FINAL REPORT - TASK 1. MARKET SURVEY

MARKET RESEARCH AND PROTOTYPE DEVELOPMENT OF A DEVICE TO ALLOW TRANSMISSION OF MULTIPLE LOW RATE DIGITAL VOICE SIGNALS VIA SATELLITE

DSS FILE: 06ST.36001-3-1130
CONTRACT NO: 0ST83-00291

SPAR

DOC-CR-SP-84-027

FINAL REPORT - TASK 1. MARKET SURVEY

MARKET RESEARCH AND PROTOTYPE DEVELOPMENT OF A DEVICE TO ALLOW TRANSMISSION OF MULTIPLE LOW RATE DIGITAL VOICE SIGNALS VIA SATELLITE

DSS FILE: 06ST.36001-3-1130
CONTRACT NO: OST83-00291

Prepared for: Department of Communications
Communications Research Center
Shirley Bay
Ottawa, Ontario

Prepared by: Spar Aerospace Limited
Ste Anne de Bellevue, Quebec

Date: June 1984 Project: 1502-H

Project Engineer: _____

Project Manager: _____

Spar Aerospace Limited
21025 Trans-Canada Highway
Ste-Anne-de-Bellevue, Quebec
Canada H9X 3R2

Phone (514) 457-2150

DEPARTMENT OF COMMUNICATIONS

COMMUNICATIONS RESEARCH CENTRE

RELEASABLE

DOC-CR-SP-84-027

ORIGINAL DOCUMENT: REVIEW AND PUBLICATION RECORD

SECTOR	BRANCH	DATE
DGSTA	DSS	1984

PURPOSE This form is for use during review of the DOC-CR contractor reports. It is designed to: record decisions for classification, record reasons for classification and cautionary marking; provide for indexing requirements.

INSTRUCTIONS * 1 copy of the completed form must accompany the contractor report package submitted to the CRC Library.

* Complete the following items as applicable.

1. DOC-CR NO.	2. DSS CONTRACT NO.
DOC-CR-SP-84-027	36001-3-1130

3. TITLE:	4. DATE
Market research and prototype development of a device to allow transmission of multiple low rate digital voice signals via satellite. v.1--Final report - Task 1: Market survey.	June 1984

5. CONTRACTOR

Spar Aerospace Ltd.

6. SCIENTIFIC AUTHORITY	7. LOCATION	8. TEL. NO.
B. Bryden	DSS/CRC	998-2515

9. CONTRACTOR REPORT CLASSIFICATION:

RELEASABLE [XXX] CONDITIONALLY RELEASABLE [ ] NON-RELEASABLE [ ]

* REASONS FOR CLASSIFICATION:

10. NO. OF COPIES SUBMITTED TO LIBRARY:

EXECUTIVE SUMMARY [ ] FINAL REPORT [XXX] 3 copies

.....

Scientific Authority's Signature

.....

Date

This form is not official therefore it is not signed.

FINAL REPORT

TASK 1. MARKET SURVEY

TABLE OF CONTENTS

Communications
Systems
Division

21025 Trans-Canada Highway
Ste-Anne-de-Bellevue, Quebec H9X 3R2
Telephone: (514) 457-2150
Night: (514) 457-9856
Telex: 05-822792

SPAR

VIA COURIER

SPAR FILE: 1502-H GEN.1

14 May 1984

Supply and Services Canada
Science and Professional Services
Directorate, 11C1 Place du Portage
Phase III, 11 Laurier Street
Hull, Quebec
K1A 0S5

Attention: Mr. Grant W. Reader
Science Procurement Officer

Reference: DSS File 06ST.36001-3-1130
Contract Serial No. OST83-00291
Spar Project No. 1502-H

Subject: Market Survey of Multiple 2.4 Kbs Voice Digitization System for Prospective Application to Single Channel per Carrier Voice Channel Units of Satellite Earth Stations

Dear Mr. Reader,

Monthly Letter Report No. 3 (dated May 7, 1984 and revised May 14, 1984), covering summary of Contract activities for the month of April, reported that no essential market exists for the type of digital multiplexer referenced in the Contract. Furthermore, the report concluded that no substantial market was foreseen for any Multiple Vocoder System employing 2.4 Kbs voice digitization for application to any telecommunications system; Satellite, Microwave, Cable or Landline.

The May 7th draft issue of Monthly Letter Report No. 3 was reviewed at the request of Spar, with Mr. Bryden of Scientific Authority at Communications Research Center on Friday, May 11th. Mr. J.A. Collins represented Spar at this meeting. Mr. Bryden stated at the meeting that the market survey work was completed to the full satisfaction of the Scientific Authority, notwithstanding that the results were not quite what was originally expected, and that there was no necessity for Spar to undertake further survey of the market place nor to give further substantiation to the conclusions already reported by Spar. Spar agreed to undertake no further work other than to incorporate requested revisions in a final issue of Letter Report No. 3 and prepare a summary of the conclusions of the Market Survey. It was further agreed that Task 2 of the Contract covering the development of a digital multiplexer was not required as a result of the market survey results and accordingly the Scientific Authority would process instructions to you to arrange termination of the Contract.

