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INSET AND POLE-MOUNTED APPROACH LIGHTING SYSTEM SEQUENCE FLASHERS

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FINAL REPORT

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16. Abstract

The subject report was to determine the suitability of two types of sequence flashers, pole-mounted and inset, to operate in an approach zone incorporating either inset lighting or above ground lighting. The work involved: (1) laboratory photometric measurements; and (2) analysis of pilot's response to test flying the light systems. The results of the tests indicate that with minor modification the units may be used in the field.

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INTRODUCTION

PURPOSE.

The purpose of this program was to evaluate two similar types of sequence flasher light fixtures for Category I and II Approach Lighting Systems (ALS). These fixtures incorporated capacitor-discharge power supplies, xenon gas filled light sources, and a method of varying the light intensity to be compatible with the steady-burning light. The first fixture tested was designed to be pole-mounted for use on a standard approach light system structure; the second tested was to be installed (inset on a runway) where aircraft would operate on the surface over the fixtures, in an overrun-protected area. As ascertained by the conclusions reached in this report and from other pertinent data, a Federal Aviation Administration (FAA) design specification will be established to define the operational and technical requirement to design the fixtures.

BACKGROUND.

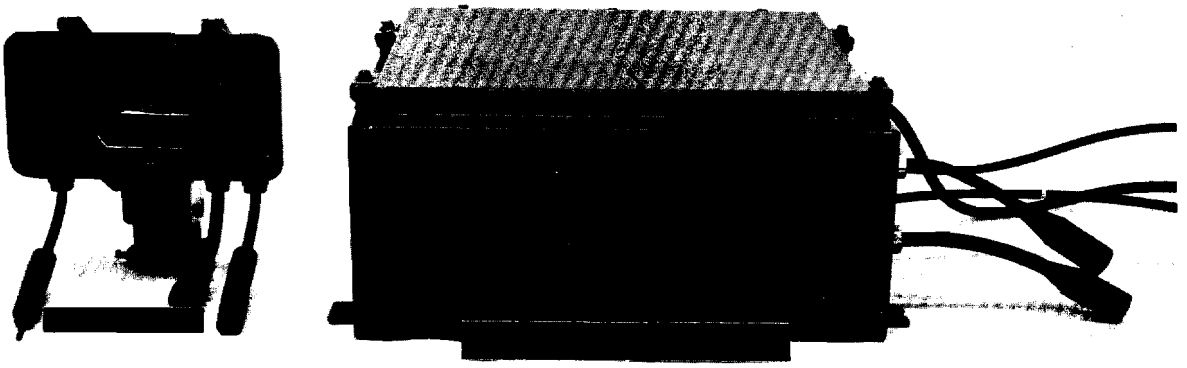
In order to provide clearance above obstructions that extend into a standard glide path, at a number of airports it has been necessary to displace the runway threshold lighting uprunway from the beginning of the useable runway pavement. It is necessary that they be installed inset into the pavement where approach lights are employed. In order to utilize the pavement for taxiing and takeoffs, the light fixtures must have a negligible vertical projection. The inset fixtures are also required where an extended protected overrun area is provided.

This report completes the program to provide an inset lighting system for an approach zone to support a displaced threshold or an overrun protected area. Previous reports have evaluated the steady-burning inset light fixture. That fixture is defined in Specification FAA-E-2491. Any further testing on improvements to the expected flasher specification will be performed by programs established for the improvement of airfield lighting.

DISCUSSION

EQUIPMENT DESCRIPTION.

The pole-mounted sequence flasher and the in-pavement sequence flasher are shown in figure 1. They are essentially identical except that component packaging and optical systems are dissimilar to suit their individual operational requirements. The units were developed under Contract DOT-FA71-WA2557. The overall design consists of a linear xenon-flash tube mounted in an efficient reflective optical system with a suitable capacitor-discharge power supply that has the capability of three-step dimming the light output. Optical radiation output is maximized by using a small linear light source and a precision collector mirror. These fixtures require a



(a) POLE-MOUNTED SEQUENCE FLASHER

(b) IN-PAVEMENT SEQUENCE FLASHER

FIGURE 1. SEQUENCE FLASHER LIGHT FIXTURES

relatively low electrical energy input and, therefore, dissipate minimum heat within the fixture. The xenon light differs from the conventional "strobe" light in that it has the capability of multiple brightness steps.

TEST PROCEDURES.

Laboratory light intensity distribution measurements were performed on both units: the pole-mounted fixture and the inset fixture. The measurements were made using the highest power output step of the power supply. In addition to measuring the maximum candela and the effective intensity, individual pulses were measured to determine the relative signal strength at the high, medium, and low intensity settings.

The units were installed in the approach zone of runway 13 at the National Aviation Facilities Experimental Center (NAFEC) at stations 15, 16, 17, 18, and 19 (1,500 to 1,900 feet from the runway threshold). Subject pilots then observed the light signals and compared them with those of the standard commissioned facility during visual flight rules (VFR) night flying. The pilots then were asked to answer a questionnaire (figure 2). Since photometric data is contained herein and pilot's opinions were logged during VFR conditions, it is deemed not necessary to fly the system under instrument flight rule (IFR) conditions. Information for IFR conditions can be extrapolated from the data collected.

No attempt was made to determine whether these specific fixtures should be approved for use in the National Airspace System. This would be performed later in response to specifications written by the sponsoring activity. Some minor considerations are noted under "Test Results." These considerations were taken from visual observations and would be appropriate to present-day specifications and good engineering practices.

TEST RESULTS

LABORATORY TESTS.

Appendix A exhibits the photometric measurements performed on the pole-mounted unit. In addition to a complete readout of the light distribution at the highest output setting; plots of individual pulses for the high, medium, and low intensity settings were performed.

Appendix B exhibits the photometric measurements performed on the inset unit. In addition to a complete readout of the light distribution at the highest output setting, plots of individual pulses for the high, medium, and low intensity settings were performed.

FIELD TESTS.

POLE-MOUNTED UNIT. The following are the replies to the pilot questionnaire (appendix C) involving eleven pilots:

1. In flying a well-centered instrument landing system (ILS) approach, the five experimental stations compared (favorably, unfavorably) with the standard discharge lights. Eleven pilots checked favorably. There were no negative responses.

2. In flying one degree left (right) with a one-half full scale glide path down signal, the five experimental stations compared (favorably, unfavorably) with the standard discharge lights. Eleven pilots checked favorably. There were no negative responses.

3. In flying one degree left (right) with a one-half full scale glide path up signal, the five experimental stations appeared (favorably, unfavorably) with the standard discharge lights. Eleven pilots checked favorably. There were no negative responses.

4. Are you satisfied that the experimental lights (can, cannot) be used in place of the standard system? Explain. Nine pilots were satisfied that the experimental units could replace the standard units. One of the affirmative responses was restricted to that of VFR conditions, since he, "only saw the lights under VFR conditions." The two negative responses were explained as follows:

- I believe that the test cannot be conclusive inasmuch as burying the test fixtures in the standard system compromises the ability to compare: the eye has a light retentive capability much the same as a camera with (an) open lens eventually gets saturated with light.

- Uncertain - does not seem to be much difference between the lights, but if only experimental lights were working, the results might be entirely different.

5. Does the dimming feature supply any important function to the operating pilot? Explain. The following are the responses:

- Seems to be dimmer than standard system and a bit less glaring in low only. (In) medium and high (I) cannot tell the difference from standard system.

- No

- Once again, I couldn't detect a difference.

- I don't know. I saw no difference.

- There was very little apparent difference between the lights even with the experimental (light steady-burning) on low setting.

- I was unable to distinguish any significant difference on any of the approaches. The experimental lights were "drowned" in the conventional's (fixture) brightness.

- Could be used to reduce glare in certain fog and haze conditions. Experimental lights seemed to produce less glare under conditions flown this date.

- Yes. It appears to remove the brilliant glow of the strobes at lower settings.

- No, slightly less glare.

- It could, under different visibility conditions.

- Dimming feature is important to ... changing weather conditions.

INSET UNIT. The following are replies by seven pilots to the questionnaire (appendix C):

1. In flying a well-centered ILS approach, the five experimental stations compared (favorably, unfavorably) with the standard discharge lights. Seven pilots checked favorably. There were no negative responses.

2. In flying one degree left (right) with a one-half full scale glide path down signal, the five experimental stations compared (favorably, unfavorably) with the standard discharge lights. Seven pilots checked favorably. There were no negative responses.

3. In flying one degree left (right) with a one-half full scale glide path up signal the five experimental stations appeared (favorably, unfavorably) with the standard discharge lights. Five pilots checked favorably. Two pilots did not respond.

4. Are you satisfied that the experimental lights (can, cannot) be used in place of the standard system? Explain. Six pilots checked can. One pilot did not respond. The following explanations were given: (a) cannot see any difference between the two systems; (b) experimental lights have less distracting glare than standard lights and still do the job; and (c) under night ceiling and visibility unlimited, weather (CAVU WX) only.

5. Does the dimming feature supply any important function to the operating pilot? Explain. Five pilots checked yes. One pilot did not respond. One pilot responded in the negative. The following are the explanations:

- Reduces glare on bright, clear nights.

- As a variable for different visibilities.

- The adjustment for different visibility conditions is a very desirable feature. Under the CAVU conditions that this flight operated in, the experimental lights were preferable to the standard because there is less halo and reflective effect especially at low altitudes.

- a. At (steady-burning) low intensity step 2, approach experimental lights lost in (steady-burning) lights.

  b. Experimental lights more directional than commissioned.

  c. Experimental lights does not have a glow like the commissioned.

  d. Experimental lights not easily seen from side; and

  e. Generally looks very favorable (this response is from the pilot that did not respond to questions 3 and 4).

- The experimental lights are unsatisfactory on lowest intensity. Highest intensity were equal or better because of apparent less glare (this pilot did not respond to question 3).

- It was evident that experimental lights on high brightness were easier on the eye than the standard strobes. Even though their brightness seems to be comparable. They were producing much less "halo." The feature of being able to adjust to current ambient weather conditions seems highly desirable. General aviation aircraft not possessing landing lights of high candlepower often find themselves in a "black hole" after passing night-vision destroying high-intensity strobes. Being able to modulate the strobe output will help to alleviate this condition.

- Experimental lights not bright enough to "blind" the pilot (this is the response from the pilot that responded negatively).

MINOR CONSIDERATIONS.

The pole-mounted unit which weighs 11 pounds has two high-voltage cables entering the light unit which make it very difficult to mount on a standard structure. The pole-mounted inset units have three cables connecting the power supply to the light unit. Neither unit has a method of monitoring for equipment failure.

CONCLUSIONS

1. The equipment tested is an adequate replacement for presently-installed sequence flasher-light components or runway-end identifier components.

2. The photometric data for the pole-mounted flasher lighting equipment indicates a consistently good output light distribution with extensive horizontal coverage. The pilot responses sufficiently indicate a valid operational capacity. The three-step dimming capability is a useful feature: it is effective in reducing unwanted glare.

3. The conclusions are identical to the above for the inset flasher lighting equipment with the exception that the horizontal light distribution is more restrictive. This is not considered a deficiency since under present conditions pilots do not expect to receive downwind guidance from the sequence flashers. Also, since it is quite unlikely that the entire system would be inset, the pilots would receive guidance from the above units that were pole-mounted.

