORG	••	2.	Ties	111.				1761		
COMP	ORGANIZATION TITLE	TYPE	ACTUAL MAN-QTRS			PROJECT	ED DIRECT (MAN-YEARS		
		ORG	LAST QTR	AVAL	v 19 57		19 58	FY 19 59	FY 1960	TO COM
TR	WC-1177 P			AVAL	RORD	AVAL	RORD	RORD	RORD	RORD
	WS-117L Project Office, WDD	R	1.0	0.5	1.0	0.5	1	1 . 7		
LR.	Aerial Reconnaissance Lab.,	i	1		1	0.5	1.0	2.0	2.0	*
	WADC	R	0.5	0.5	0.5	0.5	0.5			l
		İ.	1	İ	1		1 0.5	0.5	0.5	*
	İ	1	i	l ·		i	Í	1 1		
2			ļ		ł	į		1 1		
	TOTALS:	1	1.5	1.0	1	1	1	1 1		
*	TOTAL MANDON			1.0	1.5	1.0	1.5	2.5	2.5	*
,i	TOTAL MANPOWER DOLLARS:		2,730	7,280	10,920	7,280		1 1	· ·	
	· '	ł	1 1		F-,	7,200	10,920	18,200	18,200	91,000
		l .	1 1		1	ł			j	
			- I			i	1			
	•						· 1		1	
- 1		·	ł . }		l				- 1	
			ľ		1			.]		
j			ł					[
1	* Continuing Requirements				ł i	•	Ì		1	
i	sourcing reduirements								- 1	
ĺ					i 1			į.	- 1	
		. 1		j	i				- 1	
- 1		ĺ				- 1	1		- 1	
. [l de la companya de la companya de la companya de la companya de la companya de la companya de la companya de		ļ.			Ţ	1	1		
1	· · · · · · · · · · · · · · · · · · ·		. 1		j]				
]				· ·	. 1	İ	- 1	
		İ	ŀ				1			
	· ·					1		1		

D.



		RADO	ONTRACT I	FUNDS ANN	ΙĒΧ							2. RE	PORTS	CONTRO)L SYNC	IOL.
TITLE	SY\$1	EM X	PROJECT	TASK	□от	HER		•				PAGE 3. DA	TE	07		PAGES
(SECRET TITLE) IMPRAR (UNCLASSIFIED TITLE)	ED RECON	naissan Em G. W	ICE FOR AR	S, WS-117	T.				HAL X			a. NÚ	2 Ap	ril 1	<u>957</u>	
ITEM	PROJOR	S. END	CONTRACT	II. BPM	12 PREV	/ YR\$	13. py	l	14. FY	58	18. FY	50	1761		т	
SUBSYSTEM G, WS-117L		CAY			900	OTHER		ОТНЕ		OTHER		OTHER		OTHE	17TO (
G, WS-11/L	1761	E	04 (647) - 97	2-117			191 M		1000		3000		3000g		1000	\top
	•		P-100 Pu P-200 Pu	ds: ds:				150M		500M		550M		500M		200
											•					
											·					*
			_				·			.						
			P-600 P-100				1911		M000.		M000		3000M	1	0000M	
			P-200				ľ	150 <u>M</u>	•	MOO		550M	5	M00		2000 2000
	1			.												
											-					
													.			
TOTAL				-+	+	٠,	011/1	5000 77	,,,,,	0000	704 E	ECOC =	0000		\perp	
C FORM 110 PREVIOUS		L_	ORM ARE OBS			-	748 14	DOM IT		uespu	VET 3	302 3	OODK 3	500 4 (1)	D COOK	4000

PAGE 13 OF 14 WD-57-01352 THE PROPERTY OF

	•	" , " -R & ;	D COST EST	diate re	APITULATIO	Maria Commity	`\	** **	<u></u>	S CONTROL :	THEOL.
		🗆 शका	III 🔃 PROJ	OCT T	ASK OTH	E R	<i>i</i> .	•	PAGE 3. DATE	OF	PAGE
4. UNCLASS SUBSYST	THE TITLE					n 4.4 * ***	S. HOTTAL.	3	2 April	1957	
			NS YEARS	0. 000	· ·		CHAMEE		1761		
7.	ITEM	900	OTHER	* ***	AL YEAR 57		AL YEAR 58	D. FISC.	AL YEARSY	E. 70 C	
••	A. TOTAL			 	OTHER		OTHER	•••	OTHER	500	CHPLETE
CONTRACT	 	 		191M	150M	1000M	500M	3000M	550M	13000M	4000g
	3. AVAILABLE	 		191M	·					-	40002
ı,	C. NEW REG	 			150M	1000M	500M	3000M	550M	13000M	/
	A- TOTAL							- 17		23000 <u>B</u>	4000M
MATERIEL	B. AVAILABLE					 					
<u>. </u>	C. HEW REQ									 	
FACILITIES	3										
MANPOVER					1						
1.		2.7	<u> </u>	10.	. 9 <u>M</u>	10	. 9er	18.	214	109.	ne .
TRAINING	· . ']	İ									
TEST ITEM					-						- (
						. :-					
TEST PUPP	ORT AIRCRAFT					14	UK				# 1 m
SOSTOTAL				191M	150M	1000M	500M	2000-			·-
TOTAL		2.71		~				3000M	550M	13000M	4000M
DC FORM	116 PREVIOU			351.	771 	1571.9	M	3568 2	M .	17109	 N

PAGE 14 OF 14 WD-57-01352

Raprod tion of this document in whole to part is prohibited except with parassion of the office of origin.

RDB PROJECT CARD	New Project		REPORTS C	ONTROL SYMBOL
1. PROJECT THE (UNCLASSIFIED TITLE) Ground-	Space	2. SECURITY	S. PROJECT NO	i ms er
Communications Subsystem for	ARS, WS 117L	SECRET	1762	
,	•	4. INDEX NUMBER		i e
6. BASIC MELD OR SUBJECT			2 Apri	1 1957
and the or suppedi	7. SUBFIELD OR SUB.	MECT SUBGROUP		7A. TECH. OBJ.
Strategic Air Warfare System	117L 46-Communi	ications		SA-9A, 9B 10, IO-9
COOMIZANT AGENCY	12. CONTRACTOR AI	ND/OR LABORATORY	CONTR	ACT/W.O. NO.
Ommand. Directing Agency	Lockheed Airc	raft Corpora	tion AF	04(647)-97
7 55		_	[
HQ, ARDC, WDD			·	
OFFICE SYMBOL FELEPHONE NO.	F(()) 19) n	The state of the s		
WDTR X-1343				The state of the s
6. REQUESTING AGENCY	13. RELATED PROJECT			COMPL DATE
,, ,,,,	\mathcal{C}			1959
O USAF				1962 1 //
1. PARTICIPATION, COORDINATION, INTEREST SAF/AMC-P USN/CND/T	WS 117L	4		1965
SAF/AMC-P USN/CND/I AC-I USA/C/S-I		<u>ت</u>	OP. EV	AL.
DC-I Other/CIA-I	14. DATE APPROVED	And the second second	18. FY	PISCAL ISS. (M
TC-I			Prev	
PGC-I	15. PRIORITY	1.2	57	
·	1 A	16.	58_	5000M
	- LA	- A (Missi	1001 59	
				5000M
	this project		60	6000M
9. This is the initial report on O. REQUIREMENT AND/OR JUSTIFICATION	this project		60 61-65	

The objectives of this project are to assure the satisfactory development of equipment to perform all of the functions concerned with air to ground data transmission and receipt, establishment and maintenance of contact with the vehicle (including acquisition tracking, and ground control), orbital computations, and command communications.

Reference ARDC System Requirement No. 5 dated 17 October 1955.

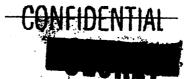
21a Brief and Military Characteristics:

The "Ground-Space Communications" ground equipment will provide for acquisition and tracking, reception of data, and transmission of specific commands to a satellite vehicle moving on an orbit at approximately 300 miles altitude. This capability will be provided for a maximum radio range from the ground stations. In addition, the ground equipment will provide for interstation ground communications, including transmission of reconnaissance data; computation necessary for acquisition, programming and for geographic

22. RDB

QWNGRADED AT 12 YEAR INTERVALS: NOT AUTOMATICALLY חבטן אטטובובט טטט טוס בטטט זט

PAGE 31 OF PAGES WP-57-01143



registration of the vehicle position, telemetry reception and recording, and a synchronized timing system.

The electronics to be contained in the vehicle and which are to be developed under this project will provide the means for transmission of the reconnaissance data to the ground receivers, control and programming of the vehicle payload functions, telemeter encoding and transmitting, vehicle timing and, as an important function of the command facility, a destruct command channel.

b. Approach

A system of ground stations will be strategically located to provide efficient tracking, command control, and intercept of the vehicle. When the vehicle is within radio range of a station, an acquisition and tracking system will determine the position of the vehicle and transmit the position data to the orbit computer. Discrete program commands will be based upon a determination of the position of the vehicle in its orbit. The high-gain telemetry and reconnaissance data receiving antennas will be slaved to the tracking system. The video output from the data link receivers will be available for data storage. The directional data link antenna on the vehicle will be scanned so that the ground receiver can detect errors in its direction. Antenna orientation in the vehicle will be corrected over the command link.

The station locations are to be determined to provide maximum coverage while still preserving security. Inter-station communication systems are to be used; these will rely on wire and radio nets.

The major problems to be overcome are (1) high reliability of vehicle electronic equipment due to long unattended operation in a foreign environment, (2) development of a steerable airbrone data link tracking scheme, and (3) availability of a suitable data transmitting tube.

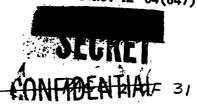
"See Tasks"

c. Subsystem Tasks

The Ground-Space Communication Subsystem is divided into the following tasks:

- la. Task No. 39840 (Uncl Title) Acquisition and Tracking Equipment
- b. Contractor: Lockheed Aircraft Corporation Missile Systems Division P. O. Box 504 Sunnyvale, California

Contract No. AF 04(647)-97



CONFIDENTIAL

(UNCLASSIFIED TITLE) Ground-Spanis Communications Subsystem for ARS, WS 117L Project 1762 -2 April 1957

> Task Advisor: Mr. J. Fallik, RADC - RCEMBL - X71217 Mr. G. H. Parker, RADC

c. Objective: The objective of this task is to design, develop, fabricate and test acquisition and tracking equipment for the WS 117L Flight Test and Operational Phases.

Acquisition equipment will insure the acquisition of a vehicle at a maximum line-of-sight range for a 50 elevation angle from the ground station, ground surveillance. One such equipment will be provided at each Vehicle Tracking and Intercept Station.

Each Intercept Station will contain ground tracking equipment whose primary purposes will be to obtain vehicle position and velocity data for orbit computations, and to dynamically orient ground data receiving antennas at the vehicle in order to receive reconnaissance data.

d. Early test flights will utilize modified pulse radar equipments for tracking. During later flights, nulling interferometers or radars will perform the tracking function. Independent acquisition equipment will be provided at all times.

The approach will be to utilize existing techniques and equipments insofar as possible.

- 2a. Task No. 39841 (Uncl Title) Vehicle Transponder Beacon Equipment
- b. Contractor: Lockheed Aircraft Corporation
 Missile Systems Division
 P. O. Box 504
 Sunnyvale, California

Contract No. AF 04(647)-97

Task Advisor: Mr. A. J. Falkowski - WADC - WCLNO-2 - X21239

- c. Objective: The objective of this task is to design, develop, fabricate and test the vehicle beacon equipment utilized to supply a tracking signal for the ground acquisition and tracking equipments. During a good with the ground pulse radar will be provided. In the later test phases the tracking signal furnished to the ground nulling interferometers, if used, will be supplied by either the vehicle telemeter or data transmitter.
- d. A beacon having all the required features is not available in inventory or in the process of R&D. However, related items are being developed by Evans Signal Laboratory of the Army, NRL, and the Air Force Missile Test Center.
- e. A program is necessary to develop beacon equipment compatible with the vehicle and associated ground equipments.

PAGE 3 OF 3



3a. Task No. 39842 (Uncl Title) Orbit Computing and Ground Programming Equipment

b. Contractor: Lockheed Aircraft Gorporation
Missile Systems Division
P. O. Box 504
Sunnyvale, California

Contract No. AF 04(647)-97

Task Advisor:

- c. Objective: The objective of this task is to design, develop, fabricate and test the ground orbit computing and programming equipment. A computer will be provided at each Vehicle Intercept and Control Station to compute the vehicle's orbit for indexing reconnaissance data, reacquisition, and vehicle programming. A master computer at the Master Intercept Station, will have an additional capability relative to determining the operating mode of each Intercept Station.
- d. The orbit computer will be selected and requisitioned from several which are now under development and which meet requirements. Required input-output devices will be developed.
 - 4a. Task No. 39843 (Uncl Title) Ground Timing and Synchronization Equipment
 - b. Contractor: Lockheed Aircraft Corporation
 Missile Systems Division
 P. O. Box 504
 Sunnyvale, California

Contract No. AF 04(647)-97

Task Advisor: Mr. G. H. Parker, RADC, RCEMBL Mr. J. Fallik - RADC - RCEMBL - X71217

- c. Objective: The objective of this task is to design, develop, fabricate and test the ground timing equipment required to provide a time base for the weapon system. Timing equipment will be provided at each Intercept Station suitably synchronized with the over-all timing system and possessing sufficient accuracy to permit geodetic indexing of vehicle position.
- d. The approach will be to select and procure the necessary equipment such as crystal oscillator secondary standards, and standard radio receiver and time delay equipments. Auxiliary equipment will be designed and developed as required.



5a. Task No. 39844 (Uncl Title) Vehicle Programming and Timing Equipment

b. Contractor: Lockheed Aircraft Corporation
Missile Systems Division
P. O. Box 504
Sunnyvale, California

Contract No. AF 04(647)-97

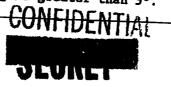
Task Advisor: Mr. A. J. Falkowski - WADC - WCLNO-2 - X21239

- c. Objective: The objective of this task is to design, develop, fabricate and test of vehicle programming and timing equipment. The vehicle programmer will accept and store commands received over the command link and release them for execution at the correct time. Vehicle timing equipment will be provided since the sequence of programmed actions is dependent upon time. Timing is also necessary in the vehicle to provide a means for geodetically indexing the reconnaissance data.
- d. Although the items of hardware to accomplish these task functions are within the state-of-the-art, specific items are not available in the inventory. A development program is therefore necessary.
 - 6a. Task No. 39845 Ground Command Control Equipment (Uncl Title)
 - b. Contractor: Lockheed Aircraft Corporation
 Missile Systems Division
 P. O. Box 504
 Sunnyvale, California

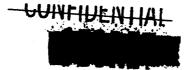
Contract No. AF 04(647)-97

Task Advisor: Sidney Rosenberg, RADC, RCVO - X-3117

- c. Objective: The object of this task is to design, develop, fabricate and test the Ground Command Control Equipment for the WS 117L System.
- (1) The purpose of the ground command control equipment is to transmit operational program commands and time signals to the vehicle in proper form, sequence and quantity for both real time and programmed vehicular, time-sequenced execution. It will also be capable of initiating "lost bird" operation. The equipment will be capable of transmitting reliable commands (via a high gain directional antenna) to the vehicle at radio range up to 2000 n. miles for elevation angles greater than 5°.







(2) An encoder will be employed to transform commands to a suitable form for modulation of the transmitter carrier. Command coding will be capable of being changed periodically for security purposes. Means will be provided to automatically indicate correct reception and decoding of the commands at the vehicle.

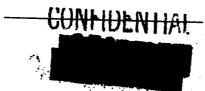
d. Proposed Approach

- (1) When a pulsed radar-transponder combination is used for primary tracking, consideration will be given to the possible use of a common transmitter and/or antenna for primary tracking and command control purposes.
- (2) For the early Pioneer Test Program, the following engineering approach will be taken:
- (a) Procure and modify, if necessary, a suitable high power results of interference and jamming studies.
- (b) Procure and modify a suitable standard parabolic antenna and pedestal for item (a) above.
- (c) Develop and fabricate an antenna feed system for a circular polarized antenna.
- (d) Assemble, and conduct compliance and field tests on
- (3) For the Advanced Ground Command Control Equipment, the following engineering approach will be undertaken:
- (a) Investigate methods of improving transmission reliabil-
- (b) Design, develop, fabricate and test an Advanced Command Control Transmitter and Modulator.
 - 7a. Task No. 39846 (Uncl Title) Vehicle Command Receiving Equipment
 - b. Contractor: Lockheed Aircraft Corporation
 Missile Systems Division
 P. O. Box 504
 Sunnyvale, California

Contract No. AF 04(647)-97

Task Advisor: Mr. A. J. Falkowski - WADC - WCLNO-2 -X21239





(UNCLASSIFIED TITLE) Ground-Space Communications Subsystem for ARS, WS 117L

- c. Objective: The objective of this task is to design, develop, fabricate and test the command receiving equipment in the vehicle. This equipment will receive commands from the ground command transmitting equipment either for real time or programmed actions. It must, therefore, be compatible with the ground command equipment, and must also be compatible with associated vehicular equipment.
- d. The approach to this task will be to utilize known techniques and develop hardware compatible with expected vehicle life and environment.
 - 8a. Task No. 39847 (Uncl Title) Ground Reconnaissance Data Receiving
 - b. Contractor: Lockheed Aircraft Corporation
 Missile Systems Division
 P. O. Box 504
 Sunnyvale, California

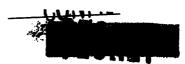
Contract No. AF 04(647)-97

Task Advisor: Mr. Sidney Rosenberg - RADC - RCVO - X3117

c. Objective:

- (1) The purpose of the Ground Reconnaissance Data Receiving Equipment will be to provide all the necessary facilities for reception, processing, recording, storage and monitoring of the visual, ferret and information transmitted by the vehicle during readout.
- (2) The equipment will meet the system requirements at all vehicle ranges within radio range of the ground station. The receiving equipment will consist of high-gain, steerable antennas of large receiving aperture, feeding highly sensitive microwave receivers which will demodulate the signal to yield video data to the recorders.
- (3) In the case of the ferret reconnaissance, the information bandwidth requirements are considerably less than those necessary for visual than that in the visual data receiver. The ferret receiver will be less will be capable of receiving telemetry-type signals from the vehicle
- (4) The infrared data receiving equipment will be capable of handling a number of telemeter channels for infrared reconnaissance data.





d. Approach

(1) Visual Receiving Equipment

(a) The development program of the Visual Data Receiving Equipment will be divided into three (3) phases as follows:

L. A. test phase during which a basic receiver will Prototype (test) antenna, pedestal, and feed system to prove feasibility (Pioneer) system.

2. The design, development and fabrication of the elevation azimuth, elevation-traverse or 3-axis antenna pedestal mounts will be determined. A determination will be made of the feasibility of using a prescribed modulation (such as amplitude modulation) imposed by scanning the transmitted beam for accurately

3. The design, development and fabrication of the Advanced and Surveillance Visual Data Receiving Equipment.

S-band and will be frequency modulated. As a preliminary step, the receiving equipment will be designed for handling 6 megacycles video bandwidth signals. Utlimately, the video bandwidth may approach 20 megacycles, depending upon the ultimate vehicle transmitted visual data requirements. A circularly-polarized parabolic antenna having a gain of at least 50 db (for linearly-polarized signals) will be initially used to determine its suitability. Initial use will be made of low noise, travelling-wave tube input. Other types may be used if deemed more desirable.

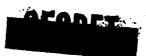
(c) For the recording, storage and playback of the Advanced bandwidth capabilities, will be developed, fabricated and tested. Recorders employing several rotating heads will be investigated.

(2) Ferret Data Receiving Equipment:

The development of the ferret data receiving equipment will be divided into three phases, as follows, to provide progressively greater frequency coverage as more powerful vehicular power supply systems become available: Pioneer Ferret, Advanced Ferret and Ferret Surveillance. Data receivers, parabolic antennas, R-F feed systems, and 3-axis pedestals will be developed, fabricated and tested for the three types of ferret receiving equipments.

PAGE & DE 31

WIVFIDENTIP



(UNCLASSIFIED TITLE) Ground-Space Communications Subsystem for ARS, WS 117L Project 1762 - 2 April 1957

(3) Infrared Data Receiving Equipment

Experimental and prototype receiving equipments will be designed, fabricated and tested using telemetry-type techniques.

- 9a. Task No. 39848 (Uncl Title) Vehicle Data Transmitting Equipment
- b. Contractor: Lockheed Aircraft Corporation
 Missile Systems Division
 P. O. Box 504
 Sunnyvale, California

Contract No. AF04(647)-97

Task Advisor: Mr. A. J. Falkowski - WADC - WCLNO-2 - X21239

c. <u>Objective</u>: The objective of this task is to design, develop, fabricate and test equipment which will be capable of transmitting reconnaissance transmission rate or information transfer per unit time will be the maximum possible commensurate with system requirements.

The visual data link will incorporate high-gain directional antennas at both the transmitting and receiving ends of the link. As a preliminary objective, the visual data link will be designed for handling signals, the video bandwidth of which is approximately 6 megacycles/sec advanced systems will be in the order of 20 megacycles/sec.

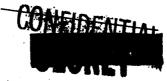
For ferret reconnaissance data, the information bandwidth requirements will be considerably less than those necessary for visual reconnaissance. Accordingly, the data link will be modified by narrowing the bandwidth of the ground receiver and, if possible, employing a shaped-beam antenna in the vehicle. Consideration will be given to employing visual system.

The information bandwidth requirements of the infrared reconnaissance data transmitters are sufficiently small to allow transmission on a

d. The approach to this task will be to utilize known techniques and develop hardware compatible with expected vehicle life and environment.

DD Form 613 (cont.)

CLODET 31



10a. Task No. 39849 - Ground Telemeter Receiving Equipment

b. Gontractor: Lockheed Aircraft Corporation
Missile Systems Division
P. O. Box 504
Sunnyvale, California

Contract No. AF 04(647)97

Task Advisor: Mr. Sidney Rosenberg - RADC - RCUO - X3117

c. Objective: The purpose of the Ground Telemeter Receiving Equipment is to provide all necessary facilities for the reliable reception, processing, recording and storage of vehicle instrumentation and environmental ground station. The receiving equipment will be capable of extracting the range information and applying it to the ranging circuitry of the tracker equipment when the ranging data is transmitted from the vehicle telemeter transmitter.

d. Proposed Approach:

(1) In the Engineering Prototype, non-orbiting test program available AFMTC telemeter receiving equipment (modified as required) will be used to the maximum extent at each of the contemplated AFMTC down-range Vehicle test program, standard VHF telemeter receiving the low latitude, orbital as required) will be used to form a complete telemetering receiving facility. A directional antenna will be employed which will be capable of tracking the telemetered signal emanating from the vehicle or being dynamically slaved to the tracking antenna.

(2) Concurrent with the above work, a program will be undertaken to progressively develop early test and advanced equipment operating at C-band or S-band frequencies to provide additional channel capacity and receiver bandwidth for high-latitude operational orbits. Data telemetering during these orbits will be primarily concerned with monitoring the status of the equipment in the vehicle.

11a. Task No. 39850 (Uncl Title) Vehicle Telemeter Transmitting Equipment

b. Contractor: Lockheed Aircraft Corporation
Missile Systems Division
P. O. Box 504

Sunnyvale, California

PAGE 10 OF 3



(UNCLASSIFIED TITLE) Ground-Space Communication Subsystem for ARS, WS 117L

Contract No. AF 04(647)-97

Task Advisor: Mr. F. C. Karabaich - WADC - WCLCE-5 -X30253

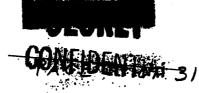
- c. Objective: The objective of this task is to design, develop, fabricate and test the vehicle telemetering equipment and associated instrumentation utilized in conjunction with the WS 117L flight test. This equipment will be provided for obtaining range, environmental, and equipment status early flight tests. The telemeter transmitting equipment will be provided for to vehicle data transmitting equipment where telemeter bandwidth is adequate.
- d. During low latitude test flights at AFMTC, the vehicle telemeter equipment will be compatible with AFMTC instrumentation. Concurrently development of advanced equipment will proceed utilizing known techniques.
 - 12a. Task No. 39851 Ground Communications Equipment
 - b. Contractor: Lockheed Aircraft Corporation
 Missile Systems Division
 P. O. Box 504
 Sunnyvale, California

Contract No. AF 04(647)-97

Task Advisor: Mr. Sidney Rosenberg - RADC - RCUO - X3117

d. Objective:

- (1) The purpose of the ground communications equipment is to provide communications facilities within and between the individual ground installations of the system. The interstation communication net will include:
- (a) General Operational (administrative and logistic) and command circuits (including vehicle antenna tracking programs and trajectory data).
- (b) Reconnaissance (visual, ferret and infrared) data
- (2) The interstation operational and command net will link the vehicle Intercept, Control, Telemetry and Data Acquisition Stations together and each station to the Intelligence Center. The data channels will connect each station with the Intelligence Center.
- (3) The interstation data transmission circuits will handle information of sufficient bandwidth to be eventually capable of transmitting



OTOPET

(UNCLASSIFIED TITLE) Ground-Space Communication Subsystem for ARS, WS 117L Project 1762 - 2 April 1957

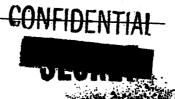
the complete reconnaissance information received from the vehicle in the Surveillance System. Facilities for storage of the received information on magnetic tape or other storage media will be provided. The storage facility will be capable of non-destructive readout of information for preliminary evaluation or for re-transmission without further processing. The storage medium will be of a permanent nature to permit storage for long periods of time.

- (4) Wherever possible within the constraint considerations of security, practicality and time, the interstation communication facilities will be integrated with the AF Communication Support System, S-456L (SR-132, GOR-129).
- (5) Error detection and correction techniques will be employed to insure the accurate transmission of the reconnaissance, command and orbital tracking data between the ground-based stations. Suitable security secrecy and low detectibility.
- (6) Internal communications will be provided at each Launching Site and Intercept and Control Stations, as required, for efficient and reliable operation of the subsystem. These facilities will provide for all phases of the operation, i.e., pre-launch, launch, ascent guidance, non-orbiting and orbiting phases.

d. Proposed Approach

(1) Interstation Communication Facilities

- (a) The general operational and command circuits will make maximum use of conventional wire lines carrying voice, teletype, code and/or graphics (facsimile) messages with radio nets as back-up. Commercial circuits will be used wherever security considerations permit such use.
- of narrow bandwidth links such as land lines, high frequency radio and/or microwave relay, and high-speed aircraft. Techniques using facsimile, slowed-down video, etc. will be considered for transmission of a limited amount of information which may be deemed vital. Later in the Surveillance System, will be used, capable of handling the complete reconnaissance information received from the vehicle.
- (c) Alternate routing will be employed for all interstation communication links to minimize vulnerability to accidental or enemy destruction.



PAGE 12 OF 3



- (d) Frequency, space and/or time diversity combiners will be used to minimize losses due to fading.
- (e) If environmental conditions permit, equipment specifications.
- (f) The following work program will be followed in the engineering approach to the communication requirements:
- facilities will be used to the maximum extent to tie-in the three ground based stations. Leased land-lines will also be used linking the test sites (in-Central U.S.A.)
- 2. Leased land-lines and narrow band radio nets will then be installed linking the operational stations.
- 3. Interim and Advanced wide-band communication links will be developed, procured or rented. The specifications for these links will be based upon operational experience and requirements to be established.
 - (2) Intrastation Communication Facilities:
- (a) A study will be made of the man-machine relationships involving human factor analysis of the required traffic flow of information within each Intercept Station.
- (b) Intra-communication facilities will include, but not be limited to, the following: 'automatic dial equipment, sound-powered phones, public address and pagin equipment, analog and digital data transmission and display equipment, remote monitoring and display devices, intercom facilities, maintenance phones, and emergency alerting and warning facilities.
 - 13a. Task No. 39852 (Uncl Title) Ground Support Equipment
 - b. Contractor: Lockheed Aircraft Corporation
 Missile Systems Division
 P. O. Box 504
 Sunnyvale, California

Contract No. AF 04(647)-97

c. Objective: The objective of this task is to design, develop, fabricate and test the ground support equipment necessary to maintain, test and



calibrate all the operating equipments of this subsystem. The ground support equipment will include pre-launch support equipment for check-out of the vehicular equipments which form portions of this subsystem.

- d. The approach will be to establish requirements and, subsequently, procure or develop the required ground support equipment.
 - 14a. Task No. 39853 (Uncl Title) Propagation Research
 - b. Contractor: Lockheed Aircraft Corporation
 Missile Systems Division
 P. O. Box 504
 Sunnyvale, California

Contract No. AF 04(647)-97

Task Advisor: Mr. L. Colin - RADC - RCEMB - X71217

- c. Objective: The objective of this task is to provide information and data relative to propagation anomalies as they affect the operation of WS 117L. The following are typical data which may be required in order to fulfill the requirements of this weapon system:
- (1) Entire time spectrum of the index of refraction of the troposphere and ionosphere at a particular geographic location.
- (2) Mean (e.g. monthly or yearly) time delay through the troposphere and ionosphere as a function of elevation angle frequency and geo-
- (3) Root Mean Square of the fluctuations in time delay through the troposphere and ionosphere as a function of elevation angle, radar frequency and geographical location.

The operational Vehicle Intercept and Control Stations will be complemented with the requisite equipment for obtaining the basic radar of this task

- d. The approach will be to:
 - (1) Monitor work in the field of radio propagation research.
- (2) Monitor and provide consulting services relative to contractor's radio propagation experiments with a satellite vehicle as a source of electromagnetic radiation.
- (3) Develop a method of predicting the ionospheric and tropospheric bending effects from measurements, based on the results of d-(1) and d(2) above.



