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EVALUATION OF THE ANIK-B COMMUNICATIONS PROGRAM

Volume 1: End-State
Phase 2 Pilot Projects
Industrial Benefits

Submitted to the Department of Communications
by CPER Management Consulting Inc.

Ottawa
July, 1983

EVALUATION OF THE ANIK-B

COMMUNICATIONS PROGRAM
(Phase Two)

VOLUME 1

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PREFACE

This evaluation of Phase Two of the Anik-B Communications Program of the Department of Communications (DOC) was conducted for the DOC Assistant Deputy Minister-Space, through the Department of Supply and Services (DSS File No. 21ST.36001-2-3865).

The purpose of this evaluation project was to evaluate Phase Two of the Program, to prepare a final evaluation of the manufacturing and industry goals of the Program, and to determine the extent of achievement of the overall service development goal of the Program.

The evaluation consisted of three tasks:

- No. 1: an evaluation of the individual Phase Two pilot projects and aggregated activities;
- No. 2: an evaluation of the industrial benefits resulting from the Program;
- No. 3: a review of the effectiveness of three particular processes of the Program (the weaning of subsidized experimenters, involvement of the private sector and identification and resolution of policy issues).

The assessment of the extent of achievement of the overall service development goal, referred to as the "end-state" evaluation, draws heavily on the results of the first and second tasks and serves also as an executive summary for them.

The results of the evaluation are presented in three separate volumes:

- Volume 1: End-State evaluation and Tasks No. 1 and 2
- Volume 2: Task No. 3
- Volume 3: Annexes

EVALUATION OF PHASE TWO OF

THE ANIK-B COMMUNICATION PROGRAM

END-STATE EVALUATION AND EXECUTIVE SUMMARY

Submitted to:

Department of Communications
by CPER Management Consulting Inc.

Ottawa
August, 1983

EVALUATION OF PHASE TWO OF THE ANIK-B COMMUNICATIONS PROGRAM

End-State Evaluation and Executive Summary

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"END-STATE" EVALUATION AND EXECUTIVE SUMMARY

1.0 Introduction to the Phase Two Evaluation

1.1 Background

The Anik-B communications satellite, launched in 1978 by Telesat Canada, was a hybrid communication system in that it operated in both the 6/4 GHz and the 14/12 GHz frequencies. The 6/4 GHz capacity was used by Telesat to deliver its commercial services, while the 14/12 GHz capacity, installed at the instigation of the DOC, was an experimental service. The 14/12 GHz capacity was leased by DOC from Telesat for a period of 4 1/2 years, for the purpose of conducting experiments, pilot projects and demonstrations of the new service and its associated equipment.

The federal government's overall Anik-B program, as authorized by the Cabinet in 1975, had a number of objectives, two of the most important being the development of the 14/12 GHz service and the contribution to the establishment of a prime spacecraft contractor capability in Canada, i.e. SPAR Aerospace.

The phrase "Anik-B Communications Program" refers to the Program of experiments and pilot projects that used the 14/12 GHz capacity of the satellite to develop new communication services and associated ground segment industries using that frequency range. This study deals with this Communications Program and service development objective only. Recent studies conducted by officials of MOSST and IT&C on the space prime contractor policy present a further perspective on the Program and related initiatives of the government.

1.2 Purpose and Design of the Phase Two Evaluation

The purpose of this evaluation was to: evaluate Phase Two of the Program; evaluate the manufacturing and earth segment industry development part of the Program; and, assess the extent to which the overall service development goal of the Anik-B Communications Program had been achieved.
The evaluation had three tasks:

No. 1: evaluation of the individual Phase Two Pilot projects and aggregated activities;

No. 2: an evaluation of the industrial benefits resulting from the Program; and

No. 3: a review of effectiveness of three particular Program processes (the weaning of subsidized users, involvement of the private sector, and the identification and resolution of policy issues).

As well, the project was to conclude with an assessment of the extent of achievement of the overall service development goal of the Program. This is referred to as the "end-state" evaluation.

1.3 Report Format

This Volume 1 of the evaluation report contains the results of Tasks No. 1, No. 2 and the end-state evaluation. The end-state evaluation is presented first as it draws heavily on the results of Tasks No. 1 and No. 2. and serves as an executive summary for them.

The report on Task No. 3 is presented in Volume 2. All annexes are presented separately in Volume 3.

1.4 The Evolving DOC Service Development Goals: The Need for an "End-State"

The development of the 14/12 GHz communication service by DOC began with the launch of the HERMES experimental satellite in 1976, and the subsequent exploratory field trials and projects designed to explore new applications for telecommunications, with some emphasis being placed on those applications that would use a 14/12 GHz satellite-based service. The projects and experiments were relatively short-lived, and in general did not provide sufficient evidence for individual experimenters to make cost-effectiveness analyses.

The HERMES program was followed by the Anik-B Communications Program of pilot projects and experiments designed to give experimenters the continuing pre-operational experience that was considered necessary to resolve the technical issues and permit the experimenters to make comprehensive viability decisions on 14/12 GHz uses that had been explored in the HERMES Program.

The Communications Program itself was divided into two Phases. Phase One ran from April 1979 to February 1981; Phase Two from March 1981 to September 1982.

Each of the elements in the sequence: HERMES - Anik-B (Phase One) - Anik-B (Phase Two) had different but complementary goals in that each was designed to build on the developments of the previous activities and further the development of a 14/12 GHz communication service.

The goals, however, were couched initially in very general terms, referring to a need to contribute to "increased awareness", "determination of viability", "developing knowledge", and similar phrases. Although the DOC goals became somewhat more specific as time progressed, it was agreed by the consultants and DOC Space Sector management during the Phase One evaluation that those general goals did not reflect accurately the true service

development intent of the Program. It was decided that a statement of ultimate purpose, or desired "end-state", for the Program was required for the evaluation.

1.5 The "End-State"

The end-state description used for the evaluation was derived from the following statement of the mandate for DOC Space Sector Programs provided by DOC management:

> "the orderly growth and establishment of a viable Canadian commercial tele-communications system, services and industry".

It was further agreed by DOC management that the above mandate led to the following desired end-state for the Anik-B Communications Program:

> "the establishment of a viable commercial 14/12 GHz satellite communication service and industry"

That is, the ultimate purpose of the Program was to lead to the establishment of a viable commercial communication service and industry based on the 14/12 GHz band. Three points should be noted here:

i) While the desired end-state was the establishment of such a service, it was recognized clearly that the DOC Program would be only one of a number of contributions to such an achievement. The Program would act by influencing others, notably Telesat and potential users, to commit their organizations to this new service;

ii) The word "viable" was interpreted to mean "free of direct government subsidy of this particular service"; and

iii) "Commercial" meant only that the service was to be offered by a commercial organization. It did not imply that the users were necessarily commercial organizations.

1.6 Four Indicators of End-State Achievement

Four indicators of achievement were then used to determine the degree of achievement of this end-state. They were:

i) the existence of a 14/12 GHz satellite communications service offering, by a commercial organization, with sufficient paying customers, paying commercial rates, so as to ensure service viability free of direct government subsidy of the service;

ii) The existence of a manufacturing industry for the earth segment part of a 14/12 GHz service offering;

iii) the emergence of a support industry to provide technical consulting, operations and other support services to users of the 14/12 GHz offering; and,

iv) the existence of a policy and regulatory framework conducive to the continuing viability of the 14/12 GHz service.

These four indicators were to offer separate, but related, perspectives on the degree of achievement of the end-state. An overall assessment of the Program would depend upon the relative weights assigned to the four indicators. No weighting of the indicators is done in this report.

2.0 Achievements

We present below the current achievements of the above four indicators.

It must be noted that the field of telecommunications is a rapidly changing one. The achievements presented below represent conditions as at the time

of writing (June, 1983) and thus represent a static "snapshot" of a very dynamic environment. The reader should be aware of this limitation in the reported achievements.

2.1 A Viable Service Offering

2.1.1 The 14/12 GHz Service Offering

Telesat Canada currently has three operating communication satellites which have 14/12 GHz services:

- The 14/12 GHz portion of Anik-B which reverted to Telesat upon the expiry of the DOC lease in September 1982;
- Anik C-3 launched in November, 1982; and,
- Anik C-2 launched in June 1983.

A fourth satellite, Anik C-1, is due to be launched in 1984.

As of July 1, 1983, only the Anik C-3 satellite is available for use by Telesat customers. C-2 will become available to users in the third quarter of 1983.

The C-3 satellite has 32 channels available for use - 16 in the Western Beam and 16 in the Eastern Beam.

2.1.2 Paying Customers and Rates for Anik C-3

The following conditions prevail as of July 1, 1983.

In the Eastern Beam 15 of the 16 channels are in use: 8 delivering TV broadcasting including TV Ontario, 6 being used by TCTS for message services and one being used by Telesat.

The Western Beam is not yet filled. Nine of the 16 channels are in use: four for TV broadcasting and tele-education, one for Telesat usage, and four for TCTS message services. There are no U.S. customers now on C-3.

Current Telesat rates for a channel are $817,000 per year for the unprotected pre-emptible service, which is what all current users have requested. All current users are paying this or a similar rate.

The bulk of current commitments of C-2 are accounted for by GSAT in the U.S. for direct-to-home broadcasting in the States. The lease runs to mid-1985 when the Americans will transfer to their own satellite, G-STAR.

Telesat business plans now envisage sufficient demand for two of the three Anik-C satelites, and thus Telesat is now looking for markets for the excess capacity which may appear during the 1984-1988 period.

2.1.3 Viability of the 14/12 GHz Service Offering

All current users are paying commercial rates for the service, or a rate derived from it by a method approved by the CRTC. Telesat senior officials report that the present C-3 service offering rates are not sufficiently profitable to Telesat. Telesat had requested a rate of $945,000 per channel but the CRTC had reduced this to the present $817,000. The TCTS support payments to Telesat, made under the TCTS guarantee of a rate of return on Telesat equity, are required to bring the revenues up to the guaranteed level.

On the other hand, a significant number of actual and potential users are of the view that the rates are too high.

A CRTC rate hearing has been scheduled for the Fall of 1983 at which the issue will be resolved.

A large majority of users and participants in the Communications Program attributed their decision to use the 14/12 GHz service to significant benefits of that service as opposed to alternative services, in particular:

- Freedom from terrestrial interference in siting both uplinks and earth receive stations;
- smaller size of the uplink and earth receive terminals, permitting greater flexibility in locating them; and
- a combination of two technical features (regional beams and the acceptability of the 1/2-channel signal on Anik-C3) that make the service particularly attractive to the pay-TV and regional broadcasters.

2.1.4 Conclusions on Service Offering Indicator

It is obvious that a substantial 14/12 GHz service offering is in place by a commercial organization, and that a significant number of major clients in Canada and the U.S. have decided to adopt the service for their operations, at least on a short-term basis, and are paying commercial rates to do so on the basis of perceived significant benefits.