APPENDIX A

POLE-MOUNTED SEQUENCE FLASHER DATA

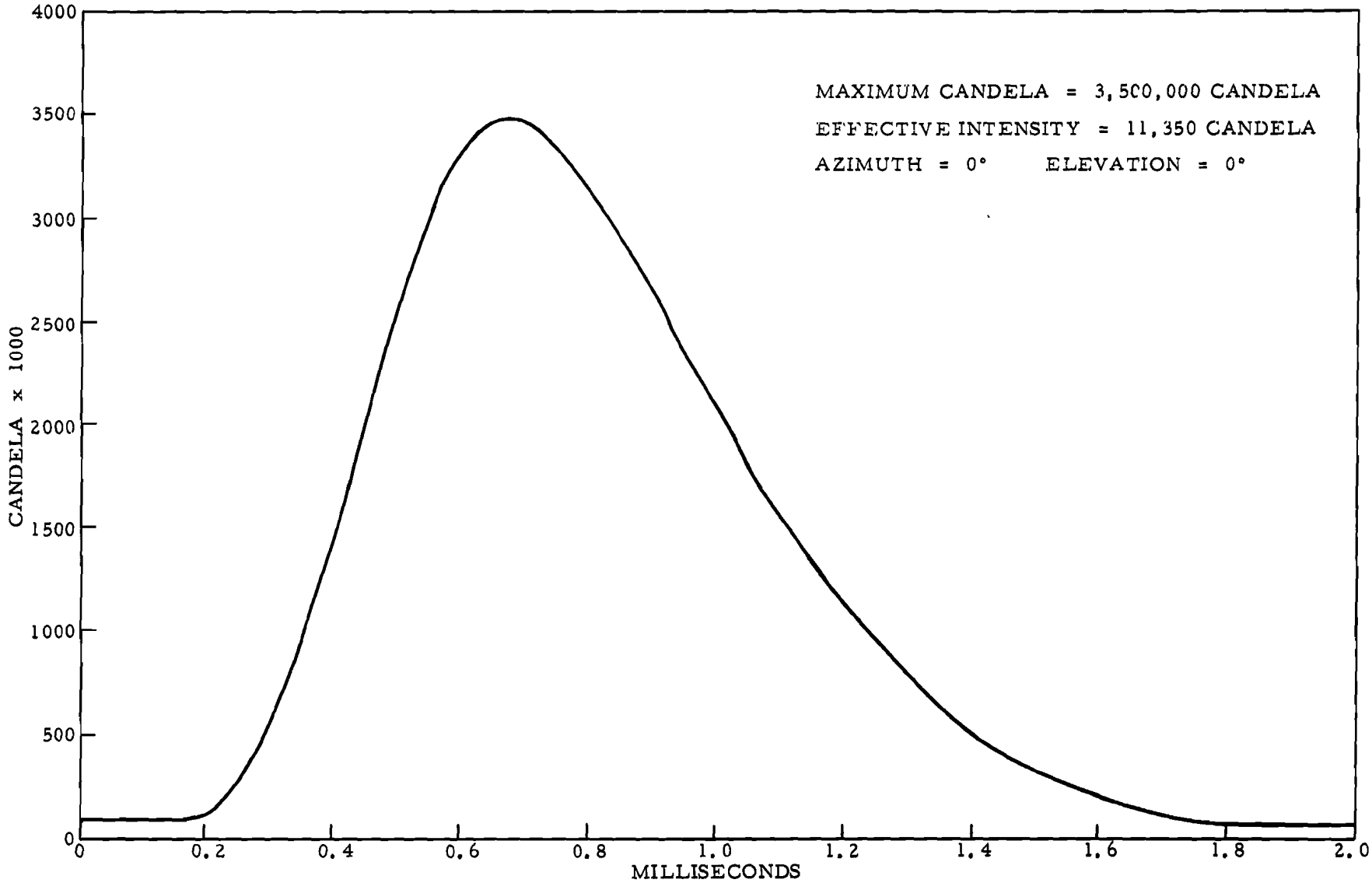


FIGURE A-1. POLE-MOUNTED SEQUENCE FLASHER - LOWEST INTENSITY

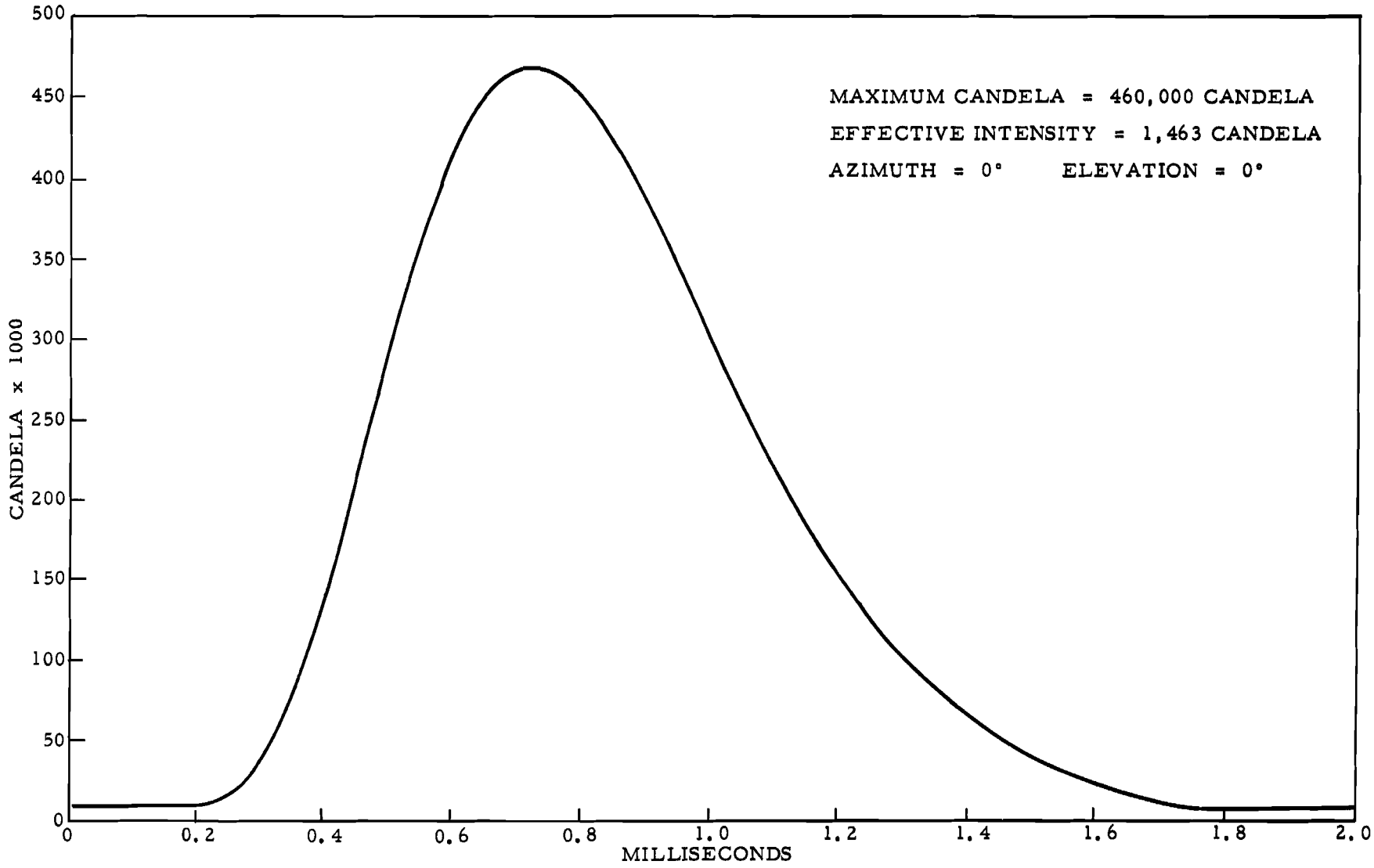


FIGURE A-2. POLE-MOUNTED SEQUENCE FLASHER - MIDDLE INTENSITY

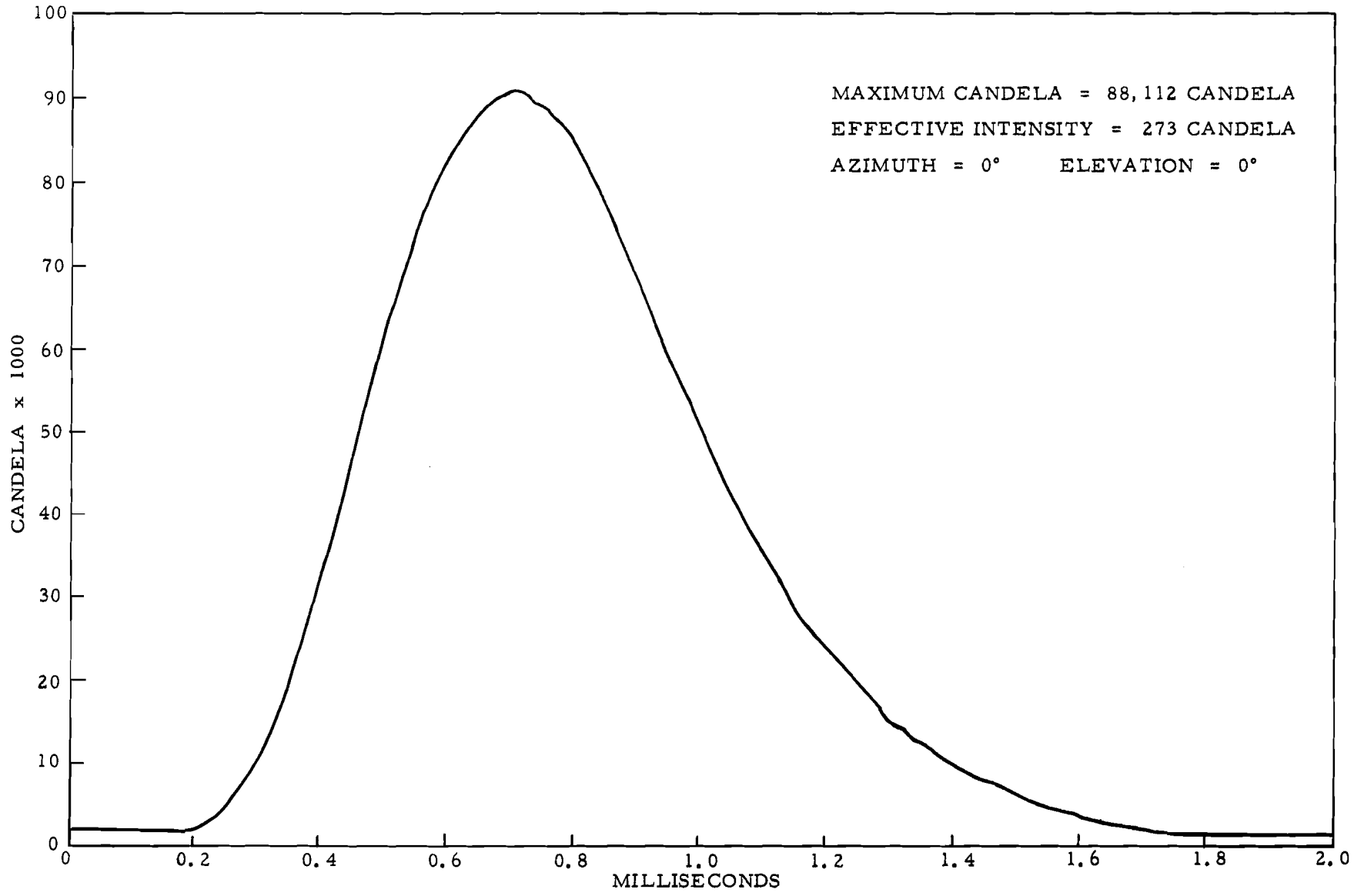


FIGURE A-3. POLE-MOUNTED SEQUENCE FLASHER - HIGHEST INTENSITY

POLE-MOUNT SEQUENCE FLASHER (HIGHEST INTENSITY)

