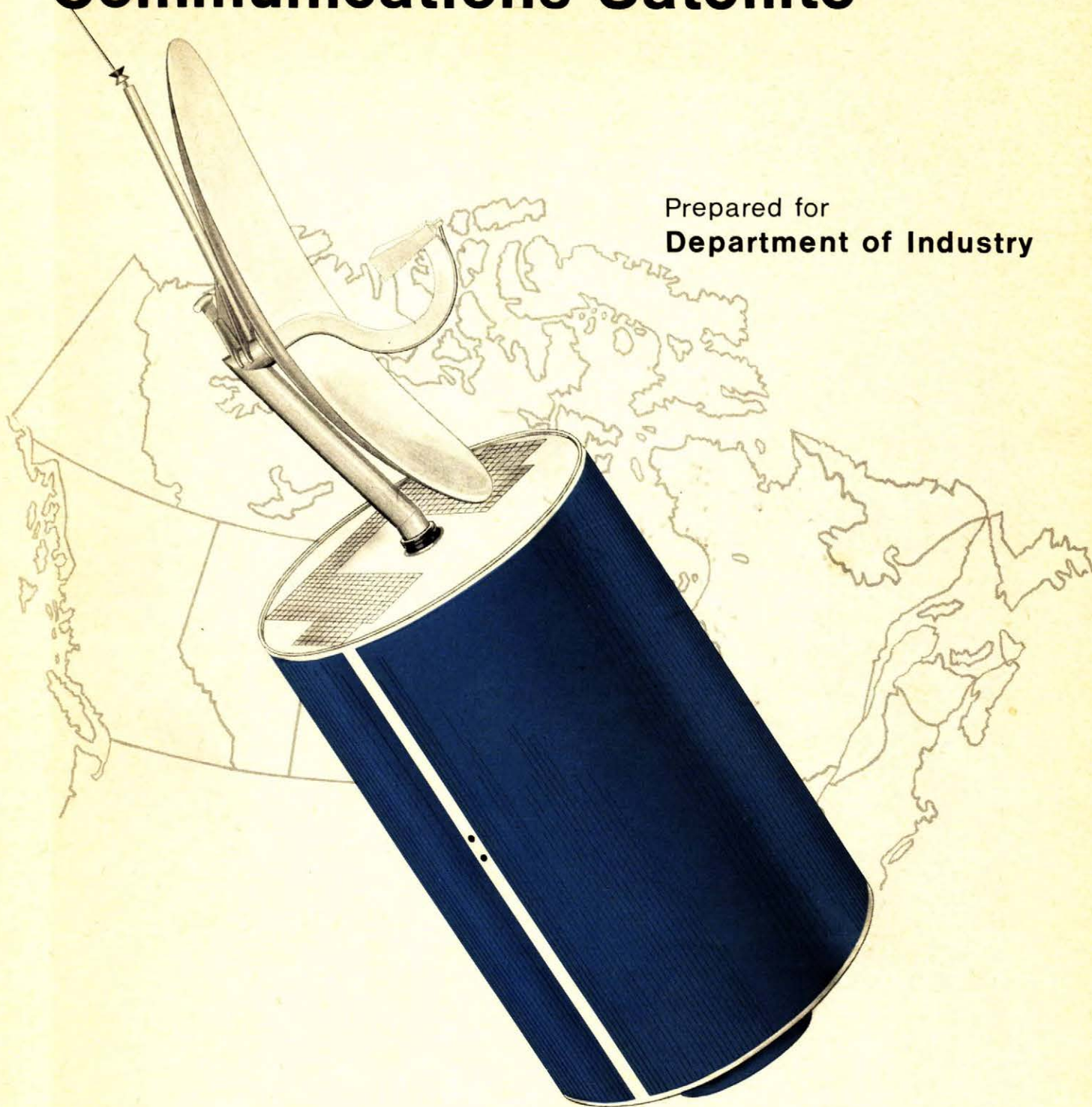


TL
796.5
.C2R2
v.5

Study Program for **Canadian Domestic Communications Satellite**

Prepared for
Department of Industry



Final Report
Volume Five - Program Costs

RCA Space
Systems



STUDY PROGRAM
for the
DESIGN, DEVELOPMENT AND SUPPLY
of a
DOMESTIC SATELLITE COMMUNICATIONS SYSTEM

FINAL REPORT
VOLUME 5, PROGRAM COSTS

Prepared for
DEPARTMENT OF INDUSTRY
by
RCA LIMITED, Space Systems
1001 Lenoir Street, Montreal

PREFACE

This report is submitted by RCA Limited to the Department of Industry in compliance with Section 4.2 of the Statement of Work forming part of D.O.I. Contract, File No. IRA. 9122-03-4.

