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## 1.0 PURPOSE AND NATURE OF THE REQUEST FOR INFORMATION

- 1.1.1 Public Services and Procurement Canada (PSPC) is requesting Industry feedback regarding a Ground Based Optical (GBO) System for the Surveillance of Space 2 (SofS2) project to provide a Space Situational Awareness (SSA) capability for the Department of National Defence (DND), and potentially other partners including Other Government Departments and Agencies.
- 1.1.2 Canada has previously released a request for information (RFI) (file number W8474-187639/A) that sought information on solutions for an SSA capability that could include Space Based Optical (SBO) Sensors, GBO Sensors, or a combination of the two. The SofS 2 project is now considering a solution that includes both GBO and SBO project segments, wherein each segment would be subject to separate implementation timelines, and separate Request for Proposal (RFP) processes. This RFI solely addresses the request for solutions to a GBO System for SSA. A separate RFI for the next step for the SBO will be posted in the near future.
- 1.1.3 The objectives of this RFI are to:
- a. Inform Industry of DND's SofS 2 requirements for a GBO System;
  - b. Obtain input from Industry on the feasibility, deficiencies, and proposed improvements with respect to potential options to meet the requirements;
  - c. Align this requirement with the Industry's capabilities, as applicable;
  - d. Seek Industry input on potential economic leveraging opportunities; and
  - e. Obtain indicative costing estimates from Industry.
- 1.1.4 This RFI is neither a call for tender nor an RFP. No agreement or contract will be entered into based on this RFI. The issuance of this RFI is not to be considered in any way a commitment by Canada, nor as authority to potential respondents to undertake any work that could be charged to Canada. This RFI is not to be considered as a commitment to issue a subsequent solicitation or award contract(s) for the work described herein. This RFI is for informational purposes only.
- 1.1.5 Although the information collected may be provided as commercial-in-confidence (and, if identified as such, will be treated accordingly by Canada), Canada may use the information to assist in defining a solution to meet the project's High Level Mandatory Requirements (HLMRS) and for budgetary purposes.
- 1.1.6 Respondents are encouraged to identify, in the information they share with Canada, any information that they feel is proprietary or confidential. Canada will handle the responses in accordance with the Access to Information Act and will not disclose proprietary or commercially sensitive information concerning Respondents or third

parties, except and only to the extent required by law. For more information, see: <http://laws-lois.justice.gc.ca/eng/acts/a-1/>.

- 1.1.7 Respondents are asked to identify if their responses, or any part of their responses, are subject to the Controlled Goods Regulations.
- 1.1.8 Participation in this RFI is encouraged, but is not mandatory. Respondents should note that this RFI is not a pre-selection process and that there will be no short-listing of potential suppliers for the purposes of undertaking any future work as a result of this RFI. Participation in this RFI is not a condition or prerequisite for the participation in any potential subsequent Industry Engagement activities, or solicitations.
- 1.1.9 Respondents will not be reimbursed for any cost incurred by participating in this RFI or for any activities associated with the Industry consultation including, but not limited to, travel or hospitality.
- 1.1.10 Responses to this RFI will not be returned to Respondents. Responses will not be formally evaluated. The responses received may be used to inform Canada of available solutions and possible procurement approaches. Canada will review all RFI responses.
- 1.1.11 A review team composed of representatives of Canada will review the responses. Not all members of the review team will necessarily review all aspects of each response. Canada reserves the right to hire any independent consultant, or use any of Canada's resources that it considers necessary to review any response. Independent consultants that may be provided access to responses will be subject to a Non-Disclosure Agreement.
- 1.1.12 A Fairness Monitor has been appointed to oversee this project to ensure all vendors are treated equally throughout the engagement and procurement processes.