...../2

In accordance with the agreements of the above referenced meeting, Spar has concluded all work against the Contract as of Tuesday, May 15th. Expenditures of Task 1, the Market Survey, will be less than 75% of the estimated Contract value for Task 1; no costs have been incurred, of course, on Task 2 covering the development phase. Spar will shortly submit its final progress payment claim covering the work in the first two weeks in May or when you so instruct us to do so.

Spar is pleased to present the following general summary of the major factors that contribute to the conclusion of a very limited to no market for a Multiple Voice Digitization System using 2.4 Kbs vocoders. Specifically the Contract requirements for Task 1 Market Survey covered a Multiple Voice Digitization System that would combine four 2.4 Kbs vocoders into a 9.6 Kbs data stream for use within the data handling capabilities of Single Channel per Carrier Voice Channel Unit of an earth station. This conclusion was reached as a result of Spar's market survey contact with four major users of SCPC FM voice channel units; Entel of Argentina, Embratel of Brazil, Mexican government authorities associated with the SatMex domestic satellite system, and Pacific Power & Light Company who own and operate the Alascom Satellite Communications System. The following major reasons support the disinterest of these agencies in considering the application of narrow band voice digitization in their telecommunications system: -

a) they are not amenable to any reduction from toll quality service

b) they are not motivated, in absence of competitive forces, to reduce costs to their major clients with subsequent reduction in revenues

c) the VOX advantage of 3.6 to 4 dB is lost with a multiple vocoding system and this reduces the X4 cost advantage by a factor approaching 2

d) there is not a critical bandwidth restriction at the present time of the user agencies, using either the leased Intelsat space segment or a domestically owned one, to impel them towards bandwidth conservation measures particularly if they carry the penalty of reduction from toll quality (e.g., in Brazil).

e) most of the domestic satellite operating agencies using SCPC-FM Voice Channel Units (e.g., Brazil, Indonesia, Alascom, who operate their own space segment, and Argentina, Colombia, Peru, Nigeria, Algeria, Sudan, Saudi Arabia and other nations who have an Intelsat leased space segment) have an HPA in their existing earth stations that will accommodate the addition of extra channel units to fulfill traffic growth requirements and this approach is more cost effective than one of multiple PELPC vocoders and does not entail degradation from toll quality service.

...../3

In addition to the market survey addressed to Single Channel per Carrier FM Systems as reported above, Spar investigated potential market applications of multiple narrow band voice digitization in telecommunications systems employing microwave radio relay, landline and cable, and all digital satellite earth stations. This also brought out the conclusion that there was a limited market for any multiple narrow band voice digitization system. The prime reason for this is that the multiple vocoder by the very nature of the adjective 'multiple', has its widest application when connected into the Switched Telephone Network rather than operating as a 'private' telephone network and any wide scale integration into the switched network is not only extremely awkward in respect to interface with the vocoders but also the quality is below toll quality standards using the standard carbon microphone handsets rather than the special linear microphones that optimize the voice quality of 2.4 voice digitization.

A potential market for a multiple vocoder system was investigated covering voice communications between North American cities and to up to 21 oil drilling platforms in the Hibernia oil fields off the coast of Nova Scotia and Newfoundland. The vocoder system would adapt to a 1-watt K-band transmit/receive earth station having a 2.5 meter antenna with the object of providing a minimum of 2 and up to 4 voice circuits instead of only one as could be provided by such a 1-watt station without vocoding. However, user agencies (Shell Oil, Maritime Tel & Tel, and Newfoundland Telephone Company) were less amenable to this approach which has voice quality below toll standards than one in which a 4 watt solid state power amplifier would replace the 1 watt one and permit two toll quality voice circuits to be used instead of one.

Full details of information in support of the market conclusions referenced above is given in the revision to Monthly Letter Report No. 3 covering activities for the month of April.

We trust that we will shortly be in receipt of a Contract amendment that will terminate the subject Contract for any work beyond May 15th with the understanding that the Contract requirements have been fully discharged by Spar Aerospace Limited to the full satisfaction of the Scientific Authority.

Yours very truly,

A.J. Mercik
Manager Contracts
Communications Systems Division

CC: Mr. R Bryden, Scien Authority (with Attachment)

MONTHLY LETTER
REPORT No. 3
covering period
month of April
&
FINAL REPORT

MARKET RESEARCH
OF
MULTIPLE VOCODER SYSTEM

USING NARROW BAND

VOICE DIGITIZATION

DSS Contract OST-36001-3-1130

Serial OST83-00291

Submitted to

Communications Research Centre, Ottawa
Attention:- Brian Bryden
and
Department of Supply and Services, Hull
Attention:-Dr.Grant Roader

Spar Aerospace Limited
Communications Systems Division
21025 Trans Canada Highway
Ste Anne de Bellevue, P.Q.
H9X 3R2

Spar Project 1502-H

Rev.0 May 7, 1984
Rev.1 May 14, 1984

SPAR

CONTENTS

1. SUMMARY OF COSTS INCURRED

Costs incurred on the Multiple Vocoder Market Survey Program including G&A expenses, during the month of April '84 were $10,200.93 as detailed in the table below or approximately $11,244 at the sales level including fee and Canadian Value Added (CVA).