The report is in six volumes, namely:

Volume 1	Design Considerations
Volume 2(a)	Spacecraft Design - Electrical
Volume 2(b)	Spacecraft Design - Mechanical
Volume 3	Technical Appendices
Volume 4	Program Plan
Volume 5	Program Costs

The information contained in the report is supplied to Her Majesty for use solely in connection with the design, development, manufacture, operation, repair, maintenance and testing of a Canadian Domestic Satellite Communication System.

VOLUME 5 - PROGRAM COSTS

1.0 SCOPE

This volume supplies cost estimates for the implementation of the space segment of the Canadian Domestic Satellite Communication System as required under Section 5.0 of the Statement of Work forming part of D.O.I. Contract, File No. IRA. 9122-03-4.

It also provides some explanation of the estimating methods employed, the basic assumptions made, and any information considered necessary for the complete understanding of the cost estimates.

It should be stated that the estimated cost supplied in this volume does not constitute a firm cost proposal. It is based on the best information available at this time and is derived by standard Company estimating techniques and procedures. It is a responsible budgetary cost estimate, developed in considerable detail, but it should be recognized that any subsequent firm quotation would take into account the form of contract proposed and other factors not determined at this time.

In our judgement, however, the cost estimates supplied herein are realistic in the sense required by the Statement of Work and can be used with confidence in the long term planning of the Canadian Domestic Communication Satellite System.

2.0 COST ANALYSIS PROGRAM

2.1 Estimating Method

The techniques used to develop the cost estimates supplied in this volume are those used by RCA Limited for all Space Systems projects. The task breakdown matrix described in Volume 4, Section 1 is also used to accumulate project costs. The basic formation of this matrix is illustrated in Figure 1 and a sample page is supplied as Figure 2. For every marked crosspoint a separate estimate is developed containing labor and material costs together with overhead, burden, G & A expenses and travel and living expense where applicable. In order to ensure precision these estimates are made down to the unit level, i.e. one level below that required for this report. The individual estimates are provided by the engineer or administrator who will be responsible for the work or who has previous experience in the activity involved, and the whole cost matrix forms the basis of a cost control system when the program is implemented.