## 2.0 LEGISLATION, TRADE AGREEMENTS, AND GOVERNMENT POLICIES

### 2.1 National Security Exception

- 2.1.1 A National Security Exception (NSE) allows Canada to exclude a procurement from some or all of the obligations in the relevant trade agreement(s), where Canada considers it necessary to do so in order to protect its national security interests specified in the text of the NSE. Potential Respondents are advised that an NSE has been invoked under the authority of PSPC's Assistant Deputy Minister - Procurement Branch. Details are available at: <https://buyandsell.gc.ca/policy-and-guidelines/supply-manual/section/3/105> ; The NSE is provided for in the following Agreements:

- a. North America Free Trade Agreement;

- b. Canada-European Comprehensive Economic and Trade Agreement;
- c. World Trade Organization Agreement on Government Procurement;
- d. Canada-Chile Free Trade Agreement; and
- e. Canadian Free Trade Agreement.

## 2.2 Controlled Goods Provisions

- 2.2.1 As SofS 2 may require the production of or access to Controlled Goods (CG) that are subject to the Defence Production Act, Respondents are encouraged to familiarize themselves with the provisions of the Controlled Goods Program (CGP) at the earliest opportunity. Details on how to register under the CGP are available at <http://www.tpsgc-pwgsc.gc.ca/pmc-cgp/enregistrement-register-eng.html>.

## 2.3 Industrial and Technological Benefits

- 2.3.1 The Industrial and Technological Benefits (ITB) Policy, including Value Proposition, may apply to SofS 2. For more information on the ITB Policy, consult the ITB website: [www.canada.ca/itb](http://www.canada.ca/itb).

## 2.4 Green Procurement

- 2.4.1 Respondents are requested to identify and cost potential areas of development, manufacturing and/or project delivery that leverage environmentally friendly standards and/or processes. For more information on the Green Procurement Policy, consult the Treasury Board Secretariat (TBS) website: <http://www.tbs-sct.gc.ca/pol/doc-eng.aspx?id=32573>.

## 3.0 SOFS2 PROJECT BACKGROUND

### 3.1 Space Situational Awareness

- 3.1.1 A wide range of satellite services are essential to not only military operations, but also critical to civilian, scientific, and economic sectors. These services include secure and unsecured communications, reconnaissance, targeting, navigation, battle damage assessment, ballistic missile early warning, weather data collection and prediction, arms control verification, time synchronization, and high-resolution imagery. As the number of space assets that provide essential services increases, the more important awareness in the space domain becomes to all stakeholders.
- 3.1.2 The space environment is increasingly congested due to the current and projected dramatic increases in debris and presence of commercial and other satellites, including those of potential adversaries. Currently, there are over 500,000 objects in Earth's orbit

greater than 1 cm in size traveling at velocities of over 29,000 km/hr, and the number of objects is expected to increase significantly. As an example, there are approximately 13,000 “near misses” between objects orbiting the Earth per week; this is expected to increase to 20,000 by 2019<sup>1</sup>.

3.1.3 SSA is the knowledge of the orbital parameters and, as required, state (e.g. identity, configuration, orientation, and tumbling motion) of any object in orbit around the Earth or entering Earth’s space domain. These orbiting objects are referred to as Resident Space Objects (RSO), and include active and inactive satellites, and space debris (e.g., discarded launcher or deployment hardware, the products of collisions of RSOs, etc.).

3.1.4 SSA aims to provide a complete understanding of the space domain and how it can affect operations conducted in that and every other domain. In brief, space surveillance consists of the following activities:

- a. Charting the present position of RSOs and plotting their anticipated orbital paths, thereby:
  - i. Allowing predictions of when and where possible collisions or near approaches will occur;
  - ii. Allowing predictions of when and where a decaying space object will re-enter the Earth's atmosphere; and
  - iii. Preventing a returning space object, which to radar looks like a missile, from triggering a false alarm in missile-attack warning sensors.
- b. Detecting new RSOs in space;
- c. Maintaining a running catalogue of RSOs;
- d. Characterizing RSOs through analysis of their light signatures, thereby enabling:
  - i. Determination of an RSO’s configuration, and orientation; and
  - ii. Identification of an RSO, and possibly its country of origin.

## 3.2 Participation in the Space Surveillance Network (SSN)

3.2.1 Canada is a member of the Combined Space Operations (CSpO) <sup>2</sup> initiative, through which it contributes its SSA products to a US-led Space Surveillance Network (SSN). In

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<sup>1</sup> Source: <https://www.newscientist.com/article/dn18050-space-debris-threat-to-future-launches/>

<sup>2</sup> The CSpO initiative is an international collaboration initiative among Canada, US, UK, Australia and New Zealand to improve defence space coordination of efforts and to enhance individual space capabilities.

return for its continued contributions, Canada receives access to a wealth of SSN data products produced by key allied systems.