21d. Other Information

(1) General: This subsystem is one of several under WS 117L. The cognizant agency for the system is the Western Development Division of Headquarters ARDC. The responsibility for advising on technical matters in the subsystem tasks has been assigned to Rome and Wright Air Development Centers. Appropriate references are listed in Paragraph 21g of this document.

A related effort, also being undertaken by the Department of Defense, is the Navy Vanguard Program, which is concerned with tracking a satellite vehicle, computing the satellites' orbit, and telemetering data from the vehicle to ground stations.

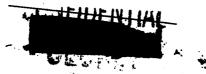
(2) Survey of Similar Existing Standardized Equipment or Techniques:

The only existing standard equipments which may be used in this subsystem are ground telemetering receiving equipment and ground communications equipment. Otherwise, every attempt will be made to utilize known techniques in the development of hardware. Some of these techniques are:

- (a) Interferometer measurement techniques
- (b) Frequency standard and timing techniques
- (c) FM transmission techniques
- (d) Radio propagation measurement techniques
- (3) Survey of Similar Equipment or Techniques in Process of R and D. Some of these are:
- (a) 60 foot automatic positioning telemeter antenna being developed by Radiation Inc., Melbourne, Florida
- (b) COTAR position measuring equipment being developed by Cubic Corp., San Diego, California
- (c) Three axis tracking mount being developed by Reeves Instrument Corporation, Long Island, New York
- (d) Ground transmitters (IKW) modified for FM data link use by Collins Radio Co., Cedar Rapids, Iowa.

In order to meet the requirements of this subsystem, maximum utilization will be made of existing technique and equipment developments. Duplication of





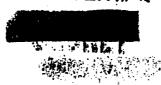
- (4) Replacement Recommendations: The equipments developed for this subsystem will have possible utility at instrumented test ranges, in navigation systems, in tactical control systems, etc. The nulling interferometer, for instance, will provide a replacement capability for pulse radar trackers. Data transmission and reception equipment may offer replacement capabilities for similar equipments used in other systems.
- a severe operational burden on maintenance, organization, and logistics in inasmuch as these phases will involve large undertakings and considerable effects are implied on logistics, maintenance, organization, etc. It is facilities.

21e. Background History: The concept of the Advanced Reconnaissance System is a result of studies conducted at the Rand Corporation. A study completed in 1947 together with similar investigations by other contractors concluded that a satellite vehicle was feasible as a reconnaissance vehicle but not as a weapon carrier. In 1950 the Research and Development Board vested satellite custody in the Air Force, and Rand was directed to explore its possible military were made to the Air Staff in late 1950 and a formal report (Rand 217) followed time were television (RCA), attitude control (North American Aviation), nuclear Vitro Corporation).

Recommendations for the ARS development were made by Rand in November 1953, and these were followed by the final report (Rand-262) in February 1954. The Air Force Requirement was written in August 1954 and issued on 29 November 1954. This requirement, SR-5, directed system design studies in order to determine the technical and economical magnitude of a full scale development effort. Rome Air Development Center was listed as a participating center for specific technical design study area in ground-air communications, including acquisition tracking and command of the flight vehicle.

In early 1955, RCA, Lockheed Aircraft Corp., Glenn L. Martin Company and Bell Telephone Labs were solicited to bid for a contractual design study effort of one year's duration. Proposals received from RCA, Lockheed and Martin were evaluated by USAF personnel on the acquisition, tracking, system. Bell Telephone Labs did not bid. In May 1955 an evaluation conference was held at WADC attended by representatives of all the participating standard contract to each of the three bidders on the basis of different approaches.

These contracts were awarded in the 1965 and cost of \$500,000 each.





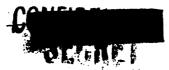
Other historical events of importance are listed as follows:

- a. Creation of Headquarters ARDC Directorate of Systems Management at Wright-Patterson AFB the latter half of 1954. The Advanced Reconnaissance directorate.
 - b. Creation of an ARS Technical Advisory Group.
- c. Issuance of New System Requirement No. 5, dated 17 October 1955 directing the submission, upon request, to Headquarters ARDC (Western Development Division) of information necessary for the preparation of a System of this plan to Headquarters USAF was April 1956.
- d. Official transfer of Advanced Reconnaissance System responsibility to the Western Development Division of Headquarters ARDC in December 1955.
- e. Submission by the design study contractors (RCA, Lockheed and Martin) of System Development Plans on 1 March 1956.
- f. Evaluation of contractor technical competence by participating
- g. Preparation of an abbreviated System Development Plan by the participating centers for submission to higher headquarters.
- h. Official approval of WS 117L System Development Plan dated 2 April 1956.
- i. Selection of Lockheed Aircraft Corporation as the weapon system contractor in May, 1956.
- j. Preparation of contractual work statement and revised System Development Plan documentation in January 1957.

DD Form 613 (cont.)

CONFIDENTIAL

WD-57-01143



21f. Future Plans

Plans relative to development growth and required resources are specified in the applicable annexes. It should be noted that the extent of the envisaged development program is of considerable magnitude and difficulty. Therefore, periodic amendments relative to plans and resources are to be

8. References:

- 1. System Requirement No. 5, dated 29 November 1954.
- 2. Task Plan for Task 15002, dated 25 April 1955.
- 3. System Requirement No. 5, dated 17 October 1955.
- 4. Letter from Commander, WDD to Commander, RADC, dated 23 December 1955, Subject: (U) Support of Advanced Reconnaissance System.
- Rand Corporation Report R-262, "(Unclassified Title) Project FEED BACK Summary Report, Volume I", (Secret Report), dated 1 March 1954.
- 6. WDD WS 117L Development Plan, dated 2 April 1956.

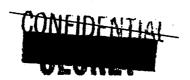
21h. Coordination and Signature Block:

WILLIAM O. TROETSCHEL

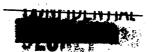
Captain, USAF Project Engineer FREDERIC C. E.

Colonel, USAF

Assistant for WS 117L

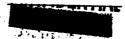


PAGE 18 OF 31



		R							•																			2,	RE.	PO	473	CC	WI	ROI	37	700	ル
4. FITLE	SYSTEM [3 P	RO	JEC	T	C	J T	'AS	K	C	_	OTE	IE A	t	, *									·				3.	DAT	TE	· ·	٠.		٠.		·····	
***************************************												-																. :	2 A	φr	:11	1	95	7			
(Unclassified Title) GROUN	D-SPACE COM							_								5.	190	ITI	AL.	X	Γ					_	٦		KUI			_	_	<u> </u>	_		
	- 01202 (08		ATC	AI.	TOI	NS	FO	R A	AR:	3,	WS	1	17	L		1	CH	ANG	BE,								ł			٠							
SCHEDULE		T	_		_				_	 -	_		_			丄			_								- 1	3	176	2							•
TITLE	PROJECT OR TASK NR	L		9			_	_	_		19	_	5 7		_		AL							7	_	• 5		_	_	_	_	_	_				
Ground Space Communications	1744	1	4	ᆙ	×	미	٠ [ر	<u>• M</u>	1	2	2	1	A	- 1	IN	l _o	Ħ	-1	J	. T.	Ť.	Τ.	7	+		==	_	+		5		Ľ	19.0	51		0,0	247
T ST ST STANDARCECTORS	1762	Н	4	A	Н	Ц	1	\mathbf{L}				П	7	R	۲	1	H	┧	7		+	ť	+	+	4	4	1	4	4		ŀ	Ŀ	٤		4]	1	7.19
		11	4	L	Ш			Γ	Т	П		П	7	7	1	Ħ	Н	7	╼	4	+-	+	+	+	+	4	- 2	1	ֈ_	C		P	T	\mathbf{I}	Т	Т	E
		Ц	1	L	Ŀ		\mathbf{I}	Т	Т	П		П	7	+	+	Н	Н	+	+	+-	┿	+	+	4-	+	4		1	┸	D				Т	Т	T	1
		Ц	1	L	П		Ι		Т	П		1	7	+	+	H	\dashv	7	+	+	+-	+	4	+	+	1	÷	1	1	0				T	T	Н	
Acquisition & Sec. 14		Щ	L	\perp		\Box	Τ	T	Г	П	П	7	十	+	✝	Н	+	+	+	+	+	+	+	+	4-	Ļ	1	Ŀ	L					T	T	77	1
Acquisition & Tracking Equip		Ш	┸			\Box	Ţ	F		П		7	+	+	+	Н	+	+	+	┿	+	┾	4-	+-	╄	Ļ	1	丰	丄		\Box		T	T	\top	Ħ	1
			4				Т	Т	٠.	П	. 1	7	٦,	.+-	+	Н	+	+	+	╀	┨-	╀	+	4	Ł	Ļ	╀	丄	<u>_</u>			П	Т	T	1	† †	
			l		П	Т	Т		П	Н	ч	۲+	#	4	H	Н	╁	+	£	Б	ĮO.	P	4	4.	1	Ļ	Ł	Ŀ	Ŀ				-		÷	***	-
Interferometer			\perp	П	П	T	1	1	Н	\dashv	1	+	+	+-	Н	H	4	+	+	╀	↓_	Ļ	╀	↓	Ľ	L	L	L	Γ		5	П	T	T	1	П	- -
MURITALIONSCOL			Г	П	П	7.	1	Н	Н	1	7	ᆂ	+	1	Н	Н	+	+	+	1_	 	↓_	L	L	L	1	L	L	Γ	П	×1	Т	丁	+	†	††	-
		\mathbf{J}	Τ		П	1	7	П	Н	-	7	۳	₩	Ψ.	Н	\dashv	-+-	+	╄	₽-	ļ.,	ļ.,	Ļ	Ļ	L	L	c	Ιc		П	P	\neg	Ŧ	T		Ħ	- +
Vehicle Treserve		\perp	Τ	П	T	T	1	Н	\vdash	+	+	╅	+	┿	Н	\dashv	+	+	+	↓_	!	L.	ļ.,	L	L	L	n	L	\prod		Т	\neg	7	+			E
Vehicle Transponder/Beacon Transponder	39841	T	Т		\neg	╈	1	Н	Н	-+	╌┼	┿	╅	┿	Н	+	+	+	4	┞-	-	١.,	L	L	L	L	L	Г	П	٦	\neg	\top	十	┿~	Н	- -	J.
rranshondsr		Т	Т	П	\top	+		Н	-	-	7 1	+	╁	╆	Н	+	+	4-	4	L	L	L	L	L			Γ	Γ	П	T	T	7	\top	+	H	H	iB
		7	T	П	7	+	+	Н	+	Ť	۴	+	추	+	H	4	4	4	C	D	0	P	L				Γ	Г	П	7	E	ナ	十	+	H	┝÷	-
Beacon		7	1	П	+	+	H	H	+	+	┿	+	4-	1	-4	4	4	4	丄	L		L					Γ		ΓŦ		J	十	+	+-	H	┝╅	
Descon		7	\top	H	+	+	Н	H	+	+	+	┶	┺	H	4	4	4	1	L								Г	П	П		K	ナ	†	+	Н	H	╼┼╌┤
behild Committee		\top	1	H	╅	╈	H	-	+	+	+	뿌	R	쀠	-	4	4	Ŀ	L	Ш			L				5	0	М		<u> </u>	+	十	+	H	+	-+
rbit Computing & Ground	39842	1	М	\dashv	+	+	Н	+	+	┿	+	+	╁	Н	4	4	┸	┸	L								Б		П	7	7	+	十	+	┝┪	+	- 무슨
rograming Equip.		1	Н	+	+	┿	Н	+	+	+	+	+	╄	Н	4	4	1	L										П	\dashv	+	+	+	+	H	-+	-+-	-121
Orbit Computer		1	Н	7	╈	+-	Н	+	+	+	+	┶	L	Н	4	4	L	Ľ	L		I				\Box		П	7	7	+	+	+	╁	Н	⊢┼	+	
	·	+	H	7	+	┿	Н	+	+	+	+	P	B	R	4	4	Ŀ	Ŀ			$oldsymbol{\mathbb{I}}$	_			d	P	П	╛	\dashv	+	十	+	┿	Н	7	+	+-1
· · · · · · · · · · · · · · · · · · ·		\dagger	H	7	╅	╁	H	+	+	┿	+	4	Н	Н	4	4	L	Ш			Ι	П		П	Ы	1	┪	┪	十	十		+	┿	₩	\dashv	+	트
Ground Programmer		Ħ	H	╅	十	╆	H	+	+	+	+	╀-	Н	Ц	4	4	L	Ŀ		\Box	Ι	П	٦	\neg	ਰ	•	7	7	+	╈	+	┿	╁	Н	+	+	14
		11	Н	+	┿	╀╌	Н	+	+	+-	+	-	Н	Ц	1	1	上	L		\Box	Т	٦	7	7	ਰ	3	7	7	十	+	+	十	+	Н	+	+	-14
		H	Н	┪	╌	╆	+	4	+	+	4	1	Щ	Ц	┸	L				Т	Т	7	٦	7	ਜ	٦	7	7	┿	+	╁	+	╁	⊬	+	+	JE.
round Timing & Syn.	39843	++	H	╁	+	Н	+	+	4	+	┸	Ц	Ц	Ц	1		\Box			Т	T	7	┪	7	a	┪	7	+	+	+	┿	┿	Н	⊢	+	4	14
Equip.		H	⊢┼	╅	┿	Н	+	4	+	1	4	ш	Q	R		Γ	Γ		_†	7	1	1	7	_	-	긃	+	+	+	十	┿	+-	Н	⊬	+	+	₽K.
		+-	⋈	+	╇	┥	4	4	4	╄	╀.	Ш	Ш	$\perp \Gamma$	\mathbf{I}	Ι			1	7	T	1	7	-	7	4	+	+	十	十	+-	+	Н	Н.	4	+	E
		╁┥	+	+	+-	H	4	4	4	┺	L	Ш		\perp	Ι	Γ	П	7	7	7	†	†	7	+	#	+	╅	十	十	+	╄	+-	Н	4	4	+	11
		┧	+	+	+	Н	4	4	╀	L.	┖	Ш		I	Γ		П	7	7	T	†	†	+	+	4	╅	+	+	+	┿	+	₩	Н	4	4	+	K
		₩	-1	1	h		M	=4	d,	40	b			\mathbf{I}	Γ	Г	П	7	7	†	†	t	+	+	+	┿	+	+	┿	+	+	₩	Н	+	4	4	Ш
C . JUL S. 103 PREVIOUS EDITIO		1 I	т	7				-	-		-	-11	-	_	7	_	-	-	-	_		_	_		-1	ı	1		1	١.		. /			-1		1 1

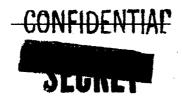
CUNCLASSIFIED TITLE) GROUP SCHEDULE TITLE Ground Space Communications	SYSTEM COMPANY OF THE STREET O								36																							_		
SCHEDULE TITLE			MI	·																						ľ	2	A:	pri	11	19	57	-	
SCHEDULE TITLE				·	PI(MS	F	OR.	AH	ıs,	W	1	17İ	٠			MPI AM			3					_	1	NU	MB	ĒR		_			
	T	Т		÷	_	_		-		. <u> </u>						L.		••									1	762	2 -			٠		
Ground Space Com	PROJECT OR	t	_	19	56		Ė			-	19	57	7							1 Ye			÷	_		<u>-</u>			_			_	_	
	1762	Ł	Δ	•	4	10	1	•	ы	<u> </u>	1	ग	A e	T.	IN	۵.	jŢ,	-	Τ̈́	Ţ,	គ្នា	· 14	+	_	59	_	┝╌	* 6	<u>\$</u>	ŀ	196	1	Į	
	1/02	+	Н	-	4	╀	Н	4	+	+	1	Ц	12	I	П		T	İ	Ь	-	Ħ	Ť	Τ	Ŧ	۲	1,1	H	ċ	+	ᆣ		ᅷ	4	-
		H	Н	+	+	Н	Н	+	+	╀	₩	+	╀	╀	Н	4	1	L	Г	\Box	П	I	I	I	I			ᄬ	-	۴	1	╅	+	-
	ļ <u>-</u>	П	口	1	İ	H	Ħ	†	†	十	+	+	┿	╁	H	+	╀	╀	H	H	Н	4	4	\bot	Г	Ц	I	Ō	Γ			士	T	•
Vehicle Programming & Timin	30064	H	Ц	4	1	П	\Box	I	I	I	口	士	I	T	H	+	+	+	H	Н	┝┼	+	十	╀	1	Н	+	+	\Box	Ц	J	I	L	•
Equip,	37044	H	┥		+	₽	4	+	4	4	П	_ lo	R	à		I	İ		H	Н	+	+	†	╁	+	H	十	+	Н	Н	+	+	L	
		H	+	╅	╀	Н	+	+	+	44	₩	4	\perp	Ц	1	I	L		口	Ճ	I	士	t	+	H	H	+	+	Η	\dashv	+	┿	╀╌	1
Ground Command Control Equi	. 39845			A	十	H	+	╅	╁	Н	Н			H	+	+	╀	Ц	Ц	П	$\operatorname{\mathcal{I}}$	I	c	I		₫	土	\top	H	7	+	+	Н	i
		Ц	\Box	I	L	П	I	士	ナ	H	H	╬	1	М	+	╄	╁	Н	Н	\dashv	+	╄	ᅀ	4	P	I	I	\Box		コ	土	\top	H	ı
Vehicle Command Receiving	202/4	Н	4	4	L	Ц	I	${\mathbb T}$	Ι	П		1	П	H	+	+		Н	Н	-	╁	+	숀	H	Н	+	+	\sqcup	Ц	J	I	\square		ĺ
Equip.	39846	Н	+	*	Н	Н	4	4	\perp	П		Б	R	1	I	Ť		H	7	十	╈	十	15	Н	Ⅎ	+	+	H	4	4	+	Н	П	ĺ
		+	+	┿	Н	╟	┿	+	╀	H	\dashv	1	П	\Box	I	L			I	コ	T	1	L,	Н	4	十	┿	Н	┍╂	+	┿	H	\vdash	ŀ
Ground Recon Data Rec Equip.	39847		+	T	H	$\vdash \uparrow$	+	┿	╁	H	+	╁	닒	-1	+	+	Н	Ц	4	\bot	I	$oldsymbol{\Gamma}$	C		I	土	1	H	\top	+	+	╁	-+	ŀ
•		\Box	I	I	П		T	十	T	H	+	₩	P	ᠲ	+	Н	Н	+	+	+	+	13	Ы	Н	P	I	\perp	П	\Box	工	土	П	7	į
Vahicle Data Transmit Equip	39848	4	4	1	Ц	\Box	I	Ι		口	Ï		H	+	+	Н	Н	╅	+	+	╄	6	Ŋ	Н	4	+	4	Н	\bot	Ţ	$oldsymbol{\perp}$	П	I	
	37048	+	+	1	Н	+	4	1	Ц	\Box	I	\Box		I	Ī	П	Ħ	†	†	+	+			a	ᇦ	1	╁┤	⊢∔	∔	∔	+-	H	4	
		+	┿	+	Н	+	┿	╀╌	Н	┝┿	+	₩	Н	1	Ţ	Ц		.]	Ι	I	İ	П	_	ă	4	十	H	1	十	+	╁┥	H	+	-
Fround Telemeter Rec Equip Limited:	39849		1	A	H	+	十		Н	+	┿	╁┤	Н	+	+·	Н	4	4	4	4	\perp	П		q	I	I	I		+	+	H	-	+	•
ALECCEG:		Į	I	\Box		I	T	П	H	1	十	Ы	R	+	+-	Н	+	+	┿	ᆂ	-	Н	4	4	1	Ι	П	I	I	I	П	\Box	十	•
		∔	+	Н	4	Ŀ	Г	\Box		工	土	П	7	+	†	H	7	+	╁	占	+	H	+	+	4	╄	H	4	\perp	I	П		I	•
dvanced:		╁	+	Н	4	╀	+	Н	Ц	4	\perp	П	\perp	Ι			1	1	十	C	-	H	+	+	╁	╁	₩	+	+	╄	₩	4	4	
		+	+	Н	+	+		Н	4	+	+	H	B.L	ļ	П	\Box	I	D	1	I			T	ď	P	†	H	+	+	╄	Н	╬	+	-
elicle Telementer B		I	I		1	+	Н	H	+	+	┿	H	+	╄	┦┤	+	4	1	Ļ	\perp	П	П		Ď.	Ι		口	士	T	t	H	+	+	•
edicle Telemeter Trans Equip Limited:	39850	L	L	\Box	I	I		Ħ	1	十	十	H	十	╁	H	+	╀	╀	₽	4	Н	4	4	<u>d</u>	Ţ		П	I	Γ	Γ	口	士	十	٠
		+	1	Н	1	Γ		\Box	I	I	Ι	0 1	Į B	1.	Н	+	+	╁	t	6	H	+	+	╀	╀	H	H	4	F	\Box	Д	I	I	۰
		+	Н	H	+	1.	H	4	4	Ţ	\Box	Д	I	Γ		Ī	I	T	t	Б	1	十	+	+	+	Н	⊬	+	╀	H	+	4	\perp	•
		t	Н	-	\pm	\mathbf{f}	Н	,	+	十	₩	4	1	Д	П	Ţ	T	L	Γ	c		士	†	+	7	H	H	+-	H	Н	+	+	 	
DG 1 JUL 163 PREVIOUS EDITE	MS OF THIS DAY				Ţ,	Ж	H		ŧ	3	4	*	느	Ш	Ш	Ļ	1	L		Ц		I	I	Γ			士	士	H	H	十	╁	+	

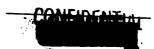


			L																						۴	REI	POR	18 (CON	TRO.	L SY	MB OI	
4. TITLE	SYSTEM [Ð	PRO	JEC	T] T	ASI	•		ОТ	HE	R												5.	DAT							
										_		_			Ta.				_				_		L				1 1	1957	7		
(UNCLASSIFIED TITLE) GROUND	-674														ľ		HT I		Z						6,	MÜ	62	R	_			_	_
SCHOOL STATE	-SPACE COM	W)	IIC	AT:	COM	IS 1	OR	Ā	R8,	W	3 1	17	L			CH	A NG								l	1/	02						
SCHEDULE		L										_			۲,	CAL	-				_	·			L_		_			_			
TITLE	PROJECT OR	L		19 5	6	\Box				1:	•	57		_								_	_				_						7
Ground Space Communications	TASK NR	12	싴	<u> </u>	N	0	٠,	· M	1	w] .	٦,	Ī	•	رآه	J.	1.	-1			٩.,	- T	+	_	59	4		60			61	Jī	2.fe	泗
	1762	Н	Ц		L	\Box	$oldsymbol{\mathbb{I}}$	Γ	П	T	Ť		R	7	+	H	H	1	\ \	ť	•	4*	ļ٠		42	12			1 2		4 7	131	31
		Ц	4	1	Ш	П	\mathbf{I}	Γ	П	\top	T	П		ナ	1	Ħ	+	₩	╨	₩	+	+-	╀	H.	· _	4-	c	1	p.	<u> </u>	\perp	\Box	٦
		Ц	1	┸			Τ	Γ		T	7	Н	H	十	Ť	H	+	╁	┿	Н	+	╄	1	L:	· ,_	1	וַם	\perp	\perp	\coprod	\mathbf{T}	П	٦
Webicle Telemeter Trans Euin		Н	4	1	Ц	Ц	\perp			Т	T	П	\vdash	╅	+	††	+	╁	+	╂┪	+	╀	-	Ь,	+	+	O	_	\perp	\coprod	I	П	7
Advanced:	39850	Н	4	4	Ш		Ι	Π	П	Т	Т	П	+	\top	†-	17	┰	╈	╄	Н	+	┿	Н	-	ļ.	₽	Ц	1	\perp	П	$oldsymbol{\mathbb{T}}$	П	7
INTERCEU:		Ц	4				T	Γ	П	7	T	Н	P	十	†-	H	┿	╁	R	Н	+	╀-	Н	-4		┺	Ц	\perp	\perp	П	丁	П	7
	·	Ц	1	1	Ц		Г			T	\top	Н	7	+	+	-	+	49	18	Н	+	╄	0	P.	.i	┦	Ц		1.	П	T	ΓT	7
round Communication Equip.		Ц	4	1	Ш		\mathbf{L}	П	Т	Т	Т	\Box	_	✝	\vdash	H	+	╁	Н	╁	┿	╀	D.	-	-ļ-	H		丄	\perp	Ш		П	7
Intra-Station:	39851	Ц	1	A		$oldsymbol{\mathbb{T}}$	Γ	П		T	Ħ	П	\top	十	1	\vdash	+	╁╴	Н	Н	+	₽,	c.	4		Ц	Ц	上	\mathbf{L}	LT	T		7
		Ц	\perp	L		T	Г	П		1	П		R	+	Н	Н	+	╁	Н	Н	+	Н	Н	٦.	┷	Ш	\perp	L	Ι		\Box		7
		Ц		\perp		Ι	Г	П	\top	1	\sqcap	*	╨	4	H	┰	+-	╀	┨	Н	┿	Н	Щ	ᄘ	4_	Ц	\perp	\perp	\mathbf{L}	\Box	\Box		1
Inter-Station:		Ц				\perp	Т	П	7	1	Ħ	7	╈	+-	Н	+	+	╁╌	H	+	+	Н	Д	4	4	Ц		\perp	Γ	$\Box \Box$	T	7.	T
Limited:		Ц	\perp			Т	Т	П	7	1	Н	7	╈	╁╴	Н	┿	┿	+	Н	4	+	Н	c.	4	┺	Ц	\perp	\perp	Π	$\Box T$	П	1	†,
		\perp	┙		LŢ	Т	П	П	_	1-	П	7	R E	+	H	+	+-	╁	Н	+	+	Н	4	4	4_	Ц	丄		\square		П		T
		\perp			Т	T	П	\neg	1		H	*+	4	4-	Η	+	┿	Н	Н	+	+	Н	ф	ᆚ	\perp	Ц	$oldsymbol{\perp}$	Γ	П	\top	\sqcap	1	
Advanced:			Ι		Т	Т	П	\neg	\top	\vdash	1	+	+-	╁	Η	+	┿	Н	-4	4	4	Н	4	1.		Ц	\perp	Τ	П	\top	\sqcap	7	†
		\perp			T	Т	П	┪	1	Н	Н,	٦t.	RR	+	Н	┿	+-	Н	4	+	+-	4	니	┸	Ш	\sqcup		Г	П	\top	\sqcap	_	t
			Γ		T	T	П	ナ	+	Н	H	4	4	Н	⊦+	+	+-	Н	4	4	┺	Ц	4	1		\Box	Ω	┢	П	7	1	1	ţ,
round Support Equip.			Γ	П	Т	Т	П	7	+	Н	H	+	+-	Н	H	┿	+-	Н	4	+	Н	4	4	┸	Ш	_[·	\mathbf{p}	П	П	\top	\Box	十	۲
Support Equip.	39852	\perp	Γ	A	Т	1	П	7	1	Н	o li	٦.	;ϯ·	Н	\dashv	+	+	Н	4	4	Н	\perp	1	┸		\perp	c	П	П	\neg	\vdash	+-	۲
		\mathbf{I}	Γ	П	7	1	П	+	1	Н	7	4	4	Н	+	┿	Н	•	이	4	4	4	┸	\perp	\Box	\perp	T	П	П	\top	\sqcap	+	H
copagation Research		Ι	Τ	П	7	1	П	十	+	Н	+	┿	╁	Н	+	+-	H		ᆈ	4	Ц	4	Ŀ		\square	$oldsymbol{\mathrm{I}}$	Т		П	_	\vdash	+-	×
op-Sectoff Research	39853	\mathbf{I}	Ι	A	1	1	Н	+	+	+	+	+	-	Н	- Ł	╫	₩	_	c	Ł	П	4	\perp	L		$oldsymbol{\mathbb{T}}$	I		П	\top	\vdash	+-	냋
		Ι			T	1	П	十	11	7	+	+	44	Н	-	+	₩	T	4	12	1	ᆁ	1	1	Ŀd	9	1			\top	\sqcap	+	Γ.
		\mathbf{I}		П	Т	П	\Box	7	††	-	╅	+-	┪	H	+	+-	₩	4	+	╄	Н	4	\perp	Ш		\perp	Γ	П	٩	\forall	\sqcap	+-	_
		Ι			7	П	7	十	Н	7	┿	+	Н	Н	┿	┿	Н	+	+	╀-	Н	\bot	┸	Ш		$oldsymbol{\perp}$	Γ	П	\Box	\top	\sqcap	11	Γ
		Ι	П		Т	П	7	+	††	7	╅	╁	Н	H	┿	+	H	+	+	╄-	Ц	4	丄	Ш		\perp	Γ	П	Т	\top	_	+	_
		Γ	\prod	T	Т	П	7	+	Ħ	-+	十	+-	╁┤	+	+	+-	⊦∔	+	+	╄	Н	\bot	┸	Ш			\prod		Т	T^{\dagger}	\top	\forall	_
		Γ	\Box		T	П	十	十	⇈	+	╈	╆	┥	+	┰	╂┤	Н	+	+	╀-	Н	4	1	П		\perp	\prod		I	11	7	⇈	_
		Γ	\Box	J	T	П	\top	†	⇈	+	+	╆	┥	+	+	+	${}\mapsto$	+	+	╄	\sqcup	4	┺	П	\perp	\perp	\prod		Τ	\prod	\top	\vdash	٦
		Γ	П	T	Τ	П	7	1	H	+	+	+-	┥	+	+	+	⊦∔	+	+-	Н	Н	4	\perp	Ш	\perp	\perp	\prod		T	T	\top	††	٦
		Γ		I	Τ	Id	지:	de		ф	ĸ.	tt	M	#	┰	╁┥	$\vdash \downarrow$	+	+	₩	Ц	┸	L	Ш	\mathcal{I}	I	\prod		T	\sqcap	\top	H	٦
C JUL 85 103 PREVIOUS EDITIO	NS OF THIS FOR	.				U	Uİ	П	æ		4	H	μĮ			Ч	ч		_	ш	Ц,	_	L	Ц	J	\mathbf{L}	\prod	J	I	T^{\dagger}	\top	\vdash	٦
		- ~	~= (-	ULE																_	U	1	~ 7	_	_	-		744	3	_		_

