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2 March 1967

MEMORANDUM FOR: Director, National Reconnaissance Office

SUBJECT : HEXAGON Sensor Subsystem Debriefing Charts for Itek

1. Attached are copies of the briefing charts I plan to use in the 3 March 1967 HEXAGON Sensor Subsystem Debriefing for Itek.

2. The Management, Production and Logistics Evaluation Review will be a once over lightly presentation of five to ten minutes. The remainder of the briefing concerns the Technical Evaluation. This part of the briefing is structured around two parts. The first part deals with the six fundamental problem areas identified during the evaluation. The second section deals with the 15 proposal deficiencies identified in the 1 September presentation to you. During the course of the briefing I will also discuss the strong points of the design as identified during the Source Selection.

3. The briefing is planned for a one to one-and-one-half hour period. I don't plan to permit extensive discussion of the evaluation but will, of course, permit limited questions for clarity.

4. If you require any discussion of the presentation or wish any modification be made, I will be available at your request.

LESLIE C. DIRKS

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MANAGEMENT, PRODUCTION AND LOGISTICS EVALUATION REVIEW

Past Performance..... Generally satisfactory.

Management & Organization..... Satisfactory except for configuration management plan.

Master Planning & Scheduling

Design & Development Schedule..... Optimistic. Little attention to back-up in high risk areas.

Statement of Work..... Incomplete.

Follow-on Production Plan..... Weak.

Reliability Plan..... Poor.

Facilities, Special Tooling & GFP

Facilities Development Schedule.... Optimistic. Inefficient space utilization plan.

Production Capability..... Satisfactory except for optimistic schedule and lack of attention to long lead procurements.

Quality Assurance Plan..... Satisfactory.

Manpower..... Unrealistic engineering build-up rate.

Financial Capability & Accounting Policy... Generally satisfactory.

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ITEX

FUNDAMENTAL PROBLEM AREAS

- DRUM CURVATURE EFFECT
- SCANNING MIRROR AT HIGH INCIDENCE ANGLE
- NON-IMAGE FORMING LIGHT
- SCAN ANGLE DEPENDENCE OF EXPOSURE
- FILM THICKNESS VARIATIONS
- 14:1 ASPECT RATIO FOLDING FLAT

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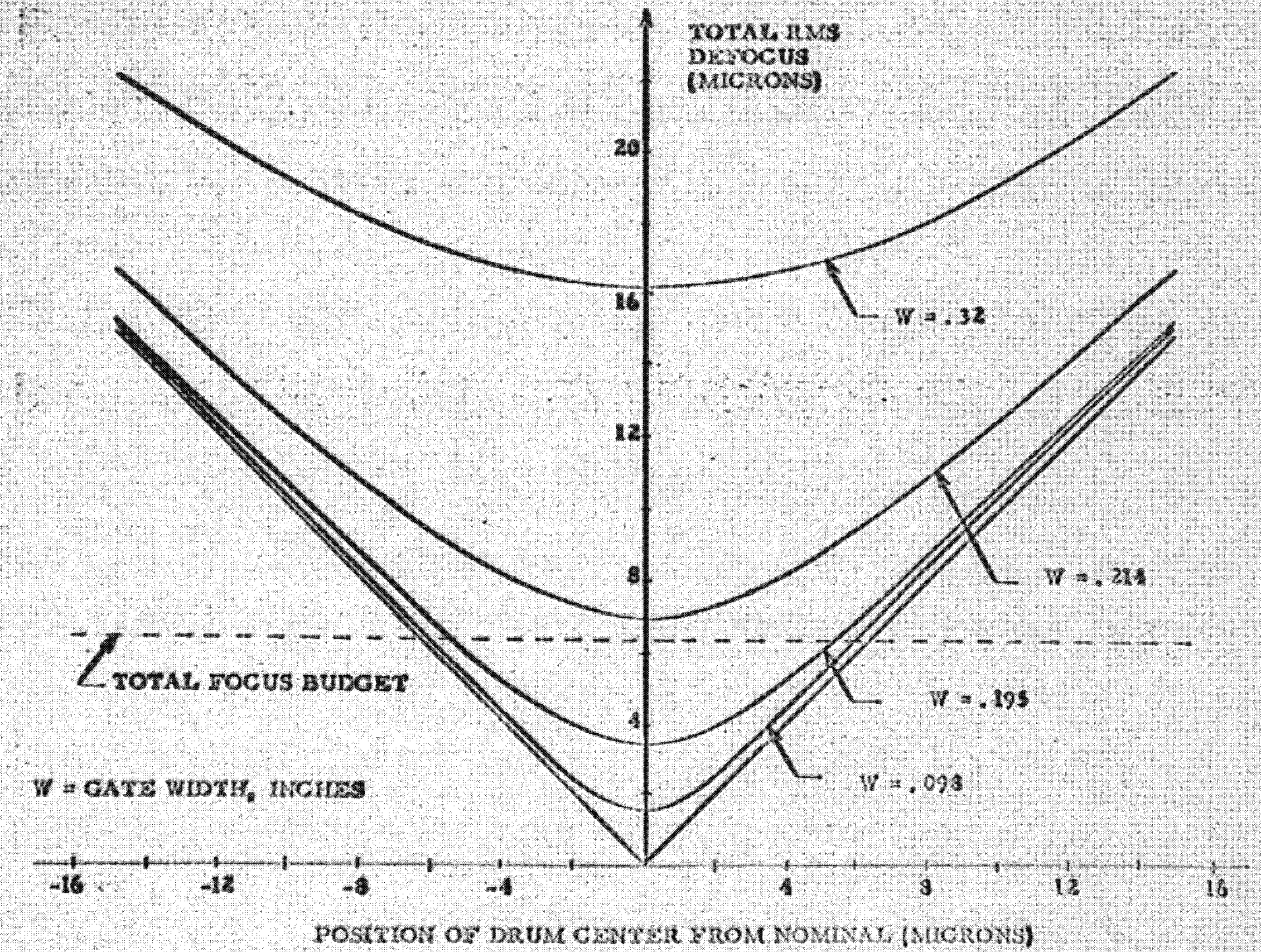
CURVED PLATEN DEFOCUS EFFECT



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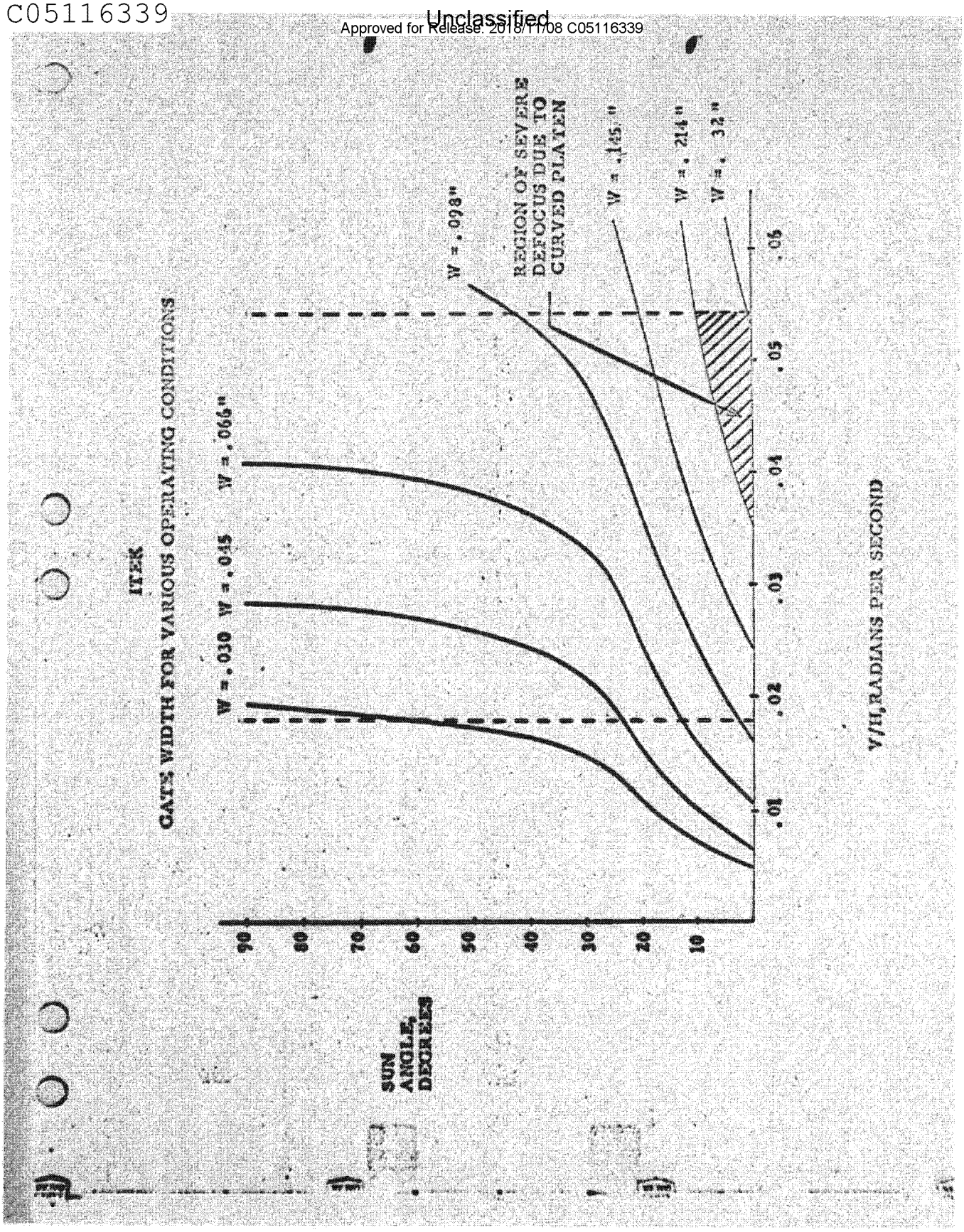

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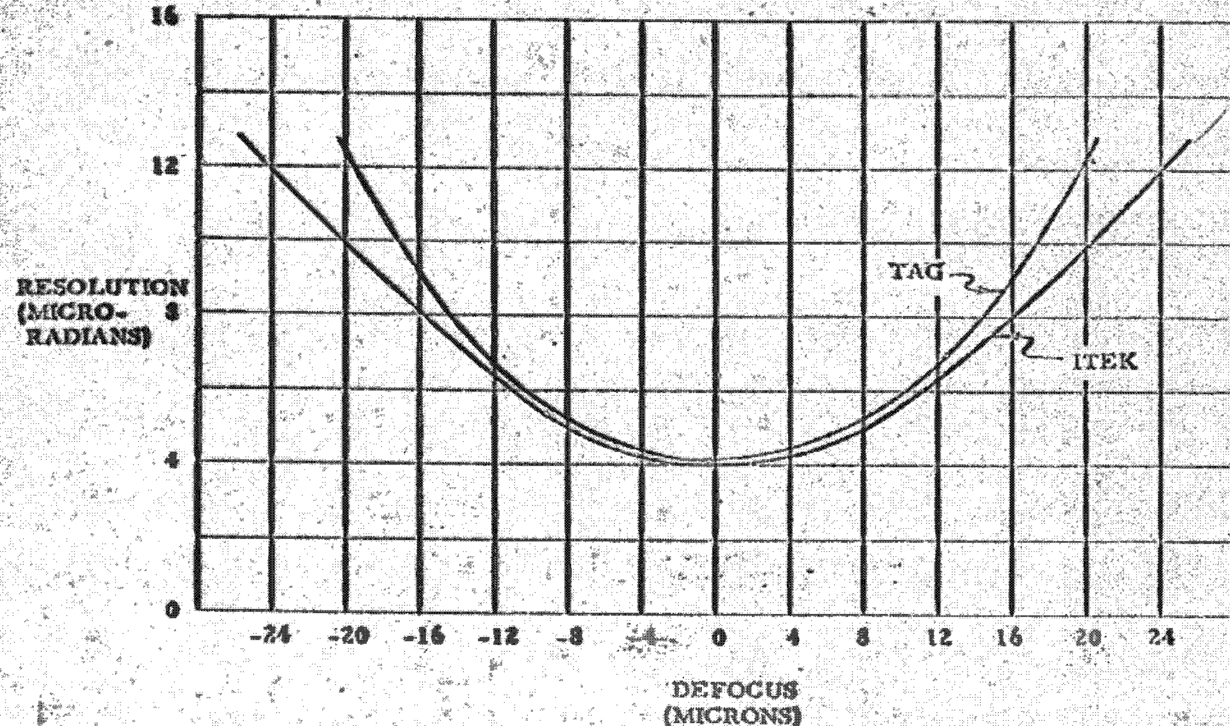
ANGULAR RESOLUTION VS. DEFOCUS