ELEVATION = 0°

AZIMUTH	MAX. CANDELA X 1000	EFFECTIVE INTENSITY (CANDELA X 10)	AZIMUTH	MAX. CANDELA X 1000	EFFECTIVE INTENSITY (CANDELA X 10)	AZIMUTH	MAX. CANDELA X 1000	EFFECTIVE INTENSITY (CANDELA X 10)
-56	377	131	-17	3506	1165	22	3318	1070
-55	452	164	-16	3205	1058	23	3657	1175
-54	716	214	-15	3468	1150	24	3544	1159
-53	716	245	-14	3205	1053	25	3506	1149
-52	867	306	-13	3468	1137	26	3280	1056
-51	980	344	-12	3205	1051	27	3205	1027
-50	1056	371	-11	3355	1102	28	3431	1122
-49	1056	363	-10	3280	1074	29	3129	1016
-48	1131	394	- 9	3318	1101	30	3242	1062
-47	1320	450	- 8	3242	1066	31	2865	934
-46	1433	504	- 7	3091	980	32	2828	909
-45	1395	482	- 6	3091	1008	33	2714	882
-44	1659	559	- 5	3355	1116	34	2903	950
-43	1659	566	- 4	3129	1034	35	2564	827
-42	1621	564	- 3	3393	1114	36	2601	841
-41	1923	632	- 2	3393	1115	37	2601	852
-40	1998	660	- 1	3393	1108	38	2526	819
-39	2036	685	0	3500	1149	39	2187	710
-38	2149	723	1	3318	1099	40	2187	711
-37	2262	757	2	3468	1135	41	2111	689
-36	2300	789	3	3468	1135	42	2074	665
-35	2224	742	4	3280	1082	43	1998	652
-34	2526	846	5	3468	1135	44	1885	617
-33	2601	872	6	3431	1122	45	1659	534
-32	2639	882	7	3468	1132	46	1659	528
-31	2714	912	8	3431	1120	47	1433	461
-30	2865	959	9	3544	1156	48	1357	433
-29	2903	976	10	3431	1119	49	1357	430
-28	2941	979	11	3695	1201	50	1093	360
-27	3091	1028	12	3695	1188	51	1131	365
-26	2941	986	13	3544	1151	52	905	282
-25	3205	1067	14	3770	1218	53	829	259
-24	3280	1092	15	3695	1171	54	716	194
-23	3393	1125	16	3770	1221	55	452	135
-22	3355	1123	17	3808	1230	56	377	106
-21	3129	1030	18	3808	1237			
-20	3431	1134	19	3582	1169			
-19	3468	1155	20	3506	1137			
-18	3468	1162	21	3732	1207			

POLE-MOUNT SEQUENCE FLASHER (HIGHEST INTENSITY)

ELEVATION = 1°

AZIMUTH	MAX. CANDELA X 1000	EFFECTIVE INTENSITY (CANDELA X 10)
-56	302	93
-54	566	184
-52	829	264
-50	1018	315
-48	1169	372
-46	1395	447
-44	1583	505
-42	1772	578
-40	1923	630
-38	2149	697
-36	2149	690
-34	2526	805
-32	2639	855
-30	2790	905
-28	2677	880
-26	2790	906
-24	3242	1056
-22	3280	1082
-20	3355	1092
-18	3167	1029
-16	3393	1096
-14	3129	1015
-12	3318	1087
-10	3280	1075
- 8	3393	1103
- 6	3129	1022
- 4	3129	1006
- 2	3431	1131
0	3468	1140
2	3431	1125
4	3393	1126
6	3468	1139
8	3167	1034
10	3431	1137
12	3544	1175
14	3657	1189
16	3695	1218
18	3431	1123
20	3393	1106
22	3355	1100
24	3732	1215
26	3506	1162
28	3431	1135
30	3318	1090
32	3129	1027
34	2714	885
36	2526	825
38	2337	786
40	2149	698
42	1960	639
44	1734	576
46	1734	564
43	1508	491
50	1169	391
52	1018	334
54	716	204
56	415	130

POLE-MOUNT SEQUENCE FLASHER (HIGHEST INTENSITY)

ELEVATION = 2°

AZIMUTH	MAX. CANDELA X 1000	EFFECTIVE INTENSITY (CANDELA X 10)	AZIMUTH	MAX. CANDELA X 1000	EFFECTIVE INTENSITY (CANDELA X 10)
-56	339	92	22	3506	1137
-54	490	146	24	3506	1135
-52	792	246	26	3129	1022
-50	980	310	28	3091	1005
-48	1169	357	30	3205	1036
-46	1395	442	32	3129	992
-44	1433	439	34	2865	930
-42	1734	561	36	2526	814
-40	1772	567	38	2337	753
-38	2111	677	40	2300	753
-36	2300	743	42	2111	682
-34	2526	814	44	1734	563
-32	2488	771	46	1621	519
-30	2790	897	48	1395	440
-28	2865	936	50	1320	408
-26	2978	960	52	1018	325
-24	3129	1020	54	716	224
-22	2978	954	56	415	114
-20	2978	957			
-18	3129	1003			
-16	3129	993			
-14	3205	1017			
-12	3091	996			
-10	3393	1103			
- 8	3355	1090			
- 6	3431	1114			
- 4	3468	1121			
- 2	3355	1082			
0	3431	1112			
2	3393	1103			
4	3431	1097			
6	3393	1096			
8	3242	1043			
10	3431	1122			
12	3506	1132			
14	3431	1104			
16	3544	1161			
18	3506	1147			
20	3468	1126			

POLE-MOUNT SEQUENCE FLASHER (HIGHEST INTENSITY)

ELEVATION = 3°

AZIMUTH	MAX. CANDELA X 1000	EFFECTIVE INTENSITY (CANDELA X 10)	AZIMUTH	MAX. CANDELA X 1000	EFFECTIVE INTENSITY (CANDELA X 10)
-56	339	95	22	3280	1082
-54	566	179	24	3506	1151
-52	792	251	26	3129	1013
-50	943	293	28	3091	984
-48	1056	335	30	2941	967
-46	1357	439	32	3091	993
-44	1433	454	34	2903	963
-42	1734	555	36	2677	889
-40	1734	560	38	2564	857
-38	1960	634	40	2149	715
-36	2111	676	42	2187	712
-34	2262	723	44	1960	649
-32	2375	770	46	1772	583
-30	2828	907	48	1433	471
-28	2677	863	50	1282	410
-26	2752	886	52	1056	346
-24	3129	1007	54	716	226
-22	2903	938	56	415	143
-20	3318	1067			
-18	3355	1081			
-16	3167	1026			
-14	3355	1081			
-12	3318	1078			
-10	3431	1122			
- 8	3129	1020			
- 6	3393	1114			
- 4	3431	1129			
- 2	3506	1146			
0	3468	1131			
2	3167	1035			
4	3242	1064			
6	3205	1032			
8	3506	1149			
10	3544	1176			
12	3582	1179			
14	3318	1083			
16	3355	1105			
18	3695	1178			
20	3695	1196			

POLE-MOUNT SEQUENCE FLASHER (HIGHEST INTENSITY)

ELEVATION = 4°

AZIMUTH	MAX. CANDELA X 1000	EFFECTIVE INTENSITY (CANDELA X 10)	AZIMUTH	MAX. CANDELA X 1000	EFFECTIVE INTENSITY (CANDELA X 10)
-56	339	100	22	3242	1051
-54	566	181	24	3468	1123
-52	792	247	26	3355	1090
-50	980	309	28	3167	1027
-48	1169	370	30	3129	1008
-46	1357	431	32	2941	968
-44	1433	454	34	2828	922
-42	1734	561	36	2677	881
-40	1960	633	38	2526	828
-38	2149	698	40	2149	709
-36	2262	741	42	2149	687
-34	2526	803	44	1734	570
-32	2601	837	46	1546	511
-30	2752	895	48	1395	454
-28	2865	932	50	1320	407
-26	2790	890	52	905	299
-24	3129	1011	54	716	227
-22	3242	1049	56	415	135
-20	3280	1064			
-18	3431	1109			
-16	3129	1001			
-14	3393	1112			
-12	3167	1022			
-10	3129	1018			
- 8	3431	1121			
- 6	3205	1023			
- 4	3468	1130			
- 2	3506	1131			
0	3468	1119			
2	3205	1017			
4	3167	1023			
6	3205	1020			
8	3544	1137			
10	3242	1038			
12	3468	1125			
14	3582	1168			
16	3695	1203			
18	3732	1209			
20	3582	1169			

POLE-MOUNT SEQUENCE FLASHER (HIGHEST INTENSITY)

ELEVATION = 5°

AZIMUTH	MAX. CANDELA X 1000	EFFECTIVE INTENSITY (CANDELA X 10)	AZIMUTH	MAX. CANDELA X 1000	EFFECTIVE INTENSITY (CANDELA X 10)
-56	415	144	22	3431	1111
-54	566	196	24	3091	983
-52	829	290	26	3205	1054
-50	1018	356	28	3205	1033
-48	1282	414	30	2714	886
-46	1395	466	32	2865	935
-44	1546	520	34	2752	900
-42	1734	583	36	2601	840
-40	1960	641	38	2262	732
-38	2111	701	40	2074	669
-36	2262	748	42	2036	677
-34	2375	784	44	1772	586
-32	2564	841	46	1470	492
-30	2714	892	48	1357	446
-28	2865	944	50	1018	328
-26	2941	979	52	829	274
-24	3091	1021	54	528	184
-22	2865	950	56	415	137
-20	2978	991			
-18	3318	1088			
-16	3129	1016			
-14	3167	1053			
-12	3167	1027			
-10	3431	1122			
- 8	3431	1123			
- 6	3431	1130			
- 4	3393	1122			
- 2	3506	1136			
0	3355	1078			
2	3468	1116			
4	3205	1022			
6	3205	1026			
8	3468	1126			
10	3431	1101			
12	3167	1017			
14	3205	1032			
16	3544	1161			
18	3582	1156			
20	3205	1032			

POLE-MOUNT SEQUENCE FLASHER (HIGHEST INTENSITY)