The medium term prognosis for viability of the service offering is mixed. If Telesat continues with the present plans to launch Anik C-1 in 1984, there may be considerable excess capacity when its U.S. contracts expire. Telesat is now seeking alternative markets for this capacity.

2.2 Manufacturing Industry for the Earth Segment

The report on Task No. 2 of this study, Industrial Benefits, reported that the set of DOC/DSS product development contracts had not yielded the sought-after viable Canadian manufacturing industry for the earth segment of the 14/12 GHz service. However, the contracts did generate direct and spin-off benefits.

The large market foreseen originally for Canadian manufacturers was in the production of direct-to-home low-cost TV terminals (LCETS). It is now clear that U.S. and other foreign competitors will capture the large share of that market in both Canada and the U.S.

Major reasons for this result explained in the Task No. 2 Report, are as follows:

- failure on the part of the interested parties, including the companies and DOC itself, to ensure that the necessary policy and regulatory changes were made to enable the markets to develop in Canada while Canadian firms had a lead in the technology;

- the lack of aggressive marketing in Canada of satellite communication services; and

- lack of competitiveness on the part of the companies in the mass manufacturing and distribution skills that would have been required.

Several Canadian firms are showing some promise in the field of higher-cost, high-technology products that do not require mass production and distribution skills. One particular example is the low-cost telephony terminal.

2.3 Support Industry

The consulting team found no evidence of the existence of a support industry to the 14/12 GHz service offering, outside of Telesat itself and the telephone companies.

The companies contracted by DOC to operate 14/12 GHz equipment during the Communications Program did so as a once-off effort but could do so again for DOC or others if the need arose.

2.4 Policy and Regulatory Framework

The existing policy and regulatory framework obviously permits the establishment of the above-noted significant 14/12 GHz service offering. However, participants and observers have all stated that policy and regulatory barriers were the major impediments to an even broader usage of the new service.

The following specific issues were raised.

(i) Existing regulations do not permit users to own and operate their own 14/12 GHz uplinks. In the view of users, this leads to excessive charges for uplink rentals and operations, and also to a lack of responsiveness to the needs of users who must move uplinks about, sometimes at short notice. Recent Telesat contracts have begun to show some flexibility on the issue, at least for 6/4 GHz uplinks.

(ii) The 14/12 GHz satellite service is not marketed aggressively to individual potential users

Three factors account for this, as follows:

(a) Telesat is prohibited from selling directly to end-users, except broadcasters, by the terms of its agreement with TCTS;

(b) The TCTS members have large investments in terrestrial operations and frequently see it to their advantage to use terrestrial means rather than satellite;

(c) The practice of the TCTS companies (i.e. the telcos) would seem to be to make major, long-term commitments to services rather than catering to the individual needs of potential customers. An example is the TCTS commitment to the "Integrated Satellite Business Network" (ISBN) using the 14/12 GHz service, due to be introduced in 1984. It would seem that the TCTS view is that high-capacity systems such as the ISBN will drive down the price, and make the service more attractive to a wider range of end-users. In the meantime, however, individual non-broadcast potential customers of 14/12 GHz service are deterred by the rates and encouraged to use other satellite or terrestrial means to meet their needs.

(iii) Users see the need for a greater range of rates for service usage

Major potential users argue that there should be a greater range of rates available for usage of the 14/12 GHz satellite segment. These rates would reflect type of use, length of time the service was required and could perhaps allow for the sub-leasing of short-term excess capacity. The latter question is a controversial one, in that it could open up the possibility of creating new "common carriers" inadvertently.

3.0 Effect of the Anik-B Communications Program on the Reported Achievements

In the previous section, we have noted the achievements under the four indicators. In particular, it was noted that a major 14/12 GHz service offering was now in place and that it was being used by a significant number of customers paying commercial rates for the service.

In this section we address the critical question of the role of the Anik-B Communications Program in effecting this achievement. The question is: would this achievement, or even a more substantial one, have occurred anyway without the DOC program?

A review of the situation makes it clear that the Communications Program did not contribute to the original Telesat decision to introduce a 14/12 GHz service.

According to Telesat and TCTS officials, this decision was made by Telesat-TCTS during the 1976-1977 period. Design of the Anik-C 14/12 GHz satellites was finalized in January 1977, with a tentative launch date for the first of the "C" satellites set for 1980. Anik-B was not launched until November 1978, 1 1/2 years after this Telesat - TCTS decision, and the Communications Program of DOC began shortly after the launch of "B".

Thus, a 14/12 GHz service offering probably would have come into being even without the DOC Communications Program.

The question then becomes: would the current usage, viability and date of introduction of the 14/12 GHz service offering have been affected if the DOC program had not taken place?

It will be seen below that, notwithstanding Telesat's decision to proceed with the Anik-C Program well in advance of the Communications Program, the Communications Program played an important role in developing business for the 14/12 GHz service offering.

It is important to note that the Telesat - TCTS decision to introduce a 14/12 GHz service was based on commitments made by TCTS members for usage of the new service largely for handling message traffic. TV broadcasting, the target of much of the subsequent DOC development work through the Communications Program, was then seen by TCTS and Telesat as being the secondary market for the new service. No commitments were made at that time by the TV broadcasters. Further, Pay-TV, which has now become a major user of the 14/12 GHz service, was very uncertain with the CRTC on record as being opposed to it.

Of the 24 channels currently being used on Anik C-3, twelve are used for TV broadcasting and tele-education. The importance of these two markets to the viability of Telesat's 14/12 GHz offering becomes even more pronounced when C-2 is considered, with its heavy committment to TV broadcasting in the United States, and when it is noted that the original TCTS estimates for message traffic have not yet been realized.

The TV broadcasting and tele-education markets are precisely the two upon which DOC focussed the large share of its resources under the Communications Program.

Only two of the twelve TV broadcasters and tele-education organizations now using the 14/12 GHz service came to it via the Communications Program (see report on Task No. 2). However, the "demonstration effect" of the Communication Program pilot projects and demonstrations, which lasted up to two years, is held to be a significant factor in the decisions of the other Canadian broadcasters to use this service. The major effect of the demonstration aspect of the Program was to establish viewer acceptance of the signal quality of these medium-powered satellites. This effect has been acknowledged by the broadcasters themselves and by Telesat officials.

Further, the experience of the DOC TV broadcasting pilot projects is held to be a significant factor in the decision of U.S. broadcasters to go for lower powered satellites than had been planned for direct-to-home TV broadcasting, and thus to use Anik C-2 on an interim basis until their domestic satellite is available. The evidence for this is almost all anecdotal, which is to be expected in such a situation. Nonetheless, it is convincing. Telesat officials point to demonstrations to U.S. representatives of companies which are now customers, and discussions and correspondence exchanges which took place between Telesat and its U.S. customers. Further evidence of the impact of the DOC Program can be seen in the fact that a Canadian company is to receive royalties from a major U.S. contender in the direct-to-home market, the royalties being paid for LCET technology developed under the Program.

A final point to be considered is that the very concept of a demonstration program for the 14/12 GHz service using a hybrid (i.e. 6/4 GHz and 14/12 GHz) Anik B satellite, had originated with the DOC.

The absence of the Canadian and U.S. TV broadcasting and tele-education markets, which were largely stimulated by the DOC projects, would probably place the current offering in a difficult financial position. It takes a considerable volume of telephone-message traffic to generate the revenues of one TV broadcast.

The conclusion reached by the consulting team is that the demonstration effect of the DOC Anik-B Communications Program has played a major role in generating the current demand for, and viability of, the 14/12 GHz service.

EVALUATION OF PHASE TWO OF THE ANIK-B COMMUNICATIONS PROGRAM
REPORT ON TASK AREA NO. 1: IMPACTS AND EFFECTS OF PILOT PROJECTS AND AGGREGATED ACTIVITIES

Submitted to:

Department of Communications
by CPER Management Consulting Inc.

Ottawa
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ANNEXES (Bound Separately in Volume 3)

Annex A: Evaluation Questionnaires For Task Area No. 1

Annex B: List of Respondents For Task Area No. 1

Annex C: Phase One and Phase Two DOC Program Goals

SUMMARY OF CONTRIBUTIONS TO SERVICE DEVELOPMENT OBJECTIVE

I Background and Approach

The Anik-B Communications Program of the DOC was a service development program in that its prime objective was to stimulate the establishment of a 14/12 GHz satellite communications service in Canada. Requirements for service had been identified earlier in the CTS Hermes Program, continuing Anik B experiments and other studies.

Task No. 1 of this evaluation examined the extent to which the pilot projects and aggregated activities of Phase Two contributed to this service development objective.

The purpose of Task No. 2 of the evaluation (reported on later in this volume) was to assess the extent to which the secondary DOC objective of establishing a viable Canadian manufacturing industry for the earth segment of a 14/12 GHz satellite communication service had been accomplished.

This Task No. 1 report contains the results of the evaluation of the impacts and effects of the individual pilot projects and aggregated activities conducted in the Phase Two Anik B Communications Program.

II Results

The Phase Two pilot projects and aggregated activities have achieved the following results which contribute to the 14/12 GHz service development objective and the DOC space mandate In satellite communications and, which can be attributed to the Communications Program:

- To-date, two of the twelve experimenters have become major users of the commercial 14/12 GHz satellite services as a result of the pilot projects. Two other participants are still seriously considering the use of this service, and one other is now using 6/4 GHz satellite services in its operations. The two users commited to follow-on service are both publicly-funded, educational broadcasters.

- The service benefits of the system such as the quality of the signals received and the advantages, including lack of backhaul costs, of being able to locate a 14/12 Ghz uplink in metropolitan areas, the potential for the small and low-cost earth terminal, and the transportability of the 14/12 Ghz uplink were all important factors in decisions to invest in 14/12 Ghz systems over terrestrial microwave and 6/4 Ghz satellite systems.

- Issues of cost, policy, institutional arrangements, and regulation have been identified as the major impediments to broader acceptance of the service. In particular the following issues were raised:

  - The ownership and operation of uplinks, especially for users requiring transportable services. As well, the annual uplink rental fee of Telesat was an argument raised in favour of user-ownership. For users of transportable terminals the ownership issues was identified as a major problem because lack of owership prevented them from having the flexibility required to meet their needs;

  - The structure of the Telesat rates for the space segment, which is considered to be unresponsive to the needs of users; and,

  - The time consuming process, for non-broadcast users, of acquiring service from both a TCTS member and then Telesat was seen to increase space segment costs to end-users as a result of "agency" fees charged by the TCTS members.

- The policy issues raised have been known since early in the Program. While the individual experimenters have used the results of their projects to press for regulatory, cost and institutional changes, DOC has not marshalled the results of the projects in an effort to bring about the necessary changes.