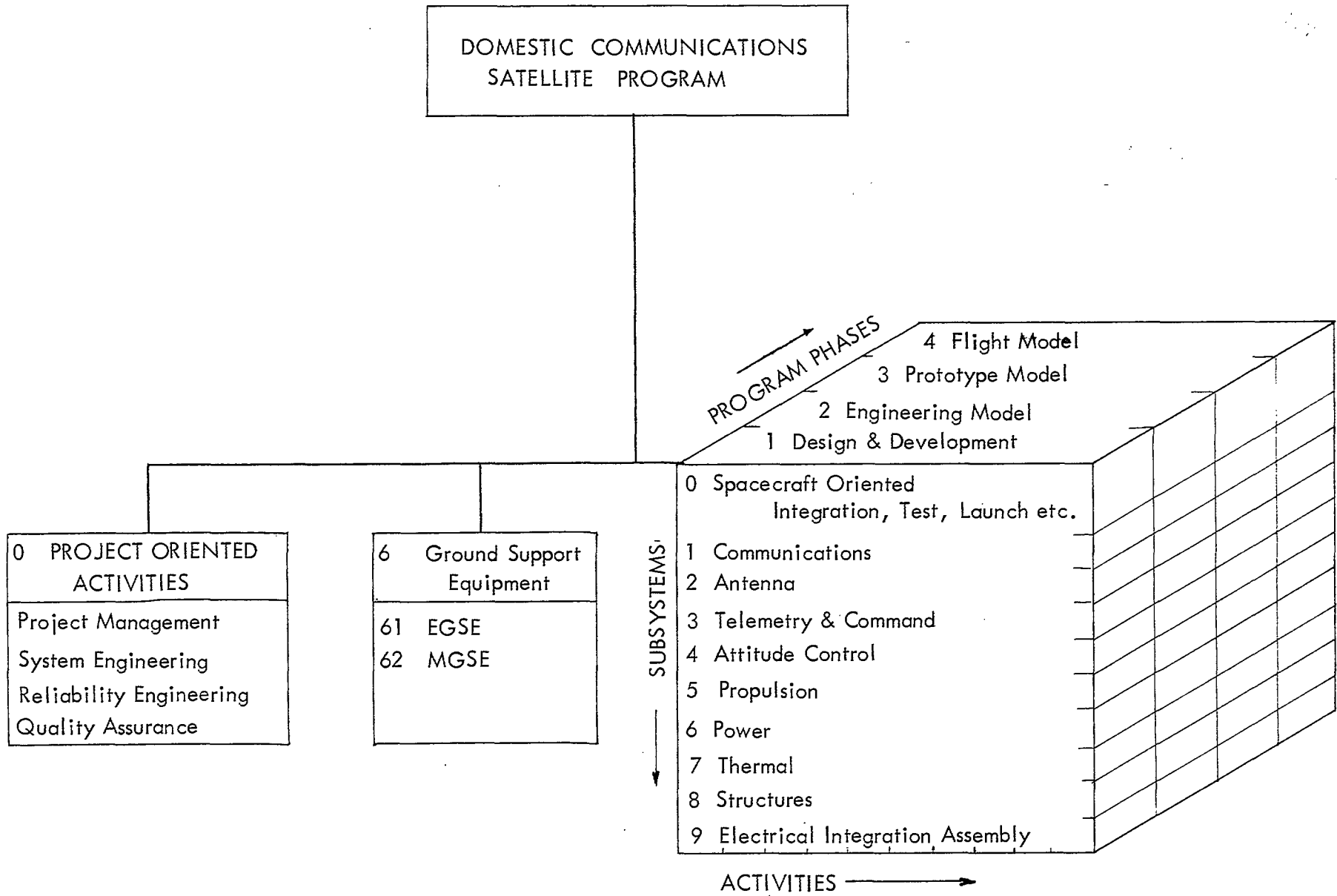


Figure 1
 Pictorial Representation of Matrix developed
 for Program and Cost Analysis

TASK BREAKDOWN MATRIX		PROGRAM					ENGINEERING						MFR.		INTEGRATION			LAUNCH							
		Project Management	System Engineering	Reliability Engineering	Q.A. Engineering	Q.C. Support	Subcontract Material	Design and Development	Test Design	Unit Testing	Factory Follow-up	Subcontract Follow-up	Fabrication	Assembly	Subsystem Integration & Test	Spacecraft Integration & Test	Spacecraft Qualification/Acceptance	Range/Launch Operations	Post Launch Operations						
Project :	CDCS 2220/1																								
Date :	October 21, 1968																								
Revision :	3 Page 7 of 23																								
ENGINEERING MODEL		01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
20.00	Engineering Model					•															•				
21.00	Communications Subsystem		•	•																•					
21.01	Command Suppress Filter							•		•															
21.02	Comb Filter							•		•															
21.03	Coax Switch Spdt					•						•													
21.04	6 GHZ TDA					•				•		•													
21.05	Mixer							•		•															
21.06	Local Oscillator							•		•															
21.07	4 GHZ TDA					•				•		•													
21.08	Driver TWT					•				•		•													
21.09	I/P Multiplexer/Equalizer							•		•															
21.10	PIN Diode Attenuator							•		•															
21.11	Output TWT					•				•		•													
21.12	Isolator 4 GHZ					•						•													

Figure 2
Sample Page of Task Breakdown Matrix

2.2 Cost Estimate Structure

For the purposes of this presentation, the estimated program costs are supplied under the following main program phases:

Code 0	Program Management
1	Development Model Phase
2	Engineering Model Phase
3	Prototype Model Phase
4	Flight Model Phase
6	Ground Support Equipment
7	Transportation

Further, the costs for each model phase have been broken down into the following subsystems:

Code 00	Integration and test
01	Communications Subsystem
02	Antenna Subsystem
03	Telemetry/Command Subsystem
04	Attitude Control Subsystem
05	Propulsion Subsystem
06	Power Subsystem
07	Thermal Subsystem
08	Structures Subsystem
09	Electrical Integration Assembly Subsystem

In addition, Ground Support Equipment costs are broken down between electrical and mechanical GSE.

