SMITHSONIAN ASTROPHYSICAL OBSERVATORY

HARVARD COLLEGE OBSERVATORY

A Tabulation of Meteor-Echo Rates

JULY 1965 - JUNE 1966

By R. G. Lacy

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A TABULATION OF METEOR-ECHO RATES
JULY 1965 - JUNE 1966

R. G. Lacy*

Introduction

This report presents a tabulation of echo rates obtained during the first year of operation of the Radio Meteor Project's echo analyzer. The schedule for observing these meteor rates is the same as the one used by the project to record radio meteors on 70-mm film. According to the schedule (see Table 1), two observations on consecutive days are made for each hour of the day, during a 5-day period. This period is then repeated every other week, starting on a Monday. In practice, the actual hours of operation may vary considerably from the schedule. The actual hours of operation for the period July 1965 through June 1966 are shown in Table 2. During this period the schedule was expanded to include coverage of the major meteor showers. In addition, equipment rebuilding, tests, and debugging during the fall of 1965 altered the planned schedule to some extent.

For the purposes of this report, the echo rates have been grouped under one of two headings. The rates that were observed during the normal schedule (see Table 3) are listed under the heading "Scheduled Operation," whereas the rates observed during a major shower are listed under the name of that shower. Each rate is listed under the

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proper magnitude level, and opposite the time of day it was observed. Designation of the half-hour is omitted. The figures shown are hourly rates; no other adjustment has been made. Table 4 provides a comparison of Table 3 with the meteor-acquisition rates obtained on 16-mm film. The threshold sensitivity in this case lies between magnitude levels 1 and 2. The figures shown in Table 4 are actual meteor counts for a 5-minute period of observation made 15 minutes before and after the hour.

The following section describes the magnitude levels and calibration of the equipment. These must be taken into consideration when the echo rates are used.

The Echo Analyzer

The echo analyzer is an automatic device for counting meteor echoes above a preset magnitude. The magnitude is set periodically at four different levels every half hour, as shown in Figure 1. Level 1 is examined twice during the cycle, for 2 minutes each time. Levels 2, 3, and 4, being less sensitive, are given 4, 8, and 14 minutes, respectively.

In addition to magnitude selection, a further discrimination is made on the basis of echo duration. Echoes that last for more than 12 seconds are assumed to be airplanes, and are rejected. Also, a second meteor in the same range interval, and at the same time, is suppressed.

Table 5 shows a history of the echo analyzer calibration. It lists the voltages at the input of the receiver corresponding to the four levels, and the transmitter power P_t for each day of operation during

the period July 26, 1965, through June 3, 1966. Transmitter power P_t is the sum of the power output of the north and south troughs of the antenna. The coefficient K_i is the ratio $(V_i)^2/P_t$. The absolute value of K_i in watts is $(K_i)(2)(10^{-20})$. From November 9 through November 19, 1965, the values of the receiver input voltage were uncertain, and lie within the range given in the table. This was due to a discrepancy in measuring the output of the calibrating generator during this period. The coefficient K was determined from an average of the two given values of the receiver input voltage.

Table 1. Schedule of operation of the Harvard Radio Meteor Project transmitter, Havana, Illinois

