

**Department of Communications**

# MSAT MANUFACTURING IMPACT STUDY

---

## **Volume I: Executive Summary**

**MARCH 1985**

QUEEN  
P  
91  
.C655  
B548  
1985  
v.1

A report from  
The Marketing and Economics Group

**Woods Gordon**  
Management Consultants



Government of Canada  
Department of Communications

Gouvernement du Canada  
Ministère des Communications

6977-6-9

DOC CONTRACTOR REPORT

DOC-CR-85-020

DEPARTMENT OF COMMUNICATIONS - OTTAWA - CANADA

TECHNOLOGY AND INDUSTRY SECTOR

TITLE: Study to Determine the Impact of Mobile Satellite (MSAT)  
Services in Canada on the Canadian Manufacturing Industry

AUTHOR(S): R. Blanchard  
H. Berndt  
C.M. Deane

ISSUED BY CONTRACTOR AS REPORT NO: N/A

CONTRACTOR: Woods Gordon Management Consultants

DEPARTMENT OF SUPPLY AND SERVICES CONTRACT NO: OSM83-00001

DOC REQUISITION NO: 36100-2-4430

DOC SCIENTIFIC AUTHORITY: John H.C. Braden

CLASSIFICATION: Unclassified

This report presents the views of the author(s).  
Publication of this report does not constitute DOC  
approval of the report's findings or conclusions.  
This report is available outside the Department by  
special arrangements.

DATE: April 1985

Canada

COMMUNICATIONS CANADA  
CRC

DEC 20 1985

LIBRARY - BIBLIOTHÈQUE

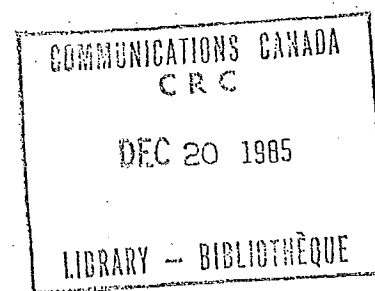
**Department of Communications**

# **MSAT MANUFACTURING IMPACT STUDY**

---

## **Volume I: Executive Summary**

**MARCH 1985**



A report from  
The Marketing and Economics Group

**Woods Gordon**  
Management Consultants



A MEMBER OF ARTHUR YOUNG INTERNATIONAL

## Woods Gordon

Management Consultants  
P.O. Box 251  
Royal Trust Tower  
Toronto-Dominion Centre  
Toronto, Canada M5K 1J7  
Telephone: (416) 864-1212  
Telex: 06-23191

March 29, 1985

Mr. J.H.C. Braden  
Manager, MSAT Economic Studies  
Department of Communications  
300 Slater Street  
Ottawa, Ontario  
K1A 0C8

Dear Mr. Braden:

We are pleased to submit our report for the MSAT Manufacturing Impact Study.

Due to the range and complexity of the analysis for this assignment, our report is in three volumes:

- Volume I is the Executive Summary.
- Volume II is the Analysis of Industry Capabilities, Export Market Prospects and Manufacturing Impacts.
- Volume III is the Impact Data.

Our analysis suggests that MSAT could generate significant manufacturing and economic impacts in Canada. However, certain federal measures will help to maximize these benefits. Among the most important of these are:

- Develop a joint Canada/U.S. system for start-up by 1989 or 1990.
- Launch the Canadian spacecraft first in each generation.



Woods Gordon

- 2 -

- Prime contract the Canadian spacecraft domestically.
- Provide support for industry's development of new MSAT product lines.
- Aggressively pursue export markets with manufacturers.

It was a pleasure to undertake this assignment for the Department of Communications. Please call if you need further assistance.

