

OSA = 4942-64.



9204-SHC64- 113

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8 September 1964

Dear Jim:

Transmitted herewith are five (5) copies each of the DD-250 form covering the shipment of the Interface Specification (9204-SHC64-105) under Contract MB-1957 on 31 August 1964.

Copies #1 thru #5 of this document were transmitted to L. Dirks on 31 August 1964. Copy #10 is enclosed for your records.

Please sign two copies of the DD-250 form and return to W.N. Snouffer, P.O. Box 115, Bedford, Massachusetts.

Very truly yours,

Contract Administrator

Enclosures: 6

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9204SHC64-105

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28 August 1964

## INTERFACE SPECIFICATION

## 1. SCOPE

1.1 This specification defines the system configuration and envelope, weights and balance, and requirements for power, connectors, telemetry, vehicle motion performance, vehicle programmer command signals, film and thermal environment for proper interface between the camera system and vehicle.

## 2. APPLICABLE DOCUMENTS

Drawing No. SK66500

## 3. REQUIREMENTS

## 3.1 SYSTEM SIZE AND CONFIGURATION

3.1.1 The camera system configuration and envelope, mounting point locations, window size, shape and location, and intravehicle film path are as shown on Drawing No. SK66500. The vehicle shall accept the main camera assembly as a unit without any requirement for disassembly or realignment.

3.1.2 Access doors and work platforms shall be provided in the vehicle for assembly and pre-launch adjustment.

3.1.3 Attitude control jets shall be located to minimize plume interference and structural excitation at the cameras.

3.1.4 Mechanisms for separating stages and the window shall not produce excessive shock loads at the camera interface.

3.1.5 All vehicle joints shall be light tight.

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3.1.6 Pressure relief valves shall be provided around light tight boots to prevent rupture of same and to prevent sudden loads on camera components during ascent phase.

### 3.2 SYSTEM WEIGHTS AND BALANCE

#### 3.2.1 Total System Weight

Main Cameras (less film)	2,142 #
S/I Camera (less film)	45
RV Takeup Unit (including cutter/sealer)	50
Intra-Vehicle Film Guides	3
Total Film Load	<u>805</u>
Total	3,045 #

#### 3.2.2 Center of Gravity Locations

The center of gravity locations for main and S/I cameras are shown on Drawing No. SK66500.

#### 3.2.3 Momentum Unbalance

Steady angular momentum balance will not exceed 85 lb.ft.sec. about the yaw axis, and 10 lb.ft.sec. about the roll and pitch axes. Short duration torque unbalance about the roll, pitch, and yaw axes will not exceed 5.0 lb.ft. per axis.

### 3.3 POWER REQUIREMENTS

#### 3.3.1 Prime Power

##### a. Continuous Film Transport

Table 1 includes the power requirements for the camera system for 30 starts on each camera system with power being supplied to each optical bar drive to maintain a momentum balance

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whenever one camera is operating. 50% of the time has been assumed as an allowance for each camera to operate separately.

Starting Energy	1,527,200 watt sec
Running Energy	<u>12,898,900</u> watt sec
Total Energy Required	14,426,100
Power Control 10%	<u>1,442,000</u>
	15,868,100 watt sec
Tolerance 30%	4,400 watt hrs
	5,700 with 30% Tolerance

b. Intermittent Film Transport

Table 2 includes the power requirements for the camera system for 30 starts on each camera system with power being supplied to each optical bar drive to maintain a momentum balance whenever one camera is operating. 50% of the time has been assumed as an allowance for each camera to operate separately.