The cost breakdown supplied is, we believe, in accordance with the directions given by the D.O.I. Technical Office during the progress of the study and is sufficiently detailed for the purpose for which it is supplied.

3.0 ASSUMPTION AND CONDITIONS

The estimates supplied in this volume are based on the following assumptions and conditions.

- a) The entire scope of the work is as defined in Volumes 1-4 of this report and will be implemented in the manner described.
- b) The work will be performed within the time schedule proposed in Figure 3, with an approximate starting date in mid 1969.

- c) The costs supplied have been compiled in accordance with Department of Defence Production Costing Memorandum, DDP-31.
- d) The labor rates used are the 1969 rates provisionally approved by Audit Services Branch, for the ISIS "B" program, plus a reasonable allowance for escalation over the course of the program.
- e) No element of profit has been included. It is expected that profit and incentives would be negotiated within the context of the procurement procedures established by the Corporation formed to own and operate the proposed system and that no useful purpose would be served by our making any assumptions as to profit at this time.
- f) Customs Duty is included only on the Ground Support Equipment. For the flight models and all development and hardware costs associated with and leading to the flight models, we have assumed that Sales Tax and Customs Duty would not be applicable.
- g) Reasonable contingencies in accordance with standard Company estimating practices have been included.
- h) All costs are quoted in Canadian funds; conversion of quotations by proposed USA suppliers has been made at the current rate of exchange.