- There have been significant contributions to the issue of aggregation by two pilot projects and the Telesat Radio Demonstration/Experiment.

- There has been an increase in awareness in Canada and abroad of the service benefits of 14/12 GHz, and gains in knowledge and technical expertise.

- The spot beams and the footprint coverage of the current Telesat service offering in 14/12 GHz (Anik C-3) meet the needs of some important potential users identified, but eliminate others who participated early in the Program. For participants requiring national coverage, the cost of the 6/4 Ghz system is more attractive to them than the 14/12 Ghz system which requires two uplinking facilities. For those requiring northern service, the current 6/4Ghz offerings cover this area while the 14/12Ghz offerings do not.

EVALUATION OF PHASE TWO OF THE ANIK-B COMMUNICATIONS PROGRAM REPORT ON TASK AREA NO. 1: IMPACTS AND EFFECTS OF PILOT PROJECTS AND AGGREGATED ACTIVITIES

1.0 INTRODUCTION

1.1 Background and Purpose

The Anik-B Communications Program is a program of the Space Sector of the Department of Commmunications (DOC). The Program is aimed at developing services and establishing a support industry for the 14/12 GHz satellite system in Canada. The DOC efforts in 14/12 GHz satellite communications began with the Hermes CTS Program of experiments which was followed by the Anik-B Communications Program. Service needs had been identified in the Hermes Program and other DOC studies prior to the commencement of the Anik B Program. The Hermes Program consisted of a series of short experiments testing the 14/12 GHz technology and its possible uses, whereas the Anik-B Communications Program was characterized by relatively extended pre-operational use of the 14/12 GHz services of the Anik-B satellite through pilot projects. In the Anik-B Program experimenters were given the opportunity to assess the viability for their organizations of the 14/12 GHz service through "hands-on" use of the satellite facilities.

The Communications Program consisted of two phases. The difference between Phases One and Two of the Anik-B Program can be noted in the different goals that were set for them by the DOC. (See Annex C). A major difference between the two phases was that Phase One emphasized viability assessments and experimentation, whereas Phase Two also assisted those Phase One experimenters who had made positive viability decisions in Phase One by providing them with a service bridge to commercial 14/12 GHz satellite service. Both programs were also aimed at developing awareness and knowledge of 14/12 GHz systems and services and advancing Canadian satellite capability.

This Task No. 1 report contains the effects and impacts that can be attributed to the pilot projects and aggregated activities of Phase Two. It is not a report on the service development effects of the Phase Two Program as a whole. In particular, it omits an analysis of the effects of Phase Two on the decision by Telesat to invest in the service offering i.e. the Anik C satellites. This point will be picked up in the final "end state" report on the overall achievement of the service development objective.

1.2 Approach and Method

The DOC goals for the Program were very general in nature, containing no indicators of program achievements. Thus, in consultation with DOC officials it was agreed that the following indicators developed by the consultants would be used to identify the effects and impacts of the pilot projects and aggregated activities. The indicators are presented in order of priority. As the ultimate purpose of the Program was service development, the introduction of new services on follow-on 14/12 GHz commercially-operated satellite systems was the highest ranked indicator of program effects.

i) Commitment by Phase Two participants to the introduction of new services on follow-on commercially-operated 14/12 GHz satellite systems;

ii) Identification and provision of information on 14/12 GHz telecommunications policy and regulatory matters and contributions to their resolution;

iii) Identification of means for aggregating users' needs; and,

iv) Increases in levels of awareness and expertise in the participating organizations of the 14/12 GHz satellite systems and services; as well as advancements in capabilities by

Canadian organizations in satellite communications technology, and service delivery.

A related indicator of the general service development mandate of the DOC space sector which was also used was:

(v) The introduction of new services on other space telecommunications systems.

"Other" effects of the Phase Two pilot projects and aggregated activities were also identified and are contained in this report.

The following methods were used to collect and assess the information on the individual pilot projects and aggregated activities:

(i) A review was conducted of the files maintained on each of the projects and activities at the Anik B project office of DOC (Communications Research Centre at Shirley Bay);

(ii) The set of five evaluation indicators was developed to measure goal achievements;

(iii) Using the indicators, an evaluation questionnaire was developed. The questionnaire also contained questions on causality;

(iv) Respondents (primarily experimenters and sponsors) were mailed a questionnaire and responded either by face-to-face interviews or telephone interviews. The timing of the project did not allow for written responses. Interviews were conducted in most cases with two or more representatives (experimenters, and sponsors) of the pilot projects. For one of the three aggregated activities only one individual was interviewed;

(v) Relevant information gathered from the industrial benefits evaluation served, in some cases, as a cross-check of the interview results; and

(vi) An assessment was made of the service development effects which could be attributed to the Program. Attribution refers to effects which can be legitimately said to be "caused" by the intervention of the Program activities.

Annex "A" contains the interview questionnaire.
Annex "B" contains a list of the respondents.

1.3 Format of This Report

The remainder of this report contains three sections. Section Two presents an overview of the Phase Two pilot projects and aggregated activities. Section Three presents an analysis of the effects and impacts of these activities as measured in terms of the indicators identified in Section 1.2. Section Four summarizes the effects and impacts of the pilot projects and aggregated activities.

2.0 PHASE TWO PILOT PROJECTS AND AGGREGATED ACTIVITIES: AN OVERVIEW

The Phase Two Program consisted of nine pilot projects and three aggregated activities. Some projects, originally planned for Phase Two, only commenced in the very limited Phase Three Program.

2.1 Pilot Projects

The pilot projects are grouped into three classifications:

i) New Pilot Projects;
ii) Pilot projects which were extensions of those conducted in Phase One but were still experimental; and,
iii) Projects which were using the Phase Two Anik B facilities as a bridge until commercial 14/12 GHz service became available.

Below we show the distribution of the Phase Two projects according to this classification scheme. As well, we note those projects for which financial contributions were made to the DOC by participants.

New Pilot Projects

- THE CBC Satellite News Gathering Project (SNG)
- The Canadian Petroleum Association Project (CPA)

Note, however, that the CBC was a Phase One pilot project experimenter in the PDPP.

Phase One Extensions

- Inuit Tapirisat of Canada (ITC)
- Ontario Ministry of Government Services (OMGS)*
- Program Delivery Pilot Project West (CBC, BCTV)
- ACCESS Alberta
- CNCP (TDMA)

*NOTE: The OMGS project consisted of both an extension of their Phase One Project plus a service bridge.

14/12 GHz Commercial Service Bridge

- Knowledge Network of the West
- TV Ontario (Program Delivery Pilot Project East)

Projects for which Experimenters Contributed Financial Resources for Satellite Usage and Terminals

The projects for which experimenters made financial contributions to the DOC were:

- The Canadian Petroleum Association Project;
- The Program Delivery Pilot Project West (CBC and BCTV);
- ACCESS Alberta;
- Knowledge Network of the West;
- TV Ontario (PDPP EAST); and,
- CNCP.

2.2 Aggregated Activities

One of the objectives for the Phase Two Program was to explore means for aggregating users' needs. The intent of "aggregation" is to reduce costs to users by sharing their satellite and/or ground equipment resources. The Phase Two aggregated activities were initially intended to contribute to this objective. However, as the Phase Two Program developed, the aggregated activities were used as a means for accomodating new requests for Phase Two participation as satellite resources decreased and for which similar pilot projects were already being conducted.

The three aggregated activities which were examined were:

The Manitoba Telephone System activity (MTS);

The Dome Petroleum activity; and

The RCA Canada activity.

In all three of these activities the participants received broadcast signals transmitted by participants of major pilot projects (i.e. the PDPP East and West Projects). A brief description of the projects of each of the organizations is presented below.

In the Manitoba Telephone System's (MTS) projects IDA and Science and Man (SAM), the MTS installed earth terminals to receive the TV Ontario broadcast signal. The purposes of these two interrelated projects were to:

i) test the quality of the signal received on the fringe of the Anik B footprint;

ii) convince the Department of Education of Manitoba of the desireability of receiving the TV Ontario signal, and provide a vehicle for the Department to assess the TVO programming content to determine it's suitability for Manitoba.

The activity lasted about one year. In project IDA the TVO signal was picked up and transmitted to one school and 100 homes in the same community. In project SAM the TVO signal was transmitted to seven schools and no individual homes.

RCA Canada tested the technical performance of a series of DBS terminals and the acceptability to the audience of the signal received. The RCA project picked up the La Sette signal and the TV Ontario signal in Toronto, Ottawa/Hull, Montreal and Winnipeg. RCA purchased five receive terminals from SED and several Electrohome indoor units which were modified by SED. The activity was to be used by RCA to assist them in making a decision on whether to enter the DBS equipment market. The project lasted about ten months.

A brief project was conducted by Dome Petroleum in which television entertainment was transmitted to an offshore drillship. Dome used the programming from the PDPP West.

2.3 Telesat Radio Demonstration/Experiment

For about one month, but only using a few hours of satellite service, Telesat experimented with the use of the 14/12 GHz satellite to test its use for distributing radio signals. The experiment consisted of technical tests aimed at examining the quality of the signal when transmitted via satellite. Telesat had done no such previous field testing.

3.0 CONTRIBUTIONS OF PILOT PROJECTS AND AGGREGATED ACTIVITIES TO DOC GOALS FOR THE PHASE TWO PROGRAM

3.1 Pilot Projects

3.1.1 Commitment by Experimenters to the Introduction of New Services on Follow-on Commercially-Operated 14/12 GHz Satellite Systems

A fundamental measure of the effectiveness of the Phase Two Program is whether or not Phase Two project participants have introduced, or have plans to introduce into their organizations, the use of 14/12 GHz satellite services on follow-on commercially-operated systems.

The current status of the use of 14/12 GHz services by project participants can be described by the following categories:

i) user of commercially-operated 14/12 GHz satellite system and services;
ii) still considering the use of commercially-operated 14/12 GHz satellite services;
iii) new user of other satellite system;
iv) new user of other telecommunications services; and,
v) not using any new telecommunications services.

Users of Commercially-Operated 14/12 GHz Satellite Services

Two of the nine pilot projects resulted in their experimenters' commitment to 14/12 GHz satellite service. These experimenters were the Knowledge Network and TV Ontario (TVO). Both organizations are now paying for 14/12 GHz satellite service on Telesat's Anik C-3.

Both TV Ontario (TVO) and the Knowledge Network of the West participated in the Phase One Program and both used the Phase Two Program as a bridging service prior to the availability of service on Anik C-3, having made positive decisions on the viability of using 14/12 GHz services on the basis of their Phase One projects. Both paid a monthly fee to the DOC for use of the satellite and earth station resources in Phase Two.