### 3.3 Current Situation

- 3.3.1 In 2013, DND launched Sapphire, an SBO sensor that provides valuable SSA to both Canada and its allies. From its low-earth orbit, Sapphire looks outwards into the deep space orbits populated by communications systems, global positioning systems, and missile warning satellites, in order to track RSOs.
- 3.3.2 Sapphire provides critical data to Canada and the US SSN, which is used in the preparation of collision avoidance solutions for space asset stakeholders and for persistent surveillance of space assets to safeguard against potentially hostile acts from our adversaries.
- 3.3.3 Sapphire's five-year design life was reached in early 2018, and though it continues to operate well, there is no guarantee that it will operate until a replacement satellite can take over.
- 3.3.4 In light of the current situation, Canada is investigating options to replace Sapphire with an enhanced capability that meets the needs of the rapidly evolving space domain. It is envisioned that this enhanced capability may include both a next generation SBO System and a GBO System.
- 3.3.5 Requirements for the proposed GBO System are currently under development. This RFI will address the GBO System requirement.

## 4.0 SOFS2 GBO SYSTEM OVERVIEW

### 4.1 GBO System Objectives

- 4.1.1 The SofS 2 project is considering a GBO System as a means to mitigate a potential loss of SSA should Sapphire fail prior to the next generation SBO becoming available. Further, it is expected that the GBO System would supplement the next generation SBO System to achieve an even greater SSA capability.

### 4.2 GBO System Concept Description

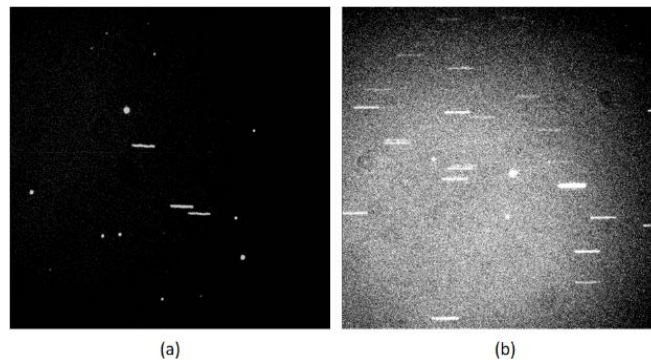
- 4.2.1 **The GBO Sensor:** The GBO Sensor is an optical telescope(s) that searches for, tracks, and obtains characteristics of objects orbiting the earth. The telescope(s) is fitted to a sensor which can capture an image or series of images of the required target RSOs.
- 4.2.2 **GBO Sensor Targets:** The GBO Sensor is expected to be tasked to make observations of RSOs in deep space-i.e. RSOs having altitudes greater than 5000 km. In particular, the



Geosynchronous Orbit (GEO) is of primary interest, followed by the Medium Earth Orbit (MEO) and Highly Elliptical Orbit (HEO) regimes. GBO Sensors will be located to optimize coverage of deep space regimes.

**4.2.3 GBO Sensor Modes of Operation:** The GBO Sensor must gather observations of RSOs with the objective of extracting their astrometric and photometric information. The photometric data must include spectral (colour) information. This photometric data will be used to aid in identifying the object, or in determining what it is doing (e.g. tumbling). GBO Sensors must collect the observations of RSOs in the two following modes of operations:

- a. Sidereal Stare Mode (SSM). In this mode of operation, also referred to as Star Stare Mode, the sensor points to a location in the sky, where the RSO is expected to be located at a later time, and begins to track a known star within the field of view (FOV) in a sidereal motion. The expected RSO position in the sky is determined using the latest available ephemeris data for that object. When the RSO is expected to pass through the FOV of the sensor, an image is taken. In this image, the stars appear as point sources and the RSO will appear as a streak. An example of an SSM image is illustrated in Figure 1a.
- b. Track Rate Mode (TRM). In this mode of operation, the sensor moves along the expected path of the RSO which has been determined using the latest available ephemeris data for that object. As the sensor tracks the RSO, it acquires an image. In this image, the stars appear as streaks and the RSO will appear as a point source. An example of a TRM image is illustrated in Figure 1b.



