



























TABLE 5  
COMBINED INSTRUMENT PACKAGE

Instruments	Mass (kg)	Dimensions (cm)	Power (watt)	Model Selection	Warmup Time (sec)	Instrument ON Time (sec)	Status Indicators	Modes of Operation*	Data Accuracy	Data Display	Data Bandwidth (BPS)
<u>70mm Pulse-type Camera</u>					2	0.1-10.0	Radiation Level Monitor	M, SA	10%	C-scope on Earth	
#1 (spectral reference and #1 stereo)	3.1	10 x 22 x 17 + magazine	75	Itek 70mm D/N (modified)			Thermocouple				
#2 (UV)	2.5	10 x 22 x 17	75	Itek 70mm D/N			Thermocouple				
#3 (IR)	2.5	10 x 22 x 17	75	Itek 70mm D/N			Thermocouple				
#4 (2nd stereo)	2.7	10 x 22 x 17 + magazine	75	Itek 70mm D/N (modified)			Thermocouple				
<u>Spectroradiometer</u>	10.0	45 x 26 x 15 + 45 x 54 x 19	50	P-E SG-4 (modified)	30-60	1 to 20	Scope Display of Signal	M, SA	5%	C-scope on Earth	$2.8 \times 10^2 - 10^4$
<u>Interferometer Spectrometer</u>	4.0	8.13 x 16 x 16	10	Block I-4T (modified)	30-60	0.1 to 3.0	Scope Display of Signal	M, SA	5%	C-scope on Earth	$3.03 \times 10^2 - 0.1 \times 10^3$ (with 0.4 sec max. scan rate)
<u>TV (includes display)</u>	5.0	15 x 20 x 28 + 15 x 15 x 20	25	GEC ED 6038 (SONY monitor)	2	On during entire experiment	None	M, SA	10%	Monitor in Vehicle	
<u>Radiometer (3-channel)</u>	7.0	16.5 x 24 x 21	20	Block E-9B or P-11	30-60	1 to 10	Scope Display of Signal	M, SA	5%	C-scope on Earth	$70 - 7 \times 10^3$
<u>Flying Spot Scanner</u>	9.1	15 x 15 x 25	20		30-60	Not in operation during measurement time per frame	None	SA	10%		$3.2 \times 10^4 - 3.0 \times 10^7$
<u>Auxiliary Equipment</u>	5.0	SEE TABLE 4									

\* SA - semiautomatic  
M - manual



TABLE 6

## SURFACE GEOPHYSICAL MEASUREMENT INSTRUMENTS

Measurement	Instrument(s)	Range of Measmt	"On Time" Per Measurement	Data Format	Mass (kg)	Volume (cm <sup>3</sup> )	Power (watts) (operating)	
Gravity Surveying	LaCoste-Romberg Gravity Meter	161, 750-162, 250 mgal	1 min	manual record	5.9 (with battery)	6936.	4.	
	Falling Ball Gravimeter	0-2 x 10 <sup>5</sup> mgal	0.25 sec	Binary	2.7	2125.	3.	
Magnetic Field	Metastable Helium Magnetometer	0-300γ	1 min	0-5 VDC	4.	3848.	5.	
	Schoenstedt Fluxgate Magnetometer, Model RAM 43C	0.1-300γ	As desired	0-2.5 VDC	1.5	2713.	2.5	
	Varian V4948 Rubidium Vapor Magnetometer	0.1-300γ	Continuous monitoring	FM; 5cps-3kc at 0-5 VDC	2.7	2106.	3.5	
Surface Electrical	1. Resistivity	Resistivity meter 4 electrodes for above Cables for above	1-10 <sup>7</sup> ohms	10 sec per reading	0-5 VDC	1.5	295.	27.
							352.	N. A.
	2. Spontaneous Polarization	Potentiometer	0.003-3. v/m	5 sec per reading	0-5 VDC		Included with resistivity meter above	0.5
	3. Electric Pulse	Generator Detector System	1-10 <sup>5</sup> ohm-cm	60 sec	0-5 VDC	3.0	4375.	10.
	4. Magnetic Susceptibility, Resistivity	Impedance Detector	10-10 <sup>5</sup> micro-cgs 1-10 <sup>4</sup> ohm-cm	5 min	0-5 VDC	3.7	236.	10.
	5. RF Antenna	Transmitter	10 <sup>-1</sup> -10 <sup>9</sup> ohm-cm	5 min	1 channel	3.0	12,000. (Electronics Only)	10.
	6. Inductive Field	Coil, Impedance Bridge	10 <sup>-1</sup> -10 <sup>4</sup> ohm-cm	0-1 sec	1 channel	4.0	320. (Electronics Only)	1.
7. Electrostatic Potential Gradient	Capacitor Plates, Vibrating Reed Electrometer	10 <sup>-2</sup> -10 <sup>4</sup> mv/m	0-1 sec	1 channel	2.0	320. (Electronics Only)	1.	
Surface Nuclear Measurements	1. Gamma-Gamma	Gamma Source, Gamma Ray Detector	0.8-8gm/cm <sup>3</sup>	5-10 min per surface measmt	0-5 VDC	2.7	860.	5.
	2. Neutron-Neutron	Pulsed Neutron Source, Neutron Detector	0.01-10 ev	5-10 min	0-5 VDC	6.9	1720.	35.
	3. Natural Gamma Ray	Gamma Ray Detector Count Rate Meter, Data Processor	0-10 <sup>2</sup> 0-10 <sup>3</sup> 0-10 <sup>4</sup> 0-10 <sup>5</sup> cps	Continuous during traverse	Binary	3.6	565.	10.
	4. Neutron-Gamma	Pulsed Neutron Source, Gamma Ray Detector	0.1-8 Mev	5-10 min	Binary	6.4	1175.	30.
	5. Spectral Gamma	Gamma Ray Detector, 32 Channels of 128 Channel Analyzer	0.1-2.8 Mev	Continuous during survey	Binary	3.7	861.	12.
Penetration Resistance	Penetrometer	To depths of 10 ft	---	0-5 VDC	2.7	7549.	7.	
Gas Analysis	Quadrupole Mass Spectrometer	2-80 AMU	1.5 min	0-5 VDC	4.55	8430.	23.	