TV Ontario (TVO) has been a user of commercial 14/12 GHz satellite services since September 18, 1982. Initially TVO took commercial service on the Anik B satellite and then switched to the Anik C-3 satellite in mid-January 1983. TVO has 11 high power main transmit sites for South Ontario service, 35 low power transmitters and is linked to about 40-50 cable systems (continually increasing), with about 150-170 LPRT's in Southern Ontario. TVO is paying commercial Telesat rates for the space segment plus an additional $120,000 annually for uplinking. As well, a 10% agent fee is paid to Bell Canada. The contract with Telesat is for a five year period.

The bridging service provided in Phase Two allowed TVO to continue its northern service and according to TVO officials, prevented a public outcry had they been cut off while waiting for Anik C-3 service. The Southern Ontario service via Anik C-3 was not possible on Anik B and it was the fact that TVO could switch their microwave and rebroadcast services for Southern Ontario to satellite which made the use of Anik C-3 financially viable for them.

The Knowledge Network of the West is paying Telesat Canada for service to about 140 receive sites (continually increasing) at an annual rate of $817,000 for the space segment. The Network is paying $120,000 per year for uplink facilities but is still negotiating its contract with Telesat. There was a high level of

political support for the use of 14/12 GHz satellite services for education in B.C. The approach taken was to put in place an actual service during the project by installing community earth terminals. This was an action taken to ensure that the 14/12 service would be introduced by Telesat by making it difficult for the Federal Government to withdraw the service to remote and under-served areas.

Still Considering The Use of 14/12 GHz Service

Two of the nine projects, those of ACCESS Alberta and CNCP fall into this category.

While the Executive and Board of Directors of ACCESS are fully committed to the introduction of 14/12 GHz services, Ministerial approval has not yet been given to the proposed satellite-based long distance interactive education service. ACCESS has reserved space on the the next in the 'C' series of satellites to be launched.

The Executive of ACCESS is of the view that the interactive capability which could be achieved through use of the satellite services is a key service feature which would not only maintain but expand the market for ACCESS in the future. As well, current annual operating expenditures of ACCESS on its existing communications services for radio and television would cover the annual operating costs for the space segment. Use of the satellite service would expand the kinds and hours of service which ACCESS could offer to users.

ACCESS participated in the Phase One program but did so by mailing tapes to the British Columbia Institute of Technology (BCIT), and then using the B.C. uplink. In the Phase Two program ACCESS had its own uplink. The view of ACCESS

officials was that the Phase Two project established credibility with users thus generating support required in seeking Ministerial approval for the proposed 14/12 GHz satellite-based interactive distance education network.

The Executive of ACCESS is to submit to its Minister in May'83 a proposed operational plan for introducing the 14/12 GHz service, and expects a decision on the proposal by the Fall of 1983.

CNCP participated in both Phases of the Program and reported to be making plans to use 14/12 GHz satellite service. Provision has been made in the organization's 1984 budget for the purchase of earth terminals and the lease of satellite capacity. CNCP officials have informed Telesat of their plans to use 14/12 GHz services but have not begun any negotiations for the service. A major study is now underway in CNCP to determine how they should integrate the 14/12 GHzservice into their overall communications system.

CNCP has also examined the possibility of utilizing 6/4 GHz satellite service and has determined that it will also be used, especially for cross-border traffic with the U.S.

The main factor for CNCP in favour of 14/12 GHz service is its lack of interference problems in metropolitan areas and thus the lack of expensive backhaul costs associated with 6/4 GHz service. The project allowed CNCP to transfer service from wireline to satellite and prove that the service could be easily incorporated into its communication system; and, in conjunction with GTA, it allowed CNCP to provide a "real" 14/12 GHz satellite communications service to two government departments (CEIC and Atmospheric Environment Service).

Users of Other Satellite Services

One experimenter falls into this category: the Inuit Tapirisat of Canada (ITC). The ITC was a Phase One participant. Their Phase Two project was a 3-4 month extension of its major Phase One Project. There was no charge to the ITC for satellite usage in Phase Two.

The ITC project and the Phase One "TNI" project, both aimed at providing indigenous television services to Inuit communities, resulted in the creation of the Inuit Broadcasting Corporation (IBC) which was incorporated and granted a network license in the summer of 1981. The IBC is now using the 6/4GHz services of the CBC to deliver its television programming for 5 hours weekly to 32 communities in the North West Territories, Northern Quebec and Labrador. The IBC pays $155,000 annually for uplink facilities. The IBC receives the transponder resources free of charge from the CBC.

BCTV is not put into this category for the following reasons.

The BCTV which used the satellite to extend its broadcast coverage considered that commercial 14/12GHz service was not financially viable for them. The BCTV signal is now being picked up by CANCOM which operates at 6/4 GHz. The major benefit to the BCTV of the project was that it created a demand for BCTV's programming. Several communities switched from the 14/12 GHz Anik B service to 6/4 GHz service so that they could continue to pick up the BCTV signal once it switched to the CANCOM system. BCTV is a shareholder in CANCOM but the executive interviewed stated that this investment decision was not a result of participation in the Program.

Users of Other Telecommunications Services

The Ontario Ministry of Government Services (OMGS) is the one Phase Two participant falling into this category. The OMGS had a Phase One project providing teleconferencing services

between Toronto and remote Northern Ontario locations to a variety of Government Ministries.

The Phase Two Project was two-fold:

i) a 12 month extension of the Phase One satellite-based teleconferencing service to Thunder Bay. The extension served as a bridge until commercially-operated terrestrial microwave service was available; and,

ii) a two-to-three month new experiment aimed at testing teleconferencing services to Sudbury and North Bay, specifically for the Ontario Ministry of Health.

The OMGS did not pay DOC for the use of the satellite service.

As a result of the Phase Two project the OMGS has contracted with Bell Canada to provide a terrestrial-based multiple purpose teleconferencing service to both Sudbury and Thunder Bay. The Thunder Bay service is now fully operational.

Prior to the Anik B project there was no microwave link to either Sudbury or Thunder Bay for teleconferencing purposes. The Phase One and Two projects created the demand for the teleconferencing service and resulted in the introduction of the commercial services noted above.

The costs for a point-to-point satellite-based teleconferencing service to these locations were significantly greater than that for terrestrial microwave. However, the interest of the OMGS in 14/12GHz service would be re-awakened if the price became competetive with terrestrial microwave.

No New Telecommunications Services Introduced

Two of the Phase Two experimenter groups have made relatively firm 'no' decisions on the use of 14/12 GHz satellite service and have not introduced other new telecommunications services. These are the CBC, involved in both the PDPP West Project and the Satellite News Gathering Projects; and the Canadian Petroleum Association (CPA) and its participating member companies.

The CBC's Satellite News gathering project (SNG) involved the use by the CBC of a transportable uplink facility to provide on-the-spot news coverage. CBC officials stated that they are convinced of the service and cost benefits for SNG of 14/12 satellite as compared to 6/4 GHz satellite service. However, current regulations on ownership of uplinks and the fact that CBC must use a Telesat operator for the uplink are major impediments to them. This is due to the fact that an immediate response is required for on-the-spot news coverage and the existing arrangement for ownership and operation of the uplinks prevents such response. As well, every time CBC uses the uplink they must pay the Telesat "out of pocket" expenses, which they say can get relatively high.

The CBC is currently conducting a review of the particular means which should be used to distribute its programming. The decision as to whether or not the CBC should renew its microwave contracts will be made within the next year. A CBC official informed us that the price to renew existing microwave contracts would be significantly less than the anticipated costs of 14/12 GHz satellite service. The decision to be made by the CBC is basically two-fold: should they use satellite or terrestrial services? and, if satellite is selected, should they use 6/4 GHz or 14/12 GHz? Due to the national programming mandate of the CBC, the Anik C-3 footprint would not meet

many of their needs. As well, CBC officials stated that they plan to follow and not lead the technology trends for distributing television broadcast services. Within the CBC different factions exist for and against both 6/4 GHz and 14/12 GHz satellite services.

It is anticipated by the CBC officials interviewed that the Corporation will not make any fundamental decisions on new technologies to be used to distribute CBC broadcast services until the preferred technology is clearly identified. Microwave operators are apparently very flexible, allowing the CBC to renew its contracts on close to a month-to-month basis.

The Canadian Petroleum Association Project has not resulted in changes to the telecommunications plans of participating companies. None of the individual firms involved is considering seriously the commercial use of 14/12 GHz services. Nor is the CPA, for its member companies, giving consideration to the introduction in the immediate future of commercial 14/12 GHz services. The major problems for the CPA members are the southern tilt of the Anik C-3 satellite and the inability to own uplinks. The latter problem is very important since current regulations prevent the companies from moving quickly between sites. The CPA project is still underway, working with the CRC on the building and testing of a stabilized earth terminal for installation on off-shore drill rigs.

3.1.2 Identification, Provision of Information and Resolution of Policy, Regulatory and Institutional Issues Concerning the Use of 14/12 GHz Commercial Satellite Services

This section reports the effects on the policy goal. While the DOC Program goal does not make reference to the actual

resolution of policy issues, we looked for such impacts as tangible evidence of efforts in the policy area.

The following are the issues raised by Phase Two participants with respect to the introduction and use of the 14/12 GHz commercial satellite service. The issues identified are grouped into the following categories:

(i) Institutional/Organizational;
(ii) Responsiveness to Users' Needs; and,
(iii) Costs of the Commercial Service.

Nearly all Phase Two participants who have not introduced 14/12 GHz service into their operations identified a mix of regulatory/policy and/or institutional issues including cost as their main reason for not moving to commercial service.

(i) Institutional/Organizational Issues Identified

It was argued that the control of the satellite services' market by TCTS telephone companies, except for broadcasters, has resulted in an institutional environment characterized by the following features:

- High costs for space segment service. This is a complex issue and is related to a rate structure that is seen to be not responsive to the users' demands;
- Very little marketing of 14/12 GHz satellite services, assumed by Phase Two participants to be due to previous investments of telcos in both terrestrial and 6/4GHz satellite services;
- Complex and time consuming processes (i.e. involvement of telephone companies as a third party between the customer and Telesat) involved in installing 14/12 GHz

service. This was particularly important for resource industries and other users of transportable terminals (eg. SNG) where timing and immediacy of action are often essential; and,

- Inability of users to own uplinks, which causes problems not only from a financial point of view but also prevents resource industry and other users of transportable uplinks (eg. CBC) from responding to their own needs for timeliness.

A general comment made by B.C. participants was that the Federal Government's approach to regulating satellite communications puts up roadblocks to end-users, resulting in 'denial of service', when, in fact, the technological developments themselves could result in improved services to Canadians.

CNCP raised an issue which is not directly related to 14/12 GHz service but illustrates CNCP's overall concern regarding the institutional arrangements for satellite service in Canada. CNCP is concerned that Telesat is responsible for arranging cross-border satellite communication services with the United States, when it is a member of TCTS together with the telephone companies, which are CNCP's competitors.