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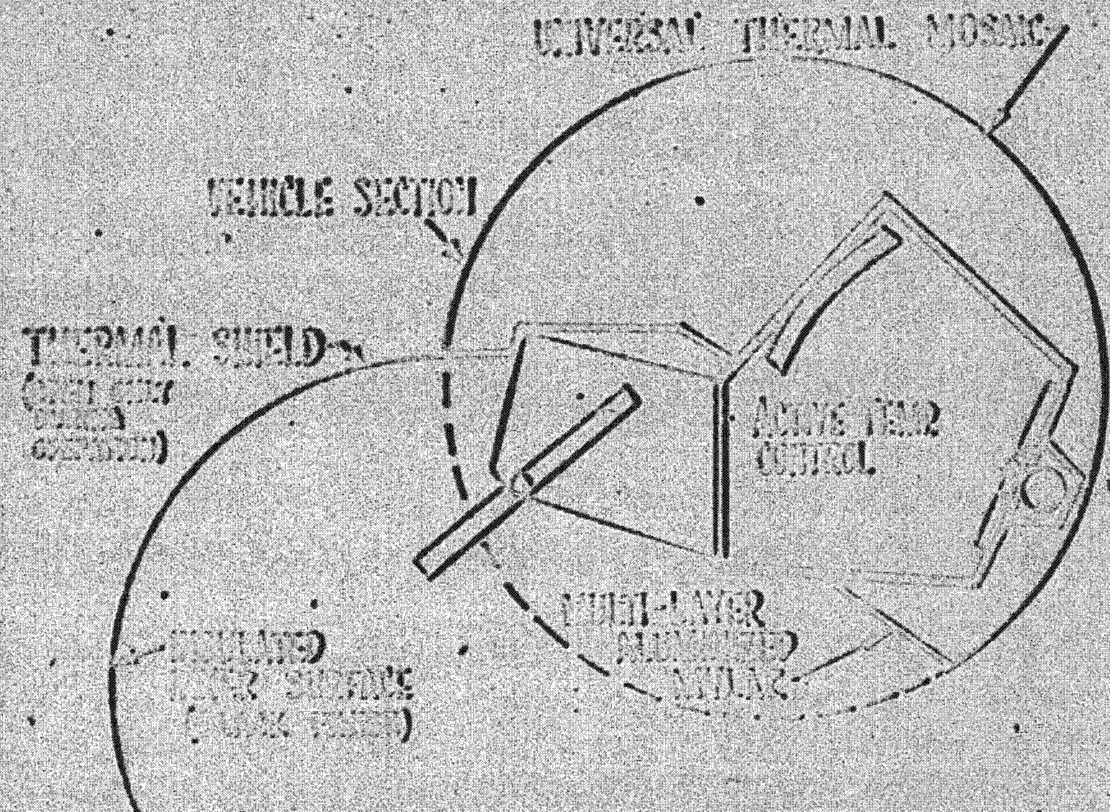
THERMAL CONFIGURATION



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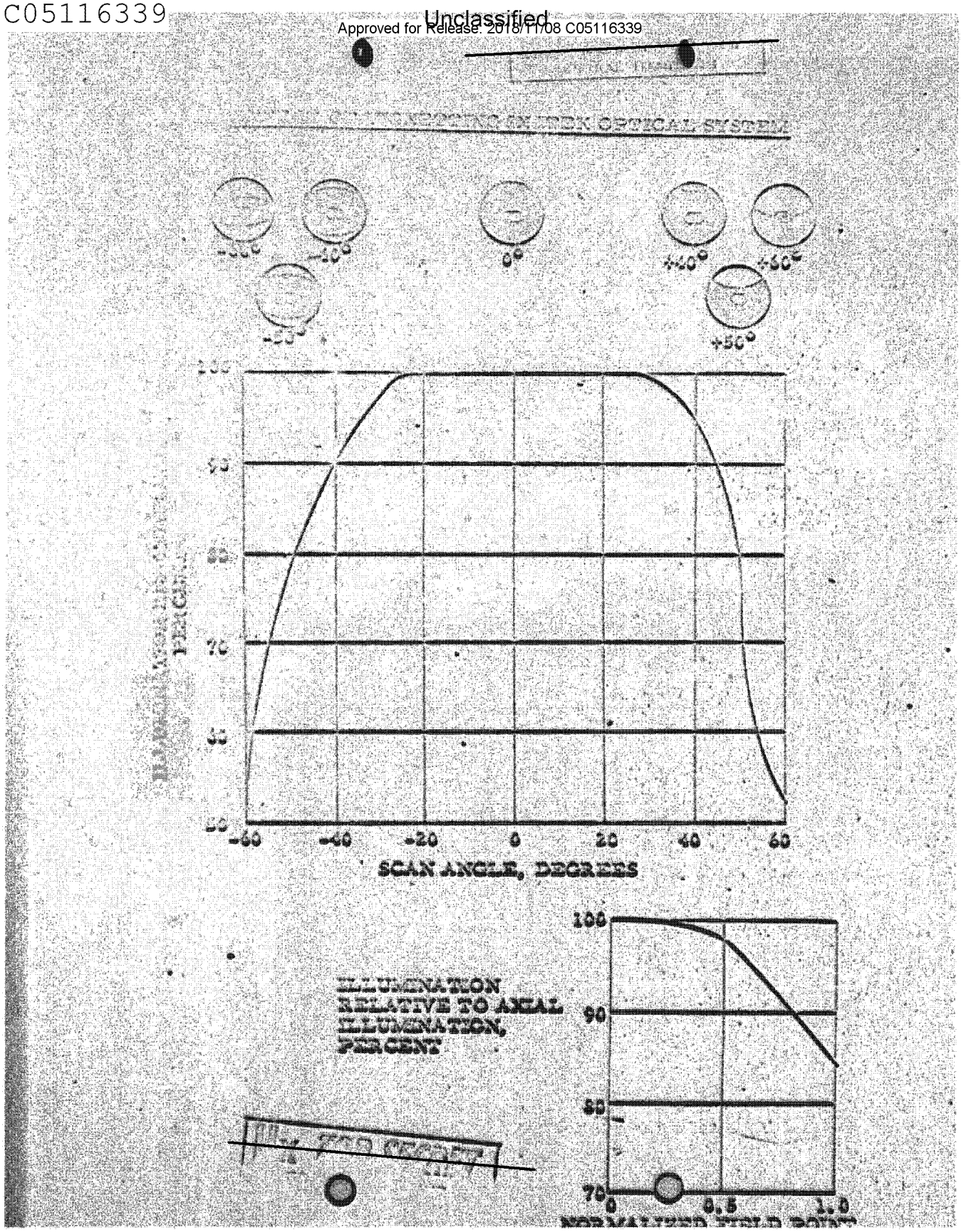

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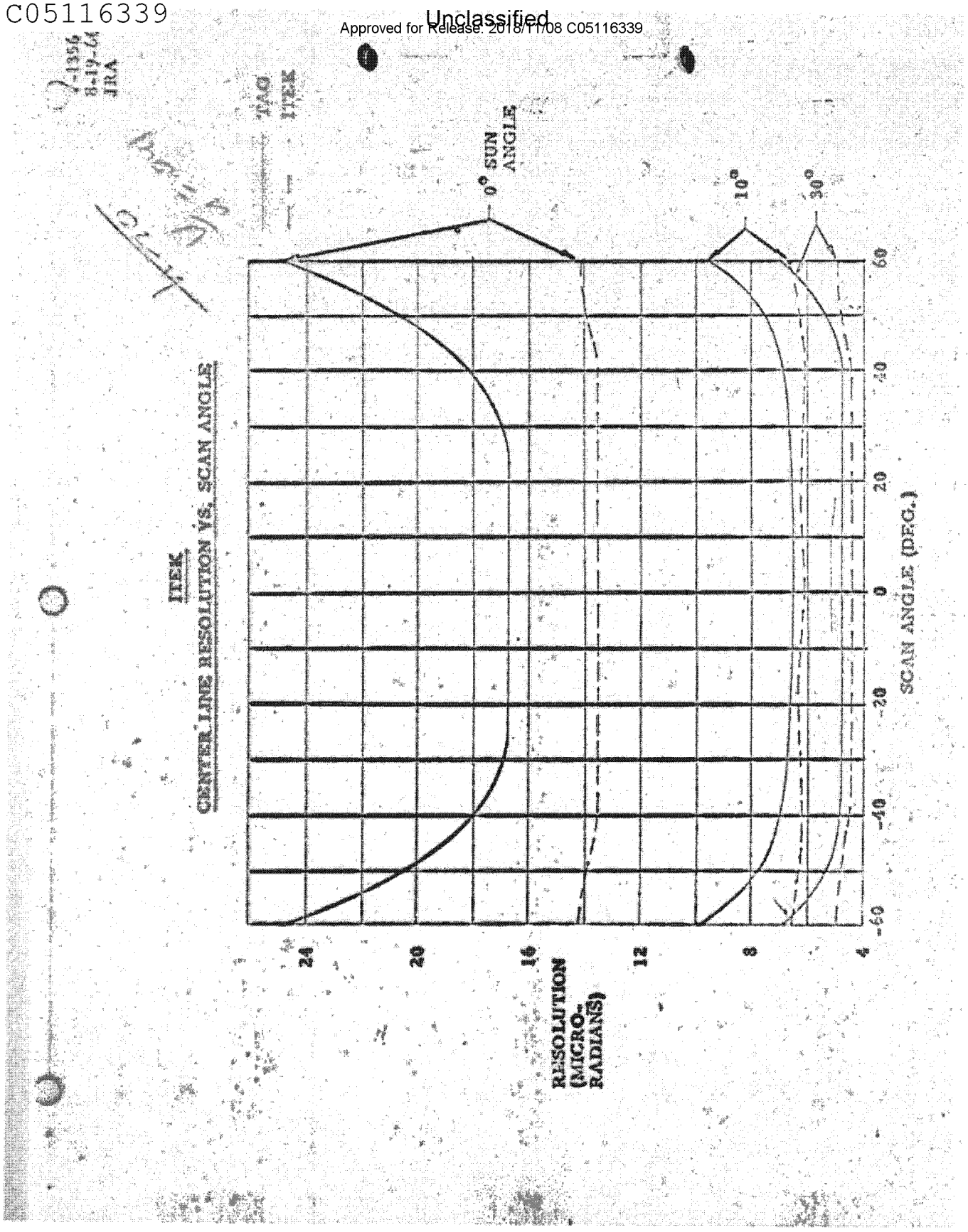

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ITEK PROPOSAL DEFICIENCIES

- SYSTEMS ANALYSIS
- DRUM POSITION SENSOR
- THERMAL DESIGN AND ANALYSIS
  - SCANNING MIRROR GRADIENT
  - FOLDING FLAT GRADIENT
  - FILM CHUTE TEMPERATURE
  - HEATER POWER
- FOCUS SENSOR DESIGN AND ANALYSIS
- TORQUE MOTOR DESIGN AND QUALIFICATION
- SPACE VEHICLE DOOR REQUIREMENT

- FILM DRUM DESIGN
- DRUM/MIRROR SERVO
  - TORQUE DISTURBANCE ANALYSIS
  - "HOT" CAGING
- SCANNING MIRROR SERVO
- FMC SERVO

- REEL DRIVES
- FILM PATH CONTROL
- SHUTTER MECHANIZATION
- TORQUE DISTURBANCES
  - LOOPER ACTION
  - A SYNCHRONOUS START/STOP
- CAGING

