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25 SEP 1968

MEMORANDUM FOR: Chief, Design & Analysis Division

SUBJECT : CORONA Area Coverage, January 1967 to July 1968

REFERENCES : See Appendix A

I. INTRODUCTION

A compilation of CORONA area coverage data for the period January 1967 to July 1968 is presented in this memorandum.

The Committee on Imagery Requirements and Exploitation (COMIREX) submits reports[1] after each CORONA mission which reflect the current coverage status of the USIB search requirements in terms of clear, stereo, panoramic photography of the USSR, East European Satellites, Communist China, and North Korea. To complete the CORONA area coverage picture, the Mapping and Charting status is included in these reports.

The data presented in this paper have been extracted from the above-mentioned COMIREX reports. A list of the inclusive dates of area coverage status is shown in Table 1. The annual and semiannual requirements are summarized and discussed separately.

II. CORONA AREA COVERAGE REQUIREMENTS

On 8 November 1966, USIB approved a plan for using the KH-4 missions primarily in a search mode.[2] This plan stipulates that stereoscopic cloud-free photography (about 90 to 100 percent) should be planned as follows:

1. About 80 to 90 percent of built-up areas (1.8 million sq. nmi) of the Soviet Bloc and Communist China semiannually.

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2. Approximately 75 percent of the underdeveloped areas (2.8 million sq. nmi) of the Soviet Bloc and Communist China annually.

3. Approximately 2.5 million square nautical miles of intelligence coverage outside the Soviet Bloc and Communist China annually.

4. Seven to ten million square nautical miles of coverage outside the Soviet Bloc and Communist China for mapping and charting.

In addition to search and mapping and charting requirements, approximately five percent of the film on each mission is allocated to targets and areas of current intelligence interest. These targets may require a priority of "Extraordinary" requiring the camera to be turned on each time over the target regardless of weather or altitude, or they may be selected in lower priorities but designated for CORONA coverage because they may be effectively covered at this resolution.

The present requirements for mapping, charting, and geodesy coverage are based on a 1965 estimate of needs[3&4], some re-evaluation of needs in 1966[5&6], and a refinement aimed specifically at the role of the [redacted] System, submitted to the Board 22 July 1968[7] and noted with some further clarification by DIA on 1 August 1968[8]. The success achieved in the past three years in obtaining mapping and charting coverage in all areas except the equatorial belt has resulted in a considerable change in the statement of the requirement to NRO. NRO is now requested to allocate a modest percentage of film to mapping and charting and to take maximum advantage of weather opportunities in areas of interest to mapping and charting without interfering with the specific requirements for the collection of other intelligence. Chart 1 displays the equatorial bad weather belt.

III. SUMMARY

The CORONA System area coverage averaged 66 percent of the semiannual area during the time period January

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1967 to July 1968. For the fourteen six-month reporting periods, the average number of missions and active days per six-month period were 4.5 and 60, respectively.

The average collection against the annual requirement was 70 percent. The average number of missions and active days per annual period were 8.4 and 106, respectively.

Figure 1 summarizes graphically the performance of the CORONA System against both the semiannual and annual search requirements during the eighteen month period. Note the best performance appears in periods which include the winter months (i.e. January 1967, March 1967, and March 1968). Percent semiannual search area accomplishment is plotted as a function of days on orbit in Figure 2. There appears to be little difference between 50 and 65 days per period. In other words, the additional (fifth) mission in a six month period added very little in terms of periodic accomplishment.

Figure 3 presents a tabulation of the Sino-Soviet area coverage performance on an individual mission basis. For this Table, gross coverage is defined as that area in clear, stereo, panoramic photography within the particular requirement region--semiannual or annual. This area is mission unique in the sense that duplicate coverage within the mission of an area segment does not increase the area coverage. This recoverage is possible due to swath overlap or multiple attempts at particular area segments. The gross coverages by mission are plotted chronologically in Figure 4. Also, the area coverage acceptable for mapping and charting purposes is presented in Figure 4. With the exception of Mission 1035 (September 1966), Missions flown during the winter months obtained greater search coverage. These missions were 1038, 1044, and 1045 in January 1967, November 1967, and February 1968, respectively.

Against the mapping and charting requirement, the CORONA average collection was 0.340 million square nautical miles per mission for the sixteen missions (1036 through 1047). Individual mission collection is tabulated in Figure 5. The MC&G coverage is separated into Sino-Soviet, Equatorial Belt, and Other areas.