Yours truly,

*Woods Gordon*

c.c.: R.F. Blanchard  
C.M. Deane  
H.A. Berndt

I. EXECUTIVE SUMMARY

TABLE OF CONTENTS

	<u>Page</u>
LETTER OF TRANSMITTAL	
1. INTRODUCTION	1
2. INDUSTRY CAPABILITIES	1
3. EXPORT MARKET PROSPECTS	3
4. ESTIMATED IMPACTS	4
5. CONCLUSIONS	10



Woods Gordon

## MSAT MANUFACTURING IMPACT STUDY

### I. EXECUTIVE SUMMARY

#### 1. INTRODUCTION

This study's primary objective was to estimate the industrial and related economic impacts that could be generated by manufacturing MSAT system equipment in the 1985-2002 period. There were three other objectives within this overall goal:

- Assess Canadian industry's capabilities to develop and produce MSAT system equipment.
- Assess the potential export markets for Canadian-made MSAT system equipment.
- Advise the Department of Communications (DOC) on the key problems that might interfere with Canada's ability to maximize the potential manufacturing and economic benefits from MSAT.

The extensive analysis we assembled to satisfy these objectives is presented in Volume II of this report. Volume III contains the detailed impact estimates. In this volume, we endeavour to summarize the most important conclusions reached in this study.

#### 2. INDUSTRY CAPABILITIES

By means of a survey conducted in 1983, we determined that 31 Canadian manufacturers are interested in developing and producing MSAT system equipment.

This group contains most of the leading firms in the domestic space and mobile communications manufacturing industry. Many of these companies already have products similar to those being considered for MSAT.

TABLE 1  
CANADIAN FIRMS INTERESTED IN MANUFACTURING MSAT PRODUCTS  
SUMMARY STATISTICS\*

	<u>1981</u>	<u>1982</u>	<u>1983</u>
<u>Sales Revenues:</u>	(Millions)		
All Sales	<u>\$634.4</u>	<u>\$798.5</u>	<u>\$873.8</u>
Space/MSAT-Related Sales:			
Domestic	\$ 56.3	\$ 75.6	\$ 81.9
Export	<u>55.1</u>	<u>105.0</u>	<u>168.7</u>
TOTAL	<u>\$111.4</u>	<u>\$180.6</u>	<u>\$250.6</u>
<u>Employment:</u>	(Actual Values)		
All Operations: Engineering	n.a.**	2,295	2,073
Production	n.a.	7,017	6,751
Other	n.a.	<u>3,125</u>	<u>3,011</u>
TOTAL	n.a.	<u>12,437</u>	<u>11,835</u>
Space/MSAT-Related: Engineering	n.a.	654	812
Production	n.a.	705	1,214
Other	n.a.	<u>576</u>	<u>693</u>
TOTAL	n.a.	<u>1,935</u>	<u>2,719</u>
<u>R&amp;D Expenditures:</u>	(Millions)		
All Operations	n.a.	<u>\$71.0</u>	<u>\$103.1</u>
(Share of Total Revenues)		(9%)	(12%)
Space/MSAT-Related	n.a.	<u>\$ 9.3</u>	<u>25.8</u>
(Share of Space/MSAT-Related Revenues)		(5%)	(10%)

\* Includes only manufacturing firms that responded to the survey. Also, among the interested firms, several are not represented due to inadequate responses.

\*\* Employment and R&D expenditures in 1981 were not covered in the surveys for this study.

SOURCE: Surveys by the INTERDEPARTMENTAL COMMITTEE ON SPACE and WOODS GORDON in 1983.



The table opposite summarizes the key data we collected from these interested companies in 1983.

The sales revenue data show that these companies are already quite active in producing equipment similar to that which will be required for MSAT.

The sales data also reveal that the interested firms obtain a substantial portion of their revenues from business activities beyond those that might be extended to include MSAT. This suggests that these firms have the depth needed to get into new MSAT product areas.

Table 1 reveals that the group of interested manufacturers has been reasonably successful in exporting — primarily to the United States — their existing product lines that are similar to those required for MSAT. This experience will be valuable when efforts are made to penetrate the potential MSAT export markets.

Finally, the summary data in Table 1 indicate that the interested firms already allocate a significant portion of their revenues to research and development. This suggests that they have the facilities and technical capabilities to perform some of the development of new MSAT system equipment.