(ii) Responsiveness to Users' Needs

While the cost of 14/12GHz satellite services could be included in this section, its importance justifies that it be dealt with separately (see below). The following problems were identified as issues by participants regarding responsiveness to needs:

- Lack of marketing work by Telesat and telephone companies to identify telecommunications needs and to promote the 14/12GHz satellite service. In fact, some telco officials reported to us that they were now beginning such work;

- Lack of commitment by Telesat (according to experimenters) to research and development in the 14/12 GHz satellite communications field.

Two projects identified the above two issues as particular problems and addressed them directly: the CPA project; and, the CBC Satellite News Gathering project. One of the main objectives of the CPA project was to define and make Telesat and the DOC aware of the telecommunications needs (i.e. ruggedness, flexibility, transportability) of the petroleum industry. In fact, an official of one member company stated that the main reason for his company's participation in the Program was to establish a working relationship with both the DOC and Telesat Canada for defining the petroleum industry's telecommunictions needs and for possible future R and D work.

A CBC official was of the view that Telesat gained some awareness of the needs of broadcasters for satellite services in the area of on-the-spot news coverage. However, lack of responsiveness by Telesat was evident, he argued, in the fact that Telesat has not come back with a promised re-design of the transportable uplink for satellite news gathering.

- A lack of recognition by Telesat of 14/12 GHz satellite users other than full schedule broadcasters. It was argued that this lack of recognition could be seen by examining Telesat's rate structure;

- The tilt of the Anik C-3 satellite does not provide coverage north of the 60th parallel, an area which is identified by the petroleum industry as becoming more

and more important. Broadcasters said that the spot beam coverage of C-3 is not suitable for national program needs.

(iii) Costs of 14/12 GHz Satellite Services

Many of the above identified issues were viewed by program participants as having direct and significant implications on the cost of satellite service. Representatives of the CPA, the BCTV, the CBC and the OMGS have all identified cost as a major barrier to their introducing 14/12 GHz satellite sources into their telecommunications systems. Participants stated that the operating costs for 14/12 GHz service just could not be justified by the enhanced service it provided.

A cost issue which was raised on a recurring and common basis was the annual charge levied by Telesat Canada and the telcos to rent an uplink. Users have informed us that they could purchase an uplink, amortized over a three year period, for the annual rental charge made by Telesat. However, our judgement is that the real issue here is the desire on the part of users to own and operate their own uplinks.

Experimenters (eg. TVO, Knowledge Network OMGS) have also contested the Telesat tariffs for the space segment.

Some users argued that the Telesat rates should reflect:

- the use made of the satellite service, in particular broadcast vs non-broadcast (eg. telephony); short term uses; and, regional vs provincial or national use;
- the user of the service, eg. preferential tariffs for public sector users.

In conclusion, policy, regulatory, institutional and cost issues have been identified by Phase Two participants. Participants have intervened in the interrogatory processes regarding Telesat tariffs and have made presentations to both DOC officials and the CRTC to change policies and regulations. Other less formal approaches have also been used by participants. Except for the recent resolution of earth station ownership, these are precisely the issues identified in Phase One and no changes have been made. Participants identified these policy issues as the most critical remaining impediment to the introduction of commercially-operated 14/12 GHz satellite service.

3.1.3 Increased levels of Awareness, Knowledge and Expertise of the 14/12 GHz Satellite System and Services and Advancement of Canadian Capabilities in Satellite Communications and Service Delivery

Given the broad nature of such a goal, all projects could report some accomplishments. The approach used to identify changed levels of awareness and competence was as follows:

(i) To ask the opinions of the respondents on the levels of awareness of 14/12 GHz satellite services in their own and their user institutions (where appropriate) and seek their views on the differences made by their Phase Two participation;

(ii) To identify actual changes in the experimenter organizations and, if appropriate, their user institutions, which indicate a changed corporate view of 14/12 GHz satellite services; and,

(iii) To examine new potential and actual users, services and needs which were identified as a result of the Phase Two project.

"Awareness", "competence" and "needs identification" have been gained by Phase Two participants both specifically for the 14/12 GHz satellite system and services and for other telecommunications systems and services. The following results reported to the evaluation team are assessed as being attributable to the Phase Two Program.

(i) Awareness of 14/12 GHz Satellite Systems and Services

- Increase in user demand (both cable companies, and educational institutions) for the 14/12 GHz satellite-based service of the Knowledge Network, and TVO including groups outside of B.C. and Ontario, respectively;
- International awareness of the educational applications of the 14/12 GHz service and of the "networking" model for distance education as witnessed by the many visiting delegations to the Knowledge Network and TVOntario;
- Promotion of 14/12 GHz services in general to both Canadian and international groups by TVO (eg. provision of consulting advice to Australians).
- Identification by officials of the Knowledge Network and the B.C. Ministry of Universities, Science and Communications of potential additional uses of their 14/12 GHz service (eg. court system, emergency services, radio);
- Very limited increase in the awareness of CBC, located in the network centres, the CBC Distribution and Operations Group and the CBC in British Columbia, of the potential of 14/12 GHz service;
- Establishment in Access Alberta of technical resources to run an operational 14/12 GHz satellite based interactive education system;
- Corporate level and user agency support for the satellite services of ACCESS Alberta due, in part, to reduction in

apprehension regarding possible centralization effects of long distance education;

- Limited increase in awareness by field staff of CPA participating companies of use of 14/12 GHz services for field (mostly drilling) operations (e.g. Amoco);
- Participation by TV Ontario with the CRC in a project investigating two-way 14/12 GHz satellite service to remote locations in 3 schools in Northern Ontario. The system would provide the schools with access to data bases such as Telidon. This is seen as a potentially very important project for TVO;
- A change in the level of knowledge about 14/12 GHz satellite service within CNCP from 'zero' to a broad base throughout the orgnization, including senior mangement; and,
- Marketing by CNCP of 14/12 GHz services, e.g. started meeting with potential customers such as banks and petroleum companies to discuss their needs.

For many of the pilot project participants, their Phase One projects had much greater impacts than their Phase Two projects on their respective levels of knowledge, expertise and competence with the 14/12 GHz system and services, e.g. TVO, Knowledge Network of the West with the B.C. Ministry of Universities, Science and Communications, the British Columbia Institute of Technology, The Inuit-Tapirisat of Canada, BCTV, and OMGS. The Phase One evaluation report could be referenced for more information on this issue.

(ii) Awareness of Other Telecommunications Services

The following reported effects are assessed as resulting from the Phase Two Program:

- Ministerial support for teleconferencing in Ontario and the identification by OMGS officials of other potential uses of their teleconferencing service;
- Increased awareness by Ministry of Health officials of what is involved in the design and implementation of a telehealth system;
- Promotion campaign conducted by OMGS, independently, for the use of teleconferencing; and, the establishment of the "Audio Teleconferencing Task Force" by OMGS in conjunction with the Ministries of Transportation and Communications, and Energy. The Task Force has a promotions mandate;
- Awareness of teleconferencing and satellite services by private sector companies in Northern Ontario due to seeing the satellite terminal on-site; and
- Increased awareness (reported by a CBC official) by Telesat Canada through the CBC's "SNG" Project of broadcasters' operational requirements for ruggedness, transportability, built-in telephone service and simplicity.

3.1.4 Aggregation

An objective of the Phase Two Program was to examine means for aggregating users' needs and resources. While the aggregated activities were initially intended to address this issue, contributions to this objective were also examined in evaluating the effects and impacts of the pilot projects.

The importance of aggregation is highlighted by the current study on the subject proposed to the DOC by the Premier of Newfoundland and now being conducted jointly by the DOC and the Newfoundland Department of Communications.

Two of the Phase Two projects, although not designed specifically to address the issue of possible means for aggregation, consisted of the aggregation of users' needs and resources. The results are summarized below.

(A) The PDPP West (CBC, BCTV) and the Knowledge Network of the West Projects involved the transmission of three signals per transponder on the satellite. It was proven in the Phase One Program that such an arrangement was technically feasible, although with reduction in the quality of the signals. As a result, officials of the B.C. Ministry of Universities, Sciences and Communications are now regarding the one channel of Knowledge Network as three, two of which could be used for other purposes.

During Phase Two, Knowledge Network and ACCESS Alberta also had to coordinate their use of satellite time. ACCESS officials are considering, should their 14/12 GHz service plan be adopted, a variety of additional uses (eg. data transfer, radio) of the capacity which would be available to them in renting a full transponder.

(B) The Ontario Ministry of Government Services' Phase Two project examined explicitly the possibilities of aggregation with other users. OMGS shared ground and satellite resources with TVO. As well, the OMGS is essentially in the business of aggregation (i.e. it provides a teleconference service for multipurpose government uses to a varity of Ontario Ministries). In fact, in the

telehealth portion of the OMGS project, the Ministry of Health was to share the uplink facilities with another organization, and had arranged to have the facilities installed on the grounds of that organization. As it evolved, the other organization did not participate in the Phase Two Program.

The major conclusion of the OMGS on 'aggregation' was that aggregation could work with similar organizations or with groups which required different hours of satellite times. By 'similar organizations', OMGS officials were referring to their demands on satellite time (i.e. OMGS as an 'occasional user' could share satellite resources with other 'occasional users', as opposed to the situation in the pilot project in which OMGS was sharing satellite resources with TVO which was a continous user).

As OMGS officials pointed out, there were two levels of aggregation involved in their project. First, the aggregation of the needs for all of the involved Ontario Ministries for voice, data and video communications. At this level of aggregation, the OMGS has implemented a system for aggregating needs and consolidating satellite and satellite-related ground resources. On the second level was the aggregation of resources between OMGS and other users (eg. TVO). At this level the project identified criteria, eg. similar organizations in terms of usage patterns, for aggregation. This form of aggregation would consist of organizations with similar usage patterns, possibly coupled with dedicated circuits for users with a provision for insured peak load times based on need.

Both of these projects, therefore, yielded important results on aggregation.

3.1.5 Other Effects

Respondents were requested to identify other third party and spin-off effects of their pilot projects, (eg. on the market or industry for 14/12 GHz satellite services; on other satellite services and technology developments; and, on other telecommunication services and technology). Note here that the majority of other effects with respect to non-14/12 GHz satellite communications has been dealt with in Sections 3.1.1 and 3.1.2. The following "other" effects are limited to those concerned primarily with Canadian industry:

- The OMGS contracted with three separate firms to build, according to OMGS specifications, equipment for their teleconferencing service (e.g. a wireless remote control unit);

- According to OMGS officials their teleconferencing project resulted in Bell Canada's renewed interest in teleconferencing. Apparently Bell had disbanded its teleconferencing unit but as a result of the project and subsequent demand for service by OMGS, Bell's interest in teleconferencing was renewed;

- Amoco, a member of the CPA project, learned that certain applications of communications technology had potential benefits for their seismic and drilling operations.

3.2 Aggregated Activities

The following are the results of the three aggregated activities.