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IV. DISCUSSION

A. SEMIANNUAL SEARCH

The unique percent contribution by mission to the semiannual search area coverage for each of the reporting periods is shown in Figure 6 for 1967 and Figure 7 for 1968. The method of determining the unique percent contribution by mission is described by the following example. For the six-month period ending in January 1967, Mission 1036 contributes its total coverage of 21 percent of the total semiannual area. Mission 1035 contributes an additional 37 percent, although the unique mission coverage was 42 percent. The remaining 5 percent of Mission 1035 was duplicate coverage of area accomplished by Mission 1036. Next unique coverage for Mission 1037 with respect to Missions 1036 and 1035 is listed. Finally, the coverage for Mission 1038 is unique relative to the preceding missions in the period.

As shown in Figures 6 and 7, there are seven periods which contain five missions and seven periods which contain four missions. Of particular interest is the fact that the average performance is virtually the same whether there were four or five missions in a period (i.e. 66.9 percent as opposed to 67.1 percent). However, the range in performance is 59 to 73 percent (5 missions per period) compared with 52 to 85 percent (4 missions per period).

A summary of the data appearing in Figures 6 and 7 is presented in Figure 8. Lifetime and performance in terms of area coverage are shown for individual missions and reporting periods. The range is the minimum to maximum value for a particular Item. An example, there were 13 J-1 missions (Item) which had lifetimes ranging from 9 to 16 days (Range). The lifetime average for these missions was 12.9 days.

In particular, note the wide range in periodic status which has a minimum of 52 percent and a maximum of 85 percent area coverage. The corresponding days on orbit are 45 days (minimum) and 74 days (maximum). Apparently little correlation exists in days on orbit and periodic status. For example, the best performances 76 and 85 percent were obtained with only 46 and 49 days on orbit

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which are near minimum. The poorest performance for a six month period was 58 percent obtained by 88 days on orbit

B. ANNUAL SEARCH

The percent contribution by mission is shown in Figures 9 and 10. Figure 11 presents a summary of these data. Six of the fourteen periods contain nine missions and the remaining eight periods encompass eight missions. If those periods (January 1967 and March 1967) which contain Mission 1030 are excluded, the average periodic performances are 64.5 and 71.5 percent for eight and nine mission periods. The reason for excluding Mission 1030 is its unusually high degree of accomplishment which was 59 percent of the underdeveloped area.

The best performances for individual missions are 36 percent and 25 percent for Missions 1040 and 1046. These missions were on orbit in April 1967 and March 1968. It is interesting to note that the Mission 1030 was launched in March 1966. Again excluding Mission 1030, the maximum annual performance of 82 percent was for the period ending in March 1968. This period contained both Missions 1040 and 1046 as well as the maximum number of days on orbit (120). Also, the poorest annual performance of 58 percent was obtained by a near minimum days on orbit (86).

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/AS/MAB/D&AD

Attachments: a/s

Disbribution:
[redacted]

[redacted]

APPENDIX A

1. Monthly Report on Overhead Imagery Reconnaissance Memorandum for the United States Intelligence Board
2. [redacted]
3. [redacted]
4. [redacted]
5. [redacted]
6. [redacted]
7. [redacted]
8. [redacted]

[redacted]

[redacted]

TABLE I

INCLUSIVE DATES OF AREA COVERAGE STATUS

Last Mission in Period	Built-up Areas	Underdeveloped Areas
1047	9 Dec 1967 - 5 July 1968	7 Aug 1967 - 5 July 1968
1103	9 Dec 1967 - 15 May 1968	16 June 1967 - 15 May 1968
1046	15 Sept 1967 - 30 Mar 1968	30 Mar 1967 - 30 Mar 1968
1045	15 Sept 1967 - 7 Feb 1968	30 Mar 1967 - 7 Feb 1968
1102	16 June 1967 - 22 Dec 1967	15 Jan 1967 - 22 Dec 1967
1044	10 May 1967 - 11 Nov 1967	Nov 1966 - 11 Nov 1967
1101	10 May 1967 - 21 Sept 1967	Nov 1966 - 21 Sept 1967
1101	30 Mar 1967 - 21 Sept 1967	Sept 1966 - 21 Sept 1967
1043	30 Mar 1967 - 30 Aug 1967	10 Aug 1966 - 30 Aug 1967
1042	15 Jan 1967 - 30 Jun 1967	10 Aug 1966 - 30 Jun 1967
1041	15 Jan 1967 - 23 May 1967	22 Jun 1966 - 28 May 1967
1040	Nov 1966 - Apr 1967	Apr 1966 - Apr 1967
1039	21 Sept 1966 - 5 Mar 1967	9 Mar 1966 - 5 Mar 1967
1038	10 Aug 1966 - 26 Jan 1967	3 Feb 1966 - 26 Jan 1967

