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## Industry Engagement Process for Enhanced Satellite Communications Project – Polar

(W6369-180123/B)

# Summary of Feedback and Outcomes



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## **Table of Contents**

- 1. Introduction**
- 2. Industry Engagement Process**
- 3. Acronym List**
- 4. Summary of Feedback and Outcomes**
- 5. Conclusions**
- 6. Next Steps**

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## 1. Introduction

Public Services and Procurement Canada (PSPC) released a Request for Information (RFI) (W6369-180123/B Amendment 006) on November 16, 2020 to provide Industry with an update on the progress of the Enhanced Satellite Communications Project – Polar (ESCP-P) and request Industry feedback regarding its Arctic Narrowband and Wideband Beyond Line-of-Sight communications capability for the Department of National Defence (DND) and the Canadian Armed Forces (CAF). The RFI analysis team did not evaluate or rank the responses submitted by Industry.

With this RFI, Canada sought to:

- a. Share the progress of ESCP-P with Industry and detail the scope of the proposed preferred capability;
- b. Seek feedback from Industry on potential areas that could result in cost and/or schedule efficiencies without impacting the desired capability; and
- c. Seek feedback and proposed hybrid architecture solutions from Industry.

One-on-one meetings were also conducted as part of the project engagement activities.

## 2. Industry Engagement Process

Industry Engagement Period	<ul style="list-style-type: none"><li>• Posting of RFI: 16 November 2020</li><li>• RFI Responses Requested: 18 March 2021</li><li>• One-on-one meetings: 7 October 2021</li></ul>
Information disclosed under the RFI	<ul style="list-style-type: none"><li>• ESCP-P RFI (document)</li><li>• ESCP-P RFI Business Requirements (document)</li></ul>
Government Participants	<ul style="list-style-type: none"><li>• ESCP-P Project Team and stakeholders consisting of:<ul style="list-style-type: none"><li>○ Department of National Defence;</li><li>○ Public Services and Procurement Canada;</li><li>○ Innovation, Science and Economic Development Canada;</li><li>and</li><li>○ Canadian Space Agency.</li></ul></li></ul>

Participants that signed the ESCP-P Rules of Engagement	Airbus Corporation Allam Advisory Group ATCO Structures & Logistics Beyond Aerospace Ltd. CB2.0 Communications Inc. C-CORE CIEL Satellite L.P. Comsat, INC. DRS Technologies exactEarth Ltd. General Dynamics Mission Systems Grintex Technologies Inc. Harris Corporation Hunter Communications Canada Inc. Inmarsat Intelsat General Corporation Iridium Satellite LLC Kepler Communications Inc. Kratos Communications Ltd. L3 Technologies Canada Inc. Lockheed Martin Space Magellan Aerospace MDA Corporation Omnispace Canada ULC. Peraton Canada Corp. Raytheon Canada Ltd. Rhea Inc. SED, a Division of Calian Ltd. SES Networks Space Systems/Loral, LLC T24 Defence Telesat Canada Thales Alenia Space The Boeing Company Viasat Inc.
RFI responses submitted	Four firms submitted responses to the RFI
Clarification Questions sent to Respondents	Clarification questions were sent to all four respondents with responses received by mid-June 2021
Participants at the follow-on one-on-one meetings	Two firms participated in a follow-on one-on-one meeting

Questions and Answers from Industry	16 questions were received from Industry during the RFI process with an additional 25 questions received during the one-on-one sessions. Canada has provided responses to all questions.
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### 3. Acronym List

CAF	Canadian Armed Forces
DND	Department of National Defence
ESCP-P	Enhanced Satellite Communication Project - Polar
FOC	Full Operational Capacity
HEO	Highly Elliptical Orbit
HLMR	High Level Mandatory Requirement
IOC	Initial Operational Capability
ITB	Industrial and Technological Benefits
LEO	Low Earth Orbit
MILSATCOM	Military Satellite Communications
NB	Narrowband
OISL	Optical Inter-Satellite Links
PSPC	Public Services and Procurement Canada
RFI	Request for Information
SATCOM	Satellite Communications
TAP	Three-Apogee
TRL	Technology Readiness Level
WB	Wideband

### 4. Summary of Feedback and Outcomes

Respondent Summary Information Section 4.2.1	Industry was requested to provide a brief high-level company summary that includes background information and information on Space and Ground Station heritage.
Feedback	In general, the responses that were received from Industry were fulsome in nature, addressing the request, with two firms providing information on Space and Ground Station heritage.
Outcome	Canada has determined that traditional SATCOM space and ground heritage exists to deliver the ESCP-P capability.