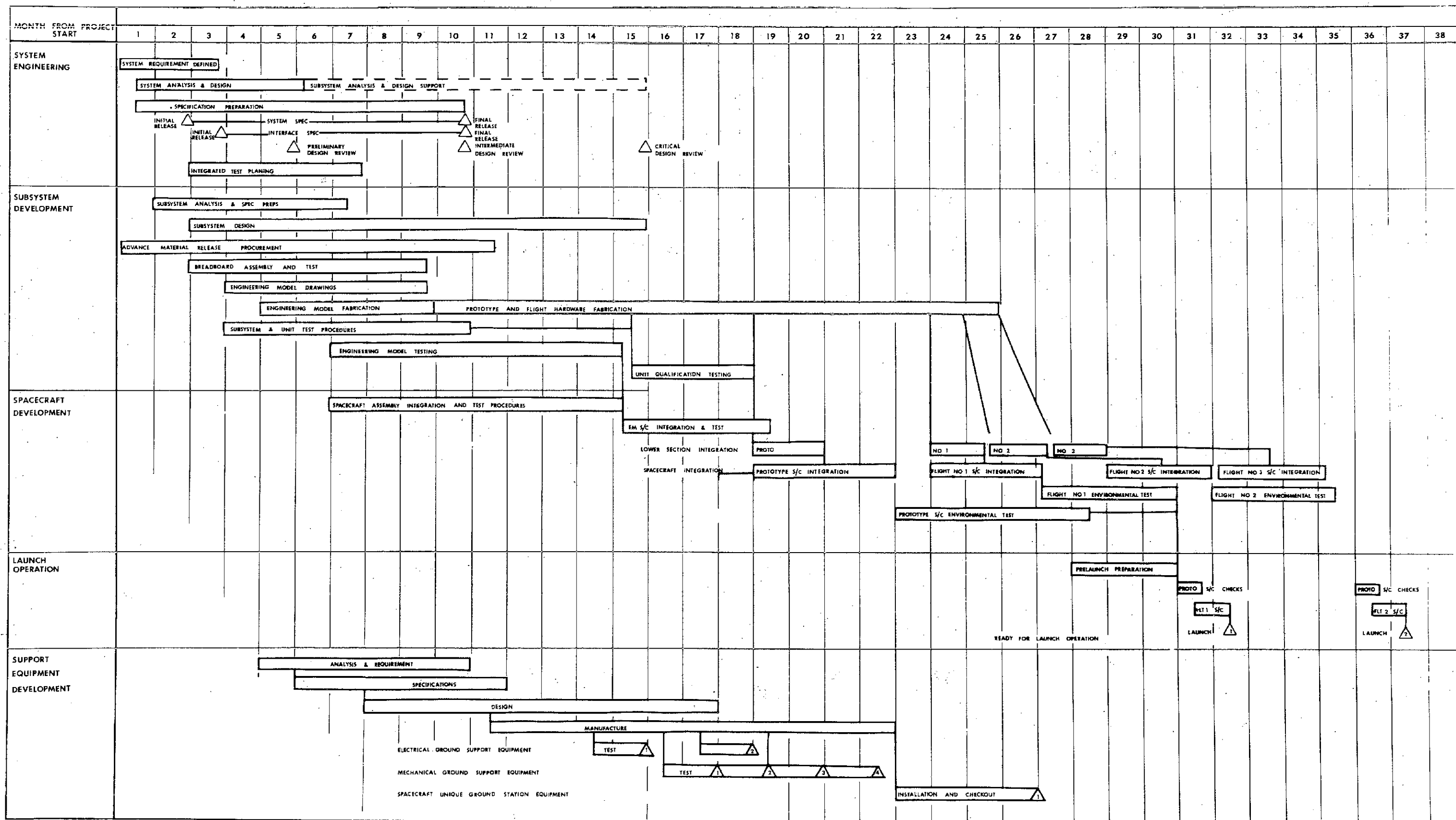


Figure 3

4.0

PROGRAM COST SUMMARY

On the basis of the conditions and assumptions noted above our estimated costs for the complete program are as follows:

Program Management 6,094,089

Development Model Phase

10	Integration & Test	455,363	
11	Communications Subsystem	2,119,586	
12	Antenna Subsystem	80,269	
13	Telemetry/Command Subsystem	385,198	
14	Attitude Control Subsystem	2,430,264	
15	Propulsion Subsystem	1,534,129	
16	Power Subsystem	1,606,743	
17	Thermal Subsystem	583,860	
18	Structures Subsystem	667,532	
19	Electrical Integration Assembly	630,445	
	Subsystem		10,493,389

Engineering Model Phase

20	Integration & Test	174,274	
21	Communications Subsystem	704,236	
22	Antenna Subsystem	56,729	
23	Telemetry/Command Subsystem	340,362	
24	Attitude Control Subsystem	538,986	
25	Propulsion Subsystem	331,951	
26	Power Subsystem	398,585	
27	Thermal Subsystem	-0-	
28	Structures Subsystem	60,129	
29	Electrical Integration Assembly	229,983	
	Subsystem		2,835,235

Prototype Model Phase

30	Integration & Test	1,193,032
31	Communications Subsystem	1,244,381
32	Antenna Subsystem	83,748
33	Telemetry/Command Subsystem	298,423
34	Attitude Control Subsystem	683,383
35	Propulsion Subsystem	452,425
36	Power Subsystem	691,391
37	Thermal Subsystem	109,045
38	Structures Subsystem	495,773
39	Electrical Integration Assembly	297,223
	Subsystem	

5,548,824

Flight Model Phase

40	Integration & Test	3,369,413
41	Communications Subsystem	2,231,195
42	Antenna Subsystem	153,059
43	Telemetry/Command Subsystem	755,848
44	Attitude Control Subsystem	1,910,085
45	Propulsion Subsystem	1,152,972
46	Power Subsystem	2,016,795
47	Thermal Subsystem	269,464
48	Structures Subsystem	1,340,853
49	Electrical Integration Assembly	796,051
	Subsystem	