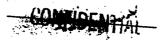


- Contract awarded
- Fabrication of development model started (Prototype flight article)
- Bevelopment model fabrication completed (Prototype flight article) C.
- End of contractor compliance testing of development model (Acceptance test)
- Ground Test starts
- P. Integration with first flight (Completion of ground test)
- E. Completion of functional testing of development model to demonstrate capability (After flight test approval)
- J. Preparation of procurement data (End)
- K. Production Engineering (End)
- Q. Design studies completed
- R. Engineering Analysis Report
 - Technical Reports





	RADM	LATERII	EL AMMEX				2. REPO	RTS CONTROL	STREEOL
□3YS1		. •		OTHER			PAGE 3. DATE	OF	PAGE
7	and, and ITAL	<u>. </u>		TEM	E. INITIAL C		1	11 1957 ER	
Cost Estimates: Gross: 12,040 Met: 12,040 SUPPLY & EQUIPMENT	000 ,000	NAÏ	HIBHANCE		AMSPORTATION Delayed		FICATIONS Syed	12;040	000
Nomenclature Including S/N	Estimated		Total Requir	ements		Time Pho	and Was A	12,040	
Including 5/N	Unit Cost	Grs (ty Gross Cost	Met Qt	Met Cost	PY 56	PY 57	Requirem	
Class 16-A Command Receiver and Decoder Improved ARW 59(R-786)	20,000	10	200,000	10	200,000	71 36	40,000	FY 58 60,000	FY 59
igh Speed Digital Computers lass 16-B, Van Mounted	1,250,000	4	5,000,000	: 4	5,000,000			2,500,000	2,500
M/MPS-19 adar Sets (Part of AN/MSQ-1A adar)	600,000	4	2,400,000	4	2,400,000			1,200,000	
utomatic Positioning Telemeter ntenna & VHF Acquisition Sys.	300,000	1	300,000	1	300,000			300,000	,
elemetry Receiving Station	300,000	4	1,200,000	4	1,200,000		300,000	600,000	300,0
mmand Link Transmitters	100,000	10	1,000,000	10	1,200,000	1	300,000	200,000	500.0
S. Kennedy 28 foot parabolic	100,000	2	200,000	2	200,000		100,000	100,000	,-
flector and Antenna Pedestal d Drive	75,000	4	300,000	4	300,000		75,000	150,000	75,00
	į						ĺ		
C 1 JUL SS 167 PREVIOUS EDITION			CONFIDE	NTIA					
C 1 JUL SE 107 PREVIOUS EDITION	S OF THIS PORM	ARE OB	101		•	PAG	E 23	0F-31	



R & D MATERIEL AMERIC CONTINUATION SHEET

SUPPLY & EQUIPMENT Homenclature Including S/N	Estimated	200	tal Require	pents		Time Pho	ad Hat 4		
mentations including S/N	Unit Cost	Grs Qty	Gross Cost	Met Oty	Met Cost	FY 56	ed Het \$ 1	Requirement	
Class 17C Timing & Synchronization Equip. Including Crystal Con- trolled Frequency Standard Count-Down Frequency Divider	140,000	5	700,000	5	700,000		140,000	FX 58	FY 59
& Synchronometer. GR 1100 AP Miscellaneous Test & Calibration Equip.			280,000		280,000		70,000	140,000	70,000
Class 19F 30 KVA Power Units Type SF 30G & Trailer	5,000	8	40,000	8	40,000	-	10,000	20,000	10,000
less 50H Truck Units for MPS-19 adar, Type M-45, 2½ Ton x 6 Cargo Vehicle	20,000	4	80,000	4	80,000	•	20,000	40,000	20,000
oresight Tower for MPS-19 (Class Unknown)	5,000	4	20,000	4	20,000		5,000	10,000	5,000
O foot automatic positioning elemeter (Class Unknown)	300,000	1	300,000	1	300,000			300,000	
					TOTALS:		1,665,000	5,910,000	4,465,0
		<u></u>	NEIDEN	 4 					

DEME

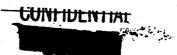
PAGE 24 OF 3/ WD-57-01143



		MANPOWE	R AMEX					2. REPOR	TE CONTROL	SYNGOL
		PROJECT	TASK [OTHER				PAGE S. DATE	OF	PAGES
4 UNCLASS	FIEO TITLE				0. INITIAL			9. NUMBE	ril 1957	
GROUND	-SPACE COMMUNICATIONS SUBSYSTEM	POP And	*** ****		CHANG			1		
ORG	I	0.	ACTUAL	111.	1			1762		
COMP	ORGANIZATION TITLE	TYPE	MAN-QTRS		to 57	PROJECT	Y 19 58	7		
			LAST QTR	AVAL	RORD	AVAL	RORD	FY 15g	FY 1960	
WDTR	WS 117L Project Office, WDD	R	0.5	0.5	1.0	0.5	2.0	2.0	2.0	RORD
RCU	Directorate of Communications, RADC	R	1.3	0.6	1.8	1.2				
RCEM	Missile Support Laboratory RADC	R		,		1.2	4.0	4.0	4.0	*
CLN .	Communications and Navigation		4.5	4.5	5.5	4.5	6.5	7.0	7.0	*
į	Laboratory, WADC Directorate of Technical	R	0	0.4	1.0	0.4	2.0	2.0	2.0	
	Services, RADC	8	0	0.5	0.5	1.0	1.0	1.0	1.0	
	Flight Control Laboratory WADC	R	0	0.5	0.5	0.5	0.5	0.5		
	Total Manpower		6.3	7.0	10.3	8.1	16.0	16.5	0.5 16.5	
	Total Manpower Dollars:		11,466	50,960	74,984	58,968	116,480	120,120	1	600,600
	*Continuing Requirement									
			,							
			MAN	FIDEN	r ነ እን]			

ARDC 1 Jul 80 109 PREVIOUS EDITIONS OF THIS FORM ARE OBSOLETE

PAGE 25 OF 31 WD-57-01143



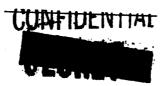
ŀ		□ \$751		ONTRACT PROJECT									 		CONTR	OL STREE	OL
Ļ				J020,	L IASK		THER				,		PAGE DA		OF		AGI
ľ	GROUND SPACE COLOR	ILE)											1 .	_			
	GROUND-SPACE COMMUNIC	ations su	BSYSTE	M FOR ARE	WO 1199				P- 100	TIAL C			6. NU	April	<u> 1957</u>	<u> </u>	
,					#0 TT/	L				ANGE	,			MERN			
	ITEM	PROJ OR	. END	CONTRACT	111.	100							1 1:	762			
_		TASK NR	ITEM	NUMBER	BPSN		V YRS	19. p	, 57	14. PY	58	10. #					
	Ground Space Communi-	1760		 	 	- 000	OTHE	900	OTHE		OTHER		OTHER	16 ,		1770 C	ОМР
	cations Subsystem	1762	E	F04(647)	2-117	535M	.j	l		T		1	OT HERM	600	OTHER	800	07
		l	l	97		7335	1	1472	4	5000H		5000M	1	60001]		
		1	1	i	l	1	1	1.	1	j	ı		I	COOOL		20,00	PM
	· i		i	l	P-100 F	1300	l	Í				ĺ	1	l		1	
				i i	ł		ł	l	420M	1 :	DOOM.	Ι.	3000e		2500		l
				j	P-200 P	unde	1		135M	1 1					2300		25
					,			1	F-32E	i i	90M		2285M		5600a	,	ļ,,
		1							ı						-0004	. 1	L45
	l	j	. 1	Sub Tota		1 1				1 1	- 1				- 1	İ	• 50
	- 1	ı	ı	DOD TOTAL	s :	1 1		1		[ſ	ľ	- 1	- 1	j	- 1	
	į.	I I	- 1	' j.	P-600	1	1				- 1	- 1	Í		- 1	- 1	- i-
		i	- 1	l l	¥-000	535M	- 1	1472		5000m		5000a	ł		- 1	- F	•
	1	l l	ľ	1	P-100	1 1	- 1			T	·	7000	- 1	6000	ı þ	:0,00b	Ņ
	·	1	ł			1 1	1	- 1	420M	1:	200ak	I.	3000	- 1		4.3	
	· ·	1	- 1	f ₁	P-200	1 1	- 1	.		- 1	T	- 1	, count	- 1	250de	- 1	250
		1	- 1			1 1	- 1		135M	- 1	908	la	285M	- 1	5600M	. 1	
	. 1	ı		1		1 1	- 1	- 1	- 1	- 1		- 1		1	SOUTH	- 14	450
	1	1	- 1	. 1		1 1	- [- 1	- 1	· 1	ı	ļ	- 1		- 1	- 1	
	l l	í	- 1	1			ı	- 1	- 1	- 1.		- 1	- 1	- 1	1	- 1	
		ł		- 1	- 1		- 1	- 1		- 1	- 1		1	- 1	- 1		
	'	. 1		- 1	ł		ı	- 1	1	- 1		- 1	- 1	f			
		1	1	1	. [- 1	ı	- 1	- 1	- 1	- 1	ı	.	- 1		
	i	1	J	1	į	- 1	ı	- 1	- 1	- 1	- 1	ŀ			.	- 1	
	1		- 1	1.		- 1	1			- 1	- 1	- 1	- 1		- 1	- 1	
	·	- 1	l	1	ĺ	1	- 1		- 1	1		- 1	- 1	1.	- 1	- 1	
_		- 1	1	j	- 1		- 1	- 1			- 1		- 1			- 1	
_										- 1		- 1			- [
	TOTAL	- 1	- 1		_	35	- 1,	-, -					- 1		- 1	- 1	
	FORM 110				CONE	Ach.				000 20	90 50	00 52	85 60	00 810	10 200	200	
•	1 JUL SS 110 PREVIOUS	EDITIONS OF	744		- white	坪井	HA	_ []	K	M /	н н		H H	M PI	70 200 M	000270	100

WD-57-01/3

WIND IN THE

							·		I a proces	S CONTROL S	
		R & I	COST EST	TIMATE RECA	PITULATIO	N				- SUNTROL S	THE OL.
		SYSTE		ECT TA			•		PAGE	OF	PAGES
4. UNCLASSI					LJ 01188				S. DATE		
Ground-	Space Communi	cations Su	bavatem f	or ADC to	1130		S. HOTTAL		4. HUMBER	L 1957	
-	ITEM	A. PREVIO	US YEARS	D. Proces	L YEAR 57	C. FINC	L		1762		
7.		000	OTHER	***	OTHER	FISC			AL YEAR 59	E. TO C	OMPLETE 65
·	A. TOTAL	535M		14724		T	OTHER	900	OTHER	900	OTHER
CONTRACT	3. AVAILABLE	535M		1472M	555M	5000M	2090M	5000M	5285	26000M	35,100
	C. HEV REQ			14/24	 	╁			 	ļ	
ι,	A. TOTAL	1		 	555M	5000M	2090M	5000M	5285	260001	35,100
MATERIEL	D. AVAILABLE				1665м		5910M		4465		
: *	C. NEW REQ			 	 					_	
FACILITIES				 	1665M	 	5910M	,	4465		
	·										
MANPOURA 1.		11.	5M	75.	OPM '	116.	.5M	120	. 1M	720.	35.50
TRAMMS		N	· A	}						 	
test ites		N/A		 	ļ — —						
5.		- "/]									
	ORT-MACRAFY	N/A									
SUSTOTAL		535M		1472M					•		
TOTAL				14/28	2220M	5000M	8000M	5000M	9750M	26000M	35,100M
	a 116 PREVIO	546.		376	196 15-12		.5M	14870	114		20.7M

PAGE 27 OF 31 WD-57-01143



Ground-Space Communications Subsystem for ARS, WS 117L

General Design Specification

A. Statement of the Problem

The Ground Space Communications Subsystem includes provision for:

- 1. Acquisition and tracking of the orbiting vehicle
- 2. Command of the vehicle from a ground station
- 3. Transmission and reception of data from the vehicle to the ground station
- 4. The necessary inter-station and intra-station communications
- 5. Computing the orbit and geographic indexing of vehicle position

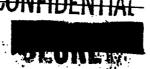
B. Approach

The test stations located at Cape Cannaveral, Antiqua, Ascension, and Hawaii will provide the required acquisition and tracking information of the orbiting vehicle, data necessary for design of the orbit computer and determination of read-out time for acquired reconnaissance data. The South Central United States Station will serve as both R&D prototype and an operational Vehicle Intercept and Control Station. Operational studies to date (to be extended by immediate future study) indicate that the test sites will be distributed approximately as follows:

Test Stations:

- 1. Hawaiian Island Station
- 2. AFMTC (Planned use of existing facilities only).
- 3. Antiqua or St. Lucia Island
- 4. Ascension Island (Planned use of existing facilities only).
- 5. Camp Cooke, California
- 6. Northwest Station, i.e., Annette Island, Alaska
- 7. Northeast Station, i.e., Presque Isle, Maine
- 8. Southwest Station, i.e., Amarillo, Texas

Coordination will be accomplished so that, if at all possible, the South Central (U.S.) station will be located at the same site as the WS 117L Intelligence Center.



PAGE 28 0:31 WD-57-01143



The primary tracking system will consist of radar direction finding and/or nulling interferometer and C.W. ranging equipment. The ranging system components include the command transmitter, command receiver, telemeter transmitter, telemeter receiver, and ranging phasemeter. Acquisition will be accomplished with the assistance of a correlation receiver. The primary direction finder will incorporate a pencil beam tracking antenna. In the early test program, tracking will be achieved by pulse radar-transpender equipments.

Stations numbered 1,6,7 and 8 above, will contain acquisition and tracking equipment, an orbit computer, a command transmitter, a reconnaissance data receiving and recording system, a telemeter receiving system, programming and timing equipment, and connections to the ground communications net.

Stations numbered 2,3,4 and 5 above, will include most, but not all, of the above equipment.

The command link will transmit functional program commands and time signals to the vehicle. Should a directional antenna be utilized by the satellite as part of the ground space communications link, signals for antenna orientation on subsequent passes will be transmitted over the radio-transponder link (when used) for increased redundancy and communications security. The primary command link will be capable of turning on the telemeter transmitter or transponder-beacon for lost-bird operation.

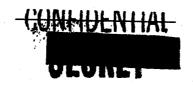
A ruggedized mechanical escapement type programmer will be utilized for the earlier vehicles. An improved programmer, using punched tape or some other storage technique, will be used for the more complex vehicles and, where possible, the programmer will be coupled to the vehicle's timing system. A matrix (magnetic core storage) system shows promise for the more complex operational vehicles and will be investigated.

The timing for the early orbiting vehicles will be provided by the programmer. However, as reconnaissance data becomes available, the timing system must be of such accuracy that there will be no degradation of the data. If investigation indicates that undue complexity will not result, a timer more suitable for the final operational system will be designed and used throughout the test and operational type flights. All the intercept stations, WS 117L and acquired data can be correlated.

The orbital computers at the intercept stations will use tracking data and past orbital history to provide future orbital data and a time-synchronized recording of positional information will be available for future orbital and programming computations and for read-out with the time-synchronized reconnaissance data recordings. The computers at the intercept stations will not require the sophistication of the computer at the Master Vehicle Intercept and Control Station, but each will be capable of growth from the initial use for early flight tests to a final system.

The space-to-ground transmission of the reconnaissance data will be accomplished to furnish the maximum data commensurate with system requirements.





For the visual systems, simultaneous investigations will be made relative to simplicity, early availability and utility of a satellite fixed data transmitting antenna scheme as well as the more complex steerable antenna arrangement. The transmitter tube will be chosen to meet ARS reliability. The data link receiving antenna will be a large parabelic antenna slaved to either the direction finder or to the tracking radar.

The ferret data link system will either be identical to the visual data transmission scheme or utilize standard telemetering techniques.

Suitable time-synchronized recording of the reconnaissance data will be performed at each intercept station, and then transmitted to the Intelligence Center.

The infrared data will be multiplexed on the telemetering data link.

Ground communication facilities will be established in order to permit the rapid transmission of time-synchronized reconnaissance and orbital data from each intercept station to the Intelligence Center, the transmission programming orders from the Intelligence Center to each intercept station, and the transmission of routine information. Initially, narrow bandwidth wire and radio nets will be furnished. Wide bandwidth communications between the intercept stations and the intelligence center will be provided early enough so that at no time will the ground communication capability cause constraint in rapid data transmission.

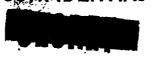
The launch station, each intercept station, and the Intelligence Center will contain the necessary intra-station communications required for efficient operation.

C. Solutions and Recommendations

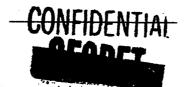
It will be necessary in the early programs to provide space-to-ground telemetering as the major means of conveying vehicle instrumentation data to the ground. It will play a major role in the development cycle, and, therefore, every attempt will be made for a high order of reliability. Standard FM/FM or PWM/FM telemetering techniques will be used in the early program. More refined vehicles will contain space-to-ground telemetering equipment as part of the operational equipment. This will be necessary in order to maintain continuous contact with vehicular equipment so that adjustment and switching of critical circuits may be accomplished by ground command. Consideration will be given to a redundant telemeter transmitter and/or use of the transponder as a telemetering instrument.

Early low latitude orbital flights will provide significant utility by virtue of the fact that existing ground tracking radars at AFMIC and Ascension and WS 117L ground tracking radars at Antiqua and Hawaii will track a transponder in the vehicle, orbital computation methods will be tested, telemetering equipment will be utilized and possible direct space-to-ground data transmission will be attempted.

During all phases of the program, continuing attention will be given towards developing techniques for degreesing the vulnerability of the



PAGE 30 OF 31 WD-57-01143



communication links to interference and jamming. This will be accomplished by conducting operational studies or development programs as required.



PAGE 31 OF 31 WD-57-01143

RDB PROJECT CARD	SECURITY CLASSIFICA				
	NEW PROJECT	47	REPORTS	CONTRO	N ever
1. PROJECT TITLE	1	1417		D-ROS(A	48
(UNCLASSIFIED TITLE) DATA		2. SECURITY	3. PROJECT	NUMBER	
	PROCESSING SUBSYS	TEM SECRET	1763		
ron .	K2 M2-11/L	4. INDEX NUMBER			
	•		or are out to	VIE.	
. BASIC FIELD OR SUBJECT	7 (119)	2-117L	2 Ap	ril 1	957
trategic Air une	7. SUBPLEID OR SU	BLECT SUBGROUP		7A. T	ECH. O
trategic Air Warfare System	117L 39. Recon	Interpretation	and .		₹9A,
. COGNIZANT AGENCY	Compac	acion.		10	. 0
ir Research & Development	12. CONTRACTOR	IND/OR LABORATORY	CONT	RACT/W.	-
Ommand					U. NQ.
DIRECTING AGENCY	SEC. 21.	•			
Q ARDC WESTERN DEVELOPMENT	DEC. 21.	C		none	
IVISION (WDD)					
A LEGISTORE NO. /					
DTR Or2-0171 X	1326 12. strayto pakite				
//	13. BEATE PAGE	The same of the sa		. COMPL	. DATES
HEADQUARTER. USAF	- 1177 COV	A Day	alb.	1961	
AF /AMC-P AFOIN HO ITEMS	(WS-4380 ~	ं वर्ष	DEV.	1963	
			De Jay	1965~	-71
APGC-I AFSS-I USA/C/S-I ACIC-I	THE DATE APPROVED	1		FISCA	11 het 15, 11
SAC-I TAC-I Other: CI		_ <i>સ્ક</i>	REV	V.7	ЗМ
ADC-I USN/CNO-I	15. PRIORITY		57		9M
	1A	AMTERIU	58	1/100	MOM
		- Conserv			MOM
This is the initial Report	on this Project.		61-6	1/600	140
REQUIREMENT AND/OR JUSTIFICATION			Total	2853	21vi
REQUIREMENT AND/OR JUSTIFICATION GOR No. 80 (SM-2C) dated	16 Warrah 1055		Total	2868	2M
GOR No. 80 (SM-2C) dated	16 March 1955 and	SR No. 5 dat	Total	2863	2M
GOR No. 80 (SM-2C) dated tablishes the requirement f			Total	2868	2M 1955
GOR No. 80 (SM-2C) dated tablishes the requirement f pable of accepting and proceeding the recommendation of the comments.	essing visual, fer	ret and infoa	Total ed 17 Oct ta Handli	ober	2M 1955 stem
GOR No. 80 (SM-2C) dated tablishes the requirement for pable of accepting and proceeding and proceeding and proceeding and much greater number aluated and analyzed to it.	essing visual, fer cles. Reconnaissa of "pieces" ofint	ret and infra nce Satellites elligence than	ed 17 Octate Handling data	ober ng Sy from	2M 1955 stem
GOR No. 80 (SM-2C) dated tablishes the requirement for pable of accepting and proceed the reconnaissance vehicles a much greater number aluated and analyzed today, at the page for the pag	essing visual, fer cles. Reconnaissa of "pieces" ofint or which is antic	ret and infras nce Satellites elligence than ipated to be	ed 17 Octate Handling data sare exp	ober ng Sy from ected g col	2M 1955 stem
GOR No. 80 (SM-2C) dated tablishes the requirement f pable of accepting and proceed the reconnaissance vehicles a much greater number aluated and analyzed today, stems in the near future. The will overtay the reserver.	essing visual, fer cles. Reconnaissa of "pieces" ofint or which is antic This great increas	ret and infra nce Satellites elligence than ipated to be of e in quantity	ed 17 Octate Handling data sare exp	ober ng Sy from ected g col	2M 1955 stem
GOR No. 80 (SM-2C) dated tablishes the requirement finable of accepting and proceed the reconnaissance vehicles a much greater number aluated and analyzed today, stems in the near future. The will overtax the present on timeliness of information	essing visual, fer cles. Reconnaissa of "pieces" ofint or which is antic This great increas intelligence data	ret and infra nce Satellites elligence than ipated to be of e in quantity handling syst	Total ad 17 Oct ta Handli red data s are exp is bein collected of colle	ober ng Sy from ected g col by o cted	1955 vstem to lecte
GOR No. 80 (SM-2C) dated tablishes the requirement for pable of accepting and proceed the second and proceed the second and analyzed today, at the second and analyzed today, at the second and analyzed today, at the second and analyzed today, at the second analyzed today, at the second analyzed today, at the second analyzed today, at the second analyzed today, at the second analyzed today, at the second analyzed today, at the second analyzed today, at the second analyzed today, at the second analyzed today, at the second analyzed today, at the second analyzed today, at the second analyzed today.	essing visual, fer cles. Reconnaissa of "pieces" ofint or which is antic This great increas intelligence data is of mounting i	ret and infra- nce Satellites elligence than ipated to be of e in quantity handling syst	ad 17 Octate Handling data sare explicated of collected of collected at a data has	ober ng Sy from ected g col by o cted time	1955 stem to lecte
GOR No. 80 (SM-2C) dated tablishes the requirement for pable of accepting and proceed the second assumed the second assumed to the second and analyzed today, at the second as the secon	essing visual, fer cles. Reconnaissa of "pieces" ofint or which is antic This great increas intelligence data is of mounting is cially designed and tem to minimize the	ret and infra- nce Satellites elligence than ipated to be of e in quantity handling syst mportance. A d developed ar	ed 17 Octate Handling data sare explicated of collected of collected at a data han ound the	cober ng Sy from ected g col by o cted time dling char:	1955 stem to lecter
GOR No. 80 (SM-2C) dated tablishes the requirement for pable of accepting and proceed the second and proceed the second and analyzed today, at the second and analyzed today, at the second and analyzed today, at the second and analyzed today, at the second and analyzed today, at the second and analyzed today, at the second and analyzed today, at the second analyzed today, at the second analyzed today, at the second analyzed today, at the second analyzed today, at the second analyzed today.	essing visual, fercles. Reconnaissa of "pieces" ofint or which is anticular increas intelligence data is of mounting it is ally designed ancem to minimize the ected raw data.	ret and infra: nce Satellites elligence than ipated to be of e in quantity handling syst mportance. A d developed ar e time needed The requirement	ed 17 Octate Handli red data s are exp n is bein collected of colle em at a data han ound the	cober ng Sy from ected g col by o cted time dling char:	1955 stem to lecter
GOR No. 80 (SM-2C) dated tablishes the requirement for pable of accepting and proceed the second and proceed the second and analyzed today, at the second and analyzed today, at the second and analyzed today, at the second and analyzed today, at the second and analyzed today, at the second and analyzed today, at the second and analyzed today, at the second analyzed today, at the second analyzed today, at the second analyzed today, at the second analyzed today, at the second analyzed today.	essing visual, fercles. Reconnaissa of "pieces" ofint or which is anticular increas intelligence data is of mounting it is ally designed ancem to minimize the ected raw data.	ret and infra: nce Satellites elligence than ipated to be of e in quantity handling syst mportance. A d developed ar e time needed The requirement	ed 17 Octate Handli red data s are exp n is bein collected of colle em at a data han ound the	cober ng Sy from ected g col by o cted time dling char:	1955 stem to lecter
GOR No. 80 (SM-2C) dated tablishes the requirement for pable of accepting and proceed the second second and proceed the second and analyzed today, at the second and analyzed today, at the second and th	essing visual, fercles. Reconnaissa of "pieces" ofint or which is antice. This great increas intelligence data is of mounting it is of mounting it is motion in the case of th	ret and infra: nce Satellites elligence than ipated to be of e in quantity handling syst mportance. A d developed ar e time needed The requirement ion of automat type technice	ad 17 Octate Handling data sare explicated of collected of collected at a data han ound the to product can ultion, mechanical data.	cober mg Sy from ected g col by o cted time dling charge meating the column and t	1955 stem to lectather
GOR No. 80 (SM-2C) dated tablishes the requirement for pable of accepting and proceed the second assence which wide a much greater number aluated and analyzed today, stems in the near future. The autil overtax the present in timeliness of information item must therefore be especially of this collection system intelligence from the coll best satisfied through the ctronics miniturization and	essing visual, fercles. Reconnaissa of "pieces" ofint or which is antice. This great increas intelligence data is of mounting it is of mounting it is designed and the mounting it is ally designed and the planned exploitation modern production.	ret and infra: nce Satellites elligence than ipated to be of e in quantity handling syst mportance. A d developed ar e time needed The requirement ion of automat type techniques	ad 17 Octate Handling data sare explicated of collected of collected at a data han ound the to product can ultion, mechanical data.	cober mg Sy from ected g col by o cted time dling charge meating the column and t	1955 stem to lectather
GOR No. 80 (SM-2C) dated tablishes the requirement for pable of accepting and proceed the second assumed the reconnaissance vehicles and analyzed today, stems in the near future. The second is a will overtax the present of information them must therefore be especificated in the collection system in the second intelligence from the collection intelligence from the collection intelligence from the collection in the collectio	essing visual, fercles. Reconnaissa of "pieces" ofint or which is antice. This great increas intelligence data is of mounting it is ally designed ancem to minimize the ected raw data. planned exploitation modern production 85, dated 3 Augus	ret and infrance Satellites elligence than ipated to be de in quantity handling systemportance. A developed are time needed the requirement to of automate type techniques 1956, and Section 195	ad 17 Octate Handling data sare explicated of collected of collected at a data han ound the to product can ultion, mechanical data.	cober mg Sy from ected g col by o cted time dling charge meating the column and t	1955 stem to lectather
GOR No. 80 (SM-2C) dated tablishes the requirement for pable of accepting and proceed the second second and proceed the second and analyzed today, at the second and analyzed today, at the second and th	essing visual, fercles. Reconnaissa of "pieces" ofint or which is antice. This great increas intelligence data is of mounting it is ally designed ancem to minimize the ected raw data. planned exploitation modern production 85, dated 3 Augus	ret and infrance Satellites elligence than ipated to be de in quantity handling systemportance. A developed are time needed the requirement to of automate type techniques 1956, and Section 195	ad 17 Octate Handling data sare explicated of collected of collected at a data han ound the to product can ultion, mechanical data.	cober mg Sy from ected g col by o cted time dling charge meating the column and t	1955 stem to lectather
GOR No. 80 (SM-2C) dated tablishes the requirement for pable of accepting and proceed the second accepting and proceed to the second accepting and proceed to the second accepting and proceed to the second accepting and analyzed to day, at the second accepting to the second acceptance of the seco	essing visual, fercles. Reconnaissa of "pieces" ofint or which is antice. This great increas intelligence data is of mounting it is ally designed ancem to minimize the ected raw data. planned exploitation modern production 85, dated 3 Augus	ret and infrance Satellites elligence than ipated to be de in quantity handling systemportance. A developed are time needed the requirement to of automate type techniques 1956, and Section 195	ad 17 Octate Handling data sare explicated of collected of collected at a data han ound the to product can ultion, mechanical data.	cober mg Sy from ected g col by o cted time dling charge meating the column and t	1955 stem to lectather
GOR No. 80 (SM-2C) dated tablishes the requirement for pable of accepting and proceed the second assumed the reconnaissance vehicles and analyzed today, stems in the near future. The second is a will overtax the present of information them must therefore be especificated in the collection system in the second intelligence from the collection intelligence from the collection intelligence from the collection in the collectio	essing visual, fercles. Reconnaissa of "pieces" ofint or which is antice. This great increas intelligence data is of mounting it is ally designed ancem to minimize the ected raw data. planned exploitation modern production 85, dated 3 Augus	ret and infrance Satellites elligence than ipated to be de in quantity handling systemportance. A developed are time needed the requirement to of automate type techniques 1956, and Section 195	ad 17 Octate Handlifed data is are explicated of collected of collected of collected at a data han ound the to product can ultion, mechanism where the collected in the collecte	cober mg Sy from ected g col by o cted time dling charge meating the column and t	1955 stem to lectather
GOR No. 80 (SM-2C) dated tablishes the requirement for pable of accepting and proceed tablishes the requirement for the state of accepting and proceed table of accepting and proceed table of accepting and proceed table of a much greater number aluated and analyzed today, at the state of a table o	essing visual, fercles. Reconnaissa of "pieces" ofint or which is antice. This great increas intelligence data is of mounting it is of mounting it is ally designed ancem to minimize the ected raw data. In planned exploitation modern production 85, dated 3 August 1956, direct ubsystem which is:	ret and infrance Satellites elligence than ipated to be de in quantity handling systemportance. A developed are time needed the requirement to of automate type techniques 1956, and Section 195	ad 17 Octate Handling data sare explicated of collected of collected at a data han ound the to product can ultion, mechanical data.	cober mg Sy from ected g col by o cted time dling charge meating the column and t	1955 stem to lectather

INT DECLASSIFIED. DOD DIR

(UNCLASSIFIED TITLE) Data Processing Subsystem for ARS WS-117L

2 April 1957 Proj 1763

- a. Tailored to the collection characteristics and capabilities of the reconnaissance satellite,
- b. Designed to centrally provide for rapid and efficient processing and dissemination of all satellite collected data in a manner which best

21. Brief and Military Characteristics

This project covers the design and development of a completely integrated Intelligence Data Processing Subsystem including the equipment, techniques and procedures to transform recorded, raw, photographic, ferret and infrared data into useful intelligence. This data processing subsystem will incorporate timely intelligence feedback from other intelligence collection systems and agencies to insure:

- a. Best operational employment of the satellite collection capabilities.
- Optimum extraction of information from the raw data collected.