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FAILURE RATE DATA

	FAILURES/DAY
RFP REQUIREMENT	0.003
CONTRACTOR ESTIMATE	0.000438
TAG ESTIMATE	
BASED ON CONTRACTOR SUBSYSTEM DATA	0.038
BASED ON CONTRACTOR PARTS COUNT AND MIL-STD COMPONENTS	0.0047
BASEC ON CONTRACTOR PARTS COUNT AND HI-REL COMPONENTS	~0.003
Δ SBA FAILURE RATE ATTRIBUTABLE TO OPERABLE DOORS	(5000 HR MTBF/DOOR* ⇒ $\Delta\lambda$ = 0.0096)

wrong

* equivalent MTBF

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ITEK SENSOR SUBSYSTEM

WEIGHT EVALUATION

ITEM	PRO-OSAL WEIGHT 30-DAYS		EVALUATION WEIGHT 30-DAYS		DELTA WEIGHT
OPTICAL SENSORS	2678		2510		-168 (1)
ICS STRUCTURE	----		155		+155 (2)
SUPPLY AND TAKEUP SPOOLS	360		536		+176 (3)
FILM HANDLING HARDWARE	75		75		----
THERMAL PROVISIONS	----		168 (1)		+168
ELECTRONICS, CABLES & CONNECTORS	125		125		----
WEIGHT EMPTY		3238		3569	+331
FILM (SO-380)	900		1439		+539 (4)
TOTAL SENSOR SUBSYSTEM WEIGHT		4138		[illegible]	+870

NOTES:

(1) THERMAL PROVISION WEIGHT REMOVED TO ALLOW SEPARATE LISTING

(2) IMPROVEMENT OF STEREO ANGLE CONTROL AND CAMERA ALIGNMENT CHARACTERISTICS

(3) RESIZING DUE TO INCREASE IN FILM LOAD

(4) FILM LOAD INCREASE DUE TO WASTAGE, OVERLAP AND NADIR RESOLUTION REQUIREMENTS

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FILM WASTAGE DISTRIBUTION

REQUIREMENT	% OF FILM LOAD
INTER-FRAME SPACING (3/4" PER FRAME)	.7
EDGE SPACING FOR DATA RECORDING (1/2")	4.3
MONOSCOPIC FRAMES DURING STEREO OPERATION (4.5 FRAME/CAMERA)	19.6/18.8*
FRAME-TO-FRAME START TIME UNCERTAINTY (1FRAME/CAMERA)	4.5/4.2*
FRAME-TO-FRAME OVERLAP (3% USEFUL FORMAT)	2.7
TOTAL	35.8/34.7%

* 90/84 NM PERIGEE ALTITUDE

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Attachment 2
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Category 1
Table III

ITEK DEFOCUS BUDGET

• FOCUS SENSOR	
Gain Change	.75 microns
Unbalance (Detector 4%)	.50
Servo Loop Threshold	.75
Penta Deviation	2.2(5.2) microns
• FILM POSITION SENSOR	.62 microns
• FILM DRUM CONTACT	1.0 microns
• DRUM/BEARING ECCENTRICITY	0.38 microns
* (FILM THICKNESS VARIATION)	(2.0) microns
• VIBRATION	1.1
• INITIAL FOCUS SETTING	
Collimator Error	1.0
Determination of Best Focus	2.25
• SCANNING MIRROR DISTORTION	1.1
RSS	5.9 microns
• OBJECT DISTANCE VARIATION	2.24 microns

* This term accounts for film thickness variations which occur at frequencies beyond the the band pass of the focus adjust mechanism.

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ERROR SUMMARY
(30° SUN ANGLE)
(V/h = 0.041)

- MANUFACTURING TOLERANCE .1 λ RMS
- FOCUS
  - RANDOM 5.71 μ
  - MEAN ± 2.24 μ
- LINEAR SMEAR - μ RAD (ACROSS TRACK/ALONG TRACK)

FIELD POSITION/SCAN ANGLE

		60	30	0	-30	-60
MEAN	1.0	.10/-.74	.06/.05	.04/.21	-.11/-.12	-.46/-.96
2σ		.78/.62	.82/.65	.83/.66	.81/.65	.79/.62
MEAN	0.5	.06/-.74	.05/-.06	.06/.07	-.06/-.18	-.39/-.9
2σ		.79/.62	.82/.64	.84/.66	.82/.65	.79/.62
MEAN	0	.02/-.72	.04/-.14	.08/-.03	-.01/-.19	-.33/-.81
2σ		.79/.62	.82/.64	.84/.66	.82/.65	.79/.61
MEAN	-0.5	-.01/-.65	.04/-.18	.10/-.1	.04/-.17	-.27/-.68
2σ		.79/.62	.82/.65	.84/.66	.82/.65	.79/.62
MEAN	-1.0	-.05/-.56	.01/-.19	.12/-.14	.09/-.12	-.20/-.51
2σ		.79/.62	.83/.65	.84/.66	.82/.65	.79/.62

Figure 3.8-2

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SYSTEMATIC LINEAR SMEAR
(WORST LOCATION)

SOURCE	SMEAR RATE (M RAD/SEC) ALONG TRACK	SMEAR RATE (M RAD/SEC) ACROSS TRACK
EDGE EFFECTS		
FORWARD MOTION	.20 (.22)*	.124
EARTH RATE	.059	.032
DISTORTION	.002 (.0009)	.043 (7×10^{-6})
SLIT WIDTH EFFECTS		
FORWARD MOTION	.008 (.015)	.004
SCAN RATE	.046	.001 (.016)
OFFSET SLIT	0 (.059)	0 (.02)
EARTH CURVATURE	.096 (.835)	.084 (.224)
C_L COMMAND APPROXIMATION	(.03)	(.129)

* NUMBER IN PARENTHESIS ARE TAG ESTIMATES

Figure 3.8-3

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LINEAR SMEAR ERROR BUDGET

(WORST LOCATION)

SOURCE	TOLERANCE - 2σ ITEK (S E)	SMEAR RATE (M RAD/SEC) ALONG TRACK	ACROSS TRACK)
SCAN ANGLE ERROR	4 SEC (.5 DEG)	.0008 (.11)	.0002(.09)
FOCAL LENGTH (SYNC DETERMINATION)	.0048 IN	.0 (.001)	.21
DRUM ALIGNMENT	45 SEC	.47	0
VIBRATION			
DIAGONAL MIRROR			
PITCH	(.0002 RAD/SEC)	(.2)	(0)
CRAB	(.000121 RAD/SEC)	(0)	(.1)
CAMERA			
PITCH	.0003 RAD/SEC	(.3)	(.01)
ROLL	.0003 RAD/SEC	.3 (.068)	.3 (.24)
YAW	.0003 RAD/SEC	(.24)	(.3 (.068)
FILM VELOCITY SYNC	.038%	.011	.82
FILM VELOCITY MODULATION	.4% (1.34%)	.0	.002 (.07)
DRUM MODULATION	.4% (2.5%	.038(.24)	.0
$\Delta(V_x/h)$	.00027 RAD/SEC	.252	.034
$\Delta(V_y/h)$	(.00003 RAD/SEC)	(0)	(.03)
SCAN MIRROR RATE	.1% (.8%)	.039 (.312)	.005 (.04)
DRUM DIMENSIONS	10°F (4×10^{-4} IN)	0	.12 (.1)

Figure 3.8-4

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Page 173 of 225

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LINEAR SMEAR ERROR BUDGET

(WORST LOCATION)

SOURCE	TOLERANCE -2σ ITEK (SE)	SMEAR RATE (M RAD/SEC) ALONG TRACK	ACROSS TRACK
CAMERA ALIGNMENT			
PITCH	6 MIN	.035	.03[illegible]
ROLL	6 MIN	.057	.065 (.018)
YAW	6 MIN	.0	.017 (.067)
DIAGONAL MIRROR ALIGNMENT			
PITCH	(5 MIN)	(.05)	(.5)
CRAB	(12 SEC)	(.2)	(.003)
OPTICAL AXIS ALIGNMENT TO ROTATING MIRROR			
PITCH	(1.4 MIN)	(.015)	(.1)
YAW	(4.1 SEC)	(.043)	(0)
VEHICLE ATTITUDE			
PITCH	.5 DEG	.18	.15
ROLL	.5 DEG	.289	.089 (.07)
YAW	.6 DEG	.0 (.03)	.10
VEHICLE RATES			
PITCH	.015 DEG/SEC	.262	.013
ROLL	.015 DEG/SEC	.059	.262 (.25)
YAW	.015 DEG/SEC	.219	.068

Figure 3.8-5

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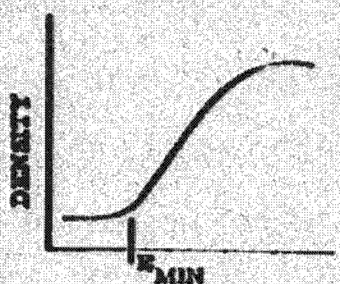
EXPOSURE TIME DETERMINATION

- **METHOD OF COMPUTATION**



$$t = \frac{4 (f)^2 P}{10.8 (T)(2 EI)(B)} \quad ; \quad E.I. = \frac{1}{2 E_{MIN}}$$

NOTES:
- T GIVEN AT ZERO SCAN ANGLE
- FORMULA GIVES GOOD AGREEMENT WITH GRAPHICAL APPROACH
- AIM PENALIZED FOR UNDER-EXPOSURE AT LARGE SCAN ANGLE (2X MAX)

- **VARIATION WITH SUN ANGLE**

SUN ANGLE (DEGREES)	BRIGHTNESS (FT-LAMBERTS)	EXPOSURE TIME (MILLISECONDS)
0	200	2.38
5	240	1.98
10	300	1.59
20	450	1.06
30	600	0.79
60	720	0.66
90	750	0.63

Figure 3.8-6

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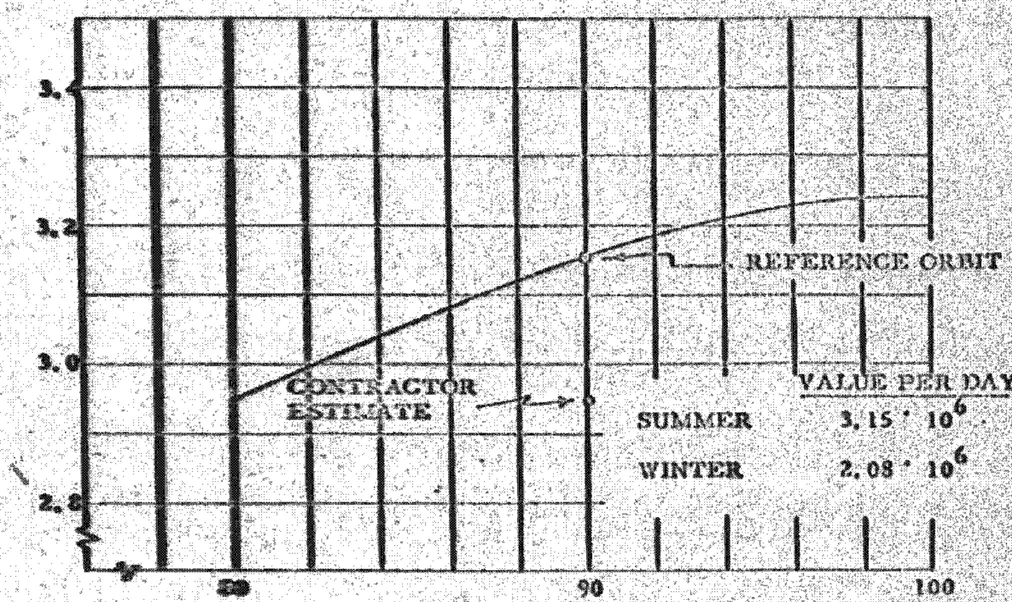
VALUE PER DAY VS. PERIGEE ALTITUDE (SUMMER)

VALUE PER DAY 10^{-6} (NM^2)



PERIGEE ALTITUDE (NM)

Figure 3.9-7

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VALUE PER DAY VS. PERIGEE ALTITUDE (SUMMER)