3.2.1 Commitment by Experimenters to the Introduction of New Services on Follow-on Commercially-Operated 14/12 GHz Satellite Systems

The following is the status of each of the experimenters with respect to the use of follow-on 14/12 GHz satellite service.

- One of the experimenters, the Manitoba Telephone System, (MTS) has plans to introduce 14/12 GHz service for telephone and eventually video communications in four communities in Manitoba. MTS has ordered four of the "Spacetel" digital telephony terminals and one central control unit from Microtel Pacific Research and plans to order a total of 20 terminals, eventually. According to MTS officials the terminals will be in place at the end of this year (1983). The 14/12 GHz system will replace both H.F. and 6/4 GHz satellite service

  MTS officials expressed the opinion that their Phase Two participation contributed only indirectly to the above telecommunications plans using 14/12 GHz satellite.

- The Manitoba Department of Education is still negotiating with TV Ontario to receive its signal on an operational basis, but to-date the copyright costs have been too high to make it feasible for the Department.

- Dome Petroleum has not put in place an operational system for receiving television broadcast services via the 14/12 GHz satellite service. The efforts of Dome in this area have not been continued, although the CPA pilot project which is continuing into Phase Three, will be providing a similar service. Dome is a participating member of the CPA project.

- To date, RCA Canada has not made any commitments to the 14/12 GHz satellite system and services.

3.2.2. Identification, Provision of Information and Resolution of Policy, Regulatory and Institutional Issues Concerning the Use of Commercial Satellite Service

The issue of competition between DOC-sponsored satellite technologies was raised (eg. 14/12 GHz telephony developments vs MSAT).

3.2.3 Increased Levels of Awareness, Knowledge and Expertise of 14/12 GHz Satellite System and Services and Advancement of Canadian Capabilities in Satellite Communications Technology and Service Delivery

Officials of only one of the experimenter organizations (Manitoba Telephone System) reported contributions to this goal. MTS officials stated that their overall experience with 14/12 GHz satellite technology and services through DOC Programs (i.e. CTS and Anik B), was a learning process for them. The early tests stimulated interest in the system and services. The projects demonstrated the concept of small, portable receive terminals and proved that the quality of the signal on the fringe of the footprint was acceptable. One MTS official stated that the rapid transition in the SAM project from the one community served in the IDA project to seven, demonstrated the contribution of the experimentation to increased awareness. According to MTS officials the IDA project created momentum within MTS and awareness by the public who saw the six foot dish on their roof.

MTS officials considered the Phase II experiment to be a market trial as well as a technical trial and therefore, conducted a lot of publicity on the project. Within MTS, however, the use of the 14/12 GHz satellite to provide services to remote communities was always a highly visible project to senior management.

3.2.4 Aggregation

Originally the aggregated activities were intended to address the question of aggregation. However, as the Phase Two Program evolved, they were used as a means to accommodate new users with the limited satellite resources available.

The three aggregated activities simply picked up the signals transmitted by other pilot projects. Thus, the aggregated activities made no contribution to this objective.

3.2.5 Other Effects

An official from RCA Canada reported that a division of RCA in the U.S. was aware of and watched the results of their aggregated activity. RCA (U.S.) is apparently now working on developing a TVRO. Information gathered to-date does not allow us to say whether the TVRO is for the 6/4 or the 14/12 GHz band.

3.3 Telesat Radio Demonstration/Experiment

3.3.1 Commitment by Experimenters to the Introduction of New Services on Follow-on Commercially-Operated 14/12 GHz Satellite Systems

Telesat's experiment resulted in continued support by that organization to service development in the field of radio distribution via satellite. The project gave Telesat officials their first opportunity to actually test the concept. However, officials informed us that they now considered 6/4 GHz to be the most appropriate satellite service for radio distribution. The main reason for this decision is that results of Telesat's market analyses have demonstrated that the demand

for radio services would be for national programming. The regional nature of the Anik C-3 footprint made it more cost-effective to offer the service at 6/4 GHz, which could also accommodate regional radio programs. A proposal has been submitted to Telesat management on the introduction of a satellite-based radio distribution network.

3.3.2 Identification, Provision of Information and Resolution of Policy, Regulatory and Institutional Issues Concerning the Use of Commercial Satellite Service

A Teleset official noted that a regulatory change would likely be required to allow the implementation of the proposed radio distribution system. The proposal is based upon the sharing of a transponder between about 20 users in order to make economic use of the space segment.

3.3.3 Increased Levels of Awareness, Knowledge and Expertise of 14/12 GHz Satellite Systems and Services and Advancement of Canadian Capabilities in Satellite Communications Technology and Service Delivery

No effects were reported here.

3.3.4 Aggregation

The proposal to Telesat management to introduce a satellite-based radio distribution system is based upon the sharing of a transponder between about twenty radio stations, thus contributing to the aggregation objective.

3.3.5 Other Effects

No other effects were reported.

4.0 SUMMARY OF FINDINGS

The following is a summary of the results of the pilot projects and aggregated activities, including an assessment of the extent to which the Phase Two activity caused the results.

4.1 Service Development in 14/12 GHz and Other Satellite Services

(i) Two of the nine pilot projects were responsible for commitments by experimenters to the introduction of new services on follow-on 14/12 GHz commercially-operated satellite systems. The Knowledge Network of the West and TV Ontario (TVO) are now paying Telesat Canada for service on Anik C-3.

Both Knowledge Network and TVO participated in the Phase One Program and used Phase Two as a bridging vehicle until follow-on commercial 14/12 GHz service became available from Telesat.

(ii) Two projects, one conducted by ACCESS Alberta and the other by CNCP, resulted in the two organization's continuing serious consideration to the introduction of follow-on 14/12 GHz satellite services.

(iii) One project, the Inuit Tapirisat Project resulted in the use by the experimenters of 6/4 GHz satellite service. The ITC project resulted in the creation of the Inuit Broadcasting Corporation, which now uses the 6/4 GHz service of the CBC.

(iv) One of the projects, conducted by the Ontario Ministry of Government Services (OMGS), resulted in the introduction by OMGS of a new teleconferencing service via terrestrial microwave.

(v) The BCTV is now a shareholder of the CANCOM 6/4 GHz distribution system and the BCTV signal is now being picked up by CANCOM. An executive of BCTV informed us that the decision to invest in CANCOM was not influenced by the Program. The effect of the pilot project was to create and demonstrate the demand for BCTV programming in under-served areas.

(vi) Two of the experimenters groups', the CBC and the participants in the Canadian Petroleum Association's (CPA) project, have introduced no new telecommunications services as a result of their projects, and have no immediate plans to do so.

(vii) One of the three aggregated activity experimenters, the Manitoba Telephone System, is now introducing 14/12 GHz satellite service into its operations but the decision to introduce the service was only slightly related to the Phase Two participation.

(viii) Another of the aggregated activities, the Telesat Radio project, resulted in continued support by Telesat to its work in the field of radio distribution by satellite. However, Telesat has decided to pursue this activity in the 6/4 GHz frequency band. The market is believed to be a national one, but the Anik-C footprints are regional.

4.2 **Policy Identification**

(ix) The existing institutional and policy environment was viewed by participants as the major remaining impediment to their acquiring the service benefits of the 14/12 GHz satellite system.

(x) The most frequently cited reason for not introducing services on the 14/12 GHz system was that the costs of the service were seldom justified, even given the improved coverage and quality that experimenters attributed to it. Both the Telesat space segment tariffs and the uplink rental fees were identified as major impediments.

(xi) All participants cited the unwieldy process of having to acquire service via both a telco and Telesat Canada. This process was viewed as increasing the annual operating costs charged for 14/12 GHz service. Petroleum industry and other users of transportable uplinks added that this arrangement increases the time involved in acquiring service for individual sites. The recent change permitting broadcasters to deal directly with Telesat is in the direction desired by participants.

(xii) All of the above issues had been identified earlier in the Anik B Program. While the participants have individually used the results of pilot projects to press for regulatory and institutional changes, DOC has not marshalled the results to effect the necessary changes.

(xiii) The footprint of the Anik C-3 satellite was also identified as a major impediment to the intoduction of certain services. The footprint was a problem for those requiring national coverage (e.g. CBC, Telesat Radio) and for those requiring northern services (e.g. CPA).

4.3 Aggregation

(xiv) Two pilot projects and the Telesat Radio demonstration/experiment yielded significant results on aggregation. However, the aggregated activities, initially

intended to identify possible means for aggregation, made no contribution to this objective.

4.4 Awareness, Expertise and Capabilities in Satellite Technology and Services

(xv) The contributions of the Phase Two projects to this goal are contained in Sections 3.1.3, 3.2.3 and 3.3.3.

4.5 Other Effects

Other Phase Two effects can be found in sections 3.1.5, 3.2.5, 3.3.5 and 3.4.5)

EVALUATION OF PHASE TWO OF THE ANIK-B COMMUNICATIONS PROGRAM
REPORT ON TASK AREA NO. 2: INDUSTRIAL BENEFITS

Submitted to:

Department of Communications
by CPER Management Consulting Inc.

Ottawa
August, 1983

EVALUATION OF PHASE TWO OF THE ANIK-B COMMUNICATIONS PROGRAM
TASK AREA NO. 2: INDUSTRIAL BENEFITS

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EVALUATION OF PHASE TWO OF THE ANIK-B COMMUNICATIONS PROGRAM
TASK AREA NO. 2: INDUSTRIAL BENEFITS

EXECUTIVE SUMMARY

The primary purpose of the Anik-B Communications Program of the DOC was to stimulate the establishment of a 14/12 GHz satellite communications service in Canada to meet needs that had been identified in the earlier HERMES experimental program. In meeting these needs through the new 14/12 GHz service, a range of economic and social goals were to be accomplished. Industrial development objectives were secondary in the Program.

Task No. 1 of this evaluation examined the extent to which the pilot projects and aggregated activities of Phase Two contributed to this primary service development objective.

The purpose of Task No. 2 is to assess the extent to which the secondary DOC objective of establishing a viable Canadian manufacturing industry for the earth segment of 14/12 GHz satellite communication services, has been accomplished as a result of the contracts let by DOC and DSS to industry as part of the Anik-B Communications Program.

The finding of this project is that the set of DOC/DSS product development contracts has not yielded the sought-after viable industry. The following points are noted in the report:

- The largest single market envisaged for 14/12 GHz earth segment products was direct-to-home low-cost TV receivers (LCET's). It is now highly likely that American and other foreign manufacturers will capture the large share of that market in both Canada and the U.S., in some cases using technology developed in Canada as a direct result of the DOC/DSS contracts. Most of the Canadian firms do not have the production or marketing skills to compete in mass markets.

- Seven out of the eleven firms that received development contracts are either out of the satellite communications business entirely, or are not involved in areas related to the contracts.
- Several of the Canadian companies show promise in the field of higher-cost, high-technology products that do not require mass production and distribution skills (eg. 14/12 GHz telephony terminals).

