27 October 1967

THE CORONA IMPROVEMENT (J-3) PROGRAM

DEVELOPMENT HISTORY

In the spring of 1965 the DDR&E Dr. Fubini suggested to [redacted], the OSP CORONA Project Manager, that a look at a CORONA Improvement Program might be desirable. [redacted] directed his West Coast Resident Office to study the problem and report to him NLT 1 June. A series of meetings followed between LMSC, GE, Itek, [redacted] and the Project Office. Failure modes and operational deficiencies of the existing J system were studied, as were the "C" system coverage requirements, weather data, reliability data, etc. From the studies a matrix of feasible system designs was developed, with all recommended designs incorporating improved pan and stellar index camera systems and an improved command system. The major variables in the matrix were launch vehicle, film load, orbital lifetime, and RV configuration. The Resident Office had concluded that a significant cost savings could be realized by adopting the Atlas-Agena launch vehicle, 30 day orbital missions, increased film load, and reduced launch rate. The DNRO, however, elected to maintain the Douglas launch team, approving a modest upgrading to accommodate the increased payload weight of the new Constant Rotator and DISIC camera systems.

A go-ahead was issued in July 1965 to Douglas, Fairchild, and Itek for the Thorad, DISIC, and CR systems respectively. As initially defined the first J-3 launch was targeted for January 1967, however, for budgetary and other reasons the DNRO delayed issuance of go-ahead to LMSC and GE until April 1966. The eight month delay resulted in a six month schedule slip, with the first launch rescheduled at the April 1966 Interface Meeting for 25 July 1967.

Schedules of critical design reviews, qual test program, hardware deliveries, and system test activities were established to meet this target date. Final design reviews for the camera, SRV, electrical system, structual aspects, and total payload were set for 23 August 1966, 7 September 1966, 7 October 1966, 17 February 1967, and 14 April 1967 respectively. All were conducted according to plan. Deliveries of the camera systems and SRV's to AP were several weeks behind the target schedule, however, these slippages were made up during systems test. The J-3 qual program proceeded smoothly throughout, with J-3 being somewhat of a "first" for reconnaissance payloads in that a full qual program was conducted, and the qual program was completed in advance of the first launch. In early July 1967 it appeared as though the target launch date might be met, however, a Corona problem was uncovered on both pan and DISIC cameras during thermal altitude testing and two HIVOS test reruns were required. CR-1 was available for launch on 7 September 1967

approximately six weeks behind the original target date of 25 July 1967. The first J-3 launch took place on 15 September 1967.

The design goals of the J-3 system were basically as follows:

Constant Rotator Panoramic Camera

a. Removal of camera system oscillating members and reduction of error budget vibration components.

b. Improvement of V/H match from 5% to 2%.

c. Proper camera cycling rates at altitudes down to 80nm (minimum J-1 altitude is 100nm).

d. Elimination of camera failures caused by film pulling out of rails. (Two such J-1 failures have been experienced in the past two years.)

e. Capability of handling ultra thin base (UTB) film. (An increase of 50% in coverage at no increase in weight.)

f. Exposure control through variable slit selection.

h. Capability of handling alternate film types and split film loads (color, infra-red, etc.).

i. Improved lens performance.

j. Pan geometry without affect on imagery (J-1 systems require IMC traces in the format area).

DISIC

a. Improved terrain camera performance (increased focal length 1.5" to 3").

b. Independent mapping capability.

c. Improved shutter reliability.

d. Removal of stellar launch window restrictions (J-1 launch windows are governed by stellar windows).

e. Elimination of stellar camera flare (increased knee angle and improved baffle design).

All Systems

a. Removal of limited shelf life items.

b. Removal of items affecting R-1 readiness capabilities.

c. Reduced power requirements.

At the June 1965 briefing to Dr. McMillan the Resident Office presented one time cost figures for the CORONA Improvement Program as indicated in Column I. Actual cost figures for the development program are shown in Column II.

