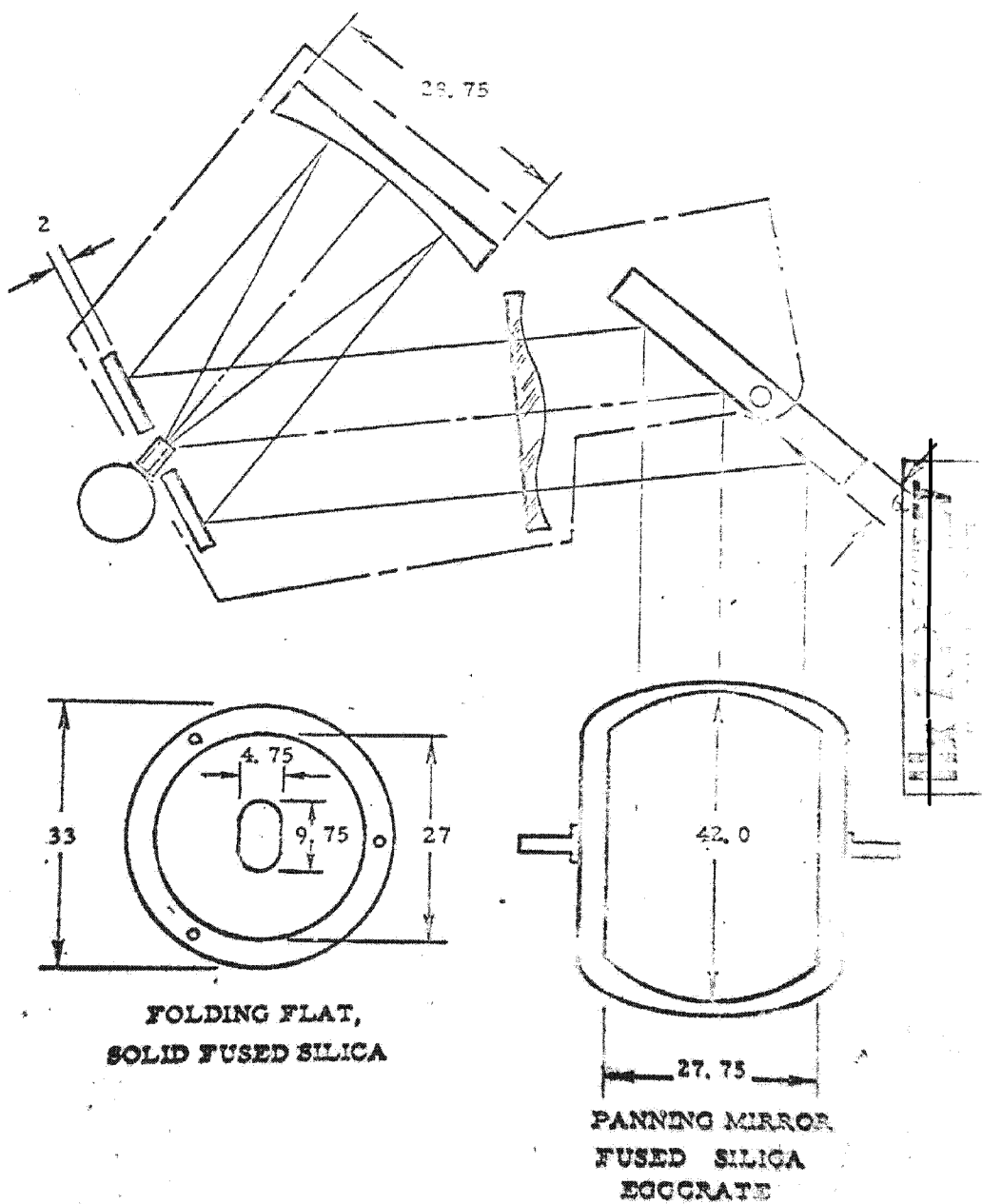




**ITEK OPTICAL SYSTEM  
1/2 48-INCH FOCAL LENGTH**

Unclassified

BYE-52679-66

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |          |                           |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|---------------------------|
| <b>TRANSMITTAL SLIP</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |          | DATE<br>14 September 1966 |
| TO: Colonel Dave Carter                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |          |                           |
| ROOM NO.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | BUILDING |                           |
| REMARKS: Dave:<br><br>Attached are copies of the view-graphs used in my 15 August presentation to the Land Panel. I have not included copies of the performance charts in that most of them were superseded by those used in the 1 September presentation to Dr. Flax. Some of the numbers presented on various of these charts were preliminary and have since been changed; therefore, wherever there is a contradiction between the 1 September and 15 August charts, the 1 September numbers should be used. |          |                           |
| FROM: Leslie C. Dirks                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |          |                           |
| ROOM NO.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | BUILDING | EXTENSION                 |

FORM NO. 241  
FEB 66REPLACES FORM 36-8  
WHICH MAY BE USED.

(47)

HEXAGON SENSOR SUBSYSTEM.  
TECHNICAL PROPOSAL SUMMARY

~~TOP SECRET~~  
Special Handling

Unclassified

Unclassified

EYE-52679-66

CONFIGURATION COMPARISONOPTICAL PARAMETERS

|                                              | <u>ITEK</u> | <u>PE</u> |
|----------------------------------------------|-------------|-----------|
| Focal Length                                 | 48 inches   | 60 inches |
| Aperture                                     | 24 inches   | 20 inches |
| f/number                                     | 2           | 3         |
| Filter                                       | 2.43        | 3.77      |
| Central Obstruction<br>(Percent of Aperture) | WR-12       | WR-12     |
|                                              | 8.65%       | 13.3%     |

Film

|                                                         |              |            |
|---------------------------------------------------------|--------------|------------|
| Format Width                                            | 5.5 inches   | 6.0 inches |
| Film Width                                              | 6.0 inches   | 6.6 inches |
| Film Type                                               | S0-380       | S0-380     |
| Film Quantity (total-2 Cameras<br>for a 30-day Mission) | 1392 lbs     | 1701 lbs   |
| Format Length (120-degree scan)                         | 100.5 inches | 128 inches |

Configuration and Weight

|                                 |            |             |
|---------------------------------|------------|-------------|
| Scan Angle                      | 120 Degr   | 120 Degr    |
| Stereo convergence Angle        | 30 Degr    | 20 Degr     |
| Weight, Sensor Subsystem        | 3569 lbs   | 2549 lbs    |
| Sensor subsystem Maximum Length | 110 inches | 88 inches   |
| Design Perigee/Apogee           | 169 inches | 154 inches  |
| Swath Width From Perigee        | 90/137 NM  | 92.5/134 NM |
|                                 | 325 NM     | 327 NM      |

~~TOP SECRET~~  
Special Handling

Unclassified

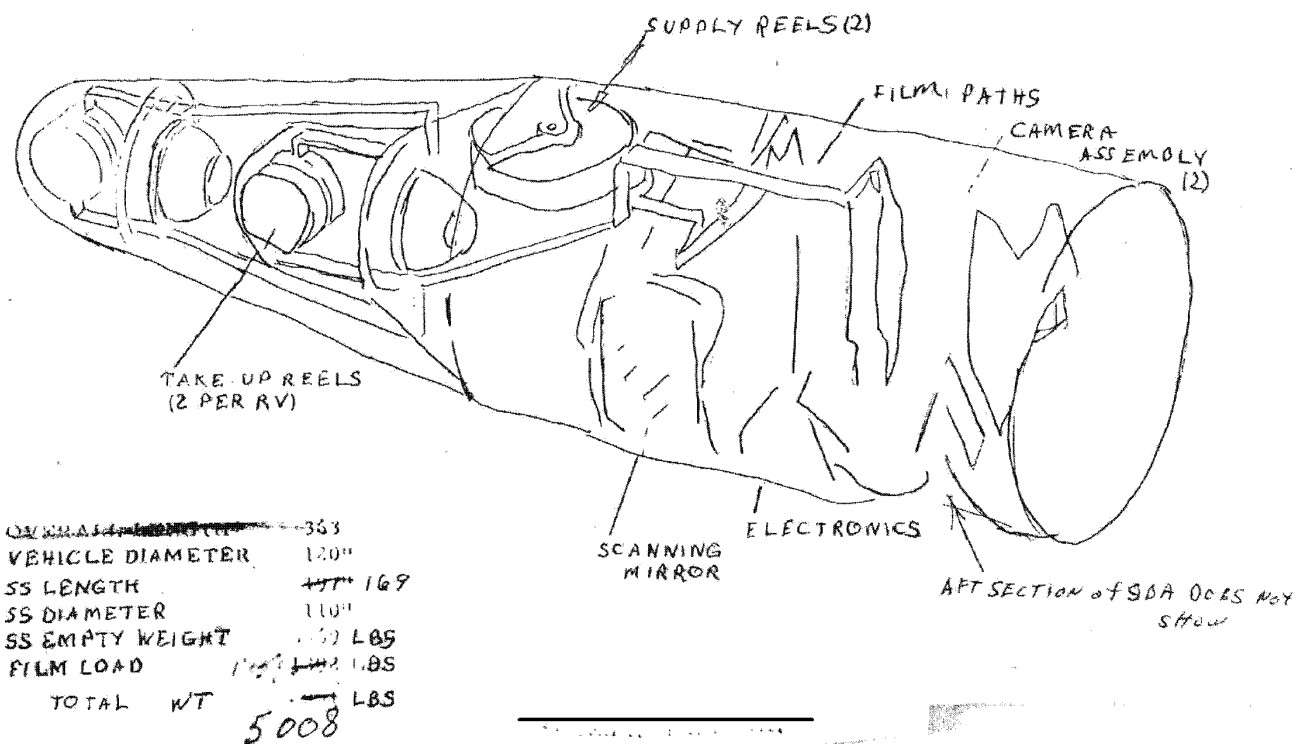
6160

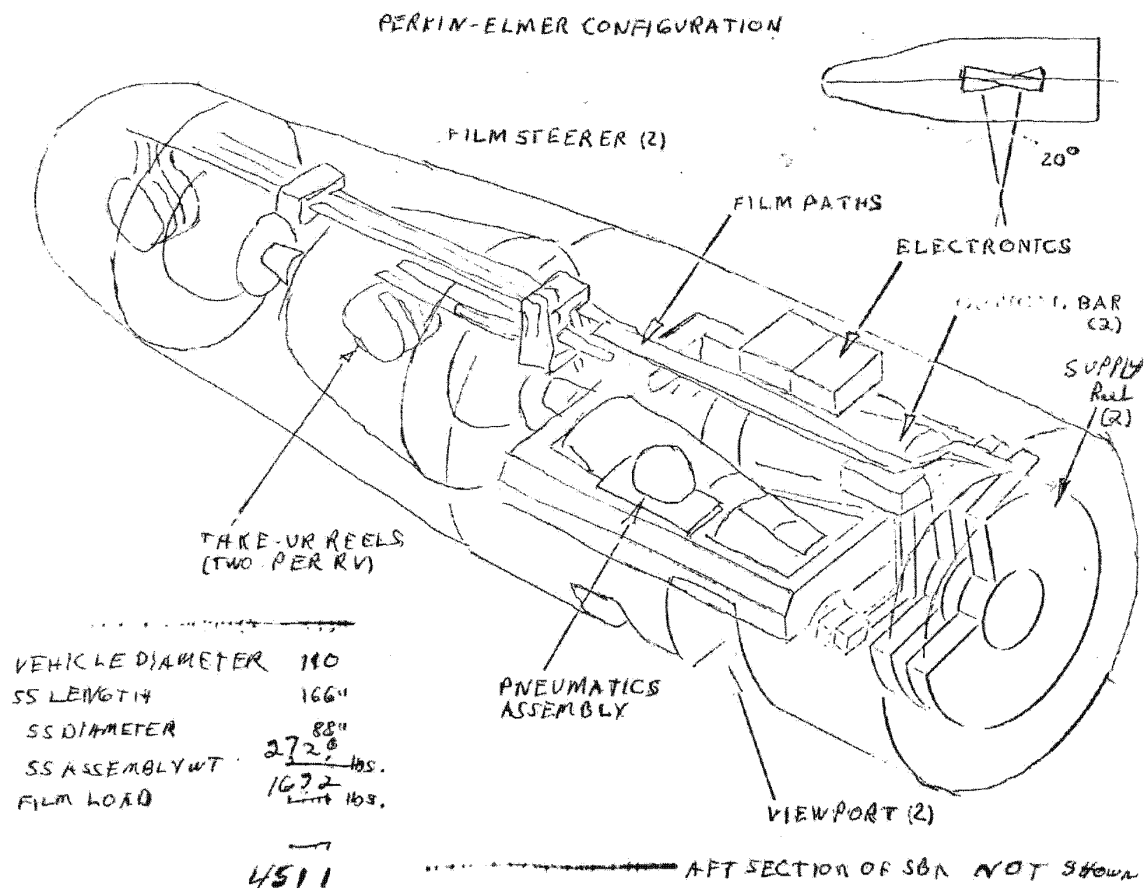
[illegible]

1 of 3

5. FY 1967 INCREASED FUND APPROVAL FOR THIS SENSOR EFFORT IS HELD TO \$30,000,000 AT THIS TIME, IN ADDITION TO THE \$2,756,109 AUTHORIZED FOR JULY THROUGH SEPTEMBER. THIS