**Figure 1. Examples of SSM and TRM images, (a) and (b) respectively.**

- c. Search Mode: Searches may be implemented in either TRM or SSM and uses patterns to search the vicinity where the RSO was expected to be. The search parameters, such as search pattern, will depend on the expected velocity vector of the RSO, and the amount of nearby space to be searched.

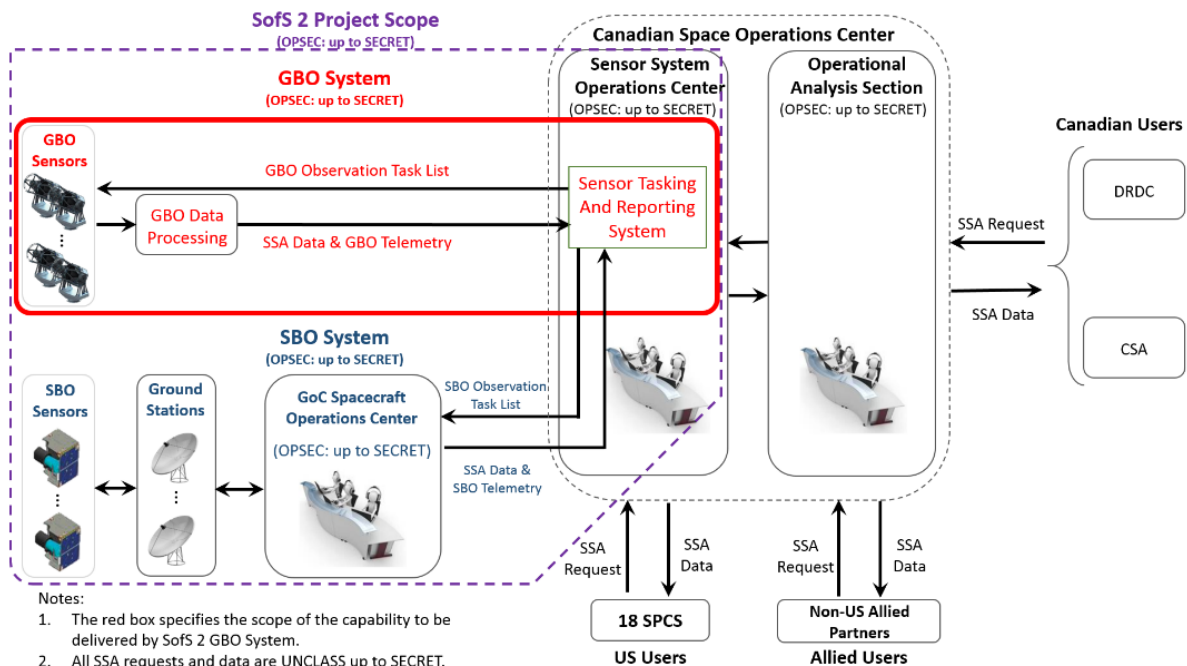
**4.2.4 GBO Data Processing System:** The GBO processing system takes the raw images captured by the GBO Sensor and enhances, compiles, and correlates the images with

other data sources to produce the observation data requested. The GBO Sensor processing will require correlation of RSO observations with the US Satellite Catalogue (US SATCAT).

4.2.5 **Sensor Tasking and Reporting System:** The Sensor Tasking and Reporting System is a centralized system that ingests observation requests from various organizations, and transmits corresponding taskings messages to the GBO Sensors. The GBO Sensors capture imagery as tasked, and the processed observation/SSA data is transmitted to the Sensor Tasking and Reporting system. It is envisioned that the Sensor Tasking and Reporting System would incorporate a scalable interface allowing it to task additional sensors.