	Est. June 1965	Actual
LMSC	[redacted]	[redacted]
Itek		
GE		
Total	[redacted]	[redacted]

13 new

As can be seen, the major variance is in the pan camera development. The increased costs at Itek were primarily associated with enlarged scope of the UTB, PG, and exposure/filter control developments; and with the addition subsequent to the briefing of a lens improvement program. Actual one time design and qualification costs at LMSC were extremely low since the [redacted] includes one time developments costs of [redacted] for a data subsystem which includes a recoverable digital tape recorder and its associated ground automatic data processor. The tape recorder data has proved extremely beneficial both in flight and ground test.

One time costs at GE include [redacted] for two sets of new SRV-AGE. Costs of these AGE were less than one-quarter the cost of similar AGE procured by another NRP program in the same time period. Part of the cost savings were associated with the use of mini-block terminals with pin inserts, which eliminated the need for costly terminal board panels. A DOD cost improvement award was given to GE personnel for their design work on the J-3 AGE.

DISIC integration costs are included in the LMSC and GE figures, however, DISIC one time development costs and Thorad development costs have not been shown since these contracts were administered by [redacted] The increase in cost of a J-3 payload over a J-1 payload is approximately [redacted]

From a technical standpoint the J-3 development has been an outstanding success. All design goals have been achieved, and the first flight has demonstrated the adequacy of the qual program and the reliability and compatibility

of the hardware. The problems experienced on the CR-1 flight were of a minor nature, and can be corrected for CR-2 without major rework. The two sigma pan camera performance predictions as presented to the DNRO at the 15 June 1965 CORONA Improvement Program briefing were as follows:

	100 NM		90 NM		80 NM	
	0°	30°	0°	30°	0°	30°
Along Track	7.6	8.7	7.0	7.9	6.4	7.2
Across Track	7.7	14.9	7.1	14.0	6.5	13.2

The better Corn target performance data from the forward camera on Mission 1101 yielded approximately 6 feet along track and 10 feet across track from an altitude of approximately 89nm. The loss of scan resolution has been attributed to a dynamic lift problem aggravated by lower than normal temperatures on orbit. The performance nonetheless was judged to be the best ever from a CORONA system, and substantiates the validity of the design concept. Since the improved lens does not become available until CR-4 and since the altitude of Mission 1101 was higher than desired, the ultimate performance of the J-3 system is yet to be demonstrated.

In conjunction with the J-3 development program, a forward looking program of photographic investigation has been carried out to determine the most promising techniques of intelligence enhancement. The program, designated EKIT because of the cooperation between Eastman Kodak and Itek, has provided the foundation for Systems Testing on CR-1 through CR-4. The CR-1 through CR-4 tests will in turn provide the basis for a deeper investigation into the potentials of multiband work in intelligence reconnaissance work in the future.

[redacted]