Based on these findings, we concluded that the group of manufacturers interested in MSAT would have the fundamental capabilities to develop and manufacture the full range of MSAT system elements, including:

- The spacecraft.
- The central control station.



- The user/operator equipment (terminals, base stations and gateways).

### 3. EXPORT MARKET PROSPECTS

We undertook a detailed analysis of the potential for Canadian MSAT equipment manufacturers to export their new product lines. This research included:

- An extensive literature review.
- Consultations with representatives of DOC and Canadian industry.
- Field trips by Woods Gordon's study team members to Australia, several European countries and the United States.
- Special requests for information by Spar Aerospace Limited from senior officials in Brazil and Nigeria.

Our principal conclusion from this analysis was that the United States would likely be the strongest export market for Canadian MSAT equipment manufacturers over the next 10-15 years. Other markets could emerge — e.g., the ASEAN<sup>1</sup>, Australia, Brazil, Mexico — toward the end of the '90s. But these prospects seem quite remote at this time.

There are major reasons for this weakness in worldwide demands for MSAT systems:

- Terrestrial technologies are cutting into the potential mobile satcom markets in many countries — e.g., wide-area cellular mobile-telephone systems.

---

<sup>1</sup> The Association of South East Asian Nations.



- Satellite fixed and mobile communications systems are also serving some of the potential MSAT markets -- e.g., INMARSAT, INTELSAT and dedicated national satellite communications systems.
- Mobile satcom is perceived to be an expensive service, with the capacity to serve a limited population segment. It is thus placed well down on priority lists, behind expansion of fixed telephone and television/radio broadcasting systems.
- Decision-makers in many countries simply do not know anything about systems like MSAT, and would need to see a working model -- preferably in a high-profile country like the U.S. or Canada -- before they would consider acquiring such a system.

#### 4. ESTIMATED IMPACTS

We developed a computerized model that simulates the effects producing MSAT system equipment could have on Canadian manufacturers, and through them on the Canadian economy.

We developed four scenarios to test the plausible range of these manufacturing and economic impacts. Each of these scenarios entails assumptions about one or all of the following factors:

- Total number of units of mobile satcom equipment -- spacecraft, user/operator equipment and central control station -- purchased in each market.
- Penetration of these markets by Canadian manufacturers (i.e., proportion of total purchases made by Canadian manufacturers).
- Unit prices of Canadian-made mobile satcom equipment.
- Breakdown of costs of Canadian-made mobile satcom equipment into domestic materials, foreign materials, labour, taxes and other costs.



Our assumptions concerning these factors were based on a variety of sources:

- The total number of purchases of each MSAT system element in the Canadian market was developed by DOC, based on Woods Gordon's Phase B MSAT Market Study and Telesat Canada's independent market assessment.
- The foreign markets -- the U.S. and the rest-of-world -- were derived from our evaluation of MSAT export market prospects as part of this study.
- The Canadian penetration rate assumptions were based on our consultations with representatives of Canadian industry, the detailed manufacturing capabilities survey conducted by the Interdepartmental Committee on Space and Woods Gordon, and our investigation of export market prospects for MSAT.
- The unit prices for all of the MSAT system elements were estimated by DOC in consultation with representatives of industry (manufacturers and technical consultants), the Communications Research Centre and Telesat Canada.
- The cost breakdowns for the various MSAT system elements were developed jointly by Woods Gordon and DOC using data supplied by individual manufacturers interested in producing MSAT spacecraft, terminals, base stations, gateways and central control stations.

The details of these scenarios are presented in Volume II and Volume III, but the essentials are as follows.

The Base Case Scenario consists of two mobile satellite communications systems. One of these is a joint Canada/U.S. system. The other is developed by another country or group of countries (e.g., the ASEAN, Australia, Brazil or Mexico).