The total costs incurred to the end of April were 55% of the amount scheduled in the Spar Travel Plan for the program submitted on February 29, 1984, this percentage being due primarily to the delayed April 9 delivery to Spar of the Demonstration Vocoders for use in the Market Survey.

The following table summarizes the expenses attendant with Spar's Invoice #3 covering the month of April and the previous two invoices covering February and March work:-

	Invoices #1&2 Progress Report 1&2	Invoice #3 Progress Report 3	Total to April 30 incl.	Spar Travel Plan of Feb. 29/84
Period	Jan30-MBr31	Apr2-Apr30	Jan30-Apr30	Jan30-Apr30
Week Number	1-9 incl.	10-13 incl.	1-13 incl.	1-13 incl.
Days Worked	25 1/2	20	45 1/2	63
Direct Labour Cost @ $300/day	$7650	$6000	$13650	$18900
Documentation Cost	$400	$35	$435	$800
Travel/Living Cost	$1389.87	$2889.08	$4228.95	$14250
Total Direct Cost	$9389.87	$8924.08	$18313.95	$33950
Total incl G&A	$11904.76	$10200.93	$21243.69	$38204
Total, Sales Level	$12172	$11244	$23416	$42108

Notes:- In view of the fact that this report, originally prepared expressly to cover activities for the month of April only, is now a Final Report following the May 11 decision of the Scientific Authority to terminate the contract because of the lack of market potential for Multiple Vocoders, it is necessary to state the additional expenditures registered in the month of May up to and including May 15 when all Spar direct expenses on the contract ceased. This information is as follows:-

	Month of May	Total to May 15
Direct Labour Cost	$5,400.00	$19,050.00
Travel & Living Costs	$ 725.55	$ 5,389.50
Total Direct Costs	$6,125.55	$24,439.50

2. DEMONSTRATION UNITS OF THE 2.4 KBS VOCODERS

Spar took delivery of two (2) demonstration models of the PELPC Vocoders from Dr. Brian Bryden at Communications Research Centre, Ottawa, on Monday, April 9.

3. SUMMARY OF VISITS MADE PRIOR TO APRIL WITHOUT THE USE OF THE DEMONSTATION VOCODER UNITS

1)	ENTEL, Buenos Aries, Argintina	These 4 visits made use of hard copy of 16-page VU-graph Spar presentation material prepared on multiple vocoder system
2)	EMBRATEL, Rio de Janeiro, Brazil	
3)	PEMEX, Mexico City, Mexico	
4)	CPIC/RCMP, Ottawa	
5)	The Energy Telecommunications & Electrical Association (ENTELEC) Annual Conference, Housten, Texas, March 12 to 15 at which representatives of the following companies participated in the listening tests:- GTE Geo/Sat Comm Halliburton Services Harris Corporation M/A-Com Scientific Atlanta Petroleum Communications, Inc. Pacific Gas and Electric Company	Made use of long distance listening test of 2.4 Kbs vocoded conversations from Dr. Bryden and his Lab staff with standard telephone handsets carbon mikes) at each end.

4. SUMMARY OF VISITS MADE DURING MONTH OF APRIL AND 1ST 2 DAYS OF MAY

	Date	Day	Company or Agency	Purpose
a)	April 10	Tuesday	Communications Systems Division of Spar	Presentation, Demonstration & Discussion
b)	April 11	Wed	Maritime Telephone & Telegraph, and Newfoundland Telephone Company	"
c)	April 12	Thurs	CRC	Repair of short cct.
d)	April 18	Wed.	Telesat	Presentation, demonstration and discussion
e)	April 19	Thurs	CRC	Operational check of demo units
f)	April 24	Tues	Western Union, Upper Saddle River, N.J.	Presentation, demonstration, and discussion
g)	April 25	Wed	RCA Americom, Princeton, N.J.	"
h)	April 25	Wed	RCA Astro Electronics Hightstown, N.J.	Discussions
i)	April 30	Mon	Government Telephone Agency, DOC, Ottawa	Presentation, demonstration and discussions.

j)	April 30	Mon	L.H. Lee, President, Comdat Telecommunications Inc., Ottawa	Presentation, demonstration and discussion
k)	May 1	Tues	Tempest Security Integrators Inc.	Discussions and demonstration
l)	May 1	Tues	Dept of National Defence	Preliminary discussions & demo.
m)	May 2	Wed	Satellite and Aerospace Systems Division of Spar	Presentation, demonstration and discussions.

5. PLANNED VISITS DURING THE MONTH OF MAY

(prior to decision to terminate the project because no further information was required to support the conclusions made by Spar in Letter Report #3)

a) Quebec Hydro, Montreal
b) Teleglobe Canada, Montreal
c) CNCP Telecommunications, Toronto
d) Northwest Telephone, Toronto
e) Terra Nova Communications, Toronto
f) AEL Microtel, Vancouver
g) Shell Oil, Calgary
h) Dome Petroleum, Calgary