ESCP-P Hybrid System Architecture Delivery Section 4.4.2.1	Industry was requested to provide an overall description of a proposed hybrid system architecture and detail if the proposed architecture would require relaxing the protection and/or control HLMRs. Responses should detail benefits and trade-offs including potential cost, risk and schedule efficiencies.
Feedback	Responses addressed the request to provide a description of a proposed hybrid solution. The responses indicated that the HLMRs can be met through various hybrid designs including a combination of commercial and purpose-built constellations and a fully purpose-built hybrid constellation.
Outcome	Canada has determined that when satellite control resides outside of DND, a hybrid solution can be considered among the possible solutions for ESCP-P and may offer potential cost and schedule efficiencies in some areas when compared to a purpose-built solution.
ESCP-P Hybrid System Architecture Delivery Section 4.4.2.2	Industry was requested to outline if the proposed architecture provides a similar, equivalent, or superior capability to the preferred purpose-built system that hosts both NB and WB capability. Responses should include benefits and trade-offs including potential cost and schedule efficiencies.
Feedback	One response indicated that a hybrid solution could be superior as the inclusion of commercial constellations in the solution decreases the complexity of the purpose built portion of the constellation and could result in the deployment of some capabilities significantly earlier than currently planned. Cost comparisons were not provided.
Outcome	Canada has determined that a hybrid solution can be considered among the possible solutions for ESCP-P; however, further analysis is required regarding the impacts to the user segment such as terminal interoperability.
ESCP-P Hybrid System Architecture Delivery Section 4.4.2.3.a	Industry was requested to provide details on possible technical issues related to communication and telemetry synchronization issues between NB and WB handover that may result both in terms of user access (i.e. a single user accessing both systems simultaneously) as well as satellite and payload command and control if their proposed architecture includes constellation combinations comprising of two or more different constellations.
Feedback	Responses indicated that inter-constellation handover would be managed via the ground segment. No synchronization issues were outlined or addressed for user systems using both NB and WB. Users accessing both systems may require two different terminal types.

Outcome	Canada has determined that synchronization between NB and WB user access is not seen as an issue beyond the user system requiring two different terminal types.
ESCP-P Hybrid System Architecture Delivery Section 4.4.2.3.b	In a constellation that is comprising of two or more different constellations, Industry was requested to explain the feasibility of handovers within the constellation and across constellations and outline how these would be achieved.
Feedback	Responses indicated that inter-constellation handover would utilize the ground segment. Seamless WB user handover is indicated to require user terminals capable of tracking and maintaining two simultaneous connections. Make-before-break handovers for NB Integrated Waveform is not a function available today.
Outcome	Canada has determined that technical issues related to seamless handovers, where it is supported by the technology available today, reside with the user segment's ability to access two or more different constellations, or satellites within a constellation, simultaneously.
ESCP-P Hybrid System Architecture Delivery Section 4.4.2.3.c	Industry was requested to explain the feasibility of handovers between the constellation(s) proposed and existing constellations currently or envisioned to be used by the CAF (e.g. Wideband Global SATCOM, Mobile User Objective System).
Feedback	Responses indicated proposed solutions would be interoperable with US and allied systems and user terminals. Responses in which handovers were specifically addressed indicated that handover between existing constellations and those proposed for ESCP-P would be realized via the ground segment.
Outcome	Canada has determined that interoperability with existing MILSATCOM systems is possible with handovers likely to be realized through the ground segment.
ESCP-P Hybrid System Architecture Delivery Section 4.4.2.3.d	In a hybrid solution (i.e. Purpose built and leased services), Industry was requested to explain how Canada would participate or manage Payload Missions Operations with a commercial provider.
Feedback	Responses indicated control and management of a commercial payload service would be realized via requests sent through secure virtual interfaces to existing commercial mission and payload operations.
Outcome	Canada has determined the level of control and integration with commercial systems is limited in comparison to that of a dedicated system.