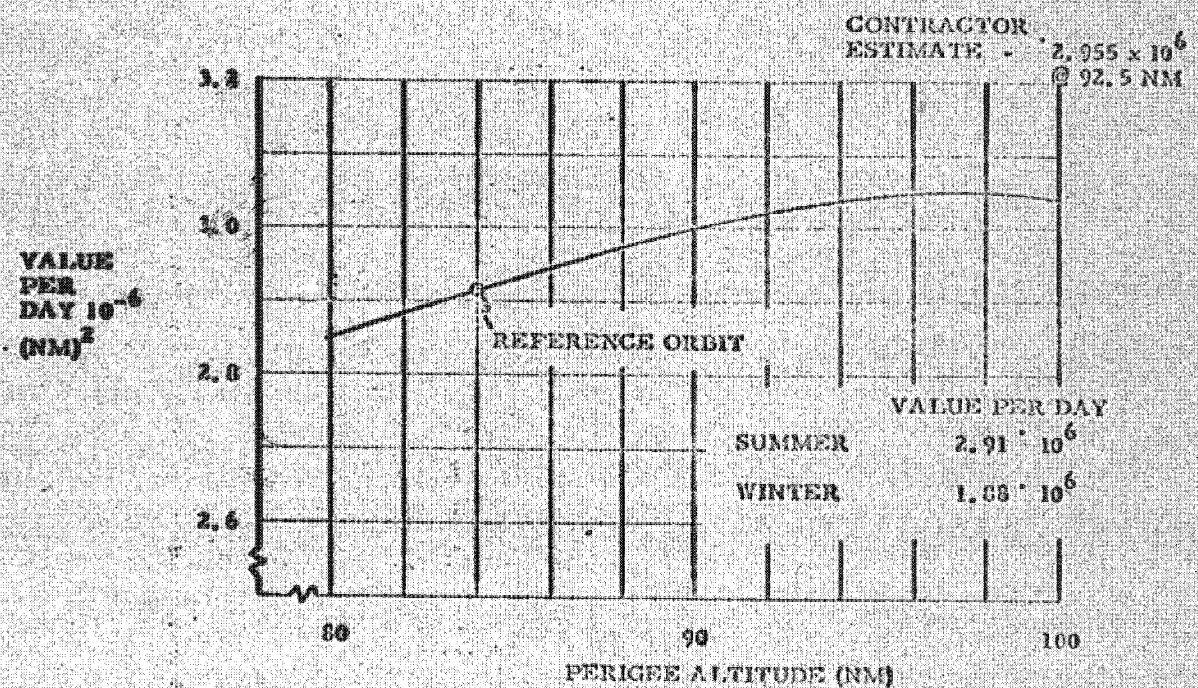

Figure 3.9-10

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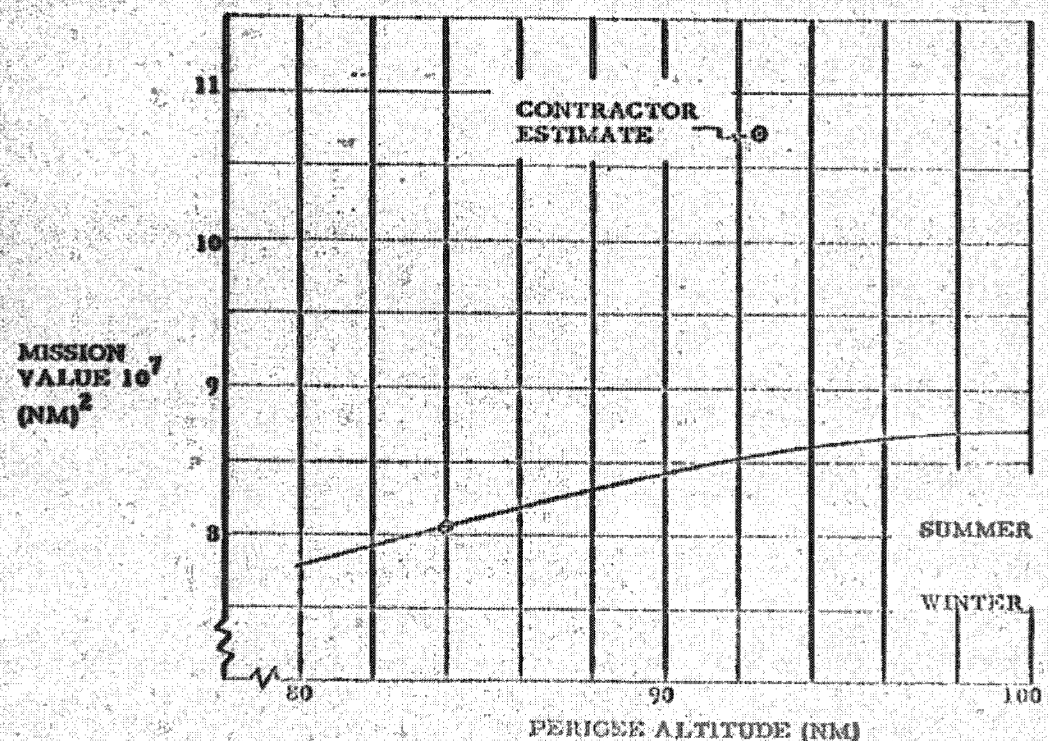
MISSION VALUE VS. PERIGEE ALTITUDE (SUMMER)



MISSION VALUE

SUMMER	UTB	8.06×10^7
	TB	7.28×10^7
WINTER	UTB	5.21×10^7
	TB	4.70×10^7

Figure 3.9-13

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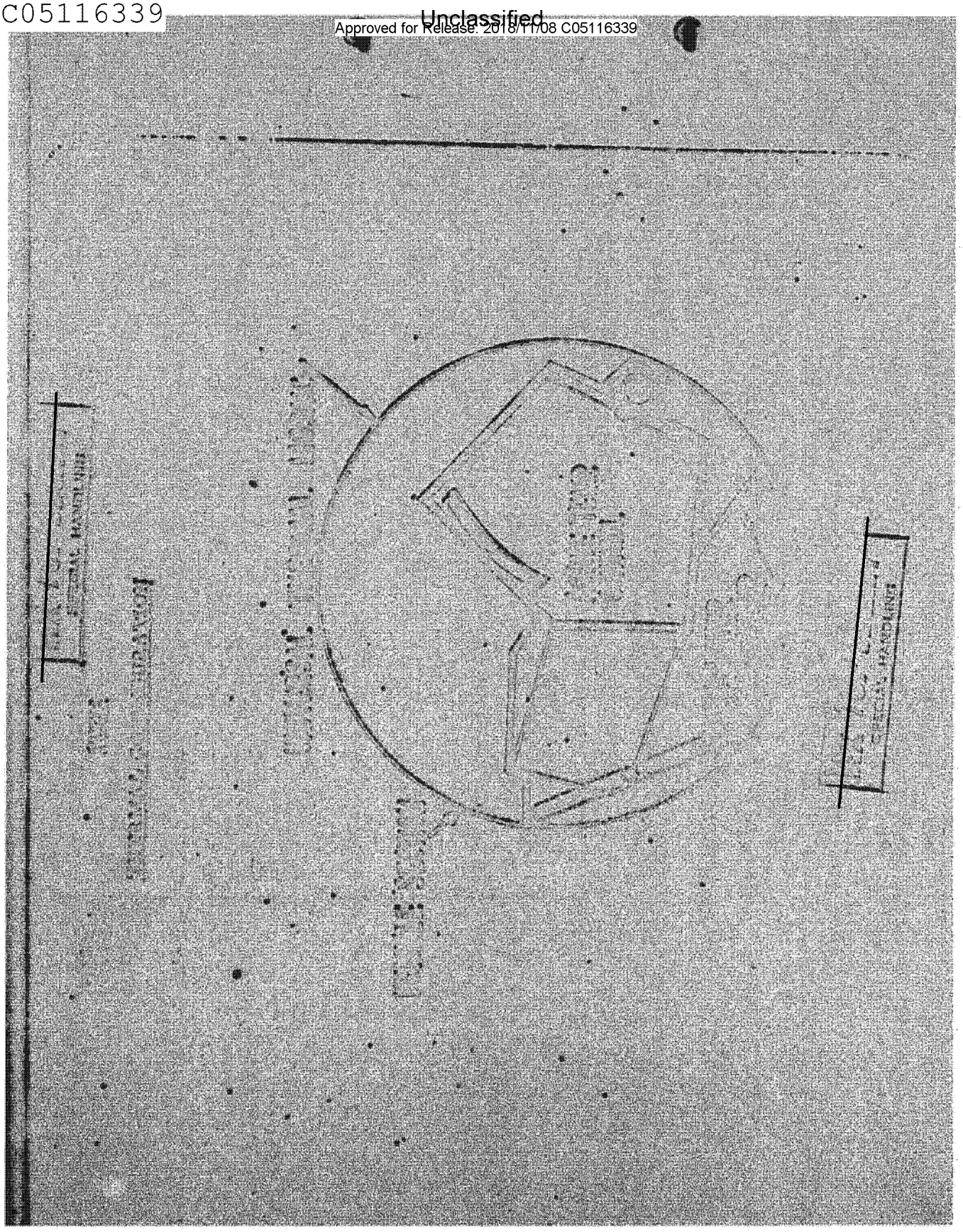

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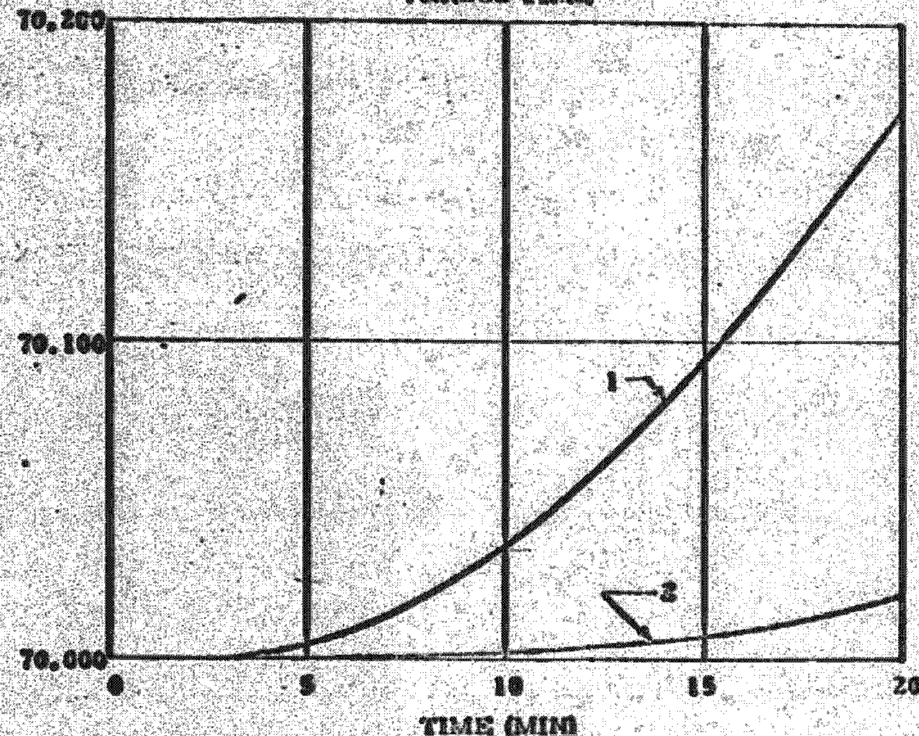
FOLDING MIRROR TEMPERATURE VERSUS TIME



1 BACK SIDE

2 MIRROR SIDE

NOTE:

- Q GRADIENT CAUSED BY HEATING FROM FILM DRIVE ASSEMBLY
  - THIS GRADIENT TENDS TO REDUCE DEFORMATION CAUSED BY INCIDENT SOLAR ENERGY THROUGH THE OPTICAL SYSTEM

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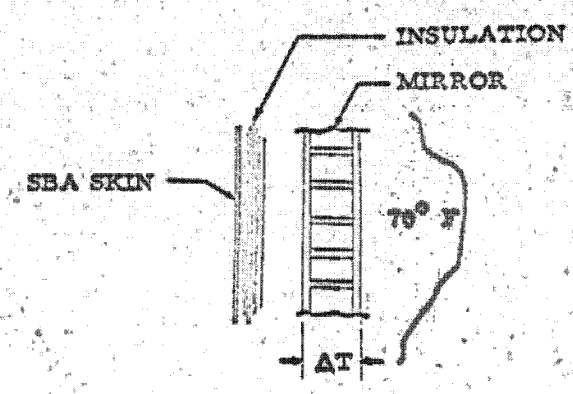
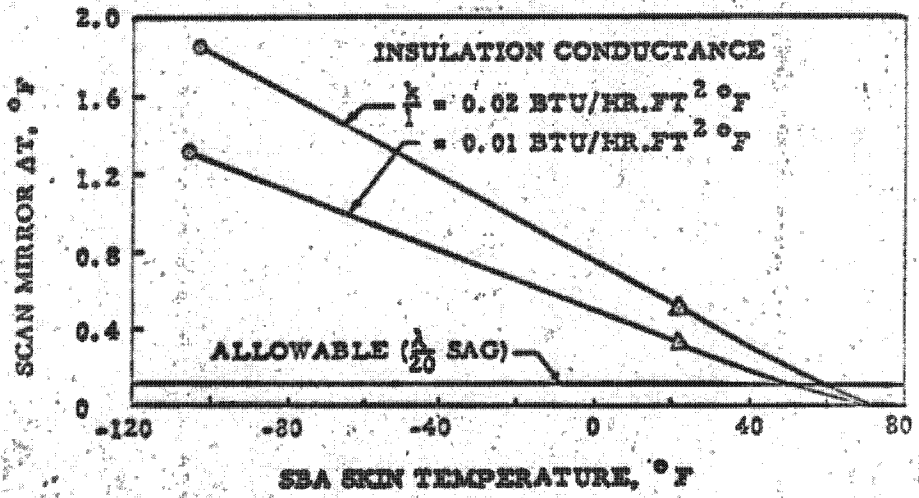
SCANNING MIRROR TEMPERATURE DIFFERENTIAL, ΔT
WITH NO DOOR HEATERS, CRUISE MODE





. SKIN TEMP. (CALCULATED BY TRW):

β	- 60°	+ 60°
T_{skin}	⊙	▲

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ERRORS IN THERMAL CONTROL POWER ESTIMATES

1. ITEK USED (k/ℓ) FOR CRYOGENIC TEMPERATURE RANGE;

   (k/ℓ) FOR ROOM TEMPERATURE IS 10 TO 30 TIMES HIGHER

2. ITEK USED DATA FOR AN "IDEAL" INSULATION;

   REAL SYSTEM WILL HAVE DISCONTINUITIES, CORNERS, FIELD JOINTS, ACCESS HOLES, ETC.