6. SUMMARY OF CONTACTS MADE (by telephone or in person) DURING APRIL FOR MARKET SURVEY INFORMATION GATHERING, ASIDE FROM PRESENTATIONS/DEMONSTRATIONS

a) Dr.Peter Kabal, McGill University
b) Llyod Kubis, Advanced Development, Motorola
c) Dr.Peter Lawrence, President, Tempest Security Integrators, Ottawa, and former Canadian representative for Time and Space Processing Inc.
d) Robert H. Robinson, Vice President, Marketing, Time and Space Processing Inc., Santa Clara, California.
e) Robert L. Toellner, Halliburton Services, Duncan, Oklahoma
f) T.F.Degnan, Business Development Manager, Geo/Sat Comm, Houston, Texas
g) Robt. Ball, Canadian Police Information Centre, RCMP
h) Don Terrant and Y. Magalios, Newfoundland Telephone Company
i) W.F.Barrett and B.A.Mukhida, Maritime Tel & Tel
j) John Livingstone, Western Union, New Jersey
k) Dr.H.J. Moody and L.A.Keyes, Satellite and Aerospace Systems Division, Spar Aerospace Limited
l) John Barkwith, Communications Systems Division, Spar.

7. SEQUENCE, FORM, AND SUBSTANCE OF PRESENTATION/DEMONSTRATION BEFORE COMPANIES AND AGENCIES

7.1 Introduction

Introductory remarks of 1/4 to 1/2 hour duration, depending upon the audience, were given prior to the VU-graph presentation and the vocoder demonstration, covering the following topics:-

a) Purpose of Presentation/Demonstration
--specifically a market survey on application of multiple 2.4 Kbs vocoder (x4), as developed by CRC/DOC, with the aim of defining the specification and the market requirements for the digital multiplexer element of the multiple vocoder system.

b) Highlight history of 2.4 Kbs Vocoders in the USA
--2.4 kbs vocoders have been marketed for past 7 years
--major suppliers (Time & Space Processing, and Centagram Corp.)
--major users (military and security agencies of the govt.)
--degree of "muxing" for a multiple vocoding system (very little, primarily single dedicated voice circuits)
--special linear microphone and quality earpiece built into standard telephone handset to promote appreciable enhancement in voice quality as compared to dynamic or carbon microphone and regular telephone earpiece
--very little application to long haul leased dedicated circuits as a measure to provide more voice channels by multiple vocoding and accordingly a reduction in voice channel costs

c) Major Advantages of 2.4 Kbs Voice Digitization Relative to that at 4.8 and 9.6 Kbs
--component count, complexity and cost of vocoders at 2.4 and 9.6 Kbs is in the order of one half of that which is expected of a Multi-pulse 4.8 Kbs vocoder when it is developed
--less bandwidth
--greatter availability
--2.4 Kbs vocoders can provide full duplex operation over unlimited distance with 100 % of dialed-up customers using QAM modems whereas with 9.6 Kbs voice digitization this percentage is approximately 50 % and would be appreciably less than 100 % with a 4.8 Kbs system

d) Major Advantages of 2.4 Kbs PELPC vocoding relative to ACSSB and NBFM systems
--least bandwidth
--least power requirements
--higher equipment reliability

e) Major reputed advantages of CRC-developed PELPC 2.4 Kbs vocoders relative to that of other designs
--improved voice quality and much less cost due to concerted research/development activity over the past 4 years aimed at application to the MSAT satellite system and involving advanced approaches to development of algorithms and making use of latest available chip devices.

f) Prospects for Voice Quality Improvements in 2.4 Kbs Vocoding
--incremental over the next two years according to Brian Bryden of CRC and 4.8 Kbs multi-pulse vocoding may approach toll quality in that time.

7.2 Listening Test Through a Portable Tape Recorder of CRC Test Tape of 2.4 Kbs PELPC Vocoding using Linear Microphone Input

This tape was played to give the audience an initial indication of the quality of the 2.4 Kbs vocoder as developed by CRC in advance of the VU-graph presentation and a talk test through vocoders using dynamic and carbon microphones. The recording covered male and female voices of:-

--2.4 Kbs vocoding representative of that provided by demo units
--4.8 Kbs vocoding using same vocoder hardware except for memory
--4.8 Kbs vocoding using a newly developed CRC algorithm and in in which the reproduction was a simulation from CRC's VAX computer
--reference voice recording without the use of vocoders

7.3 VU-Graph Presentation

A VU-graph presentation consisting of 16 charts, as previously submitted to the Design Authority, was made to foster a clear understanding of the multiple vocoder system and potential applications to leased lines and to satellite earth stations using SCPC FM and Delta Mod Voice Channel Units and to all-digital stations having 56 Kbs digital input. This part of the presentation brought forward free flowing disccussions.

7.4 Demonstration Using Demonstration Vocoder Units

a) The first demonstration consisted of playing a CRC "clean" tape (i.e. without vocoding) through the portable tape recorder and then through the two vocoders. This demonstration clearly showed the degradation in received quality of the standard earpiece in the telephone handset to that of the small speaker in the portable recorder.

b) The second vocoder demonstration consisted of playing a tape prepared by Messrs Collins and Hall of Spar through the portable recorder and in which a dynamic and then a carbon microphone was used. This test clearly demonstrated the degree of quality enhancement provided by the linear microphone used in the CRC demonstration tape. This tape also had a recording in a noisy environment in an effort to simulate the noise on an oil platform, and a test with multi folds of a hankerchief over the mouthpiece to attenuate the "puff-puff" breath sounds. This recording provided a simulation of the degree of voice quality that might be expected by used of the vocoders in the Telephone Switched Network.

c) The third vocoder demonstration consisted of a talk test by members of the audience through the vocoders as spaced apart into separate rooms using successively CRC-supplied dynamic microhones and standard telephone handset carbon microphones. This test gave a further indicatiion of the voice quality that might be expected through the Switched Telephone Network in which standard telephone handsets would be used.