### 4.3 The GBO System within the Canadian Space Surveillance System

4.3.1 Figure 2 shows how the GBO System (shown in red) fits within the Canadian Space Surveillance System (CSSS). The role of the GBO System is to respond to tasks generated either by the 18<sup>th</sup> Space Control Squadron (18 SPCS), the Sensor System Operations Centre (SSOC), or the Canadian Space Operations Centre (CANSpOC). Note that the Sensor Tasking and Reporting System is shown within the desired location at the SSOC.



**Figure 2. Conceptual representation of the GBO System (outlined by red box) within the context of the CSSS. Note: the purple outline contains the SofS 2 project scope, which includes the SBO Segment.**

## 5.0 GBO SYSTEM PRELIMINARY REQUIREMENTS

### 5.1 General

5.1.1 This section provides the preliminary requirements for the GBO System, which are subject to change. Industry feedback is being sought on the feasibility and array of compliant solutions available. Canada is also open to suggestions to improve the requirements. Hence, the requirements state the function and performance level, but not the particular methodology to be employed (unless driven by constraints).

### 5.2 GBO System Assumptions

- 5.2.1 The following are assumptions driving the proposed GBO System requirements:
- a. The urgency to implement a GBO System solution will necessitate Commercial off-the-shelf (COTS) equipment;
  - b. A telescope with a 1-metre aperture is the general limit of COTS telescopes;
  - c. Canada intends to deliver a GBO System that will operate and be supported for a minimum period of 10 years, though it is anticipated that the system service life and usage will continue well beyond that.

### 5.3 GBO System Constraints

- 5.3.1 The following are constraints to the proposed GBO System requirements:
- a. Canada is seeking an optical capability, rather than a radar capability;
  - b. Canada is seeking to own and operate a GBO System, versus procuring SSA data from a third party system; and
  - c. The GBO System must be located within Canada on DND premises due to the security requirement and the ability to maintain national control over the system.
  - d. The GBO Sensors must utilize Canada's Secret network infrastructure. This network infrastructure may pose bandwidth limitations.

### 5.4 SofS2 High Level Mandatory Requirements

5.4.1 Functional and performance requirements will be derived from the HLMRs in Table 1. Note that as these HLMRs apply to the SofS2 capability as a whole, a portion of the HLMRs are not applicable to the GBO System; namely HLMR-02.

**Table 1 – SofS2 Capability High Level Mandatory Requirements**

<b>Id.</b>	<b>HLMR</b>	<b>Requirement</b>
HLMR-01	Deep space surveillance	The ability to detect, track, characterize and monitor deep space Earth-orbiting artificial objects having orbit altitudes greater than 5,000 km and having an apparent visual magnitude <sup>3</sup> of 17.5 and brighter.
HLMR-02	Coverage (Not applicable to the GBO requirement)	<b>NOT APPLICABLE TO THE GBO REQUIREMENT:</b> The ability to observe objects anywhere on the geostationary regime within a 12- hour period.
HLMR-03	Interoperability	The ability to interface with the US SSN as a contributing deep space surveillance sensor in the conduct of allied space operations.
HLMR-04	Information security	The ability to communicate information at a classification level that is commensurate with the level of operational security required by the space surveillance missions performed by the SofS 2 capability.
HLMR-05	Responsive control	The ability for Canadian operators to plan, operate, manage, monitor, and prioritize deep space surveillance tasks in accordance with Canadian priorities and mission timelines.
HLMR-06	SSA Data Continuity	The ability to continuously collect deep space surveillance data over a minimum period of 10 years.

## 5.5 GBO System Security Requirements

5.5.1 The data associated with tasking GBO Sensors and the observation data generated by the Sensor is classified as SECRET. The requirements in the remainder of the requirements section address how the GBO System elements are to address the physical and information security of the tasking and observation data.

5.5.2 The following pertains to the security standards referenced within this document:

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<sup>3</sup> The magnitude scale is a measure of brightness as seen by an observer on the Earth and commonly used by astronomers as well as the space surveillance community. As a reference, the brightest star that can be seen by the human eye is equal to an apparent brightness of 1 magnitude while the dimmest is equal to an apparent brightness of 6 magnitude.