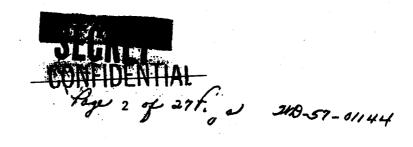
Data will be acquired from the satellite through radio transmission channels and reception at ground receiving stations. The ground receiving stations will identify, record, and retransmit this information to a central point, for simplicity termed the ARSIC (Advance Reconnaissance System Intelligence Center). The Intelligence Data Processing Subsystem located primarily within the ARSIC will be capable of all functions necessary to transform the recorded raw data into useful intelligence. The functional areas which must be investigated and considered to insure the efficient production and availability of intelligence in the forms, frequencies and quantities desired by various users : are: processing, screening, interpretation, collation, evaluation, indexing, storage and retrieval, analysis, display, dissemination and presentation.

Development of this subsystem must make maximum use of the Intelligence Data Processing Subsystem design concept, equipment, techniques, and procedures recommended and/or under development in support of System 438L, "USAF Intelligence Data Handling System". It appears that some of these techniques and equipments will meet some of the needs of this subsystem.

21b Approach

The WS-117L is being developed on a development schedule phased over a period of years and including a variety of configurations, capabilities, and useful vehicle life spans. It is planned to develop the Data Processing Subsystem on an orderly growth basis which is phased to the collection capabilities and operational ability of the system.

To be realistic, the design and development of the subsystem must be founded upon:



(UNCLASSIFIED TITLE) Data Processing Subsystem for ARS WS-117L

2 April 1957 Proj 1763

- (1) A definition and/or simulation of the raw data (end product) of the collection subsystems,
- (2) An analysis of the uses of these defined end products; i.e., who wants what information, for what use, how often, and in what form.

Each separate use of the data must be studied to determine the processing steps involved from the initial receipt of the raw data through the production of a finished output which best satisfies that use. Once the end products of the collection subsystems are defined, a design for efficiently processing the information can be sensibly conceived. Simultaneously, research effort must be initiated to attack technical problems that threaten the development of vitally needed equipments. Large scale equipment development efforts will normally follow the completion and be guided by the system design framework and the results of the Equipment Application and Techniques Exploration Task. Following the equipment development and testing, the components will be combined, installed, and tested as a system to point out the final modifications and debugging required before it is operationally ready.

In order to meet the changing capabilities of the collection systems it will be necessary to conduct a continuing research and technical development effort on techniques and procedures for application to the more advanced facilities. The concept of the initial data handling center is one of relative simplicity. Limited amounts of mechanization and automation will be adequate to handle efficiently the early data yields of the ARS. This will provide the capacity for the orderly evaluation and development of more complex components to meet more stringent requirements as the system grows.

c. Tasks

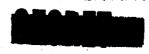
The areas which will require development effort have been divided into general functional areas as listed below. As work progresses these tasks will require expansion to reflect various intelligence functional areas and/or to relate the development work required to the particular sensing technique employed. Operational characteristics, to the degree possible at this time, are included in the general design specification of the development plan.

(1) Task No. 39856 - Simulation of ARS Data Input

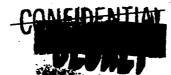
Contractor: Not Yet Determined

Technical Advisor: Mr. F. Kelly, RCWIO, Intelligence Laboratory RADC, Rome, New York

The objective of this task is to realistically simulate all types of predicted end products of the successive collection versions of this system. These simulated end products should include the range of resolution, cover repetition and quantity values anticipated or possible. This data is



y 3 portage 210-57-01144



(UNCLASSIFIED TITLE) Data Processing Subsystem for ARS WS-117L 2 April 1957 Proj 1763

fundamental in determining the usefulness of the raw data to the variety of potential users, and, consequently, the requirements for the processing involved. Results of this phase of the work will be the basis for the final design of the data-handling system and will determine the procedures and characteristics of the equipment needed to best satisfy the data processing requirements for each subsequent version of the reconnaissance vehicles.

(2) Task No. 39857 - Intelligence Data Processing System Design

Contractor: Not Yet Determined

Technical Advisor: Mr. R. Libby, RCWI, Intelligence Laboratory, Rome, New York

This task embraces the study work required to produce a design of a Subsystem (including procedures, equipment and technique) to efficiently transform the collected raw data into useable intelligence. Basic input data to this design study effort will be supplied in part by the simulation task. Possible uses of the collected product against the intelligence needs of major elements of the intelligence community as well as such factors as operational desirability, technical feasibility, and logistic supportability will be considered in arriving at the preferred system design.

(3) Task No. 39858 - Equipment Application and Technique Experimentation

Contractor: Not Yet Determined

Technical Advisor: lst/Lt. A. Buckland, RCWIO, RADC, Rome, New York.

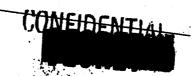
The objective of this task is to provide a source of technical knowhow for individual application to the variety of functions and processes included within this subsystem and to single out apparent choke points in the data handling system against which investigative effort should be concentrated. It will provide input to the systems design group concerning the feasibility of techniques and equipments which exist or can be developed and made available for systems integration. The output of this task will be reports and technical

- (a) Selection and modification of existing commercial and indevelopment equipment.
- (b) the performance characteristics and specifications of the development items required, including the optimum technical approach.
 - (4) Task No. 39859 Equipment Development

Contractor: Not Yet Determined

Technical Advisor: Mr. F. Kelly, RCWIO, Intelligence Laboratory, RADC, Rome, New York

J 24B-57-01144



(UNCLASSIFIED TITLE) Data Processing Subsystem for ARS WS-117L

2 April 1957 Proj 1763

The objective of this task is to actively develop those hardware items which are not commercially available or in development, but required by this sub-system. Included will be modifications to existing equipment when appropriate to insure their maximum applicability. Guidance on the items to be developed and their functional specifications will stem from the Systems Design Task and the Equipment Application and Technique Experimentation task.

(5) Task No.39860 - Intelligence Data Processing Subsystem Integration and Test

Contractor: Not Yet Determined

Technical Advisor: Mr. R. Libby, RCWI, Intelligence Laboratory, RADC, Rome, New York

The objective of this task is the accomplishment of the overall contractor systems management functions to insure its operational availability, prescribed performance, and its working integration with the other parts of the intelligence system. It will include but not be limited to: the systems engineering, complete installation and equipping of the ARSIC, and the combined test of all individual items which comprise this subsystem under simulated and operational uses. Command Post Exercises (CPX) using products of the simulation program as well as test run data from the functional test of the visual, ferret, and infrared subsystems for input data will be accomplished to checkout and modify the individual component and overall subsystem procedures, operation, and performance.

(6) Task No. 39855 - Intelligence Parameters and Data Processing Subsystem Criteria Studies

Contractors: Planning Research Corporation 10966 LaConte Avenue Los Angeles, California

> Aero Services Corporation 210 East Courtland Street Philadelphia, Pennsylvania

Physical Research Laboratory, Boston University 707 Commonwealth Avenue Boston, Massachusetts

Ohio State University Columbus, Ohio

Battelle Memorial Institute 505 King Avenue Columbus, Ohio





UNCLASSIFIED TITLE: Data Processing Subsystem for ARS WS-117L

2 April 1957 Proj 1763

Broadview Research and Development 1127 Chula Vista Avenue Burlingame, California

Task Engineer:

Mr. Frank Kelly, RCWIO Intelligence Laboratory RADC, Rome, New York

Task Technical Advisors:

Major W. E. Callanan, RCWIR 1/Lt. L. R. Buckland, RCWOO 1/Lt. R. E. Moss, RCWIO Mr. A. L. Downing, RCWIP

Intelligence Laboratory RADC, Rome, New York

Objective:

This task will provide analytical data as an input to the WS-117L Planning function to determine intelligence requirements and design criteria. It is aimed at determining the optimum detail, volume, and accuracy of the "sightings" to be made by the reconnaissance sensing equipments, by spelling out the information requirements of the users and translating these into meaningful quantitative terms and specifications. Effort will also be devoted to those areas relating the human behavioral characteristics to the intelligence processing and analysis functions. This study will include the exploration of possible applications of machine techniques for the automation of the "non-judgment" work areas within these functions.

(7) Task No. 39861 - Personnel, Training and Human Engineering Support

Contractor: Initially an In-House Effort. Eventaul contractor not yet determined.

Task Engineer: Dr. P. Bersh, RCSH, Human Factors Laboratory, RADC, Rome, New York

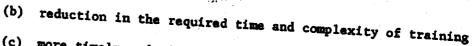
The objective of this task is to provide all necessary human engineering support for the Data Processing Subsystem. This task will develop criteria and specifications for training techniques, equipment, and simulators. It will also include the production of Qualitative Personnel Requirements Information (QPRI) covering all analysis, interpretation, operator and maintenance jobs required for the operational employment of this subsystem. The Data Processing Subsystem is extremely complex and, hence, the design of equipment and the integration of components into larger units must be accomplished in a manner which takes full cognizance of human capabilities and limitations. The gains to be achieved by appropriate human engineering will include:

(a) increased operate the state of the state

Tage 6 of 27 Y ages 210-57-01144

(UNCLASSIFIED TITLE: Data Processing Subsystem for ARS WS-117L

2 April 1957 Proj 1763



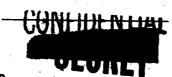
- (c) more timely and efficient processing of information through-
- d. (1) There will be no development duplication between this subsystem and systems 438L, 456, and 461L, but rather considerable effort will be made to take advantage and exploit the similarities of the programs for maximum trade off of the attained equipments and techniques. This subsystem will be made completely compatible with system 438L, and when operational, these systems will be mutually supporting and complimentary in nature.
- (2) The operational employment of this system will require that the number of photographic interpreters and intelligence specialist trainees be increased, and the new techniques resulting from this development may require modification and expansion of the existing training programs.

e. Background History

The concept for using a satellite vehicle as a platform for reconnaissance equipment can be considered as the natural outgrowth of the requirement for obtaining intelligence information of a potential enemy whose area and security preclude its effective collection by ordinary aerial reconnaissance or other means. The need for timely and continuous intelligence information to assess a potential enemy's capabilities and probable intent has become more critical as the advancement of technology has given them offensive weapons with intercontinental range and greater destructive powers. The impetus which motivated the military establishment to foster work on new methods for collection of intelligence information came from the realization that current reliable pre-hostilities intelligence is required to insure proper direction of National Planning in development of effective counter-force weapons and counter-force strategy. The results of the numerous studies conducted since 1946 at the direction of the Department of Defense concluded that a Satellite Intelligence System was feasible and would satisfy to a great extent the requirement for intelligence information to aid the national planners in making decisions pertaining to counter-force strategy and development of effective measures against possible attack.

The concept of the Advanced Reconnaissance System is a result of studies conducted at the RAND Corporation. A study completed in 1947 together with similar investigations by other contractors concluded that a satellite vehicle was feasible as a reconnaissance vehicle but not as a weapon carrier. In 1950, the Research and Development Board vested satellite custody in the Air Force, and RAND was directed to explore its possible military utility.

17 Fages



(UNCLASSIFIED TITLE) Data Processing Subsystem for ARS WS-117L 2 April 1957 Proj 1763

Recommendations for an expanded study of reconnaissance applications were made to the Air Staff in late 1950 and a formal report (RAND-217) followed in April 1951. Feasibility studies for critical subsystem initiated at that time were television (RCA), attitude control (North American Aviation), nuclear auxiliar power units (Bendix Aviation, Frederick Flader, Allis Chalmers,

Recommendations for the ARS development were made by RAND in November 1953, and these were followed by the final report (Rand-262) in February 1954. The Air Force requirement was written August 1954. Requests for proposal for systems studies were made March 1955, and the studies leading to this development plan began in June 1955 and were completed in June 1956.

The present concept of operation of the Satellite Intelligence Center was evolved as a combined effort of the Intelligence Laboratory, RADC, and the various Air Force commands. As the development of the system progresses, the concept of operations may be re-evaluated in light of changing requirements with modifications anticipated. f. Future Plans

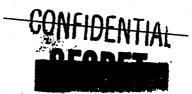
The extent of future plans is outlined in Tab 1, General Design Specifications. Revisions to the basic plan will be accomplished throughout the development cycle to insure timely and valid decisions.

g. References

- 1: RAND Corporation Report R-217, April 1951.
- 2. RAND Corporation Report R-262, February 1954.
- 3. Systems Requirement No. 5 dated 27 November 1954, revised 17 October 1955.
 - 4. GOR No. 80 (SA-2C) dated 16 March 1955.
- 5. DD Form 613, entitled "Advance Reconnaissance System: Project No. 1115", dated 19 April 1955, RCS: DD-R&D/A/119.
- 6. Project 1115, Task 15000 (Unc1) "Intelligence Parameters Study for Advanced Reconnaissance System".
- 7. Project 1115, Task 15001 (Uncl) "Study of Intelligence Processing Methods for Advanced Reconnaissance System."
- 8. RADC Document entitled (Unc1) "Intelligence Requirements as Developed for the 1960-65 Time Period," dated 1 June 1955, Control Nr NI-2443.

DD Form 613 (cont.)

218 g 27 Page 218-57-01144



(UNCLASSIFIED TITLE) Data Processing Subsystem for ARS WS-117L 2 April 1957 Marie Control Proj 1763

- 9. ATIC Document entitled (Uncl) "Technical Intelligence Considerations for Advanced Reconnaissance System 1115," dated 11 October 1955,
- 10. ACIC Document entitled (Uncl) "Study of Position Information Needs," dated 1 April 1955, control Nr. D5-6800-1.
- 11. Document entitled (Uncl) 'United States Air Force Indications Plan" (Short title - USAFIP), dated 16 November 1955, prepared by the Directorate of Intelligence, HQ. USAF, Washington, D. C., Control Nr. NR. NI-5986. (Collection Plan covering strategic Warning Indicators).
- 12. System Requirement No. 13 dated 14 January 1955; amendment No. 1 dated 10 August 1956.
- 13. System 438L, Project 4586 and all associated tech and project reports.

Tasks:

45888 - Operational Intelligence Data Processing Equipment

45823 - Weather Data Automatic Reader

45828 - Reconnaissance Systems Integration

45830 - Automatic IBDA Processor

45831 - Automatic Target Analyzer

14. System 438L, Project 4588 and all associated task and project reports.

Tasks:

45889 - Intelligence Data Handling System Design Task

45890 - Machine Fact Correlation for Intelligence Analysis

45893 - Indexing Intelligence Documents for Automatic Machine Retrieval

15. System 438L, Project 4591 and all associated task and project reports.

Tasks

45910 - Basic Minicard Equipment

45911 - Minicard Conversion Equipment

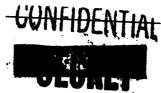
45912 - Lens Components

45913 - Minicard Camera & Enlarger for Aerial Photographs

45914 - Remote Televiewer for Minicard Display

45916 - Viewer Processor MX-1993-G

DD Form 613 (cont.)



(UNCLASSIFIED TITLE) Data Processing Subsystem for ARS WS-117L 2 April 1957 Proj 1763

16. Project 4597 and all associated task and project reports

Task

45331 - Communication Intercept System Design

17. Project 4594 and all associated task and project reports

Tasks

45940 - Intelligence Classification and Indexing Techniques

45941 - Intelligence Coding Techniques

45820 - Intelligence Data Presentation Techniques

45822 - Intelligence Data Retention and Retrieval Techniques

18. Project 4599 and all associated task and project reports

Task

45861 - Photo Interpretation Mechanization

19. Project 5500 and all associated task and project reports

Tasks

45910 - Radar Target Data Processor

45902 - Infrared Target Characteristics and Utilization

45903 - Infrared Data Analysis

20. System 438L, Project 5532 and all associated task and project reports.

Tasks

45925 - Major Elint Processing Central

45926 - RADINT Data Processing

21. System 438L, Project 5533 and all associated task and project reports.

Tasks

45960 - Rapid Intelligence Data Handling System Design

45961 - Military Tel autograph Development

10 of 27 Pages 210-57-01144

DD Form 613 (cont.)

-CONFIDENTIAL

CEONET

(UNCLASSIFIED TITLE) Data Processing Subsystem for ARS WS-117L

2 April 1957 Proj 1763

Tasks (cont.)

45962 - Magnetic Tape Duplicator/Transmitter Development. 45963 - Geographic Indexing, Searching and Plotting

h. Coordination and Signature Block

HAROLD F. WIENBERG

Major, USAF

Project Engineer

FREDERIC C. E. ODER

Colonel, USAF

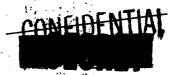
Asst. for WS 117L

AFA

DD Form 613 (cont.)

CONFIDENTIA.

31B-57-01144



DATA PROCESSING SUBSYSTEM FOR ARS, WS117L

General Design Specification

1. General

a. Statement of the Problem

- (1) The primary problem involves the establishment and implementation of a realistic program to insure the timely design and development of an efficient Intelligence Data Processing Subsystem. This subsystem must possess the capability of transforming the variety and steadily increasing volume of raw data collected by the WS-117L, as programmed in the combined operational and development schedule, into meaningful intelligence which satisfies user requirements. The fundamental objective and requirement expressed by GOR No. 80(SM-2C) dated 16 March 1955 and SR No. 5 dated 17 October 1955 is to develop the WS-117L to be of maximum value to the U.S. Intelligence Community and key decision making agencies and individuals. The WS-117L will be an addition to the operating USAF Intelligence Collection System. It will have the unique capability of providing a substantially continuous "look" at those areas and things which are of primary and critical importance to the Department of Defense and other key government agencies, such as the Department of State. It is anticipated that the constant high rate, high volume collection capability of the WS-117L will greatly exceed the standard data handling capabilities of the intelligence organization. The planned USAF intelligence organization and structure will therefore require systemitized augmentation with equipment, techniques, procedures, and people to effectively utilize this newly collected product. The timing and development of this subsystem must mate with the ARS development and operation and must be compatible with, support, and receive feedback from the other elements of the intelligence
- (2) The fact that the WS-117L will provide the capability of obtaining intelligence information of areas heretofore inaccessible to other collection methods makes it mandatory to obtain maximum operational utility of the system during the development phase. Hence, there is a requirement for essentially three versions of the Intelligence Data Processing Subsystem phased timewise to match the developmental growth and capability of the collection system. The problem is to insure sufficient capacity within the Data Processing Subsystem during its development to efficiently utilize of the satellite vehicle.

b. Approach

(1) The approach as set forth in the subsystem plan is based on an evolutionary concept to:

possible time.

(a) Secure useable information at the earliest

Pay 12 por Payer

210-57-01144

١,

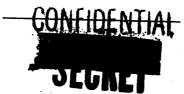


- (b) Encourage a pattern of normal development growth and firm knowledge of the product defining needs.
- (c) state of the art development, defining possible handling (timeliness and reliability).
- (2) It is intended that this subsystem development be phased to match the realistic operational demands and requirements for the WS-117L product, and to be compatible with the volume and type of system collection capabilities for each subsequent version of the reconnaissance vehicle. It will therefore be required to serially:
- (a) Engage in studies and work leading to a data handling the requirements for the initial and interim operating systems.
- (b) Initiate the required equipment development programs and perform required engineering to install and test the system while concurrently conducting research on techniques and procedures for applications to the more advanced facilities.

c. Solution

- (1) The philosophy underlying the development of the Data Processing Subsystem is based on conclusions arrived at through studies accomplished since 1946 by the United States Air Force and various scientific organizations. These conclusions are summarized as follows:
- nation can be obtained by a Satellite Intelligence System.
- feasible and is practical for development at this time.
- (2) The success of the overall program is dependent upon the following factors which apply specifically to the Data Processing Subsystem:
- (a) Continual cooperation and coordination between the United States Air Force and industry throughout the development of the WS-117L
- system development to insure scheduling of effort to meet the operational dates established for the WS-117L Weapon System.





- (c) The integration of personnel, techniques, procedures and equipment through a growth program concept where the system is transformed from the more simple to the complex. The growth will be in the direction of increasing the capacity of the Data Processing Subsystem to handle higher quality and greater quantity of more diverse data, i.e., visual, ferret and infrared, accurately and rapidly.
- (3) The WS-117L unique feature which offers a continuous surveillance capability while enjoying high relative physical invulnerability over presently inaccessible areas must be exploited. It should be initially viewed as a revolutionary extension of aerial reconnaissance, with its collected collected data from all appropriated sources.
- (4) In order to design a Data Processing Subsystem to support a collection system as unique as the ARS, all of the eventual uses of the data must be known. Each separate use of the ARS data must be studied in order to discover all of the processing steps involved from the receipt of the input ARS information to the production of a finished output which satisfies work can be worked out. Simultaneously research effort can be started to attack technical problems that threaten the successful development of required equipment. With the subsystem design framework completed, equipment developments can be started aided by the results of the foregoing research. Individual and operate the subsystem.

The Data Processing Sub-System design has been divided into a series of tasks. The division is based on time phasing rather than function, and as it is planned, the overall systems development will progress from the first to the last. The general tasks areas are as follows:

- (a) Intelligence Parameters and Data Handling Criteria Studies
- (b) Simulation of ARS Data Input
- (c) Subsystem Design.
- (d) Equipment Application and Technique Exploration
- (e) Equipment Development.
- (f) Data Processing System Integration and Test
- (g) Personnel Training and Human Engineering Support.

Pay 14 of 27 Payed



- (5) Simulation of ARS collected product. In order to specify the uses of the ARS data, a simulation program must be carried out. Photographic output at simulated ARS resolution and quantity taken at ARS repetition frequencies must be obtained and analyzed. Ferret and Infrared collection outputs will also be accurately simulated. Working groups consisting of prospective intelligence users and the subsystem designers will collectively determine the usefulness of the data, and outline the requirements for the processing involved. These results will be used in a subsystem design phase which will determine the procedures and characteristics of the equipment needed to satisfy the processing requirement.
- (a) Photographic cover will be produced of the following types of targets at accurately simulated ARS scale VS resolution, commensurate with the various planned ARS configurations. This requirement will involve high altitude flights with short focal length cameras of known areas, which have both seasonal and non-seasonal changes, and slow change versus anticipated rapid change in construction, movement, etc.
 - (1) Missile Test Centers
 - (2) Urban Areas
 - (3) Airfields
 - (4) Industrial Areas
 - (5) AEC Sites
- target areas will be produced at normal small serial reconnaissance scales, approximately 1/10,000, so that the photo interpretation can be made on a week-to-week basis, unencumbered by exceedingly small scales.* This effort determine the full effect such repetitive cover has on operating procedures, involved in handling this information.

*This photo cover should be flown on a schedule 2-3 times/week daytime basis (random time selection) and following a supply build up of new data should be expanded to include repetitive night cover of the same areas for comparison.

CONFIDENTIAL

31B-57-01144



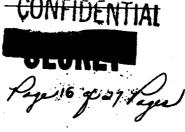
(c) Laboratory methods will be developed to degrade conventional aerial photgraphs so that they are respresentative of the ARS scales, resolution and contrast. These photographs should be the best representation of ARS photography that can be obtained without making high altitude flight tests. The purpose of developing such degrading methods is to provide simulation data as soon as possible to minimize the delay involved in obtaining ARS type flight test data.

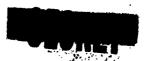
community and other agencies noted below will be required to determine the possible users of the simulated photography obtained in (a) and (b). The the efficient design of the Data Processing Subsystem:

- (1) ACIC
- (2) D/I Hq USAF
- (3) Weapon System Offices (Weapon Guidance Input)
- (4) 438L
- (5) Hq SAC
- (6) Hq TAC

Estimates will be made of the quality of ground received data required to satisfy requirements of the users (with the aid of further simulation) to provide meaningful goals and objectives to the collection subsystem developments as well as providing criteria concerning volume, flow pattern, analysis techniques, dissemination nets, etc., for the data handling subsystem designs. Simulation of the data input produces by the ferret given ferret sensor and ground environment, the quantity and form of the data will be calculated and simulated. In conjunction with appropriate determine its possible utility. Electronic intelligence and communications ments will be made to provide guidance to sensor developments and criteria for design of the improved Data Processing Subsystem.

(6) Subsystem Design. The Data Processing Subsystem will be designed to provide for the efficient handling of the data collected by the various configurations of the ARS vehicles. The data obtained from the simulation program will be a basic input to this subsystem design and will provide the means of realistically determining user needs. Equipment developments will be undertaken for all of the components of the subsystem



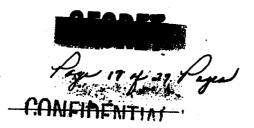


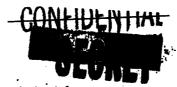
as specified by this design. The subsystem design phase will be a continuous effort, and using simulated data of improved versions of the ARS, future requirements and growth of the Data Processing Subsystem will be studies. In this way, the early subsystem can be designed with general awareness of future system requirements, and hence, should provide a framework for improvements. The problem of centralized vs decentralized data processing transmission of data between ground implications of ground to ground transmission of data between ground intercept stations as a function of incorporated in the initial subsystem design studies. A continual with ARDC technical developments and applicable commercial developments will be programmed during the major portion of the cycle.

- (7) The Equipment Application and Technique Experimentation Task, and the Equipment Development Task will be accomplished as outlined in the project plan. There are no specific items noted at this time since it is intended to base hardware developments on a firm knowledge of the potential input to the photo interpretation group (and hence utility) and on a well designed system basis.
- (8) Data Processing Subsystem Integration and Test. This work will be done in two phases:
- (a) research investigation leading to the preparation of detail design specifications for fabrication purposes for the installation and equipping of the ARSIC for purposes of research and development test of the subsystem under simulated and operational use;
- (b) complete installation of subsystem equipment necessary by 1 March 1960.

During the intervening 6 months period, between that date and the 1st high latitude scheduled launch, CPX-type operations using products of the simulation program for input data will be accomplished to check out and modify the individual component and overall system procedures and performance. This engineering practices and where practicable equipment conforming to applicable JAN specifications.

- (a) This work will include but not be limited to:
- items necessary for operation of the ARSIC (excluding items in the AF inventory).
- for implementation of the ARS data handling subsystem.

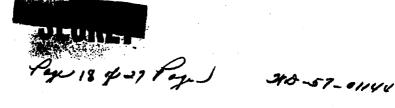




3. Qualitative personnel requirements information for operation of the ARS data handling subsystem.

4. Facility requirement estimates and plans necessary for implementations of the ARS data handling subsystem on a research and development operational test basis. These will include, but not be limited to, the following (this excludes facility cost, but includes equipment lay out

- (a) Space
- (b) Accessory equipment
- (c) Air conditioning equipment
- (d) Power
- (e) Communications channel
- (f) Security (physical and communication requirements)
- 5. Nomenclature description data for each component equipment and major equipment group of the subsystem. These descriptions will contain a functional description of the item and will be submitted as soon as the essential mechanical and electrical characteristics for descriptive purposes
- 6. Proposed operational procedures for effective operation of the subsystem and integration of its output with the elements of the 438L System. These will include definitive data flow charts, file-up grading procedures, and special computer programs, in such detail that personnel trained in operation of the equipment per se and capable of performing existing photo interpretation processes could implement the subsystem on a trial basis. Operational procedures evolved while optimizing the efficiency of this subsystem will correspond to existing organizations and procedures insofar as possible.
- 7. Estimates (cost and manpower) for contractual technical services for the subsystem (facilities provided) in order to operate it on a one year research and development operational test basis. This will include services for error and reliability check outs.
- 8. Estimates of consumable material required for operation of the subsystem on a one year research and development operational test basis (tape, ribbons, films, processing materials, etc.).
- 9. Completion of a detailed ARS data processing testing program to be accomplished in the 6 month CPX test phase, which program is designed to check out system performence, reliability, saturation points,





d. Time Sequence of Development:

- (1) As previously stated, the Data Processing Subsystem must provide for the orderly transformation of the raw data collected by the reconnaissance satellites into meaningful intelligence. The requirement for rapid processing of intelligence information is acute, and the problems of speed are of higher priority than ever before. Storage and recall components which encompass large storage capacity in small space must provide intelligence information in a very short search time basis for all users.
- (2) The development of the subsystem will be from the simple requirements of handling the gross pioneer product to the more complex requireferret and infrared collection media. The general scheduling of the systems and their brief description follows:
- configuration must be chosen to achieve the minimum modification to existing Air Force data handling systems now in R&D. This subsystem must be of unitized design, so that later developments in component processing equipment (based on the improved collection techniques by later versions of the satellite) may be composed of many persons with easily developed assists to the information extraction process rather than automatic equipment. This system must have the the initial reconnaissance capabilities during this period and be compatible with other elements of the Operating Intelligence Data Handling System.
- (b) Interim Subsystem October 1961 The subsystem connecessary modifications to commercial and/or military components, including the initial subsystem must be completed during the latter part of FY60, and complete subsystem tests must be accomplished in time to insure a data reduction facility capable of handling the advanced photographic and ferret versions of the satellite. Again, the processed output must be compatible with the Operating Intelligence Data Handling System. The volume of ARS collected data will be approximately three (3) times that of the initial system.
- (c) Final Subsystem July 1963 This subsystem will consist of operational versions of data processing equipment, techniques and procedures not now recognized, but resulting from the logical development of the previous two subsystems. Much of the final equipment will come about as a result of solutions to subsystem operational problems encountered in the initial and interim subsystems. The primary output of the system will be all source evaluated ARS semi-finished and/or finished intelligence which will be





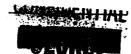
fed into the Operating Intelligence Data Handling System existing in this period and disseminated to other special elements of the intelligence system. The volume of ARS collected data will be approximately three (3) times that of the interim system and ten (10) times that of the initial system.