8. SUMMARY OF REACTIONS TO THE PRESENTATIONS & DEMONSTRATIONS

8.1 to the CRC Test Tape played prior to the VU-graph presentation

--a spokesman for the commercial mobile radio operating systems (Mr. Larry Lee, president of Comdat Teleommunications Inc. of Ottawa) declared the quality of the 2.4 Kbs recording "quite acceptable".

--telephone company representatives from GTE, NTC, MTT, NU, and RCA Americom stated that the 2.4 Kbs quality was not up to the toll requirements of the STN. They volunteered that this quality might be competitive with the "2 kHz" analogue voice circuits used on some trans-Atlantic services where bandwidth is at a premium

--MTT and NTC representatives, in considering the 2.4 Kbs quality of service for multiple vocoding between Hibernia oil platforms and the STN, stated the voice quality was "quite acceptable" for this type of service and expressed the hope that it could be retained using standard telephone handsets as distinct from the special conditioning associated with a linear type microphone.

8.2 to the CRC "clean tape recording" (recorded using a linear microphone with no vocoding applied) played through the two vocoders and received on a standard telephone handset.

--as mentioned in Section 7.4 a) this test showed the quality degradation from the small speaker in the portable tape recorder to that of the earpiece in the telephone handset

--the mobile radio spokesman stated this quality would generally be "unacceptable"

--representatives of Geo/SAT Comm and Halliburton Services of the "oil patch" community stated that this quality would be "acceptable" if it could be sustained through the STN.

--representatives of MTT (Bill Barrett and Badru Mukhida et al) and Newfoundland Telephone (Don Terrant and Y.Magalios) stated that this voice quality was "acceptable" for application to a minimum of 2 and a maximimum of 4 voice circuits on a 56 Kbs all-digital, 1-watt K-band Sparcom type earth station using a solid state PA as provisionally planned for operation in the Hibernia oil field for communications into the North American switched telephone network.

8.3 to the Spar-prepared tape recording of communications through the vocoders using CRC-supplied telephone handsets having dynamic and carbon microphones

--"unacceptable" to the spokesman for the mobile operators

--"tolerable voice quality and intelligability" to MTT and NTC representatives as a trade-off for the provision of two or four 2.4 vocoded voice circuits through a 1-watt K-band earth station against one only toll quality circuit without any vocoding in their planned communications between the Hibernia oil platforms and the STN

--"unimpressive, marginally acceptable" to representatives of Shell Oil Company to whom MTT played the best portions of this tape in which the volume was turned down to reduce the distortion

--MTT and NTC engineers considered they would be better served for their planned Hibernia telecommunications system by waiting for Spar to come up with a 4-watt solid state K-band earth station that would accommodate two toll quality voice circuits. Until such an HPA becomes available they may well be content to restrict their communications between the oil platforms and the STN to one only voice circuit.

Note:- This talk test through the two demo vocoders was ranked equivalent in subjective quality to the tests conducted in March during Spar's attendance at an energy telecommuniscaations conference in Houston, Texas in which long distance calls were made from Houston to Brian Bryden at CRC in which he was connected into the STN via two 2.4 Kbs vocoder in tandem and using a carbon microphone.

8.4 to the audience talk test through the two vocoders using CRC-supplied telephone handsets (dynamic and carbon microphones)

--same comments as noted in Section 8.3 at the bottom of page 6

8.5 to the voice quality improvement represented by the simulated recording of the new CRC 4.8 Kbs algorithm relative to the recording of the 2.4 Kbs vocoding

---

--all listeners canvassed during April remarked on the very distinctive quality improvement, and stated that if this quality could be realized in "hardware" their reactions for prospective applications, for single channel operation as well as multiple vocoding, may be modified from that referenced above pertaining to the 2.4 Kbs vocoding.

--generally speaking the companies and agencies canvassed were more sensitive to the "quality" comparison aspects of the 2.4 and 4.8 Kbs vocoders rather than those of "price". This was highlighted by MTT and NTC in their considerations of multiple vocoding on K-band satellite links to up to 21 oil platforms in the Hibernia oil fields. Their main concern was to get at least four "good as possible" voice circuits through a 1-watt, all-digital 56 Kbs earth station notwithstanding cost of the type of vocoding.