The first generation of the joint Canada/U.S. system would begin with the launch of a small Canadian satellite in 1989. An

**Table 2**  
**Base Case Market Summary**  
**(1989-2002)**

System Element	Canadian Market			U.S. Market			Rest-of-World Market		
	Total Sales (#)	Canadian Penetration Rate (%)	Total Canadian Sales (#)	Total Sales (#)	Canadian Penetration Rate (%)	Total Canadian Sales (#)	Total Sales (#)	Canadian Penetration Rate (%)	Total Canadian Sales (#)
Spacecraft	2	100	2	2	100	2	2	100	2
Terminals: MRS	88,405	80	70,724	88,405	20	17,673	7,155	80	5,724
MTS	31,450	80	25,160	31,450	20	6,287	2,470	80	1,975
DACS Alarm	14,365	80	11,492	14,365	20	2,872	1,325	80	1,060
Polling	31,135	80	24,909	31,135	20	6,228	3,395	80	2,716
Base Stn. UHF Private	1,870	80	1,494	1,870	20	373	130	80	104
SHF 2 ch.	25	80	19	25	20	5	4	80	3
3 ch.	23	80	18	23	20	4	4	80	3
4 ch.	13	80	10	13	20	2	3	80	2
5 ch.	19	80	15	19	20	3	6	80	5
7 ch.	44	80	35	44	20	2	3	80	2
10 ch.	61	80	49	61	20	12	8	80	6
Gateways: 5 ch.	9	80	7	9	20	2	6	80	5
10 ch.	38	80	30	38	20	7	6	80	5
Central Control Station	1	100	1	1	DAMA	DAMA	1	100	1

**NOTE:** Total Canadian Sales may not precisely equal Total Sales multiplied by the Canadian Penetration Rate. This is because of rounding at the annual level.



Woods Gordon

- 6 -

identical U.S. spacecraft would be launched one year later. Each satellite would back-up the other in case of a system failure. The second generation system would consist of a larger Canadian satellite launched in 1996 and an identical U.S. spacecraft launched the following year.

The mobile satcom system developed by another country or group of countries is assumed to start in 2001 with the launch of the first of two satellites. Each of these would be equivalent to the first generation Canada/U.S. spacecraft.

The total purchases assumed for the MSAT system elements in the Canadian market over 1989-2002 are shown in Table 2. These reflect a careful assessment of the demand for MSAT equipment by Woods Gordon (Phase B MSAT Market Study), Telesat Canada and DOC.

Such detailed projections are not available for any of the potential export markets. Thus, we made the simplifying assumptions that:

- The same number of purchases would be made in the U.S. market as in Canada over 1989-2002 (see Table 2).
- The same number of purchases would be made in the rest-of-world market during 2001-2002 as in Canada during 1989-90 (see Table 2).

Based on our analysis of the interest and capabilities of Canadian manufacturers, we concluded that domestic firms could make a significant proportion of the MSAT equipment sold in this country.



We assumed that their abilities would be aided by development assistance from the federal government. These incentives include \$15 million to develop the Canadian spacecraft, \$9 million to develop the user/operator equipment, and \$6 million to develop the DAMA system for the central control station.

For the Canadian market in the Base Case Scenario, therefore, we assumed that domestic manufacturers would prime contract the satellites, build the central control station and make 80 percent of the terminals, base stations, and gateways (see Table 2).

For the U.S. market, we assumed that a Canadian firm would prime contract both satellites. This reflects two of the Canadian market assumptions:

- The Canadian MSAT would be launched ahead of the U.S. spacecraft, so the contract would be let sooner.
- The Canadian MSAT would be prime contracted by a domestic firm, so that it could bid competitively in the U.S. owing to the economies of making two identical spacecraft.

We assumed that Canadian firms would be able to capture a 20-percent share of the U.S. market for terminals, base stations and gateways. Also, we assumed that the DAMA computer software developed for the Canadian central control station would be exported to the U.S. (see Table 2).

Our belief is that the mobile satcom system sold outside of Canada or the U.S. would be essentially a turn-key system. The penetration rates for the rest-of-world market are thus assumed to be the same as for the Canadian market (see Table 2).