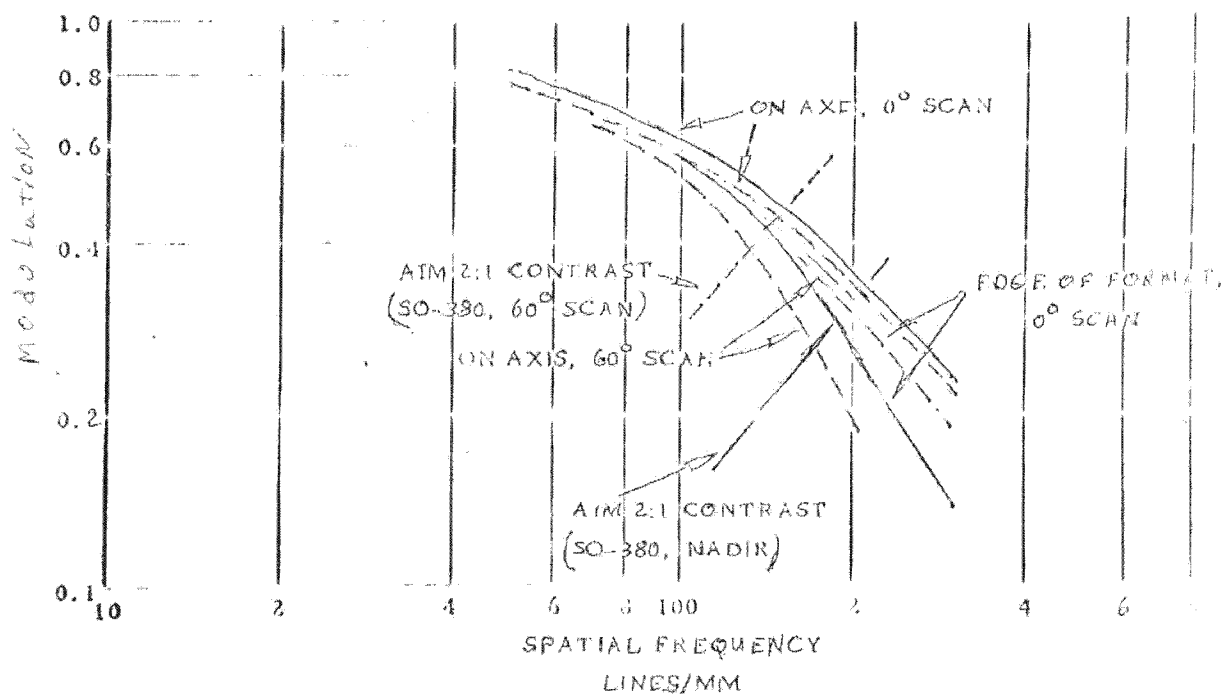
**Page Denied**

ITEK CONFIGURATION



Attachment 3

ITEK  
MODULATION TRANSFER FUNCTION



ZERO SMEAR

ZERO DEFOCUS

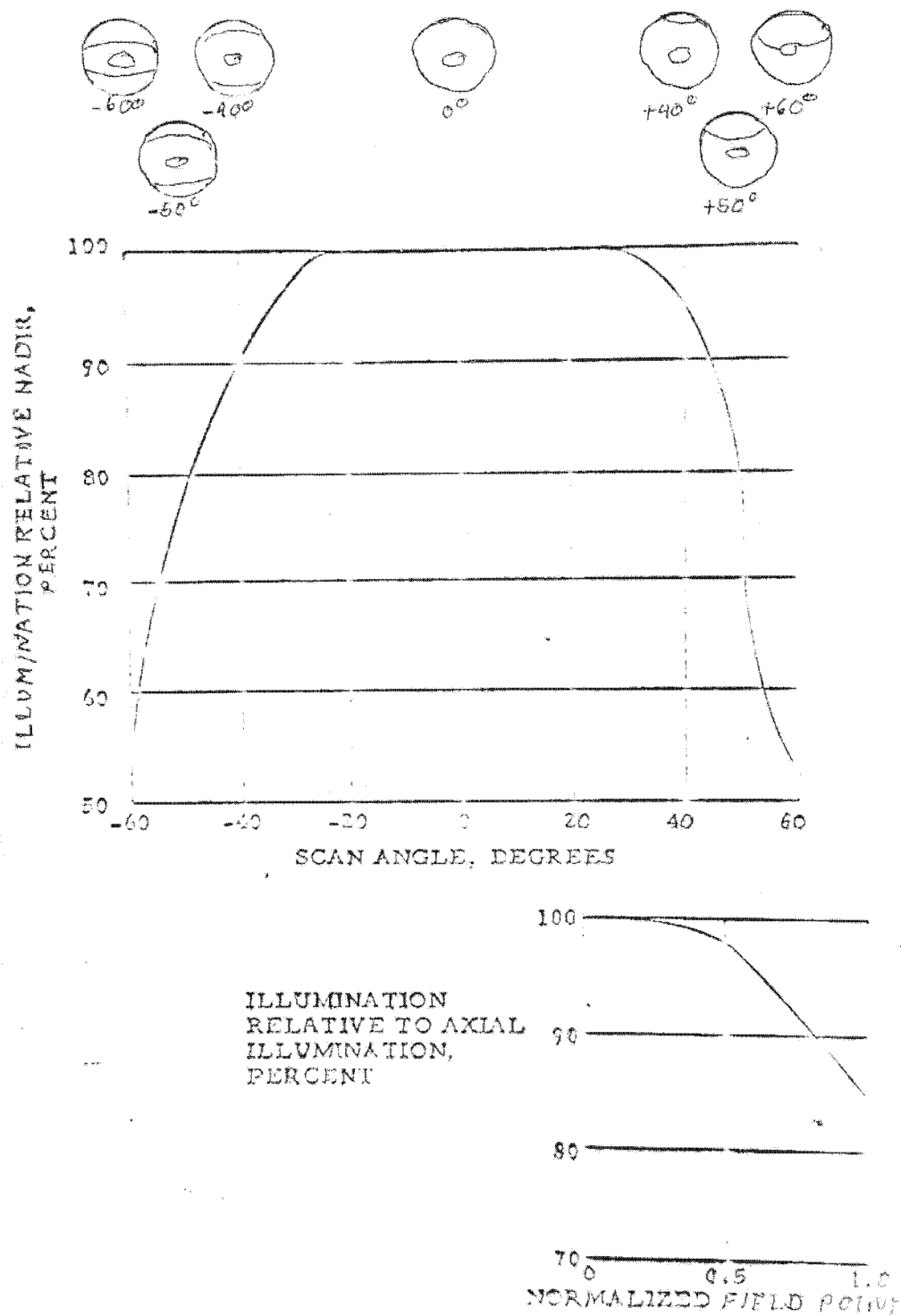
.1A MANUFACTURING TOLERANCE

~~TOP SECRET~~  
Special Handling



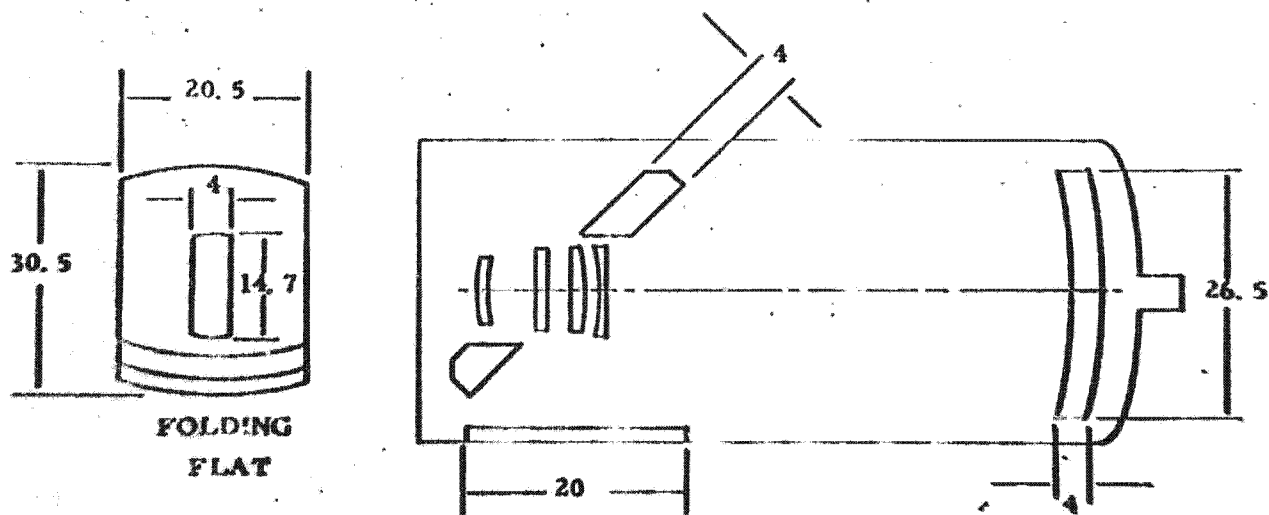
Unclassified

## EFFECT OF VIGNETTING IN ITEX OPTICAL SYSTEM

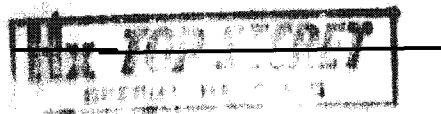


Unclassified

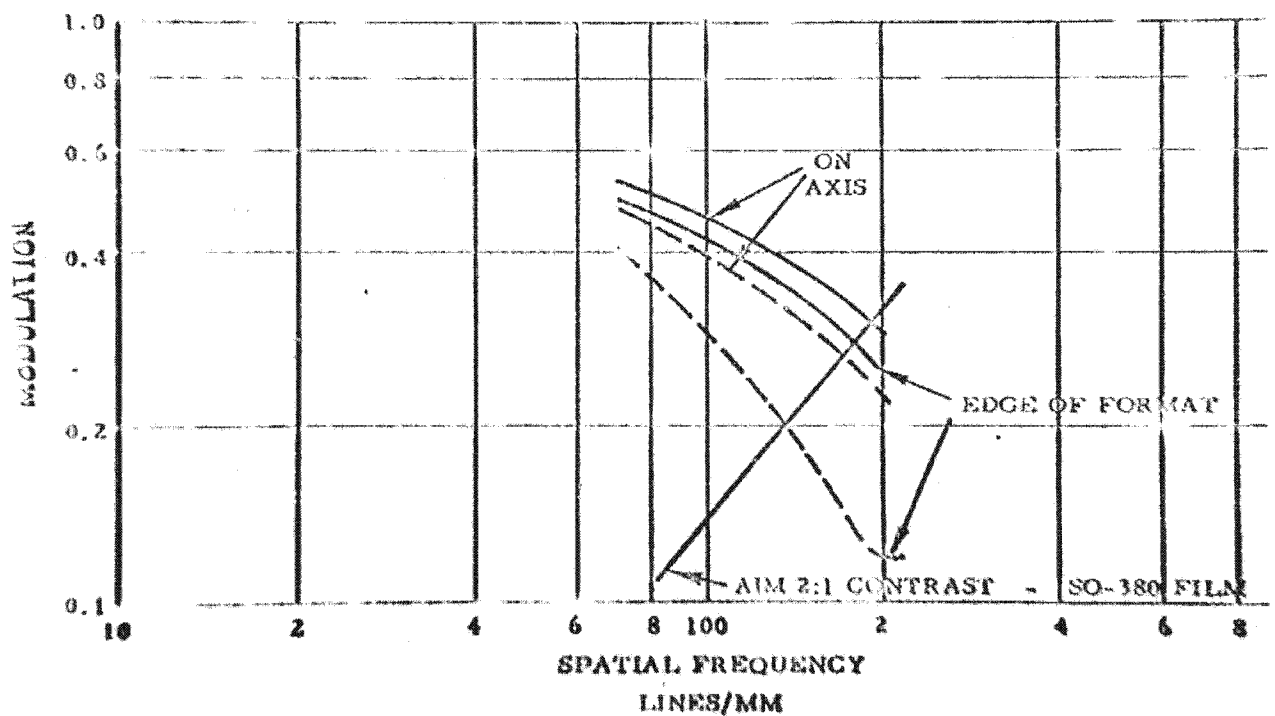
PERKIN-ELMER  
OPTICAL SYSTEM  
f/3 60-INCH FOCAL LENGTH



HERAEUS DRILLED-CORE  
FUSED SILICA,  
PRIMARY AND FOLDING FLAT



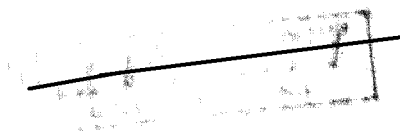
PERKIN-ELMER  
 MODULATION TRANSFER FUNCTION, NADIR



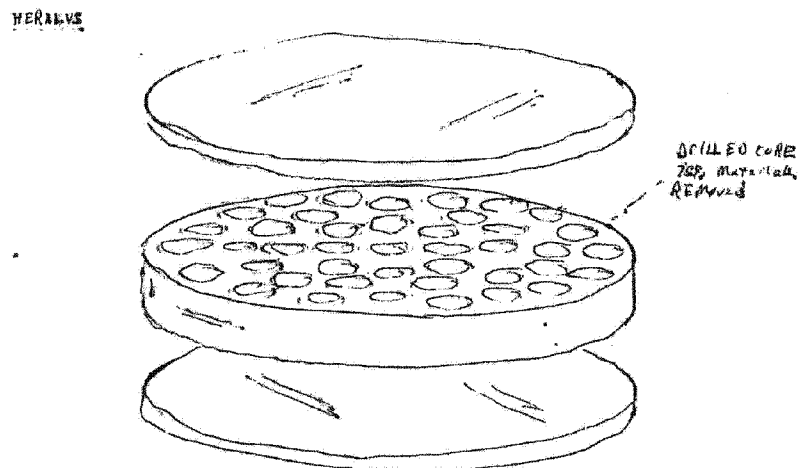
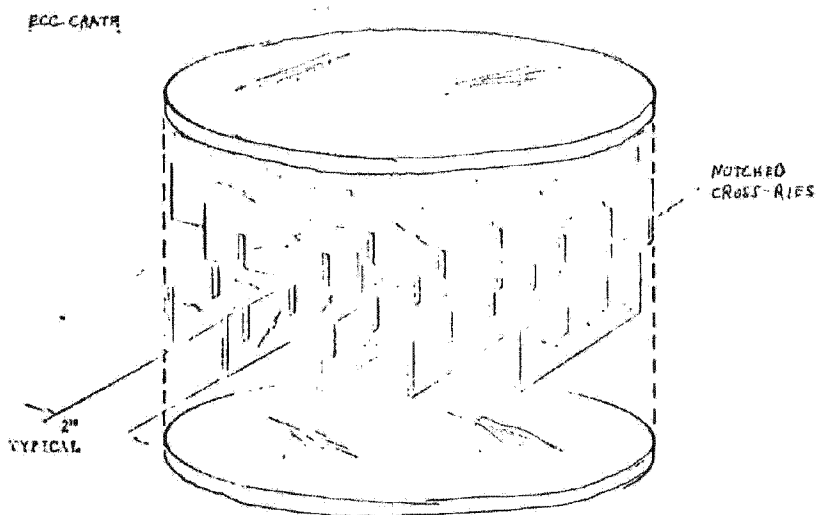
ZERO SKEW  
 ZERO DEFOCUS

MANUFACTURING TOLERANCE:  $C_s = 7$

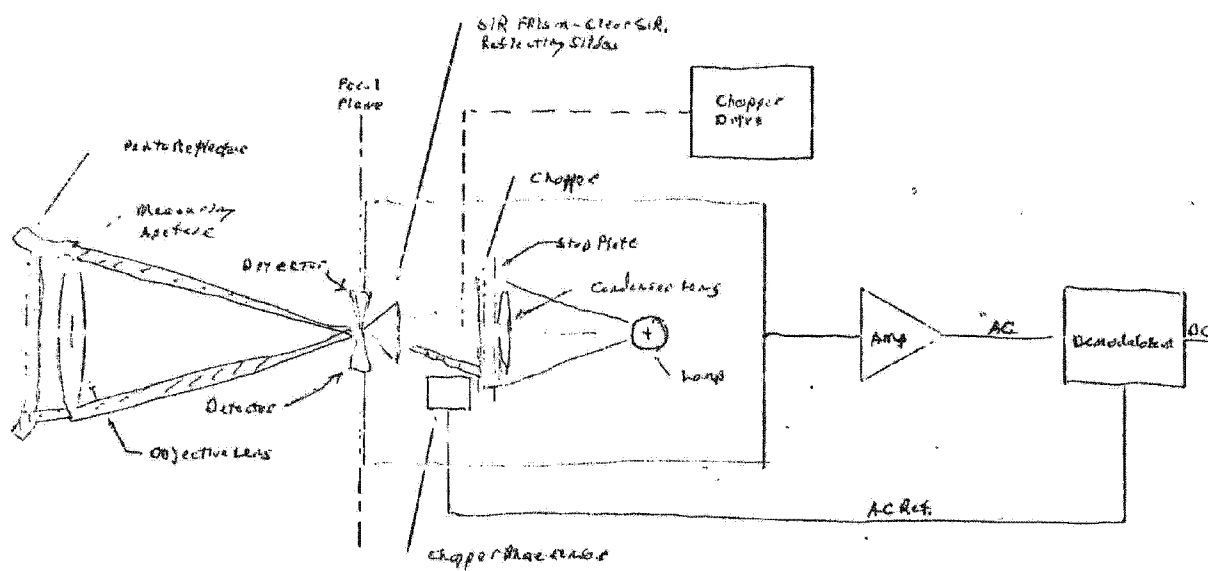
ALONG TRACK  
 ACROSS TRACK



## PERKIN-ELMER MIRROR STRUCTURAL FORMS

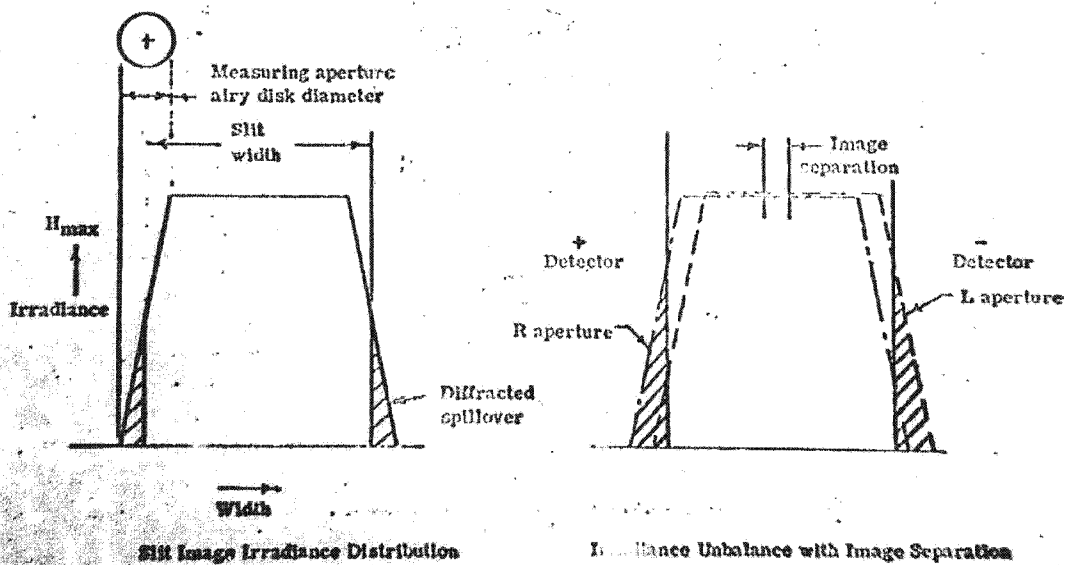


FOCUS SENSOR FUNCTIONAL Diagram



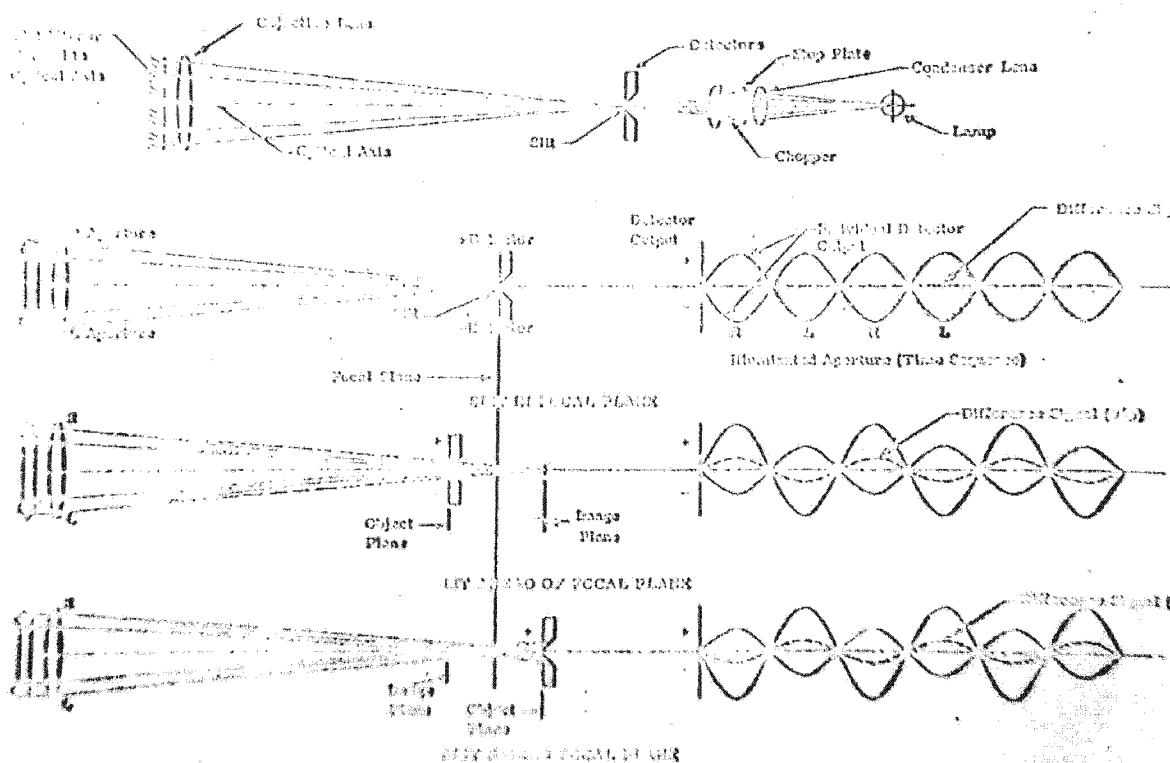
~~TOP SECRET~~  
SP-6 Col. H. G. L. K. S.