8.6 to the VU-graph presentation describing prospective applications for a multiple 2.4 Kbs vocoding system

---

--audiences uniformily stated the VU-graph presentation, together with the Spar introductory remarks, gave them a clear appreciation of the prospective application of vocoders in a multiple vocoding system

8.7 prospective application of a X4 multiple 2.4 Kbs vocoding system to earth stations having SCPC-FM Voice Channel Units

--as a result of discussions with Entel of Argentina, Embratel of Brazil, and with SatMex authorities in Mexico, Spar has provisionally concluded, subject to discussions with Alascom satellite communications personnel, that there is little interest in this application for the following reasons as previously referenced in Monthly Letter Report No. 2:-

a) not amenable to any reduction from toll quality service
b) not motivated, in absence of competitive forces, to reduce costs to their major clients with subsequent reduction in revenues
c) the VOX advantage of 3.6 to 4 dB is lost with a multiple vocoding system and this reduces the X4 cost advantage by a factor approaching 2
d) there is not a critical bandwidth restriction at the present time of the user agencies, using either the leased Intelsat space segment or a domestically owned one, to impel them towards bandwidth conservation measures particularly if they carry the penelty of reduction from toll quality.(e.g. in Brazil).
e) most of the domestic satellite operating agencies using SCPC-FM Voice Channel Units (Brazil, Indonesia, Alascom) have an HPA in their existing earth stations that will accommodate the addition of extra channel units to fulfill traffic growth requirements and this approach is more cost effective than one of multiple PELPC vocoders and does not entail degradation from toll quality service.

9. PROSPECTIVE APPLICATIONS OF 2.4/4.8 VOICE DIGITIZATION ARISING FROM SPAR PRESENTATIONS/DEMONSTATIONS MADE TO THE END OF APRIL, 1984

9.1 General

Adaptation of narrow band voice digitization into telecommunications systems, using either single or multi channel vocoding, is driven by five major market requirement trends as listed below. It is significant that single channel rather than multi channel vocoding is more applicable in fulfilling most of these market trends.

a) system simplifications and economies associated with compatibility with digital systems
--the telephone industry is consistently promoting the orderly trend towards a total digital switched network accommodating both telephone and data. 32 Kbs will supercede the current 64 Kbs within 3 years in the major traffic routess of North America following the orderly resolution of system interface problems associated with the change and this in turn will be superceded by a 16 Kbs system during the 1990 decade subject to its acceptance in light of competing technologies at that time--e.g fibre optics

b) efficient channel utilization and bandwidth reduction
--e.g. the MSAT satellite planning makes use of 2.4 Kbs PELPC vocoding as the means to achieve 5 kHz channel spacing and thus 800 voice channels in the allocated 4 MHz spectrum slot

c) message storage and retrieval
--e.g. the electronic "mail box" to provide community telephone message storage and retrieval capability equivalent to that provided by private telephone answering machines with appreciable savings using say 2.4 Kbs vocoding relative to that of 64 Kbs or an analogue scheme and wherein reduction from toll quality would be quite acceptable.

d) security/encryption
--voice digitization, particularly using 2.4 Kbs PELPC, fulfills this market trend using an economical ($350) D/A modem for application to an unconditioned telephone line and with the addition of an economical digital encryption device to provide effective security of transmission.

e) integrated voice/data telecommunications
--32 Kbs voice digitization, then that of 16 Kbs, will fulfill the trend towards an Integrated Service Data Network (ISDN) for both voice and data

9.2 Without Multiplexing of the Vocoders

a) for secure communications using add-on encryption, representing a market that will likely expand from traditional government security and military requirements into the industrial sector
--2.4 Kbs system requires linear type, microphone to attain acceptable quality
--2.4 Kbs system not generally applicable to the STN

b) for efficient channel utilization and bandwidth reduction
--MSAT operating separately from the STN
--commercial mobile systems
--trans-Atlantic satellite voice circuits in competition to 2 kHz analogue circuits

c) data storage and retrieval
--e.g. community electronic "mail box"

d) integration of voice and data
--e.g. for a telephone order wire circuit between computer terminals for carrying instructions on schedule and operational procedures etc dealing with data exchanges, using telephone handsets. Degradation from toll quality for such order wire service would be generally acceptable because the voice content would usually follow a set format. Such an order wire service would save the cost of a separate long

distance phone call for any voice arrangements associated with computer-to-computer data transfers

Notes-Is signigicant that in the seven year history of commercial 2.4 Kbs vocoders in North America as marketed by Time And Space Processing of Santa Clara, California and also by Centagram there has been no significant market acceptance of the vocoders to multi channel applications despite marketing measures to promote such use. Rather the applications have been restricted to government security agencies and the military requirements. This information was gathered by Spar from lengthly discussion with the Vice President of Marketing of Time and Space Processing, Mr. Robert Robinson and by his former Canadian sales representative, Mr. Peter Lawrenc, now president of Tempest Security Integrators of Ottawa.

9.3 With Multiplexing of the Vocoders

a) No significantly sized market is foreseen at the present time for a multiple 2.4 Kbs vocoding system that makes use of telephone handsets that are specially equipped with a linear type microphone as required to give necessary quality enhancement. This is because of the operational awkwardness of a multi number of the special handsets in a given location in addition to the existing complement of standard handsets
Oil exploration/development companies generally require not more than two voice circuits that must connect into the STN. Because of the high daily cost of their field operations the companies are not amenable to reduce communications charges at the expense of possible faulty information exchanges between field and headquarters arising from less than optimum voice quality of service

b) No significantly sized market for a multiple 2.4 Kbs vocoding system is foreseen operating within the Switched Telephone Network where at least one of the end connections uses a standard telephone handset. This is because of the "unacceptable" quality as commented upon by the mobile users, the "oil patch" community, and the telephone companies.

c) A market for a multiple 2.4 Kbs vocoder system might develop if the voice quality using standard telephone handsets could be advanced towards or to the level of that currently associated with a linear type microphone