TABLE 3

## COST COMPOSITION AND UNIT PRICE ASSUMPTIONS

System Element	Cost Composition*				Total	Unit Prices (1984 Canadian Dollars)
	Materials		Labour	Other		
	Domestic	Foreign				
			(Percentages)			
Spacecraft: First Generation	2	50	23	25	100	\$105 million**
Second Generation	2	50	23	25	100	\$126 million
User/Operator Equipment:***						
Terminals	9	12	42	36	100	\$1,825 - \$3,290
Base Stations: UHF	11	15	42	32	100	\$2,140
SHF	35	4	40	21	100	\$84,000 - \$122,000
SHF Gateways	30	5	43	22	100	\$128,500 - \$140,000
Central Central Station:						
DAMA	1	11	64	24	100	-
Other	21	5	49	25	100	-
Total	-	-	-	-	-	\$27 million**

\* Percentages given for terminals, base stations and gateways are averages of all categories.

\*\* Includes federal government support -- \$15 million for the spacecraft and \$6 million for the central central station -- which would only apply in the first-generation Canadian system.

\*\*\* Prices shown for user/operator equipment are weighted averages over 1989-2002. In the impact calculations, these prices decline gradually over the period due to the learning curve effect.



The total sales by Canadian firms in these three markets — obtained by multiplying total purchases by penetration rates — are summarized in Table 2.

The unit price and cost breakdown assumptions used in the Base Case were developed by preparing rough specifications of the MSAT system elements. These were then compared to equivalent existing space and terrestrial communications products to determine the approximate costs of domestic materials, foreign materials, labour, taxes and other costs (see Table 3). The unit price assumptions shown in Table 3 were obtained by applying standard industry mark-ups to these production cost estimates.

It must be noted that these prices are preliminary estimates, used here only for illustrative purposes. Changes in technology and costs may occur before actual prices can be determined. As a result, the values shown in Table 3 should not be taken as final.

The other three scenarios were derived by altering some of the key assumptions used in the Base Case. These differences are summarized as follows:

Optimistic Scenario: Adds a further rest-of-world mobile satcom system (start-up in 1997) to the Base Case. Canadian firms prime contract all eight spacecraft, build the Canadian and rest-of-world central control stations, and supply the U.S. DAMA. They also succeed in winning 90-percent shares of the domestic and ROW user/operator equipment markets, and a 40-percent share of the U.S. market. Canadian content is also higher than in the Base Case.

TABLE 4

ESTIMATED MANUFACTURING IMPACTS DUE TO MSAT\*  
(1985-2002)

<u>Scenario</u>	<u>MSAT INDUSTRY</u>			<u>TOTAL ECONOMY</u>	
	<u>Sales</u> <u>Revenues</u> (\$ millions)	<u>Operating</u> <u>Profits</u> (\$ millions)	<u>Net</u> <u>Exports</u> (\$ millions)	<u>Employment</u> (person-years)	<u>GNP</u> (\$ millions)
Base Case	\$1,126	\$183	\$199	33,009	\$1,494
Optimistic (Index to Base Case)	\$1,627 (145)	\$263 (144)	\$611 (307)	48,197 (146)	\$2,169 (145)
Moderate (Index to Base Case)	\$921 (82)	\$146 (80)	\$148 (74)	25,381 (77)	\$1,139 (76)
Pessimistic (Index to Base Case)	\$370 (33)	\$56 (30)	- -	11,727 (36)	\$440 (29)

\* Dollar values are millions of 1984 Canadian dollars.



Woods Gordon

- 9 -

Moderate Scenario: Same as the Base Case in all respects except Canadian user/operator equipment penetration rates reduced to 50 percent for the Canadian market and 10 percent for the U.S. and rest-of-world markets.