- (3) The technical responsibility for the task areas listed below must be combined into one contract in order to most efficiently accomplish the objective of this subsystem:
 - (a) Subsystem Design
 - (b) Equipment Application & Technique Exploration
 - (c) Equipment Development
 - (d) Data Processing Subsystem Integration and Test.

SEGRET Py 20 p 27 Py

Name of the last

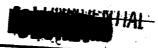
	SYSTEM						3				***								•						:	2	REI	OR	73 (CON	7780)L S	m	ВС
TITLE	SYSTEM		-	(UJI	ECT		Ш	TA	SK] 0	THE	R													3.	DAT	•		<u> </u>	_			
IIIM: ACCTOTON					_					-					- 10-												2 /	Anr	·f 1	10	DET	,		
DATA PROCESSING SUBSYSTEM	FOR ARS.	W9	11	71												IN									\neg	4.	NUM	021	11		12/		_	_
SCHEDULE				.,,		_										CH	ANG	E							- 1									
	γ	4													_ــ												176	3	•					
TITLE	PROJECT OF	٠	_	19	<u>57</u>		oxdot				19	58			_ <u>`</u>	AL	EN	DAI	RY	EA	RS.			_									19	-
Data Processing Subsystem		4	44	브	0	N C		•	M A	u	٠١.	٨١٠	I.	al.	• D	۱.,		<u>'</u>	-	<u> 59</u>	_			19	60	\mathbf{I}	13	61	T	1:	6	2 1		-
- DIMAYA CEM	P-1763	+	4	Ц		\perp		\Box	Т	П	1	1		7	+	4	4	*1	4=	42	ŀ۰	ч	1	1	1	•	2	•	4	1	T.	1.1	. T.	÷
- Tasks -	 -	4.	4_	Ц	_	\perp	\prod	T	Т	П	7	+	 	+	+	Н	+	+	+	╀_	Ц	Ц	4	\perp	\perp	B	7	П	\top	Ŧ	ħ	ol	, †	=
Intelligence Parameter	 	4	┺	Ц	1	\perp	\Box		Т	П	+	1	\vdash	+	╅┥	Н	+	+	╀	1	Ц		┙	\perp	Γ	T	П	П	\top	十		n'	4	-
Data Processing Criteria S	39855	+	\vdash	Ц	1	\perp	\Box	$oldsymbol{\mathbb{T}}$	П		+	11	\vdash	十	╁┪	+	+	+	+	\vdash	Ц	-	$\perp \Gamma$	Ι	Ι	Γ		\neg	十	十	H	4	+	-
		+	Ы	Ц	1	\perp	\Box	\perp	П	T	┰	††	+	+	╅┥	+	+	+	+-	Н	Ц	4	\perp	Γ	Ι	Г	П	7	十	+	Н	+	+	-
Simulation of ARS Data Inpu	 	+	Ш	4	1		\Box	Ι	П	7	十	††	+	╁	╁┼	+	+-	+-	╀-	┰	Ц	1	\perp	I	Ι	Γ	П	T	77	d-	H	+	+	Ⅎ
		4	Н	4	1			T	П	丁	+	††	+	┿	╀┽	+	+	╄	╀-	Н	4	4	┸	Γ	Γ	П	П	\top	7	Ť-	11	┿	┿	┪
nterligence Data Processin	 	+	Ц	4	L			T	П	T	+	††		╅-	╀	+	+	+-	▙	Ц	4	4	┸	1	Γ		П	T	T	Ť	İΤ	÷	÷	┥
		44	Ц	4	\perp	\Box		T	П	7	+	H	┪-	┿	╁	+	+	╀		Н	4	_	\perp		Г		\neg	7	1	†	H	+	╆	4
Initial System	39857	44	Ц	1	L			T	П	十	+-	††	+	+	╌┼	+-	+	╄-	Н	4	4	┸	\perp	L	Γ		T	7	†	† –		+	Ŧ-	i
. Interim c		\sqcup	4	4	L	П	\Box	T	П	+		1	+	1-1		-	+-	Н	Н	4	4	4			Π		T	\top	T	Н	-	+:	+	÷
Surveillance System		Н	4	1		П		T		1	1	1	+-	Н	-	4-	╀┈	Н		4	4	1			Π		T	1	\vdash	H	+	+-	-	ļ
System		₩	1	┸		П	Т		\Box	+		H	╅	╁┪		4-	+-	Н	_	4	4	<u>q</u> _	\perp		П		7	\top	1	H	+	+	+-	۲
quipment Application &		Н	4	\perp		\Box	\Box	Т		+	Н	+	+	╁┥	+	+-	+-	Н	4	4	4	1	\Box		\Box	П	T	\top	ta	H	十	+	H	t
echnique Exploration		Н	┵	┸	L		Т	П		†	Н	+	+-	⊢	+	+-	Н	Н	4	4	1	L			П	7	T	1	17	一十	+	+	Н	ŀ
Initial System	39858	Ц	4	┸	\prod		T	П	\top	+	╆╅	-+-	+	╁┼	┿	+-	Н	Н	4	4	4	L	\prod		П	\neg	T	+	Н	1	+	╆	H	H
Surveillance System		Ц	┸	L	\Box		Т	П	1	1	H	+	╅┥	Н	+	+-	Н	Н	4	4	1	L			П	T	7	1-	\vdash	7	十	+-	Н	۲
System		Ц	1	\perp			T	П	\top	+-	H	+	╁┤	Н	+	+	Н	4	4	┸	19	L			П	7	7	†	H	+	+	+	⊢┼	۲
Dipment Development		Ц	\perp	\perp	П	\Box	Т	П	7	\vdash	H	╅	╁┤	+	+-	₩	Н	4	4	1	1	L			T	7	T		d	十	+	╁┤	H	_
Initial System	39859	Н	1		П	\Box	7	П	1	П	1	+	╅╅	+	+-	₽	Н	4	4	4	1				\top	7	1	\Box	7	+	+	Н	\dashv	-
Interim System		Ц	\perp	L	П	Т	T	П	\top	T	+	+	B	┰	+	H	Н	4	4	_	L			\Box	7	Т	T	Н	\vdash	+	┿	Н	4	_
Surveillance System		4	┸		\Box	T	Т	П	+	Н	+	+	17	+	+-	╁┥	4	4	4	10	10	Q	_		P	7	7	E	7	+	+	Н	-	-
System		4	1	L	\Box	T	T	П	十	Ħ	+	+	++	+	+	Н	-	ᄟ	1	1	L			c h	010	ol	\top	1			┿	\vdash	+	=
		4	1	L		Т	П	7	+	11	+	+-	H	┿	+-	Н	-	4	4	1	L		$oldsymbol{ol}}}}}}}}}}}}}}$	Т	Ti			М	\neg	士	۵		_	I
		4	L			7-	\Box	1		Н	+	┿	╁┼	+	++	Н	4	4	1	1				I	Т	7	П	H	十	₩	ᄤ	9	4	Į
		L	L			Т	\sqcap	十	1	1	+	+	-	+	+4	\vdash	4	4	1	L	Ш		\perp	T	Т	T	П	\dashv	+	+	H	\dashv	+	-
street will be desert in		┸	\perp		\Box	T	П	1	\top		+	+	╁	┿	+-1	+	+	+	4	L	Ш		I	I	Т	T	П	7	十	┿	₩	+	+	_
ntract will be Awarded Tost	CNO. 3985	Щ.	ياد	i1	Ma.	d i	p4	7	\top		╅	1	┝╌┼╴	┿	╁╌╁	4	4	4	4	Ц			\perp	Т	Т	T	П	7	+	+	₩	┿	+-	-
Warded Tak	-No 3985	4	39,	57	$oxed{T}$	36.	Ed	7	dod	,	1.		+		+-	-	+	╀	4	Ц		\perp	\mathbf{I}	T	Т			7	十	+-	₩	┿	+-	_
ntract will be Awarded Tosl		1		\Box	F	F	H	W	17	H	7	۲,91	+	рy	,34	4	4	41	\$ 5			\int	I	Ι	Γ	П		+	+	+	┢	+	+	-
		4_			Ι	Γ		7	14	c	٧/	Ħ	#	+-	₩	4	+	╀	Ц	Ш		I	Γ	Ι	Γ	П	\dashv	+	+	+	H	+	+-	-
FORM 103 PREVIOUS EDITIO	HS OF THIS FOR	1	17	ΙT	T					Ė	7	11	ш.		ட	_L		1		H	ſ	Т	Т	Т	r	П	-+	+	+	₩	-+	_	┺	J



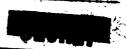
RECEDULE 1763 ***ECHEDULE 1763 ***ECHEDULE 1765 ***TARK CONT'd) 15 57 10 58 10 59 10 50 1151 152 10 country 12 58 12 59	4. TITLE	SYSTEM		R EP) TH	8 D	٠					•						- 1				co	NTR	OL S	YMB	OL
Title PROJECT ON TASK NR J A D N D J F N A M J J A D N D J N D N D N D N D N D N D N D N D	(UNCLASSIFIED TITLE)						_	_	_	_	<u>.</u>						S			_						\perp	2 /	Apz	:11	19	57			
Tasks (cont'd) Tasks (cont'd)	SCHEDULE	M FOR ARS,	W	3-1	17L		(c	on	t'd	I)						-					l					1	N	UNIO	ER					
Tasks (cont'd) ### A		PROJECT		_	19	57	_	_	_	_			_	_			CA	LEN	DA	RY	FAI					\perp	17	763						
Engineering for Data Processing Subsystem Implementation Installation and Test 39860 Initial System Interim System Surveillance System Surveillance System Surveillance System AA Q Q Q Q Q Q Q Q Q Q Q Q Q Q Q Q Q Q	Tasks (cont'd)	TASK NI	· .	1				;	F	w l	ماء	"	<u>58</u>	T.	_	_	1			19 5	9		\top	1:	• 6	0	_	106	_	_	. Z 7	_		_
Inginering for Data Processing Subsystem Explementation Installation and Test 39860 Initial System Interim System Surveillance System ersonnel Training and Human Engineering Support 39861 Initial System Interim Syst				Ц.	П	\Box	I	T	П		+	H	4	+	읙	* 5	낟	! !	-	AM	Ŀ	•	1	1/2	1	1.	_	_		_				
Initial System Interim System Surveillance System Example 1	ngineering for Data Proce	seine		4	Н	\perp	I	Γ		T	1	H	+	₩	-	-+-	╀	┦┦	4	4	Н		Ι	${\mathbb T}$	${\mathbb T}$	П	7	+	Ħ	H	+	1	'	딘
Initial System Interim System Surveillance System Example 1		7.0		+	Н	4	1			\Box		\sqcap	十	H	+	┿	╀	Н	4	+	Ц	4	\perp	I			T	1	H	Ŧ	700	行	-	2
Interim System	IIIS CALLACION and Teas	3986	\leftarrow	+	₩	4	1			${\mathbb T}$	П	\sqcap	\top	Н	+	+	┿	Н	+	+	Н	4	L	Γ				1	Ħ	+	+	H	7	14
Surveillance System ersonnel Training and Human Engineering Support 39861 Initial System Interim System Surveillance System A Q Q Q Q Q Q Q Q Q Q Q Q Q Q Q Q Q Q	Initial System		-	+	Н	4	丰	Ц		Т	П	\sqcap	7	Н	+	┿	╁┈	H	+	₽-	Н	┵		L		П	\top	7	H	+	+	₩	+	⊣
Surveillance System ersonnel Training and Haman Engineering Support 39861 Initial System Interim System Surveillance System A Q Q Q Q Q Q Q Q Q Q Q Q Q Q Q Q Q Q	Interim System			+	Н	4	1	Ц	\perp	\mathbf{I}	П	\neg			+	╁	+-	·+	4-	4-4	Н	4	┸	L			7	\top	\vdash	+	+	+	╬	\vdash
ersonnel Training and Human Engineering Support 39861 Initial System Interim System AA Surveillance System AA OQ OUTPRINT AA O	Surveillance System	 	-+	+-	Н	4	L	Ш	\perp	\mathbf{I}	П	\top	Н	H	+	+-	1-1	+	+-	Н	Ц	_c	Ю				\top	7	E	十	++	┢	┰	-+
######################################		†	-	┽┈	H	4	Н	Ц	\perp	\perp	П	T	\top		+	+-	Н	+	╀	-	4	+	1	Ц		C	0		PT	十	ÌΤ	+	╅┥	ᆎ
Initial System Interim System Surveillance System A A Q Q Q Q D D D D D D D D D D D D D D	ersonnel Training and		\dashv	+-	4	+	Н	1	\perp	$oldsymbol{\mathbb{L}}$	П	\top	77	+	+	+-	Н	+	+-	Н	4	4	١.,	Ц		$-\mathbb{T}^{2}$	В	T	\sqcap	+	†+	cl r	╗┼╌┤	
Interim System Surveillance System A A Q Q Q Ontract will be Awarded Task Nos. 39856, 39857, 33838, 39859, 39860, by 30 June 1957.	ruman Engineering Support	39861	+	+	+	+	Н		4	L	\Box	T	П	十	+	t	Н	+	╁-	╁┤	+	4	Н	Ц	Ц	┙	\perp	\Box	T	十	11	+	7+	
Surveillance System A Q Q Q Q Q Q Q Q Q Q Q Q Q Q Q Q Q Q	LULLIZI SVStem	1-300	+	╅┥	+	+	Н	4	┸	\perp	$\Box \Box$	T	П	7	1	Н	4	+	+	H	+	+	Н	Ш		\perp	I	П		7	!	+-	+-	
Ontract will be Awarded Tesk Nos. 39856, 39857, 39858 39859, 39860, by 30 June 1957.	Interim System	 	+	╂╌╂	+	+	Н	4	丄			T	П	+	+	\vdash	at	+	Н	₩	4.	╀	Н	Ц	_	\perp	I		7	7	ri	·ŕ	- }-	- 1
Ontract will be Awarded Task Nos. 39856, 39857, 39858 39859, 39860, by 30 June 1957.	Surveillance System	 	+	₩	┿	4	Н	4	\perp			T	П	7	1	Н	4	+-	Н	1	4-	╀-	Ц			\perp	\mathbf{I}^{-}	17	1	7	1		 -	·· }
Ontract will be Awarded Task Nos. 39856, 39857, 39858, 39859, 39860, by 30 June 1957.		†	+	₩	+	Н	Ц		\perp	П	A	7	\sqcap	\top	$\dagger \exists$	H		+-	Н	4	+	L	Ц	잋	\perp	Γ	T		+	1.1	- 	1	i	
Ontract will be Awarded Task Nos. 39856, 39857, 39858, 39859, 39860, by 30 June 1957.		 	+-	⊢∔	4	Н	4	┸	\perp	П	Т		\vdash	+	H	+	╅	+	Н	4	+	Ц	Ц	_	\perp	\mathcal{I}	П	1	7	11	ot-	+-	┝╌┞╴	+-
CONFIDENTIAL		 	┿	Н	+	Н	4	┸	L	\Box		\forall	1	╈	Н	+	+	+-	Н	4	╄.	Ц	\sqcup	\perp	\perp	Τ	M	7	+	77	4	+-	⊬	┿
CONFIDENTIAL		<u> </u>	+-	Н	+-	Н	4	\perp			T	\forall	1	+	H	╅	+	+	4	+	╀-	Ц	4	┸	\perp	Γ	П	7	7	††	+	+-1	-+-	+-
CONFIDENTIAL			+-	Н-	+-	Н	4	\perp			Т	П	_	1	H	┿	┿	╁┤	+	4	+-	Ц	4	┸	\perp	Γ			+	ŤŤ	+	+-1	+	+-
CONFIDENTIAL			+-	-	+-	Н	4	┸	П		Т	П	\neg	\top	H	+	+-	╁┤	+	4-	Н	Ц	4	\perp	\perp		П	7	1	H	+	╆┪	+	┯
CONFIDENTIAL			╁┤	+	╀┥	Н	4	\perp		\perp	T	П	1	Н	1	+	┿	₩	+	+	Н	4	┸	L	\perp			7	1	\vdash	+	╆┿	+	╃┩
CONFIDENTIAL			╂┩	+	44	Н	1	L	Ш	\perp	Т	П	7	H	+	+	╁	₩	+	+	Н	4	1	┸	\perp		Т	7	T	\vdash	+-	┢┼	+	╁┤
CONFIDENTIAL	ontract will be Awarded Ta	sk Nos 20	ᆲ	+-			4	Ш		\perp	T	\sqcap	_	H	+	+	╁╴	₩	+	+-	Н	4	1	L			\top	\top	H	\vdash	+	⊢	+-	╁╌┨
CONFIDENTIAL		2.5 2.08. 35	49	43	76	4	39	85	8	39	85	7.	398	60	<u>.</u>	+	ᅕ	H	+	4.,	Ļ	4	┸	L	\Box		Т	T	П	_	+-	\vdash	+-	╁┪
			++	┿	┰	4	4	Ц		\perp		\sqcap	7	M	+	7	۲	۳	雫	卢	24	4	1	L	П		T	T	П	+	++		┿	
			╁┼	+	Н	4	1	Ш	_[\perp	П	\top	17		╅	+	1	₩	4-	₩	4	4	1	L	П	\Box	Т	T	\sqcap	+	+	+	+-	H
			₽	+	Н	4	1	Ц	\perp	I	П	\neg	\top	\vdash	+	+	Н	+	╀	₩	4	1	┺	L	П	\Box	T		\sqcap	+	H	┰	╆┵	;⊢1
			₩	╄	Н	4	Ц	Ц	I	${\mathbb T}$	П	\top	\forall	+	+	╆	Н	+	+-	Н	4	4	Ц		П	$\Box T$	Т	П	\neg	十	H	+	+-/	-
			₩	4-	-4	4	Ц	\perp		Γ	П	\top	T	+	+	Н	Н	+	╀	Н	4	丰	Ш		\Box	T	Т	П	\top	+-	╆	+	╁┼	\dashv
			+	44	4	4	Ц	\mathcal{I}	\mathcal{I}	Γ	\sqcap	7	Н	+	╈	Н	⊢	+	١.,	Н	4	4	П			\mathcal{I}	T	П	\top	+	H	-	┿	\dashv
			4	┦┤	4	+	Ы	Ή	AII	I	A.	T	Ħ	al.	+	╁┪	+	+	1	Н	4	1	Ц		\Box	T	Т	П	\top	+	+	+	╁╌╂	\dashv
			+	₩	4	44	Ľ	4	1	1	먓	.Tr	Ħ	Ŧ	1	⊢	+	+	Н	4	1	\perp	Ш		\mathcal{I}	T		\Box	十	++	+	+	⊬	4
	FORM 102		_	Ц	Ц,			J	31:			土	U	Ŧ	1-	⊢┼	+	+	Н	4	1		Ш	\Box	J	Т		\sqcap	+	H	+	┿	⊦∔	4



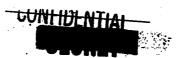
- Contract Awarded
- Fabrication of development model started (Prototype flight article)
- Development model fabrication completed (Prototype flight article)
- End of contractor compliance testing of development model (Acceptance test)
- Ground Test starts
- Integration with first flight (Completion of ground test)
- E. Completion of functional testing of development model to demonstrate capability (After flight test approval)
- J. Preparation of procurement data (End)
- Production engineering (End)
- Q. Design studies completed



	R&D	MATERIEL DJECT (- ANNEX □TASK □ OT	Hed	,		2. RE	PORTS CONTR	OL STIES
4. TITLE			. —				3. DAT		
(UNCLASSIFIED TITLE)	MATA PROCESSING S	UBSYSTEM	POR ANG		S. INITIAL		2 A	ril 1957	
			TOR AKS,		SHAMS		S. NUM	BER	
Cost Estimates: Gross:	SUPPLY	MAIN	ENANCE	179			1763		
Met.	1,500,000 1,500,000			144	MSPORTATIO	M COM	CONICATION	8 TOT	AT
8. SUPPLY & EQUIPMENT	72.07,000							-02	
Momenclature Including S	Retimated	Ι,	heal n						
including S	/N Unit Cost	Grs Qty	Gross Cost N	ents		Time Pi	ased Het		
Minicard System,		•		r vey	Met Cost	FY 56	FX 57	PY 58	ents
AN/GSQ-11 Complete	1,500,000	1	1,500,000		1			1	PY .
			-,500,000	1	1,500,000			1	
			1		l 1		l	İ	1,50
		1			i 1		1	l	
		1	1		1 1				2.
		- 1	1			1			
			- 1						
	1 1	- 1		- 1	1				
•	f f			- 1	1	1	- 1		
		- 1	·	. 1	f	ı	i	- 1	
	1 1	- 1	- 1		I	1	I	í	
		- 1	I			- 1		. 1	
	- 1 - I.	1	- 1	- 1	· j	- 1	}		
		1	1		.]	- 1		- 1	
	· [- 1	l l]	- 1		. 1	
	1 i	- 1	- .			- 1	- 1	- 1	
·		- 1	1				1		
		1	1	- 1	1	1.		· 1	
C PORM 187 PREVIOUS	-	CONF	IDENTIA	-	<u> </u>		. 1	- 1	



4. UNCLA	SYSTEM D	D MANPON	TASK	OTHER	1			PAGE 2. DATE		L STREOF
DATA P	ROCESSING SUBSYSTEM FOR ARS, WSI		•		S. Barton	AL. E		2 Ap	ril 1957	
7. ORG COMP CODE	ORGANIZATION TITLE	9.	ACTUAL MAN-OTHE	111,	EHAI	***		4. HUIsas 1763		
	The state of the s	TYPE	MAN-QTRE	,	Y 19 58	PROJECT	ED DIRECT	MAN-YEARS		
		┽	LAST OTR	AVAL	RORD		V 19 59	FY 19 60	PY 1961	TO CO
WDTR	WS1171 P		1			AVAL	RORD	RORD	RORD	ROR
RCWIO	WS117L Project Office WDD Intelligence Lab, RADC	R	1	1	li	1	1			
		R	5	4	1	1	1	2	2	*
rdsh	Human Factors Lab, RADC	R	0		0	4.8	7.5	12.5	14.0	*
Ž.	TOTAL:					1.0	2.0	2.0	2.0	*
•	Total Mampower Dollars:		6	5 .	5	6.8	10.5	16.5	18.0	*
	- Dollars:	. 1	10,320	36,400	36,400	49,500	74,400	120,100	121 000	٠,
								,200	131,000	655,0
								ĺ		٠
				.			 :			
		İ		.						
.					.			•		
.					.					
C . Form		CO	VFIDENT	14.			.			



•		2 & D C	ONTRACT I	TUNOS ANN	EX .							2. RE	PORTS (ONTRO	L SYNCE	OL.
	SYST		PROJECT			PME e						PAGE		07	P	AG Es
	_	_				MEK						S. DAT	_			
TITLE								_					pril	1957		
(UNCLASSIFIED 1	CITIE)								IAL D			e. NU	MER			
DATA PROCESSIN								CHA	ME E			1	763			
ITEM	PROJOR TASK HR	- EHO ITEM	CONTRACT NUMBER	II. DPM	12 page		12. FY	57	14. PY	58	10. FY	59	14. p	160	17TO C	-
		CAT	MANAGER		900	OTHER	***	OTHER		DTHER		OTHER		OTHER		OTI
Data Processing Subsystem	1763	E		2-117	513M		969M		2000M		6900		6000e		27000	Т
].			P-200 F	nds:			80M		350a		4230		5000 <u>1</u>		1.30
								•		1			İ			
									ļ .							l
		ł								Í						ŀ
										ŀ						İ
							•									
					٠ ا									1		
			·		1		į									
	į					i	l	ļ	1				1			
					ı	- [İ					 	l		J	
								- 1	1		!	1	I	- 1	- 1	
				1	1		l		J	I	1	- 1	- 1	- 1	*	
				i			ł	- 1					- 1	-		
		Į	· ,	סאבות			ı	į	i	- 1			- 1		- 1	
TOTAL				UNI III	LNI	쌂	 +		 -							٠.
	1 1	ł	1	15	, w 4		969	880	2000	3500	6200 l	4230	600d	50002	7000	130

		R &	D COST	ESTIMATE REG	CONFID	ENTIAL	•			S CONTROL	STOROL
<u></u>				COURCE TA	ж 🔲 от	IER .		•	PAGE 3. DATE	OF.	PAG
4. 00	CLASSIFIED TITLE									pril 1957	
Dai	a Processing	Subsystem for	ARS. We	1177			S. MITTAL CHAMS	.0	4. HUMBER	PETT 132 /	
1	17 Elle	A. PREV	IOUS YEARS	0, 8100	AL YEAR 57				176	2	
7.		000	OTHE				CAL YEAR 5	8 D. F190	AL YEAR 5		-
1	A. TOTAL				OTHER	- ***	ФТИЕВ		OTHER	000	COMPLETE
-		51394	1	969M	1				-	+	OTHE
CONT	RACT J. AVAILA			- JUM	880M	2000M	3500M	6200M	. 4230M	19000M	
				969м	j	i	1		 	LEGUNA	3200
l .	C. MEW RE			7034		+			ł	1	j.
1				I	880m	2000M				 	┪
	A. TOTAL	1			1	20008	3500M	6200M	4230M	19000M	32000
	<u> </u>			1.	1						1 3200
MATE	RIEL D. AVAILA	-			 	 	ļ		1500M	1	1
					1	ł	1			 	
	C. NEW RE	•	1			 	 			1	I
					1	ı	·				
PAG	LITIES	İ	1			1	 		1500M		
		İ	j	1	1	i	i	I			
10,					<u> </u>	<u> </u>	1			1	1
MAN	POWER	10	.304	1 .				-		<u> </u>	
11.				3	6.4 <u>M</u>	3	74	.4м	120.	h	
			T					1	440.	۳.	768.0
TRA	******		ł	- 1	1						,
ie.			N/A				ļ	1 1			ŀ
-				*	 						l
TEST	17100		N/A								
4,]	1		1
TRAY	SUPPORT AMERA	_		7				1			i
	Annual America	77	N/A	1 1				i T			
4.								j	1		
-								 			
	FOTAL	513M		1 0000] [7		
u.				969M	M088	2000M	3500M	6200M	5730M	,,,,,,,,	
TOT	AL ·	[[3/3UE	19000M	32000M
		523.3M		1885.4M		SS74.4M		jí	<u> </u>		
RDC ,	PORM 116 P			M ARE ORSOLETE		1574.4M		12050.1H		51786.0M	

	Tipe of Refort 1 19 14-11			• ·	
R&D PROJECT CARD	Rewritten Project		REP	ORT CONTROL STREET	
1. PROJECT TITLE (UNCLASSIFIED Title)	O DED CASSING	-	DD-	R&D/A/119	٠
OPERATIONS SUBSYSTEM FOR THE ADV	ANCED RECONNATEGANOR	2. SECURITY OF PE		a. PROJECT NO.	٦
SYSTEM (SYSTEM 117L) b. (SYSTEM	.117L POSS)	SECRE 4. INDEX NUMBE	_	8728	
				S. REPORT DATE	7
6- BASIC FIELD OR SUBJECT	7. SUB FIELD OR SUBJECT SUB GRO	2-117 OUP		2 April 1957	╛
Strategic Air Warfare System	Personnel Utilization	on. 65		AT SECT OFF	ı
. (117L)					1
a COGMITANT AGENCY Air Research and	12. CONTRACTOR AND/OR LABORAT	ORY	CONTRA	CT/W. O. NO.	4
Development Command Western Dev.D	Lockheed Airci	raft Corp			1
AFPTRC	Office for QPI Maintenance Le	61		•	ı
10. REQUESTING AGENCY	Operator Labor	ibora tory	AF	04(647)-97	1
Hq USAF	Personnel Labo	ratory			1
. 11. PARTICIPATION AND/OR COORDINATION	13. RELATED PROJECTS			<u> </u>	ı
AMC (I) ACIC-I				COMPLETION DATES	7
APGS (I) USN/CND-I	WS-117L		RES.]
ATC (I) USA/C/S-I SAC (I) Other AFC-P		<u> </u>		ec 1960	J
ADC (I) Other AFC_P		-	OP. EVAL		h
CIA (I)			IR. FY	PISCAL ESTIMATES	1
1 277 (1)	A DIN AMBOYO	-	56		1
11-012		(L) 1 (1) (E)	57	72 8M	4
	18. PRIORTY 10. MAJOR CATE	1000Y	-58-1		-
This rewritten report supersedes project dated 28 February 1956	IA (Visaties	s)-,-,	59	164.0M	┨
This rewritten report supersedes	New Protect sents	. VZ.	60	124 OM	1
				4	1
20. REQUIREMENT AND/OR JUSTIFICATION REQUIT PERSON	t for the		otel	467 OM	1
20. REQUIREMENT AND/OR JUSTIFICATION Requirement Requirement No. 5, dated 17 Octobe preparation of a System Development	r 1955, which direct	establis	ied b	y ARDC System	1
preparation of a System Developmen	+ Diam Danner III	or cure cell	ret f	o support the	
the execution of the WS 117L Devel	opment Plan was assis	med under	inica.	support in	
ARDC System Development Directive for inclusion of project for devel	No. 117L, dated 17 Au	lgust 1958	gne p	rovisions of	l
for inclusion of project for devel formation (QPRI) was contained in	opment of Qualitative	Personnel	Requi	rements the	
formation (QPRI) was contained in 1956. ARDC Project Development Di	Amendment No. 2 to SI	D No. 117L.	date	od 1 October	
1956. ARDC Project Development Diplementation of this Center's plan	rective No. 8728, Oct	ober 1956,	direc	cted da-	
No. 8728, dated 28 February 1956) original plan for development of two separate actions First: the	or ws 117L. Require	ment for re	-writ	ing the	,
two separate actions First: the Center concerned with the development	Wesner System Design	stablished	48 4	result of	
			deve	lopment	
TET TO THE OF CATALITY LESSENCY LA	Maniana i- i-		Seco		
agencies concerned with the personn	el and training aspec	cts of weap	on sy	stem 117L.	
22, GASD (RAD) SN. GN.					
On.	₹ €. ¾		X.	I. C.	•
DD . APRIL 613	ACCIPIED	,	PAGE	1 OF 7 PAGES	
I JAN 88, WHICH MAY BE USED.	engul (L)				

K

(UNCLASSIFIED Title) a. PERSONNEL OPERATIONS / SUBSYSTEM PRORESEMBLADUANCES / RECONNAISJANCE SYSTEM 11/L) b. (SYSTEM 117L POSS)

21a. Brief of Project and Objective:

The development of this project will utilize the technical and operational capabilities of the Air Force Personnel and Training Research Center in the production of systematic information relevant to the personnel and training requirements of the total weapon system 117L development plan.