The major segment of this new market is likely to be for use in small, all-digital, 2.5 meter, K-band earth stations having low powered solid state amplifiers wherein the multiple vocoding system gives the option of increasing the voice trunk capacity of the station from one to twenty two of the 2.4 Kbs circuits or to eleven

of the 4.8 Kbs circuits. For such applications the vocoders and the associated digital multiplexer would be located at the earth stations and the end user would connect to the station through the national analogue or digital telephone network and he would use his regular home or office telephone handset for such communications

Without further quality enhancement of the 2.4 Kbs vocoder, the Market Survey identified a potential application of "X4 2.4 Kbs" multiple vocoding systems for Maritime Tel & Tel and Newfoundland Telephone Company for voice circuits between each of 21 oil platforms and the North American STN. This would involve a total of 168 vocoders and 42 digital multiplexers. However, as mentioned previously the main need is for 2 voice circuits wherein 4 would represent a bonus situation. The availability of a 4-watt solid state K-band HPA would fulfill the 2 channel need with toll quality service and may likely be a prefered approach to that of multiple vocoding with its degraded voice quality.

Spar interface with the "oil patch" fraternity at the March 12 symposium in Houston, Texas of The Energy Telecommunications & Electrical Association identified a potential market of 4168 1-watt K-band earth stations in North America and its offshore areas before 1990. Most of these potential earth station users stated that 2 voice circuits would be adequate, one for business, the other for personal calls for the site crew. It is not unreasonable to project that this minimal number of trunk circuits would grow to the complement of 4 as are being provisionally planned by MTT and NTC for Hibernia communications. However, in the absence of bandwidth limitations at K-band and the need for close to toll quality service when connected into the STN it is doubtful that multiple 2.4 Kbs vocoding would be the acceptable approach to fulfill such an application.

10. PROVISIONAL SPAR COMMENTARY ON THE MULTIPLE VOCODER SYSTEM CONCEPT at the Half-Way Mark in the Market Survey Task

a) A "private" multiple vocoder system, operating independently from the STN, brings about a special telephone system to optimize the utilization and the leased cost of one long haul leased circuit and assumes that four or more trunk circuits are required for such an application

b) Such a "private" special telephone system, complete with a distinctive ring-up/switching interfacce with the company PABX, special handsets, and vocoders, as represented by the multiple vocoder system, requires an extra investment cost to the user company over and above his leasing costs for the dedicated circuit.

c) For the extra cost of a partial duplicate telephone system in the company's operations, and the awkwardness of having two different telephone handsets at a multiple number of specific locations in the company, the user pays the penalty of degradation from toll quality service---not seemingly an attractive proposition

d) The multiple vocoder system by it very nature of "multiple", will generally find most of its applications when connected into the Switched Telephone Network rather than operating as a "private" telephone network, and this being the case the prolification of vocoders at many locations and their respective interface with PABX's presents a very awkward system that seems would not be acceptable to the telephone companies to whose equipment the vocoding system would connect.

e) The multiple 2.4 Kbs vocoder system operating in the STN, and thus using standard telephone handsets, will at most represent a reasonably modest market niche rather than general market acceptance. The market niche will encompass a fringe user community, generally associated with communications to remote locations, who has a strong requirement for four or more "tolerably acceptable and intelligible" voice circuits as attained by the vocoding principle as compared to, say, one circuit of toll quality or less.

f) The multiple vocoder system concept stands against the steady trend in office communications for greater flexibility and provision of convenience features. The multiple vocoder system intrinsically does not have the capablility for rapid and cost effective implementation of features that are being incorporated by the standard telephone system---e.g. call forwarding, conference calling, speaker phone service etc.

g) It is highly problematical that the the multiple vocoder concept will represent any cost savings that would warrent the deprivation of toll quality service, forfeiture of features of the standard telephone system, and the operational awkwardness of having a special service telephone system additional to that of the standard commercial one provided by the telephone company.

h) Multiple vocoding could only represent a significant market in the STN or ISDN if essentially toll quality could be achieved using standard telephone handsets. The "multiple" aspect suggests that the vocoding be basically carried out at either 2.4 or 4.8 Kbs where the multiplying cost advantage is more pronounced as compared to 9.8 and 16 Kbs. However, the telephone industry have no long range plans to incorporate voice digitization below 16 Kbs having assigned synthetic quality performance to PELPC systems that would not be acceptable for operations within the STN or ISDN.

11. PROVISIONAL COMMENTARY ON THE TYPE OF DIGITAL MULTIPLEXER TO MEET PROSPECTIVE MULTIPLE VOCODER MARKET APPLICATIONS

Spar recommends that any digital multiplexer development that follows on from the Market Survey (Task 1 of the DSS Contract) depart from the "X4 2.4 Kbs" system currently referenced in the contract for Task 2 and which is specifically addressed to application to SCPC-FM systems, to one that will accommodate a more flexible complement of prospective user applications and hence a larger market. Input ports for 2.4, 4.8 and 9.6 Kbs are suggested with an output of 56 Kbs such that the multiplexer can accommodate a mixture of various data rates as well as voice digitization at 2.4, 4.8 and 9.6 Kbs. With such a 56 Kbs multiplexer any "bits" in excess of the sum of the inputs would be discarded.