ESCP-P Hybrid System Architecture Delivery Section 4.4.2.4	Industry was requested to detail the challenges that exist related to the provision of inter-satellite links either optically and/or using Radio Frequency technology.
Feedback	Responses did not specifically address existing challenges related to provision of inter-satellite links. Two responses indicated that the use of inter-satellite links in the proposed system, beyond what already exists in commercial systems, is not recommended.
Outcome	Canada has determined that the use of OISL is unlikely to provide any significant advantages to ESCP-P.
ESCP-P Hybrid System Architecture Delivery Section 4.4.2.4.a.	Industry was requested to provide an overview on optical inter-satellite link technology especially related to ESCP-P security/protection requirements
Feedback	Responses did not address this request.
Outcome	Canada has determined that the use of OISL is unlikely to provide any significant advantages to ESCP-P.
ESCP-P Hybrid System Architecture Delivery Section 4.4.2.4.b.	Industry was requested to detail any differences in space and ground architecture that would be necessary in a system using inter-satellite links in contrast to more traditional systems.
Feedback	Responses did not address this request.
Outcome	Canada has determined that the use of OISL is unlikely to provide any significant advantages to ESCP-P.
ESCP-P Hybrid System Architecture Delivery Section 4.4.2.5	Industry was requested to comment on the benefits and trade-offs of the proposed architecture in terms of pass times (including eclipse mitigation), radiation impacts, latency, high-level link budgets and Doppler shift correction.
Feedback	Responses indicated latency improvements with their proposed solution over that of the ESCP-P preferred option published in the RFI. One response indicated Doppler shift compensation techniques would be implemented in the ground segment with the user segment terminals requiring some software modification for residual Doppler. One respondent indicated that lower radiation levels of their proposed orbit compared favourably to that of Molniya and TAP orbits. In addition, the respondent also emphasized the significantly lower latency times associated with a LEO commercial Ka-band constellation as compared to those representative of a system in a HEO orbit. High level link budgets were also provided by one respondent.
Outcome	Canada has been provided with further information on latency and Doppler shift correction that will aid in the refinement of requirements.

ESCP-P Hybrid System Architecture Delivery Section 4.4.2.6	Industry was requested to outline protection and security options available to improve passive defences, both in space and on the ground, which would allow a system to survive and operate through different forms of electronic attack. Information on costs and level of risk associated with each of these passive defence strategies should be incorporated into the response and be specific to the proposed architecture.
Feedback	Responses varied from the use of narrow beams and beam-hopping in addition to encrypted Telemetry, Tracking & Command links to more complex anti-jamming capabilities and the use of specific waveforms. No specific costs or levels of risk were provided in response.
Outcome	Canada has been provided with further information on passive protection measures that are currently available that will aid in the refinement of requirements.
ESCP-P Hybrid System Architecture Delivery Section 4.4.2.7	Industry was requested to detail key differences in security measures/elements employed in Space and Ground systems, between Commercial and Military NB and WB SATCOM systems.
Feedback	Responses did not specifically address the key differences that exist.
Outcome	Canada will continue to assess available protection measures in the process of refining requirements.
ESCP-P Hybrid System Architecture Delivery Section 4.4.2.8	Industry was requested to provide their estimated/forecasted bandwidth growth of both NB and WB systems in both the commercial and military domains over the next 5-10 years.
Feedback	Two responses noted increased growth to date with significant growth expected in the future, however, forecasts and timelines were not provided.
Outcome	Canada assumes that future growth should be considered in the development of the ESCP-P system.
ESCP-P Hybrid System Architecture Delivery Section 4.4.2.9	Canada is considering trade-offs of decreasing the service life from 15 to 10 years. Industry was requested to provide a high level breakdown of how the reduction in service life could be achieved (e.g. parts selection, reliability and redundancy architecture), the risks associated with it and the potential cost impact.
Feedback	One response indicated a reduction in service life would not result in significant savings and recommended remaining with the 15 year mission life.
Outcome	Canada has determined that a reduction in mission life would not be advantageous.