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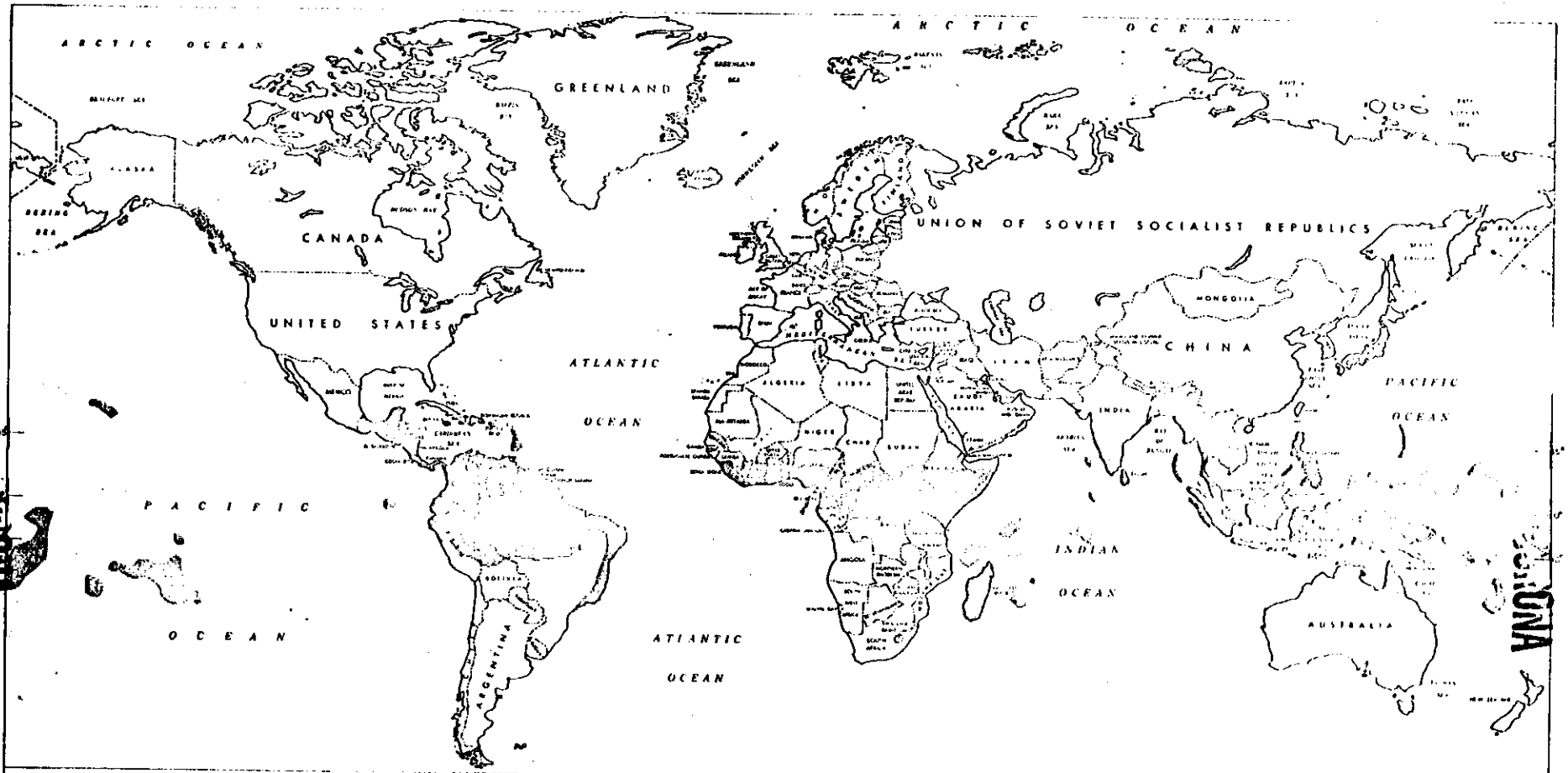
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UNITED STATES
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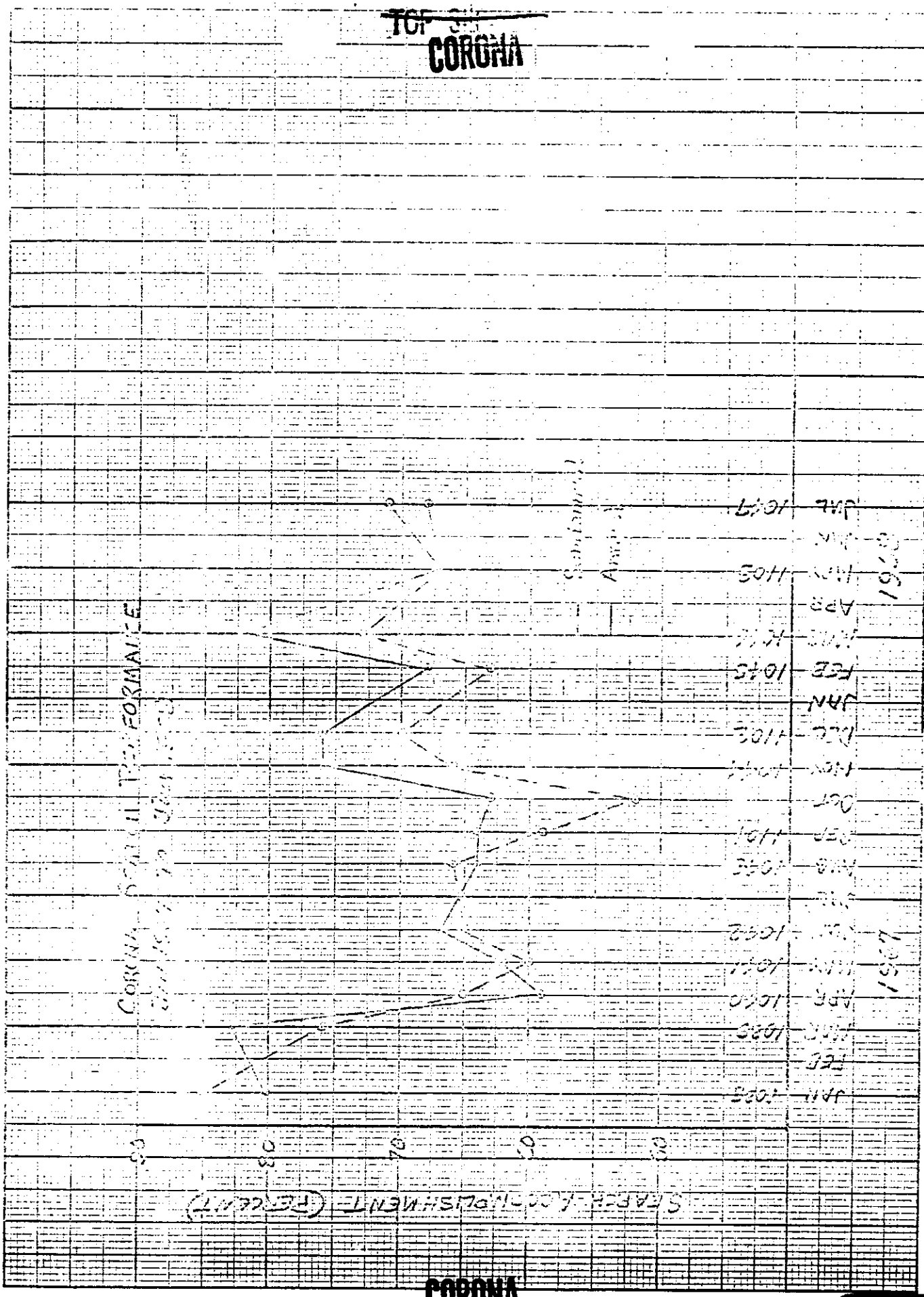
PACIFIC OCEAN
ARGENTINA
ATLANTIC OCEAN
ARCTIC OCEAN
UNION OF SOVIET SOCIALIST REPUBLICS
MONGOLIA
CHINA
INDIA
PACIFIC OCEAN
INDIAN OCEAN
AUSTRALIA
EQUATORIAL BAD WEATHER BELT
BAD WEATHER BELT