The revised multiplexer design concept would represent a change of scope to Task 2 of the Contract. Spar will not undertake to cost the development of any revised multiplexer design until so advised to do so by DSS following the Scientific Authority's review of this Monthly Letter Report No. 3.

12. REQUEST FOR A MEETING WITH THE SCIENTIFIC AUTHORITY TO REVIEW THE SUBSTANCE GIVEN IN THIS MONTHLY LETTER REPORT

In view of the fairly wide departure from the expected findings of the Market Survey as referenced in Spar's proposal to the findings as reported in this Letter Report, Spar requests a meeting with the Scientific Authority before May 15 if possible.

Notes:-This referenced meeting was held at 3 PM, Friday, May 11 at CRC involving Mr.Brian Bryden, the Scientific Authority, and John A Collins representing Spar Aerospace Limited. This copy of Letter Report No. 3 incorporates the revisions to the draft copy requested by Mr. Bryden.

APPENDIX "A"

LIST OF COMPANIES OR AGENCIES

AND ASSOCIATED PERSONNEL

CONTACTED AS PART OF INFORMATION GATHERING

FOR

MARKET SURVEY, TASK 1

"MULTIPLE VOCODER" PROJECT

	COMPANY OR AGENCY VISITED/CONTACTED	Personnel Contacted	
1)	ENTEL Buenos Aires, Agentina	H. Garfinkle	
2)	EMBRATEL Rio de Janeiro, Brazil	B. Himmelgryn L. Pinho	
3)	Geo/Sat Comm 6909 Southwest Freeway Houston, Texas 77074 (713)778-3100	T.F. Degnan J.F. Lockett	R.D.McCormick
4)	Petroleum Communications, Inc 201 Evans Road New Orleans	A. Petranek	
5)	M/A-Com Germantown, MD. (301)234-2086	Thomas E. Stilwell	
6)	Pacific Gas and Electric 77 Beale Street San Francisco 94106 (415) 781-4211	John S. Rae	
7)	Harris Corporation Melbourne, Florida 32901 (305) 724-3809	Pat Faris	
8)	Haliburton Services Duncan, Oklahoma 73536 (405) 251-4397	Robert L. Toellner George Copland	
9)	Maritime Telephone & Telegraph Halifax, Nova Scotia (902) 421-5091	R.A. Corkum B.A. Mukhida L.G. Brophy D.F. Cosman	M.P. Pothier R.A. Ehrhardt W.F. Barrett D. Bower
10)	Newfoundland Telephone Company St. Johns, Newfoundland (709) 739-2000	D. Terrant	Y. Magalios
11)	Telesat Canada 333 River Road, Vanier City, Ottawa (613) 746-5920	Nazmin Alani Matt Lok Don Weese Mike Zuliani	Al Perala Alan Stones Geoff Wade S.M. McKay
12)	Western Union One Lake Street Upper Saddle River, N.J.07458 (201) 825-5000	J. Livingstone Dick More Sigmund Dudek	Jim Kelly Hans Nord

13) RCA Americom
400 College Road East
Princeton, N.j. 08540
(609) 734-4181
Sam Friedman
Tom Mitchell
Robt. Duhamel

14) Comdat Telecommunications Inc
Ottawa
(613) 236-3862
L.H. Lee

15) Government Telephone Agency
300 Slater Street, Ottawa
(613) 995-7227
H. Macumber
Joe Van Beek
T.K. Chu
V. Grebler
Andre Turcotte
Penny Barber
Oswald Hoch
Jim Carson

16) Time and Space Processing Inc
Santa Clara, California 95051
(408) 730-0200
Robert H. Robinson

17) Tempest Security Integrators
1750 Courtwood Crescent
Ottawa (613) 226-3227
Peter John Lawrencee
Steven Baker
R.E. Jenkins

18) Department of National Defence
Ottawa
Dr. George Pullan

19) McGill University & INRS
(514) 768-6691/382-6783
Dr. Peter Kabal

20) Canadian Police Information Centre
RCMP, Ottawa
(613) 993-9740
Rick Brouzes
Bob Ball

Communications Systems Division

Trans-Canada Highway
Ste-Anne-de-Bellevue, Quebec H9X 3R2
Telephone: (514) 457-2150
Night: (514) 457-9856
Telex: 05-822792

SPAR

May 22, 1984.

Canadian Patents and
Development Limited
275 Slater Street,
Ottawa, Ontario
K1A 0R3

Attention: Mr. T. Da Silva
Marketing and Licensing

Subject: Linear Prediction Vocoder
(Your case 720, file 380-7920)

Dear Mr. Da Silva,

I am pleased to inform you that on May 11, 1984 Spar Aerospace Limited returned to Mr. B. Bryden, Communications Research Centre the one complete demonstration unit of the 2.4 Kbs Linear Predictive Coding System which SPAR had taken on a loan basis on April 9, 1984.

Additionally we advice you that SPAR has conformed to all the provisions of the Confidential Disclosure Agreement for which an executed copy was mailed to you on March 16, 1984.

Yours very truly,

J.A. Collins

c.c.: Mr. B. Bryden, CRC
Mr. G. Reader, DSS