ELEVATION = 6°

AZIMUTH	MAX. CANDELA X 1000	EFFECTIVE INTENSITY (CANDELA X 10)	AZIMUTH	MAX. CANDELA X 1000	EFFECTIVE INTENSITY (CANDELA X 10)
-56	339	122	22	3129	1027
-54	490	168	24	2978	992
-52	716	230	26	3167	1058
-50	943	321	28	3091	1023
-48	1056	350	30	2714	914
-46	1320	434	32	2790	943
-44	1395	473	34	2601	876
-42	1697	565	36	2375	779
-40	1923	619	38	1998	659
-38	1923	626	40	1998	652
-36	1998	663	42	1697	563
-34	2111	700	44	1320	423
-32	2300	761	46	1320	409
-30	2375	800	48	980	326
-28	2715	890	50	792	258
-26	2903	963	52	679	197
-24	2752	893	54	415	143
-22	2790	924	56	339	125
-20	2941	961			
-18	2941	973			
-16	3318	1089			
-14	3242	1064			
-12	3318	1090			
-10	3091	1010			
- 8	3393	1115			
- 6	3129	1004			
- 4	3431	1138			
- 2	3129	1018			
0	3205	1065			
2	3205	1072			
4	3242	1070			
6	3468	1171			
8	3506	1169			
10	3205	1060			
12	3544	1184			
14	3205	1062			
16	3544	1185			
18	3506	1166			
20	3431	1136			

POLE-MOUNT SEQUENCE FLASHER (HIGHEST INTENSITY)

ELEVATION = 7°

AZIMUTH	MAX. CANDELA X 1000	EFFECTIVE INTENSITY (CANDELA X 10)	AZIMUTH	MAX. CANDELA X 1000	EFFECTIVE INTENSITY (CANDELA X 10)
-54	415	162	22	3167	1023
-52	566	203	24	2752	893
-50	792	272	26	2639	854
-48	905	312	28	2714	885
-46	1018	352	30	2601	842
-44	1320	440	32	2300	752
-42	1433	489	34	2149	696
-40	1546	521	36	1998	649
-38	1923	635	38	1734	574
-36	2036	681	40	1508	513
-34	2074	685	42	1169	397
-32	2300	771	44	1056	353
-30	2262	743	46	905	304
-28	2714	879	48	716	229
-26	2752	916	50	566	196
-24	2865	945	52	490	164
-22	2903	959	54	377	131
-20	3129	1028			
-18	3205	1055			
-16	3205	1062			
-14	2941	967			
-12	3280	1084			
-10	2941	974			
- 8	2978	980			
- 6	3393	1109			
- 4	3355	1110			
- 2	3091	1020			
0	3318	1089			
2	3318	1068			
4	3393	1088			
6	3355	1079			
8	3318	1072			
10	3280	1057			
12	3318	1069			
14	3280	1061			
16	3091	979			
18	3091	980			
20	3242	1045			

POLE-MOUNT SEQUENCE FLASHER (HIGHEST INTENSITY)

ELEVATION = 8°

AZIMUTH	MAX. CANDELA X 1000	EFFECTIVE INTENSITY (CANDELA X 10)	AZIMUTH	MAX. CANDELA X 1000	EFFECTIVE INTENSITY (CANDELA X 10)
-52	377	124	24	2488	801
-50	452	145	26	2337	751
-48	528	171	28	2187	700
-46	754	230	30	1923	596
-44	905	290	32	1923	599
-42	1093	359	34	1621	516
-40	1169	365	36	1357	421
-38	1320	424	37	1282	381
-36	1621	526	40	1056	339
-34	1734	563	42	905	285
-32	1772	563	44	829	252
-30	1923	614	46	716	232
-28	2074	671	48	566	183
-26	2187	697	50	490	169
-24	2300	738	52	415	161
-22	2714	874	54	377	124
-20	2790	894			
-18	2639	849			
-16	2714	880			
-14	2941	947			
-12	2828	899			
-10	2828	917			
- 8	2903	930			
- 6	3091	980			
- 4	2941	951			
- 2	2941	965			
0	3242	1085			
2	2978	1002			
4	3280	1085			
6	2903	957			
8	2941	970			
10	2903	959			
12	3091	1024			
14	2865	966			
16	2828	950			
18	2903	980			
20	2601	818			
22	2526	793			

POLE-MOUNT SEQUENCE FLASHER (HIGHEST INTENSITY)

ELEVATION = 9°

AZIMUTH	MAX. CANDELA X 1000	EFFECTIVE INTENSITY (CANDELA X 10)	AZIMUTH	MAX. CANDELA X 1000	EFFECTIVE INTENSITY (CANDELA X 10)
-52	358	122	26	1697	558
-50	415	138	28	1451	480
-48	490	171	30	1414	469
-46	547	189	32	1244	407
-44	641	213	34	1074	358
-42	679	223	36	943	306
-40	792	273	38	829	283
-38	1056	351	40	773	257
-36	1112	372	42	716	238
-34	1376	462	44	679	229
-32	1489	499	46	584	205
-30	1546	520	48	566	192
-28	1697	558	50	471	162
-26	1979	656	52	452	153
-24	2036	679	54	415	134
-22	2205	728			
-20	2356	775			
-18	2375	789			
-16	2469	812			
-14	2545	835			
-12	2356	777			
-10	2451	796			
- 8	2658	876			
- 6	2507	816			
- 4	2752	908			
- 2	2809	918			
0	2564	814			
2	2771	905			
4	2752	884			
6	2677	881			
8	2451	798			
10	2620	851			
12	2526	830			
14	2507	814			
16	2394	789			
18	2187	709			
20	2262	742			
22	1923	628			
24	1942	639			

POLE-MOUNT SEQUENCE FLASHER (HIGHEST INTENSITY)

ELEVATION = 10°

AZIMUTH	MAX. CANDELA X 1000	EFFECTIVE INTENSITY (CANDELA X 10)	AZIMUTH	MAX. CANDELA X 1000	EFFECTIVE INTENSITY (CANDELA X 10)
-52	339	125	26	1188	396
-50	396	131	28	1037	346
-48	452	158	30	999	321
-46	452	155	32	961	298
-44	547	191	34	961	308
-42	660	223	36	848	282
-40	697	240	28	735	235
-38	792	271	40	735	238
-36	811	281	42	641	210
-34	848	290	44	566	191
-32	943	316	46	528	177
-30	1150	394	48	490	166
-28	1301	435	50	452	155
-26	1357	455	52	396	135
-24	1602	529			
-22	1602	525			
-20	1847	607			
-18	1866	607			
-16	2055	675			
-14	2074	683			
-12	2149	700			
-10	2017	669			
- 8	2243	744			
- 6	2092	694			
- 4	2149	712			
- 2	2319	768			
0	2149	704			
2	2092	694			
4	2243	737			
6	2187	717			
8	1960	636			
10	1998	651			
12	1942	629			
14	1753	573			
16	1866	604			
18	1734	570			
20	1621	539			
22	1338	440			
24	1320	439			

POLE-MOUNT SEQUENCE FLASHER (HIGHEST INTENSITY)

ELEVATION = 11°

AZIMUTH	MAX. CANDELA X 1000	EFFECTIVE INTENSITY (CANDELA X 10)	AZIMUTH	MAX. CANDELA X 1000	EFFECTIVE INTENSITY (CANDELA X 10)
-52	358	98	26	1056	348
-50	358	116	28	1018	336
-48	396	129	30	867	282
-46	434	135	32	867	283
-44	452	141	34	811	270
-42	490	156	36	698	228
-40	566	176	38	660	205
-38	584	188	40	584	192
-36	698	224	42	584	186
-34	773	242	44	528	176
-32	829	263	46	452	145
-30	886	288	48	452	152
-28	886	293	50	396	136
-26	961	313	52	358	109
-24	999	325			
-22	1169	386			
-20	1301	417			
-18	1263	403			
-16	1414	457			
-14	1451	470			
-12	1470	483			
-10	1395	446			
- 8	1565	505			
- 6	1565	504			
- 4	1489	483			
- 2	1602	525			
0	1565	499			
2	1546	503			
4	1470	483			
6	1338	433			
8	1414	461			
10	1338	441			
12	1338	437			
14	1282	419			
16	1301	417			
18	1282	412			
20	1244	403			
22	1150	374			
24	1112	361			

POLE-MOUNT SEQUENCE FLASHER (HIGHEST INTENSITY)

ELEVATION = 12°

AZIMUTH	MAX. CANDELA X 1000	EFFECTIVE INTENSITY (CANDELA X 10)	AZIMUTH	MAX. CANDELA X 1000	EFFECTIVE INTENSITY (CANDELA X 10)
-52	283	88	26	886	301
-50	358	106	28	829	281
-48	377	119	30	792	265
-46	377	115	32	735	247
-44	434	136	34	754	250
-42	490	156	36	698	238
-40	509	157	38	660	223
-38	584	188	40	660	215
-36	660	210	42	528	184
-34	660	203	44	509	184
-32	735	239	46	452	158
-30	735	236	48	415	147
-28	792	254	50	396	141
-26	961	300	52	377	133
-24	886	290			
-22	961	308			
-20	1131	381			
-18	1169	390			
-16	1150	389			
-14	1150	381			
-12	1169	392			
-10	1112	362			
- 8	1188	389			
- 6	1244	403			
- 4	1188	394			
- 2	1112	374			
0	1112	371			
2	1244	415			
4	1244	414			
6	1244	408			
8	1188	401			
10	1188	397			
12	1150	393			
14	1150	385			
16	1169	392			
18	1112	374			
20	1018	340			
22	1037	343			
24	980	326			

POLE-MOUNT SEQUENCE FLASHER (HIGHEST INTENSITY)

ELEVATION = 13°

AZIMUTH	MAX. CANDELA X 1000	EFFECTIVE INTENSITY (CANDELA X 10)	AZIMUTH	MAX. CANDELA X 1000	EFFECTIVE INTENSITY (CANDELA X 10)
-52	320	99	26	867	299
-50	339	112	28	773	264
-48	377	126	30	716	246
-46	415	141	32	754	261
-44	434	147	34	679	221
-42	452	150	36	660	211
-40	528	170	38	584	197
-38	547	174	40	528	171
-36	584	193	42	471	153
-34	641	216	44	434	142
-32	698	228	46	415	133
-30	716	236	48	396	121
-28	773	248	50	358	115
-26	735	242	52	339	110
-24	811	265			
-22	961	309			
-20	999	329			
-18	1056	343			
-16	1056	344			
-14	1056	348			
-12	1074	352			
-10	999	327			
- 8	1074	352			
- 6	1074	353			
- 4	1074	355			
- 2	980	321			
0	999	329			
2	1056	355			
4	1074	360			
6	1074	354			
8	999	328			
10	980	331			
12	1037	348			
14	1093	369			
16	961	323			
18	999	338			
20	943	315			
22	980	328			
24	961	310			

POLE-MOUNT SEQUENCE FLASHER (HIGHEST INTENSITY)

ELEVATION = 14°

AZIMUTH	MAX. CANDELA X 1000	EFFECTIVE INTENSITY (CANDELA X 10)	AZIMUTH	MAX. CANDELA X 1000	EFFECTIVE INTENSITY (CANDELA X 10)
-52	283	94	26	735	254
-50	339	113	28	773	259
-48	358	117	30	679	231
-46	377	125	32	698	232
-44	434	149	34	660	211
-42	471	159	36	660	210
-40	471	146	38	584	203
-38	490	154	40	547	190
-36	547	176	42	509	173
-34	547	175	44	434	153
-32	660	213	46	452	165
-30	641	206	48	415	154
-28	660	213	50	339	123
-26	716	233	52	283	94
-24	754	250			
-22	867	288			
-20	829	268			
-18	886	296			
-16	943	310			
-14	961	313			
-12	886	287			
-10	961	302			
- 8	961	297			
- 6	980	314			
- 4	886	288			
- 2	867	285			
0	867	284			
2	961	315			
4	867	281			
6	980	315			
8	961	306			
10	961	311			
12	943	313			
14	961	309			
16	943	307			
18	867	286			
20	943	306			
22	867	291			
24	792	274			