TABLE 7

## SUBSURFACE GEOPHYSICAL MEASUREMENT INSTRUMENTS

Measurement	Instrument(s)	Range of Measurement	"On-Time" Per Measurement	Data Format	Mass (kg)	Volume (cm <sup>3</sup> )	Power (Watts) (Operating)
Active Seismic	Geophones (6)	NA			5.	24,900.	0
	Cable, 200 m 7 pair	NA					0
	Amp System				4.5	7,080.	10
	Loading Poles	NA			2.6	1,620.	0
	Packaging and Shock Mount	NA			2.3	4,920.	0
	Explosives (27 packages)	NA			4.5	3,600.	0
	Detonators (10)	NA			2.3	1,000.	0
	Receivers (10)	NA			2.8	2,000.	0
	Digital Record System	0.003-3 km (subsurface horizons)	1 min	Binary	5.0	21,825.	40
Analog Record System	0.03-3 km (subsurface horizons)	1 min	Analog, 0-3 v	13.5	25,590.	40	
Sonic Velocity	Wall Coupling	0-30 m		Analog Voltage	0.45	32.8	0
	Geophone (1)	in 3-m steps			0.27	24.6	0
	Cable (35 meters)				2.7	14,700.	0
	Loading Poles				6.3	3,854.	0
	Acoustic Velocity Instrument				0.2	515.	0
	Squibs (15)				1.3	204.	0
Core Hole Electrical	Induction Logging Sonde (Less Cable)	10 <sup>2</sup> -10 <sup>12</sup> ohm-cm, 10-10 <sup>5</sup> micro-oersted/gauss	Continuous during logging	Voltage Variation	2.3	100.	2
Heat Flow	Temp Sensors and Thermal Conductivity Measuring Device	0.05-1.6 <sup>o</sup> K/m -40 to +45 <sup>o</sup> C, 0-100 watts	Conductivity: 10 hr Heat flow: months	0-5 VDC	20.4	56,634.	1.5 (continuous) and 120 for 10 hr





of drilling of 5 cm diameter hole 30 m deep and taking a 1.9 cm diameter core sample. The total system weighs 85.2 kg and requires 47.6 kwh of power. It was estimated that the total task time would be 20.95 hr and that the astronaut would be directly involved for 36.4% of the total task time.

Table 8 gives the pertinent parameters of the drill system.

TABLE 8

DRILL SYSTEM COMPONENTS

	Weight (kg) (lb)	Space Envelope (meters) (ft)
Drill bit assembly Air Motor Impactor	8.4 (18.4)	5 cm dia x 3 m long (2 in. dia x 10 ft long)
Drill Rod Extensions (9)	33.1 (73.0)	5 cm dia x 3 m long (2 in. dia x 10 ft long)
Feed, Thrust and Storage System	26.3 (58.0)	.76 m x .21 m x 3.66 m (2.5 ft x 0.7 ft x 12 ft)
Radiator	5.2 (11.5)	.018 m x .3048 m x 7.6 m (.06 ft x 1 ft x 25 ft)
Air Compressor	12.2 (27.0)	.15 m dia x .3048 m (.5 ft dia x 1 ft)
	<u>85.2</u> (187.9)	



