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28 October 1965

From: Director of NRL
To: Director of Program C.

Subj: Project Poppy Cost Estimates

Ref: (a) BYE-27225-65 of 26 ~~March~~ Oct 1965 submission
(b) - 27810-65 of 17 March 1966 submission 1965

~~Encl: (1) Comparison of Estimates for FY 64, 65 and 66~~

1. Following the submission of FY 66 estimates, reference (a), the _____ comptroller asked for an explanation of the differences as reflected in the previous estimates contained in the submission for FY 64 and 65, reference (b). Enclosure (1) tabulates the comparative items for discussion.

2. Payload costs totals show an average of $4.009 M for FY 64 and 65 and FY 66 is slightly lower or $3.755 M. Detailed comparisons are as follows: electronic totals - FY 64 and 65 average $~~3,559~~ 3,716K and FY 66 $995K. 7103 and 7104 launches were in FY 64 and FY 65. 7105 launch will be in FY 66. A tabulation of the complexity of the instrumentation is shown below:

	FY 64 7103	FY 65 7104	FY 66 7105
Number of satellites	3	4	4
Number of satellites axis stabilized	0	2	4
Number of rf data bands in collection system	12	32	41
Number of conventional diode-filter bands	12	23	24
Number of bands employing tunnel diode amplification	0	9	17
Top frequency band	4000 Mc	9500 Mc	14,800 Mc
Number of bands above 4000 Mc	0	10	15
Number of bands which allow [redacted] measurement in 1-1/2 db steps	0	1	9
Number of bands in which [redacted] measurement is made	0	1	10
Number of bands having choice of two levels of sensitivity selectable	0	0	7

a. From this tabulation it is evident that to average the costs of electronic equipment between 7104 and 7105 is not fair since 7103 only covered twelve rf bands and 7104 covered thirty-two bands. Also, 7104 included the first tunnel diode amplifier development to permit the extension in top frequency and maintain adequate sensitivity. In 7105 this was even more

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difficult to do since we were exceeding the state-of-the-art in going to 14,800 Mc and the development costs for these units were very costly. The instrumentation listed for 7105 is, to say the least, an ambitious program engineering wise. Development of this more complex hardware results in a considerably greater cost for research and development of these units.

b. Stabilization costs are ~~higher since~~ about the same though four satellites will be stabilized instead of two, ~~thus almost doubling the costs~~.

c. Power supply systems - To meet the requirements for the inclusion of more bands of rf coverage and other sophistication such as stabilization of all satellites, require considerably more power supply capacity. To accomplish this has required the design of a new satellite structure which is twenty-seven inches in diameter instead of the twenty and twenty-four inch diameter structures previously used. The power supply capacity is raised from ~~four~~ six watts to eighteen watts, requiring more solar cells by a factor of approximately ~~five~~ three to one.

d. Control systems - With the increased number of rf bands to be selected as well as the other parameters which can be read has necessitated the design of a new and more complex control system which will be fitted in each of the four satellites. There are now sixty-seven combination commands required in 7105 compared to thirty-four in 7104 and twelve in 7103.

e. Compatibility and environmental testing - The more complex instrumentation required by the increased number of rf bands will require more intensive compatibility testing, ~~hence the small escalation.~~ though with new instrumentation we anticipate lower costs.

f. Mechanical structures and fabrication - As mentioned under c. above, a new ~~longer~~ 25 diameter structure is required. This is a completely new design and we cannot borrow from previous design since it will be twelve-sided in shape instead of spherical as previously used.

g. NRL salaries and overhead - Lower costs are anticipated due ~~Raises in federal salary plus increased complexity of the design will raise the cost of fabrication.~~ to somewhat simplified design, fabrication techniques.

h. Misc. materials, travel, transportation - ~~These costs remain essentially constant.~~ Some economies in these costs are anticipated

3. Ground station (investment costs) have escalated somewhat due to general improvements and updating at the field sites (there are a total [redacted]

a. Electronics (receiving, recording and timing) - The matching of satellite data streams with optimized ground station equipment has required

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new receivers a [redacted] der updating. Also, to be responsive to the world situation rather [redacted] ve readout and analysis systems are planned for [redacted] sites. These will supplement the ability to "flash" the presence of new or sensitive electronic activity by certain field stations to NSA and the intelligence community. This is proving very effective at the single station partially so equipped now.

b. Antenna systems - Stabilization of the satellite has caused polarization problems which have necessitated updating of all sites to provide the optimum match on the ground to the satellite transmissions. It is hoped that major improvements will result in the continuity and consistency of data which should simplify data processing materially.

c. NRL salaries and overhead - The fabrication of material associated with these new antennas and other items in the updating kits at NRL will increase the labor costs.

d. Material, travel, transportation, etc. - Getting the new items in the field and installed will be fairly costly. Also, we have had some troubles with failure of some of the major electronics items due to environmental extremes at some sites which has been quite costly in material costs.

4. Facilities (investment) - During FY64 and 65 the Laboratory required additional facilities at the launch site which included a rather costly anechoic chamber. Likewise, to meet the increased requirements for secure working space at the Laboratory, extensive building modifications were required. These are not recurring costs; therefore there has been a sharp drop in these investment costs. Refinements to facilitate rapid sequential testing in the vacuum chamber and anechoic chamber are the principle new items.

5. Services (operational) - Operational field services and computer service costs have risen slightly because of the necessity of more closely observing the stabilized satellites (we now have four instead of two). [redacted]

6. While these are estimates, the Laboratory feels they are reasonably accurate. During the first three months of this fiscal year, the Laboratory obligated a total of $1,411,900, which if multiplied by four gives $5,647,600. During the remainder of the fiscal year there will be periods of heavy obligation and expenditure which will exceed the average of the last three months.

7. The Laboratory requests that the _____ comptroller release all the funds requested so the entire program can proceed on schedule and funding limitations need not be a factor which could cause us not to meet the present schedule.

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COMPARISON OF ESTIMATES FOR FY 64, 65, 66

(FY 64 and 65 estimates as submitted on 17 Mar 1965 were not separated, therefore the totals are divided by two for comparison.)

		FY 64 and 65	Average	FY 66
I.	Payload (developmental)	$8.018 M	$4.009 M	$3.755 M
	A. Electronics totals	~~673 719K~~ 1400	~~359.5K~~ 700	995K
	B. Stabilization	460 490K 958	~~245K~~ 479	400K
	C. Power Systems	103 110K 213	~~55K~~ 107	195K
	D. Control systems	155 165K 310	~~82K~~ 155	220K
	E. Compatibility and environmental testing	84 90K 174	~~45K~~ 87	50K
	F. Mechanical structures and fabrication	-	-	335K
	G. NRL salaries and overhead	1.689 1.801K 3490	~~901K~~ 1.745	1.190K
	H. Misc. materials, travel, transportation	699 763K 1470	~~382K~~ 735	370K
II.	Ground Station (investment)	2260 K	1130 K	1782 K
	A. Electronics (receiving, recording, timing)	880K 1,000	~~440K~~ 550	640K
	B. Antenna systems	60K 120	~~30K~~ 61	220K
	C. NRL salaries and overhead	325K 394	~~162K~~ 198	382K
	D. Material, travel, transportation	525K 640	~~260K~~ 320	540K
III.	Facilities (investment)	1.433K	721K	193K
	A. Test equipment and facilities	1.433K	721K	193K
IV.	Services (operational)	279K	139K	270K
	A. Operational field assistance	~~124K~~ 194	~~62K~~ 99	140K
	B. Computer services	~~40K~~ 50	~~20K~~ 40	130K
		$12.0 M	$6.0 M	$6.0 M

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