ITEK

SLIT IMAGE RADIOMETRIC CHARACTERISTICS

~~TOP SECRET~~  
Special Handling

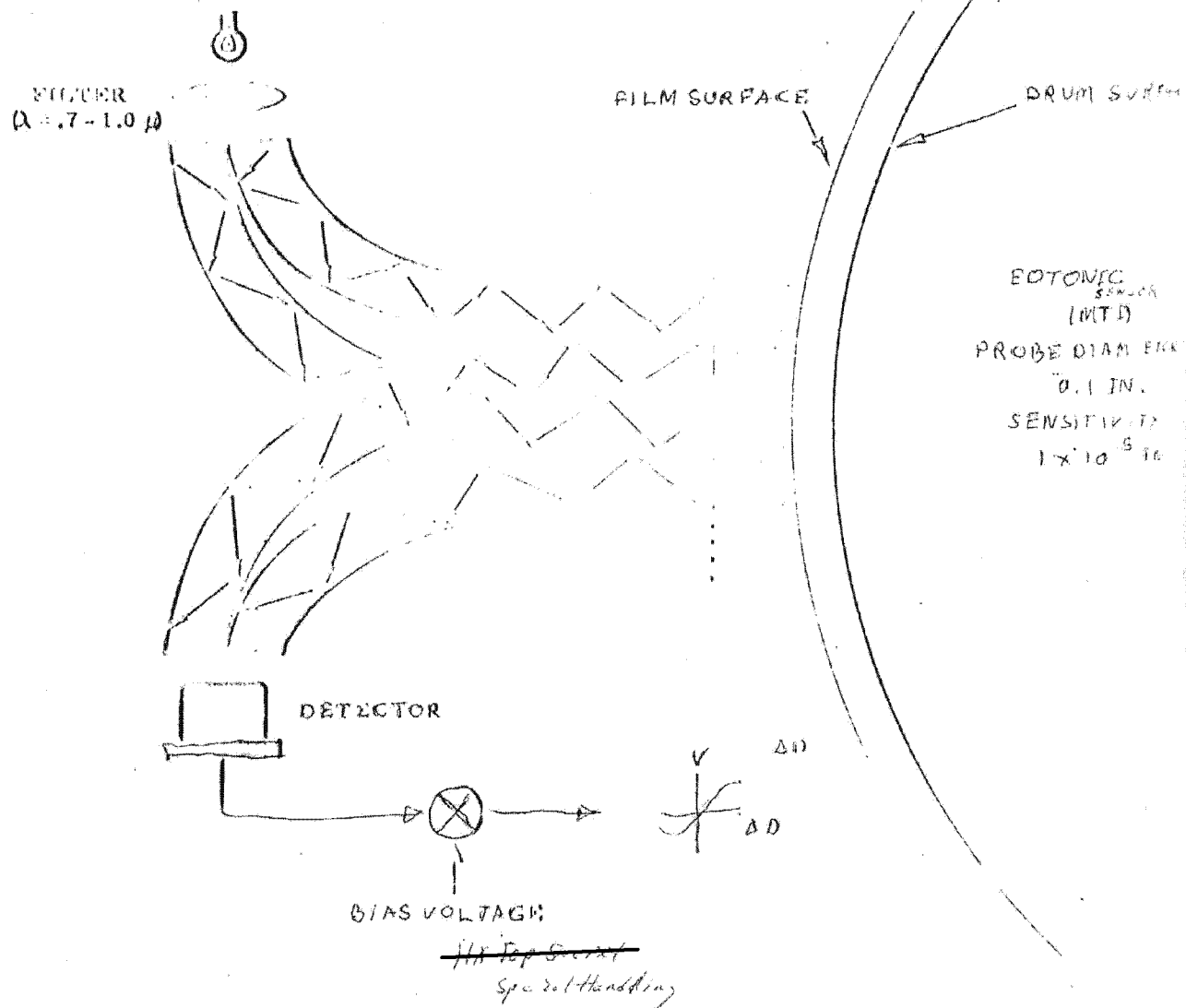
OPTICAL ARRANGEMENT AND SIGNAL CHARACTERISTICS  
OF AUTO-ILLUMINATING LATERAL SEPARATION FOCUS SENSOR



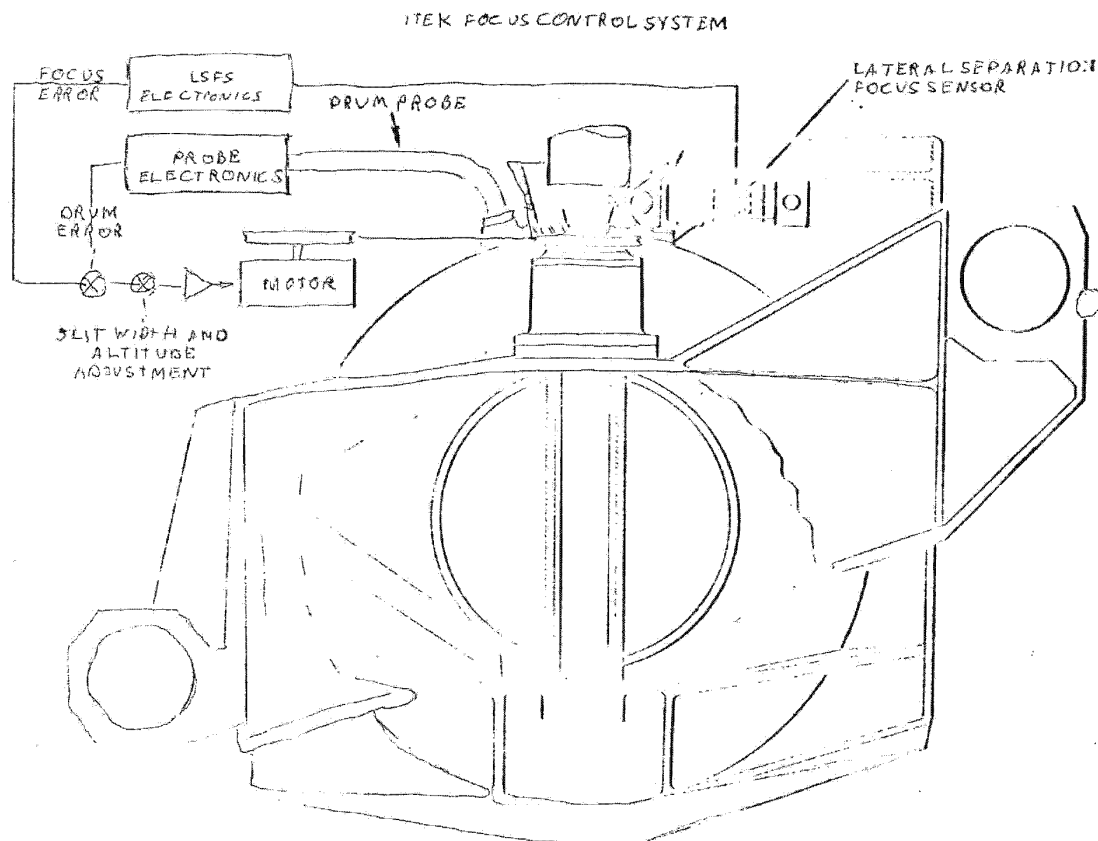
~~TOP SECRET~~  
Special Handling

ITEK

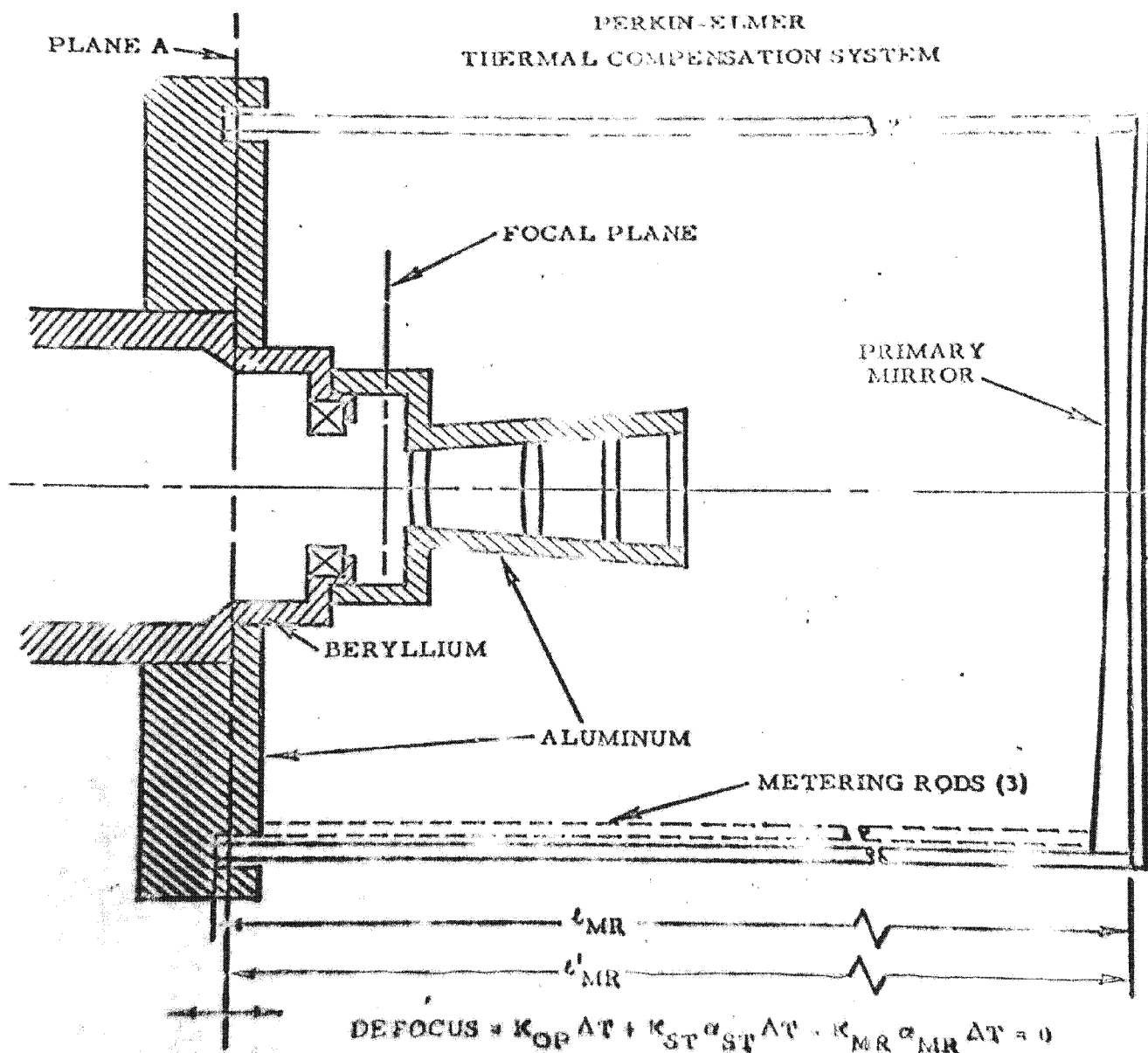
## CONCEPT FOR MEASURING FILM/DRUM POSITION





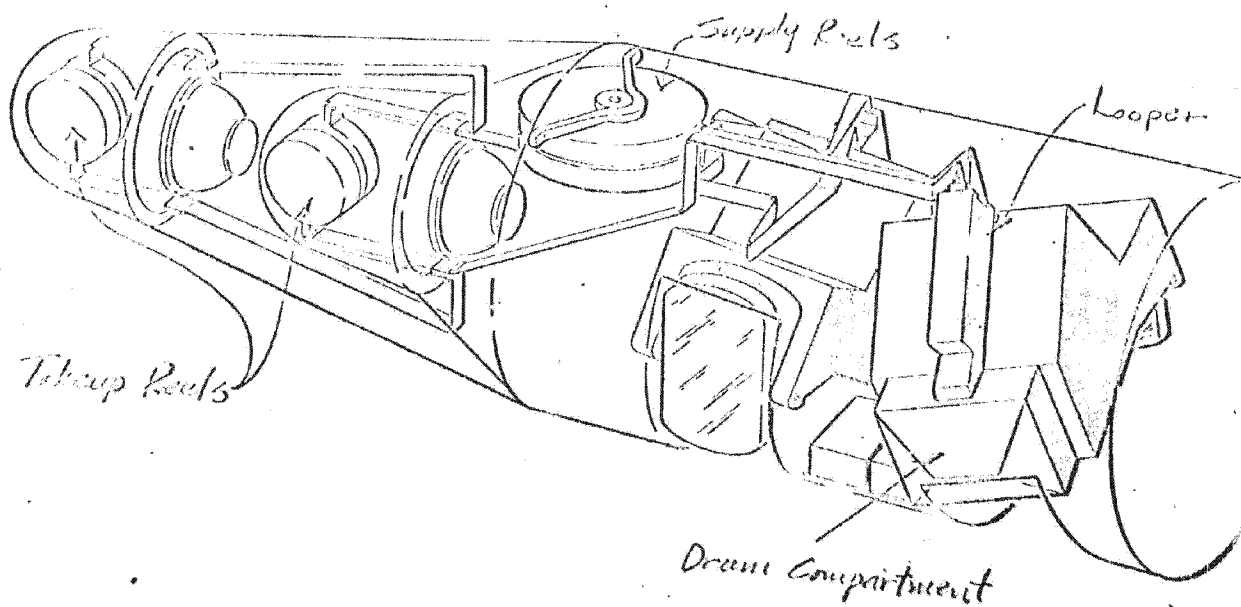


~~TOP SECRET~~  
Special Handling



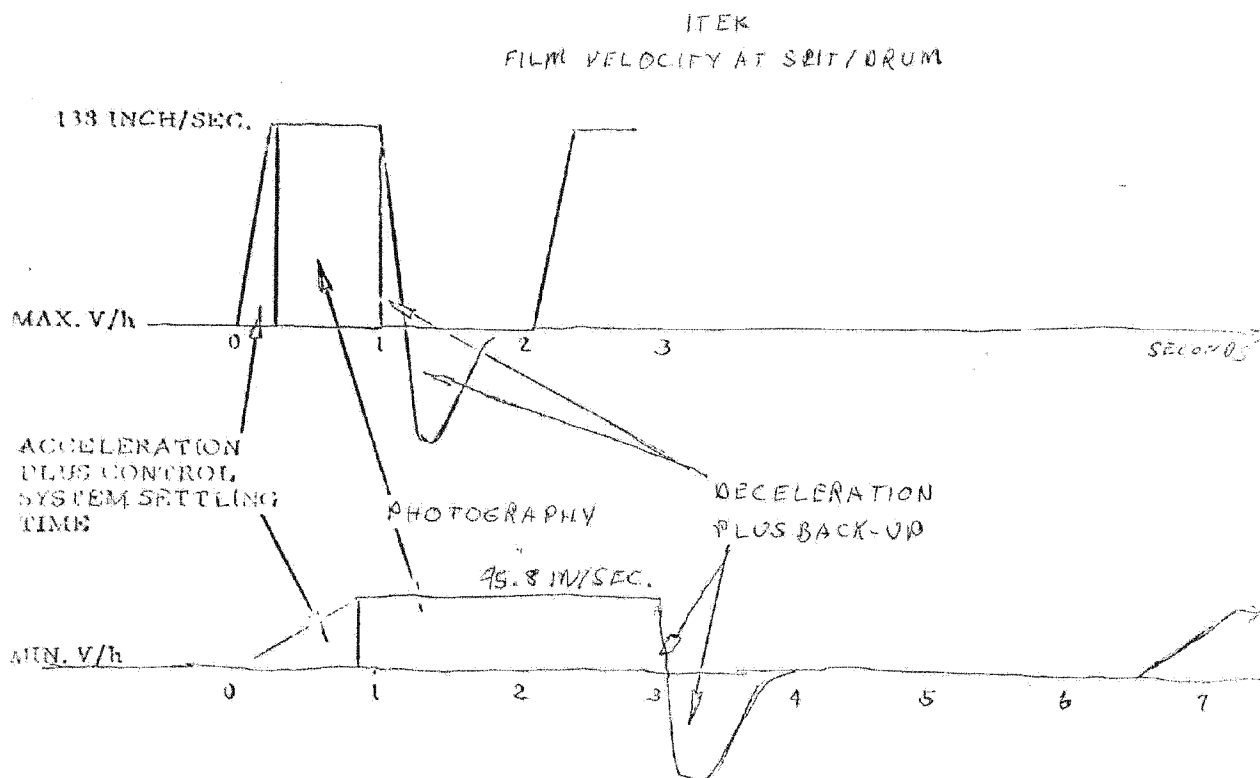
**TOP SECRET**  
 SPECIAL HANDLING

36 Film Rollers



Itek Film Path Layout

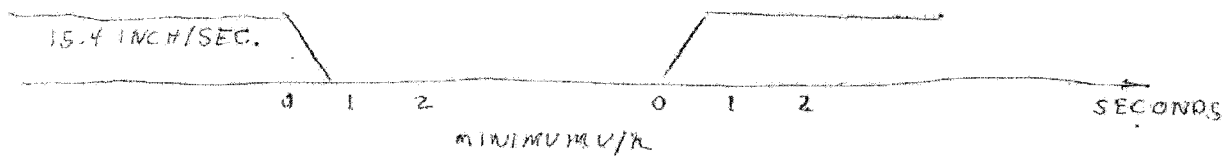
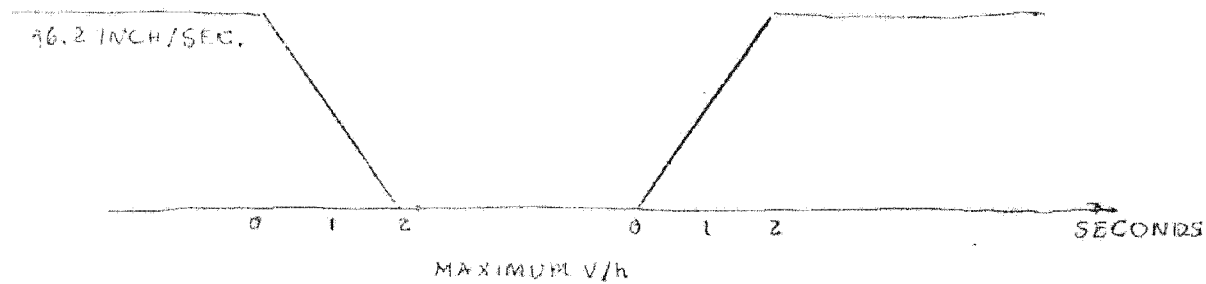
~~TOP SECRET~~  
Special Handling