DAY	HOURS (CST)
MONDAY	0000 – 0800
TUESDAY	0000 – 1200
WEDNESDAY	0800 – 1600
THURSDAY	1200 – 2400
FRIDAY	1600 – 2400

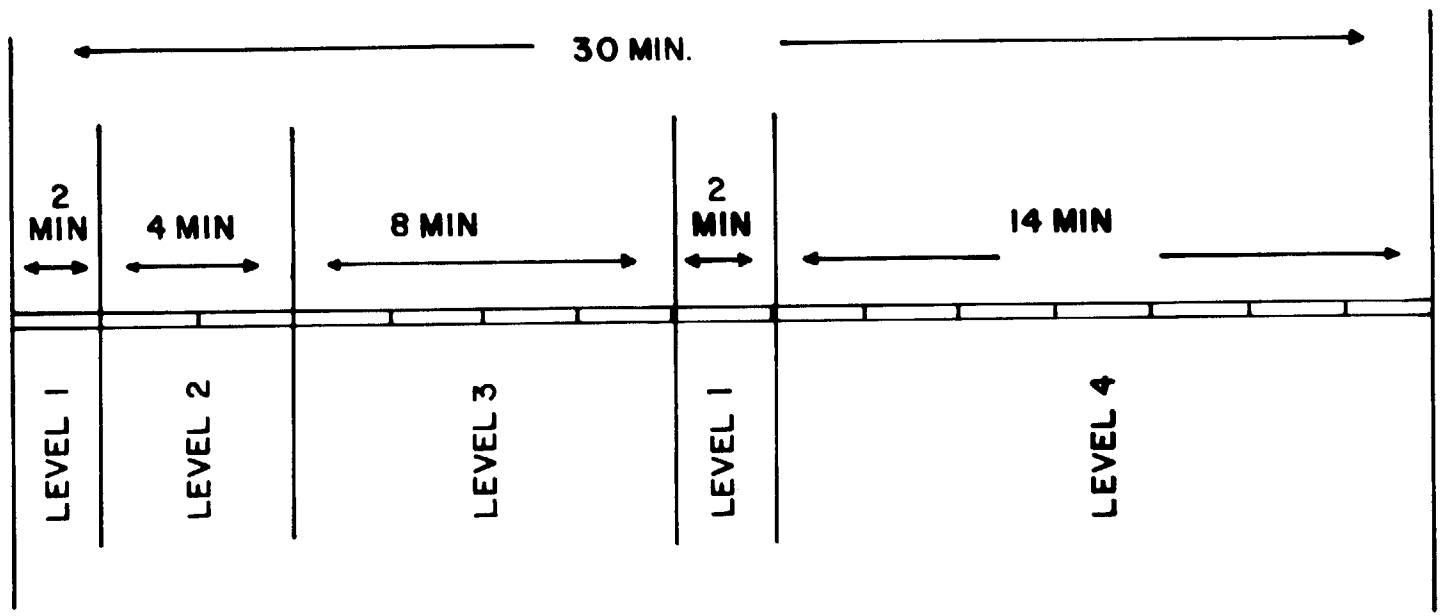

Figure 1. Periodic sequence of the echo analyzer

Table 2. Synopsis of echo-analyzer data, July 1965-June 1966

Month	Day	Year	Starting Time	Finishing Time	No. Hours Operated	Stream Hours	Name of Stream
JUL	7	1965	1230	1430	2	13-16	β Taurids
	24		0230	0900	6.5	3-6	δ Aquarids
	26		0230	0600	3.5	3-6	
			and 1600	1900		3-6	
	27		1530	2230	7	3-6	
	28		0500	1400	9	3-6	
AUG	4		0730	1100	3.5	3-6 and 7-12	Perseids (7-12)
	6		0330	1130	8	3-6 and 7-12	
	8		0300	0600	3	3-6 and 7-12	
	9		1700	2100	4	3-6 and 7-12	
	23		0000	0600	6	none	
			(rest of week of 23 not operating)				
SEP	21		0000	1130	11.5	2-6	Piscids, etc.
	22		0130	1100	9.5	2-6	
	23		0100	0330 & 1100-2130	1.3	2-6	
	24		0100	0200 & 0900-2130	12.5	2-6	
	25		0100	1300	12.5	2-6	
	28		0230	0500 & 1100-1300	3.5	2-6	
	29		1100	1500	4	2-6	
	30		1100	1430	3.5	2-6	
OCT	1		0100	0400	3	2-6	Taurids, etc.
	4		0030	0700	4	none	
	5		0100	0800	7	2-6	
	6		0700	1000	3	2-6	
	7		1200	2330	11.5	2-6	
	8		1200	1900	7	2-6	
	9		1900	2230	3.5	19-23	Giacobinids
NOV	10		0230	0430	2	2-5	Taurids, etc.
	11		0130	0500	3.5	2-5	
	12		0230	0430	2.0	2-5	
	15		0130	1100	9.5	2-5 and 8-11	Leonids
	16		0000	1030	10.5	2-5 and 8-11	
	17		0730	1030 & 1630-2330	10	2-5 and 8-11	
	18		0200	2200	20	2-5 and 8-11	
	19		0800	1030	2.3	2-5 and 8-11	

Table 2. Continued

Month	Day	Year	Starting Time	Finishing Time	No. Hours Operated	Stream Hours	Name of Stream
DEC	7	1965	0500	0730	2.5	1-7	Taurids
	8		0400	0530	1.5	1-7	
	9		0400	0630	2.5	1-7	
	14		0430	0700	2.5	1-7	
	15		0400	0630	2.5	1-7	
	21		1300	1500	2	none	
	22		1300	1430	1.5	none	
	23		1300	1430	1.5	none	
JAN	1	1966	1300	1430	1.5	11-14	Quadratids
	2		1200	1400	2	11-14	
	3		1130	1330	2	11-14	
MAR	8		0200	1100	9		
	10		1200	1700	5		
	11		1500	1600	1		
	20		0000	0730	7.5		
	22		0030	1000	9.5		
	23		0800	1330	5.5		
	24		1200	2300	11		
	25		1730	2230	5		
APR	4		0130	0730	6		
	5		0130	1130	10		
	6		0800	1530	7.5		
	7		1200	2200	10		
			- No Operation -				
MAY	16		0030	0700	6.5		
	17		0030	0600	5.5		
	18		1030	1500	4.5		
	19		1200	2230	10.5		
	20		1730	2200	5.5		
	30		0130	0500	3.5	12-16	Arietids
	31		0000	1100	11	12-16	
JUN	1		0800	1430	6.5	12-16	
	2		1500	1930	4.5	12-16	
	3		1630	2300	7.5	12-16	

Table 3. Echo analyzer rates

Scheduled Operation

September 21-24, 1965

TIME (CST)	LEVEL 1	LEVEL 1	LEVEL 2	LEVEL 3	LEVEL 4	LEVEL 1	LEVEL 1	LEVEL 2	LEVEL 3	LEVEL 4
		SEP 21, 1965					SEP 22, 1965			
0000	960	750	255	83	9					
	900	1170	330	53	9					
0100	1350	1290	420	113	13					
	900	1320	360	53	21	360	570	255	68	26
0200	1350	1110	435	165	30	1050	1320	405	113	30
	1500	1530	420	180	56	1260	1380	615	218	64
0300	1200	1770	330	150	43	1320	1080	375	218	56
	1710	1710	765	173	26	1320	1530	585	218	30
0400	1620	2130	810	188	47	1590	1290	465	173	77
	1440	1440	660	210	51					
0500	1440	1440	750	255	64					
	1320	1320	465	218	26					
0600	1950	900	585	173	26					
	1560	1470	585	165	30					
0700	1740	2160	405	158	30					
	1770	1800	780	203	60					
0800	1740	2070	420	225	47	2070	2910	135	195	81
	2130	2160	555	300	73	1470	2070	765	278	86
0900	2250	2820	750	278	86	2370	1920	900	105	56
	3030	2970	780	218	69	1800	1650	690	1005	47
1000	2040	2010	960	225	56	1290	1440	525	180	39
	1950	—	900	278	30	1560	810	600	158	39
1100	1530	1950	675	255	43	1680	1170	465	135	30
	1260	1530	705	135	51					
		SEP 23, 1965					SEP 24, 1965			
1200	360	360	240	143	90	1080	1410	435	188	43
	570	1230	465	188	21	780	990	555	165	26
1300	1170	1290	600	150	21	870	870	450	120	43
	1200	900	405	105	43	720	870	345	150	21
1400	960	930	255	143	34	810	660	195	90	43
	750	960	75	8	137	660	840	315	68	34
1500	300	900	165	98	21	630	90	240	105	21
	540	510	345	98	43	510	390	300	75	21
1600	540	840	330	83	47	570	480	165	105	570
	690	600	255	98	21	570	270	270	68	13
1700	540	510	195	90	17	360	600	195	60	13
	510	780	255	83	9	420	510	150	68	9
1800	360	630	240	60	12	300	240	165	53	9
	540	450	150	60	17	390	360	195	90	17
1900	420	420	345	60	30	780	540	165	68	17
	390	720	180	135	9	570	480	105	45	26
2000	270	450	210	38	17	510	210	150	53	17
	660	390	195	23	13	600	450	195	60	21
2100	120	300	255	38	13	690	360	195	30	26
	570	540	150	53	34	660	390	150	38	13
2200										
2300										