CHART 1

TOP SECRET
CORONA



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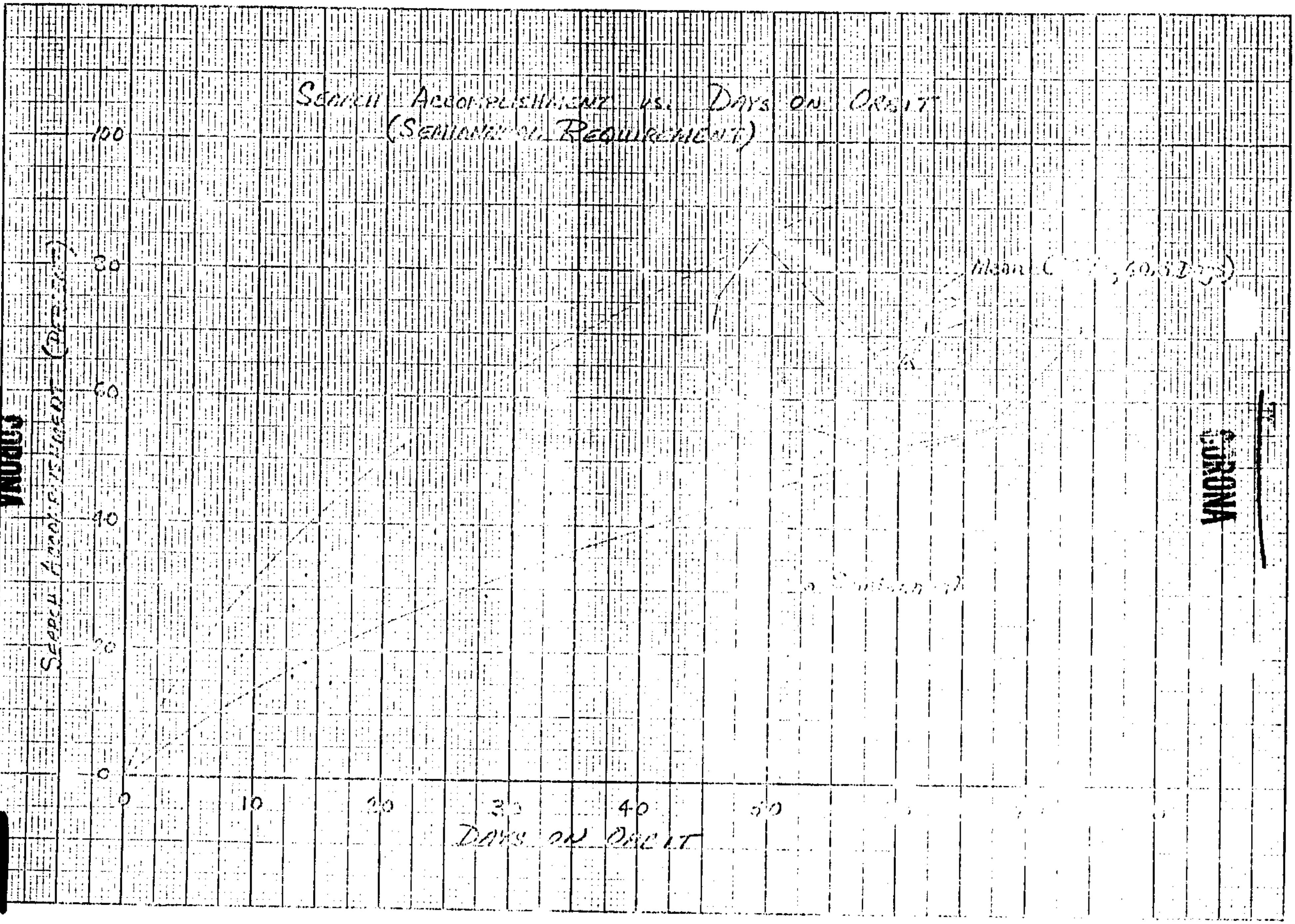