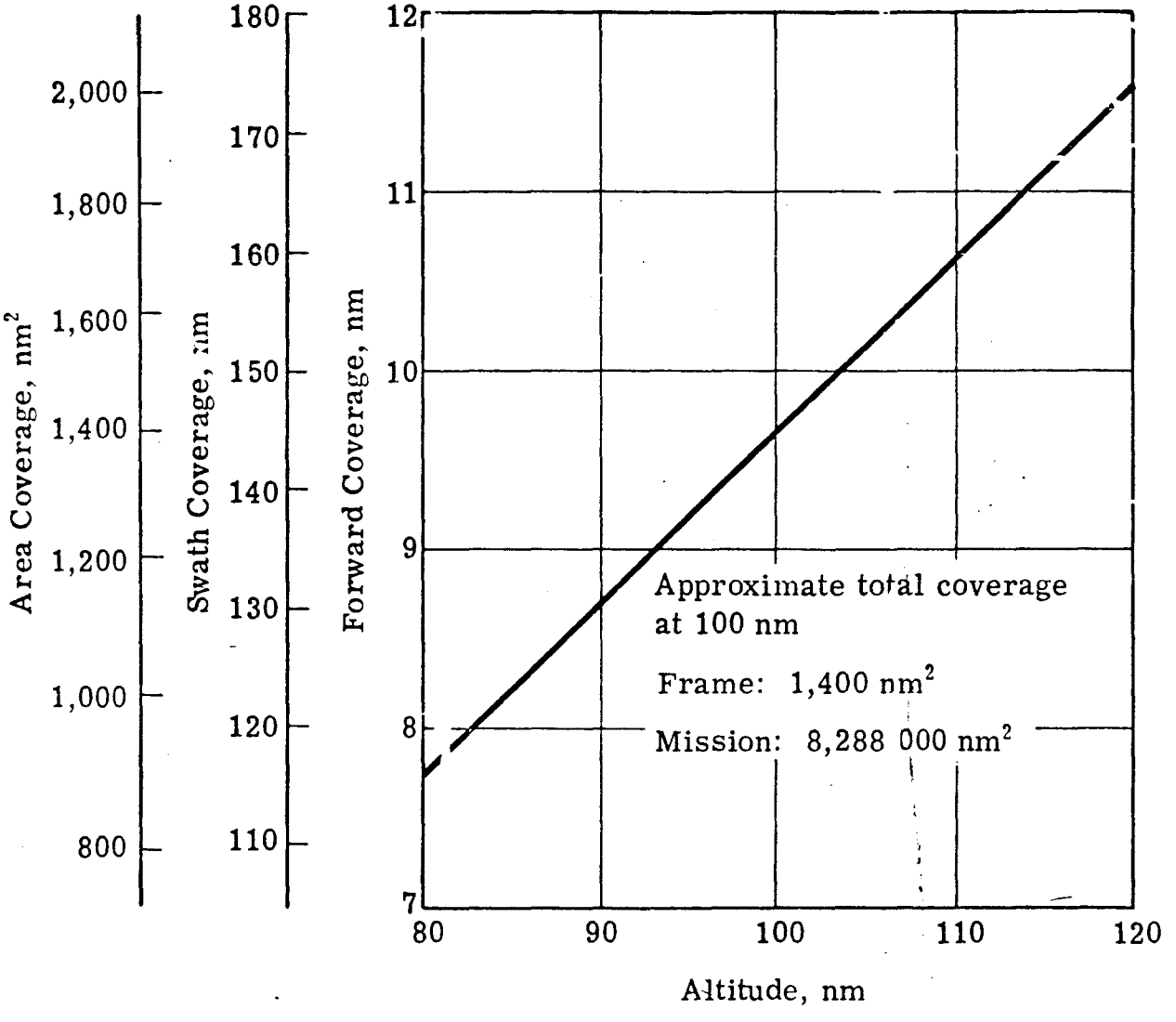
CORONA J-3 PERFORMANCE PREDICTIONS FROM ERROR BUDGET (Two Sigma Low)

	Second Generation Lens				Third Generation Lens			
	Along Track		Across Track		Along Track		Across Track	
	0°	30°	0°	30°	0°	30°	0°	30°
Resolution, lines per millimeter	130	132	126	72	155	148	151	76
Blur, microns	3.28	3.01	2.64	11.0	3.28	3.01	2.64	11.0
GRD, feet	6.4	7.3	6.6	13.5	5.6	6.3	5.6	14.8

Conditions: Altitude: 82 nm
Film type: SO-380, 3404
Exposure: 2.44 msec
Contrast: 2:1
Field angle: 0°

[redacted]

CORONA COVERAGE AS A FUNCTION OF ALTITUDE



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CORONA PERFORMANCE FILE

[redacted] PERFORMANCE PREDICTIONS
(TWO SIGMA)

	ALONG TRACK			ACROSS TRACK		
	0°	30°	60°	0°	30°	60°
RESOLUTION (L/MM)	[redacted]					
BLUR (MICRONS/MSEC)	[redacted]					
DEFOCUS (MICRONS)	[redacted]					
GRD (FEET)	[redacted]					

CONDITIONS:

[redacted]

TOP SECRET