Table 3. (Continued)

Scheduled Operation

October 5-8, 1965

TIME (CST)	LEVEL 1	LEVEL 1	LEVEL 2	LEVEL 3	LEVEL 4	LEVEL 1	LEVEL 1	LEVEL 2	LEVEL 3	LEVEL 4
			OCT 5, 1965							
0000										
0100	1560	930	360	105	51					
	1650	1590	615	113	64					
0200	2160	1890	690	180	34					
	1740	2130	690	195	73					
0300	2520	2100	780	308	73					
	2040	2100	825	278	99					
0400	1170	1680	705	195	103					
	1770	1680	600	225	52					
0500	1470	1350	795	218	47					
	1470	1380	585	203	43					
0600	1650	1410	540	233	82			OCT 6, 1965		
	1830	1440	600	188	94					
0700	1590	3660	465	240	99	2910	5490	1065	390	103
	5760	2640	690	338	120	3930	3480	1245	383	103
0800	2010	3420	915	750	99	2670	2550	915	390	112
	2880	3390	1020	345	94	2790	1830	915	330	94
0900						1680	1860	720	188	95
						1500	1650	615	225	47
1000						1560	1440	405	270	91
						2100	1050	675	180	107
1100			OCT 7, 1965					OCT 8, 1965		
1200	1230	1350	450	173	90	1110	1080	255	128	94
	1590	1350	525	150	112	1200	1230	375	150	56
1300	1140	1890	615	285	103	1110	1320	270	180	64
	1830	1680	525	293	94	930	1140	48	105	64
1400	2010	1770	585	345	137					
	1770	2700	540	165	51	780	990	465	68	43
1500	4350	7200	855	330	159	840	750	435	135	56
	6030	5550	2700	248	90	960	900	345	75	34
1600	3870	2010	765	173	43	780	840	525	113	26
	930	1260	585	165	930	660	810	465	135	43
1700	1140	1020	315	105	69	960	930	225	75	43
	840	1590	360	45	51	690	570	300	113	56
1800	270	360	450	90	150	720	990	285	113	77
	780	1020	420	53	51	720	540	315	45	69
1900	630	660	330	180	39	990	750	510	90	69
	990	870	420	113	77					
2000	900	840	405	83	47					
	810	1020	480	150	60					
2100	720	450	315	150	43					
	810	720	315	158	30					
2200	630	780	150	98	47					
	870	780	240	90	39					
2300	1290	810	405	75	56					
	1110	840	375	120	73					

Table 3. (Continued)

Scheduled Operation

March 20-25, 1966

TIME (CST)	LEVEL 1	LEVEL 1	LEVEL 2	LEVEL 3	LEVEL 4	LEVEL 1	LEVEL 1	LEVEL 2	LEVEL 3	LEVEL 4
		MAR 20, 1966						MAR 22, 1966		
0000	750	2880	135	8	0					
	1620	2340	210	26	4	240	330	60	30	9
0100	3540	3210	255	8	21	870	1440	90	15	0
	2730	3600	165	53	4	7320	4440	180	23	4
0200	4230	6090	270	45	13	2190	2640	255	15	4
	8310	5850	255	45	17	2880	5280	375	45	17
0300	3930	6960	480	60	13	6690	9540	345	60	34
	5160	7770	375	45	43	3180	7460	345	75	26
0400	2550	2160	720	75	56	450	1170	420	90	39
	3360	1380	795	135	22	3750	6120	600	38	26
0500	1020	1230	570	120	26	2460	930	660	75	13
	1350	1230	675	68	17	1380	1500	225	113	22
0600	1200	1290	540	113	9	2250	3150	510	75	26
	1170	1740	525	180	13	2130	2160	585	90	22
0700	2190	2130	495	210	60	2700	3900	780	20	25
	7770	7770	60	30	17	2310	4980	915	195	17
		MAR 23, 1966								
0800						1800	2490	1065	173	34
	5610	7590	1200	113	34	3000	2280	1230	210	64
0900	5100	4470	765	143	34	4050	6000	1095	188	60
	4980	4620	1035	98	13	8370	4110	1080	360	47
1000	5430	2880	915	180	52	5730	5550	1050	248	60
	2100	1830	720	158	39	5640	3720	1095	300	52
1100	1890	1440	645	98	52	3150	2940	1095	195	0
	1590	1770	900	210	39					
								MAR 24, 1966		
1200	1500	1650	645	113	26	1470	1290	510	90	30
	2640	7920	690	180	22	1260	1470	510	120	34
1300	4590	5070	765	158	56	1260	1950	420	83	43
	7830	4290	600	203	30	1530	1560	570	105	26
1400						6720	1440	465	105	9
						1380	1440	645	75	39
1500						870	960	480	53	30
		MAR 25, 1966				750	480	330	38	13
1600						360	510	210	30	26
						810	240	570	38	0
1700						300	270	90	15	4
	450	330	225	23	9	480	300	60	15	0
1800	690	450	150	0	9	360	210	135	23	4
	180	330	30	8	9	270	450	120	30	4
1900	150	240	60	30	9	150	240	60	30	9
	210	330	45	23	4	180	90	135	38	9
2000	150	210	120	8	0	540	120	60	8	0
	270	150	60	0	4	330	240	45	15	4
2100	150	110	60	8	0	270	180	75	0	0
	720	270	165	15	13	270	390	60	8	13
2200	240	180	120	0	4	120	60	135	15	0
	630	90	105	23	9	210	180	90	23	0
2300						150	150	45	23	4

Table 3. (Continued)