Several factors are identified as contributing to the failure to achieve the objective of a viable earth segment manufacturing industry. They are summarized below.

- The interested parties, such as private companies and including DOC itself, did not actively pursue the major policy changes that were necessary to introduce 14/12 GHz services on a broad basis. Very little effort was expended on ensuring that the various agencies and mandates were agreed on the goal of developing a 14/12 GHz service. The resulting regulatory environment served to inhibit the market. In turn, this lack of market development meant that the industry never really had an opportunity to flourish.

- Satellite services are not marketed aggressively in Canada due, in part, to the marketing agreement between Telesat and the TCTS member companies.

- Many of the companies selected for product development funding were almost totally unaware of what would be required to manufacture and market the products in the large volumes that would be required to compete internationally. These firms would probably not have been able to meet the market even if it had developed as originally envisaged.

However, the individual DOC/DSS industry contracts did generate some direct and spin-off benefits. Although this was not a formal cost-benefit study, the project team estimated the direct and follow-on sales, both for the products developed under the contracts and spin-off products that could be attributed to the original DOC/DSS funding.

In total, about $5.2 millions was contributed to companies by DOC and DSS to both acquire DOC's own test equipment and develop products. This was matched by about $5.7 millions put in by the companies. Total sales to date of both direct and spin-off products is estimated to be $23 millions, generating approximately 300 person-years of employment. Expected future sales and royalties are $27.9 millions per year over the next few years. These estimates must be treated with caution. They are provided for indicative purposes only and are neither time-discounted nor adjusted for inflation. One company accounts for about 50% of the estimated sales.

The companies participating in this evaluation made several suggestions for improving the DOC development funding approach. These suggestions are presented in the report.

1.0 INTRODUCTION

The Anik-B Communications Program of the DOC was a service development program in that its prime purpose was to stimulate the establishment of a 14/12 GHz satellite communications service in Canada. Industrial development objectives were secondary in the Program.

Task No. 1 of this evaluation examined the extent to which the pilot projects and aggregated activities of Phase Two contributed to this service development objective.

The purpose of Task No. 2 is to assess the extent to which the secondary DOC objective of establishing a viable Canadian manufacturing industry for the earth segment of 14/12 GHz satellite communiction services, has been accomplished as a result of the contracts let by DOC to industry as part of the Anik-B Communications Program.

By agreement with DOC, the scope of this Task was limited to contracts for equipment for the earth segment of the Anik-B 14/12 GH_Z communications system. Contracts for the satellite itself and for services to support the operation of the Anik-B communications service were not considered. By examining the manufacturers of equipment required by the users of the Anik-B 14/12 GH_Z communications service, this evaluation complements the evaluation made under Task Area No. 1.

The evaluation was carried out by initially reviewing DOC files on the contracts let to Canadian companies for earth segment equipment and discussing them with DOC program managers and the scientific authorities concerned in order to identify and obtain information on the contracts and the companies to which they were let. A detailed questionnaire was drawn up and sent to the companies, together with a brief description of the contracts, under a letter from DOC. This was followed up with personal or telephone interviews with senior officials of the companies, in which the questions were

discussed. In order to cross check and get different perspectives on the information provided by company officials, selected experts in the field of communications and other interested parties were consulted. The information thus obtained was supplemented by information from the sponsors of pilot projects and experiments who were interviewed under Task Area No. 1.

A copy of the questionnaire used for interviewing company officials is attached as Annex D, while the questionnaire used for consulting experts is attached as Annex E. A list of DOC officials, company officials, experts and other interested parties who were interviewed or consulted during the course of the evaluation is presented in Annex F. AIII annexes are bound separately in Volume 3.

2.0 INDUSTRIAL DEVELOPMENT OBJECTIVE AND FOCUS OF STUDY

The objective of the Department of Communications in contracting with Canadian companies for the development and production of equipment for the Anik-B system, was to establish a viable Canadian manufacturing industry for the earth segment of the 14/12 GH_Z telecommunications services. Accordingly, this evaluation was designed primarily to determine the extent to which this objective was achieved. The study also sought to identify the direct economic benefits resulting from the contracts. However, the evaluation was not intended to be a cost-benefit study, and estimates of economic benefits were to be indicative only.

3.0 THE EARTH SEGMENT

The earth segment of the Anik-B 14/12 GH_Z communications system consisted of the following basic equipment and components:

EQUIPMENT	COMPONENTS
T.V. Transmit/Receive and two-way Telephony Terminal - 9 metre fixed - 3 metre transportable	High Gain Antenna 14 GH_Z High Power Amplifier 14 GH_Z Up Converter T.V. Modem Voice Channel Unit 12 GH_Z Down Converter Low Noise Amplifier (LNA)
T.V. Transmit Only Terminal	High Gain Antenna 14 GH_Z High Power Amplifier 14 GH_Z Up Converter T.V. Modulator
T.V. Receive Only Terminal for Cable T.V. head-end application	Antenna Outdoor Unit Indoor Unit
Low Cost Earth Terminal (LCET)	Antenna Outdoor Unit - Low Noise Amplifier (LNA) - Down Converter - Oscillator Indoor Unit - Down Converter - T.V. Demodulator
Low Cost Telephony Terminals (LCTT)	Antenna 14 GH_Z Up Converter 12 GH_Z Down Converter 14 GH_Z High Power Amplifier 12 GH_Z Low Noise Amplifier (LNA) Voice Channel Unit

4.0 INDUSTRIAL CONTRACTORS

Contracts were let to the following Canadian companies for the development and production of equipment for the earth segment of the Anik-B 14/12 GHz communications system.

Andrew Antenna Company Limited
Gensat Communications Corporation
MA Electronics Canada Limited
Microtel Pacific Research Limited
Miller Communications Systems Limited
Mitel Corporation
Raytheon Canada Limited
SED Systems Inc.
Spar Aerospace Limited
The Wind Turbine Company of Canada
Victrix Limited

A brief description of the contracts is provided in Annex G.

5.0 FORMAT OF REPORT

There are five remaining parts to this report. The results contained in them are arranged in the following logical order:

Part 6	identification of direct and follow-on benefits of the DOC contracts;
Part 7	determination of whether or not the target firms are still in the 14/12 GHz satellite communication business;
Part 8	brief summary of Parts 6 and 7 to give a survey of current status;
Part 9	determination of whether or not the desired end-state of a viable 14/12 GHz earth segment manufacturing industry has been achieved; and
Part 10	anaysis of factors that contributed to the results.

6.0 ECONOMIC BENEFITS

We present in this section indications of the direct and follow-on benefits that can reasonably be attributed to the DOC contracts.

6.1 Introduction

The contracts yielded a variety of economic benefits - direct and indirect, tangible and intangible. These are reported below according to the following categories:

a) Direct Results of Contract
The level and effect of the sales under the project contracts which are over and above the acquisition of the development item; plus the economic benefits from the development contracts themselves;

b) Follow-on Business - Project Products
Level and effects of subsequent sales to date of the items directly developed from the project items.

c) Follow-on Business-Spin-Off Products
Level and effects of sales of equipment developed as a spin-off of the original contracted equipment, or unrelated equipment using a technical process developed under the DOC contract.

In addition, a report is given of the annual sales which are estimated over the next few years for both the project and the spin-off equipment.

In all of these cases the cash values are reported in nominal terms -i.e., not time discounted nor compensated for inflation. As this is not a cost-benefit study, it has been judged that the nominal values can convey a good sense of the resulting industrial benefits.

6.2 Direct Results of Contract

The DOC/DSS contracts totalled about $5.2 millions. The companies put in a further $5.7 millions, 75% of which was contributed by one company.

6.2.1 Value Added Directly by Contract

The project contracts themselves had the effect of creating, in the project firms, on the average, a Value Added of about 65% of the worth of the contracts. (Value Added is used here to mean the Contract Value less the cost of goods and services purchased outside the firm). This average represents a wide range of individual values - ranging from 35% to 85%.

6.2.2 Employment

With this Value Added within the firms, the employment generated was some 40 PY.

6.2.3 Imported Goods and Services

There was not a heavy "leakage" of funds to foreign countries as a result of the contracts; it is estimated that only about 10% of the total worth was expended on imports.

6.2.4 Knowledge Gained

Almost without exception the firms judged that they had acquired valuable technical knowledge. In addition, in many cases considerable knowledge of the related production processes was also acquired. In a few cases, a degree of marketing insight was gained also.

6.2.5 Value to Firm

In about 30% of the firms, the contract noticeably enhanced the value of the firm. This enhancement was estimated in one case to have been worth $2M; it ranged down from there to a value

of $0.5M, and to a qualitative estimate that it had the benefit of clarifying corporate strategy - principally by making the firm starkly aware of its limited ability to compete commercially. The firms themselves commited funds approximately equal to the total DOC contracts.

6.3 Follow-On Business -- Project Products

6.3.1 Subsequent Sales of Project Products

The sales of the products developed under the contracts has been limited - only some $2.6M coming within this category. The large bulk of this (about 90%) is accounted for by two sales in Canada.

6.3.2 Results of Subsequent Sales

The effects of these subsequent sales are estimated to be:

(a) Value Added -$1.9M
(b) Employment at Company - 35 PY
(c) Employment at Subcontractors - 4 PY
(d) Net Revenue - no well-established estimates but judged to be positive
(e) Imports - $140,000

6.4 Follow-On Business -- Spin-Off Products

A much larger commercial result occurred with the spin-offs from the projects; spin-offs which took the form of related products.

6.4.1 Sales of Spin-Off Products

For this category, it is estimated that the sales have been about $19.8M -of which $12M is for one single product.

6.4.2 Results of Spin-Off Sales

The estimated results of these sales are:

(a) Employment - 225 persons continually employed;

(b) Other - the other results paralleled those for the project proper, except that there appears to be a tendency towards somewhat more imports - about 20% (vs the earlier 10%).

6.5 Incrementality

In nine cases (80%), the firms state that they would not have undertaken this work - certainly not for a considerable period of time - without government assistance. In two case, (about 20%), the technical risk was judged to be high; in half of the firms the market/commercial risk was judged to be high. In all of the incremental situations it can be said the financial bases of the companies were so "thin" that they had only a very limited capacity for risk-taking; hence, the high percentage of incremental cases.

7.0 CURRENT STATUS OF FIRMS

7.1 Continuing Involvement in 14/12 GHz Equipment

The current status of the contractors is very mixed concerning their continuing involvement in the area of their individual contracts:

- Only two of the firms (18%) are still continuing with a 14/12 GHz project product;
- a further one (9%) is continuing with a spin-off product;
- still another firm (9%) is continuing with a spin-off product in the sense noted that it is produced with a production process developed under contract;;
- four firms (36%) are still in the satellite communications field, but not in areas closely related to the contracts and more particularly not in the 14/12 GHz technology; and,

- the remaining three firms (28%) are out of the satellite communications business.