3. ITEK CALCULATED POWER BASED ON NOMINAL SBA TEMPERATURE;

   ANNUAL VARIATION IN SOLAR CONSTANT, PLUS UNCERTAINTIES IN THE THERMAL ENVIRONMENT AND SURFACE PROPERTIES GIVE UNCERTAINTIES OF ABOUT $\pm 19^{\circ}$ F ABOUT NOMINAL TEMPERATURE

4. ITEK NEGLECTED HEATERS ON DOORS AND FILM CHUTES;

   DOOR HEATERS ARE NEEDED TO AVOID EXCESSIVE ΔT IN SCANNING MIRROR

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ITEK FOCUS CONTROL

DEVELOPMENT RISKS

- FILM THICKNESS VARIATION
- PENTA PRISM THERMAL DISTORTION
- SCANNING MIRROR THERMAL DISTORTION
- FOCUS SENSOR NULL AND GAIN STABILITY
- STABILITY OF MECHANICAL STRUCTURE

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PENTA PRISM STABILITY REQUIREMENTS

1. FOCAL SHIFT BUDGET ALLOWANCE = 2.2 MICRONS FOR TWO PENTAS
2. PRINCIPAL KNOWN CAUSE OF PENTA DEVIATION CHANGE IS TEMPERATURE VARIATION
3. FOCAL SHIFT FROM A SINGLE PENTA = 0.93 MICRON/°F FOR THE PROPOSED PENTA DESIGN
4. FOCAL SHIFT FOR TWO PENTAS = 1.86 MICRON/°F, ASSUMING SAME TEMPERATURE CHANGE FOR EACH PENTA
5. THERMAL CONTROL REQUIRED FOR PENTAS = ± 1.2 °F, NEGLECTING PENTA DEVIATION CHANGES OTHER THAN THERMAL
6. A 1 MICRON FOCAL SHIFT CORRESPONDS TO 0.1 SEC RAY DEVIATION CHANGE FOR A SINGLE PENTA

1.86
2.6
1488
372
5.208

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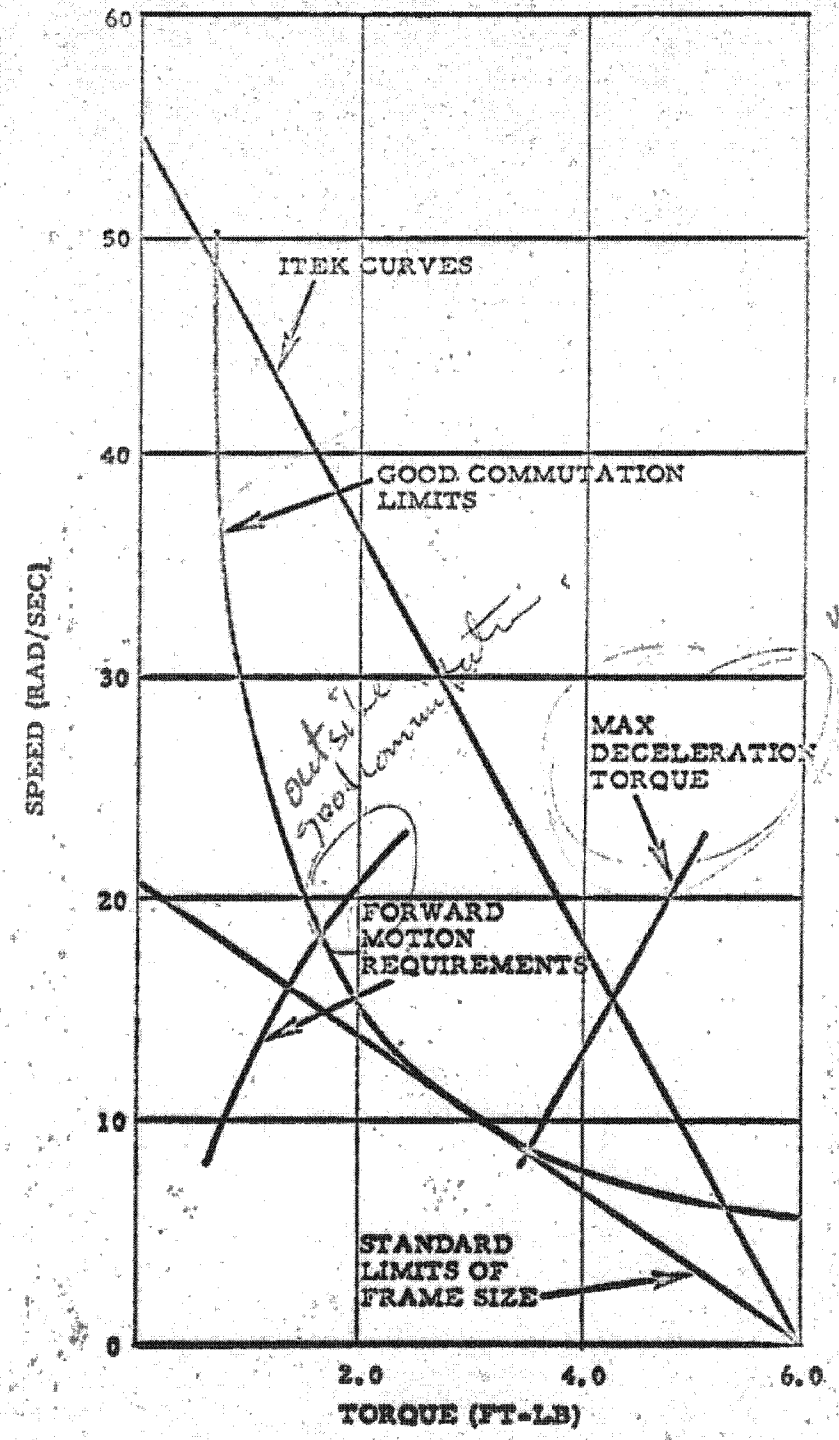
ITEK DRUM DRIVE MOTOR

PER ITEK DATA (INLAND T-5002)



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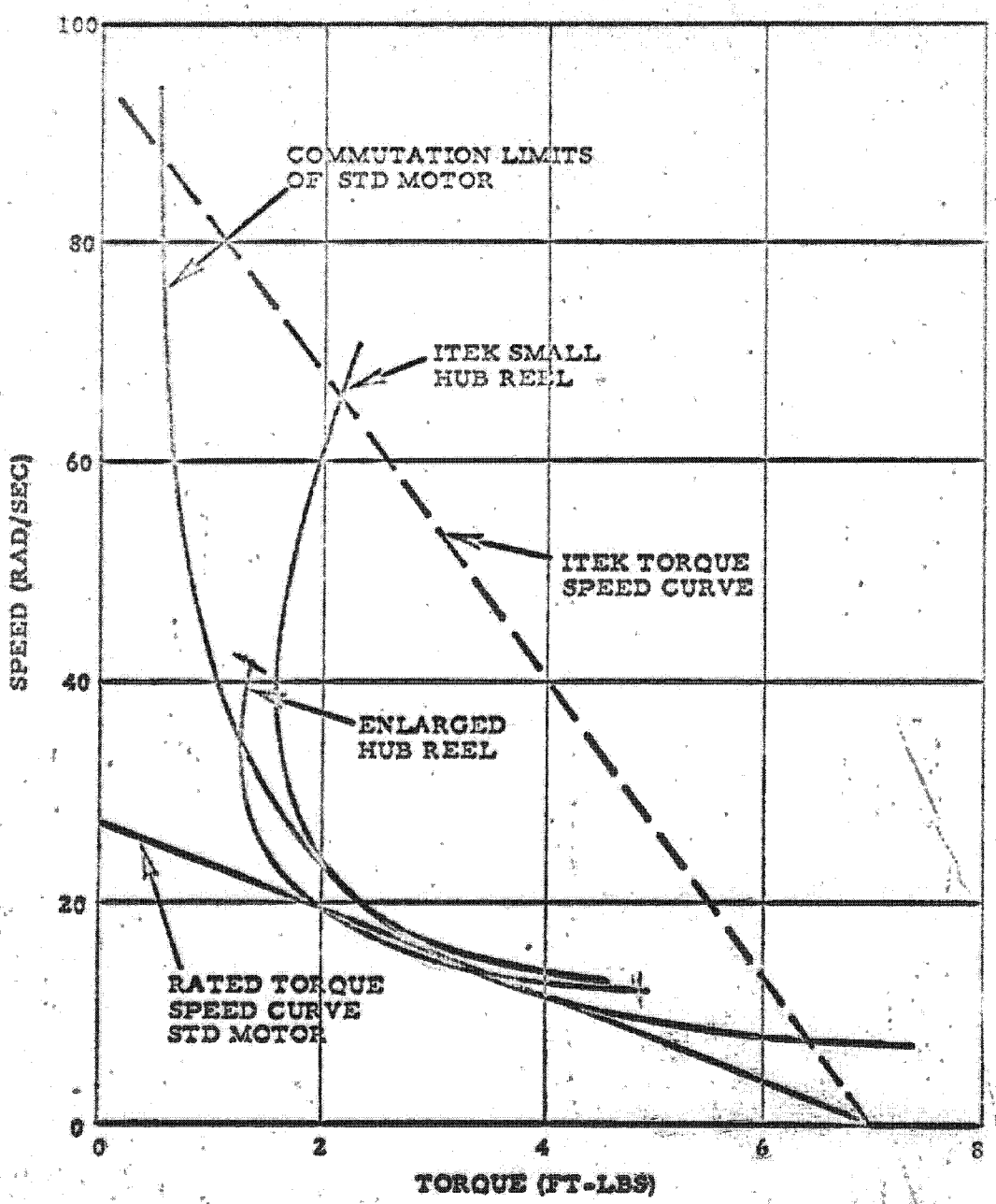
TAKE-UP REEL DRIVE MOTOR