Scheduled Operation

April 4-7, 1966

TIME (CST)	LEVEL 1	LEVEL 1	LEVEL 2	LEVEL 3	LEVEL 4	LEVEL 1	LEVEL 1	LEVEL 2	LEVEL 3	LEVEL 4
		APR 4, 1966								
0000										
0100								APR 5, 1966		
	1200	1620	225	38	4					
0200	2280	5430	165	38	13	3450	2820	210	30	9
	1710	720	255	0	4	4860	7020	330	23	0
0300	5730	4710	390	23	9	6840	6720	255	60	13
	4110	2070	375	75	30	2790	2580	300	98	13
0400	720	2100	570	113	30	3690	1590	735	128	26
	1200	1260	480	30	34	7200	870	660	60	21
0500	120	1050	615	150	39	1080	870	480	68	26
	1230	1530	675	113	21	1530	1170	540	158	9
0600	1350	1440	630	105	43	5520	750	450	75	30
	1470	1800	810	105	39	2160	1740	840	113	9
0700	4020	1830	525	83	21	2010	2010	720	113	26
	2340	2280	825	143	21	2430	480	615	105	-
		APR 6, 1966								
0800	5250	5130	1500	270	77					
	6450	5820	1845	315	77	3240	3930	795	21	43
0900	6210	3840	2460	345	69	-	4410	390	0	0
	4860	3660	1785	278	73	3780	2520	1605	24	69
1000	7050	4560	1500	285	69	1440	2190	1035	173	34
	4410	4170	1365	285	64	1680	90	840	165	56
1100	6150	990	990	90	69	1710	1410	675	105	39
	1650	2820	810	83	43					
								APR 7, 1966		
1200	3720	4890	825	150	77					
	7260	7440	825	158	94	1740	1620	345	233	56
1300	900	1260	1230	180	73	1920	1800	1215	150	64
	2130	1680	1140	188	47	1410	1560	915	150	48
1400	7020	4890	930	188	43	1170	6000	930	165	86
	6810	510	735	98	26	4050	1530	645	188	69
1500	7140	5040	645	98	17	1890	480	720	150	34
	6930	2790	540	75	0	990	2430	720	158	21
1600						1380	3540	630	75	17
						2340	360	360	113	17
1700						2490	1050	225	23	9
						3630	690	120	38	17
1800						840	2550	135	8	13
						570	1260	450	30	26
1900						420	3660	75	23	4
						210	1350	1545	0	9
2000						750	1470	105	45	0
						390	1890	105	15	9
2100						750	900	15	8	4
						750	660	75	15	9
2200						960	810	135	8	0
2300										

Table 3. (Continued)

Scheduled Operation

May 16-20, 1966

TIME (CST)	LEVEL 1	LEVEL 1	LEVEL 2	LEVEL 3	LEVEL 4	LEVEL 1	LEVEL 1	LEVEL 2	LEVEL 3	LEVEL 4
		MAY 16, 1966						MAY 17, 1966		
0000										
	5670	390	30	23	4	1290	-	135	15	82
0100	2940	900	150	15	4	540	630	90	8	13
	60	1920	270	165	163	1230	900	165	23	4
0200	1050	960	255	53	4	870	2340	270	53	4
	1200	810	150	53	13	1320	120	330	68	13
0300	1080	1440	420	68	17	2250	-	510	113	47
	1740	1410	345	75	17	1770	2580	630	83	21
0400	1530	1440	570	90	39	3630	5220	705	135	21
	1740	1560	390	98	26	6990	-	720	113	34
0500	1800	480	525	105	317	2400	2880	1020	113	43
	1530	4830	615	98	39	480	2520	2850	480	82
0600	2400	2820	915	75	34	630	6150	105	180	47
	1860	2490	690	180	56					
0700	2340	-	795	143	17					
		MAY 18, 1966								
0800										
0900										
1000										
	2010	1710	600	225	17					
1100	1260	2190	780	124	9					
	1950	1710	660	188	39			MAY 19, 1966		
1200	1560	1980	795	270	17	1470	1860	405	263	39
	2160	1770	885	300	39	2580	1770	1065	293	34
1300	2070	2370	1065	203	43	2250	2520	1125	210	43
	2340	2430	1155	240	21			REPAIRS		
1400	2970	1980	570	263	21	2400	-	1095	285	566
	2580	1860	780	255	9			REPAIRS		
1500	1800	3000	555	158	13	1380	2010	810	165	9
		MAY 20, 1966				360	750	585	105	13
1600						570	1050	510	83	9
						990	-	450	23	9
1700								REPAIRS		
	540	450	270	23	4	570	360	180	45	4
1800	600	300	330	38	4					
	450	450	315	30	4	450	-	180	8	30
1900						150	330	195	30	4
	2220	2700	150	52	4	150	120	45	23	4
2000	1500	660	315	30	0	450	-	150	15	17
	270	330	195	15	4	30	390	150	8	9
2100	300	390	240	38	9	330	210	195	15	9
	420	540	255	15	0					
2200	1110	480	225	23	4	3090	360	255	8	4
						720	-	165	8	99
2300										

Table 3. (Continued)