21b. Approach:

This project will require both contract and inservice efforts to facilitate correlation between personnel subsystem development and equipment development. Initially, great reliance will be placed upon the prime contractor to develop and systematically integrate information derived from conceived equipment design. Information will be prepared by the contractor with consultative and technical monitoring effort on the part of the AFPTRC project officer. Contract work in support of task efforts and in-service efforts are indicated below.

21c. Tasks of the Project:

- (1) Task 87151-IMPLICATIONS OF DESIGN.
- (a) Contractor: Work under this task will be accomplished primarily by the prime contractor, with consultative and technical guidance furnished by Project Officer, this Headquarters.
- (b) Objective: To provide the preliminary data needed to prepare an early report, or reports, which will forecast the general personnel subsystem requirements and the personnel and training problems that adoption of the system may generate.
- (c) Approach: Since this weapon system does not readily lend itself to the concept of control by a major air command or primary interest by a single agency of the Air Force, consideration will be given to the thorough exploration of the personnel implications under various operating—controlling conditions. Basically, the report(s) will attempt to define problems which will be generated by both operational plans and equipment design. In so doing, consideration will be given to the relationship of WS-117L to WS-107A-1 and possibly WS-107A-2 and the findings of previous research in support of these latter systems.

UNCLASSIFIED

(UNCLASSIFIED Title) 2. PERSONNEL OPERATIONS SUBSYSTEM FOR THE ADVANCED RECONNAISSANCE SYSTEM (SYSTEM 117L) b. (SYSTEM 117L POSS)

- (2) Task 87300-QUALITATIVE PERSONNEL REQUIREMENTSJINFORMATION.
- (a) Contractor: Data will be collected and assembled by the prime contractor for the production of reports which will be phased with equipment design and development.
- (b) Objective: To provide manning document information, position descriptions, and personnel selection information regarding the total personnel subsystem of WS117L.
- (c) Approach: Effort in this area will be directed toward the development of information which can be used to describe technical jobs associated with the operation and maintenance of the system. From these descriptions, forecasts of required skills and knowledges will be made. Early identification of skills and knowledges and subsequent classification, if possible, within the Air Force personnel system will permit forecast of training requirements. Information derived in the development of the foregoing area will be used for manning information when operational and maintenance concepts are stabilized

The QPRI report will comprise four sections: General Information, Manning Document Information, Training Equipment Requirements Information, and Information on Special Problem Areas. The format of the report will be patterned after AFPTRC QPRI reports which have been published for ballistic missile systems.

Section one, General Information, will describe the general purpose and function of the system, as well as stated or assumed concepts of operation and maintenance

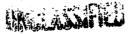
Section two, Manning Document Information, will: identify all equipment-associated operator and maintenance positions; indicate tasks performed within each job-pesition; indicate skill levels required for those positions requiring new personnel skills; and reference Air Force specialties which most nearly identify the job-positions.

Section three, Training Equipment Requirements Information, will identify in general terms the special training devices which will be needed to impart new skills required for the operation and maintenance of the weapon system. Further action in this area is defined in a subsequent task.

Section four, Special Problem Areas, will include an expansion of the problem areas (identified in the "Implications of Design" report) which can be isolated under a specific set of conditions. This portion of the report will identify personnel problems of an organizational and/or command nature.

INCLASSIFIED

Page 3 of 7 Pages



(UNCLASSIFIED Title) a. PERSONNEL OPERATIONS SUBSYSTEM FOR THE ADVANCED RECONNAISSANCE SYSTEM (SYSTEM 117L) b. (SYSTEM 117L POSS)

- (3) Task 87152-TRAINING PROGRAMS AND PROCEDURES.
 - (a) Contractor: None.
- (b) Objective: To make recommendations for the training program and training procedures to be used to obtain skills required by operator and maintenance personnel of the system.
- (c) Approach: Recommendations for specific training procedures will be made in consonance investigative findings from prior tasks. Emphasis will be given to those areas in which the training of skills may prove particularly significant and difficult.
 - (4) Task 87153-TRAINING EQUIPMENT CHARACTERISTICS.
- (a) Contractor: Preparation of a report on the training characteristics of required trainers will be an in-service Effort. Previous contractual efforts will be used, if applicable.
- (b) Objective: To identify the special training devices required for the WS-117L-training program and define the characteristics of the individual trainers.
- (c) Approach: Consideration will be given to the adaptation and/or modification of research instruments into prototype training devices. Also, attention will be given to the possible use and/or adapting of special training devices, developed for the ballistic missile training program, which possess characteristics identified by this task effort, e.g., Radar Tracking and Guidance Computer Trainer.

UNCLASSIFIED

Page 4 of 7 pages

(UNCLASSIFIED Title) a. PERSONNEL OPERATIONS SUBSYSTEM FOR THE ADVANCED RECONNAISSANCE SYSTEM (SYSTEM 117L) b. (SYSTEM 117L POSS)

The same of the sa

- (5) Task 87154-PROFICIENCY TEST DEVELOPMENT.
- (a) Contractor: To be determined. Partial in-service effort by Personnel and Maintenance Laboratories monitored by this Headquarters.
- (b) Objective: To provide valid tests of the job knowledge, skill, and schievement varity for measuring the progress and/or proficiency of operating and maintenance personnel.
- (c) Approach: This activity will consist essentially of establishing, monitoring and evaluating the test materials to be produced on a contract basis.
 - (6) Task 87155-HANDBOOKS AND JOB AIDS

Further detail on this task will be provided as the system progresses.

(7) Task 87156-TRAINING EQUIPMENT TESTING

Further detail on this task will be provided on this task as system development progresses.

21d. Other Information.

(1) General. The information basic to the preparation of reports required by Task 87151 and Task 87300 efforts will be obtained through contractual effort. Publication of these reports on a contractual basis may be accomplished with this Headquarters acting in a consultative and the monitoring acapacity. It is anticipated that contract funds in the amount indicated in ARDC Form 110 will be programmed through funding action to be taken by the Weapon System Project Office for WS 117L.

Tasks 87152, 87153, 87154, 87155, and 87156 have been included under the assumption that Tasks 87151 and 87300 will produce information which indicates further effort should be expended to meet an Air Force requirement for information in the areas covered by these tasks. However, further development effort will not be expended in those task areas in which the associated final activities are purchased by the Air Force as a contract-service, e.g. Task for development of handbooks and job aids will not be undertaken if it is determined manning on a contractual basis is required or desired.

(2) Survey of Existing Standardize Equipment or Techniques.

Node except as discussed in Task 87152 and Task 87153.

State of the same

Page 5 of 7 pages

UNCLASSIFIED

(UNCLASSIFIED Title) a. PERSONNEL OPERATIONS SUBSYSTEM FOR THE ADVANCED RECONNAISSANCE SYSTEM (SYSTEM 117L) b. (SYSTEM 117L POSS)

(3) Survey of Similar Equipment in Progress of RaD.

Survey is the made to determine possible adaptation of research instruments into special training devices. Similar exploration will be made in the area of trainers being developed for ballistic missile systems.

- (4) Replacement Recommendations. None.
- (5) Statement of Effects.

This project will yield information useful to the agencies responsible for programming the personnel and training programs required to properly man WE 117A.

21e. Background History and/or Progress.

Since the writing of the initial project card, several visitis have been made to WSPO to determine funding status and to obtain general information on status of system development. As previously mentioned, representatives from this Center participated in preparation of statement of work for contractual negotiations. WSPO clearance was obtained to make initial contacts at contractor facility to discuss development plan relevant to the personnel subsystem. System contractor personnel were familiarized with the QPRI program and the nature of tasks involved in the development plan for personnel and training problems. Visit to contractor revealed that competent staffing has been accomplished to perform the caliber of work desired. Arrangements have been made to furnish contractor with format guides for reports to be published under this development project.

21f. Future Plans. Tentative arrangements were discussed with prime contractor for publication of Task 87151 report during June 1957. Also discussed were plans for publication of initial QPRI report (Task 87300) during December 1957 or early January 1958.

The project officer will maintain close contact with WSPO to establish proper phase relationships of project effort with equipment development status which is, in turn, largely dictated by funding action.

21g. References.

- (1) ARDC System Requirement No. 5, dated 17 October 1955.
- (2) Project Development Plan No. 8728 (DD Form 613), 28 February 1956.
- (3) WS 117L Development Plan (WDD), 2 April 1956.



Page 6 of 7 pages

(UNCLASSIFIED Title) a. PERSONNEL OPERATIONS SURSYSTEM PERSONNEL ADVANCED RECONNAISSANCE SYSTEM (SYSTEM 117L) b. (SYSTEM 117L POSS)

- (4) ARDC System Development Directive No. 117L, 17 August 1956.
- (5) Amendment No. 2 to ARDC SDD No. 117L, 1 October 1956.
- (6) Project Development Directive No. 8728, October 1956.
- (7) Letter WDTR, Hq ARDC, 18 December 1956, subject, "Meeting of Technical Advisors to WS 117L".

21h. Coordination rand Signature Block.

Responsible Center, AFPTRC.

FOR STANLEY VALCIE

Major

USAF

QPRI Project Officer

THOMAS WILDES

Col

USAF

DCS/Operations

Gelonel, USAF

Assistant for WS 117L

Technical Operations (WDD)

Page 7 of 7 pages

ID	20	7.0
A 25 14 2 1		

· ·	7 ever		4																							1				rs c	ON	ROI	. 577	BC)Z.
(UNCLASSIFIED Title) ADVANCED RECONNAISSANCE SY	SYSTEM D a. PERSO STEM (SYSTEM	_	_	_		_									TI S)		8. _{ji}	NIT	IAL IGE	E] #1					_!	Ξ,	2 / NUH:	Apr	:11	11	957			_
SCHEDULE		Т		_	_	_							_	_		_												011							
TITLE	PROJECT OR TASK NR	F		19.5		Ţ	L	_	_	_	. 1	9 5	8	_			4-				YE/	_		_	19 0	, O	_	19		_		_	_	_	
System 117L OPRI	8728	ľ	1	+9	4"	뿌	1	۴	-		4	1.	Ŀ	٠	ं	2	ر ار	7	м	A	u].		4				.†.			٦.	19	10	#	00	io.
implications of Design	87151	+-	Н	2	_	╀	⊢	┝	Н	4	+	+	╀	Ц	Ц	4	\perp	I			T	Т	П	П	7	4	+	Ħ	+	+	۴	╫	#	╇	ť
OPP 7	87300	1	1 +	F	╁	┢	-	H	Н	+	+	╀	╀	Н	4	1	Ł				\Box	Т	П	П	┱	T	+	††	\sqcap	+	十	H	┿	╁	╀
Training Programs & Proc	87152	۲	┝	+	+	┥	-	Н	Н	+	+	+	H	⊢	4	4	1	L	\Box	Ι	Ι	2			T	7	†	Ħ	\dashv	+	╈	H	十	┿	H
Equipment Chan	87153	H	H	+	-	+-	Н	Н	Н	+	+	╁	+	Н	4	1	+	L	Ц	: I	$oldsymbol{\perp}$	Γ	\Box		1	J	T	Ħ	+	十	十	 	+	+-	H
PTOTICIONAL TRANS	87154	Н	\vdash	╅	✝	H	Н	Н	Н	┿	┿	╀	Н	H	4	+	4	1	Н	4	\perp		\Box			T	1	П	\top	+	+	H	+-	Н	H
MANUOUNES & JOS Alde	87155	\prod		Ţ	Ť	П	7	Н	H	+	+	╁╌	Н	H	+	+	+1	-	Н	4	4	1	Ц		_	Γ	Γ		\exists	\top		ΓŤ	✝	H	۲
Training Mouin Testing	27156	П	\top	7	1	П	4	٦	7	十	╁	i -	Н	-	÷	+	+	H	1	4	4	上	Ц		_	\mathbf{I}	\prod	П	T	T	П	\sqcap	十	Н	r
				T	T	П	\neg	┪	Ť	Ť	+	+	Н	4	+	┿	+-	Н	\dashv	4	+	₽	Н	_ 2	Щ	\perp	\Box	П	I	oxdot	П		†	Н	Γ
		П	$oldsymbol{\mathbb{T}}$	Γ	Π	П	7	Ť	7	+	+	┰	Н	\dashv	+	+	+	Н	+	4	+	\vdash	Н	4	Ļ	L	\sqcup	\Box	$oldsymbol{\perp}$	Γ	П			П	ī
Contract Awarded		П	I	$oldsymbol{\Gamma}$	Г		7	7	7	T	T	Н	H	+	+	+-	H	Н	+	+	+	H	Н	4	+	1	₽	\sqcup	1	Γ		\Box	Γ		_
Technical December		Ц	\perp	Γ				J	1	1	T	\sqcap	H	\top	+	╈	H	Н	-+	+	┿	Н	\dashv	+	╀	╀	H	\sqcup	4	Ļ	Ш	$oldsymbol{\perp}$			_
Technical Documentary Report Received		Ц	\perp				J		Ī	T	广	Н	H	十	十	+	H	Н	┰	+	+	Н	+	+	╀	╀	H	4	4	L	Ц	$oldsymbol{\perp}$	\Box		_
ABCELVAG.		Ц	_[J	Ī	I		T	П	7	7	+	†-	Н	Н	+	+	+-	Н	+	+	+-	╀-	Н	4	+		Ц	\perp	\Box		
		Ц	4	1	Ц		\Box	J	I			П	7	T	十	十	Н	-	╅	+	┿	Н	+	+	╀	H	Н	4	+	4	Ц	1	\Box		_
		4	4	1	Ц	4	1	I	I	I	L	\Box]	Ţ	T	十	П	+	+	+	+	Н	+	+	╁	Н	Н	+	+	Н	Ц	4	Ц	\bot	_
		4	4	1	Ц	4	4	1	\mathcal{I}	I		\Box	J	I	T		M	7	+	$^{+}$	+	Н	+	+	╁	Н	Н	+	┿	\vdash	\sqcup	+	Ш	4	_
		+	+	\vdash	Ц	4	4	4	1			\Box	I	Τ	Ι	T	口	7	+	†	T	Н	+	十	+	Н	┍╋	+	+	Н	1	+	Н	4	_
		+	+	-	Н	4	4	4	4	1		П	Ι	Ι	Γ			7	7	Ť	Н	+	+	╅	H	Н	\dashv	+	╄	╁┤	4	+	₽	4	
		+	+	Н	Н	4	4	4	1	1	Ц	Ц	Ι	Ι	Γ			\top	T	T	Н	+	+	+	H	Н	+	┿	+-	H	+	+	₽	4	_
		┿	╁	\vdash	Н	+	4	4	4	4	Ц	Ц	Ţ	I	Γ	П		I	I	T	П	7	+	十	Н	H	\dashv	┿	+	⊦┤	+	+	⊢∔	+	_
		╅	╁	Н	H	+	+	4	+	-	Ц	Ц	4		\Box		\Box	J	Ι	Γ		7	十	1	H	Н	十	+	╆	Н	+	+-	⊢∔	+	_
		╅	+	H	+	+	+	+	+	╀	⊣	Н	4	\perp	L	Ц		I	Ι	Γ	\Box		7	1	П	H	十	╈	╁┤	H	╅	┰	⊢┼	+	_
		+	+	┝┥	+	╁	+	+	┿	₩	\sqcup	4	4	╀	L	Ц	\perp	\perp	L	Γ	П	T	T	\top	П	7	十	十	H	H	+	+	┝┽	+	-
		+	+	Н	+	+	╁	+	+	╁┥	\vdash	-	+	╄	┖	Ш	\perp	\perp	Γ	Γ	П	\Box	T	Т	П	┪	十	十	Н	+	+	+-	┝┿	+	_
		十	\top	Н	+	╁	┿	╁	╀	Н	-	+	+	+-	Н	Н	4	1	Ļ		П	I	Ι]	\top	十	Ħ	+	十	H	_	+	-
		十	\top	\vdash	ナ	+	+	+	╁	╁┤	+	+	╀	╄	Н	⊣	4	4	╄-	1	Ц	I	\perp			J	I	T	П	7	十	\forall	+	+	4
		T	П	\Box	7	十	╈	╈	+	H	┪	+	┿	╀	Н	Н	+	+	╀-	Ļ	Н	4	\perp	\Box		\mathbf{I}	\perp	Ι	П	\top	1	\forall	十	+	٦
		T	П	7	+	T	T	†	t	H	┪	+	┿	₩	Н	\dashv	+	+	╀	L	ppu	4	4.	Ш		I	$oldsymbol{\mathbb{I}}$	Γ	口	\top	T	H	\top	十	1
		Ι	\Box		7	t	†	†	十	⇈	+	┿	+	+	Н	4	+	┿	+	Н	Н	+	╀.	Ц	┙	4	\perp			T	T	П	\top	\top	t
	•	Ι	\square		T	1	T	t	t	┪	+	╅	┿	H	Н	+	+	┿	+-	Н	4	+	╀	Ц	4	1	\perp	\Box		$oldsymbol{ o}$	T	П	\top	†	1
FORM 103 PREVIOUS EDITE	ONS OF THIS TOP	14 4				-		-	_	''			_	لــــــــــــــــــــــــــــــــــــــ	Ш	_	Щ.		ــــــــــــــــــــــــــــــــــــــ	Ш	Щ	1	_	Ц	_[I	\perp	\Box	П	I	I	\square		1	†
			w.E	~5		6 T I		* *	2.00																								_	_	-

	R & □system g	D MANPOWI PROJECT	ER ANNEX				·	2. REPORT	S CONTROL	STREEOL
ADVANCE	WIED TITLE							PAGE]	or	PAGE
COSES	ED RECONNAISSANCE SISTEM (SISTEM	1 +	. (System	117L PO	SS CHAN	. R		8728	p <u>r</u> 11 <u>19</u>	57
CODE	AND ANY ZATION TITLE	TYPE	ACTUAL MAN-QTRS LAST QTR		Y 19 57	PROJECT	ED DIRECT	MAN-YEARS		
		-	LAST QTR	AVAL			Y 19 58	FY 19 59	FY 19	T
PTQ	Office for QPRI				- RORD	AVAL	RORD	RORD	RORD	TO COM
PTF	Operator Laboratory	R	.3	.9	2.2	.2	4	3.5	-480	RORE
PTR	•	Ř	#	.2	.3	.2	.4	1.6		
TS	Maintenance Laboratory	Ŕ	#	1.5	1.5	3.8	3.8			
123	Office for Social Science Programs	Ŕ	#			3.0		4.8		
							.5			
	Total Manpower	. ,	'	· .	1					
			.3	2.6	4.0	4.2	5.1	9.9		
1	Total Estimated Manpur Dollars		1M	21M	34M	36M	43M			
1			1			<i></i>	4361	84M		
		- [-				ſ			
		1				- 1				
		- 1	- 1	I	1		- 1	1		
			- 1		1			1		
						1				i
	· ·	ŀ			- 1					

TARE OTHER PART 1 or 1 or 1 or 1 or 1 or 1 or 1 or 1 o		E PR	CONTRACT	FUNDS ANNE				L. REFORTS	CONTROL SYMB	X.
CURCLASSIFIED TITLE) a. PERSONNE OPERATIONS (SISTEM 117L) b. (SISTEM 117L) GPRI ASSERVATED TABLE SUBSET TO BE AVARAGE OF RECOGNALISATIONS SISTEMS ASSERVATED TABLE SUBSET TO BE AVARAGE OF RECOGNALISATION STATES TABLE SUBSET TO BE AVARAGE OF RECOGNALISATION STA	4. TITLE			_		o	THER	L	۰,	PA
System 117L OPRI S728 System 117L OPRI S728 CHARGE TO THE STATE STATES	SUBSYSTEM FOR FOR	ntile)	. PERSONNET	OPERATION	<u> </u>	The feature of		I .		<u></u>
YARK WILLIAM 197 17 17 17 17 17 17 1	(SISTEM 117L) b.	(SYSTEM 1	RECOMNAISSA 17L OPRI)	LICE STATEM	8	1	A	1		
System 117L QPRI 8728 12.8M 156.0M 144.0M 81.0M	AGBREVIATED		SYSTEM PROJECT OR TASK HAMBER	BUGGET PROJECT SERVES	1 .	11. 27 57	12.		114	T18.
12:8M 156.0M 144.0M 81.0M	System 117L OPRI					(50 Berende)	(In the seconds)	(to 150,000)	r FY 60	COMPLET
OTAL			0725			12.8M	156.0M	144.0M		
OTAL				İ						l I
OTAL				1						
OTAL	: •									
OTAL	_	1	- 1		J					
OTAL		1.	1.		- 1	į		- 1	- 1	
OTAL							.	j	I	
OTAL		- 1	- 1		1			- 1		
OTAL		· 1	. 1					1		•
OTAL		- 1			1					
OTAL						- '			- 1	
OTAL	٠.								- 1	
OTAL		- 1.	1.	1.			ŀ		.	
OTAL				Pro-	1					
	TOTAL	-							1.	

		R&I	COST EST	MATE REC	APITULATIO	N			2. REPORT	CONTROL	THEOL.
4. UNCLASS	PIED TITLE A.		OPERATIONS						. DATE	l or l	PAG
ABCUM	NAISSANCE SIS	TEM (SYSTE	M 117L)	b. (SYS1	M FOR THE	PRI POSS)	S. INITIAL CHANGE	.abn	J	ril <u>1957</u>	
		900	OTHER	600	TEAR OF	FISCA	L YEAR 5	D. PISCA	8728 YEAR 59	T	
	A. TOTAL			 	OTHER	400	OTHER	600	OTHER		OMPLETE
CONTRACT	S. AVAILABLE	 		12.8M		156.0M		144.0M	OTHER	600	OTHE
								244.08		81.0M	
	C. NEW REQ			12.8M		156.0M	· · · · · ·	144.0M			
	A. TOTAL				 			144.00		81.0M	
MATERIEL	B. AVAILABLE				 			· .			
	C. NEW REQ				 						
FACILITIES											
MANPOWER									Ì		
		·		10M	אננ	14M	20M	20M	23M	401	
TRAINING		1			¥1					448	44M
TEST ITEM									İ		
				l	• •						
TEST SUPPO	ORT AIRCRAFT										
							- 1				
SUBTOTAL					T						
TOTAL				12.84		156.0H		144.04		81. OM	
FORM	116 PREVIOUS			22.8M	11M	170M	20M	164M		124M	

AP-WP-L-29 MAY 53 SM

Reproduction of this document in whole or in part is prohibited except with ression of the office of origin.

2. SECURITY SECRET 4. INDEX NUMBER 2-117L	3. PROJECT N 1764 5. REPORT BA	
4. INDEX NUMBER 2-117L	5. REPORT DA	
2-117L		TÈ
2-117L		
	2 April	1957
Physics - 7B		7A. TRCH. OBJ. SA-9A, 9B 10 IO-9
	CONTR	ACT/W.O. NO.
Research		
rate		
		_
MAT O	Sec.	ZIC
S ZVIL AL	77	100
icis	ES 17 PT	COMPL. DATES
	RES. I	957
	DEV. 1	958
		959
	7	ASCH BIR (M
		10000
16,	PV50	1000M 1410M
A(Missile:	B) FY60	425M
	Total	3417M
	AND/OR LABORATORY Research Tate O IP	AND/OR LABORATORY Research Trate Set IT. Inst. OP. EVA PY57 FY58 A (Missiles) FY60

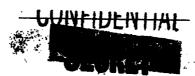
AND/OR JUSTIFICATION

System Requirement No. 5 dated 17 October 1955 and subsequent letter directive from WDD dated 23 December 1955 assigned to AFCRC the responsibility for providing environmental data which affect the design and testing of ARS vehicles. Based on independent studies by the Geophysic Research Directcrate the three design study contractors and conferences with personnel of the WSPO, it was concluded that in four areas of geophysical environment insufficient data were available for successful design and test of the Advanced Reconnaissance System Vehicles. The four so considered are (a) Meteor Physics (b) Density at Orbital Altitudes, (c) Solar Radiation in the U.V. and X-ray Region and (d) Thermal Radiation. Specific discussions of requirements for additional design data in each of these areas are included under each task.

21 a. Brief and Military Characteristics

The objective of this project is to provide environmental data considered essential to insure and simplify the design of a successful Advanced

ŀ	DOWNGRADED AT 12 YEAR 22. ROS INTERVALS: NOT AUTOMATICALLY IC & P			
	DD PORM 613	X.	1.	C.
	DD 1 JAN 32 D 13	•		



(UNCLASSIFIED TITLE) Geophysical Environment. Data for ARS, WS 117L 2 A Short Title: ARS Environment Pro

2 April 1957 Proj 1764

21 b. Approach

See individual Tasks. (21c)

21 c. Tasks

- 1. (a) T-39791 Solar Radiation Program in Ultraviolet and X-ray
 Region for ARS
- (b) This task will be accomplished through a combination of "in-house" and contractual effort. Currently the contractual effort is by Comstock and Weatcott, Inc., under Contract AF 19(604)-1889. Other contractors contemplated at the moment are: University of Chicago, Chicago, Ill. and Radio Corporation of America New York, N. Y.
- (c) Task objective is to determine the intensity of Solar U.V. and Soft X-ray radiation as it would strike the satellite and the extent of damage due to collisions of molecules; atoms and ions with the satellite surface.

Requirement and/or Justification

Vehicle design will be affected by radiation in the solar ultraviolet and X-ray region. It has been shown by GRD that the quantum yield of photoelectric effect on metals exposed to short wavelength ultraviolet is about 250 times as great as that of the conventional photoelectric effect in the visible and near UV. Thus, since a vehicle traveling at 500 km is essentially receiving unfiltered solar radiation of low wavelength, one must consider a possible "charging up" of the metal due to the loss of photoelectrons from the surface. This charge can theoretically rise to a high voltage, depending on the wavelength and intensity distribution of the incident radiation. Such a charging-up could influence the telemetering or other electronic functions of the equipment in the vehicle. Also, it is known that short wavelength ultraviolet causes deterioration of a plastic surface. This could fog plexiglass and damage rubber-like materials. Present data are inadequate to evaluate this effect simply because we do not know within several factors of ten the solar intensity above the atmosphere at wavelengths below 1500 Angstrom Units and we believe that design purposes can therefore not be satisfied.

The effect of atmospheric composition at 500 km is difficult to assess. There might be heating of the vehicle to contend with, due to recombination of atoms on the surface as well as impacts with other atoms and molecules. Such a heating effect would be super-imposed on that due to solar radiation and would act even at night when the vehicle is shielded from the sun by the earth. Since solar ultraviolet and X-ray radiation is part of the total picture of the integrated interaction of the sun and the earth's atmosphere and data of this kind are extremely scarce the measurements of these variables at vehicle altitude would be unique. These measurements would give us information as to the physical mechanisms operating in the ionosphere and delimit in an essential fashion thereonospheric functioning by giving us a better understanding of the nature of atmospheric ionization. This would assist in the forecasting of ionospheric propagation and could contribute toward the solution of the



(UNCLASSIFIED TITLE) Geophysical Environment Data for ARS, WS117L Short Title: ARS Environment

2 April 1957 Proj 1764

(d) Approach

At the present time, there are two main areas of research:

(1) A laboratory investigation of the effect of collisions of particles, atoms, molecules and ions on solid surfaces (sputtering) conjoined with the effect of recombination of atomic species on solid surfaces.

This laboratory study will be carried on mainly in-house, but with modest contract let for auxiliary studies.

Primary in this research will be the problem of developing ultra high vacuum mass spectrometer tubes for study of the effect of ion bombardment of surfaces. Such a tube would require suitable component parts, valve sealants, tubing and pumps to obtain this vacuum. This is necessary to duplicate in the laboratory pressures at satellite altitudes. The feasibility of this development has already been established by in-house work. About half of this is finished, leaving principally design engineering.

Different techniques, among them molecular beams, will be used for the acceleration of the non-charged particles on receiving test plates the nature of which will be determined by vehicle design. In particular, the effect on metals will be examined. The plates will be tested by a variety port (sputtering).