TABLE 9  
RECOMMENDED SCIENTIFIC INSTRUMENT PACKAGE

Instrument	Weight (kg)	Volume (cm <sup>3</sup> )	Power (watts)
Core Drill	85.4	643,252	3252
Mining Core Splitter	2.5	1,969	0
Nuclear Experiments Package, which includes:			
Gamma source, gamma detector, pulsed neutron source, neutron detector, count rate meter, data processor, 128 channel analyzer, source-detector shield	15.6	3,496	52
Active Seismic Package, which includes:			
Six geophones, 200 m cable, amp system, tapes, packaging and shock mount, explosives, detonators, 10 receivers	21.4	43,500	10
Sonic Velocity:			
Active seismic components plus wall coupling, cable, geophone, 15 squibs, acoustic velocity instrument	4.9	15,476	-----
70mm Framing Cameras (4)	10.0	13,520	300
Radiometer	7.0	8,340	20
Spectroradiometer	10.0	70,300	50
Interferometer Spectrometer	4.0	3,790	10
TV	5.0	3,195	15
Platform and Mounting for Boresighted Package	3.0	N. A.	-----
Film Readout Device	9.1	16,400	20
Falling Ball Gravimeter	2.7	2,125	3
La Coste - Romberg Gravimeter (w/battery)	5.9	6,936	4
Quadrupole Mass Spectrometer	4.55	8,430	28
Metastable He Magnetometer	4.0	3,848	5
Core Hole Electrical Induction Logging Sonde	2.3	100	2
EM Probing Equipment: Antennas, Impedance Measuring Device	2.7	14,200	2
Penetrometer	2.7	7,549	7
Surface Electrical Package, which includes:			
Resistivity meter, potentiometer, cables, and electronics	1.5	797	28
	204.25	867,223	3801



	<u>Weight (kg)</u>	<u>Volume (cm<sup>3</sup>)</u>	<u>Power (watts)</u>
Recommended instruments	204.25	867,223	3801
Apollo inherited equipments	31.7	92,984	33.8
Radiation hazard instruments	2.8	2,140	1.8
Data handling, storage, display	30.0	41,840	98
Internal cabling	4.4	18,000	—
Experiment connection panel	2.4	8,200	—
Equipment stowage and contingencies	<u>42.45</u>	<u>—</u>	<u>—</u>
Total	318.	1,030,387	3934.6

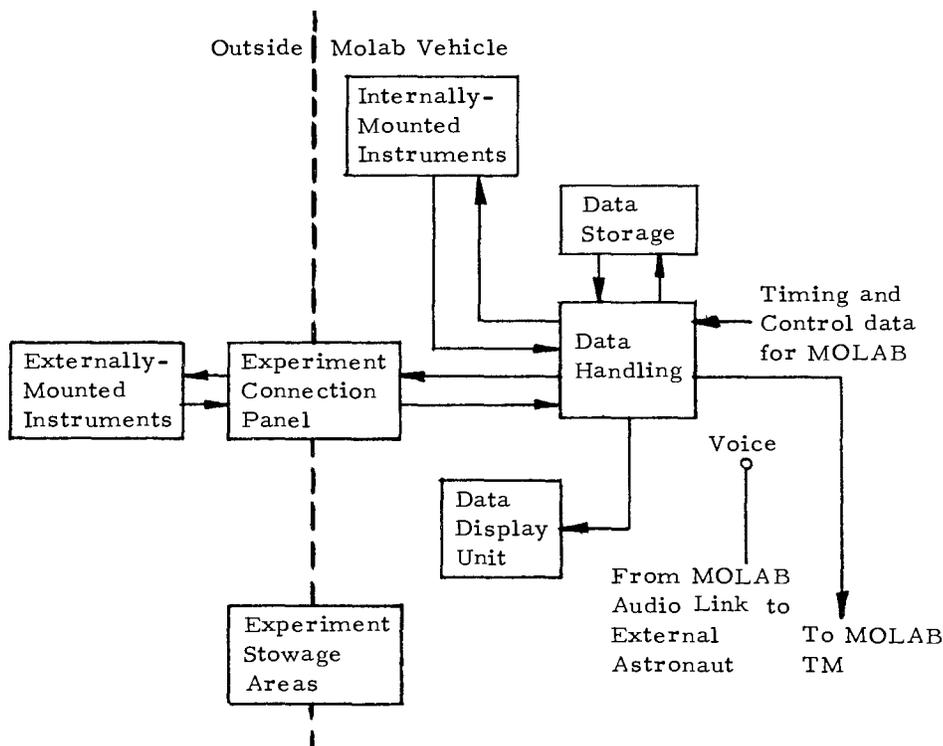


Figure 2 Simplified Scientific Instrumentation System Functional Block Diagram