Scheduled Operation

May 30 - June 3, 1966

TIME (CST)	LEVEL 1	LEVEL 1	LEVEL 2	LEVEL 3	LEVEL 4	LEVEL 1	LEVEL 1	LEVEL 2	LEVEL 3	LEVEL 4
		MAY 30, 1966					MAY 31, 1966			
0000						480	450	255	15	9
						360	480	315	15	4
0100						570	480	255	38	17
	390	600	270	30	4	660	480	270	60	91
0200	660	870	345	45	4	900	750	300	30	13
	1050	1170	420	60	9	1020	1110	630	98	4
0300	1080	1380	420	53	4	1230	1080	645	45	21
	1410	1830	600	98	0	1050	1110	645	75	26
0400	1410	1710	645	75	13	1290	1350	630	143	39
	1860	1620	765	188	9	1290	1230	765	195	17
0500	1710	480	1095	128	275	1560	1860	825	150	34
						1890	1950	690	210	21
0600						1860	1650	975	128	21
						1800	1680	915	150	21
0700		JUN 1, 1966				2040	2520	885	173	30
						2910	3090	975	188	30
0800	3270	2550	1110	263	22	2700	3180	1530	210	26
	3270	3120	1380	203	56	2520	2460	1320	158	13
0900	1980	1560	1020	180	30	3030	2700	1335	158	13
	2280	1950	885	240	43	1920	1530	1470	218	26
1000	1650	1500	930	203	21	1620	1380	825	120	21
						1770	2100	1305	188	17
1100						1680	1980	1020	120	43
	2220	1710	705	180	39					
1200	2040	1890	795	233	21					
	900	2790	1125	330	39					
1300	1950	660	1365	300	64					
	1530	2160	1170	285	51					
1400	1560	2190	1080	180	43					
	1680	1470	780	135	30			JUN 2, 1966		
1500						1350	1740	1395	98	9
		JUN 3, 1966				5070	3330	1425	90	9
1600						7470	4800	585	53	309
	1440	660	825	113	9	1110	3780	960	480	47
1700	750	660	345	83	4	360	450	465	15	4
	210	600	195	23	13					
1800	360	300	120	68	13	570	840	105	30	9
	270	270	120	30	0	2190	900	195	45	0
1900	360	120	90	23	0	330	600	195	15	0
	270	210	225	15	4	4290	3810	135	30	476
2000	210	180	75	23	4					
	60	330	120	30	4					
2100	150	360	75	23	0					
	90	510	75	60	0					
2200	30	150	120	23	0					
	360	300	105	15	9					
2300	240	270	105	15	0					

Table 3. (Continued)

Scheduled Operation

July 11-15, 1966

TIME (CST)	LEVEL 1	LEVEL 1	LEVEL 2	LEVEL 3	LEVEL 4
			JUL 11, 1966		
0000					
0100					
	1440	3210	180	23	13
0200	2670	2400	135	30	13
	1770	2100	345	75	26
0300	2670	1770	360	83	17
	2190	2640	450	98	17
0400	2850	3030	510	83	51
	2760	3060	390	120	56
0500	2430	2910	1170	128	56
	2130	2190	675	135	39
0600	2910	3150	675	113	56
	3780	4320	735	68	51
0700	3660	4650	795	158	39
0800					
0900					
1000					
1100			JUL 14, 1966		
1200	1800	2160	225	97	17
	1740	2310	375	75	34
1300	1590	1590	450	90	51
	1830	2130	450	113	69
1400	1770	1650	435	105	43
	1260	1530	405	83	26
1500	1680	1590	285	30	34
	1110	900	135	68	17
1600	930	870	240	30	4
	660	630	180	15	4
1700	840	570	150	8	17
	360	420	135	15	4
1800	300	-	90	15	51
	600	1860	60	7	9
1900	1080	1170	75	15	9
2000					
2100					
2200					
2300					

TIME (CST)	LEVEL 1	LEVEL 1	LEVEL 2	LEVEL 3	LEVEL 4
			JUL 12, 1966		
0000	1200	1170	120	15	13
	540	1170	195	53	13
0100	1410	1200	270	38	9
	1500	1260	300	30	4
0200	1470	1890	285	8	13
	2040	2220	600	83	26
0300	1650	1530	345	90	13
	1410	1950	345	8	17
0400	2280	2250	675	83	34
	2640	2430	540	53	17
0500	2220	2880	570	150	30
	2100	2760	360	105	26
0600	2160	4410	360	128	34
			missing		
0700	5100	3870	600	187	39
	3690	4740	840	150	64
0800	4350	1560	1290	150	60
	4080	3510	1005	143	81
0900	2460	3480	645	143	51
	1530	3030	555	135	56
1000	2040	-	645	105	47
	3060	2100	405	67	29
1100	1890	2400	810	53	17
			JUL 15, 1966		
	750	720	330	38	30
	300	390	180	30	4
	390	300	165	30	4
	390	450	105	8	26
	330	330	135	23	17
	150	120	165	15	9
	240	150	75	30	17
	120	240	75	23	4
	180	30	120	15	-
	120	180	75	15	-
	60	90	75	23	-

Table 3. (Continued)

Scheduled Operation

July 11-15, 1966

TIME (CST)	LEVEL 1	1	2	3	4
0000					
0100					
0200					
0300					
0400					
0500					
0600					
0700		JUL 13, 1966			
0800	3720	3600	780	127	76
	3990	4620	660	195	47
0900	3030	3120	705	120	39
	2340	1950	690	135	43
1000	4230	4980	540	180	47
	2100	2400	735	158	43
1100	1830	7020	390	45	56
	1980	1950	435	90	17
1200	1650	2880	835	135	21
	6480	2940	1110	120	26
1300	2010	2070	1170	150	34
	1350	2250	390	158	17
1400	1710	1320	840	172	17
	1830	1170	1005	210	30

Table 3. (Continued)

Meteor Streams

July 7 - September 29, 1965

TIME (CST)	LEVEL 1	1	2	3	4
	JUL 24, 1965 (δ AQUARIDS)				
0000					
0100					
0200					
	2200	2850	270	190	–
0300	2550	2600	620	–	520
	2100	3000	1100	250	115
0400	2400	7600	730	230	920
	2650	2200	930	265	138
0500	3450	2400	1320	375	120
	2450	2950	1110	270	98
0600	3100	2850	1110	320	68
	3100	2850	1000	420	73
0700	4600	4500	1320	375	132
	5100	7500	1300	375	102
0800	7450	4600	1700	650	400
	7300	3700	1300	550	600
0900	3150	–	1350	470	100
1000					
1100					
	JUL 7, 1965 (β TAURIDS)				
1200					
	1100	1080	650	270	43
1300	1320	290	480	270	160
	1090	3150	600	210	160
1400	1070	1250	420	390	24
	540	900	465	120	16
	JUL 27, 1965				
1500					
	1450	1100	540	140	43
1600	1350	530	480	128	43
	1900	1650	420	105	25
1700	940	1700	420	74	35
	1600	2500	320	76	13
1800	1750	2300	365	30	17
	4800	4750	210	39	4
1900	7700	7950	60	31	16
	6000	3800	230	45	4
2000	7800	1400	90	45	21
	900	370	105	74	21
2100	900	3850	540	62	4
	520	520	150	54	30
2200	900	680	210	98	30
	680	820	300	145	–
2300					