FILM USED IN ACCELERATION/SETTLING  
TIMES AND IN BACK-UP TIME =  
23.48 INCHES (EACH)

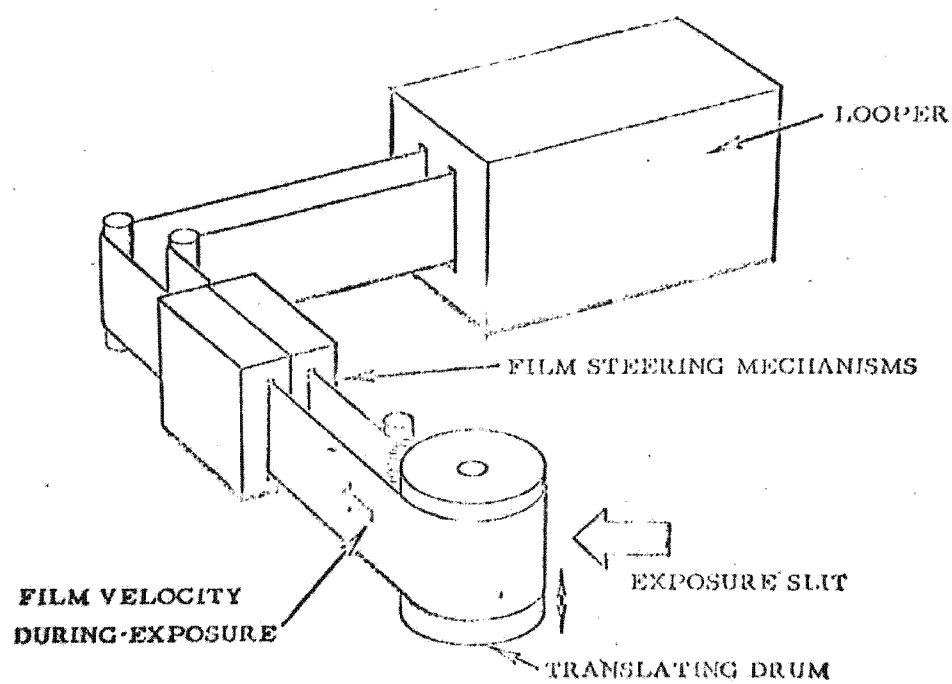
FRAME LENGTH = 100.5 INCHES

~~TOP SECRET~~  
Special Handling

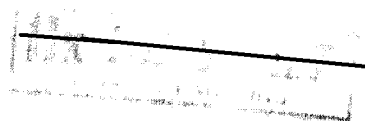
ITEM  
FILM VELOCITY AT REELS FOR STOP/START SEQUENCE

FILM ACCELERATION: 3W  
ALL CASES = 23.1 INCH/SEC<sup>2</sup>

~~TOP SECRET~~  
Special Handling

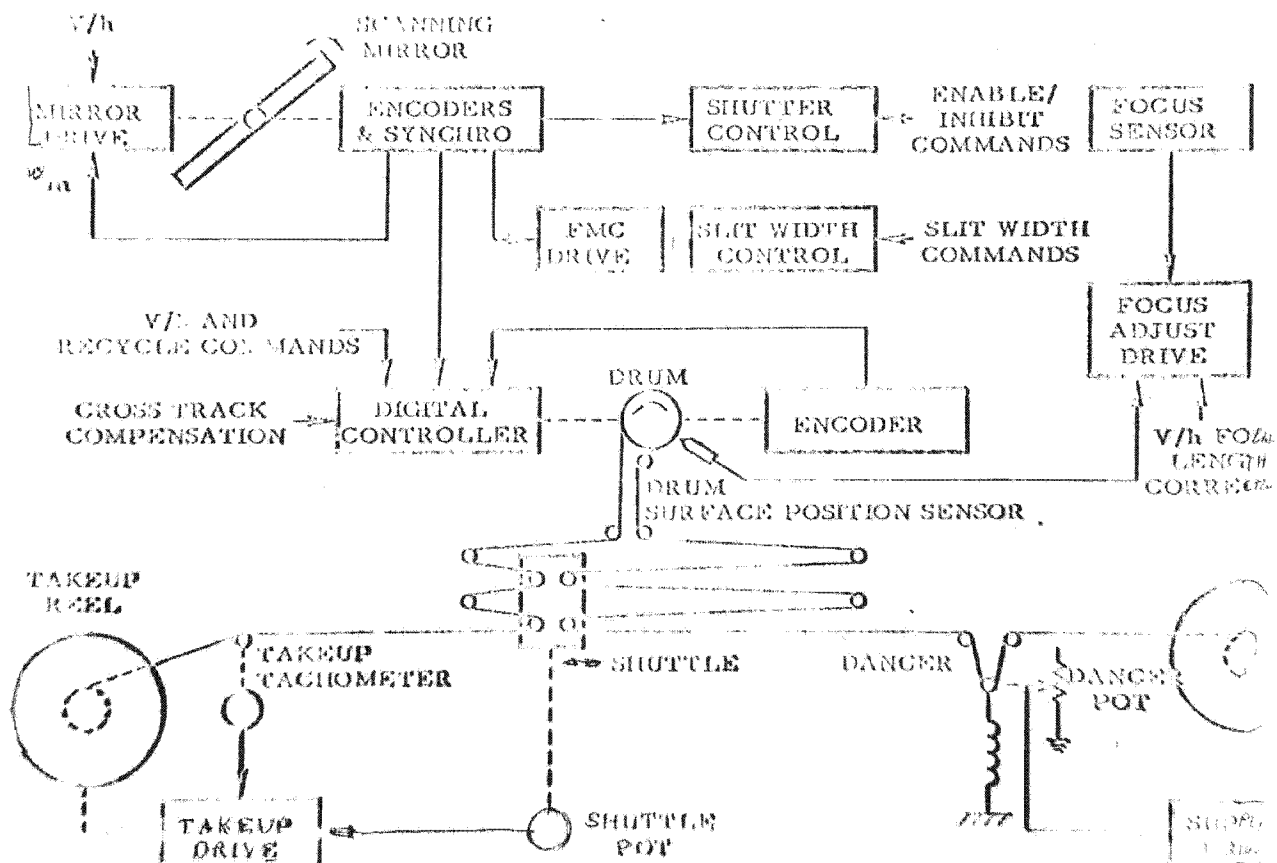


ITEK - DRUM GEOMETRY

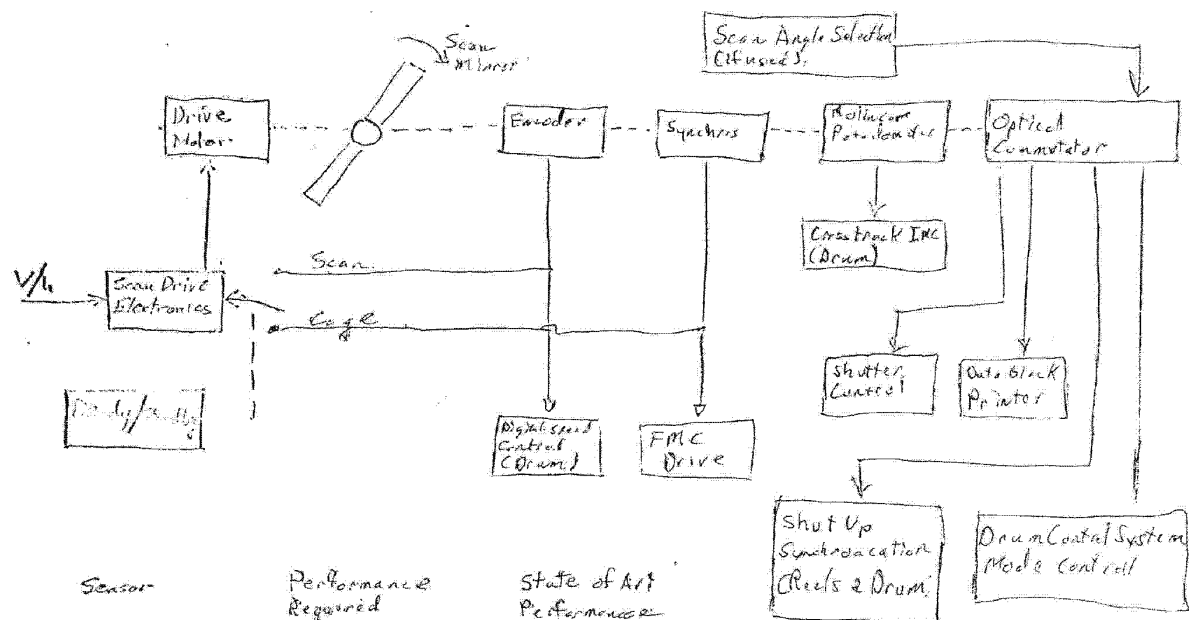


TEK

# FILM TRANSPORT CONTROL SYSTEM



Unclassified



| Sensor             | Performance Required | State of Art Performance |
|--------------------|----------------------|--------------------------|
| Encoder            |                      | < 1 sec.                 |
| Synchro            |                      | < 1 min                  |
| Nonlinear pots     | ~ 1%                 | ~ 0.5%                   |
| Optical Commutator | 12 min               | 10 sec                   |

Hx ~~For SE-401~~  
Spec's / Hand Log

Itek Scan Drive

Unclassified

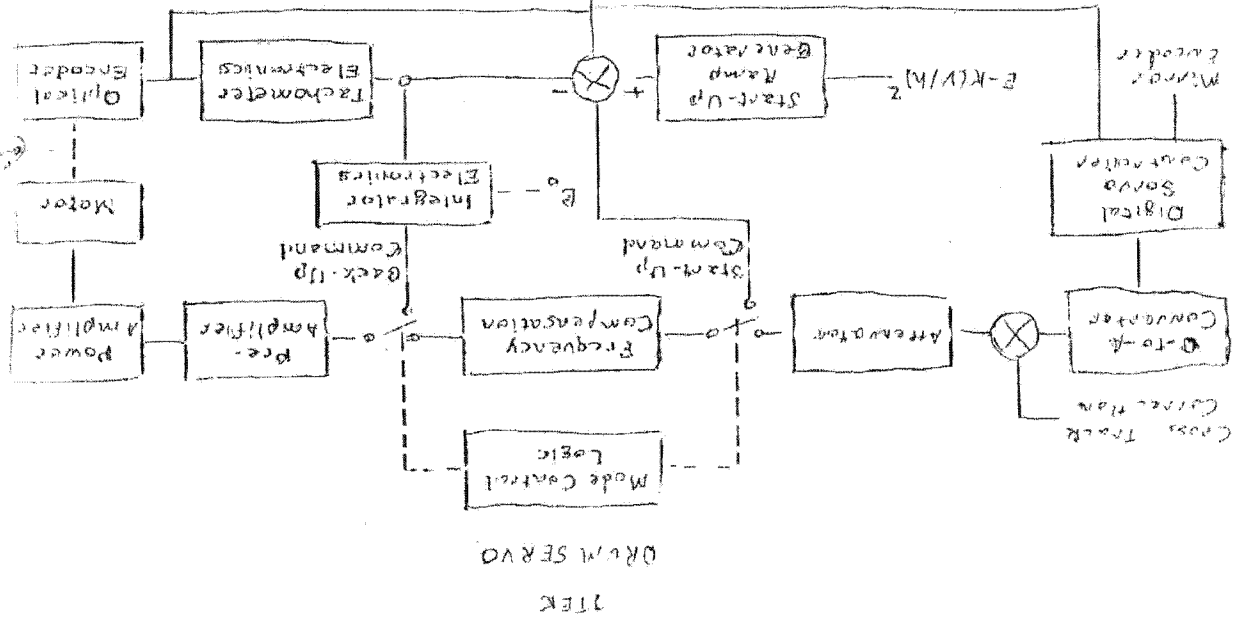


Unclassified

\* USING ITER PROPOSED MECHANIZATION  
 Overall Servo Performance  $\Delta \theta_{max} = 0.046$   
~~HA TO SELECT~~  
 Spec & 1 Hz/1111

| Required Sensors         | Required Performance | Best Performance |
|--------------------------|----------------------|------------------|
| Optical Encoders         | 10 sec               | 0.3 sec          |
| Digital Servo Controller | 0.01%                | 0.001%           |
| Digital/Analog Converter | 7 bits               | > 13 bits        |

Critical Components

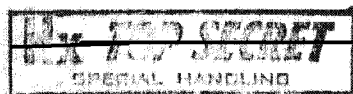


Unclassified

ITEKMOTOR REQUIREMENTS

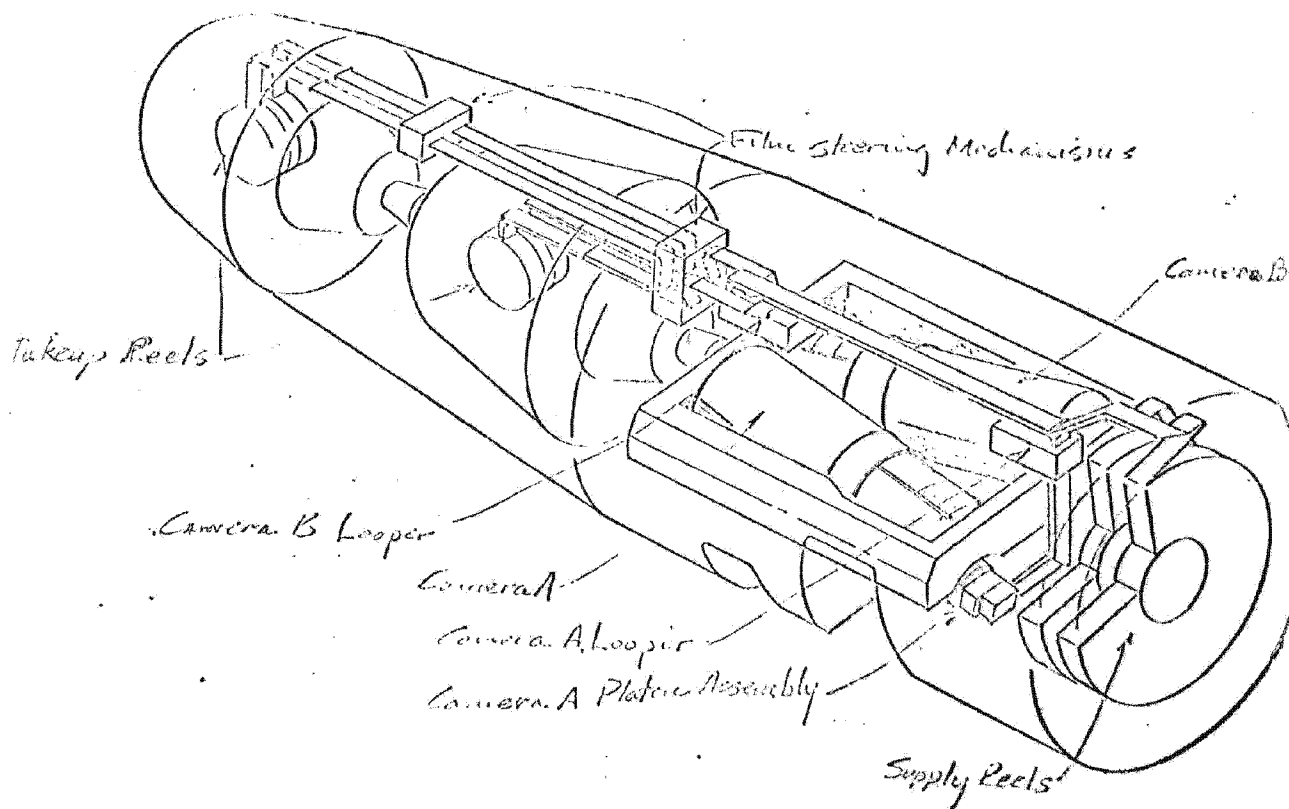
|                  | <u>STALL TORQUE</u><br><u>(FT-LB)</u> | <u>NO-LOAD SPEED</u><br><u>(RAD/SEC)</u> | <u>GEAR RATIO</u> |
|------------------|---------------------------------------|------------------------------------------|-------------------|
| DRUM DRIVE       | 6.0                                   | 56                                       | DIRECT            |
| FMC DRIVE        | 2.88                                  | 37                                       | CAM               |
| SUPPLY REEL      | 7                                     | 84                                       | 14:1              |
| TAKE-UP REEL*    | 7                                     | 84                                       | 14:1              |
| SCAN DRIVE       | 4                                     | 22                                       | DIRECT            |
| MOMENTUM BALANCE | 6.0                                   | 56                                       | DIRECT            |