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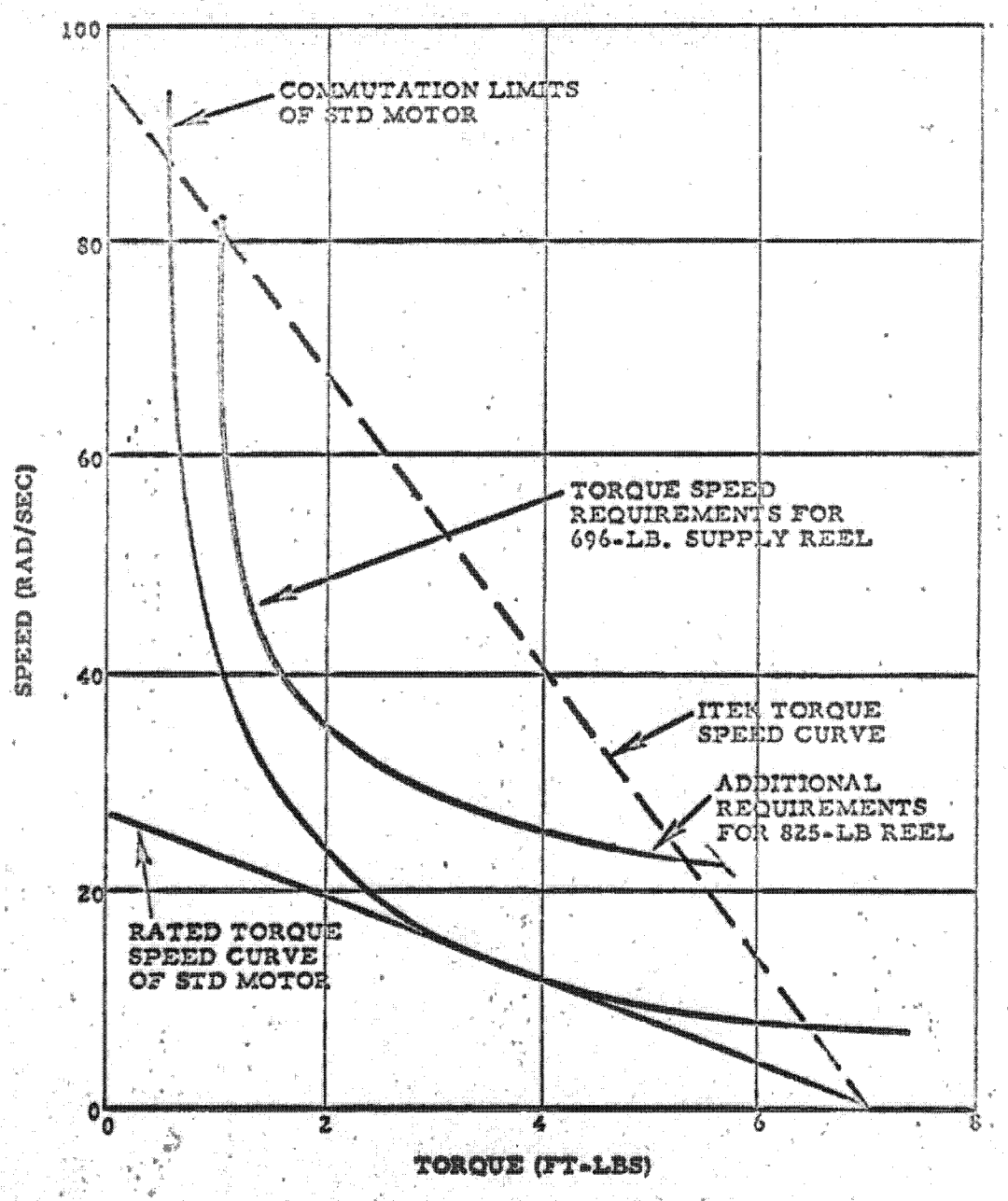
SUPPLY REEL DRIVE MOTOR



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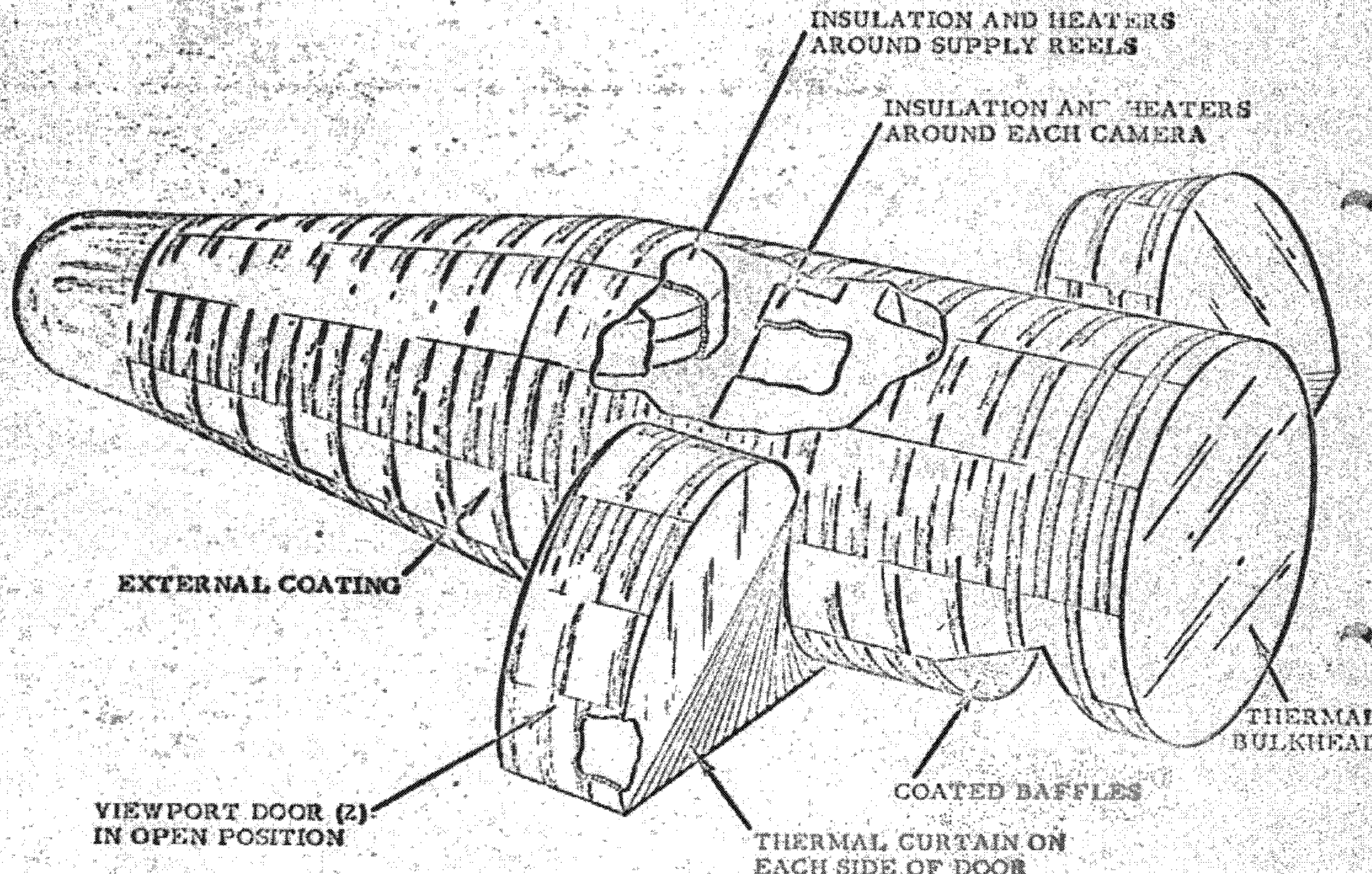
VIEWPORT DOOR AND THERMAL CONFIGURATION



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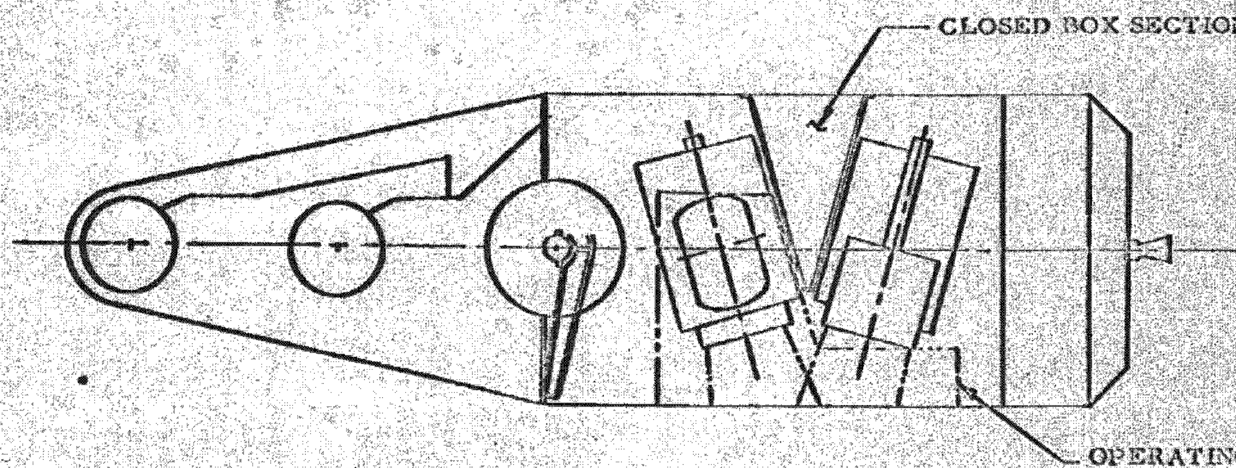
ALTERNATE ITEK SV LAYOUT



- ONE NON-LOAD CARRYING EJECTABLE STRUCTURE - EASIER DESIGN
- NO SEPARATION SHOCK LOADS - USE PIN-PULLERS/SPRINGS
- SHORT OPEN-SECTION PARTS OF STRUCTURE REQUIRE HEAVY DESIGN
- OPERATING DOOR TRAJECTORY IN YZ PLANE - EASIER DESIGN
- OPERATING DOORS EACH ~ 120° OF ARC
- CLOSED BOX SECTION SUPPORTS CAMERAS' ASCENT LOADS
- CLOSED BOX SECTION REDUCES INTER-CAMERA STRUCTURE WEIGHT

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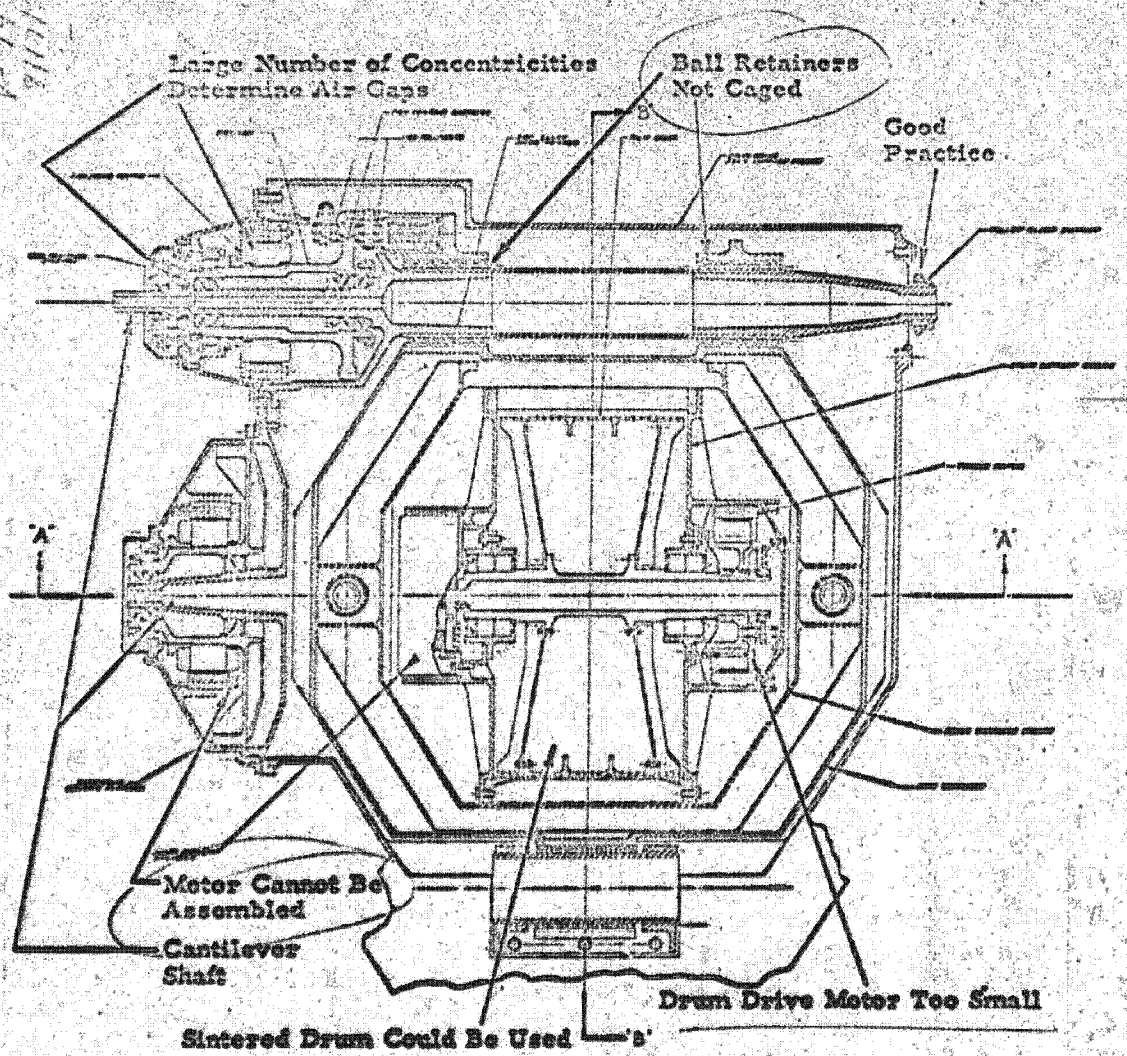
ITEK - DRUM LAYOUT