- a. The Royal Canadian Mounted Police’s “G1-026 Guide to the Application of Physical Security Zones” describes the security zones referenced in this document, and in particular the Operations and Security Zones. This document can be found using the following link: <http://www.rcmp-grc.gc.ca/physec-secmat/pubs/g1-026-eng.htm>; and
- b. References for safeguarding of equipment in regards to emissions and information security are classified SECRET, and will be provided to the successful and qualified bidder if an RFP is released.

## 5.6 GBO Sensor Locations

5.6.1 The locations for the GBO Sensors will be determined by Canada, with the driving requirement that the locations:

- a. Optimize coverage of the GEO regime;
- b. Minimize interference from light pollution, and nearby light interference;
- c. Minimize unfavourable meteorological conditions, including but not limited to precipitation; turbulence; fog; and extreme temperatures that would cause reduced astronomical seeing or issues that would prevent the sensor from operating or increase equipment failure rates;
- d. Minimize interference from obstructions (trees, building etc.); and
- e. Minimize the level of effort to meet GBO System’s physical and information security requirements.

5.6.2 In accordance with requirements 5.3.1c) and 5.6.1e), Canada has determined that the GBO Sensors will be located on DND property, where physical site security and access to DND secured network services are readily available.

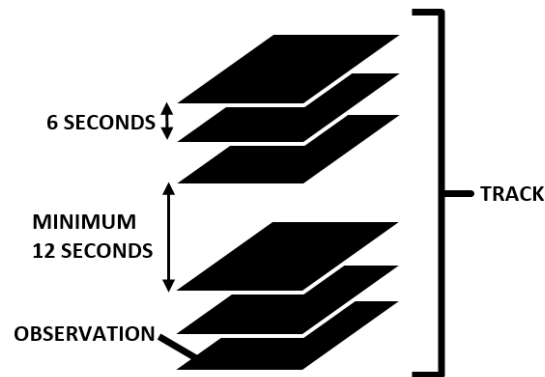
5.6.3 While the final sites are still to be confirmed, for the purposes of this RFI please assume that there will be three GBO Sensor sites, with one GBO Sensor site at each of the following locations:

- a. Canadian Forces Base (CFB) Gagetown, New Brunswick;
- b. CFB Suffield, Alberta; and
- c. CFB Shilo, Manitoba.

## 5.7 GBO Sensor Requirements

5.7.1 The GBO Sensors must:

- a. Detect, track, characterize, and monitor deep space Earth-orbiting artificial objects having orbit altitudes greater than 5,000 km and having an apparent visual magnitude of 17.5 and brighter;
- b. Determine an RSO's position to a specified degree of precision measured as one sigma angle precision less than 1 arcsecond. An arcsecond is a unit of angular measurement, where one arcsecond is equal to 1/3600 of a degree;
- c. Obtain a minimum of 130 tracks per hour per GBO sensor site. As shown in Figure 3, a track is defined as a series of six consecutive observations of an RSO. An observation is a single measurement of the RSO's position at a given time. Each observation must be separated by a minimum of six seconds, except between the 3rd and 4th observations, where a minimum of 12 seconds is required. The time to complete a track must be between 36 and 90 seconds;
- d. Be available for operations at least 98% of the time over a ten-day period, regardless of forecast or actual viewing conditions; and
- e. Operate via commands from the SSOC, without requiring on-site human intervention.



**Figure 3. Conceptual representation of the structure of a track and its observations.**

5.7.2 The GBO Sensor must minimize sources of interference by maximizing employment of technologies such as, but not limited to:

- a. Sensors that can see in near infra-red wavelengths to allow the GBO Sensors to operate longer into the dawn and dusk periods;
- b. Adaptive optics systems<sup>4</sup>, to minimize the effect of atmospheric interference;

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<sup>4</sup>Example adaptive optic systems, for reference:

- c. Vibration isolation and dampening, to minimize effects of vibrations transmitted through the ground and facility structure, and caused by winds or ground traffic;
  - d. Technologies to reduce the amount of dust that affects the GBO Sensor;
  - e. Technologies that map the local cloud cover and adjust scheduled taskings to allow observations to proceed within the openings in cloud cover;
  - f. Technologies to reduce the effects of humidity near the GBO Sensor; and
  - g. Technologies to allow the sensor to operate in temperatures below -20°.
- 5.7.3 GBO System must include a weather detection capability at each site, in order to aid the GBO Sensor in determining when it can operate. This detection capability must sense local temperature, wind speed, precipitation, and areas of cloud cover as a minimum.
- 5.7.4 All communications lines and equipment carrying or storing GBO Sensor tasking and observation data must adhere to the information security standards for safeguarding SECRET classified data. These standards will be provided as per section 5.5.2b.