Starting Energy	1,455,000 watt sec
Running Energy	<u>13,674,900</u> watt sec
Total Energy Required	15,129,900
Power Control 10%	<u>1,513,900</u>
	16,643,800 watt sec
Tolerance 30%	4,620 watt hrs
	6,000 with 30% Tolerance

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TABLE 1 - Continuous Film Transport Power Requirements

<u>Item</u>	<u>No Starts/ Stops</u>	<u>Starting Energy Watt-sec</u>	<u>Total Energy Starting</u>	<u>Running Power</u>	<u>Running Time</u>	<u>Total Energy Running</u>
Camera #1						
Film Platen Servo	30	1120	33,600	43.3	3000 sec x 7	910,000
Optical Bar Servo	40	7100	284,000	48.5	4500 sec x 4	870,000
Takeup Spool	30	7350	220,500	50w x 7 passes	3000 sec	1,050,000
Supply Spool	30	7350	220,500	50w x 7 passes	3000 sec	1,050,000
V/h Servo				156	3000 sec	468,000
			758,600			4,348,000
Camera #2 (Equal Camera #1)						
Clock (continuous)	4 day mission			13	346,000	3,460,000
Digital Logic				43.5	3,000	130,500
Telemetry				17.3	3,000	52,900
S.I. Camera				86.5	3,000	259,500
Film Loading Cassette #1				50w	3,000	150,000
Film Loading Cassette #2				50w	3,000	150,000
Cut and Splice	2	5000	10,000			
			1,527,200			12,898,900

NOTE: Power for 7 passes is provided for due to the continuance of this factor presenting itself as a possibility.

TABLE 2 - Intermittent Film Transport Power Requirements

<u>Item</u>	<u>No Starts/ Stops</u>	<u>Starting Energy Watt sec</u>	<u>Total Energy Starting</u>	<u>Running Power</u>	<u>Running Time</u>	<u>Total Energy Running</u>
Camera #1						
Film Platen Servo				1200	3000 sec	3,600,000
Optical Bar Servo	40	7100	284,000	48.5	4500 sec	218,000
Takeup Spool	30	7350	220,500	50 w x 2	3000 sec	300,000
Supply Spool	30	7350	220,500	50 w x 1	3000 sec	150,000
V/h Servo				156	3000 sec	468,000
			725,000			4,736,000
Camera #2 (E all Camera #1)						
Clock (continuous)	4 day mission			13	346,000	3,460,000
Digital Logic				43.5	3,000	130,500
Telemetry				17.3	3,000	52,900
S/I Camera				86.5	3,000	259,500
Film Loading Cassette #1				50w	3,000	150,000
Film Loading Cassette #2				50w	3,000	150,000
Cut and Splice	2	5000	10,000			
			1,455,000			4,202,900

NOTE: Power for 7 passes is provided for due to the continuance of this factor presenting itself as a possibility.

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3.3.2 Voltage Requirements

+28v $\pm$ 3v	100 amps max.	1620 watt-hrs.
-28v $\pm$ 3v	100 amps max.	1620 watt-hrs.

The 3 volt tolerances includes line drops and noise, from no load through full load, as delivered into the recording system.

## 3.4 TELEMETRY REQUIREMENTS

3.4.1 The telemetry information shall have, as a minimum a 5 KC channel information capacity, in the following sub-groupings:

- a. Fifteen (15) channels each with a minimum information bandwidth of (25) twenty-five cycles per second.
- b. Twenty (20) channels each with a minimum information bandwidth of (10) ten cycles per second.
- c. Four (4) channels each with a minimum information bandwidth of (100) one hundred cycles per second.
- d. Four (4) channels BW 1KC each (vibration).