TIME (CST)	LEVEL 1	1	2	3	4
	AUG 23, 1965				
0000	660	660	495	75	34
	1590	1080	360	143	9
0100	1590	1710	420	113	34
	1380	1590	225	158	34
0200	1920	1560	510	158	60
	2160	1710	525	150	47
0300	2790	2070	720	240	77
	2220	2100	870	300	69
0400	1800	1710	675	293	86
	2130	2310	630	270	52
0500	2520	2040	600	203	60
	2160	2430	870	255	52
0600	2610	3060	750	225	73
	AUG 4, 1965 (PERSEIDS)				
0700	2790	4260	810	285	51
0800	4680	1920	705	195	86
	960	6210	1050	240	94
0900	5670	7380	945	158	34
	2010	7290	705	188	30
1000	4560	3360	555	180	30
	2760	3900	375	98	34
1100	6060	1110	465	113	26
	SEP 29, 1965				
1200	2040	1740	1065	293	82
	1290	1590	405	195	129
1300	2340	3540	840	270	69
	1710	1860	690	218	86
1400	1860	2010	870	278	116
	1650	2010	765	263	116
1500	1650	1530	765	263	82
	AUG 9, 1965				
1600	960	630	135	60	17
	720	480	60	8	4
1700	300	510	75	15	26
	300	120	135	23	13
1800	540	420	165	15	7
	660	450	60	53	9
1900	720	420	105	15	21
	450	420	75	15	17
2000	270	570	90	60	4

Table 3. (Continued)

TAURIDS, ARIETIDS

October 4 - December 21, 1965

TIME (CST)	LEVEL 1	LEVEL 1	LEVEL 2	LEVEL 3	LEVEL 4	LEVEL 1	LEVEL 1	LEVEL 2	LEVEL 3	LEVEL 4
	OCT 4, 1965 (TAURIDS, ARIETIDS)									
0000										
	1100	760	340	133	–	NOV 11, 1965 (TAURIDS, ARIETIDS)				
0100	990	1050	350	133	–					
	1230	1430	425	90	–	570	750	15	60	21
0200	1390	1190	332	188	–	990	1020	330	23	21
	1590	1450	395	180	–	1320	1680	270	135	69
0300	1800	1830	555	205	–	1050	1530	540	98	69
	1750	1900	695	310	–	1530	1530	465	105	133
0400	1900	2200	333	285	–	1440	1680	675	143	73
	1990	1979	1050	355	–	1650	1170	870	165	69
0500	1330	1830	1050	233	–	1560	360	525	113	26
	1830	1600	410	200	–			DEC 7, 1965		
0600	1350	2100	330	205	–	450	540	150	8	51
	2150	1950	610	205	–	390	450	165	45	17
0700	1800	1790	460	225	–	780	540	150	60	43
						60	240	240	38	4
0800										
0900										
1000			SEP 30, 1965							
1100	2070	1650	470	45	120					
	1560	1710	585	263	94					
1200	1890	2100	645	293	116			DEC 21, 1965		
	1860	1710	795	338	94					
1300	2130	1950	450	270	99	1980	1470	495	105	17
	2160	1410	705	195	90	1380	1740	510	83	4
1400			MAR 10, 1965			720	1320	390	98	13
	750	510	135	0	4	1230	1170	495	45	9
1500	480	360	120	8	64					
	750	270	45	15	4					
1600	570	390	105	15	4					
	90	240	135	8	4					
1700	150	210	60	0	13					
1800										
1900										
2000										
2100										
2200										
2300										

Table 3. (Continued)

LEONIDS

November 15-19, 1965

TIME (CST)	LEVEL 1	LEVEL 1	LEVEL 2	LEVEL 3	LEVEL 4	LEVEL 1	LEVEL 1	LEVEL 2	LEVEL 3	LEVEL 4
							NOV 16, 1965			
0000						360	600	120	37	17
			NOV 15, 1965			2040	1140	195	465	26
0100						900	2430	345	585	30
	630	1020	255	75	34	1410	1950	630	975	180
0200	660	900	240	75	39	1350	2160	1695	127	39
	720	990	330	143	51	1620	990	360	180	86
0300	1320	1020	315	90	39	2400	2250	585	308	73
	1380	1320	285	143	77	2400	3750	720	285	77
0400	1440	1290	585	218	51	3480	1740	1905	255	90
	1590	1440	780	180	43	2880	2160	600	225	116
0500	1080	930	615	218	129	1140	5040	840	127	39
	1440	1140	465	150	34	2250	1650	270	165	51
0600	960	1170	345	120	77	4530	3480	945	382	77
	1050	1200	420	60	47	3330	2460	375	600	210
0700	1020	990	450	120	77	4620	2520	1185	546	159
	1290	7740	615	135	69	2220	4770	1260	187	296
0800	990	1350	750	188	73	2790	7380	1500	330	94
	1800	7650	570	218	56	8430	3480	1710	645	369
0900	1380	2130	405	165	77	1980	2670	960	285	128
	1890	2160	480	165	51	3630	3120	165	795	90
1000	2790	450	645	143	51	2730	1560	775	1130	124
	1080	180	615	150	64	1500	1770	180	75	51
1100	1260	1050	645	135	64					
1200										
1300										
1400										
1500										
1600										
1700										
1800										
1900										
2000										
2100										
2200										
2300										

Table 3. (Continued)

LEONIDS

November 15-19, 1965

TIME (CST)	LEVEL 1	1	2	3	4
0000					
0100					
0200					
0300					
0400					
0500					
0600					
0700			NOV 19, 1965		
0800	1320	1290	690	218	137
	1470	1440	735	202	111
0900	1350	1410	570	225	107
	480	1110	180	202	116
1000	1050	990	1080	278	120
	1410	750	495	128	116
1100					
1200					
1300					
1400					
1500					
1600					
1700					
1800					
1900					
2000					
2100					
2200					
2300					

Table 3. (Continued)