POLE-MOUNT SEQUENCE FLASHER (HIGHEST INTENSITY)

ELEVATION = 15°

AZIMUTH	MAX. CANDELA X 1000	EFFECTIVE INTENSITY (CANDELA X 10)	AZIMUTH	MAX. CANDELA X 1000	EFFECTIVE INTENSITY (CANDELA X 10)
-52	264	100	26	773	267
-50	283	107	28	735	246
-48	358	113	30	660	211
-46	377	125	32	660	224
-44	377	131	34	660	218
-42	396	133	36	584	209
-40	434	150	38	528	184
-38	490	166	40	509	180
-36	547	182	42	452	152
-34	509	172	44	434	143
-32	566	188	46	415	139
-30	584	186	48	377	123
-28	679	225	50	283	93
-26	660	217	52	245	86
-24	697	228			
-22	792	262			
-20	829	273			
-18	867	302			
-16	886	301			
-14	886	302			
-12	886	301			
-10	886	303			
- 8	848	288			
- 6	829	278			
- 4	886	300			
- 2	867	300			
0	811	268			
2	811	274			
4	886	296			
6	886	295			
8	829	278			
10	886	303			
12	811	277			
14	886	301			
16	867	296			
18	848	290			
20	848	293			
22	829	284			
24	792	275			

POLE-MOUNT SEQUENCE FLASHER (HIGHEST INTENSITY)

ELEVATION = 16°

AZIMUTH	MAX. CANDELA X 1000	EFFECTIVE INTENSITY (CANDELA X 10)	AZIMUTH	MAX. CANDELA X 1000	EFFECTIVE INTENSITY (CANDELA X 10)
-52	207	53	26	660	207
-50	226	63	28	679	217
-48	283	85	30	660	208
-46	283	84	32	566	181
-44	358	106	34	566	180
-42	396	116	36	490	149
-40	434	130	38	434	140
-38	452	133	40	434	139
-36	452	136	42	452	146
-34	509	153	44	396	130
-32	547	168	46	358	113
-30	528	157	48	377	120
-28	547	166	50	283	99
-26	584	180	52	283	95
-24	698	213			
-22	698	213			
-20	716	218			
-18	754	235			
-16	792	245			
-14	773	237			
-12	735	223			
-10	811	257			
- 8	754	239			
- 6	829	270			
- 4	754	241			
- 2	811	261			
0	848	287			
2	848	285			
4	792	268			
6	848	288			
8	829	270			
10	773	248			
12	829	274			
14	754	250			
16	811	268			
18	792	255			
20	773	249			
22	698	219			
24	735	234			

POLE-MOUNT SEQUENCE FLASHER (HIGHEST INTENSITY)

ELEVATION = 17°

AZIMUTH	MAX. CANDELA X 1000	EFFECTIVE INTENSITY (CANDELA X 10)	AZIMUTH	MAX. CANDELA X 1000	EFFECTIVE INTENSITY (CANDELA X 10)
-52	245	75	26	660	209
-50	264	87	28	584	192
-48	283	91	30	584	192
-46	358	105	32	528	176
-44	377	113	34	490	165
-42	396	116	36	509	167
-40	415	131	38	471	155
-38	434	141	40	415	137
-36	490	156	42	396	119
-34	509	166	44	358	113
-32	509	163	46	339	100
-30	584	193	48	358	101
-28	566	190	50	283	85
-26	679	222	52	226	69
-24	698	222			
-22	754	242			
-20	716	237			
-18	773	248			
-16	792	252			
-14	735	237			
-12	792	257			
-10	754	246			
- 8	735	243			
- 6	792	260			
- 4	792	257			
- 2	735	241			
0	698	214			
2	698	216			
4	773	239			
6	792	245			
8	698	220			
10	754	236			
12	716	226			
14	698	218			
16	698	220			
18	773	251			
20	679	220			
22	679	216			
24	716	236			

POLE-MOUNT SEQUENCE FLASHER (HIGHEST INTENSITY)

ELEVATION = 18°

AZIMUTH	MAX. CANDELA X 1000	EFFECTIVE INTENSITY (CANDELA X 10)	AZIMUTH	MAX. CANDELA X 1000	EFFECTIVE INTENSITY (CANDELA X 10)
-52	207	65	26	679	221
-50	264	88	28	584	197
-48	283	95	30	566	189
-46	358	105	32	528	178
-44	358	109	34	509	170
-42	377	121	36	490	162
-40	434	140	38	434	145
-38	434	144	40	415	134
-36	490	160	42	396	128
-34	471	155	44	377	117
-32	528	177	46	377	118
-30	528	171	48	339	109
-28	547	183	50	283	92
-26	660	207	52	207	70
-24	660	209			
-22	697	225			
-20	697	230			
-18	697	223			
-16	697	233			
-14	716	232			
-12	754	244			
-10	716	231			
- 8	773	257			
- 6	716	235			
- 4	716	240			
- 2	792	262			
0	697	225			
2	773	245			
4	773	238			
6	773	250			
8	773	250			
10	773	251			
12	754	244			
14	754	230			
16	698	225			
18	679	218			
20	679	222			
22	735	244			
24	698	229			

POLE-MOUNT SEQUENCE FLASHER (HIGHEST INTENSITY)

ELEVATION = 19°

AZIMUTH	MAX. CANDELA X 1000	EFFECTIVE INTENSITY (CANDELA X 10)	AZIMUTH	MAX. CANDELA X 1000	EFFECTIVE INTENSITY (CANDELA X 10)
-50	170	48	26	547	162
-48	226	65	28	509	152
-46	264	72	30	471	135
-44	320	85	32	434	129
-42	339	95	34	471	135
-40	377	106	36	415	119
-38	377	107	38	377	104
-36	434	128	40	358	101
-34	415	125	42	358	92
-32	471	146	44	264	74
-30	471	145	46	245	65
-28	547	164	48	207	57
-26	528	154	50	189	48
-24	547	160			
-22	584	174			
-20	584	177			
-18	679	202			
-16	660	198			
-14	679	204			
-12	660	188			
-10	660	186			
- 8	698	210			
- 6	660	199			
- 4	660	198			
- 2	660	201			
0	735	230			
2	660	213			
4	735	233			
6	660	209			
8	716	222			
10	698	213			
12	698	213			
14	660	193			
16	679	206			
18	698	211			
20	660	203			
22	641	201			
24	641	190			

POLE-MOUNT SEQUENCE FLASHER (HIGHEST INTENSITY)

ELEVATION = 20°

AZIMUTH	MAX. CANDELA X 1000	EFFECTIVE INTENSITY (CANDELA X 10)	AZIMUTH	MAX. CANDELA X 1000	EFFECTIVE INTENSITY (CANDELA X 10)
-50	170	45	26	584	190
-48	207	63	28	490	154
-46	245	82	30	471	146
-44	264	89	32	434	136
-42	358	108	34	452	139
-40	396	133	36	434	132
-38	415	144	38	396	119
-36	415	137	40	339	102
-34	452	156	42	264	84
-32	509	166	44	264	81
-30	490	158	46	226	68
-28	566	190	48	189	57
-26	641	202	50	132	38
-24	660	211			
-22	660	219			
-20	660	217			
-18	660	194			
-16	641	203			
-14	679	209			
-12	660	199			
-10	698	219			
- 8	660	194			
- 6	660	199			
- 4	698	217			
- 2	698	223			
0	660	203			
2	679	206			
4	660	188			
6	660	188			
8	698	214			
10	679	209			
12	660	203			
14	679	214			
16	660	198			
18	641	190			
20	660	209			
22	660	203			
24	660	198			