## 3.5 VEHICLE REQUIREMENTS (DURING CAMERA OPERATION)

3.5.1 The vehicle motions reflected to the supporting members of the camera system shall be maintained below the following levels during the operation of the camera system:

a. Vehicle Attitude:	Pitch Axis	$\pm$ 0.25 degrees
	Roll Axis	$\pm$ 0.25 degrees
	Yaw Axis	$\pm$ 0.50 degrees
b. Vehicle Residual Rate:	Pitch	$\pm$ 0.31 Milliradians per second
	Roll	$\pm$ 0.31 Milliradians per second
	Yaw	$\pm$ 0.31 Milliradians per second

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### 3.6 VEHICLE PROGRAMMER REQUIREMENTS

3.6.1 The vehicle programmer shall supply to the camera system the following command signals:

a. #1 Camera V/h Command Code

The V/h command code shall be a 10 bit serial binary code providing a real time V/h command accurate to 1.0% of the actual V/h rates.

b. #1 Optical Bar Start Command (OBSC)

The OBSC command shall be provided to the camera system 40 seconds prior to the start of the photography cycle, and shall be maintained through the completion of the photography cycle.

c. #1 Camera Start Command Signal (CCS)

The camera start command shall be supplied to the camera system 4 seconds prior to the start of the photography cycle, and shall be maintained throughout the photography cycle.

d. #1 Camera Film Rewind Command (FRC)

The film rewind command shall be maintained throughout the film rewind cycle.

e. #2 Camera V/h Command Code

The V/h command code shall be a 10 bit serial binary code providing a real time V/h command accurate to 1.0% of the actual V/h rates.

f. #2 Optical Bar Start Command (OBSC)

The OBSC command shall be provided to the camera system 40 seconds prior to the start of the photography cycle, and shall be maintained through the completion of the photography cycle.

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## g. #2 Camera Start Command Signal (CCS)

The camera start command shall be supplied to the camera system 4 seconds prior to the start of the photography cycle, and shall be maintained throughout the photography cycle.

## h. #2 Camera Film Rewind Command (FRC)

The film rewind command shall be maintained throughout the film rewind cycle.

## i. Standby/Operate Command

## j. Prime Power On, Camera #1

## k. Prime Power On, Camera #2

## l. Cut and Splice, Camera #1

## m. Cut and Splice Camera #2

## n. Camera Master Timing On/Off Command

## o. Camera Master Timing Reset Command

## p. Cut and Seal Camera #1

## q. Cut and Seal Camera #2

## r. Cut and Seal S/I Camera

## 3.7 CONNECTOR REQUIREMENTS

3.7.1 The vehicle shall supply input signals to the camera system through the following connectors. Final choice of connector type shall be determined consistent with applicable specifications and the number type and forms of the signals passing through the connector, and shall be subject to the approval of the camera manufacturer.

#1 - Prime Power Connector

#2 - 28v Discrete Commands

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- #3 - Digital Signals (Time, V/h)
- #4 - Telemetry Signals
- #5 - Telemetry Signals
- #6 - Ground Test Signal Input Connector
- #7 - Ground Test Signal Output Connector #1
- #8 - Ground Test Signal Output Connector #2

### 3.8 THERMAL INTERFACE

3.8.1 The vehicle wall temperature as viewed by the camera system shall be maintained at  $70^{\circ} \pm 15^{\circ}\text{F}$ , including bulkheads or equivalent closures which shall be provided forward and aft of the cameras. Size of the window shall be held to the smallest possible, consistent with the optical view shown in SK66500. Tolerance on the specified temperature applies in both time and space domains. The specified temperature shall be maintained considering inputs from sun, earth, ascent heating, and interval power dissipation, as described in this document in Section 3.3.

### 3.9 FILM REQUIREMENTS FOR FEASIBILITY MODEL TESTING

- 3.9.1 Film Type - 4404 or equivalent      7" Width
- 3.9.2 Film Length 7,000 x 12    30,000 x 3    174,000 feet
- 3.9.3 Itek will supply the following quantities of spools by 1 October 1964
  - 12 - 20 inch outside dia 6" core 7,000 ft. cap.
  - 3 - 38 inch outside dia 6" core 30,000 ft. cap.
- 3.9.4 Loaded Film Spools Required
  - 6 - 20" dia    1 - 38" dia by 1 November 1964
  - 6 - 20" dia    2 - 38" dia by 15 November 1964.

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