Cost Estimates Section 4.5.1	Industry was requested to provide rough order magnitude cost estimates for their response(s) broken down by system element.
Feedback	Responses included limited, high-level cost information.
Outcome	Canada has determined that the limited cost information provided in responses could be due to the level of detail provided by Canada in the RFI document itself. Consequently, DND has addressed the development of a project cost estimate through independent research. Additionally, future engagements with Industry may address the topic of project costs in more detail.
Schedule Section 4.6.1	Industry was requested to provide their schedule for the delivery of the capability. The objective of this request is to determine the potential schedule efficiencies for ESCP-P if it were to reduce or relax the requirements.
Feedback	Responses provided a high-level schedule stating that commercial service would be available in 2023.
Outcome	Canada has determined that its current timeline is feasible and that the inclusion of a commercial capability within the solution could possibly provide schedule efficiencies for some portions of the system.
Schedule Section 4.6.1.a.	Industry was asked when they would need to be under contract.
Feedback	Responses indicated the ability to proceed to contract at the earliest possible start date.
Outcome	Canada has determined that its current timeline is feasible and that the inclusion of a commercial capability within the solution could possibly provide schedule efficiencies for some portions of the system.
Schedule Section 4.6.1.b.	Industry was requested to provide detailed definitions of the IOC and FOC milestones in relation to the System architecture proposed. Canada anticipates that these milestones could be phased based on the complexity of the system (i.e. IOC-A, -B etc.). For the hybrid solution proposed, Industry was requested to include timelines for the system integration of a commercial capability with the purpose-built capability within their high level schedule.
Feedback	Responses did not address this request.
Outcome	Canada has assumed that its current timeline is feasible and that the requested level of scheduling detail is not possible at this juncture.
Schedule Section 4.6.1.c.	Industry was asked what the critical path was for a 2032 IOC date (i.e. what conditions need to be met to make that date).

Feedback	Responses did not specifically address this request, however, one respondent noted that there are challenges associated with synchronizing the development of user and space segments.
Outcome	Canada has determined that development of the user segment could drive the overall schedule and that optimizing the deployments of user terminals will be key to taking full advantage of the useful life of the satellites.
Schedule Section 4.6.1.d.	Industry was asked if a more aggressive contract completion than the 2036 date was achievable. And to indicate the conditions needed to be met to make an earlier proposed date.
Feedback	Responses addressing this request indicated completion much earlier than 2036 is possible.
Outcome	Canada has determined that its current timeline is feasible and that earlier timelines are possible. Canada will continue to investigate potential opportunities to meet the forecasted timelines within the framework of the Government of Canada approval and diligence process.
Schedule Section 4.6.1.e.	Industry was asked what managed issues would significantly impact the Project in terms of cost and schedule.
Feedback	Responses did not address this request.
Outcome	Canada has assumed that this level of detail is not possible at this juncture.
Schedule Section 4.6.1.f.	Industry was asked if a contract completion by 2036 is not practically achievable, identify the critical path activities driving a later completion date and specify an achievable date.
Feedback	Responses did not address this request.
Outcome	Canada has determined that its current timeline is feasible and that earlier timelines are possible. Canada will continue to investigate potential opportunities to meet the forecasted timelines within the framework of the Government of Canada approval and diligence process.
Schedule Section 4.7.1.a.	Industry was requested to indicate the key scope, schedule, and technical risks for their response(s). Key questions include: i. What are the proposed mitigation strategies for the highest impact risks? ii. What specific risks are avoided/mitigated through the Industry's design?
Feedback	Responses indicate risk is mitigated due to the reduction of complexity, the use of flight-proven heritage systems and the transfer of risk possible with a managed service as part of the solution. In addition, one response highlighted the risks