Pessimistic Scenario: Only a joint Canadian/U.S. mobile satcom system develops. All four spacecraft are prime contracted in the U.S.; Canadian firms are only sub-contractors. The Canadian central control station is built by domestic firms, and the U.S. DAMA is supplied by Canada. The Canadian market for user/operator equipment is significantly reduced from the Base Case. Canadian firms achieve the same user/operator equipment penetration rates as in the Moderate Case. Foreign content of Canadian-made system elements is increased from Base Case.

The estimated impacts obtained using these scenarios are summarized in Table 4, opposite.

Using the Base Case as the most realistic outcome, it is possible to conclude that MSAT would have a significant effect on Canadian manufacturers. By comparing the average annual impacts from MSAT to the data provided by firms interested in developing MSAT system equipment, it appears that MSAT would add:

- 25 percent to their existing space/MSAT-related sales revenues.
- 17 percent to their space/MSAT-related export sales revenues.
- 26 percent to their space/MSAT-related employment.

The relative effects on the space and earth segments separately would be similar orders of magnitude.



Table 4 clearly shows that these benefits would be substantially greater if the Optimistic Scenario materializes. This would be primarily due to the existence of a second rest-of-world market, higher penetration of all markets by Canadian manufacturers, and increased Canadian content of MSAT system equipment.

Conversely, Table 4 reveals that failure to win the prime contracts of the four Canadian/U.S. satellites, to penetrate the user/operator equipment markets significantly, and to foster the emergence of a rest-of-world market would drastically reduce the manufacturing and economic impacts from MSAT.

## 5. CONCLUSIONS

Our analysis of industry interests and capabilities, export market prospects, and manufacturing and economic impacts suggests that Canadian industry could derive significant benefits from MSAT.

Our analysis deals with the manufacturing impacts that can be traced directly to making MSAT system elements. However, Canada may derive important indirect benefits if domestic firms play a high profile role in developing and manufacturing MSAT. This is particularly so for the satellite, since space developments such as the Canadarm, BRAZILSAT and ANIK D give worldwide exposure for all Canadian manufacturing, and thus open up new channels to export markets.



Woods Gordon

- 11 -

For these benefits to materialize, the following critical steps would be necessary:

- Arrange to develop a joint Canada/U.S. mobile satcom system, in which Canadian manufacturers could be assured of a significant position.
- Move to launch the Canadian MSAT satellite first and support the procurement of this first Canadian MSAT spacecraft from a domestic prime contractor. These steps are critical for Canada to have a reasonable chance to prime contract the U.S. MSAT satellites, as well as any rest-of-world mobile satcom spacecraft.
- Specify MSAT equipment technologies that are within the grasp of Canadian manufacturers, rather than at the very leading edge. This will improve firms' willingness to participate, avoid delays, minimize quality control problems at start-up and maximize the potential for Canadians to penetrate available markets.
- Transfer technology from the federal government to selected firms in the private sector. This would encourage more enthusiastic participation by reducing development costs and minimizing domestic competition.
- Financially support new product development (e.g., grants, tax breaks, government purchases of end products).
- Provide some guaranteed purchases during the start-up of the Canadian MSAT system — e.g., the federal government could purchase or lease a substantial number of the first MSAT terminals for tests and demonstrations. This will help manufacturers earn the needed returns on their investments quickly.

The MSAT export prospects could be strengthened somewhat in several ways:

- Pursue the start of a Canadian system by 1990.
- Ensure compatibility with any U.S. mobile satcom system.



Woods Gordon

- 12 -

- Provide greater compatibility with other mobile satcom systems (especially INMARSAT).
- Undertake a joint federal government/industry program of demonstrations, trade missions, etc. to stimulate demand for MSAT.

Satisfying these conditions could reasonably produce the impacts indicated by the Base Case estimates, and might even yield the results suggested by the Optimistic Scenario.

Conversely, failure to establish a joint Canada/U.S. system, prime contract the satellite in Canada, aggressively market Canadian-made user/operator equipment, and foster a rest-of-world market could produce the impacts indicated by the Pessimistic Scenario.

Clearly, the federal government and DOC must continue to play a very active role if MSAT is to generate the manufacturing and economic benefits indicated in our report.