\*REQUIREMENTS EXCEED SPEED-TORQUE CURVE WITH TAKE-UP REEL AS DESIGNED

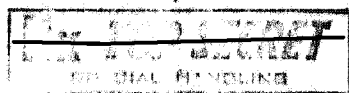


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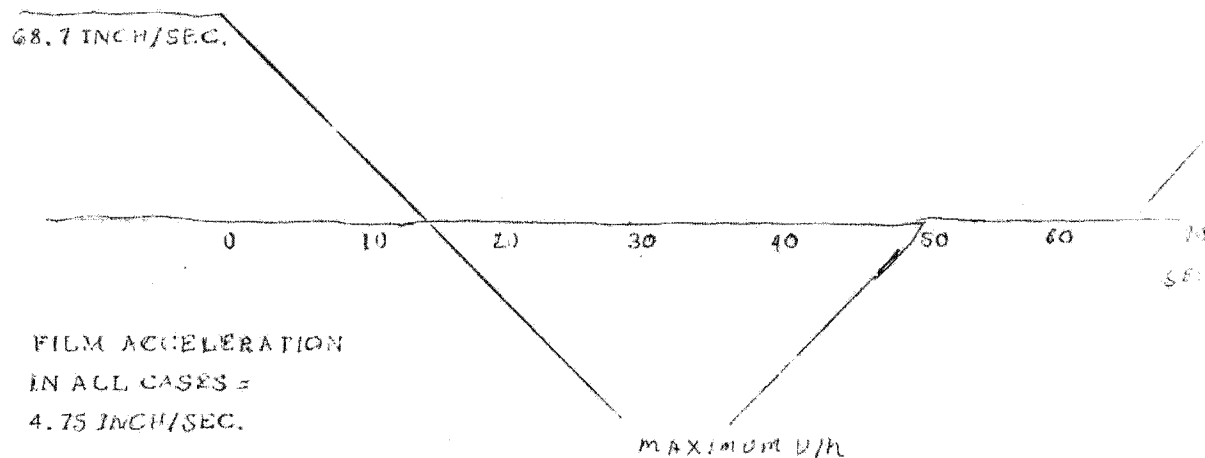
101 Film Reels  
20 Air Bars



PE Film Patte Layout

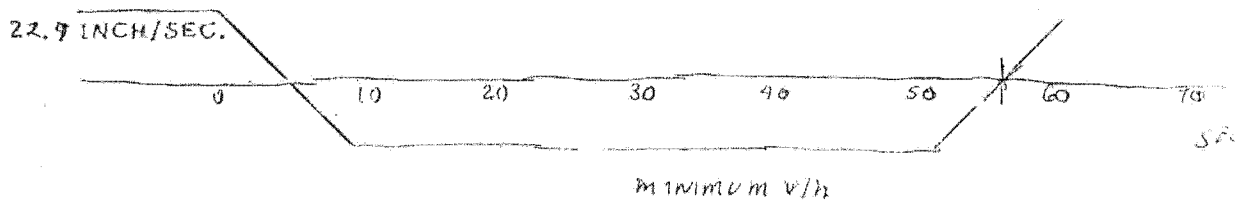


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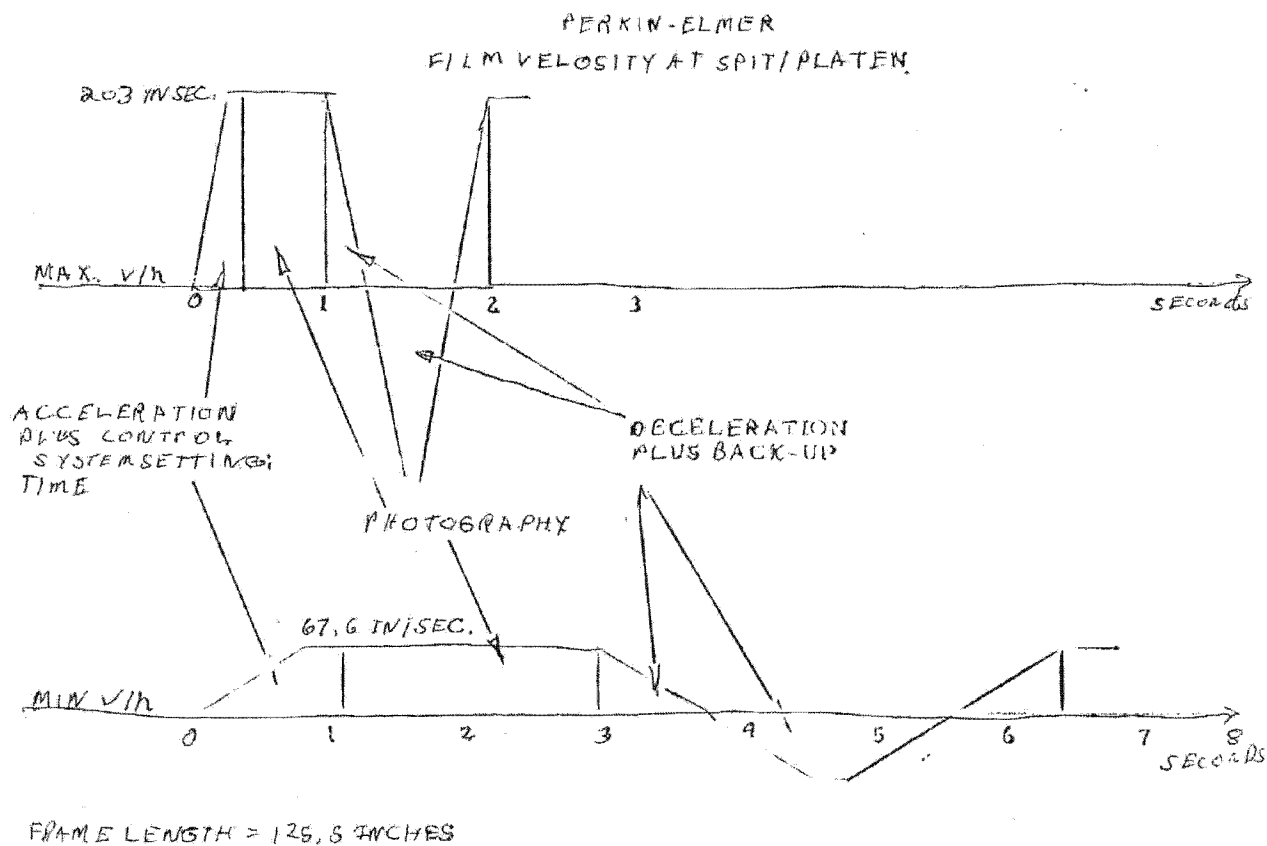
PERKIN-ELMER  
FILM VELOCITY AT REELS FOR STOP/START SEQUENCE

← STOP PLUS  
REWIND

← START UP



~~TOP SECRET~~  
Special Handling



~~TOP SECRET~~  
Special Handling

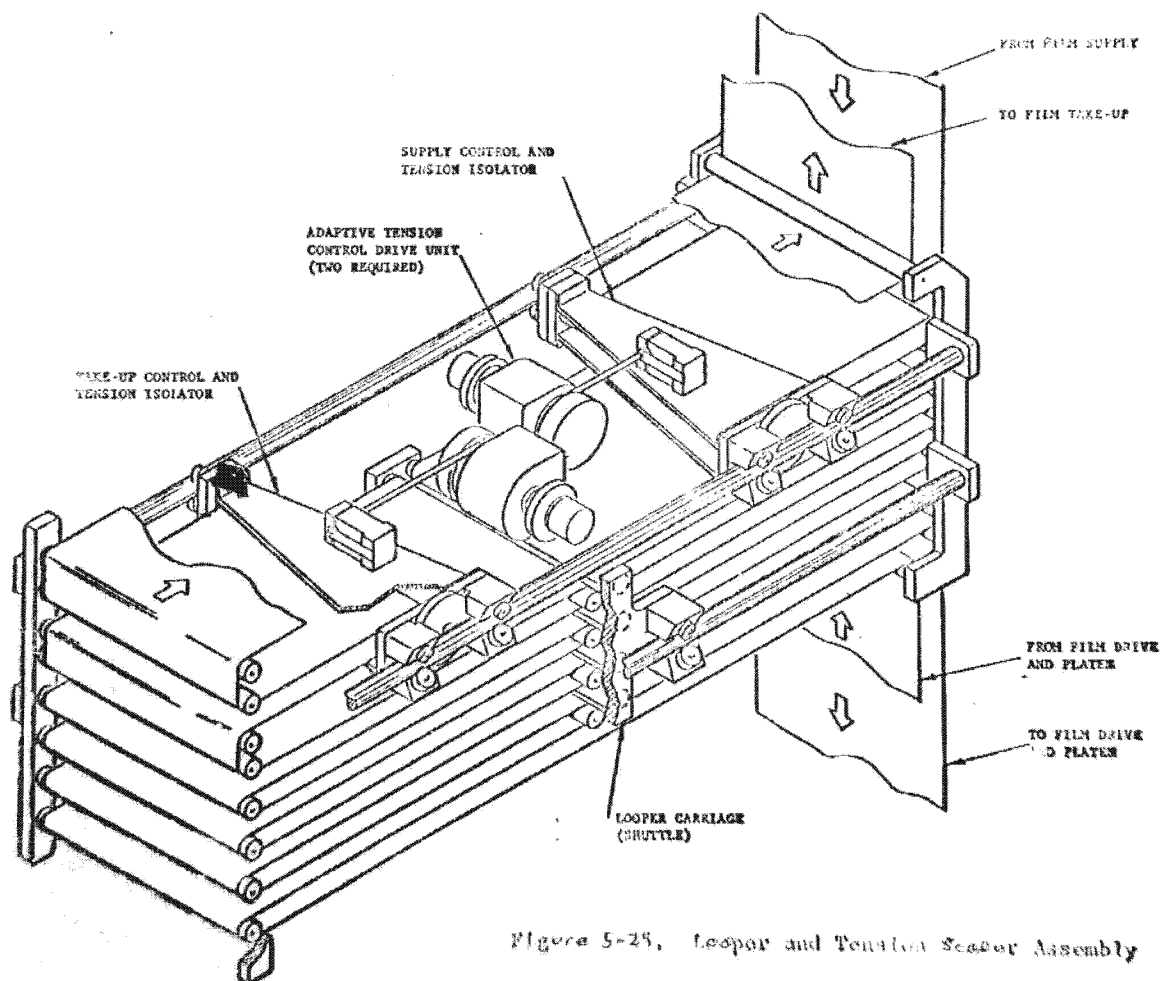
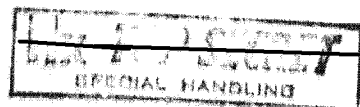
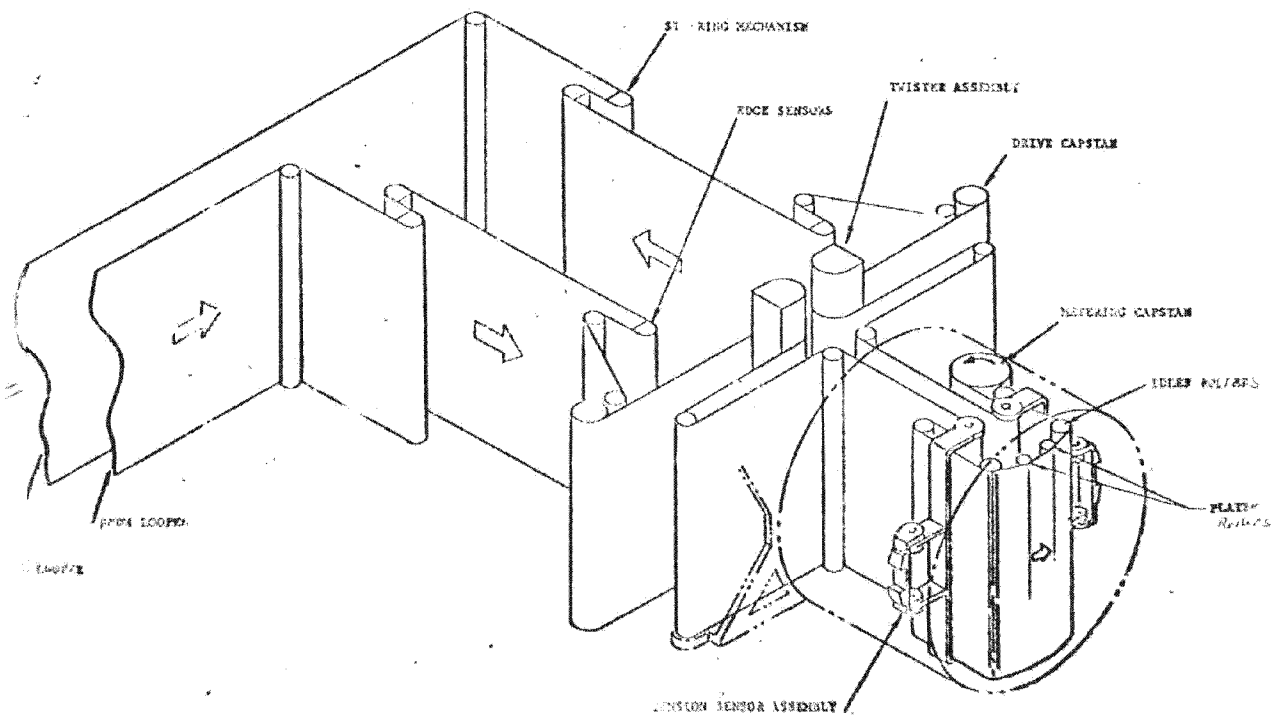