(2) Solar ultraviolet and X-ray study -- The goal set in this research is the measurement of absolute intensities of the solar spectrum 1500 Angstroms down to a few Angstroms. This program is divided into three phases, laboratory investigations, measurements of solar intensities in rockets and finally, construction of the satellite instrumentation by mini-aturization of rocket instrumentation.

This region of the spectrum is relatively unexplored; hence, a whole new system of monochromators, sources and detectors must be constructed. First, there must be the calibration against a primary detector, thermocouple not calorimetric. These secondary detectors must be reliable and reproducible. In type, they may be dependent upon the interaction of radiation with a filling gas or on the effect of radiation upon a cathode. Therefore, laboratory work will be needed to select adequate detectors.

The monochromators to be constructed are unique in design and rather elaborate in the equipment necessary to perform the desired calibration. They have already been designed and are presently under construction. To put them into actual operation will take an extensive period of working-out of the manifold details and problems involved.

under contract.

The construction of detectors will be to a large extent



Because the interaction of matter with radiation in this region is as yet little understood, the objectives can only be reached by an extensive deepening of our insights into the nature of these processes. For example, a predicted phenomena is that of photoconductivity effect. This, when more fully investigated, may yield a possible secondary type of detector.

The process of building suitable detectors can only go on simulateneously with this type of exploratory research. After the laboratory phase, the instruments will be flown in Aerobee-Hi rockets to measure the radiation intensity above the earth's atmosphere. The number of flights necessary will be at least six, possibly increasing to eight or nine depending

2. (a) T-39792 Interplanetary Matter and Meteor Physics in Relation to ARS

- (b) This task will be accomplished through a combination of "inhouse" and contractual effort. Currently the following contracts are in
 - (1) AF 19(604)-1894 Temple University
 - (2) AF 19(604)-1908 Oklahoma A and M
 - (3) AF 19(604)-1901 Smithsonian Observatory
 - (4) AF 19(604)-1892 Stanford Research Inst.

No other contracts are contemplated at the moment.

(c) The objective of this task is to determine the possible hazard from meteoric bombardments to a vehicle above the earth's atmosphere and to provide data as to the spatial distribution, size, composition, and velocity of micrometeoric matter.

Requirement and/or Justification

The hazard from meteoric collision with a body essentially in interplanetary space, unprotected by the earth's atmosphere is not very well known. The probability of collisions intense enough to destroy the vehicle or affect its operation is very important in the design of a protective "meteor bumper" to insure proper operation of the vehicle. These meteoric collisions may result in dangerous surface erosions affecting heat exchange properties and optical windows. Stability, temperature control, reliability may all be

Information regarding the influx of meteoric material into the earth's atmosphere has been collected by the following methods: visual observations, photography, radio reflections from meteor trails, and telescopic observations. From such studies and measurements, the diurnal and seasonal variations in the influx of sporadic meteors, velocities and radiants of shower meteors, velocity distribution of sporadic meteors, mass distribution of meteors, and spatial density of meteors have been determined. These measurements give a value for the rate of influx of interplanetary material into the earth's

THE STREET

(UNCLASSIFIED TITLE) Geophysical knowson and Data for ARS, WS117L Short Title: ARS Environment

2 April 1957 Proj 1764

atmosphere of 5 x 10^6 gm per day. However, these ground-based methods are limited and a grave anomaly, of importance to the ARS, exists. Since the visual and photographic methods are only sensitive to meteors of visual magnitude +5 (10-2 grams mass, 1011 ergs energy) and the radio and telescope methods to visual magnitude of the order of 48 (mass x 10-4 gm, energy 6 x 109 ergs), information derived from these methods regarding meteoric particles with mass less than 10-4 gm is seriously lacking. These smaller particles are far more numerous and therefore have a high probability of encountering a vehicle

The anomaly on the influx of interplanetary matter arises from various indirect measurements of the fine interplanetary matter. These measurements include determination of the density of matter in the zodiacal cloud, or the interplanetary dust cloud, by S. C. Van de Hulst and C. W. Allen; measurements of the nickel content in deep sea ocean sediments by H. Pettersson and H. Rotsch; and initial rocket soundings from V-2 and Aerobee rockets. These measurements indicate a rate of accretion of interplanetary matter by the earth as high as 5 x 1010 gm per day, up to a factor of 104 times higher than predicted from regular methods of observation. It seems, also, that this high rate of influx may be necessary to explain the presence of the E region ionization during the night. This higher rate leads to a probably encounter for visual magnitude 15 (energy 1010 Bev) of one hit per square meter per second. Such impact rates are significant for a vehicle with a required lifetime of about a year. These impact rates may possibly be further increased by a factor as great as 104 to 106 if geomagnetic focusing of cosmic dust particles, suggested also by S. F. Singer, was detected experimentally.

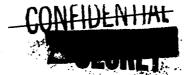
From the standpoint of ARS, the hazard to space vehicles in an interplanetary environment seems closely dependent upon the effects of interplanetary matter, as well as such other factors as cosmic radiation, atmospheric drag, and energetic solar radiation. On the one hand, relatively large impacts may result in penetration of the vehicle surface and subsequent destruction of important equipment, affecting the usefulness of the vehicle, while smaller impacts would result in an abrasion affecting the usefulness of lenses and photosensitive surface areas, etc.

It is therefore necessary to determine the probability of collisions with interplanetary particles as a function to time, and the effect of the individual collisions on the vehicle in order to determine design criteria for ARS. These requirements may be fulfilled by a measurement program involving high altitude rockets and satellite type vehicles, and direct laboratory studies of high speed impact interactions. Related studies that would support direct probing methods are also of interest in order to afford a higher degree of

(d) Approach

The areas of investigation in this task may be broadly divided into rocket and satellite experiments and laboratory studies.





(UNCLASSIFIED TITLE) Geophysical Environment. Data for ARS, WS117L 2 April 1957
Short Title: ARS Environment Proj 1764

(1) Determination of the influx of meteoric material by rocket experiments

This includes the design and construction of equipment and launching of rockets containing this equipment for the detection of meteoric material. The equipment for detecting meteoric material will operate on the principle of detecting the vibrational energy generated upon impact. This metering system with its associated ground-based receiver-recorder. Aero bee and/or Nike-Cajun rockets will be used to carry out the program. It is for final design of the ARS.

The program of research for direct rocket probing of interplanetary matter involves first the design and development of a basic piezoelectric accelerometer capable of measuring the spatial distribution and mass of interplanetary particles. Such equipment has been used by Prof. Bohn in 1949 and was used again during 1955. Hence, only minor development and calibration methods are required prior to construction of the basic unit. Such equipment is sensitive enough to detact particles of visual magnitude 25. Approximately ten to twenty detection units will be built on a semi-mass production basis. Approximately five to ten successful experimental firings from Holloman Air Force Base using Aerobee rockets are required prior to establishing a weighted statistical figure for the intensity firings at a high latitude would be required to establish the extent of a latitude dependence particularly by small meteoric particles.

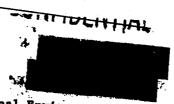
(2) Design and development of equipment for detection of meteoric material for inclusion in the ARS.

It is expected that development work in the rocket phase of detection of meteoric material will aid greatly in the development of equipment of a similar nature to be included in the early oribiting and non-orbiting ARS test vehicles. It is important that the apparatus be designed with a high degree of reliability, yet be lightweight, and have a low power requirement.

(3) Theoretical and laboratory studies and high speed impact phenomena

Essential to the measurement of interplanetary matter is a knowledge of the relation of the intensity and frequency distribution of the accoustical energy generated by high speed meteoric impacts to the mass, the mass density, and the velocity of collision with the meteoric particle. Thereby, the surface erosion and the distribution function of meteoric material in space may be determined from the ARS measurements. Polished plate experished impact measurements in the laboratory for the study of collisions of solids with gases and surfaces are required to support this subtask. In addition, optical and radio measurements of meteor influx and atmospheric interactions will also assist in the direct experimental studies.





(UNCLASSIFIED TITLE) Geophysical Environment Data for ARS, WS117L 2 April 1957
Proj 1764

High speed impact studies of particles with surfaces are possible at this time only by a method using shaped charges, since only by this means have particle velocities comparable with meteor velocities been generated in a laboratory basis. The physics of high speed interactions is not well understood, and experimental measurements at velocities up to 50 km/sec are highly desirable. Even then, it is difficult to predict the degree of success of this technique, but this approach is presently available at relatively low as a hundred times greater than previously observed, considerably different effects than theoretically predicted are to be expected.

(4) Theoretical studies

This subtask is concerned with the correlation and application of various data applicable to the problem of determining the hazard from interplanetary matter upon ARS. Where possible, information from shock tube studies, radio and optical meteoric studies, investigations of meteoric craters, deep see ocean sediments, microchemical analysis of rare gas constituents, etc., that contribute to the overall problem of the determination of the hazard of the information derived from the direct experimental program may be

The primary emphasis of the approach of the 4 subtasks, therefore, is the determination of the spatial distribution of interplanetary matter, the size distribution, and the mass density of this material, and thus with suitable laboratory studies to be able to predict the probability that meteoric the rate of erosion per unit area for a surface exposed above the earth's atmosphere. An improved understanding of the physics of hypersonic interactions in the velocity range equivalent to an energy of 50 to 1000 electron volts is also of importance.

The rocket program for detection of meteoric particles would require approximately ten successful rocket flights up to altitudes as high as influx of interplanetary matter. It should be stressed that ten successful above altitudes of 50 km. (Measurements below this altitude would be contamented by terrestrial material). From considerations of the normal difficulties ably instrumentation for fifteen rockets will be necessary. The estimated on cost of 5M per instrumentation. The cost of rockets for this work based on since the meteoric detection equipment may be used on a Nike-Cajun rocket system, also, the overall rocket cost is expected to be much lower than the





(UNCLASSIFIED TITLE) Geophysical Environment Short Title: ARS Environment Data for ARS, WS117L 2 April 1957 Proj 1764

estimate using Aerobee because the Nike-Cajun system when it becomes available would cost less than half as much as an Aerobee. The fund requirements however, are based upon rocket requirements using Aerobees.

Upon availability of an ARS vehicle as a platform for the measurement of meteoric particles, a relatively large sampling time for making measurements of interplanetary matter will be available. It is therefore of importance that meteoric detection equipment be mounted on such an early test vehicle. Such equipment must be very reliable and capable of operation over a long period of time, while its weight should be kept to a minimum. The development of equipment for the ARS is estimated to cost 50M over a two-year period, while flight and rocket testing would involve an additional 40M.

The program on research on high speed impact phenomena will be based on studies using shaped charges, and also investigations of dynamic interactions of meteoroids in the atmosphere. The estimated cost of the initial phase of this work is 80M over a two-year period.

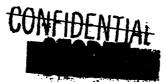
- 3. (a) T-39793 Atmospheric Density Determination at Altitudes of Artifical Barth Satellites.
- (b) This task will be accomplished through a combination of "inhouse" and contractual effort. Current contracts in effect are as follows:
 - (1) AF 19(604)-1871 University of Michigan
 - (2) AF 19(604)-1890 University of Michigan
- (c) The objective of this task is to obtain reliable values of atmospheric density, pressure and kinetic temperature between the altitudes of 200

Requirement and/or Justification

The primary objective of this task is to obtain reliable values of atmospheric density, pressure and kinetic temperature in the vicinity of 200 to 400 miles altitude, the altitude of a proposed satellite system. These data are needed in solving various problems on the design of the ARS vehicle. Some of

- 1. What altitude must be maintained by a satellite vehicle of specified size and shape in order that the atmospheric drag be sufficiently small to permit a minimum specified life time of the satellite.
- 2. How does temperature rise on the skin of the satellite vehicle due to aerodynamic heating (friction between itself and the molecules of the atmosphere) vary with altitude below 400 miles altitude.
- 3. What is the minimum value of mass to cross-section area ratio: of a satellite which will permit the required lifetime to be achieved at specific





(UNCLASSIFIED TITLE) Geophysical Environment Data for ARS, WS117L 2 April 1957 Short Title: ARS Environment Proj 1764

orbiting altitudes. The present estimates of the magnitudes of these properties are quite uncertain. Pressure and desnity may be in error by factor of 100 or-1000 at 350 miles altitude because they are based on extrapolation of values at 100 miles and on unconfirmed theories. Extension of measurements to 200 miles or 250 miles altitude would greatly improve the reliability of extrapolation to 300 miles, while measurements at 300 miles would be even better.

The task involves the study and implementation of two basically different methods for obtaining the necessary data. The first method involves the direct measurement of the drag force on a sphere falling from great altitudes after its ejection from a rocket. This method is of special interest since it is the drag force on the satellite which ultimately determines its life. Results of this measurement are free from effects of contamination from the rocket. The limitation of this method lies in the fact that the sphere must fall from an altitude of 10 to 20 percent higher than that for which the drag data are desired.

The second method for obtaining these data involves a selective ionization gauge for measuring number density of particular constituents as well as total number density. This method in principle may be used to the peak of rocket trajectory but is adversely affected by contamination from the mother rocket. Various outgassing and ejection techniques under study will minimize this limitaion.

A secondary objective of this task is to develop the necessary techniques and devices for measuring pressure, temperature and density from ARS test vehicles. This phase depends in part upon the success of the primary objectives, although the conditions for outgassing are sufficiently different to materially simplify the accomplishment of this objective.

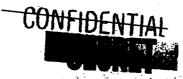
(d) Approach

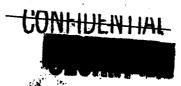
At this writing, the task appears to involve eight steps.

(1) Feasibility study of two proposed methods for measuring the required parameters.

The feasibility of two methods for the measurement of atmospheric density, pressure and temperature are being explored. These methods are (1) an extension of the falling sphere experiment and (2) the ionization gauge experiment currently being employed up to altitudes of 75 to 100 miles.

The present falling sphere experiment involves the ejection of a sphere from a rocket at high altitudes, and the measurement of the drag force of the atmosphere on the sphere as it moves though space. (It may be ejected anytime after the end of rocket powered flight and hence will rise to a peak slightly lower than that of the rocket.





(UNCLASSIFIED TITLE) Geophysical Environment Data for ARS, WS117L 2 April 1957
Short Title: ARS Environment Proj 1764

The sphere contains an accelerometer which measures tation. The sphere also contains a radio transmitter which relays the accelerometer signal to a ground recorder. The double integration of the total acceleration yields sphere altitude as a function of time to a reasonable accuracy for high angle flights. An independent complicated analytical reiteration method yields sphere velocity and altitude versus time independently. The determination of atmospheric density depends upon a knowledge of drag sphere. These values of drag coefficient have been measured in ballistic ranges and hypersonic wind tunnels.

The present ionization gauge experiment involves the measurement of ion current from ionized air molecules on one or more chambers on the surface of a rocket. The knowledge of air pressures around conical surfaces with known orientation to the air stream leads to a value of ambient pressure and to temperature if the relative velocity of cone to air is known. This system requires some kind of tracking for high accuracy although integration of pressure and temperature values results in approximate altitudes.

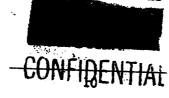
Extending the sphere experiment to higher altitudes involves increasing the area to mass ration of the sphere, shifting the range of the accelerations, corresponding to lower altitudes). The system does not work at or near zenith since the velocity is too low (approaching zero for a verital flight) for drag to be measurable.

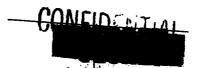
The extension of the ionization gauge method involves three main steps: (a) Adapting to rocket use existing ionization gauges designed for ver low pressures (Alpert type); (b) eliminating the effect of contamination of the measurement from rocket outgassing by housing the gauges in a separate thoroughly outgassed body which will be spring ejected from an evacuated cavity at high altitude; (c) Eliminating the uncertainty of molecular dissociation by making the gauge sensitive to only one or two specific molecular species through simple mass spectrometer techniques.

The feasibility study of the use of these methods at high altitudes is currently under way and involves a study of (a) the theoretical limitation (b) inherent sources and estimates of errors (c) engineering difficulties (d) space and weight requirements (e) estimated cost per flight. An analysis of these studies will determine which method has the better chance of success, but at present it appears that both should be tried. Perhaps both may be flown simultaneously in each rocket vehicle.

(2) Design and construction of preliminary models of equipment for one or both methods

This step of the task involves the design and construction of the equipment which is expected to be flown in the initial series of rocket





(UNCLASSIFIED TITLE) Geophysical Environment, Data for ARS, WS117L 2 April 1957
Proj 1764

flights. This step may include wind tunnel tests or rocket flight tests of specific portions of the total instrumentation for the method, as well as the final packaging of at least two sets of the equipment for the rocket flights of each of the two methods.

(3) Initial rocket flights of the equipment for one or both methods

This step includes the field operation involved in preparing the equipment for actual rocket flight together with the necessary operation of the rocket flights for each method. The preparation for two flights is insurance against rocket or other failure during the first flight.

(4) Evaluation of flight performance and necessary redesign of equipment

This step involves the detailed study of the telemeter record of the flight to determine the performance of the various parts of the measur-ing equipment, as well as the transcription of recorded data to usable form for computation of the required atmospheric parameters. Deficiencies in the performance of the equipment detected by the record are then to be removed by the equipment should already have been constructed at this point for the series of data-gathering flights and it will be necessary to take the chance of having to modify some of the components at this stage of the task.

(5) Major series of data gathering rocket flights

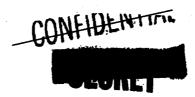
This step of the task involves the flying of three to ten sets of instrumentation for density and or pressure measurements in special 300 mile altitude rockets presently being designed for AFCRC or in non-orbiting ARS Weapons System test vehicles or both. Contact will be made with the three flights indicate sufficient self-consistency the balance of the data gathering flights can be cancelled.

The special 300 mile altitude rocket is a multi-stage system made up of existing rocket components, i.e., Cajun rockets and Nike boosters. An engineering study presently contracted for will result in engineering drawings for the necessary fins and coupling devices and nose cone necessary to combine the propulsion system into an atmospheric data gathering rocket system capable of carrying 40 lbs. of instrumentation to 200 - 300 miles. Upon completion of this engineering study, engineering drawings will be available from which the necessary parts and propulsion units may be built and purchased at an estimated cost of \$20,000 per rocket system.

(6) Analysis of data and preparation of revised atmospheric model

This step of the task involves the reading of telemeter records, the computation of the values of the atmospheric parameters, and





(UNCLASSIFIED TITLE) Geophysical Environment Data for ARS, WS 117L 2 April 1957
Short Title: ARS Environment Proj 1764

the compilation of these data into consistent atmospheric models. This step is not necessarily limited to follow step (5) chronologically, but will follow each rocket flight from which usable data results.

(7) Repackaging of equipment for test satellite vehicles

This step involves the electrical mechanical redesign of the equipment used in the rocket firings of step (5) or planned in steps (1) and (2) ARS test vehicle.

(8) Installation and flight of density and pressure measuring equipment in satellite vehicle

This phase involves the field operation of a program for measuring atmospheric density and pressure at orbital altitudes of satellite test vehicles, and would be followed by a reapplication of step (6).

4. (a) T-39794 - Thermal Radiation Program for ARS

- (b) This task will be accomplished through a combination of "in-house" and contractual effort. Present contractor is the University of Colorado under Contract AF 19(604)-1899. Additional contracts are contemplated.
- (c) The objective of this task is to measure the intensity of irradiant heat sources above the atmosphere.

The radiation environment is one of the external conditions which may grievously affect the period during which information can be obtained from an oribiting satellite.

To be operational, the design of the satellite must be engineered so as to maintain within pre-determined limits the temperatures of vital communication components, such as electronic units, batteries, etc. If and when nuclear sources are used for power, then the excess energy must be radiated away from an external heat exchanger; its design requires a knowledge of the radiation exchange environment.

The temperature of a satellite in orbit at given times and places can be calculated. Required for these calculations are a knowledgeof the interstellar heat sink into which it is radiating energy — thus cooling it — and a knowledge of the intensities of the thermal fluxes which tend to warm it. Estimates of the equilibrium temperature of the satellite can be verified only by measurements within the orbiting satellite. Under the worst condition the





(UNCLASSIFIED TITLE) Geophysical Environment .. Data for ARS, WS117 L 2 April 1957 Proj 1764

temperature within the communication equipment may cause it to fail before any information is received. A slightly more favorable but undesirable condition would be a premature failure of communcation, (Thus, should the absorptivity-equal to emissivity-of the skin of the satellite change while in orbit, the equilibrium temperature of the satellite might differ drastically from that calculated on the basis of design specifications.)

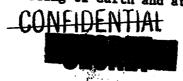
The objective of this task is, then, the development and testing of devices adequate for the measurement of the three irradiant sources-direct solar energy, solar energy reflected jointly from earth and atmosphere (I.E., albedo) and earth emissivity (in the infrared)—and the flux from a satellite into interstellar space.

It is proposed that flux measuring devices should be installed on the earliest test vehicles so that flux measurements can be obtained so long as communication with the satellite is continued. Should communications then case, and should the thermal, flux measurements seriously disagree with the values in the design calculations, at least one source of possible trouble should be identified.

During the development and testing of the devices for measuring the three sorts of radiation, balloon and rockets equipped with these devices will be flown. As scientific by-products of the testing program, some confirmation of current estimates of the intensities of the three sources will be obtained. Our present information on the radiation environment is next summarized.

Reliability of Present Estimates of the Solar Constant and the Albedo and Infrared Emission of Earth Plus Atmosphere

- a) The solar constant is believed to lie between 1.946 and 2.05 gram calories centimeter ⁻² minute ⁻¹, a deviation of 3% from the mean of 2.0 gm cal cn⁻² min⁻¹(1,396 watts meter ⁻²).
- b) For this discussion, the term albedo applies to the solar radiation reflected directly from the earth's surface and scattered and reflected from the atmosphere with its content of clouds. From point to point in the orbit of a satellite with orbital distances as now stated the albedo will be highly variable. Deviations may be expected of at least plus or minus 20 30 per cent from the mean value of the albedo which may be taken as lying between diffusely reflected or scattered back from the earth).
- c) The infrared emission of the earth may be estimated by theory. Current estimates for the various zones of latitude obtained by deduction may well be in error by 20 to 50 per cent; on the average energy to about 32 per cent of the solar constant is diffusely emitted as infrared radiation from the unit consisting of earth and atmosphere.



CONFIDENTIAL

MAN

UNCLASSIFIED TITLE) Geophysical Environment Data for ARS, WS117L 2 April 1957
Short Title: ARS Environment Proj 1764

(d) Approach

I. Introduction The following subtasks are foreseen:

(1) The design, development, testing and calibration of devices for the measurement of radiation of the following kinds.

(a) Total radiation from 0.27 to 2.7 microns (By "total" region non-selectively -- i.e., recording to heating value, not by number

- (b) Total radiation from 4 to 20 microns.
- (2) The design, development, testing and calibration of
- (3) Considered, but at present neither planned, funded nor contracted, would be the study of the temperature of a model of the satellite in a simulated radiation environment in a test chamber in the laboratory, or (about 100,000 feet).
- (4) A subtask within scope of this task, but deserving separate discussion will result in new techniques, design experience, and data important to ARS as vehicles for reconnaissance. This subtask is amplified specifically in Section II, Activities in "(4) Activities -Infrared Background

II. Activities

(1) Activities - General

The statement of the task may be amplified by noting earth and cooled by radiating energy outward. Its native temperature will absorptivity and emissivity for various parts of the spectrum from ultraviolet through far ultraviolet and the heat capacity), and the trajectory (portion of of earth when irradiated by sun plus earth, or in the eclipse shadow earth at apogee and perigee, and whether these occur in sunlight or in shadow.



(UNCLASSIFIED TITLE) Geophysical Environment Data for ARS W8117L Short Title: ARS Environment

2 April 1957 Proj 1764

may be added as the development of the satellite proceeds from the preliminary phases of design, construction, and test to the more sophisticated, complex designs. For example, possibly a fission reactor may serve as source of power for attitude control and for electronic equipment. The introduction of such a heat source will complicate the engineering considerations because the vironment of the heat exchangers.

(2) Activities --- Model Study

A possible activity which, as noted above, has not passed beyond the discussion stage, is that of the Model Study for obtaining approximate values of the equilibrium temperatures under working conditions a simulated satellite might be studied. By appropriate choice of the model, which would incorporate such devices as quartz windows inserted into the sphere, probably supplemented by isolated heat - detecting receivers, it is tested in a "Stratospheric Chamber" equipped with appropriate radiant heat sources. Or, the model satellite could be carried by balloon to high altitudes minimize convective cooling.

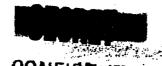
In such studies numerous experimental details would have to be carefully watched. For the receivers consideration would have to be given to the absorption of radiation by the receiving surfaces ("blackness" also to the conditions for the "color temperature" of the radiant flux), precautions against convective cooling, since in the satellite at orbital altitudes there would be no convective cooling.

Departures from anticipated temperature by the sately lite in its early history would be reason to look for unique influence -- heating by collision with meteoric matter, shortwave radiation with more than the expected intensity of gamma radiation.

Such a model might lend itself to experimental work in the design of a satellite to be powered by a fission device.

(3) Activities -- Design and development of the temperature and radiation sensing equipment

It is recognized that measuring the temperature of the skin and of the important points within the satellite in order to confirm the adequacy of the design is primarily the concern of the contractors. However, the themal flux sensors and the temperature sensors both will most likely be built around thermistors, hence, for reasons of design efficiency they would be parts of a common system. All thermal flux devices have high for absolute temperature determination.





(UNCLASSIFIED TITLE) Geophysical Environment Data for ARS, WS117L

2 April 1957 Proj 1764

It has been noted the type of thermal flux detector used should be "total" and "non-selective." As distinguished from photo-conductive detectors, the preferred type would be the "temperature" detector, i.e., the absorbed energy is measured by temperature change using a thermocouple or a thermister or equivalent.

Hence, the development and testing (including calibration) of the radiation sensors involves the use of the same accessory electronic equipment for imparting information to the telemetering system as would be used when thermistors are employed for obtaining temperature data within the satellite. A minor activity from the viewpoint of both man-hours and dollar costs, is therefore involved adding the responsibility for development, testing and calibration of the temperature sensing devices to the identical responsibilities for the devices for measuring thermal flux.

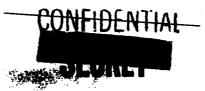
Timely and detailed reports of progress on this task will be provided so that designs of the temperature sensors and accessory electronic equipment will be available to the prime contractor for his use in instrumenting early test vehicles.

Approximately six months have passed since Contract AF 19(604)-1899 for \$40,000 was awarded to the University of Colorado for work on this task. Relatively good progress has been made in the design of compact lightweight transistorized thermal flux detectors available soon for testing in high altitude balloon flights. However, for quantitative thermal flux measurements one accepted technique is alternately to expose the radiation sensor to the thermal flux to be measured and then to view a reference standard or flux (a black-body) determined by its absolute temperature. It is demand the major effort.

(4) Activities -- Infrared Background Studies

In reconnaissance "vision" is involved. With the eye as the detector, the significant bandwidths used in vision are 0.4 to 0.7 microns. "Vision" in the ultraviolet involves a detector in the range 0.2 - 0.4 microns. In the infrared, "vision" comprises wavelengths from 0.7 to 25 microns. It is obvious that "vision" is the discrimination of an object viewed with a given bandwidth against a "background" also "seen" by the detector. Further, radiation scattered toward the detector by material between the object and the detector obscures vision (cf. visibility through fog).

Reconnaissance by use of far infrared introduces another factor not unlike the scattering effect in visibility through fog. That is, the radiation from the object and its background will be veiled by the energy emitted by the strata of atmosphere between object and detector. In the region from





(UNCLASSIFIED TITLE) Geophysical Environment Data for ARS, WS117L Short Title: ARS Environment

2 April 1957 Proj 1764

4 to 24 microns knowledge of temperatures, spectral emissivities (equal absorptions) of the specific gases of the atmosphere are required. Much is known about the pressure dependence of the absorption but easy calculation is not yet possible.

Both experimental and theoretical phases under this infrared background study are planned:

Experimental:

- (1) The design and construction of a far-infrared spectrometer to be borne aloft by balloon capable of measuring the terrestrial thermal flux, spectrally resolved from 4 to 24 microns, etc. The work to be
- (2) Design and construction of balloon borne equipment to measure attenuation of the infrared solar flux in the region of 0.8 to 9 microns at various altitudes from 5,000 to 100,000 feet, with sun at low altitudes to increase the path length through the atmosphere. The work to be contracted.

Theoretical:

(3) The thermal emission from model atmosphere corresponding as closely as possible to the terrestrial atmosphere will be calculated using the latest available and suitable modified laboratory transmission functions. The emission will be computed for various heights to be later specified in the atmosphere. The work to be contracted.

Possible contractors, and the possible Principal Investigators are:

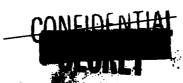
Johns Hopkins University, Prof. John F. Strong University of Utah, Prof. J. V. Hales (with Prof. W. Elsasser, Consultant, Scripps Institute of Oceanography)

Aerotronics, Glendale, Calif., Dr. Gilbert N. Plass University of Colorado, Prof. W. S. Rense University of Denver, Mr. David Murcray Ball Bros. Research Institute, Dr. David Stacey

(5) Activities - By-Products Directly Applicable to ARS

The main groups of by-products of the program of work on the Thermal Radiation program may be anticipated for ARS. One group is the reduction in the uncertainty in the three sorts of radiation intensities





(UNCLASSIFIED TITLE) Geophysical mavironment Data for ARS, WS117L Short Title: ARS Environment

2 April 1957 Proj 1764

noted as important -- the solar constant, the albedo associated with various physiographic features of the earth (both the earth surfaces itself and cloud cover meteorologically and physiographically determined), and the infrared emission. During the testing of the thermal radiation sensors during ballon and rocket flights data will necessarily accumulate which may reduce the error in present estimates of the intensity of these radiations.