13,995,735

Ground Support Equipment

61	Electrical G.S.E.	1,878,382
62	Mechanical G.S.E.	637,409

2,515,791

Transportation Costs

300,000

Total Estimated Cost, Complete Program	\$	41,783,063
---	----	------------

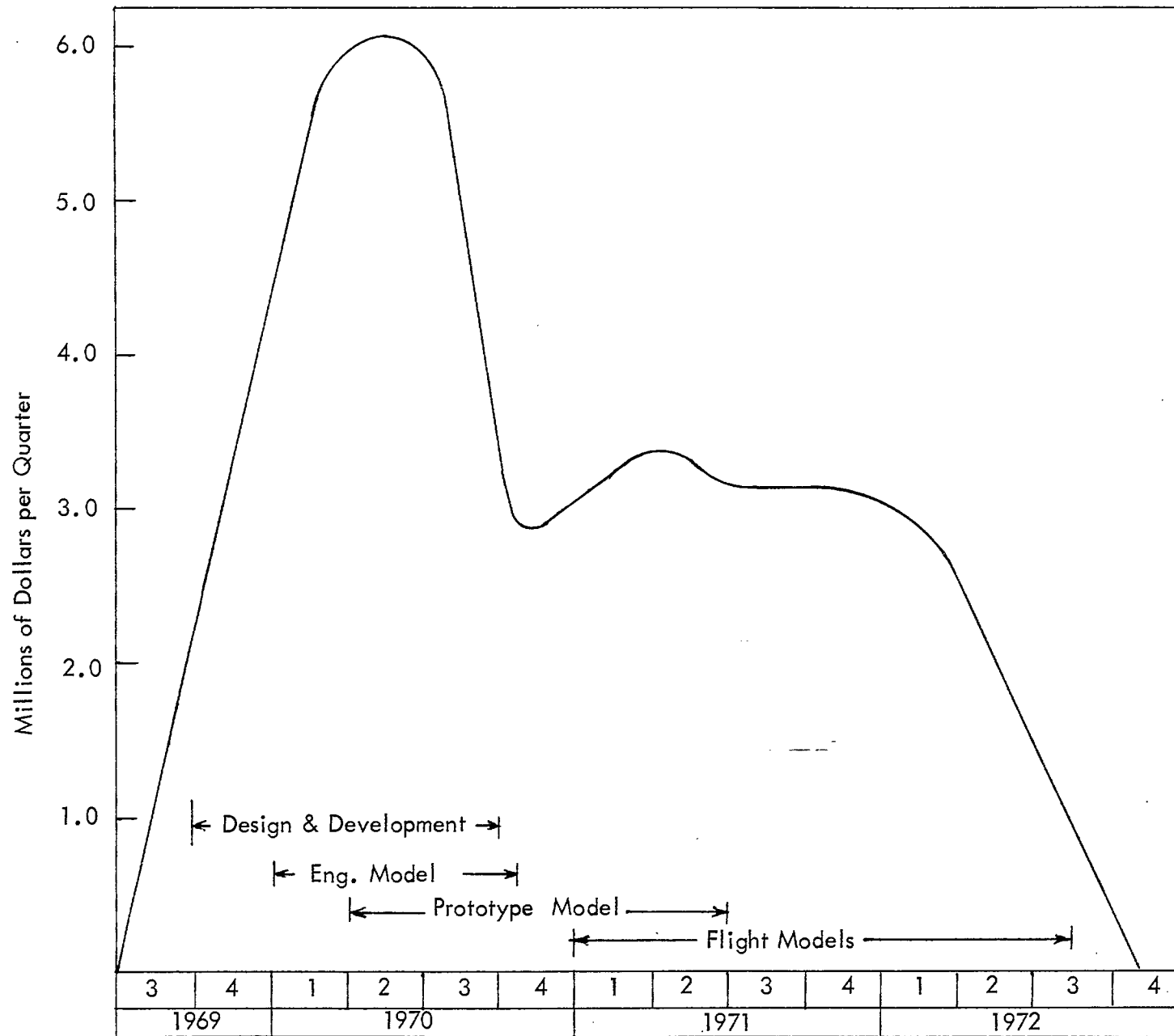


Figure 4
Estimated Rate of Expenditure

5.0 FUNDING REQUIREMENTS

Assuming a starting date of July 1st 1969 and a thirty eight month schedule as outlined in Figure 3 it is estimated that the approximate yearly funding requirements (exclusive of profit) for the program described in this report would be as follows:

Calendar Year 1969	\$ 4,070,000
Calendar Year 1970	\$ 18,470,000
Calendar Year 1971	\$ 12,660,000
Calendar Year 1972	\$ 6,480,000

A graphical presentation of the anticipated rate of expenditure is supplied in Figure 4.

6.0 CONCLUSION

It is our belief that this volume includes all the costing information required by the Statement of Work. More detailed discussion of the contents would be welcomed by RCA Limited, as would any opportunity to expand on the costing methods and philosophies applied.