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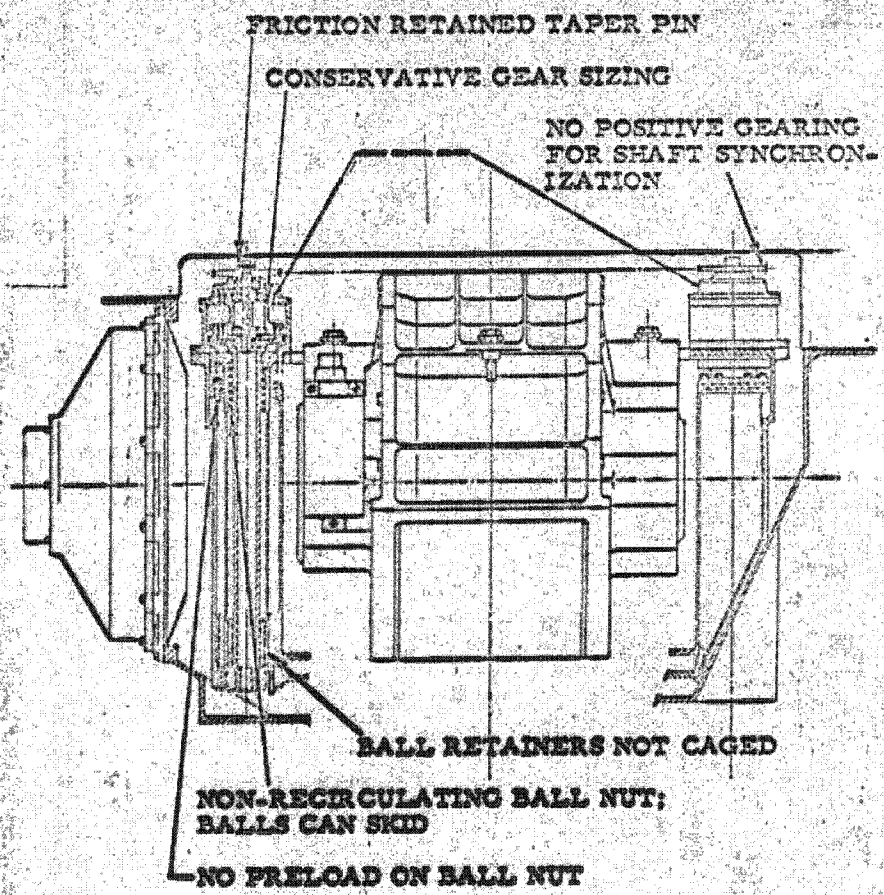
FOCUS ADJUST LAYOUT



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ITEK - MIRROR DRIVE SERVO PERFORMANCE

MAJOR ERROR SOURCES	ITEK ESTIMATE	TRW ESTIMATE OF ITEK SYSTEM	TRW ESTIMATE OF "BEST" SYSTEM
TACHOMETER	NONE AVAILABLE	.8%	.1%
SUMMING AMPLIFIER	"	.24%	.24%
DISTURBANCE TORQUE EFFECTS	"	.9%	.1%
TOTAL SERVO PERFORMANCE (RSS)	.12%	1.23%	.244%
REQUIRED SERVO PERFORMANCE	.12%	.25%	.25%

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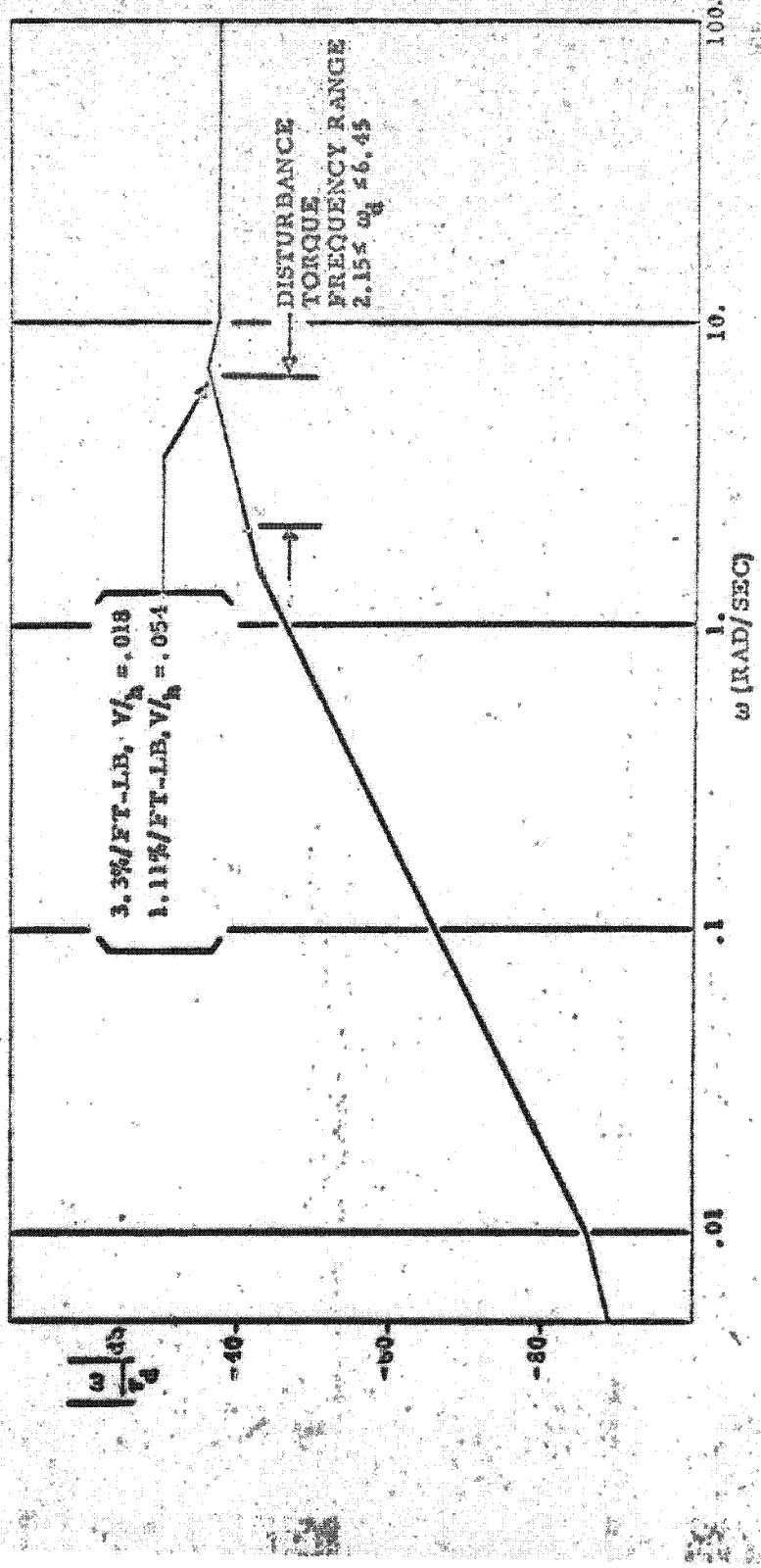

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ITEK - FMC SERVO PERFORMANCE
(LINEAR VELOCITY ERRORS)

MAJOR ERROR SOURCES	ITEK ESTIMATE	TRW CONSERVATIVE ESTIMATE	TRW "BEST" ESTIMATE
CAM PROFILE	.82%	.82%	.2%
BEARING ECCENTRICITY	NOT AVAILABLE	.02%	.02%
CAM FOLLOWER ERROR	NOT AVAILABLE	.002%	.002%
SERVO FOLLOWING ERROR	.6%	2.58%	1.38%
SYNCHRO COMBINATION	NOT AVAILABLE	.43%	.43%
PRE-AMPLIFIER	NOT AVAILABLE	.2%	.2%
TOTAL SERVO PERFORMANCE (RSS)		2.75%	1.47%
REQUIRED SERVO PERFORMANCE	.4%	≤2.5%	≤2.5%

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ITEK REEL SERVO EVALUATION

ADVANTAGES

- LINEAR DESIGN
  - PROVIDES ADEQUATE STABILITY OVER LARGE RANGES OF SPOOL RADIUS AND INTERIA
  - LEADS TO PRACTICAL, SIMPLE MECHANIZATION

DISADVANTAGES

- INADEQUATE MOTOR SIZING
- NO ROOM FOR GROWTH BEYOND 30-DAY MISSION WITH PRESENT CONCEPTS
- ABSENCE OF TACHS ON SPOOL SHAFT POSES RELIABILITY PROBLEM

PROPOSAL COMMENTS

- SYSTEM DESIGN AND ANALYSIS POORLY PRESENTED
- DUAL MODE (NORMAL-CORRECTION) BEHAVIOR NOT ANALYZED
- READY MODE BIAS OMITTED
- SPOOL HUB RADII TOO SMALL

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FILM TRANSPORT SUMMARY

- DESIGN PHILOSOPHY LEADS TO COMMENDABLY SIMPLE SERVO SYSTEM
  - SIMPLE COMMAND AND COMMAND AND CONTROL THROUGH USE OF ENCODER ON MIRROR AND OF STEP OR RAMP COMMANDS
  - WELL DESIGNED REEL DRIVE SERVOS WITH STRAIGHT FORWARD LINEAR SIGNAL PROCESSING AND FEW SENSORS
  - DRUM AND FMC SERVOS CAN MEET PERFORMANCE REQUIREMENTS (WITH ADEQUATE DRUM DRIVE)
  - IMC AND FMC COMMAND GENERATION COMPARATIVELY SIMPLE
- DESIGN NOT WELL EXECUTED
  - DRIVE MOTORS GROSSLY UNDERSIZED
  - BRUSH AND LUBRICANT PROBLEMS IN VACUUM IGNORED
  - SERVO ANALYSES INCOMPLETE
  - ERROR ANALYSES AND BUDGET INCOMPLETE
  - FILM GUIDANCE NOT TREATED
  - MECHANICAL DESIGN NOT WELL SUITED TO SURVIVE BOOST
- DEVELOPMENT COST AND SCHEDULE PROBABLY OPTOMISTIC
  - EXTENSIVE REDESIGN NEEDED
  - PROPOSED TESTING AT COMPONENT LEVEL INADEQUATE