The studies undertaken during the assessment of the radiation environment of the satellite will produce new knowledge about the energetics of the planet earth and its atmosphere. The new knowledge, as well as the sensors and accessory equipment from the task on thermal environment, will be of advantage to the contemplated Weather Reconnaissance Project in the event that is undertaken. Hard and fast lines cannot be drawn separating the work on thermal flux sensors from the work on the sensors which could be used on the Weather Reconnaissance Project. To the extent that work on this task (T-39794) advances the work on the Weather Reconnaissance Project, this later progress may be considered a by-product. However, under the Weather Reconnaissance Project would be required the production of sensors specifically adapted for installation in aircraft, and following the flights, reduction and study of the data. Such work is not contemplated in the budget proposed for this task.

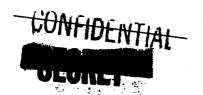
5. (a) Task 39795 - Rocket and Instrumentation Support

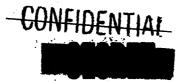
- (b) This task will be accomplished through a combination of "inhouse and contractual effort. The type of effort required by this task is being carried on by AFCRC under GRD P-7659. In P-7659 several contractors have been used and have attained a competence in their respective areas (See Approach) In view of this competence, many of the same contractors will be used to accomplish the objectives of this task. Contemplated contractors
 - 1.) Aerojet General Corporation
 - 2.) Wentworth Institute
 - 3.) Oklahoma A and M
 - 4.) New Mexico A and M
- (c) The task objective is to instrument and launch research rockets in support of the objectives of the other tasks in this project.

Requirement and/or Justification

The requirement for this task is delineated in the approach of each of the other tasks of the project.

(d) Approach





(UNCLASSIFIED TITLE) Geophysical Environment Data for ARS, WS117L 2 April 1957
Short Title: ARS Environment Proj 1764

The instrumentation and launching of research rockets requires:

- (1) The provision of vehicles and launch facilities suitable to each experiment.
- (2) The instrumentation of the nose cone. This effort may vary from simple attachment to the rocket to adaption of the experimental equipment to the vehicle and its support instrumentation.
- (3) Collateral instrumentation for tracking, telemetering, range safety, data recording, parachute recovery, special sequencing and command of experiments, orientation of sensing devices (biaxial pointing control) and others.
- ment. (4) The provision of suitable ground data recording equip-

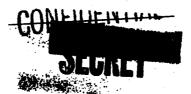
Techniques and procedures have been established under GRD P-7659 to accomplish the desired results in the above areas of effort. In order to meet the requirements of the other tasks of this project, the same techniques and procedures will be followed under this task. In particular, the same contractors and facilities will be used, where applicable, and coordination with necessary test facilities will be carried out in the same manner as under P-7659.

In order to efficiently and effectively make use of system test vehicles close coordination will be established with the prime contractor. Such liaison is necessary to adapt the experiment to system test vehicles from the standpoint of size, weight, available telemeter, power, etc.

- d. Other Information
 - Not applicable
- e. Background History

System Requirement No. 5 dated 17 October 1955 subsequent letter directive from WDD placed on AFCRC the responsibility of providing environmental data effecting the design and test of ARS vehicles. Studies by the Geophysics Research Directorate, AFCRC, the design study contractors and the ARS Weapons System office determined that in certain areas the state of the art was such that additional data would be required to satisfy the design requirements of ARS. In December 1955 and January 1956 Tasks 76971, 76972, 76973 and 76974 under Project 1115 were prepared by Geophysics Research Directorate, Air Force Cambridge Research Center. These tasks were, with certain exception approved by WDD 3 July 1956. This project constitutes a rewrite of these tasks under Project 1764 in support of WS 117-L.





(UNCLASSIFIED TITLE) Geophysical Environment Data for ARS, WS117L 2 April 1957

f. Future Plans

This project is for the specific purpose of providing environmental design data for the Advanced Reconnaissance System, therefore, the various task and subtasks will be terminated, with concurrence from the WS 117L WSPO, when it is apparent that sufficient data has been obtained in a particular field to satisfy design requirements or to determine a no hazard condition to the ARS vehicle and operational subsystems.

Conversely close coordination will be maintained with the WSPO and prime contractor so that new tasks can be timely instituted to meet requirements generated by the introduction of new design conception.

8. References

ARDC System Requirement No. 5 dated 17 October 1955 Secret Letter WDD to AFCRC sub: Support of Advanced Reconnaissance System (U) dated 23 December 1955.

WS 117L Advanced Reconnaissance System Development Plan dated 2 April 1956.

ARDC System Development Directive Advanced Reconneissance System dated 17 August 1956.

SIGNED

MURRAY ZELIKOFF Project Scientist Photochemistry Laboratory

MILTON GREENBERG Director Geophysics Research Directorate

SIGNED

GRORGE P. JONES, JR. Lt. Colonel USAF Ballistic Missile Liaison Officer Air Force Cambridge Research Center

WED I

Colonel, USAF

Assistant for WS117L

210-57-0114C



1. Special Annex for Mission Support Funds

2. Reports Control Symbol

Page of page

3. DATE: 2 April 1957

TITLE

5. Initial

6. NUMBER - 1764

(UNCLASSIFIED TITLE) Geophysical Environment for ARS, WS 117L

SHORT TITLE: ARS Environment

\$4255. of P-690-02 funds will be required in the performance of task

(I) 6 trips to Los Angeles and Palo Alto, Calif. at \$400. (2) 3 trips to Chicago, Ill. at \$125. \$2400.

375.

(3) 12 trips to New York, N.Y. at \$40.

489.

(4) Miscellaneous travel

1000.

- b. This travel will be essentially to monitor contracts and coordinate with other Centers. The requirements for FY 57 will continue through FY 58 and
- c. In FY 58 six (6) additional trips to HADC at \$400. each will be required to arrange rocket tests.
- d. In FY 59 twelve (12) additional trips to HADC or Patrick AFB at \$400. each will be required for rocket tests on apparatus.
- e. Therefore, for FY 58

P-690-02

\$6655.

FY 59

\$9055.

- \$8000. of P-690-02 funds will be required in the performance of 2a. T-39792 during FY 57. Specifically it is contemplated.
 - 12 trips to Holloman Air Development Center, N.M.

\$5400.

(2) 4 trips to San Francisco, Los Angeles area, Calif.

1600.

(3) 3 trips to Philadelphia, Pa. at \$50. each

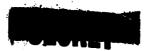
150.

(4) Miscellaneous travel; \$850

TOTAL

850, \$8000





Special Annex for Mission Support Funds (cont.)

2 April 1957 Project 1764

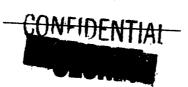
- b. Travel to Holloman Air Development Center will be performed in carrying out high altitude rocket experiments. Each rocket experiments. Each rocket firing requires at least two (2) personnel for a period of a week to ten
- c. It is contemplated that some of the shaped-charge experiments may be performed by the Poulter Laboratories in the San Francisco area. Research on High Speed Impact Phenomena will be coordinated with Rand Corporation in Santa Monica. Temple University in Philadelphia has developed acoustical apparatus for the detection of meteoric impacts.
- d. The travel requirements for this task thru FY 59 will probably remain at about \$8000. per year.
- 3a. \$5970. of P-690-02 funds will be required in the performance of

(3) (4) (5)	2 trips to Los Angeles, Calif. 4 trips to Ann Arbor, Mich. at 3 trips to HADC, N.M. at \$400. 6 trips to Chicago, Ill. at \$125 trips to New York area at \$40. Miscellaneous travel	3125. each each	\$800. 500. 3200. 250. 320.
Thie	Promat - 44 a	Total	\$6000.00

- b. This travel will be essentially to monitor contracts and coordinate with other Centers. The requirement for FY 57 will continue through FY 58
- c. In FY 58, 7 additional trips to HADC at \$400. and 2 additional trips to Los Angeles at \$400. will be required to participate in rocket data gathering
- d. In FY 59, 4 additional trips to HADC at \$400. will be required to participate in rocket data gathering launchings.
- 3. In FY 60 travel will be required as follows:

 (1) 2 trips to Los Angeles at \$40 (2) 2 trips to Chicago at \$125. e. (3) 3 trips to New York at \$40. e. (4) Miscellaneous travel 	0. each ach ach	\$800. 250. 120.
Therefore	Total	<u>300.</u> \$1470.

Therefore,	P(00 00
	P690-02
FY 58	9570
FY 59	7570
PV CO	7570
FY 60	1470





Special Annex for Mission Support Funds (cont.)

2 April 1957 Project 1764

4. \$3,225.00 of P-690-02 funds will be required in the performance of task T-39794 during FY 57. Specifically we contemplate:

4		
(1) (2) (3) (4) (5) (6) (7)	3 trips to Los Angeles, California at \$400. each 4 trips to Baltimore, Maryland at \$60. each 3 trips to Chicago, Illinois at \$125. each 2 trips to Holloman ADC, N.M. at \$400. each 2 trips to WADC, Dayton, Ohio at \$100. each 2 trips to RADC, Rome, N.Y. at \$55. each Miscellaneous travel: \$300.	\$1200. 240. 375. 800. 200. 110. 300. \$3225.
• -	_	TULLU.

a and b Travel to the Los Angeles area and to the Baltimore area is predicted on the assumption that the contractors, at least for the vehicles for scientific measurements, will be in either or both areas. Also, at least one visit to WDD is contemplated.

c. Travel to the Chicago area is included on the assumption that contractor for the temperature and radiative transfer sensors might quite probably be in Chicago or equally distant from Boston. Mass.

d. Travel to Holloman ADC looks forward to preliminary testing of instrumentation in the upper atmosphere by balloons or rockets, or both.

e. Travel to WADC and to RADC will be required to coordinate the various Center efforts. It is possible that the number listed is a minimum and that more will be required.

 \underline{f} . Miscellaneous travel to discuss specific problems with experts at various Universities will be required.

g. After FY 57 we anticipate that because of the increased activity the travel requirement will be increased to an average \$4,500. per year.

h. An annual average of \$1000. of P-690-03 funds will be required to transportation of instrumentation units during FY 58 and FY 59.

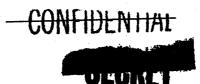
5a. \$14,000 of P690-02 funds will be required in the performance of task T-39795 during FY 58.

(3) 8 trips to Palo Alto, Calif. at \$400. (4) \$\frac{1}{4}\$ trips to Patrick AFB, Fla. at \$200. each (5) Miscellaneous	000. 600. 600. 800.
Total \$12	4,000.



CONFIDENTIAL

218-57-01140



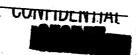
Special Annex for Mission Support Funds (cont.)

2 April 1957 Project 1764

- b. Travel to HADC will be performed to participate in launching of high altitude rockets.
- c. Travel to Los Angeles will be performed for coordination of program with WSPO.
- d. Travel to Palo Alto will be performed for lisison in obtaining technical information on use of system test vehicles,
- e. Travel to Patrick AFB will be performed for coordination and participation in launching of system test vehicles.
- f. The travel requirements in this task are expected to remain essentially the same for FY 59 and FY 60.



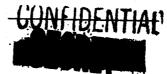
	C evends.		•		Ė											•				7	RE	POR	12 C	ONT	ROL	5776	BOL
104	SYSTEM (LOJE	CT.	. C	31/	išķ.	É	jστ				•				•	. :		-	DAT	-					
(INCTASSIPTED -		8.7		7	•	1		-			٠.	4	-		• •			r: ,									
(ONCLASSIFIED TITLE) Geoph Short Title: ARS Environment	ysical Envi	ronn	ént	Da		for					1	F	ni) (in	AL			,		1	1	NUI	ADI	11	19	<u>57 </u>		
SCHEOULE -				;, ₹		.,	7			11/1	4	Ţ., s	HAN							١.,	1	764					
B. 在 图 10 10 10 10 10 10 10 10 10 10 10 10 10		100	٠					÷.,.		• "				7/1	7			<u> </u>			. 3	,,,,		Ċ			
1964	PROJECT OR	-		55	- 1		19,70	40	23		-	ξį	LE	OAL	Y	(AP)	<u> </u>		4.4		7.6		7				
AND ENGINEERS	TARKAR	144	100	· A	źμ	- 1	ماسا		e Li	40	200	-7	1		٠.;				9 5 F		79	. 80	. 7	19		Tea	COMP
	1764	11	LI				1.	1	4 A			H			Ε.	Ш	4				£ 18.	FI	•	6.	۳.		2 3
oler, U.V. and I. Pay		11					3 74	13	7	8.5	Ŧ		44		14		18			7	Ŧ	Fål	4	17	: :	Н	44
TOTAL TEN MANAGEMENT	89791	44			<u> </u>	$\mathbf{T}_{\mathbf{z}}$.7	1	3		3	131	\sim	+	¥		2		, 74	1	3	F	d.	11	7	╀┼	+-1
Spattering.	300	44		\perp		•	17	Ft	11		*	+	13	ΣΕ,	H	ΞŁ.	162				: 13	T	7	Ħ	+	₩	++
		11	Ш,	II	Ţ	ना	Ч.						14	_16	Ы	21	17	5.5	17	3	10.7		1	11	+	╆	┿
Martin Berter & Bat		11		4 1	3	1			4		Ŧ.		13.4	- 14	Ш	Ŀ					4-1	П	#	11		┝┿	++
BOCKS PACKOT INCLUSION	39792	11.	J 12	1	1	M	4.0	7		11	*	20.0	₩	4:	3	٠.	4	21	Γ	Τ.	1.1		1	H	+-	┝┼	++
		البليا		1-1	T	T			12	++	13		131	-			Ш				111	T	1	Ħ			╅╅
Programme and the second	100					17		7	131	++	12		Н	42		Ð		17	7-1	3	4.1	ls	.	H	44	-	++
	1647	280			T	m	1.1	.†	74	4	11	-	r J	42		12				J.	I:I	ž [a- -		++	4	+4:
		213		₹.T		1:1	7.7	7	13	1	語	54 Y	14	344		Ľ		5 5	X :	(*	Ħ			1	#4	+	++
selling williams.			3.5			7.1	11	7	11	++	17			15	:1 °	1		4		T.	13				#1	-1	ناب
		لنك	47	LT	10		11	ተ	11		1.1	**		IJ	1	. ∤ ∙ `				7	চা	7	1	. 	+5	47	1-1
						4	10	ተ		1	╁┼	4	11	11	_f·		•1.	1.3		T	H	+	+	7	╁╫	+	+
			ŢΥ		Ţ	3		17	ĿΤ	4+	H	4.			11	10	h	ď	16	1	ZT.	ರ್ಷ	Н	+	1-4	4	1
ARS Yest Califolia Por	est.		4		1 4		14	7	; ;	+14	1.	1		L		\Box		2	· 1	Ŧ.	7	44	╌┤	7	++	+	Н.
ANS Zest Santele Progress			4	T	17	7	††	-	- 14	++	Η.	44	_ 4		-	\mathbf{H}	A	17	9			+-	-	+	₩	-15	1
AND IDT AND		43			П	1	1+	+	-	 - -	H	14	-	L.	4	$\mathbf{L}I$	3	7	71			+	-	╌	₩	47	<u>.</u>
10mperature Rendere	39794	$\perp \! \! \! \! \! \! \! \! \! \! \! \perp$					11	H	┝┼	11	Н	11	1	Ц		\coprod	\perp	\prod	T	П	_	+	1-1	+-	₩	11	. -
Addiation Sensore		Ш			П		1	1		1	-	44	-		L	\Box	1	П	1	П	+	77	1	+-	⊬	44	٠,
Background Studies		$\perp \! \! \! \! \! \! \! \! \! \! \! \! \! \! \! \! \! \! \!$			П	7	12	11	1	1 1 2	-	-74	6	14		Ľ	1)	\Box	7	6	9	4.1	-	╁┦	⊢	44	_
Theoretical		\perp	Π	\top		\top		Н	4		4	7.	-1-	نا	Z	1	1	īΤ	7		9 9		_	+-1	+	++	
Experimental		1.1	\prod	T.		1	1	┪		╀┪┥	+	++	4	1	Ш		\perp	П	7	М	7	77	+	┿┥	-+-	╄	44
		$\perp \perp$			1	:47	la l	₩		╀┼┼	+	H	+4	4	Ш	-55	1	3	5			,†	+	+-1	+	11	
cket Support	17.5	$\perp \perp$	\coprod					11	+	┝╁┼	+	₩	11	-44	Ш	-56	7	7	7	0	910	1.:1	+	++	+	11	4
	39795	11	$_{\rm LI}$					11	+	┝╂┵	+	Н	₩	4	11	\perp	\mathbf{L}				7"	m	+	++	+:	╬╬	44
Schedule Key:		11	\Box	\Box		77		H	+1	-+-	+	7 1	17	Z L.	Ц	12	7	7 7	17	\neg	1	f -1 -	十	┿	+	++	11
1 - Let Stude Con-		\perp	\coprod	\Box	T	\top		H	++	-++	+-	₩	++		Ш		\Box		T	7	77	\vdash	+	┿	+-	╁╁	44
4 - Termination and Table no		11	\Box	\prod	5 -	114	chn	i d	1 3	POZI	+	Н	++	4	Н	1	\Box	I	\prod	7,	T	一	+	+	+-	╁┿╴	+-1
		pot r	tct.		5 -	A	545		17		-		H	+	إيا	<u>, E</u>	M	200	fel	Sp.	ਥ ਰ	a b	HS	15	igh	₽	+-1
4 - Development Contract Al	12000	44	П	\prod	7 F	N	. 1			无王 王	#		₹,↓	+	L	<u>'</u>	4	aly	#1	þ	Ì	e te	Ť	H	7-	F+	+-1
	ONS OF THIS FOR	Ш	\coprod) F	2.	di	11	. [] .	G I		-	14	EDC	<u> 24</u>		F	αĮΙ	I R	рbı	Æ	_	+	ҥ	+-	⊬	+-1



Geophy	SYSTEM E PR			OTHER		. :		PAGE 2		PAG
Short 7	ical Environment Data for ARS, WS ltle: ARS Environment	TYPE	ACTUAL	116	S. MUTIAL CHANGE	R	ED DIRECT	2 Apri 4 NUMBER 1764	1 1957	
GRD	Geophysics Research Directorate	One	MAN-OTRE	AVAL	1057 Reno	AVAL	r 105g	FY 19 50	PY 10 A	70 C0
	AFCRC Directorate	R	4.5	,5L0	2425	720	29.0	32.0	26.0	200
	TOTAL Total Manpower Dollars		4.5 7,938	5.0 36,400	24.5	5.0		32.0	26.0	
				30,400	178,360	36,400	211,120	232,960	189,280	
•	Manpower Justification	Attacl	ıd:							
		· .].								:
		G	ONFIDE	NTIA						



		D MANPOWE						* REPORT	S CONTROL	537EO
	SYSTEM G	PROJECT	TASK	OTHER				PAGE	OF	
UNCLASOR								B. DATE		PA
eophysi	cal Environment near a	LIG 117-			Ti.			2 Ap	ril 1957	
hort Ti	tle: ARS Environment	MO II/T			. MITIAL			C MUMBER		
ORG	6.	1.			CHANGE	t [']				
CODE	ORGANIZATION TITLE	TYPE	ACTUAL	11.		200 120		1764.		
		ORG	MAN-QTRS	FY	* 57	-NOSEC 18	D DIRECT &			
1.								FY 1959	FY 1950	TOC
•	Task 39791 will require the fications equaling those of GS-additional physicists will be reproject.	h					MORD	RORD	RORD	RO
f	fications equaling those of GS- additional physicistswill be re project.	2 or Mai	or a tot	of eig	ht physic	ists (of				
	redictional physicists will be re	guired he	Two	of these	ere now	Vailable	ATTIME OF	militar	y) of qu	11-
f	TOJECE.		Rruntus 11	mediate1	y and ext	ending t	brough 41	13, and	therefo	e #1
2.	The man	1		1			HEORET C	a darati	on of the	
-	m the bear requirements	on Task to	702 4	1				i !		
Į.	nitial phases that three physici	sts and on	alectus	esuring	the influ	a of ine	Inlanet			
	n additional market program du	ing the n	exection	1C engin	er (GS-	1 to GS-	3) w 11	Ly matter	is est	ma te
	A Today (GS	tll) will b	ha		we cost	Ilrine l	more		an notifi	g Chi
Tr.	his organization (3) Enrough	the comple	****	cms	SEET AST4	of this	data d		and FI	5 9 ·
L.	tesponsible	for the on		me cusk'	. 1	1	7		ICD team	WLL
L	onisian Program. The applica	tion of ark		TTING OF	he progra	us and th				7.0
իդ	by this grown also	ory data,	and the	experimen	tal labo	ratory da	ta, and	the earth	cket and	
to	ignificant experimental laborary by this group also. The pre- pring of contractual research and ended by this team.	aration an	d prosecu	tion of	ent of a	eoretica	l design	criteria	ATSUMEDS.	o£ ,
þa	by this group also. The pre- pring of contractual research andled by this team. It is be- pliated by the team of the pre-	nd develop	ment, the	nreneval.	eneral 4	:ientifi	plans,	cordina	ATIT DE	وبمد
co	oring of contractual research and indied by this team. It is be oblision theory, mateor physicat least five (5) people. A ret phase of the research has	leved that	the score	of the	ton or a	mary and	d technic	al renor	11 I	•
þ£	at least five (5) people. A rst phase of the research has	and other	basic st	dies sh	DEODICE 1	nvolvin	acoustic	a. elec-	COMPANY OF	•
Ei	rst phase of the reserved	this time	, the man	i tude of	TIE DE HE	adled by	a team;	with a la	Dures	
- 1	tesearch has	peer comp	eted.		curs bao	gram may	not be d	etermined	1199 # 4 T	ze L
J	. 1	- 1	1	- 1	1	- 1	· •		. aneri le	ΩŒ
ŀ	1	1	- 1	- 1	. 1.	.]	I	1.	1	
- 1	· · · · · · · · · · · · · · · · · · ·		1	- 1	í			1		
- 1	ł	J	j	1	ı			Į		
ı	į		·	1		- 1		ı i	1	
		ł	1.		- 1	1	- 1		1	,
ł										
	· •	į į		ı	I.		Į		1	
		·		ł	.		- 1]	
							1			
			אסאבואי							



(UNCLASSIFIED TITLE) Geophysical Environment Data for ARS, WS117L R&D Manpower Annex (Cont.) 2 April 1957 Proj 1764

- 3. Manpower to perform research on Task 39793 will be divided into the following listed three (3) experimental teams:
 - a. Falling-Sphere Density Experiment Team

This team will consist of one task scientist (GS-12), one physicist (GS-11), and one engineer (GS-9)

b. Pressure Gauge Density Experiment Team

This team will consist of one deputy task scientist (GS-12), one physicist (GS-11), and one engineer (GS-9).

c. Data Reduction Team

This team will consist of one secretary (GS-3), and one computer (G8-9).

- 4. Responsibility of the 3 experimental teams will be as follows:
 - a. Falling-Sphere Density Team
- (1) The responsibility of the Falling-Sphere Density Team will be to modify the existing Falling-Sphere Density Measuring Technique and scientifically develop, test and launch a modified instrumentation for density measurement at altitudes up to 500 Km.
- (2) The responsibility of the task scientist is to plan and direct the over-all task program. In addition, he will directly administer the program of the Falling-Sphere team. He will consult with and advise the physicist and engineers in the theoretical study, design, development, laboratory testing, and contractual procurement of the flight model instrumentation; and will serve as Field Director at experimental test grounds.
- (3) The physicist will be responsible for carrying out the team program of theoretical work on the applied and background research pertaining to the Falling-Sphere Density Experiment. He will be concerned with the evaluation of the theoretical aspects of the experiment, and all experimental progress in related fields of research. He will consult with, advise and assist the engineer in the laboratory experimental phases of the team program, and the electronic and mechanical design of instrumentation. He will be responsible for the preparation of scientific reports and papers as required
- (4) The engineer will be responsible for the team laboratory experimental program, the electronic and mechanical design and construction of instrumentation. He will initiate procurement of instrumentation. He will





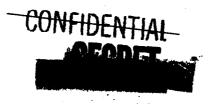
(UNCLASSIFIED TITLE) Geophysical Environment Data for ARS, WS117L Short Title: ARS Environment R&D Manpower Annex (cont.)

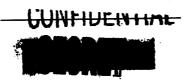
2 April 1957 Proj 1764

initiate procurement of and will monitor a contractor construction contract to build the final instrumentation for rocket installation. He will serve as field engineer during proving ground experimental tests.

5. Pressure Gauge Density Experiment Team

- a. The responsibility of the Pressure Gauge Density Team will, in consideration of present methods limited to altitudes of about 130 km, scientifically plan, develop, test, and launch a rocket borne pressure gauge instrumentation for density measurement at altitudes up to 500 km.
- b. The responsibility of the deputy task scientist will be to plan, direct and administer the program of the team. He will consult with and advise the physicist and engineer in theoretical study, design, development, laboratory meting, contractual procurement of the flight model instrumentation and will serve as Field Director at experimental test grounds.
- c. The Physicist will be responsible for carrying out the team program of theoretical work on applied and background research pertaining to the Pressure Gauge Density Experiment. He will be concerned with the evaluation of the theoretical aspects of the experiment, and all experimental progress engineer in the laboratory experimental phases of the team program and in the electronic and mechanical design of the instrumentation. He will be responsible for the preparation of scientific reports and papers, as
- d. The Engineer will be responsible for the ream laboratory experimental program, the electronic and mechanical design and construction of instrumentation. He will initiate procurement of, and will monitor a contractor construction contract to build the final instrumentation for rocket mental tests.
- 6. Data Reduction Team The responsibility of the Data Reduction Team will be to reduce telemetered, photographic, and other transmitted data that may be supplied from airborne density instrumentation; and to present this data in useful form for geophysical interpretation.
- 7. The Task 39794 Planning and Supervision will be under the direction of a Task Scientist. Throughout the period of the task, he will be responsible for the preparation and prosecution of the general scientific plans and for the coordination of work of the contributing agencies of the entire proselection of contractor, approval of proposals, supervision of both contractual





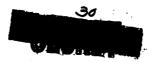
(UNCLASSIFIED TITLE) Geophysical Environment Data For ARS, WS117L R&D Manpower Annex (cont.)

2 April 1957 Proj 1764

and in-house efforts contributing to design, fabrication, test, calibration and data reduction and interpretation -- in short, the integration of the results of the contract program and the in-house programs. The Task Scientist is currently available.

- 8. a. The manpower requirements for T-39795 for Rocket and Instrumentation Support are estimated on the basis that four Research Engineers, (GS-11 to GS-13) will be required during FY 57 to accomplish instrumentation for the required program. During FY 58 an additional two Research Engineers will be required to absorb the load of frequent field trips to rocket launch sites and to maintain the heavy schedule of rocket preparation and firings. In FY 59 two additional Research Engineers will be required to conduct liaison on instrumentation of orbiting and non-orbiting test vehicles.
- b. This group will be responsible for the instrumentation of all rocket experiments in the program for coordination with launch sites, for collection and recording of data from rocket flighs and for liaison and planning with prime contractor in use of system test vehicles.

- CUNFIDEN HAL





. TITLE	ו דמינ 🗀	EM . 5	CONTRACT	FUNDS AN	MEX	THER						PAGE 3. DA	31	or 4	ol sme	OL ACE
(UNCLASSIFIED TITLE) (Short Title)	Geophysi ARS Envi	cal En	vironment t	Date for	ARS,	WS 1	17L	1	IAL A	<u> </u>		2 A 4. NU 176		1957		
FFEM	PROJ OR TASK NR	S. END ITEM	CONTRACT	II.	12 pg	EV YRS	10. FY	1	14. FY	50	18. PY		•			
ARS Environment	1764	RAT	Various	2-117	160	OTHE	422M	ОТИКА	1000	DTHER	1410	OTHER		OTHER	17TO C	ОТ
	P-10 P-20	0 Fund	.			6м				950 m	1410	470M 50M	425M			
· · · · · · · · · · · · · · · · · · ·	·	. •														
		•												,		
				j												
																i
	Sub-10		P-600 P-100 P-200		1600	6М	422 <u>m</u>	1.	0001)50e		70M 50M	25M			
TOTAL					16021	SM 4	2211	M 10	0000			-	\downarrow	4	\downarrow	
C 1 JUL SE 110 PREVIOUS	EDITIONS O	THIS P	ORM ARE OBS					10	9	50M 1	410M .	5200kr 4	25	.		



		K □ SY:	&D COSTI Fram [v] pa	STIMATE I	RECAPITULAS	FION			 _	RIS CONTRO	L STREET		
Geophys	ical Enviro	nment Dere	for ADO		TIAM []	THER			PAGE 4		32 .		
	ITEM	Amen	VIOUS YEARS	WS 117L			S. MITTAL	U	O. HUNDE	r11 1957			
7.		***	OTHER	<u> </u>	HEAL YEARS?	c. p	SCAL YEAR58	-	1764	1764			
	A. TOTAL		-		07H	IR 000	OTHER	O. P1	CAL YEAR 5	9 E. TO	COMPLET		
-	 	160M	6M	422	M -		3		OTHER	949	OTH		
CONTRACT	3. AVAILABLE	160M	6M	422		1000	950M	14108	520M	425M	0		
	C. NEW REQ			1							1		
;	A. TOTAL			_		1000M	950M	1410M	520M	425M	10		
MATERIEL	D. AVAILABLE			+	+		· ·				1		
	C. NEW REQ			+-			<u> </u>			 	 		
PACILITIES				†	+	+					+		
MANPOVER		+	<u> </u>				1				1		
		7.	9M	36.	***	1			 				
TRAMMS					48	178	.481	36.4	M	422. 2 4			
		N/A			1		1 1			-	T		
TEST ITEM		19/4	-										
TEST SUFFO	RT AIRCRAPT	N/	A		†					:			
		-				`					-		
SESTOTAL		160M	6₩	42 2 M		1000M							
TOTAL		173.9	м			2000	950M	1410M	520M	425M	0		
C , FORM	116 PREVIOU	S Programs		458	.4M	2128	.4M	1966.	/w	847.2			

CONFIDENTIAL