	associated with user terminals, but indicated that they were manageable.
Outcome	Canada has determined that the highest risk for ESCP-P resides with the user segment and its schedule alignment with the rest of the system. Canada will attempt to mitigate risk by limiting complexity and employing flight-proven systems wherever possible within the ESCP-P solution.
Schedule Section 4.7.1.b.	Industry was requested to indicate the key technical and programmatic risks associated with their selected technologies. For example, specific frequency bands should be explained.
Feedback	Responses did not indicate risks associated with specific technologies.
Outcome	Canada has determined that the highest risk for ESCP-P resides with the user segment and its schedule alignment with the rest of the system. Canada will attempt to mitigate risk by limiting complexity and employing flight-proven systems wherever possible within the ESCP-P solution.
Schedule Section 4.7.1.c.	Industry was requested to indicate the likely feasibility and key technical risks (e.g. Doppler) associated with modifying existing NB and WB terminals for use with the ESCP-P capability versus acquiring new terminal equipment.
Feedback	Responses indicate modifications are dependent on the user terminal whereby either no modification is required or modifications to tracking and software are likely necessary. One response indicated the use of constellation specific terminals as a possibility rather than the modification of existing CAF inventory.
Outcome	Canada has determined that modifications to existing user terminals will be required and that some new terminals may need to be acquired as part of the ESCP-P solution.
Schedule Section 4.7.1.d.	The intent is to minimize risk by leveraging existing technology with an established TRL, where possible. Industry was asked if a new technology be incorporated or existing technology be used in a substantially innovative manner, it should be identified along with its TRL and an elaboration on how any associated risk has been minimized with respect to the added value gained by its use.
Feedback	Responses indicate that high TRL levels using flight-proven technology should always be employed.
Outcome	Canada has determined that industry solutions will include only minor changes to existing flight-proven communication systems.

Possible Hosted Payload Opportunities Section 4.8.1	Industry was requested to provide information and feedback on the implications of including a hosted payload. Canada is interested in exploring potential opportunities to integrate an additional hosted payload; however, the possible inclusion of a hosted payload must not influence Industry's proposed solution or responses to other questions. Section 4.8 must be addressed independently, since any hosted payload requirements are outside of the scope of ESCP-P's primary mission and any opportunities for hosted payloads will only be considered once the primary mission requirements are fully met.
Feedback	Responses indicated that the hosted payload would significantly increase the platform size, which would increase the overall cost and complexity of the satellite and would require two separate launches for the spacecraft. Respondents also indicated that they have facility clearances, including personnel.
Outcome	Canada has understood that the complexity of the space segment is greatly increased with the introduction of a hosted payload but that the impact to the ground segment would be minimal.
Possible Hosted Payload Opportunities Section 4.8.2.a.	Industry was requested to provide Space and Ground Segment cost, schedule, and risk implications of testing, integrating and developing the support structure of a hosted payload as describe in Section 4.8.1.
Feedback	Responses did not address this request.
Outcome	Canada has assumed that there was not sufficient information in the RFI to allow Industry to respond with the requested level of detail.
Possible Hosted Payload Opportunities Section 4.8.2.b.	Industry was requested to provide any additional cost, schedule, and risk implications if integrating a hosted payload resulted in a need to increase the security requirements.
Feedback	Responses did not specifically address this request. Two responses indicated the existence of an in-house capability to provide the facilities and personnel required for increased security.
Outcome	Canada has assumed that there was not sufficient information in the RFI to allow Industry to respond to with the requested level of detail.