Torque disturbances

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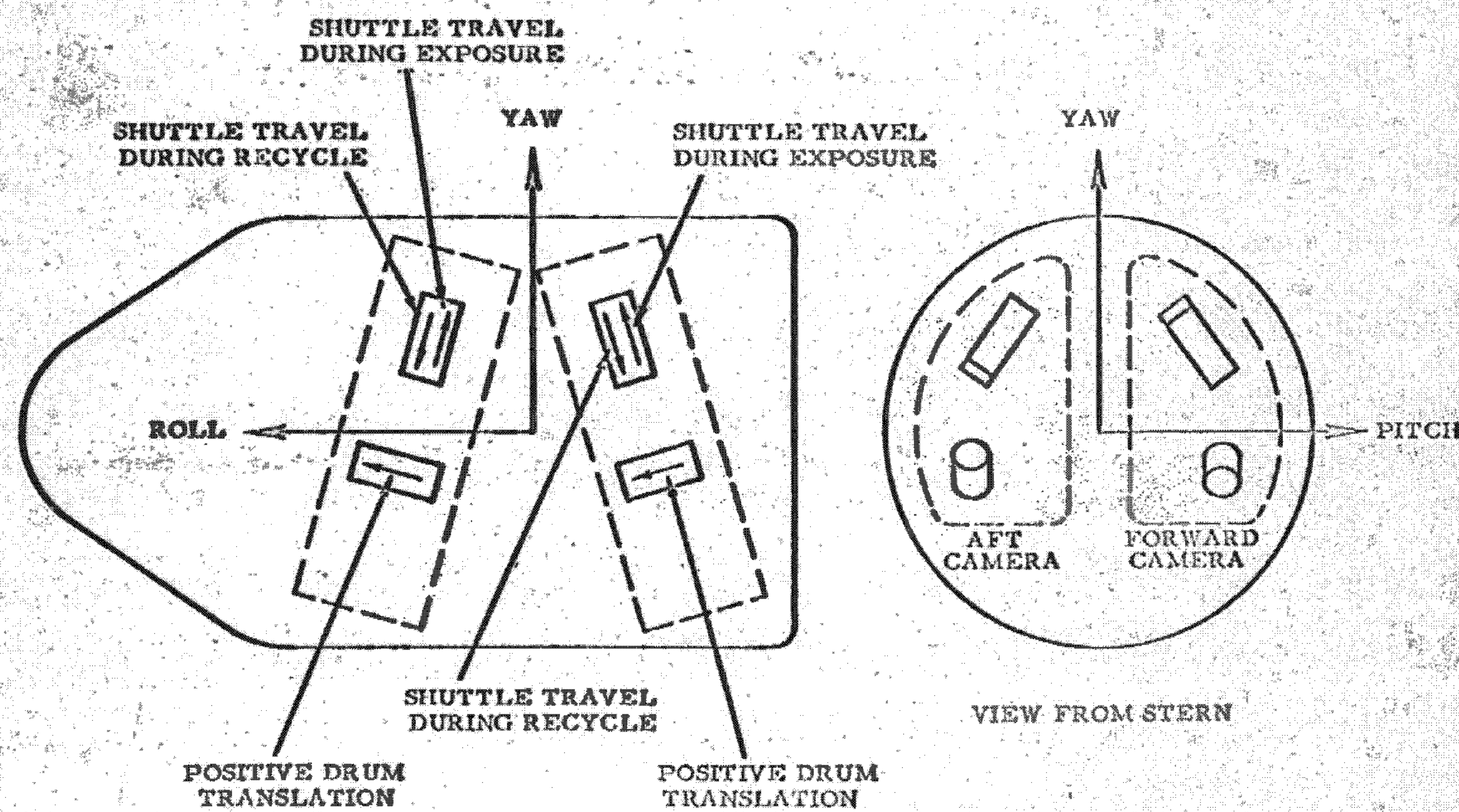
TRANSLATING MASS GEOMETRY



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ITEK PERIODIC DISTURBANCE TORQUES

- **LOOPER SHUTTLE LINEAR MOMENTUM**

  EXPOSURE DIRECTION: $mV = \frac{2}{32.2} \times \frac{15.3}{12} = 0.0791$ LB SEC

  RECYCLE DIRECTION: $mV = \frac{2}{32.2} \times \frac{23.7}{12} = 0.123$ LB SEC

- **DRUM TRANSLATIONAL MOMENTUM**

  POSITIVE VELOCITY: $mV = \frac{70}{32.2} \times \frac{.6}{12} = 0.109$ LB SEC

  NEGATIVE VELOCITY: $mV = \frac{70}{32.2} \times \frac{1}{12} = 0.218$ LB SEC

- **POTENTIAL SERIOUS ROLL PROBLEM**

  $\Delta H = \bar{m}VR = 3.4\,(.079 + .123) = .68$ FT LB SEC

  SPACECRAFT ROLL RATE $= \frac{\Delta H}{I} = \frac{.68}{3000} \times 57.3$

  $= 0.013$ DEG/SEC

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ITEK DISTURBANCE TORQUES DURING PAYLOAD START/STOP

I. STEREO OPERATION

YAW ANGULAR MOMENTUM CHANGE DURING START	= 6.75 FT. LB. SEC. (V/h=0.054)

II. MONOSCOPIC OPERATION

(MOMENTUM CHANGES ABOUT AXES OF ROTATION)

AVERAGE SUPPLY REEL START	37.3 FT. LB. SEC.
AVERAGE TAKE-UP REEL START	13.45 FT. LB. SEC.
SINGLE MIRROR START (V/h=0.041)	9.8 FT. LB. SEC.
SINGLE DRUM START (V/h=0.041, UNCOMPENSATED BY MOMENTUM WHEEL)	0.4 FT. LB. SEC.

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WASHINGTON, D.C.

THE NRO STAFF

2 March 1967

MEMORANDUM FOR DR. FLAX

SUBJECT: HEXAGON Sensor Source Selection Debriefing for ITEK

The attached briefing charts are those which Mr. Dirks plans to use tomorrow (1300 hours) in his debriefing for ITEK on their HEXAGON proposal. You requested to see these prior to his debriefing. At TAB A is the memorandum on the subject debriefing which we provided to you on February 8, 1967.

If you have any comments on these charts we will forward them to Mr. Dirks.

JAMES H. MARSHALL
LtColonel, USAF

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HANDLE VIA BYEMAN CONTROL SYSTEM

~~ISI~~ NATIONAL RECONNAISSANCE OFFICE
WASHINGTON, D.C.

THE NRO STAFF

8 February 1967

MEMORANDUM FOR DR. FLAX

SUBJECT: HEXAGON Sensor Source Selection Debriefing for ITEK

In accordance with the attached memorandum from General Stewart, I have tentatively scheduled the debriefing for ITEK for either February 28, March 1, or March 3. Mr. Dirks will make the presentation.

Mr. Philbrick indicates the following ITEK personnel will attend:

Mr. Philbrick
Mr. Levison
Mr. Wolf
Mr. Robinson
Mr. Morser

Your desires are requested as to:

a. Reviewing the debriefing prior to presenting it to ITEK. / would like to see charts.

b. Whether you plan to attend. If you do, we will arrange the schedule accordingly and plan to hold it in your office. If not, the briefing will be held at the CIA. don't plan to attend

David L. Carter
DAVID L. CARTER
Colonel, USAF

I gave him Tuesday the option if further discussion with me if he still felt it was necessary after the briefing

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WASHINGTON, D.C.

THE NRO STAFF

February 6, 1967

MEMORANDUM FOR COLONEL CARTER

SUBJECT: Sensor Source Selection Debriefing for Itek

Dr. Flax has agreed to a request from Messrs. Lindsay/Philbrick for a Sensor Source Selection Debriefing on the Itek proposal sometime after February 16. Dr. Flax asked me to make the necessary arrangements. He was very specific that this was not to be a comparison briefing of the two proposals, but rather a critique of both the strong and weak points (as we saw them) of only the Itek proposal. I gather Dr. Flax emphasized to the Itek people that there was no question of the technical feasibility of their proposal.

I have informally requested Mr. Dirks to work on this task. Please do the following:

1. Contact Mr. Philbrick and confirm that the briefing will be given and get some tentative dates after February 16.

2. Confirm in writing to CIA the requirement for this debriefing.

3. Discuss with Dr. Flax his desires as to reviewing the debriefing critique prior to its presentation to Itek or else participating in the session.

James T. Stewart
Major General, USAF
SAFSS

cc: Gen Berg

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March 10, 1967

The Honorable Alexander H. Flax
Assistant Secretary of the Air Force
The Pentagon
Washington, D. C.

Dear Al:

We are most appreciative for your helpfulness in arranging for a technical review of our recent proposal. This was held on March 3 and attended by Dick Philbrick, Walt Levison and three others of the design team. I am enclosing a copy of Dick's memo to me on the meeting which I think you will find of interest.

As Dick notes, we are satisfied that we did not make a major design mistake and I hope, even more importantly, that you will agree. For our part we now consider the subject "ancient history." However, if you have any remaining questions I know Dick or any of the others would be pleased to go over the matter with you.

Sincerely,

Franklin A. Lindsay

FAL:jmm
Enclosure

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March 10, 1967

To: Franklin A. Lindsay

From: R. W. Philbrick

The briefing which Dr. Flax arranged was received by us last Friday. It was very informative and I am no longer concerned about the possibility of our having committed a gross technical error in our proposal, and in particular of any failure to take into account the defocussing effect of the curvature of the drum in our performance analysis. Although during the March 3 debriefing Les Dirks included drum curvature as the first in a list of fundamental problem areas, he stated that he had only speculated that if we had failed to take this into account it would explain the difference between the results of the committee performance analysis and the performance analysis included in our proposal. Our own investigations have confirmed the fact that the drum effect had indeed been included in our proposal. You will remember that we had stated this to the committee when that specific point had been raised with us during their full-scale technical evaluation at Itek preceding the award.

Of far greater importance is the fact we learned at the briefing that the evaluating committee had recomputed performance (daily value and mission value) of our equipment at an operational altitude of 84 miles as compared with our recommended altitude of 93.3 miles. This was done to achieve a nadir resolution of 2.7 feet after an added 4 micron defocus error was put into the budget by the committee to account for film thickness variations. We had of course recognized the existence of such thickness irregularities and had compensated for them by the inclusion of a film plane sensor. Les explained that the committee had received information from Eastman Kodak indicating that significant thickness variations could occur every 8 inches. If this is correct, our proposed drum position servo would have to operate at frequencies beyond the capabilities of our proposed mechanization. This was new information to us. Had we known of this we could

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have designed our control loop so that it would not have been necessary to lower the operational altitude.*

The committee's increased focus budget thus lowered the computed resolution, and to compensate for this they decreased our proposed operational altitude. To achieve appropriate exposure, the committee then opened the slit wider (to .320" at very low sun angles) to compensate for the faster film drum speed introduced by the lower altitude. Because of the curvature of the drum an additional deterioration of the computed image quality at low sun angles resulted. Most of the image degradation, however, comes from the low contrast presented to any system at very low sun angles. The defocussing caused by the wider slit introduced into the committee's performance analysis degraded computed performance by approximately another 20%.

Of still more crucial importance is the value function. Les told us that the effect of the recomputation was to increase the daily value, but to lower the mission value. The dominant factor in the recomputation was the increased film usage estimated by the committee to be approximately 50%. This additional film usage was due, according to Les, primarily to an inconsistency in our proposal in which we failed to include the effect of the monoscopic operation at the beginning and end of each photographic run in computing the value function. We believe, however, that the most significant increase in computed film usage comes from the decrease in altitude since, for the same coverage, approximately 25% more film is required at 84 miles than 93.5 miles. The inconsistency noted by the committee (and which we acknowledge) requires approximately 70 frames (6.75 lb.) of monoscopic photography per day which would increase our expendables from 131.79 per day to 138.54 per day (5.1% increase) and this would decrease the nominal lifetime from 54.1 days to 51.6 days. This latter point, when raised with us during the proposal evaluation meetings, was answered by the statement that although the problem was inherent to all stereoscopic systems it is correctable and the cost is proportionate to the inertias involved.

---

* In the earlier design study we had measured the thickness variations in individual lots of film in this category. Over thousands of feet measured, we found these variations to be less than a third of the Eastman specification.

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Several other points were discussed both pro and con our system, but these were the main things affecting the value function. We were very pleased to hear Lee state in the wrap-up that in his opinion our proposed system could be built without major redesign.

Dick Phillips

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May 15, 1967

MEMORANDUM FOR GENERAL MARTIN, SAFSP

1. I have just finished reviewing a recent P&E trip report from Bill Johnson. Following are three comments extracted from this report for your information:

a. The fact that there is no agreement on such basic items as the outside diameter of the camera section, two or four EVs, the pad checkout philosophy, and even which way is up (the common coordinate system) is symptomatic of the basic divided management problem.

b. The relatively rigid attitudes displayed at the meeting is an indication that the degree of good will and spirit of cooperation which is required to make this management arrangement work efficiently is not present.

c. The areas of controversy are not yet critical, and discussions between CIA and AF are continuing. I predict that these questions will ultimately require the personal attention of Dr. Flax.

2. Hopefully, Dunn's increased attention to this program will tend to sort out some of these things. Or maybe I'm being a dreamer in thinking they can be sorted out without Flax's personal intervention and action.

3. If you have any comments--good or bad--I'd appreciate them. Otherwise I've sent this along for your information.

[redacted]

[redacted]

1. SAFSP
2. SS-7
3. SS-1

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