7.2 Expected Effects of Involvement

The best estimate of the future sales from this continuing involvement is that the sales over the next few years would be at the rate of:

(a)	Project Products	$ 8.5M/yr
(b)	Spin-Off Products	18.4M/yr
		$26.9M/yr

In addition, payments of $1 million/yr. in royalties are expected by one firm.

8.0 SUMMARY OF BENEFITS AND STATUS

The following remarks are recorded to summarize the foregoing results and to help to set them in perspective:

- The total sales, to date, of all of the projects and spin-off products is estimated to be $23M; which has yielded employment to a level of some 300 PY
- The expected future sales are $26.9M/yr.
- It should be borne in mind, of course, that sales, in themselves, do not guarantee positive economic benefits when aspects such as opportunity cost are considered.
- It must be acknowledged that the confidence limits on these best estimates of results are wide and could, in fact, include economic losses. The estimates are intended to be indicative only.

- Beyond these "harder" economic results, the firms benefitted intangibly in terms of technical production and marketing knowledge; in organizational development; and, in reputation.
- The high Value Added indicates that the contract firms themselves benefitted from the flow of funds; i.e., at the minimum, it could be said the funds flowed to the firms whose capability was to be developed, and were not spread over a number of sub-contractors.
- The bulk of the economic benefits were not from activities directly associated with the contracts; and in some cases, it is not easy to establish the degree of relationship between the spin-off equipment and the original project.
- Few of the firms are still involved in the project products.

9.0 CONTRIBUTIONS TO THE DESIRED END STATE

The end-state which DOC was attempting to bring about through the set of industry contracts was the establishment of viable Canadian manufacturing industry for the earth segment of a 14/12 GHz satellite communication service.

The fact that the bulk of the firms are not now producing the intended 14/12 GHz earth segment equipment, coupled with the firms' admissions of their inability to compete internationally, make it clear that the desired viable maufacturing industry has not materialized. Further, there is no evidence to suggest that this situation will change in the near future.

Two points must be kept in mind in interpreting this result:

(i) although the above conclusion is true for low-cost 14/12 GHz earth equipment for a high-volume DBS market, there are several Canadian companies which show promise in the field of higher-cost, high-technology products that do not require mass production and distribution skills (eg. 14/12 GHz telephony terminals); and,

(ii) a number of the firms have a residual potential for responding over time to a demand for 14/12 GHz equipment, should that demand materialize and should market conditions help to overcome the lack of competitiveness, eg. with the use of off-sets for Canadian industry.

10.0 ANALYSIS OF EVALUATION RESULTS

10.1 Original Factors and Assumptions

In the next few paragraphs we present some of the key factors and assumptions that were considered by DOC managers in planning the industrial benefits at the outset of the Anik-B Communications program. These factors and related assumptions form a type of check-list against which to set the immediately following discussion of the causal factors in the evaluation results.

The prime thrust of the Program clearly was to establish the 14/12 GH_z communication service, largely through the pilot projects. Industrial benefits were secondary.

The expectations of the industrial benefits were conditioned by the following factors, some of which were explicit, others of which were tacit.

- Canada was seen as having a very strong lead in 14/12 GHz technology;
- The most important goal of the program should be to build on this lead to establish technological success and to create market demand by demonstrating this success; and to demonstrate the advantageous characteristics of this technology through the pilot projects;

- The companies involved were commercial entities which, in general, could solve their own business (financial, marketing, production) problems and thereby become competitive - certainly in Canada and probably internationally - thus, enabling them to take advantage of the markets created;
- The market potential was there. In Canada, the need for telecommunications to Canada's remote areas and/or the demand for a rich variety of TV in the uncabled areas was expected to yield a market of several hundred thousands;
- A similar market was seen in a number of foreign countries with physical characteristics similar to Canada's (e.g., Australia, Brazil);
- The 14/12 GHz band was seen as being an incipient chosen instrument of the Canadian Government;
- As such, problems identified in the regulatory area or related to government agencies such as Telesat would be resolved to facilitate market development.

The causal factors for the results which have been identified in this evaluation can now be examined against this original perception.

10.2 Causal Factors

10.2.1 Regulatory Environment

There was a very strong concensus among those interviewed that the present regulatory environment in Canada limits competition and is not conducive to the development of satellite communication services and therefore to the development of a Canadian communications satellite manufacturing industry. The regulations that were cited as the major impediments were those that prevented end users, other than broadcasters, from owning and operating up links, and

leasing satellite service from Telesat. In addition, the regulations that prevent anyone other than Telesat from dealing directly with foreign statellite operators was seen as impeding the development of satellite communication services between Canada and other countries, in particular the United States. It was noted, in this regard that in the United States, communications are largely unregulated, and satellite communications have developed much faster than in Canada.

It appeared to some of those interviewed that the policies of the government and the regulatory agencies were often in direct conflict with the basic objectives of the Anik-B communications program, thwarting the efforts to promote services in the 14/12 GH_Z band. The decision to allow CANCOM to operate in the 6/4 GH_Z band was cited most frequently as an example of this.

10.2.2 Institutional Environment

The regulations have led to an institutional structure that was also seen as impeding the development of satellite communication services in Canada. Since Telesat is not allowed to market its satellite communications services directly to end users other than broadcasters, the telephone companies and CNCP have a virtual monopoly. However, they have large investments in terrestrial communication systems, so that the resulting economics appear to offer little incentive to promote satellite communication services or offer them at competitive rates because, as one person interviewed put it, "they would be just competing against themselves".

Telesat was thought by one interviewee to have a conflict of interest by virtue of its control over cross-border satellite communications with the United States, while it is, at the same time, a member of TCTS.

10.2.3 Market for 14/12 GHz Communication Services

It is evident from the results of the evaluation that the market for 14/12 GHz communication service has not developed as had been anticipated. This is due, in part, to the regulatory and institutional environment discussed above, and to competition from other modes of communications, such as microwave and landline, in which the service providers (i.e., the telephone companies and CNCP) have large investments to protect. The CRTC's decision to permit CANCOM to operate at 6/4 GHz was seen by many as a major setback to the development of 14/12 GH_Z service in Canada.

However, there are other reasons why satellite communication services have been slower to develop than anticipated. The data explosion which was expected to result in a very large demand for satellite communications has not occurred. Voice communications still account for a high percentage of the traffic. Despite the growing use of 14/12 GHz satellite communications for television, in particular pay T.V., most of the programming is being distributed by the cable T.V. companies.

Direct-to-home television boradcasting (DBS) at 14/12 GHz together with the large market that it would create for low-cost earth terminals, which Anik-B was expected to promote, has not materialized on a large scale to date. Although DBS will probably develop in due course in the United States, it will not necessarily develop at the same time in Canada, because of the high percentage of homes in Canada that are now served by cable.

10.2.4 Market for 14/12 GHz Earth Segment Equipment

Since the market for 14/12 GHz satellite communications services has not developed, it is not surprising that the market for 14/12 GHz earth segment equipment has not developed as expected either. The market for TVRO terminals for cable head-end applications is relatively small and is therefore easily saturated. Since it is fairly simple to manufacture TVRO terminals and does not require a large investment, there are many firms that can produce them.

There is potentially a big market for low-cost earth terminals when direct-to-home broadcasting develops. However, as indicated above, most of this market is expected to be initially in the United States. It will be large, but it will also be very competitive. Without the requisite mass production and marketing skills, most Canadian manufacturers are highly unlikely to achieve any part of this market.

10.2.5 DOC Industrial Development Policies and Programs

Without exception, contractors were very appreciative of the cooperation and assistance they had received from the Department of Communications. However, there were a number of suggestions made on how the Department might have made better use of industry and, in turn, contributed more to its development.

Several contractors thought that CRC should have concentrated on scientific research and left the development and production of equipment to industry, rather than building earth terminals and other equipment in its laboratories. In taking this approach, it was suggested that DOC should contract for complete items of equipment, rather than components.

Some contractors criticized DOC for placing contracts for the development of equipment with companies which, although technically competent, were not capable of manufacturing and marketing the equipment competitively in domestic and export markets. DOC's practice of contracting with two or more companies to develop equipment for the same requirement was seen by some as a waste of resources which simply led to useless competition, particularly if some of the companies did not have the production or marketing skills and resources to exploit the results.

10.2.6 Industrial Capability

In general, contractors appear to have been selected for their technical ability to develop the equipment required, which most of them demonstrated they had. However, with few exceptions, they have not been able to exploit the development lead that the Anik-B program gave them. There were two fundamental reasons for this:

1) Many of the contractors simply did not have the knowledge, experience or resources required to manufacture and market the equipment they developed, in particular equipment which had to be mass produced in order to achieve the economies of scale and compete with manufacturers in the United States and Japan. These companies would not have been able to supply the market for such equipment even if it had developed as had been anticipated. As a result of their experience on the program most of these companies have decided to concentrate in future on the market for expensive high quality equipment and leave the highly competitive market for inexpensive, mass-produced equipment to

others. Some are even thinking of confining their activities to product research and development and licensing other companies to exploit the results.

2) When the market for 14/12 GH_Z communications services did not develop as quickly as expected, contractors lost their technical lead over manufacturers in other countries.

10.3 Synthesis of Factors

The DOC project execution was faithful to the view that the critical aim was to establish a communication service, with the development of a manufacturing industry base as a secondary goal.

One of the unfortunate effects of this approach, from the point of view of industrial development - which is admittedly not identical with the overall program perspective - is that the industrial development goal was not pursued throughout the Canadian Government and its agencies in a coherent, well-considered fashion.

It was not coherent in that various agencies followed, or were required to follow, aims which were at cross-purposes to the industrial aim.

It was not well-considered in that firms were not chosen, even individually, much less as a group, with an eye on their ability to compete under the competitive market conditions which were bound to exist.

As noted, these observations are made from the (narrow) perspective of industrial development and not from that of the program as a whole, nor clearly from the even broader standpoints of the Government.

Nevertheless, to the degree that industrial development is an important goal, there are certain lessons which are almost the mirror image of the above points:

- All of the agencies and mandates should be "on side", and where the goal is to be compromised, then compensating action should be taken;
- Industrial development depends critically on production and marketing capabilities, the existence or the potential for these should be key criteria for the selection of firms;
- In a country of Canada's size, the development of a "chosen instrument" for at least the launching of the technology/service, should be considered. In any case, the choice of one prime contractor, who would be in a strong position to make the commercial judgement regarding associated or sub-contract firms, could very well be an appropriate approach;
- It is well known that the transfer of technology from the laboratory to the commercial market place is a tricky operation. This becomes even more so when the transfer is compounded by a government to industry displacement. Perhaps more care should be given to this aspect in future. It may be that the shift from CRC should take place at an earlier stage.