APPENDIX B

INSET SEQUENCE FLASHER DATA

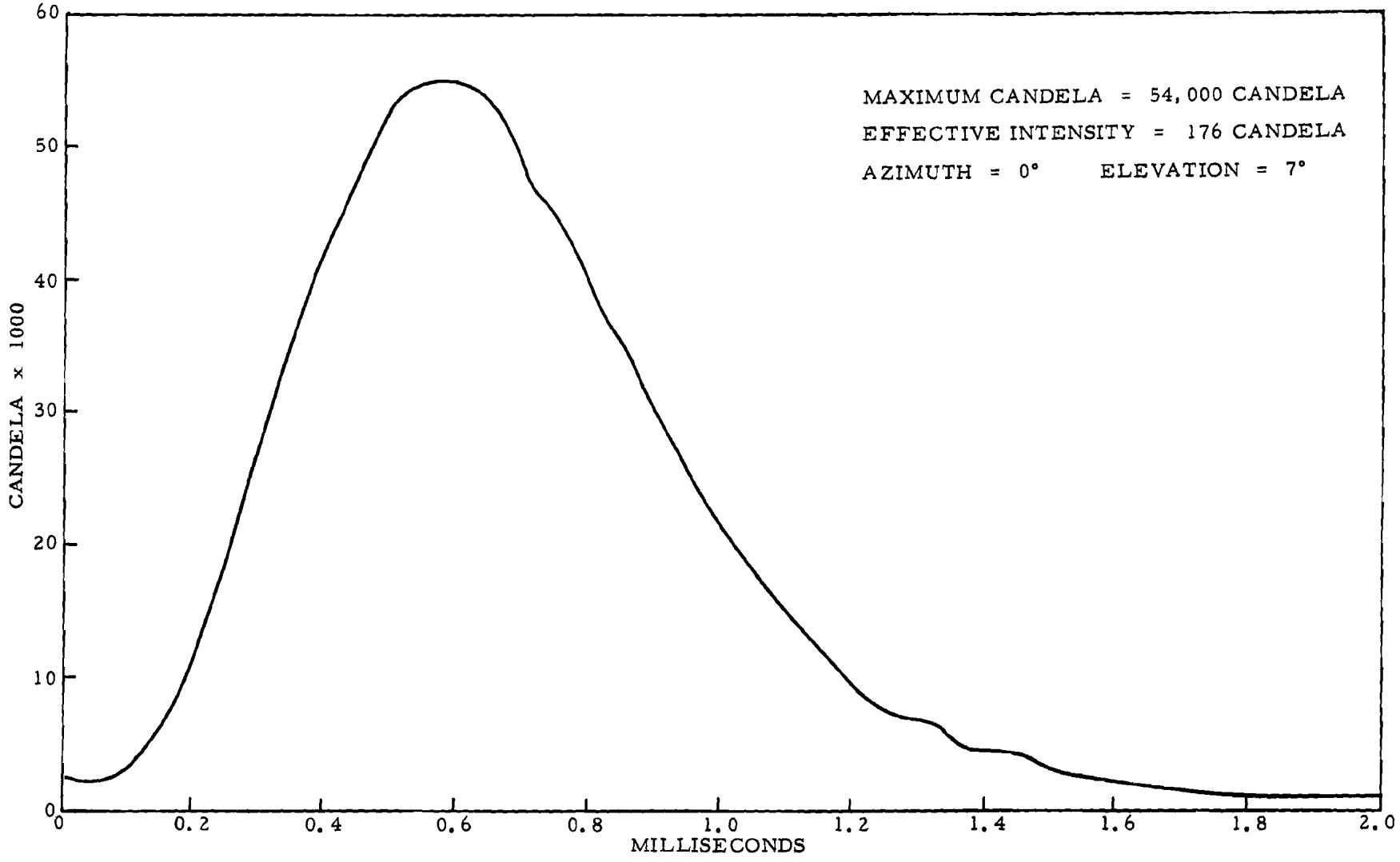


FIGURE B-1. INSET SEQUENCE FLASHER - LOWEST INTENSITY

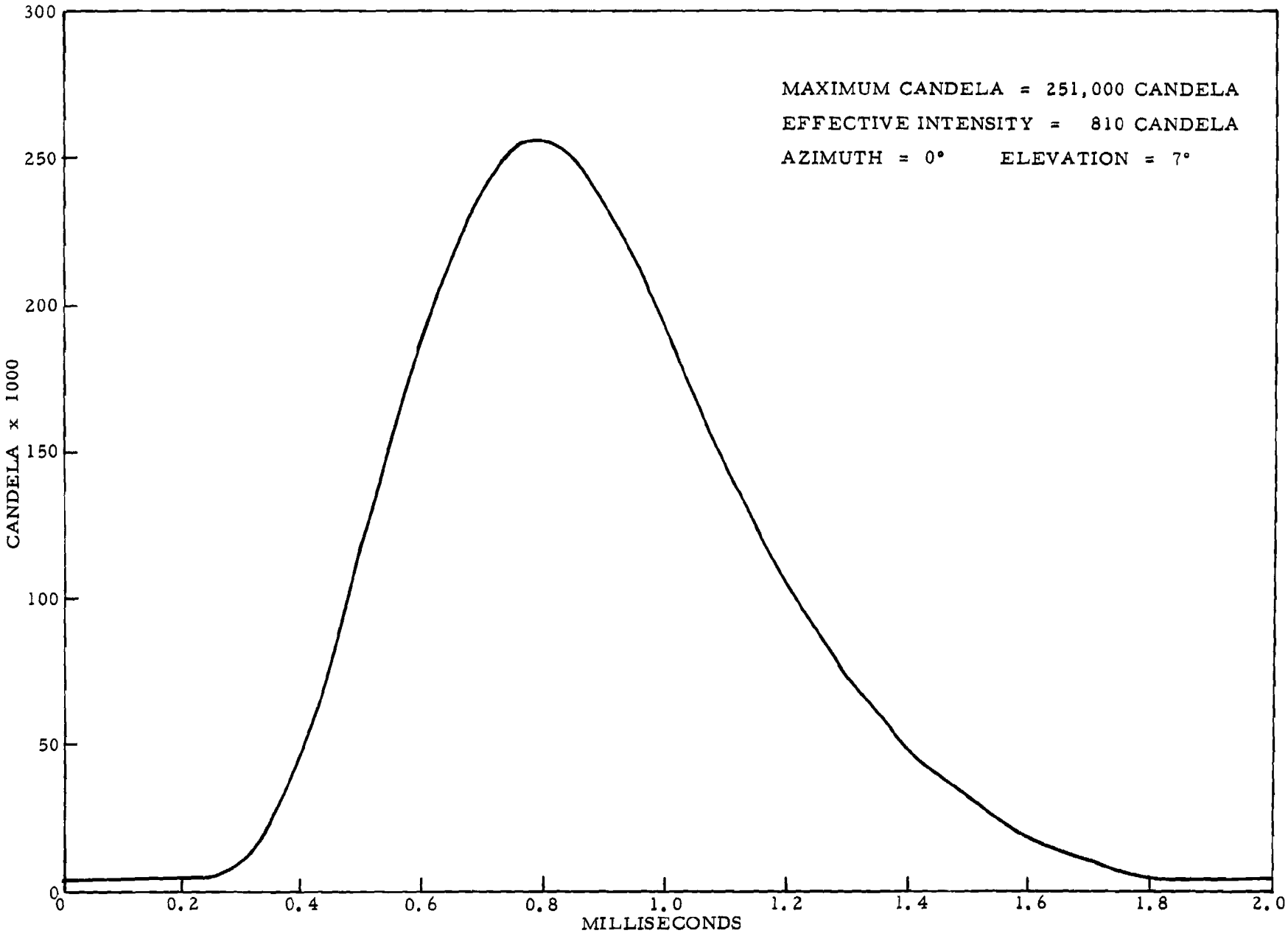


FIGURE B-2. INSET SEQUENCE FLASHER - MIDDLE INTENSITY

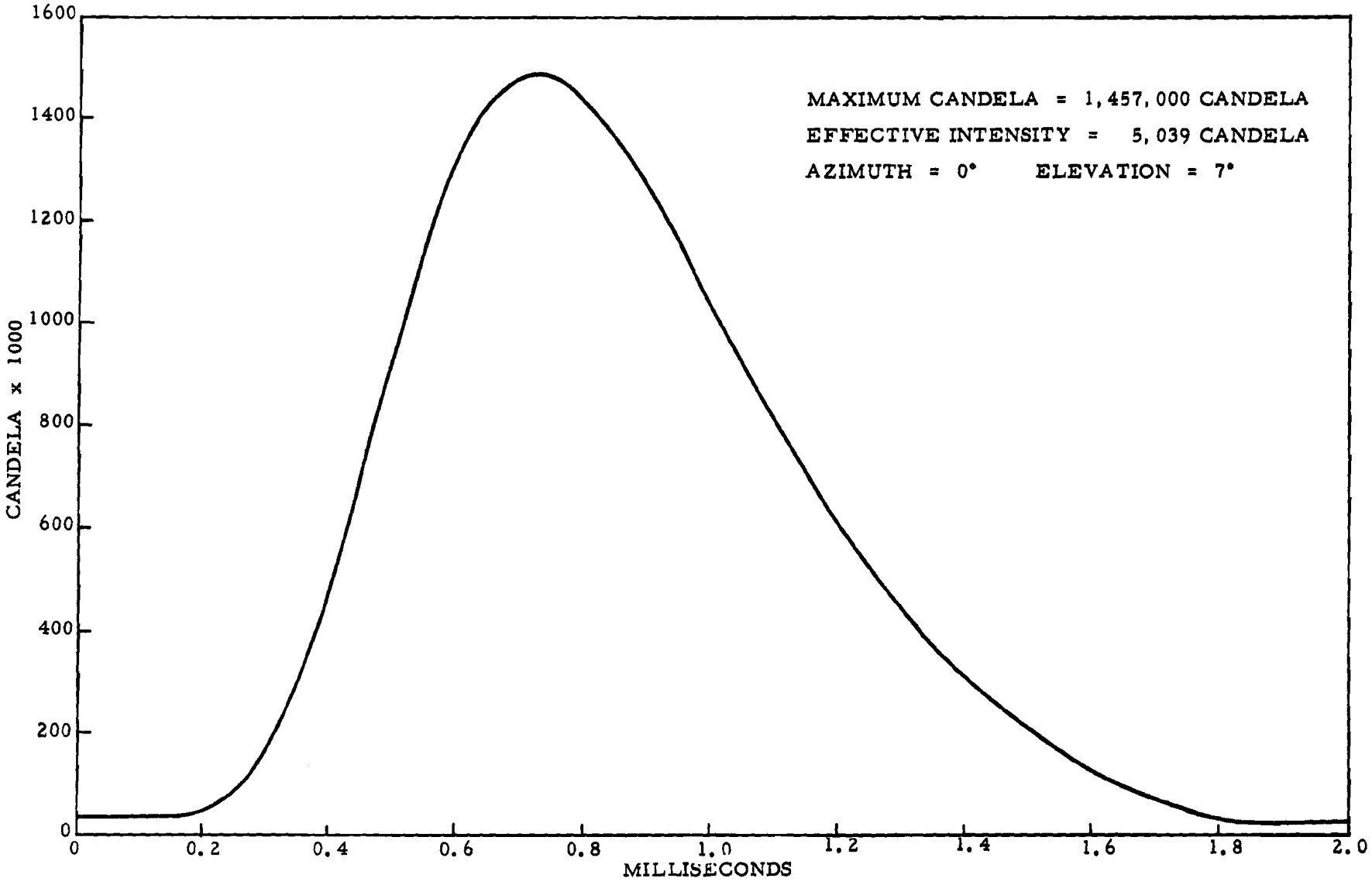


FIGURE B-3. INSET SEQUENCE FLASHER - HIGHEST INTENSITY

FLUSH-MOUNT SEQUENCE FLASHER (HIGHEST INTENSITY)

ELEVATION = 0°

AZIMUTH	MAX. CANDELA	EFFECTIVE INTENSITY
-29	46500	132
-28	108500	344
-27	186000	618
-26	209250	675
-25	186000	614
-24	193750	618
-23	209250	708
-22	271250	828
-21	302250	989
-20	348750	1154
-19	395250	1285
-18	418500	1380
-17	449500	1460
-16	457250	1528
-15	511500	1608
-14	519250	1696
-13	550250	1821
-12	581250	1923
-11	604500	2033
-10	651000	2170
-9	682000	2274
-8	705250	2367
-7	728500	2467
-6	844750	2869
-5	852500	2873
-4	906750	3031
-3	798250	2679
-2	813750	2731
-1	813750	2722
0	829250	2782
1	844750	2846
2	829250	2759
3	829250	2782
4	813750	2713
5	782750	2622
6	767250	2569
7	751750	2482
8	829250	2812
9	798250	2679
10	666500	2232
11	643250	2157
12	635500	2066
13	682000	2304
14	581250	1940
15	550250	1828
16	542500	1798
17	519250	1675
18	488250	1630
19	457250	1511
20	418500	1369
21	395250	1224
22	325500	1053
23	286750	904
24	232500	745
25	201500	643
26	217000	691
27	186000	597
28	162750	499
29	77500	214

ELEVATION = 1°

AZIMUTH	MAX. CANDELA	EFFECTIVE INTENSITY
-29	54250	148
-28	139500	436
-27	209250	655
-26	232500	746
-25	232500	754
-24	240250	773
-23	271250	859
-22	395250	1293
-21	395250	1224
-20	426250	1413
-19	527000	1741
-18	519250	1700
-17	550250	1802
-16	581250	1906
-15	635500	2044
-14	759500	2478
-13	720750	2392
-12	759500	2517
-11	782750	2603
-10	813750	2737
-9	852500	2851
-8	914500	3049
-7	937750	3130
-6	976500	3281
-5	1131500	3759
-4	1015250	3400
-3	1030750	3472
-2	1185750	4030
-1	1054000	3544
0	1054000	3527
1	1077250	3610
2	1054000	3548
3	1131500	3744
4	1030750	3443
5	1023000	3431
6	976500	3288
7	1023000	3442
8	945500	3168
9	922250	3077
10	883500	2919
11	790500	2666
12	1015250	3432
13	775000	2575
14	837000	2784
15	782750	2596
16	643250	2128
17	635500	2097
18	581250	1923
19	550250	1809
20	565750	1891
21	449500	1468
22	410750	1327
23	348750	1145
24	348750	1148
25	271250	824
26	240250	774
27	240250	758
28	178250	559
29	93000	271

FLUSH-MOUNT SEQUENCE FLASHER (HIGHEST INTENSITY)