Economic Benefits Section 4.9.2.1	Recognizing the role of research and development in space programs, Industry was requested to provide information regarding the engineering expertise available in-house related to design, build, test and manufacture of the requirements in terms of Canadian content. a. What roles in the above areas occur in Canada at this time? b. What roles in the above areas could be expected to occur directly in Canada under your proposed solution?
Feedback	Responses indicated capability exists in Canada to provide activities including design, test and manufacture of the requirements.
Outcome	Canada has determined that Canadian expertise exists to execute this program and that a minimum direct requirement can be supported.
Economic Benefits Section 4.9.2.2	Supporting the growth of prime contractors and suppliers in Canada is an objective of the ITB Policy. Industry was asked the following: a. What types of opportunities for Canadian suppliers could there be under your solution? b. Please provide information on existing relationships that could be leveraged? c. Are there opportunities or existing relationships with small and medium sized businesses (under 250 employees) in Canada?
Feedback	Responses indicated opportunities for Canadian suppliers and small and medium sized businesses within vendors' solutions.
Outcome	ITB requirements involving both direct and indirect opportunities with Canadian suppliers and small and medium businesses will be considered.
Economic Benefits Section 4.9.2.3	Industry was asked what opportunities are there to enhance innovation in Canada directly or indirectly related to ESCP-P.
Feedback	Responses indicated there is potential to enhance innovation related to ESCP-P.
Outcome	ITB requirements should involve solutions that offer direct and indirect benefits that support innovation in Canada.
Economic Benefits Section 4.9.2.4	Industry was asked the following: Are there any opportunities for Canadian-based companies to participate on exports? a. What factors hinder or facilitate these opportunities in terms of your solution?



	b. Is this a requirement that has the potential for spin-off commercialization that may include Canadian-based companies?
Feedback	Responses indicated the potential for applicability to other domains and the potential to drive export sales.
Outcome	Canada has determined that there is some Canadian industry export potential with technologies developed under the ESCP-P program.
Economic Benefits Section 4.9.2.5	Skills development and training plays a vital role in supporting a more innovative Canadian economy. Space labour force challenges have been noted in the 2019 State of the Canadian Space Sector Report: Facts and Figures 2018. Industry was asked the following: a. What potential activities are there for supporting this ITB pillar? b. How would activities under ESCP-P or in other indirect areas support skills development training?
Feedback	Two responses indicated ties to skills development and training, but were not directly linked to ESCP-P.
Outcome	Canada has determined more engagement with industry is required on this element to establish a potential target in this area.

## 5. Conclusions

Overall, the feedback from Industry was valuable in contributing to the development and refinement of the Business Requirements, Statement of Operational Requirements, and Business Case Analysis for ESCP-P.

Canada has drawn a number of observations from the RFI responses and one-on-one meetings with respondents:

- a. Hybrid solutions can be considered among the possible solutions for ESCP-P and may offer potential cost and/or schedule efficiencies as some RFI responses indicated commercial offerings for partial capabilities as early as 2023.
- b. The User Segment will be a key component of the ESCP-P solution. Canada will further explore options to minimize the complexity and the number of different terminals required to leverage the ESCP-P capability in the Definition phase. In addition, the schedules for the User, Space and Ground segments will have to be closely aligned to ensure that the ESCP-P capability can be fully utilized as soon as it is available.
- c. The use of OISL is unlikely to provide any significant advantages to ESCP-P.
- d. Only limited cost, schedule and protection information could be provided at this time due to the level of maturity of the ESCP-P requirements.



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- e. Most of the Economic Benefits requirements could be met by the ESCP-P capability.

Due to these observations, Canada has and will continue to invest time and effort conducting internal and independent analyses to develop a greater degree of certitude regarding the overall cost and in refining requirements. These activities have resulted in programmatic delays in obtaining approvals and in responding back to Industry in a timely manner. For these reasons, the Outcomes contained in this document are relatively high-level.

## 6. Next Steps

A substantial amount of work remains to be completed in order to better define Canada's requirements for the ESCP-P capability. Information on the ESCP-P RFI can be found on Buy and Sell under tender notice W6369-180123/B. Industry will be notified of further opportunities for engagement through the ESCP-P Buy and Sell notice. Canada welcomes any additional information related to ESCP-P requirements, which can be provided to the ESCP-P Contracting Authority point of contact.

The Government of Canada ESCP-P team members thank all participants for taking part in the Industry Engagement Process.

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