Figure 5-25. Loop and Tension Scissor Assembly

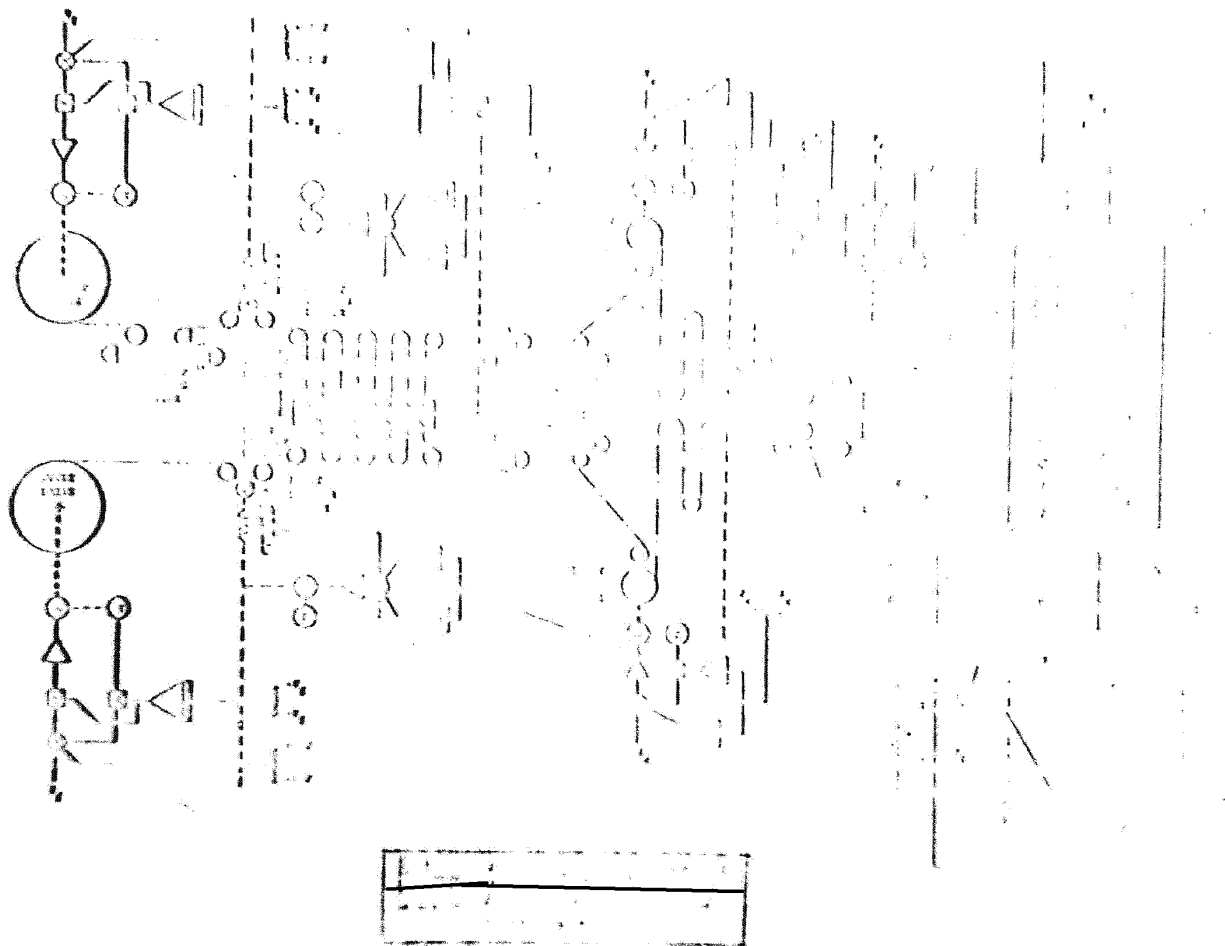


PERKIN ELMER

## DRIVE AND PLATEN ARRANGEMENT

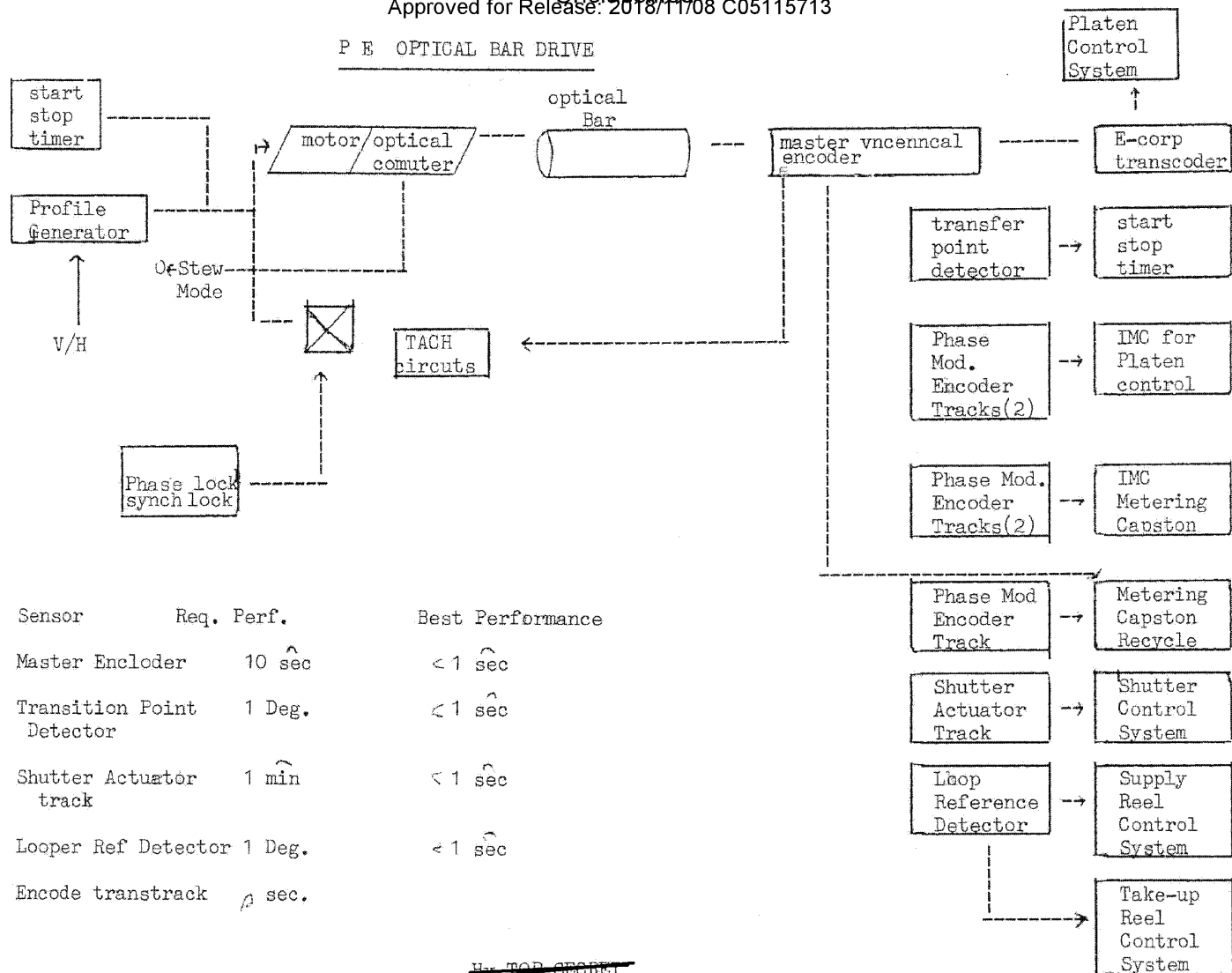


~~TOP SECRET~~  
SPECIAL HANDLING





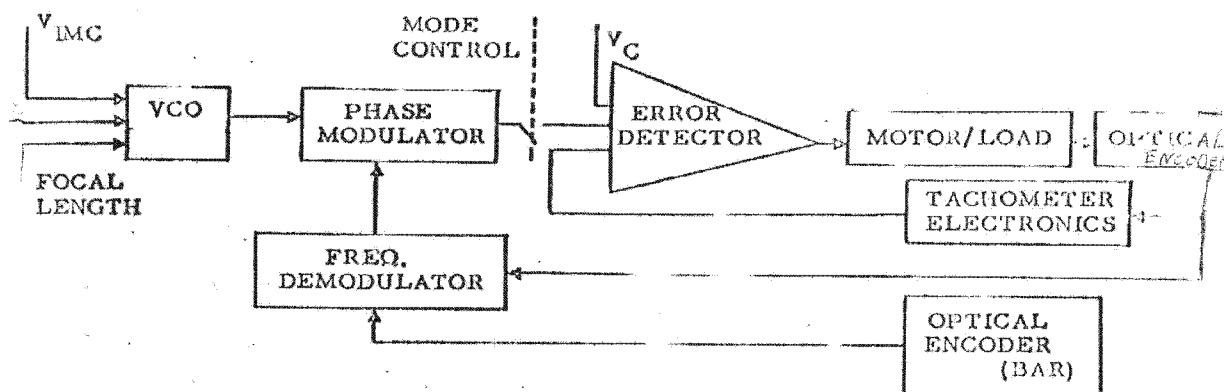
Unclassified



~~TOP SECRET~~  
Special Handling

Unclassified

PERKIN - ELMER  
METERING CAPSTAN SERVO



| REQUIRED SENSORS              | REQUIRED PERFORMANCE | BEST PERFORMANCE*           |
|-------------------------------|----------------------|-----------------------------|
| OPTICAL ENCODERS              | 10 SEC               | 0.3 SEC                     |
| TACHOMETER ELECTRONICS        | 0.1%                 | 0.1%                        |
| FREQUENCY DEMODULATOR         | 0.005%               | 0                           |
| PHASE MODULATOR               | 0.1%                 | <0.1%                       |
| VOLTAGE CONTROLLED OSCILLATOR | 0.2%                 | 0.1%                        |
| ERROR DETECTOR                | 0.05%                | 0.03% OF FULL SCALE AT NULL |

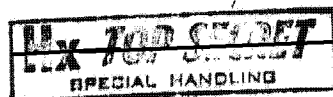
USING P-E PROPOSED MECHANIZATION  
OVERALL SERVO PERFORMANCE = 0.02%

**TOP SECRET**  
SPECIAL HANDLING

Unclassified

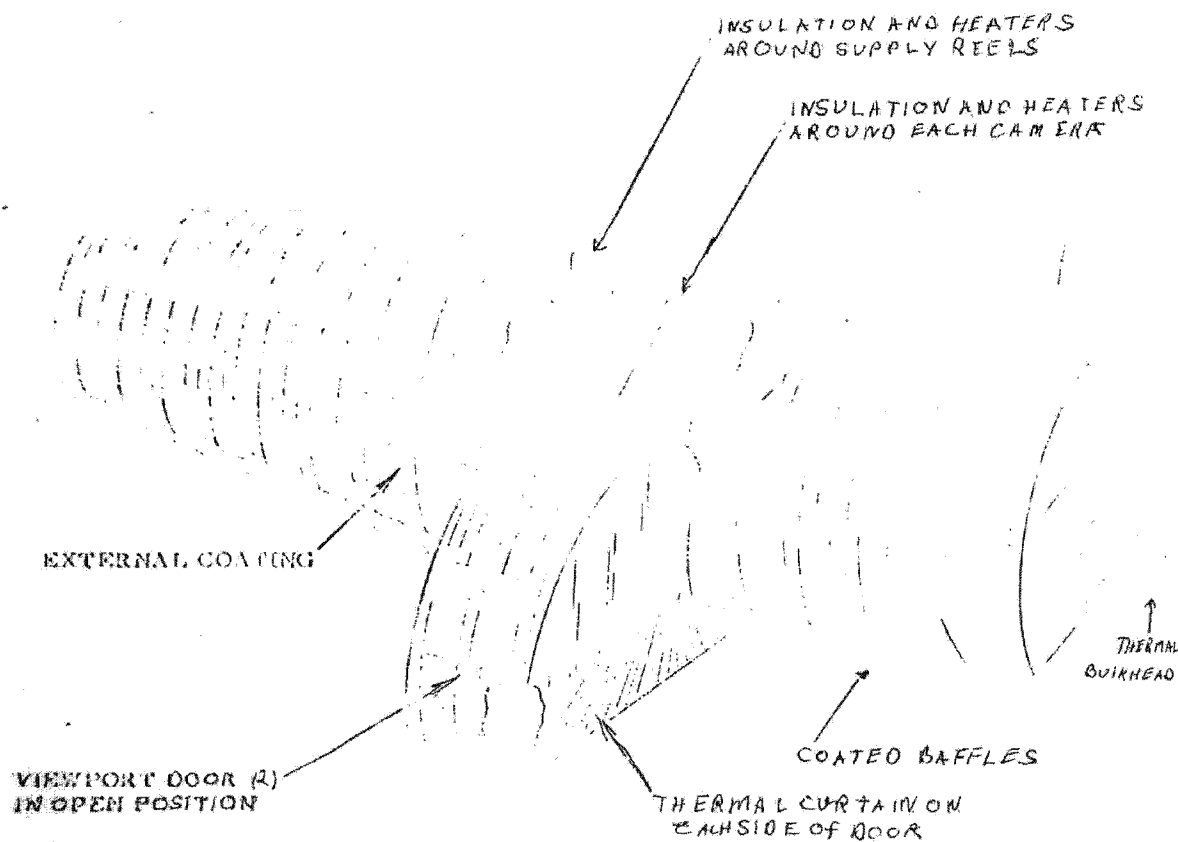
PERKIN-ELMER  
MOTOR REQUIREMENTS

|                      | <u>STALL TORQUE</u> | <u>NO-LOAD SPEED</u><br><u>(RAD/SEC)</u> |
|----------------------|---------------------|------------------------------------------|
| METERING CAPSTAN     | 2 OZ-IN             | 500                                      |
| COARSE DRIVE CAPSTAN | 80 OZ-IN            | 640                                      |
| PLATE IN ASSEMBLY    | 1.4 FT-LB           | 13                                       |
| OPTICAL BAR          | 8 FT-LB             | 22                                       |
| SUPPLY REEL          | 50 FT-LB            | 7                                        |
| TAKE-UP REEL         | 22 FT-LB            | 11                                       |



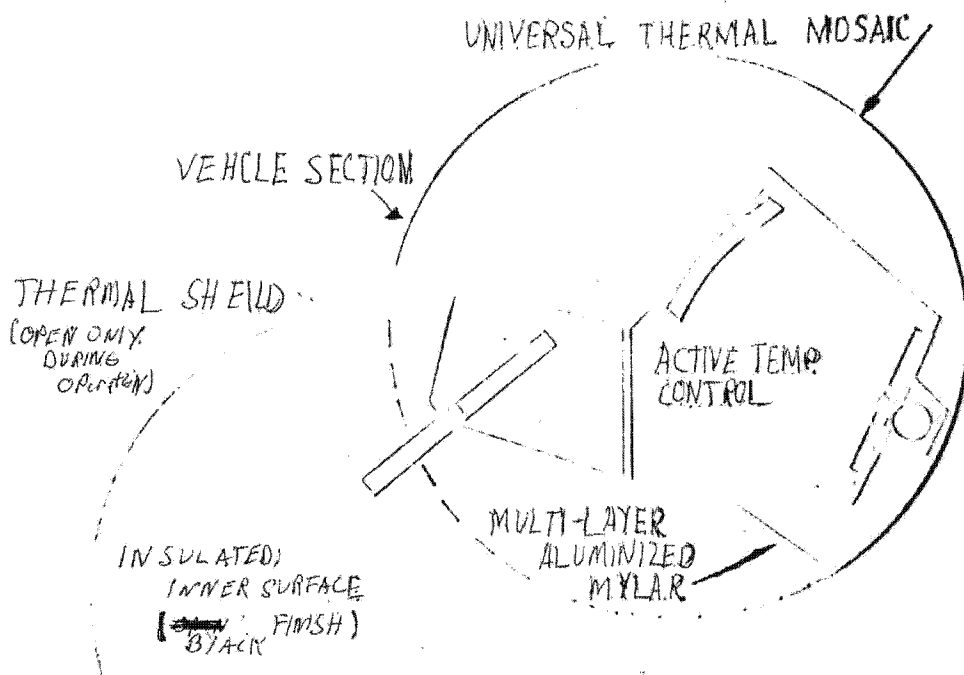
Unclassified

ITEK  
VIEWPORT DOOR AND INTERNAL CONFIGURATION.



~~TOP SECRET~~  
Special Handling

Unclassified



~~TOP SECRET~~

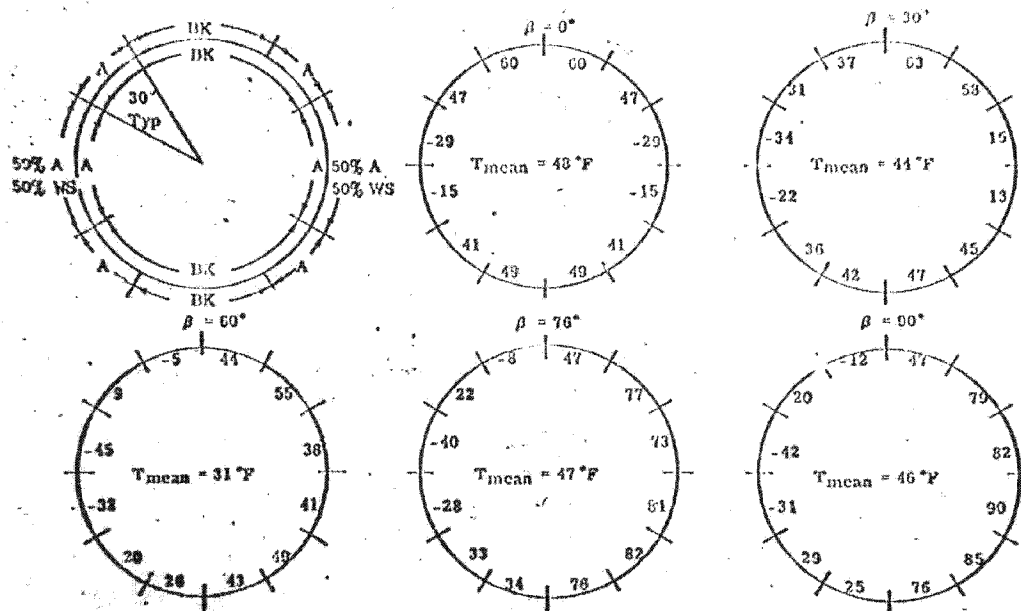
~~HX~~

Special Handling

Unclassified

~~TOP SECRET~~  
Special Handling

# ITER. THERMAL CONTROL PATTERN TEMPERATURE DISTRIBUTION



| Coating Material      | Symbol | $\alpha_g$ | $\epsilon$ |
|-----------------------|--------|------------|------------|
| Black acrylic lacquer | BK     | 0.93       | 0.89       |
| White silicone paint  | WS     | 0.17       | 0.92       |
| Polished aluminum     | A      | 0.12       | 0.04       |

~~TOP SECRET~~  
SPECIAL HANDLING

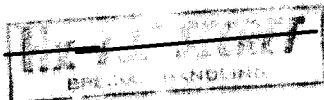
Unclassified

ITEKELECTRICAL POWER REQUIREMENTS VERSUS BETA ANGLE

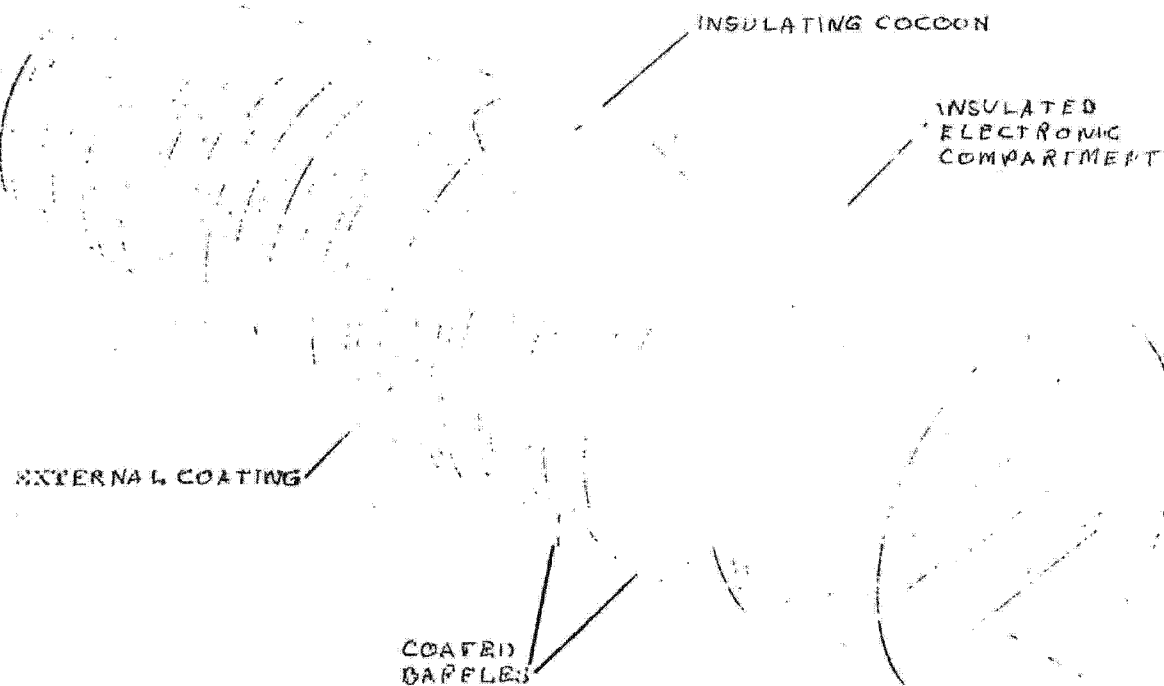
|                                                             | <u>POWER, WATTS</u>           |                                       |                                       |
|-------------------------------------------------------------|-------------------------------|---------------------------------------|---------------------------------------|
|                                                             | <u><math>\beta = 0</math></u> | <u><math>\beta = 160^\circ</math></u> | <u><math>\beta = 190^\circ</math></u> |
| CAMERA SYSTEM ORBIT-AVERAGE POWER                           |                               |                                       |                                       |
| O DOORS OPERATING ON DUTY CYCLE*                            | 17                            | 24                                    | 35                                    |
| O (OR CRUISE MODE, NO DOOR OPERATION)                       | (14)                          | (21)                                  | (25.7)                                |
| FILM COMPARTMENT ORBIT-AVERAGE POWER                        | 5.0                           | 6.7                                   | 5.1                                   |
| PEAK POWER DURING FIVE MINUTES OF OPERATION FOR TWO CAMERAS | **                            | 108.0                                 | 334.0                                 |

\* DUTY CYCLE CONSISTS OF FIVE MINUTES OPERATION PER ORBIT FOR EIGHT CONSECUTIVE ORBITS PER DAY FOR TWENTY-FIVE DAYS.