LEONIDS

November 15-19, 1965

TIME (CST)	LEVEL 1	1	2	3	4	1	1	2	3	4
0000										
							NOV 18, 1965			
0100										
0200						630	960	285	113	17
						750	1080	165	38	69
0300						1260	1320	345	98	34
						1110	1470	810	203	69
0400						1800	1320	600	210	77
						1170	1740	540	225	90
0500						2100	1560	555	195	90
						960	1290	510	165	56
0600										
			NOV 17, 1965							
0700						1650	2040	450	262	111
	2220	1410	1605	322	146	2190	1830	735	218	69
0800	2610	4500	347	697	194	1980	1830	660	203	60
	3120	2520	1020	300	133	—	1980	765	218	90
0900	5280	2100	145	338	69	2010	1440	765	218	52
	1920	2640	735	360	103	1470	1290	585	173	90
1000	2550	1530	660	205	47	900	1230	360	158	90
	5730	1560	900	540	510	750	900	420	203	73
1100						1650	1080	405	180	133
						870	1410	435	158	86
1200						1290	1530	660	308	146
						1320	1740	660	188	142
1300						1170	1260	660	180	124
						1500	1080	510	180	90
1400						1320	1230	540	195	86
						810	1440	510	105	73
1500						900	780	315	128	60
						1140	1020	300	60	56
1600						510	750	285	98	47
	900	660	135	142	17	690	720	285	173	60
1700	480	750	180	60	9	480	540	330	60	51
	390	870	255	45	30	360	390	705	45	39
1800	480	480	105	75	56	390	720	135	53	56
	390	450	225	37	26	690	630	120	68	13
1900	540	510	315	37	51	420	420	345	45	34
	570	180	300	90	—	180	270	240	53	13
2000	480	570	90	45	30	180	1020	165	53	21
	930	480	75	22	26	240	540	210	53	43
2100	210	960	60	52	38	450	390	105	45	34
	3420	390	255	30	26	420	300	195	23	26
2200	330	630	150	90	13	390	660	120	30	60
	420	420	150	7	17					
2300	420	450	105	22	13					

Table 4. Sixteen-millimeter film data.

November 15-18, 1965

Time(CST)	Nov. 15	Nov. 16	Nov. 17	Nov. 18	Nov. 19
0015	64				
0045	76	99			
0115	78	127			
0145	103	136			
0215	120	139		115	
0245	87	189		150	
0315	118	186		151	
0345	150	191		147	
0415	165	165		164	
0445	138	192		183	
0515	128	134		107	
0545	155	107			
0615	130	126			
0645	154	124			
0715	143	160			
0745	147	156	184		
0815	186	184	208	195	175
0845	152	139	182	180	181
0915	163	154	147	103	149
0945	137	180	68	97	145
1015	120	139	54	62	112
1045	98	Off	Hold	74	113
1115	106	120		56	100
1145				61	
1215				63	
1245				141	
1315				173	
1345				178	
1415				151	
1445				122	
1515				118	
1545				112	
1615				95	
1645				112	
1715				83	
1745			55	83	
1815			48	77	
1845			45	68	
1915			44	56	
1945			42	67	
2015			28	65	
2045			27	53	
2115			24	30	
2145			20	38	
2215			56	37	
2245			59	30	
2315			54	40	
2345					

Table 5. History of the echo analyzer calibration

Date		Peak power (megawatts) P_T	Input voltages (microvolts) Levels V_1	V_2	V_3	V_4	V_i^2/P_T Levels K_1	K_2	K_3	K_4
July 65	26	2.55	1.4	3.4	8.5	20.4	0.768	4.54	28.3	163
	28	2.55	1.4	3.4	8.5	20.4	0.768	4.54	28.3	163
	29	2.55	1.4	3.4	8.5	20.4	0.768	4.54	28.3	163
	30	2.55	1.4	3.4	8.5	20.4	0.768	4.54	28.3	163
	31	2.58	1.4	3.7	9.5	20.4	0.759	4.47	34.9	233
Aug 65	1	2.50	1.4	3.4	8.5	20.4	0.783	4.62	28.9	166
	2	2.50	1.4	3.4	8.5	20.4	0.783	4.62	28.9	166
	4	2.50	1.4	3.4	8.5	20.4	0.783	4.62	28.9	166
	6	2.50	1.4	3.4	8.5	20.4	0.783	4.62	28.9	166
	8	2.60	1.4	3.4	8.5	20.4	0.754	4.44	27.8	160
	9	2.50	1.4	3.4	8.5	20.4	0.783	4.62	28.9	166
	10	2.60	1.4	3.4	8.0	19.2	0.754	4.44	24.6	142
	11	2.30	1.4	3.4	8.0	19.2	0.853	5.02	27.8	160
	12	2.55	1.4	3.4	9.0	22.5	0.768	4.54	31.8	198
	13	2.55	1.4	3.4	8.5	20.4	0.768	4.54	28.3	163
	14	2.55	1.4	3.4	8.5	20.4	0.768	4.54	28.3	163
	23	2.55	1.4	3.2	7.6	18.0	0.768	4.02	22.6	127
Sept 65	21	4.55	1.6	5.5	18.5	62.0	0.563	6.65	75.2	845
	22	4.65	1.5	5.1	16.5	54.0	0.484	5.59	59.8	627
	23	4.35	1.5	4.8	15.0	46.5	0.517	5.29	51.7	497
	24	4.25	1.5	4.3	12.5	37.0	0.530	4.36	36.8	322
	25	4.50	1.5	4.3	12.5	37.0	0.501	4.12	34.8	304
	26	4.40	1.5	5.1	16.5	54.0	0.512	5.91	61.8	664
	27	4.25	1.5	4.0	11.0	30.0	0.536	3.78	28.5	212
	28	4.35	1.5	4.0	11.0	30.0	0.517	3.68	27.4	206
	29	4.35	1.5	4.3	12.5	37.0	0.517	4.25	35.9	314
	30	4.55	1.5	4.2	12.0	33.0	0.495	3.88	31.6	240
Oct 65	1	4.40	1.5	4.0	11.0	30.0	0.511	3.64	28.4	204
	4	4.30	1.5	4.6	13.8	41.5	0.524	4.93	44.4	390
	5	4.40	1.5	4.3	12.5	37.0	0.511	4.21	35.5	311
	6	4.25	1.5	4.2	12.0	33.0	0.530	4.35	33.8	256
	7	4.25	1.5	4.3	12.5	37.0	0.530	4.35	36.8	322
Nov 65	9	3.80	1.5-1.5	3.6-4.8	9.2-15.0	23.0-48.0	0.592	4.73	40.7	372
	10	3.80	1.5-1.6	3.8-5.3	10.0-17.3	26.0-56.3	0.633	5.59	52.4	508
	11	3.95	1.5-1.5	3.6-4.8	9.2-15.0	23.0-48.0	0.570	4.55	39.2	359
	12	3.80	1.4-1.5	3.7-5.0	9.5-16.0	24.5-52.0	0.553	5.08	45.5	434
	15	3.95	1.4-1.5	3.5-4.8	8.8-14.7	21.5-45.0	0.533	4.45	37.1	315
	16	3.95	1.5-1.6	3.8-5.3	10.0-17.3	26.0-56.3	0.608	5.37	50.4	450
	17	3.95	1.5-1.6	4.1-5.7	11.0-19.8	30.0-60.8	0.608	6.24	64.8	582
	18	4.10	1.5-1.6	3.8-5.3	10.3-17.3	26.0-56.3	0.586	5.18	49.4	469
	19	3.85	1.5-1.6	3.9-5.5	10.5-18.5	28.0-62.0	0.625	5.90	58.7	599
Dec 65	8	3.90	10.0	31.0	100.0	315	25.6	238	2560	25500
	9	3.90	10.0	31.0	100.0	315	25.6	238	2560	25500
	14	3.90	3.2	10.0	80.0	315	2.63	25.6	1640	25500
	15	3.95	3.2	10.0	80.0	315	2.59	25.3	1620	25100
	21	3.75	3.2	10.0	80.0	315	2.73	26.7	1710	26500
	22	3.75	3.2	10.0	80.0	315	2.73	26.7	1710	26500
	23	3.80	3.2	10.0	80.0	315	2.69	26.4	1680	26100