## 5.8 GBO Sensor Facility Requirements

- 5.8.1 The GBO Sensor must be housed within its own standalone facility, which protects the Sensor from precipitation and other adverse weather conditions.
- 5.8.2 DND will provide the GBO Sensor Facility with power, connection to a network classified at the SECRET level for communication between the sensor and the SSOC.
- 5.8.3 The GBO Sensor Facility must:
- a. Be located on DND property within an area designated as an Operations Zone as a minimum, where access control is present at all entry points to the zone;
  - b. Be built to the standards of an Operations Zone, as defined by the reference within section 5.5.2a, at a minimum;

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1. Steve J. Weddell, Richard Clare, Andrew Lambert (2019). Near Earth Object Image Restoration with Multi-Object Adaptive Optics. In: 1st NEO and Debris Detection Conference, 22 January 2019 - 24 January 2019, Darmstadt, Germany, published by ESA Space Safety Programme Office.

2. Doris Grosse, Francis Bennet, Michael Copeland, Celine D'orgeville, Ian Price, Francois Rigaut (2017). Adaptive Optics for Satellite Imaging and Earth Based Space Debris Manoeuvres. in: 7th European Conference on Space Debris, 17 April 2017 - 21 April 2017, Darmstadt, Germany, published by ESA Space Debris Office.

3. Loktev, Mikhail & Vdovin, Gleb & Soloviev, Oleg. (2008). Integrated adaptive optics system for small telescopes. Proceedings of SPIE, 2008 vol. 7015. 7015. 10.1117/12.787893.

- c. Not limit nor degrade the sensor capabilities while the GBO Sensor is carrying out observation tasks;
- d. Operate remotely (without staff in the facility), and in coordination with GBO Sensor operations; and
- e. House a DND provided and controlled cabinet, which contains the equipment that connects to the DND SECRET network.

## 5.9 GBO Data Processing Requirements

5.9.1 The GBO System must process GBO Sensor observation data, such that records of the processed observations:

- a. Detect and correlate astronomical objects (stars) in either SSM or TRM images with astrometric data such that objects are identified and coordinate locations are provided;
- b. Detect and correlate RSOs in either SSM or TRM images to entities within the US SATCAT; and
- c. Provide the angles of right ascension and declination, along with a time stamp, for each detected RSO in a data format to be specified by Canada.

5.9.2 GBO System must process the GBO Sensor observation data such that the following photometric data is provided, as a minimum, for each detected RSO:

- a. Intensity (apparent magnitude in the band within which the sensor was tasked to collect the data);
- b. Full width at half maximum measurement of the point spread function; and
- c. Signal to noise ratio.

5.9.3 As the GBO Data processing equipment is handling data classified as SECRET, it must:

- a. Be located within a Security Zone (as defined by the reference within section 5.5.2a) at either the GBO Sensor site or the SSOC; and
- b. Adhere to the information security standards for safeguarding SECRET classified data. These standards will be provided as per section 5.5.2b.

## 5.10 Sensor Tasking and Reporting System

5.10.1 A GBO System must have a centralized computer station located at the SSOC, which tasks the GBO Sensors and receives Sensor observation and Sensor status data. This



computer station will herein be referred to as the Sensor Tasking and Reporting System (STARS).