ELEVATION = 2°			ELEVATION = 3°		
AZIMUTH	MAX. CANDELA	EFFECTIVE INTENSITY	AZIMUTH	MAX. CANDELA	EFFECTIVE INTENSITY
-29	93000	341	-29	108500	358
-28	186000	647	-28	186000	631
-27	271250	884	-27	302250	1014
-26	294500	1012	-26	341000	1156
-25	325500	1102	-25	356500	1218
-24	310000	1077	-24	356500	1213
-23	341000	1185	-23	410750	1361
-22	418500	1418	-22	519250	1652
-21	465000	1600	-21	573500	1913
-20	542500	1848	-20	643250	2140
-19	604500	2042	-19	682000	2305
-18	635500	2160	-18	759500	2544
-17	775000	2627	-17	790500	2672
-16	790500	2712	-16	829250	2815
-15	728500	2497	-15	883500	2986
-14	782750	2660	-14	891250	3052
-13	806000	2750	-13	937750	3208
-12	1007500	3370	-12	968750	3329
-11	914500	3109	-11	1030750	3502
-10	930000	3192	-10	1209000	4167
-9	1007500	3436	-9	1162500	3994
-8	1054000	3602	-8	1154750	4005
-7	1077250	3713	-7	1162500	4057
-6	1131500	3811	-6	1240000	4261
-5	1131500	3871	-5	1216750	4236
-4	1209000	4170	-4	1278750	4410
-3	1216750	4173	-3	1286500	4465
-2	1340750	4660	-2	1271000	4402
-1	1255500	4257	-1	1317500	4587
0	1255500	4283	0	1263250	4419
1	1255500	4262	1	1294250	4502
2	1255500	4258	2	1271000	4412
3	1209000	4188	3	1286500	4473
4	1340750	4638	4	1255500	4343
5	1178000	4027	5	1255500	4322
6	1162500	3993	6	1255500	4305
7	1317500	4549	7	1224500	4241
8	1131500	3832	8	1201250	4173
9	1092750	3757	9	1154750	3979
10	1038500	3554	10	1147000	3963
11	984250	3372	11	1092750	3795
12	906750	3128	12	1069500	3708
13	1030750	3538	13	1023000	3550
14	883500	2971	14	1007500	3446
15	953250	3249	15	961000	3333
16	891250	3061	16	899000	3111
17	782750	2664	17	906750	3127
18	759500	2538	18	829250	2880
19	705250	2411	19	813750	2787
20	658750	2228	20	759500	2612
21	596750	2044	21	682000	2350
22	542500	1820	22	651000	2203
23	465000	1577	23	573500	1936
24	395250	1329	24	472750	1617
25	341000	1136	25	434000	1475
26	310000	1048	26	403000	1343
27	302250	999	27	333250	1128
28	232500	791	28	279000	937
29	147250	465	29	178250	609

FLUSH-MOUNT SEQUENCE FLASHER (HIGHEST INTENSITY)

ELEVATION = 4°

AZIMUTH	MAX. CANDELA	EFFECTIVE INTENSITY
-29	147250	472
-28	209250	725
-27	302250	1004
-26	317750	1070
-25	348750	1176
-24	395250	1295
-23	465000	1574
-22	558000	1898
-21	651000	2214
-20	837000	2853
-19	906750	3107
-18	968750	3353
-17	1007500	3469
-16	1061750	3703
-15	968750	3399
-14	1154750	4016
-13	1054000	3634
-12	1216750	4226
-11	1092750	3788
-10	1147000	3977
-9	1178000	4077
-8	1201250	4196
-7	1224500	4286
-6	1255500	4369
-5	1263250	4416
-4	1441500	5083
-3	1317500	4632
-2	1286500	4527
-1	1410500	5030
0	1325250	4702
1	1503500	5287
2	1333000	4698
3	1325250	4641
4	1278750	4495
5	1240000	4350
6	1224500	4316
7	1255500	4340
8	1255500	4337
9	1170250	4109
10	1170250	4103
11	1255500	4355
12	1100500	3857
13	1085000	3790
14	1054000	3670
15	1030750	3586
16	968750	3349
17	1069500	3721
18	891250	3080
19	968750	3371
20	806000	2786
21	713000	2470
22	666500	2282
23	573500	1964
24	488250	1658
25	403000	1357
26	395250	1327
27	325500	1106
28	271250	934
29	186000	662

ELEVATION = 5°

AZIMUTH	MAX. CANDELA	EFFECTIVE INTENSITY
-29	147250	423
-28	209250	691
-27	271250	883
-26	302250	989
-25	325500	1098
-24	364250	1230
-23	449500	1537
-22	635500	2092
-21	643250	2169
-20	759500	2539
-19	837000	2821
-18	1015250	3421
-17	930000	3175
-16	1007500	3381
-15	1015250	3472
-14	1100500	3767
-13	1077250	3713
-12	1271000	4410
-11	1317500	4594
-10	1209000	4200
-9	1193500	4152
-8	1395000	4899
-7	1286500	4489
-6	1255500	4397
-5	1441500	5083
-4	1271000	4446
-3	1340750	4686
-2	1325250	4671
-1	1379500	4788
0	1379500	4773
1	1309750	4620
2	1309750	4592
3	1348500	4714
4	1278750	4450
5	1309750	4575
6	1294250	4539
7	1348500	4787
8	1232250	4319
9	1271000	4437
10	1379500	4781
11	1317500	4588
12	1185750	4099
13	1278750	4420
14	1147000	3942
15	1108250	3805
16	1162500	4011
17	968750	3357
18	930000	3203
19	883500	3012
20	844750	2878
21	751750	2514
22	666500	2259
23	581250	1963
24	472750	1603
25	364250	1233
26	317750	1056
27	294500	983
28	271250	887
29	178250	610

FLUSH-MOUNT SEQUENCE FLASHER (HIGHEST INTENSITY)

ELEVATION = 6°

AZIMUTH	MAX. CANDELA	EFFECTIVE INTENSITY
-29	116250	402
-28	186000	616
-27	232500	772
-26	271250	863
-25	286750	970
-24	310000	1050
-23	403000	1317
-22	581250	1955
-21	635500	2044
-20	713000	2406
-19	798250	2720
-18	875750	2918
-17	961000	3253
-16	1007500	3364
-15	1092750	3729
-14	1077250	3663
-13	1100500	3762
-12	1139250	3878
-11	1209000	4122
-10	1255500	4285
-9	1271000	4348
-8	1263250	4359
-7	1379500	4747
-6	1340750	4624
-5	1325250	4568
-4	1379500	4715
-3	1395000	4845
-2	1410500	4895
-1	1441500	4990
0	1418250	4908
1	1410500	4902
2	1410500	4899
3	1379500	4714
4	1387250	4746
5	1596500	5629
6	1379500	4710
7	1379500	4736
8	1286500	4427
9	1302000	4468
10	1209000	4168
11	1193500	4062
12	1185750	4032
13	1162500	3941
14	1162500	3931
15	1069500	3644
16	1030750	3526
17	999750	3349
18	937750	3179
19	891250	2916
20	790500	2637
21	689750	2314
22	581250	1966
23	480500	1592
24	395250	1311
25	286750	954
26	263500	804
27	224750	737
28	193750	638
29	147250	457

ELEVATION = 7°

AZIMUTH	MAX. CANDELA	EFFECTIVE INTENSITY
-29	77500	232
-28	147250	423
-27	186000	610
-26	217000	711
-25	240250	787
-24	286750	945
-23	395250	1229
-22	472750	1573
-21	527000	1752
-20	581250	1964
-19	666500	2232
-18	829250	2765
-17	806000	2691
-16	844750	2841
-15	914500	3080
-14	1123750	3759
-13	1061750	3569
-12	1216750	4126
-11	1154750	3933
-10	1201250	4077
-9	1255500	4209
-8	1317500	4502
-7	1348500	4640
-6	1348500	4640
-5	1542250	5356
-4	1418250	4908
-3	1379500	4764
-2	1573250	5506
-1	1441500	4998
0	1457000	5016
1	1588750	5547
2	1581000	5510
3	1449250	5012
4	1674000	5877
5	1387250	4772
6	1348500	4668
7	1340750	4632
8	1503500	5135
9	1333000	4569
10	1402750	4834
11	1216750	4166
12	1263250	4349
13	1131500	3799
14	1069500	3601
15	999750	3335
16	914500	3103
17	852500	2884
18	806000	2729
19	736250	2468
20	682000	2304
21	604500	2014
22	550250	1854
23	465000	1585
24	364250	1253
25	286750	979
26	240250	802
27	201500	681
28	155000	527
29	100750	352

FLUSH-MOUNT SEQUENCE FLASHER (HIGHEST INTENSITY)

ELEVATION = 8°

AZIMUTH	MAX. CANDELA	EFFECTIVE INTENSITY
-29	62000	202
-28	100750	347
-27	155000	515
-26	178250	612
-25	209250	729
-24	263500	848
-23	325500	1107
-22	410750	1400
-21	519250	1697
-20	573500	1939
-19	666500	2266
-18	728500	2469
-17	775000	2644
-16	829250	2829
-15	1007500	3354
-14	906750	3087
-13	953250	3239
-12	1131500	3842
-11	1061750	3633
-10	1077250	3696
-9	1154750	3942
-8	1379500	4718
-7	1271000	4348
-6	1309750	4520
-5	1340750	4642
-4	1379500	4757
-3	1402750	4860
-2	1526750	5295
-1	1619750	5660
0	1402750	4874
1	1433750	4959
2	1596500	5560
3	1410500	4896
4	1387250	4786
5	1317500	4563
6	1333000	4590
7	1302000	4497
8	1402750	4826
9	1201250	4145
10	1278750	4397
11	1092750	3764
12	1061750	3636
13	1030750	3515
14	976500	3371
15	914500	3116
16	899000	3071
17	899000	3075
18	790500	2728
19	829250	2815
20	674250	2314
21	612250	2096
22	573500	1955
23	449500	1527
24	341000	1161
25	271250	907
26	209250	738
27	178250	624
28	155000	565
29	155000	238

ELEVATION = 9°

AZIMUTH	MAX. CANDELA	EFFECTIVE INTENSITY
-29	46500	206
-28	85250	344
-27	116250	426
-26	147250	522
-25	170500	592
-24	209250	718
-23	302250	1033
-22	395250	1357
-21	488250	1684
-20	565750	1940
-19	643250	2168
-18	666500	2318
-17	767250	2614
-16	821500	2817
-15	837000	2889
-14	914500	3142
-13	961000	3314
-12	984250	3406
-11	1100500	3770
-10	1131500	3902
-9	1402750	4880
-8	1271000	4410
-7	1286500	4479
-6	1302000	4509
-5	1286500	4474
-4	1402750	4881
-3	1395000	4848
-2	1340750	4703
-1	1387250	4833
0	1393250	4886
1	1426000	4950
2	1627500	5737
3	1395000	4832
4	1325250	4617
5	1340750	4657
6	1302000	4518
7	1255500	4363
8	1410500	4865
9	1224500	4242
10	1294250	4438
11	1077250	3721
12	1069500	3668
13	968750	3349
14	968750	3335
15	906750	3144
16	891250	3066
17	829250	2884
18	782750	2672
19	720750	2481
20	643250	2204
21	589000	2045
22	519250	1788
23	426250	1478
24	333250	1182
25	232500	828
26	162750	594
27	155000	548
28	116250	421
29	77500	285

ELUSH-MOUNT SEQUENCE FLASHER (HIGHEST INTENSITY)