FIGURE 2
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CORONA

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MISSION PERFORMANCE SUMMARY

Mission Number	Active Days	6.8 x 10^6 nmi^2 Semiannual Search Gross 10^6nmi^2	%	2.8 x 10^6nmi^2 Annual Search Gross 10^6nmi^2	%	9.6 x 10^6nmi^2 Total Sino-Soviet Area 10^6nmi^2	%
1029	10	2.32	40.0	0.32	11.5	2.64	27.5
1030	11	1.37	23.6	1.66	59.3	3.03	31.6
1031	8[a]	0.91	15.7	0.32	11.5	1.23	12.8
1032			Failed to Orbit				
1033*	11	1.03	17.8			1.03	10.7
1034**	10	0.63	10.9	.21	7.5	0.84	8.7
1036	12	1.43	21.0	.12	4.3	1.55	16.2
1035	10	2.83	41.6	.11	3.9	2.94	30.6
1037	12	1.37	20.1	.06	2.2	1.43	14.9
1038	13	1.86	27.3	.16	5.7	2.02	21.1
1039	11	1.59	23.3	.37	13.2	1.96	20.8
1040	9	1.32	19.4	1.02	36.4	2.34	24.4
1041	15	1.75	25.7	0.36	12.8	2.11	21.9
1042	15	1.44	21.0	0.16	5.7	1.60	16.5
1043	15	0.95	14.0	0.46	16.4	1.41	14.7
1101	13	1.07	15.7	0.32	11.4	1.39	14.4
1044	9	2.00	29.4	0.28	10.0	2.28	23.7
1102	15	1.55	22.8	0.11	3.9	1.66	17.3
1045	14	2.19	32.2	0.35	12.5	2.54	26.5
1046	15	1.67	24.5	0.75	26.8	2.42	25.2
1103	14	1.25	18.4	0.37	13.2	1.62	16.9
1047	16	1.03	15.1	0.44	15.7	1.47	15.3

* GMAIC Mission
** MC&G Mission

Figure 3

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FIGURE 4

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CORONA MISSION PERFORMANCE

MC&G COVERAGE

	Mission Number	Sino-Soviet (10^6nmi^2)	Equator Belt (10^6nmi^2)	All Other (10^6nmi^2)	Total (10^6nmi^2)
1966	1036	0.021		0.515	0.536
	1035				0.489
	1037				0.481
	1038	0.063	0.151	0.496	0.708
	1039	0.043	0.099	0.387	0.524
	1040	0.043	0.111	0.299	0.353
	1041	0.010	0.032	0.069	0.079
1967	1042	0.074	0.053	0.345	0.451
	1043	0.004		0.164	0.221
	1101	0.025		0.238	0.263
	1044	0.048		0.350	0.398
	1102	0.034	0.131	0.118	0.283
	1045		0.100	0.066	0.166
1968	1046	0.019	0.014	0.206	0.239
	1103	0.001	0.029	0.049	0.079
	1047	0.051	0.043	0.073	0.167

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Figure 5

CORONA MISSION PERFORMANCE

SEMIANNUAL SEARCH

PERCENT CONTRIBUTION BY MISSION

			1966				1967								
Mission			1036	1035	1037	1038	1039	1040	1041	1042	1043	1101	1044	1102	
Gross Contr (%)			21	42	20	27	23	19	26	21	14	16	29	23	
Days on Orbit			14	10	12	13	11	9	15	15	15	13	9	15	
6 Month Period Ending (Month)		(Mission)													Period Status / Totals Days
Jan	67	1038	21	37	10	18									85 / 49
Feb	67	-													
Mar	67	1039		42	11	18	5								76 / 46
Apr	67	1040			20	23	12	10							65 / 45
May	67	1041				14	23	12	10						60 / 48
June	67	1042				12	23	12	10	7					65 / 63
July	67	-													
Aug	67	1043					10	19	20	12	5				66 / 65
Sept	67	1101						7	26	14	6	7			59 / 67
Oct	67	1101							26	14	6	7			52 / 58
Nov	67	1044							9	21	10	11	14		66 / 67
Dec	67	1102								9	14	15	19	13	70 / 67

Figure 6

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CORONA MISSION PERFORMANCE

SEMIANNUAL SEARCH

PERCENT CONTRIBUTION BY MISSION

	1967				1968		
Mission	1101	1044	1102	1045	1046	1103	1047
Gross Pct.	16	29	23	32	25	18	15
Days on Orbit	13	9	15	14	15	14	16