Table 5. (Continued)

Date		Peak power (megawatts) P_T	Input voltages (microvolts) Levels V_1	V_2	V_3	V_4	V_i^2/P_T Levels K_1	K_2	K_3	K_4
Jan	1	3.75	3.2	10.0	80.0	315	2.73	26.7	1710	26500
66	2	3.70	3.2	10.0	80.0	315	2.77	27.1	1730	26900
	3	3.85	3.2	10.0	80.0	315	2.66	26.0	1660	25800
	4	3.85	3.2	10.0	80.0	315	2.66	26.0	1660	25800
Feb	8	3.74	3.2	31.5	250	1000	2.74	265	16700	268000
66	9	3.74	3.2	31.5	250	1000	2.74	265	16700	268000
	10	3.90	3.2	31.5	250	1000	2.62	255	16000	256000
	11	3.90	3.2	31.5	250	1000	2.62	255	16000	256000
	14	3.75	3.2	31.5	250	1000	2.73	265	16700	267000
Mar	7	3.80	4.5	31.5	250	1000	5.34	261	16400	264000
66	8	3.80	4.5	31.5	250	1000	5.34	261	16400	264000
	9	3.05	5.0	31.5	250	1000	8.20	325	20500	328000
	10	3.75	5.0	31.5	250	1000	6.66	265	16700	267000
	11	4.20	5.0	31.5	250	1000	5.95	236	14900	238000
	21	3.70	3.2	7.0	44	315	2.76	13.2	524	26800
	22	3.70	3.2	7.0	44	315	2.76	13.2	524	26800
	23	3.90	3.2	7.0	44	315	2.62	12.6	496	25400
	24	3.90	3.2	7.0	44	315	2.62	12.6	496	25400
	25	3.70	3.2	7.0	44	315	2.77	13.2	524	26800
Apr	4	3.90	3.2	7.0	44	315	2.62	12.6	496	25400
66	5	3.75	3.2	7.0	44	315	2.73	13.1	516	26400
	6	3.70	3.2	7.0	44	315	2.76	13.2	524	26800
	7	3.70	2.3	5.6	31.5	110	2.76	8.46	269	3270
	8	3.70	2.3	5.6	31.5	110	2.76	8.46	269	3270
	18	3.70	4.0	10.0	50.0	140	4.33	27.0	676	5300
	19	3.70	4.0	10.0	50.0	140	4.33	27.0	676	5300
	20	3.70	4.0	10.0	50.0	140	4.33	27.0	676	5300
	21	3.60	2.8	8.0	44	140	2.18	17.8	537	5450
	22	3.60	2.8	8.0	44	140	2.18	17.8	537	5450
May	2	3.60	3.2	7.8	44	180	2.84	17.8	537	9000
66	3	3.75	3.2	10.0	50	160	2.73	26.7	667	6840
	4	3.50	3.2	8.8	44	140	2.92	22.1	554	5600
	5	3.50	3.6	8.8	44	140	3.70	22.1	554	5600
	6	3.60	3.6	8.8	44	140	3.60	21.5	537	5450
	16	3.40	3.6	8.8	44	140	3.81	22.7	570	5760
	17	3.40	3.6	8.8	44	140	3.81	22.7	570	5760
	18	3.25	3.6	8.8	44	140	3.98	33.8	596	6000
	19	3.25	4.5	10.0	44	315	6.24	30.8	596	30500
	20	3.90	4.5	7.0	44	315	5.20	12.6	496	25400
	30	3.60	3.2	5.6	35.5	295	2.84	8.72	350	24200
	31	3.60	4.0	8.0	45	225	4.45	17.8	564	14000
Jun	1	3.50	4.0	6.2	35.5	180	4.57	11.0	360	9250
66	2	3.70	4.0	8.0	45	250	4.33	17.3	547	16900
	3	3.70	7.2	11.2	45	340	14.0	33.9	547	31200