ELEVATION = 10°			ELEVATION = 11°		
AZIMUTH	MAX. CANDELA	EFFECTIVE INTENSITY	AZIMUTH	MAX. CANDELA	EFFECTIVE INTENSITY
-29	38750	97	-29	38750	98
-28	69750	211	-28	54250	180
-27	85250	265	-27	77500	241
-26	108500	324	-26	93000	287
-25	147250	435	-25	100750	342
-24	178250	588	-24	147250	493
-23	271250	849	-23	240250	803
-22	356500	1177	-22	325500	1061
-21	441750	1474	-21	410750	1377
-20	519250	1723	-20	480500	1621
-19	604500	1990	-19	604500	2048
-18	643250	2128	-18	604500	2024
-17	705250	2355	-17	666500	2227
-16	775000	2573	-16	844750	2858
-15	813750	2718	-15	844750	2826
-14	883500	2907	-14	790500	2682
-13	906750	3034	-13	852500	2871
-12	1007500	3362	-12	1007500	3349
-11	976500	3307	-11	945500	3202
-10	1061750	3593	-10	1038500	3514
-9	1154750	3912	-9	1092750	3746
-8	1271000	4308	-8	1131500	3859
-7	1255500	4233	-7	1325250	4567
-6	1247750	4226	-6	1278750	4353
-5	1402750	4775	-5	1216750	4147
-4	1503500	5120	-4	1216750	4164
-3	1333000	4520	-3	1387250	4748
-2	1635250	5582	-2	1216750	4180
-1	1340750	4576	-1	1209000	4156
0	1317500	4482	0	1271000	4330
1	1340750	4552	1	1255500	4286
2	1317500	4493	2	1271000	4348
3	1309750	4461	3	1263250	4299
4	1309750	4450	4	1255500	4275
5	1557750	5350	5	1201250	4152
6	1278750	4360	6	1216750	4182
7	1201250	4109	7	1216750	4197
8	1224500	4174	8	1185750	4047
9	1123750	3831	9	1162500	3991
10	1092750	3719	10	1123250	3684
11	1170250	3961	11	1007500	3400
12	1007500	3360	12	1007500	3404
13	961000	3235	13	945500	3246
14	976500	3282	14	914500	3134
15	852500	2861	15	852500	2936
16	821500	2754	16	821500	2822
17	798250	2687	17	775000	2653
18	844750	2830	18	720750	2462
19	689750	2299	19	658750	2253
20	635500	2086	20	581250	2001
21	635500	2053	21	519250	1782
22	519250	1718	22	480500	1691
23	441750	1453	23	395250	1355
24	286750	949	24	271250	900
25	193750	644	25	186000	661
26	147250	431	26	116250	447
27	108500	337	27	100750	379
28	93000	299	28	79000	230
29	62000	172	29	38750	121

FLUSH-MOUNT SEQUENCE FLASHER (HIGHEST INTENSITY)

ELEVATION = 12°

AZIMUTH	MAX. CANDELA	EFFECTIVE INTENSITY
-29	23250	81
-28	38750	122
-27	54250	179
-26	73625	211
-25	81375	267
-24	116250	393
-23	178250	605
-22	255750	852
-21	379750	1265
-20	414625	1409
-19	468875	1600
-18	604500	2049
-17	608375	2061
-16	658750	2239
-15	790500	2669
-14	736250	2502
-13	844750	2884
-12	953250	3232
-11	984250	3356
-10	976500	3299
-9	1131500	3836
-8	1092750	3725
-7	1255500	4305
-6	1092750	3796
-5	1116000	3844
-4	1162500	4007
-3	1255500	4363
-2	1162500	4039
-1	1201250	4168
0	1201250	4160
1	1193500	4141
2	1209000	4178
3	1232250	4303
4	1139250	3957
5	1309750	4530
6	1131500	3882
7	1139250	3907
8	1069500	3731
9	1069500	3723
10	984250	3363
11	1061750	3610
12	968750	3317
13	961000	3265
14	825375	2782
15	778875	2633
16	782750	2681
17	674250	2304
18	639375	2158
19	643250	2177
20	503750	1722
21	445625	1496
22	403000	1375
23	317750	1074
24	209250	721
25	143375	506
26	93000	337
27	77500	272
28	58125	218
29	34875	149

ELEVATION = 13°

AZIMUTH	MAX. CANDELA	EFFECTIVE INTENSITY
-29	19375	64
-28	27125	90
-27	38750	132
-26	46500	158
-25	69750	216
-24	89125	305
-23	116250	403
-22	174375	594
-21	228625	784
-20	348750	1192
-19	379750	1293
-18	441750	1480
-17	488250	1674
-16	635500	2147
-15	670375	2270
-14	627750	2124
-13	689750	2327
-12	751750	2532
-11	891250	3008
-10	844750	2873
-9	906750	3079
-8	1061750	3572
-7	1023250	3676
-6	1023000	3497
-5	1054000	3617
-4	1131500	3847
-3	1061750	3644
-2	1061750	3669
-1	1085000	3765
0	1077250	3713
1	1085000	3721
2	1061750	3673
3	1046250	3611
4	1147000	3933
5	1154750	3989
6	1131500	3902
7	1023000	3537
8	961000	3328
9	937750	3203
10	988125	3337
11	817625	2782
12	887375	3015
13	724625	2484
14	697500	2351
15	647125	2191
16	658750	2253
17	565750	1897
18	515375	1750
19	453375	1526
20	422375	1443
21	317750	1064
22	271250	917
23	193750	651
24	135625	461
25	100750	353
26	73625	233
27	50375	175
28	38750	132
29	23250	83

FLUSH-MOUNT SEQUENCE FLASHER (HIGHEST INTENSITY)

ELEVATION = 14°

AZIMUTH	MAX. CANDELA	EFFECTIVE INTENSITY
-29	19375	61
-28	23250	91
-27	27125	105
-26	31000	104
-25	42625	145
-24	54250	189
-23	77500	258
-22	104625	357
-21	143375	468
-20	174375	589
-19	220875	735
-18	263500	887
-17	298375	1014
-16	352625	1193
-15	383625	1292
-14	422375	1421
-13	507625	1702
-12	538625	1828
-11	596750	2011
-10	647125	2184
-9	689750	2313
-8	755625	2526
-7	775000	2597
-6	790500	2679
-5	825375	2785
-4	837000	2832
-3	856375	2879
-2	899000	3047
-1	871875	2918
0	860250	2899
1	871875	2901
2	902875	3040
3	848625	2872
4	825375	2777
5	821500	2773
6	786625	2643
7	790500	2656
8	751750	2527
9	724625	2448
10	689750	2306
11	635500	2128
12	534750	1805
13	523125	1760
14	476625	1606
15	453375	1517
16	391375	1306
17	356500	1185
18	321625	1061
19	275125	908
20	232500	766
21	182125	607
22	143375	466
23	112375	358
24	81375	249
25	54250	168
26	38750	114
27	27125	74
28	19375	52
29	15500	35

ELEVATION = 15°

AZIMUTH	MAX. CANDELA	EFFECTIVE INTENSITY
-29	19375	77
-28	19375	84
-27	27125	103
-26	31000	111
-25	34875	132
-24	42625	164
-23	58125	210
-22	77500	278
-21	96875	345
-20	135625	448
-19	143375	501
-18	166625	586
-17	178250	614
-16	201500	686
-15	213125	733
-14	236375	813
-13	267375	920
-12	286750	980
-11	306125	1064
-10	348750	1198
-9	383625	1315
-8	441750	1523
-7	445625	1526
-6	468875	1606
-5	488250	1672
-4	507625	1740
-3	515375	1756
-2	565750	1908
-1	542500	1833
0	523125	1789
1	534750	1828
2	565750	1941
3	565750	1933
4	511500	1739
5	523125	1791
6	503750	1689
7	472750	1622
8	449500	1526
9	403000	1369
10	383625	1304
11	352625	1210
12	317750	1067
13	279000	942
14	259625	860
15	244125	844
16	232500	797
17	201500	666
18	182125	604
19	162750	540
20	139500	469
21	108500	369
22	89125	292
23	73625	223
24	50375	170
25	38750	132
26	31000	108
27	27125	86
28	19375	68
29	19375	68

FLUSH-MOUNT SEQUENCE FLASHER (HIGHEST INTENSITY)

ELEVATION = 16°			ELEVATION = 17°		
AZIMUTH	MAX. CANDELA	EFFECTIVE INTENSITY	AZIMUTH	MAX. CANDELA	EFFECTIVE INTENSITY
-25	23250	83	-25	23250	103
-24	31000	94	-24	31000	114
-23	38750	121	-23	34875	130
-22	46500	142	-22	42625	154
-21	58125	195	-21	50375	202
-20	77500	254	-20	58125	204
-19	96875	313	-19	73625	249
-18	112375	372	-18	81375	293
-17	135625	434	-17	100750	349
-16	151125	498	-16	112375	396
-15	151125	508	-15	135625	427
-14	158875	519	-14	135625	444
-13	170500	587	-13	143375	498
-12	166625	565	-12	131750	453
-11	178250	606	-11	135625	479
-10	197625	668	-10	143375	492
-9	244125	844	-9	147250	521
-8	224750	777	-8	158875	559
-7	236375	809	-7	158875	547
-6	259625	874	-6	162750	581
-5	267375	919	-5	174375	607
-4	275125	952	-4	182125	637
-3	286750	984	-3	174375	613
-2	286750	988	-2	170500	596
-1	286750	979	-1	174375	611
0	298375	1020	0	178250	631
1	294500	1005	1	182125	639
2	290625	1002	2	178250	631
3	279000	951	3	178250	628
4	275125	932	4	174375	611
5	267375	918	5	170500	593
6	275125	937	6	193750	646
7	244125	830	7	162750	571
8	228625	782	8	158875	560
9	217000	734	9	151125	537
10	205375	693	10	147250	519
11	193750	646	11	147250	521
12	174375	598	12	143375	489
13	174375	588	13	139500	489
14	166625	558	14	135625	476
15	155000	523	15	135625	461
16	151125	494	16	135625	473
17	155000	512	17	120125	443
18	135625	449	18	108500	390
19	116250	386	19	89125	331
20	96875	317	20	73625	235
21	81375	263	21	58125	194
22	73625	227	22	50375	161
23	50375	159	23	42625	153
24	38750	126	24	38750	134
25	31000	93	25	31000	108

APPENDIX C

SEQUENCE FLASHER LIGHTS QUESTIONNAIRE

PILOT _____ AIRCRAFT _____ DAY _____ NITE _____ WEATHER _____

There are five stations that have newly-designed inset condenser-discharge light fixtures installed. The stations are 15, 16, 17, 18, and 19 in the approach zone of runway 13. Station 15 is the sixth flashing light from the threshold of the runway. You will see the units normally at full intensity so that they should compare with the standard fixture. During several landings the intensities will be reduced to introduce you to the dimming feature and for your comment on this feature.

1. In flying a well-centered ILS approach, the five experimental stations compared (favorably, unfavorably) with the standard discharge lights.

2. In flying one degree left (right) with a one-half full scale glide path down signal, the five experimental stations compared (favorably, unfavorably) with the standard discharge lights.

3. In flying one degree left (right) with a one-half full scale glide path up signal the five experimental stations appeared (favorably, unfavorably) with the standard discharge lights.

4. Are you satisfied that the experimental lights (can, cannot) be used in place of the standard system? Explain.

5. Does the dimming feature supply any important function to the operating pilot? Explain.