\*\* MAY BE A NET INFLUX OF ENERGY AT THE APERTURE DEPENDING ON THE LATITUDE OF OPERATION.



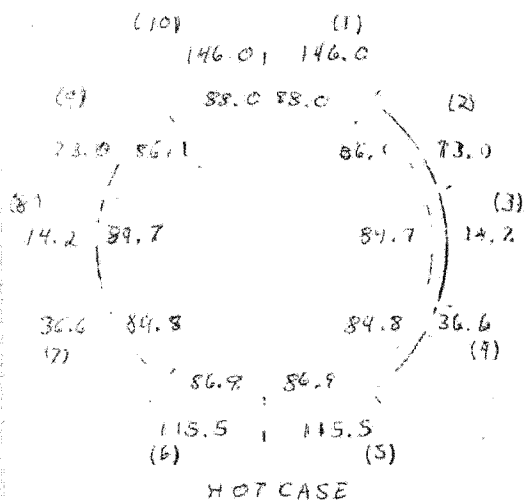
Unclassified

PERKIN-ELMER  
THERMAL CONFIGURATION~~TOP SECRET~~

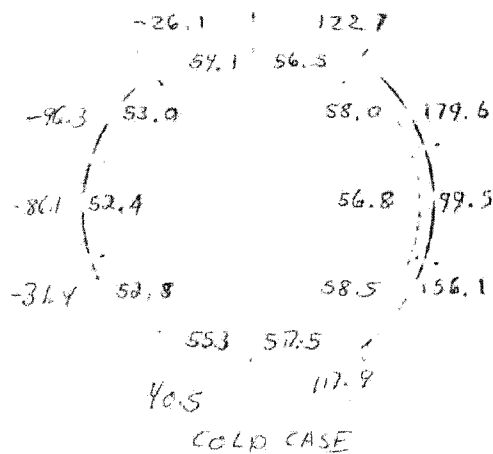
Special Handling



PERRIN-ELMER  
SBA TEMPERATURE DISTRIBUTION, °F



| COATING PATTERN |       |      |
|-----------------|-------|------|
| REGION          | W/E   | C    |
| (1)             | 1.850 | .175 |
| (2)             | 1.756 | .110 |
| (3)             | 0.498 | .640 |
| (4)             | 1.205 | .430 |
| (5)             | 2.500 | .270 |
| (6)             | 2.500 | .270 |
| (7)             | 1.295 | .400 |
| (8)             | 0.191 | .650 |
| (9)             | 1.390 | .400 |
| (10)            | 1.100 | .270 |



ENVIRONMENT CONSTANTS

|                                    | HOT CASE | COLD CASE |
|------------------------------------|----------|-----------|
| SOLAR, (BTU/HR. FT. <sup>2</sup> ) | 457.6    | 122.4     |
| ALBEDO, PERCENT                    | 0.44     | 0.32      |
| EARTH IR                           | 75.0     | 61.5      |
| a/c TOLERANCE                      | 40.017   | 40.017    |

~~TOP SECRET~~  
Special Handling

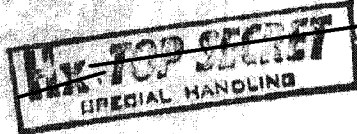
## PERKIN-WILMER

## OPTICS THERMAL ENVIRONMENT DURING CAMERA OPERATION

| PARAMETER                               | HOT CASE | COLD CASE |
|-----------------------------------------|----------|-----------|
| DAY OF YEAR                             | 2        | 132       |
| ALTITUDE, NAUTICAL MILES                | 100      | 100       |
| $\beta$ ANGLE, DEGREES                  | 0        | 60        |
| SOLAR CONSTANT, BTU/HR-FT <sup>2</sup>  | 467      | 413       |
| ALBEDO FACTOR, PERCENT                  | 70       | 10        |
| EARTH RADIATION, BTU/HR-FT <sup>2</sup> | 75       | 61.5      |

| ELEMENT                       | 30 EXTREME ABSORBED HEAT, BTU/HR-FT <sup>2</sup> |              |
|-------------------------------|--------------------------------------------------|--------------|
|                               | HOT CASE                                         | COLD CASE    |
| CORRECTOR PLATE               |                                                  |              |
| ● ALBEDO                      | 3.3                                              | 0.46         |
| ● EARTH RADIATION             | 7.6                                              | 6.2          |
| ● EMITTED TO SPACE AT 70°F    | -46.1                                            | -46.1        |
| FOLDING MIRROR (ALBEDO)*      | 0.5 TO 2.5                                       | 0.07 TO 0.35 |
| PRIMARY MIRROR (ALBEDO)       | 0.14                                             | 0.02         |
| CORRECTOR LENS GROUP (ALBEDO) | 3.9                                              | 0.56         |

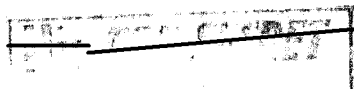
\*TRANSVERSE VARIATION (MIRROR TOP-TO-BOTTOM) INDICATED



Unclassified

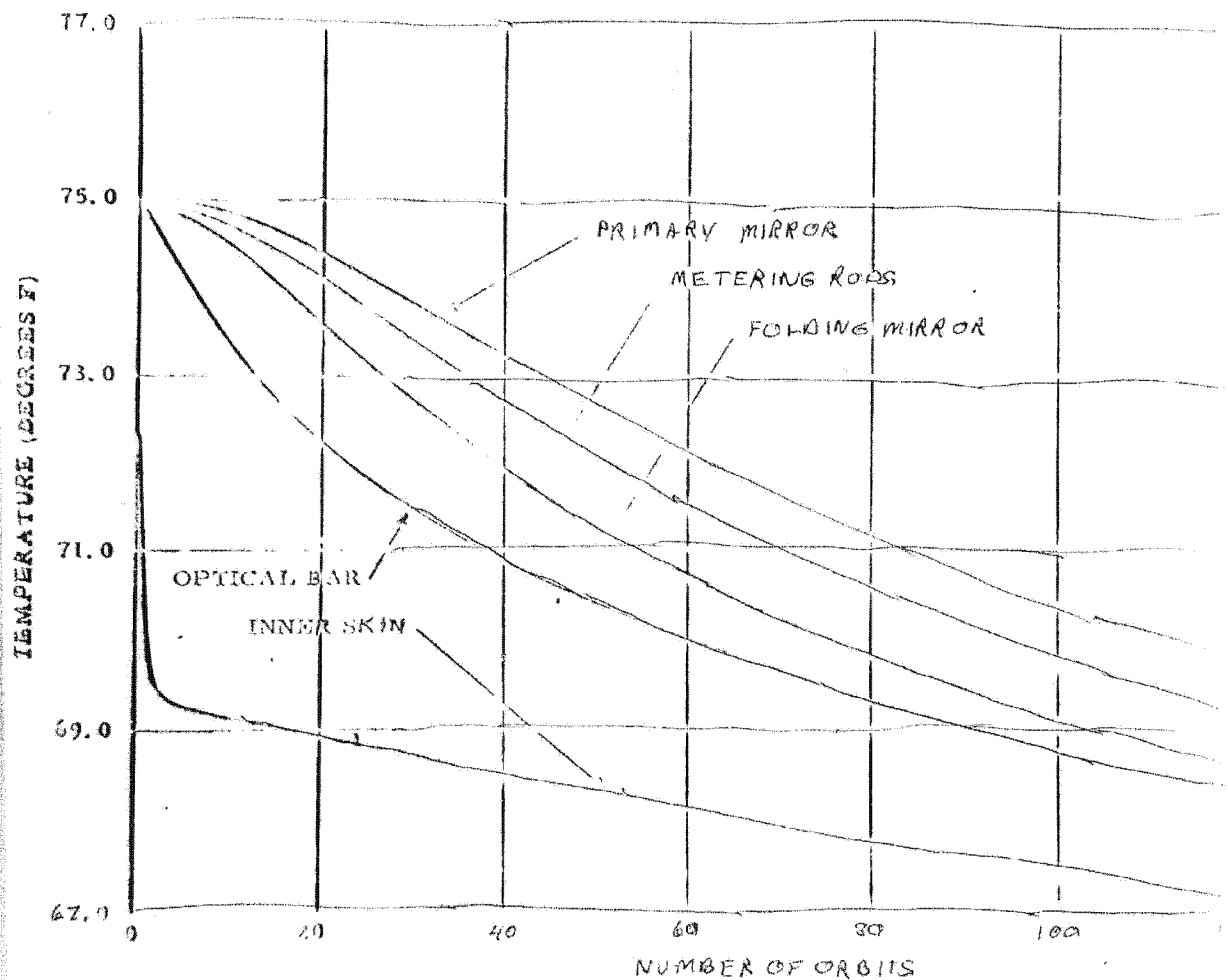
PERKIN-ELMERTEMPERATURE DISTRIBUTION OF OPTICAL ELEMENTS

| <u>Element</u>     | Uniform Temp. Change<br>(with Respect to Met. Rods)<br>Hot Case/Cold Case |                            | Axial Temp. Difference<br>( $T_{\text{Front}} - T_{\text{Rear}}$ )<br>Hot Case/Cold Case |                    |
|--------------------|---------------------------------------------------------------------------|----------------------------|------------------------------------------------------------------------------------------|--------------------|
|                    | $\Delta T, ^\circ\text{F}$                                                | Defocus Effect,<br>Microns | $\Delta T, ^\circ\text{F}$                                                               | Defocus<br>Microns |
| Window Plate       | -4.0/-1.5                                                                 | -0.72/-0.27                | -1.3/-1.0                                                                                | 0.62               |
| Exit Mirror        | 1.0/0                                                                     | 0/0                        | 0.37/0.06                                                                                | 3.0/0              |
| Entry Mirror       | 0/0                                                                       | 0/0                        | 0.05/negligible                                                                          | 0.11               |
| Retractor Element: |                                                                           |                            |                                                                                          |                    |
| No. 1              | 0.9/0.3                                                                   |                            | -0.12/0                                                                                  |                    |
| No. 2              | 1.2/0.4                                                                   |                            | -0.02/0                                                                                  |                    |
| No. 3              | 1.2/0.4                                                                   |                            | 0/0                                                                                      |                    |
| No. 4              | 2.5/1.5                                                                   |                            | -0.24/-0.20                                                                              |                    |



Unclassified

## PERKIN-ELMER SYSTEM THERMAL RESPONSE



~~TOP SECRET~~  
Special Handling

Unclassified

Electrical Power Requirements - Summary

(Design Mission)

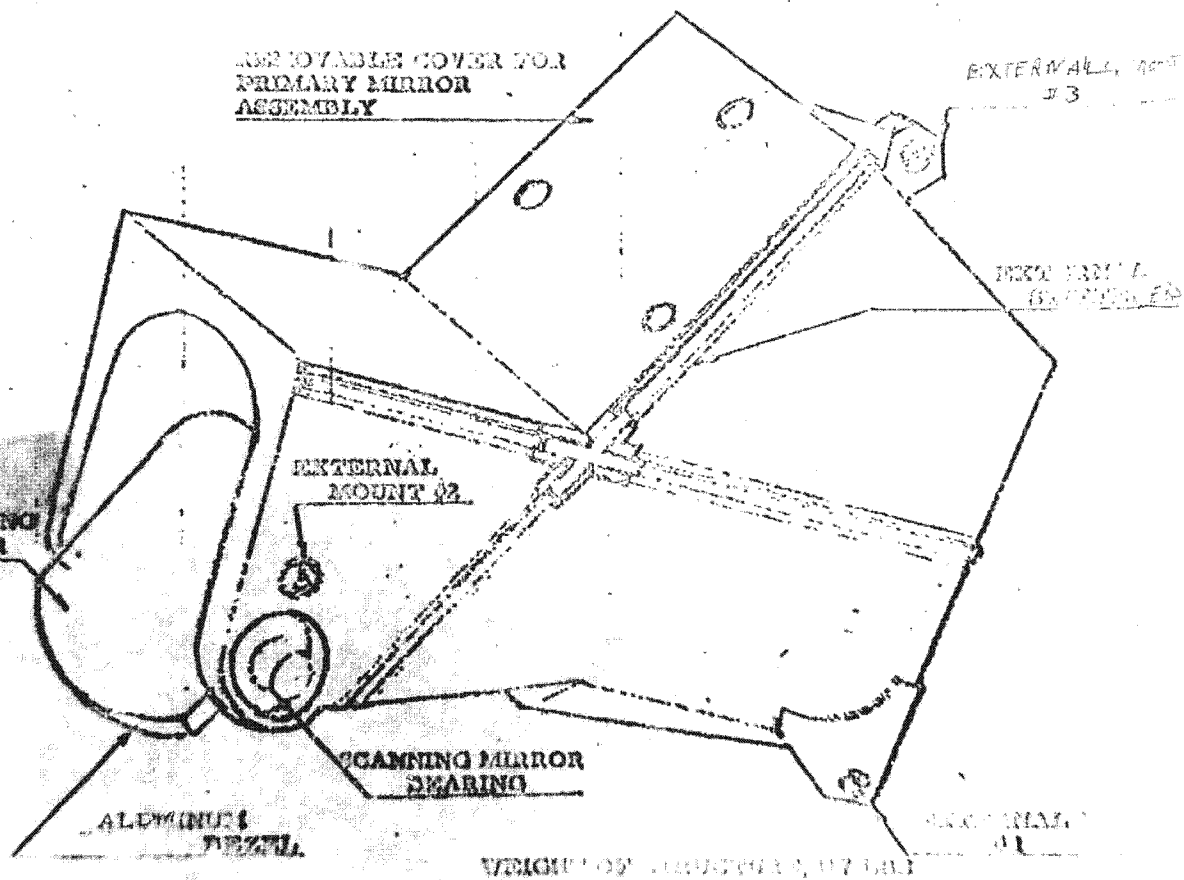
| FUNCTION           | Power Required ( Watt-Hour) |              |
|--------------------|-----------------------------|--------------|
|                    | ITEK                        | Perkin-Elmer |
| Camera             | (2,779)                     | (22,916)     |
| Steady-state       | 1,781                       | 12,396       |
| Start-stop         | 998                         | 10,520       |
| Pneumatics Control | ---                         | 2,150        |
| SBA Doors          | 600                         | ---          |
| Thermal Control    | 61,200                      | ---          |
| Total              | (64,579)                    | (25,060)     |