6 Month Period Ending (Month)	(Mission)							Period Status	Totals Days
Jan 68	-								
Feb 68	1045	5	29	14	15			63	51
Mar 68	1046	16	22	13	13	10		73	66
Apr 68	-								
May 68	1103			23	25	13	6	67	58
June 68	-								
July 68	1047			23	25	13	6	71	71
Aug 68									
Sept 68									
Oct 68									
Nov 68									
Dec 68									

Figure 7

SEMIANNUAL REQUIREMENT AREA

Item	Range	Average
Missions	16	(1036 through 1047)
Lifetime	9 - 16 Days	13.1 Days
J-1 (13 Missions)	9 - 16 Days	12.9 Days
J-3 (3 Missions)	13 - 15 Days	14.0 Days
Mission Performance	14 - 42%	23.2%
J-1 (13 Missions)	14 - 42%	24.2%
J-3 (3 Missions)	16 - 23%	19%
Periods	14	(Jan 1967 through July 1968)
Periodic Status	52 - 85%	66%
Days per Period	45 - 74 Days	60.5 Days
Missions per Period	4 - 5	4.5

[redacted]

Figure 8

CORONA MISSION PERFORMANCE

ANNUAL SEARCH

PERCENT CONTRIBUTION BY MISSION

Mission	1966 1029	1030	(1) 1031	* 1033	** 1034	1036	1035	1037	1038	1039	1040	1967 1041	1042	1043	1101	1044	1102
Gross Pct.	11	59	11	-	8	4	4	2	6	13	36	13	6	16	11	10	4
Days on Orbit	10	11	8	11	10	12	10	12	13	11	9	15	15	15	13	9	15

Period Ending (Month)		(Mission)																Period Status	Totals Days
Jan	67	1038	11	56	1	-	4	1	3	1	2							80	97
Feb	67	-																	
Mar	67	1039		59	5	-	6	1	3	2	3	4						83	98
Apr	67	1040			11	-	7	3	4	2	2	7	23					59	96
May	67	1041					2	4	4	1	3	11	25	12				62	92
June	67	1042					2	4	1	2	4	13	32	8	3			67	107
July	67	-																	
Aug	67	1043						1	4	2	3	11	29	9	3	1		64	112
Sept	67	1101							1	2	4	12	21	6	3	1	5	64	113
Oct	67	1101								2	4	12	30	6	3	1	5	63	103
Nov	67	1044								2	6	13	34	7	3	1	6	4	76	112
Dec	67	1102									2	13	35	9	3	1	6	4	3	76	115

(1) Bucket 2 mono only
* GMAIC Mission
** MC&G Mission

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Figure 2

CORONA MISSION PERFORMANCE

ANNUAL SEARCH

PERCENT CONTRIBUTION BY MISSION

	1967								1968		
	1040	1041	1042	1043	1101	1044	1102	1045	1046	1103	1047
Gross Pct.	36	13	6	16	11	10	4	13	25	13	16
Days on Orbit	9	15	15	15	13	9	15	14	15	14	16

12 Month Period Ending (Month)	(Mission)											Period Status	Totals Days
Jan 68	-												
Feb 68	1045	25	13	5	4	7	6	3	6			68	105
Mar 68	1046	34	8	4	3	6	5	2	8	13		82	120
Apr 68	-												
May 68	1103			6	6	10	7	3	10	17	8	67	110
June 68	-												
July 68	1047				6	10	9	3	10	19	8	3	68	111
Aug 68													
Sept 68													
Oct 68													
Nov 68													
Dec 68													

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Figure 10

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ANNUAL REQUIREMENT AREA

Item	Range	Average
Missions	21	(1029 through 1047)
Lifetime	8 - 16 Days	11.8 Days
J-1 (18 Missions)	8 - 16 Days	11.4 Days
J-3 (3 Missions)	13 - 15 Days	14.0 Days
Mission Performance	2 - 59%	13.4%
J-1 (18 Missions)	2 - 59%	14.1%
J-3 (3 Missions)	4 - 13%	9.3%
Periods	14	(Jan 1967 through July 1968)
Periodic Status	59 - 83%	69.9%
Days per Period	92 - 120 Days	106.5 Days
Missions per Period	8 - 9	8.4