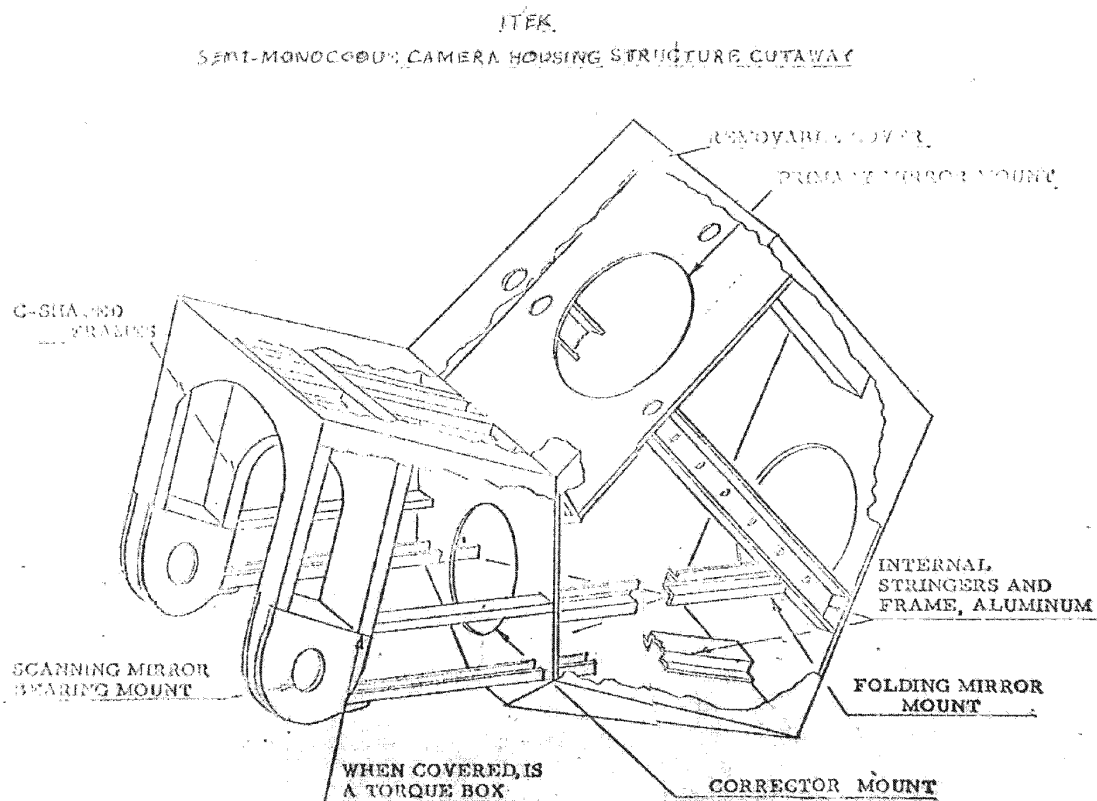
~~TOP SECRET~~

Special Handling

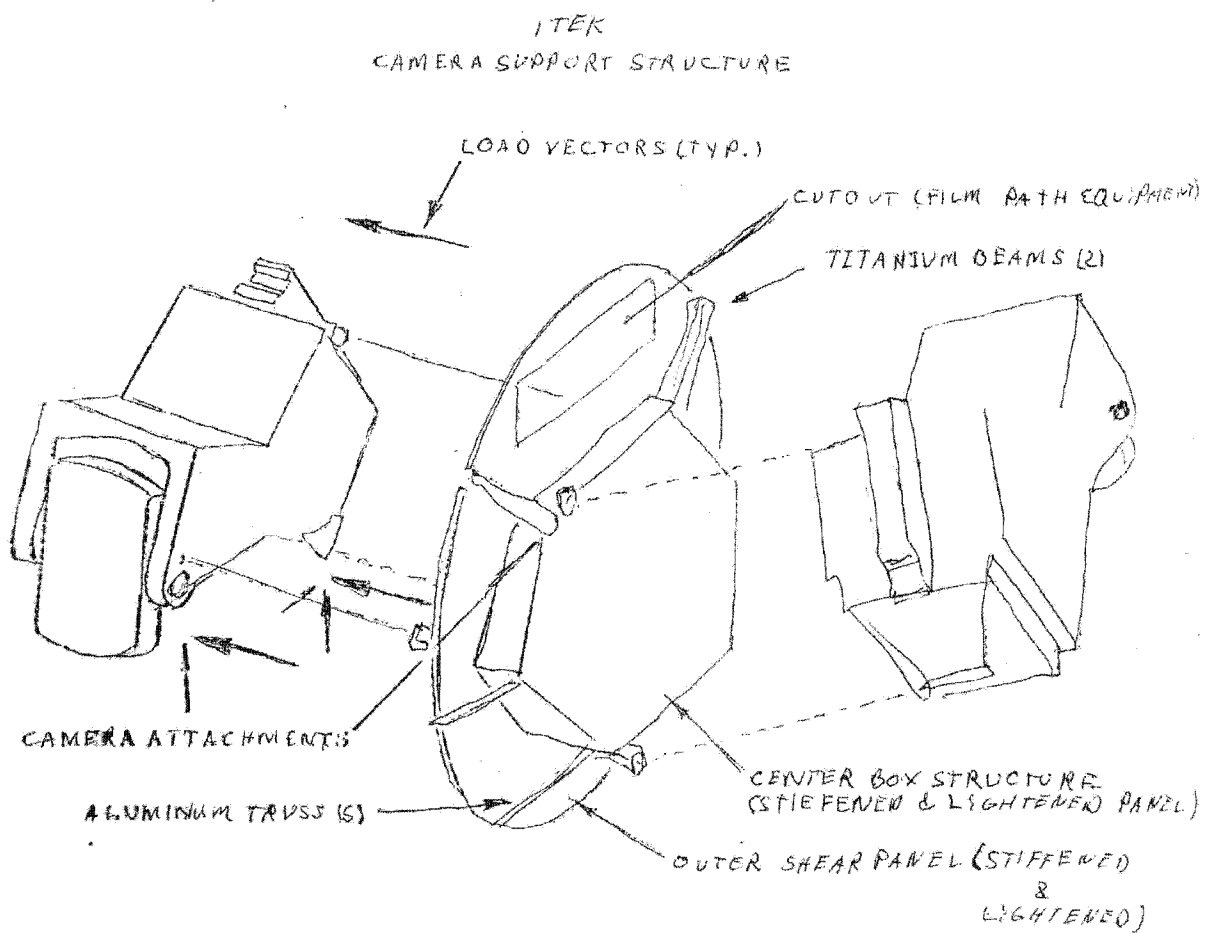
Unclassified

SEMI-MONOCOQUE CAMERA HOUSING STRUCTURE





ALL TOP SECRET  
SPECIAL HANDLING



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Special Handling



ITEK

STRUCTURAL DESIGN CRITERIA

| COMPONENT                                                   | CONDITION                                      | DESIGN LIMIT  |      | ULT. FACTOR | STIFFNESS |
|-------------------------------------------------------------|------------------------------------------------|---------------|------|-------------|-----------|
|                                                             |                                                | LOAD FACTOR   |      | OF SAFETY   | CRITERIA  |
|                                                             |                                                | AXIAL LATERAL |      |             |           |
| CAMERA FRAME<br>AND<br>COMPONENTS                           | GROUND<br>HANDLING                             | 6.0           | 6.0  | 1.5         | (A)       |
|                                                             | LAUNCH(STATIC<br>ACCELERATION<br>PLUS DYNAMIC) | 30.0          | 10.0 | 1.25        | (A)       |
|                                                             | GRAVITY<br>RELEASE                             | ----          | ---- | ----        | (B)       |
| CAMERA<br>MOUNTS<br>SUPPORT<br>STRUCTURE<br>SUPPLY<br>SPOOL | GROUND<br>SANDING                              | 6.0           | 6.0  | 1.5         | (A)       |
|                                                             | LAUNCH:                                        |               |      |             |           |
|                                                             | . STATIC<br>ACCEL.                             | 7.5           | 3.0  | 1.25        | (A)       |
|                                                             | * DYNAMIC                                      | UNDETERMINED  |      |             |           |

(A) MAXIMUM PERMANENT SET OF 0.2% AT LIMIT LOAD.

(B) MAXIMUM UNCOMPENSATED WAVEFRONT ERROR FROM TILT AND DECENTER OF 0.017λ RMS.

~~TOP SECRET~~  
Special Handling

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ITEK SENSOR SUBSYSTEM  
30-DAY MISSION DESIGN WEIGHTS

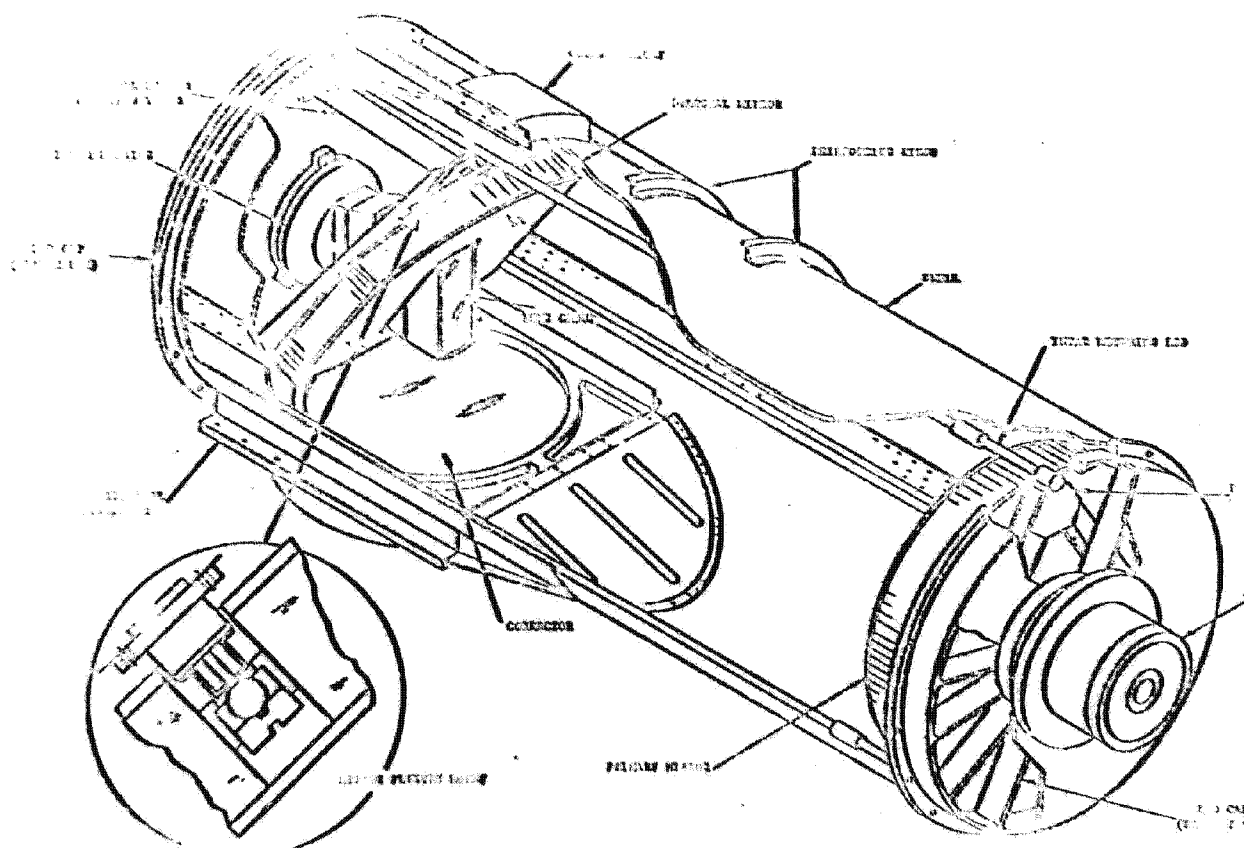
| ITEM                          | WEIGHT<br>LB- |
|-------------------------------|---------------|
| OPTICAL SENSORS               | 2,510         |
| ICS STRUCTURE                 | 155           |
| SUPPLY SPOOL ASSEMBLY         | 268           |
| ELECTRONICS                   | 125           |
| FILM HANDLING HARDWARE        | 75            |
| TAKEUP SPOOL ASSEMBLIES       | 268           |
| THERMO PROVISIONS             | 168           |
| WEIGHT - EMPTY                | 3,569         |
| FILM (SO-380)                 | 1,392         |
| TOTAL SENSOR SUBSYSTEM WEIGHT | 4,971         |



Unclassified

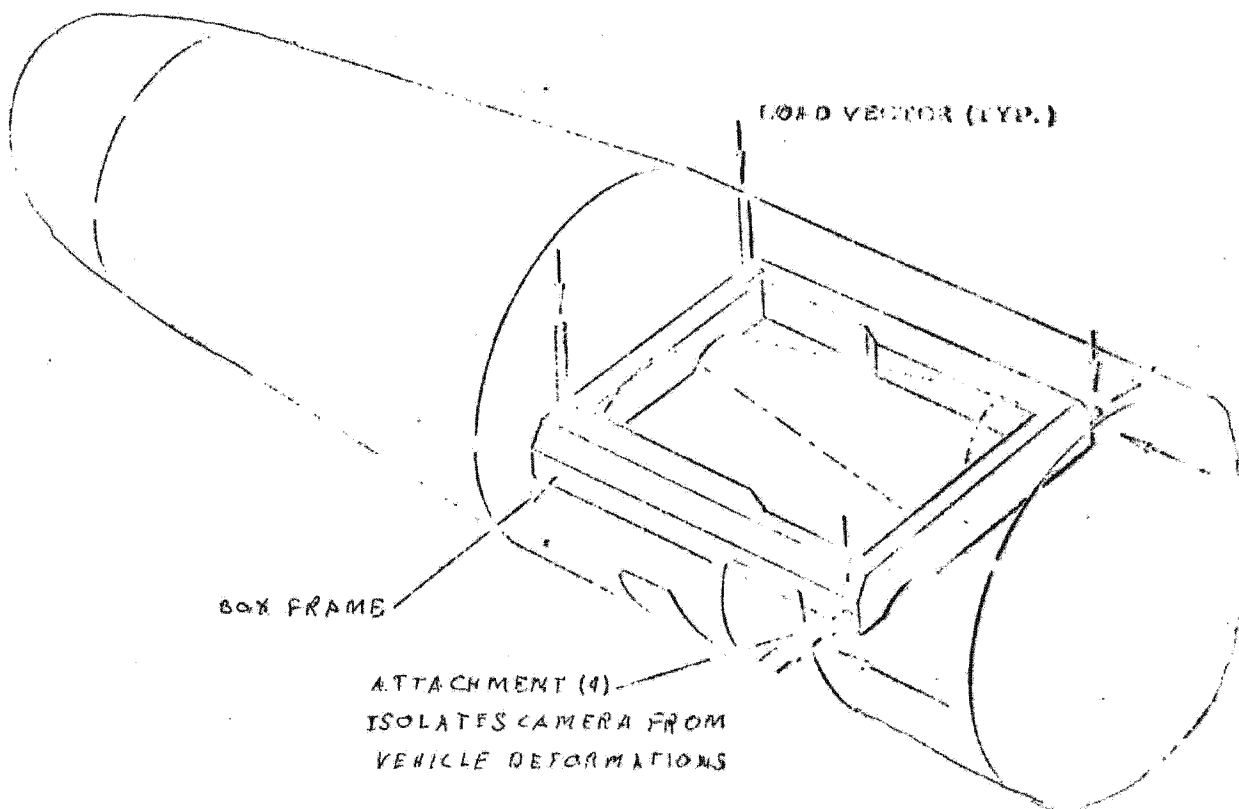
Unclassified

# PERKIN-ELMER OPTICAL BAR ASSEMBLY



Unclassified

AFKIN-ELMER  
CAMERA FRAME MOUNT



~~TOP SECRET~~

Sp. 201 Hand (50)

PERKIN ELMER

## STRUCTURAL DESIGN CRITERIA

| COMPONENT                                         | CONDITION                                   | DESIGN LIMIT<br>LOAD FACTOR |              | ULT. FACTOR<br>OF SAFETY | STRESS<br>LIMIT                                                                                      |
|---------------------------------------------------|---------------------------------------------|-----------------------------|--------------|--------------------------|------------------------------------------------------------------------------------------------------|
|                                                   |                                             | AXIAL                       | LATERAL      |                          |                                                                                                      |
| CAMERA SUPPORT<br>FRAME                           | LAUNCH <sup>(A)</sup>                       | 19.0                        | 8.0          | 1.25                     | (B)                                                                                                  |
| OPTICAL BAR &<br>PLATEN (THRUST<br>BEARING CAGED) | LAUNCH <sup>(A)</sup><br>GRAVITY<br>RELEASE | 16.5<br>----                | 11.0<br>---- | 1.25<br>----             | (B)<br>2 ARC SEC. MAXIMUM<br>AT PLATEN END                                                           |
| LOOPER                                            | LAUNCH <sup>(A)</sup>                       | 43.5                        | 8.0          | 1.25                     | (B)                                                                                                  |
| OPTICAL BAR<br>COMPONENTS                         | LAUNCH <sup>(A)</sup><br>GRAVITY<br>RELEASE | 30.0<br>----                | 11.0<br>---- | 1.25<br>----             | (B)<br>.001 IN. MAXIMUM<br>RELATIVE TO BASIC<br>STRUCTURAL TUBE                                      |
| SUPPLY REEL                                       | LAUNCH <sup>(A)</sup>                       | 20.5                        | ----         | ----                     | 0.2 IN. MAXIMUM<br>DYNAMIC DEFLECTION<br>AND 0.02 IN. MAXIMUM<br>PERMANENT DEFORM.<br>OF WOUND STACK |

(A) STATIC ACCELERATION PLUS RANDOM VIBRATION

(B) NO MEASURABLE PERMANENT DEFORMATION BETWEEN LAB AND ORBIT - LIMIT STRESSES  
ARE MAINTAINED BELOW THE PRECISION ELASTIC LIMIT.

PERMANENT-ELMER SENSOR SUBSYSTEM30-DAY MISSION DESIGN WEIGHTS

| ITEM                          | WEIGHT<br>-LB- |       |
|-------------------------------|----------------|-------|
| OPTICAL BARS                  | 1,186          |       |
| FRAME                         | 280            |       |
| SUPPLY SPOOL ASSEMBLY         | 340            |       |
| ELECTRONICS                   | 170            |       |
| WIRING                        | 102            |       |
| FILM HANDLING HARDWARE        | 140            |       |
| REEL SPOOL ASSEMBLIES         | 296            |       |
| PAINT AND INSULATION          | 35             |       |
| WEIGHT - EMPTY                |                | 2,549 |
| FILM (SO-380)                 | 1,701          |       |
| LIQUEFIED NITROGEN            | 27             |       |
| TOTAL SENSOR SUBSYSTEM WEIGHT |                | 4,277 |

~~TOP SECRET~~  
Special Handling