- 5.10.2 The STARS will be located in the SSOC Facility's Security Zone, as defined by the reference within section 5.5.2a.
- 5.10.3 The STARS must have a scalable interface that is can incorporate additional space surveillance sensors without modification.
- 5.10.4 The STARS must include the following functions:
  - a. Receive observation requests from the SSN and automatically task the requested sensors connected to the system. The SSN tasking protocol and message formats will be defined within the RFP;
  - b. Receive and store processed data as records, and receive and store raw and processed image data as records when requested by the operator; and
  - c. An algorithm to select the Sensor best suited to make a requested observation in the event that no Sensor is specified in a request, and in the event that the selected Sensor is not available/becomes unavailable. This algorithm must take into account the operational status of the Sensor, the Sensor's field of regard, and local weather at the GBO Sensor sites.
- 5.10.5 The STARS must have a user interface for a human operator to:
  - a. Make custom observation requests to the Sensors connected to the system;
  - b. View the status of the sensors; and
  - c. Retrieve and review recorded observation data and sensor status.

## 5.11 SofS 2 GBO System Implementation Schedule

- 5.11.1 It is anticipated that Canada would start implementation of the GBO System in 2022.
- 5.11.2 Canada is looking to field a GBO System capability as soon as possible as a mitigation strategy to reduce the loss of SSA in the event of a Sapphire failure.
- 5.11.3 The notional milestones are as follows, and are subject to change:

**Table 5.11 – Current Project Milestones and Schedule**

Milestone	Planning Date
Industry Day	8 Oct 2019
Industry Day One-on-One Meetings	8-10 Oct 2019
Requested RFI “Response By” Date	Oct 2019
Draft RFP	Apr 2020

## 6.0 INFORMATION REQUESTED FROM RESPONDENTS

### 6.1 General

6.1.1 Respondents are invited to submit a reply to the RFI that addresses each of the topics listed below. It is understood however, that trade-offs in the schedule, cost, capability, complexity, and risk are possible with different configurations. To facilitate the review of the responses to this RFI, respondents are asked to provide the requested information in the order in which the topics are presented below.

### 6.2 Respondent Information

6.2.1 Based on the documentation provided, respondents are requested to provide background information on their capabilities towards delivering the SofS 2 GBO System solution either individually, through partnership(s), or sub-contracting.

6.2.2 Respondents are requested to provide details of any experience in providing ground based optical sensor solutions for SSA to clients, or other transferrable experiences.

6.2.3 Respondents are requested to provide the name, telephone number, and e-mail address of a representative who may be contacted for clarification or other matters related to the respondent’s RFI response.

### 6.3 GBO Sensor Requirements to be addressed by Respondents

6.3.1 Respondents are requested to describe their recommended GBO Sensor solution(s) in as much detail as possible, in order to demonstrate achievement of the requirements stated within section 5.7.

6.3.2 Respondents are requested to include the following with their response:

- a. A description or datasheet of the performance and technical characteristics of the proposed sensor(s);
- b. An outline or chart of which HLMR and GBO Sensor requirements, stated in sections 5.4 and 5.7, cannot be satisfied, can be satisfied, or can be surpassed. If

requirements cannot be satisfied, respondents are requested to state why and to describe any trade-offs that were considered;

- c. Details on how the sensitivity, capacity and accuracy of the proposed GBO Sensor solution are achieved. For example, are multiple optical sensors required at each GBO Sensor location? Is data processing required to achieve the required sensitivity?;
- d. Details on systems used to sense local weather conditions, including: temperature, wind, precipitation, and localization of areas of cloud cover;
- e. A description of how meteorological and astronomical seeing conditions are assessed for operation of the sensor; and
- f. Details on the maintenance schedule and the length of time the sensors can be expected to operate without requiring on-site servicing or any other form of on-site human intervention.

6.3.3 Respondents are requested to provide details on the solutions they would integrate into their GBO solutions to reduce interference of the sensors, particularly in regards to near infrared sensing, adaptive optics, and dust and humidity mitigation.

## 6.4 GBO Sensor Facility Requirements to be addressed by Respondents

6.4.1 Respondents are requested to provide a description of their GBO Sensor Facility solution, including:

- a. Facility footprint, and overall dimensions;
- b. Details of all special features, such as observatory domes, or roll-on roll-off roofs;
- c. Estimated power required to service the facility and the equipment within;
- d. Facility layout, including locations of major equipment items, work, and storage areas;
- e. Heating, ventilation and air conditioning requirements; and
- f. Additional local siting requirements for placement of a GBO Facility.

6.4.2 Respondents are requested to provide details of their experience in either integrating their optical sensor solutions within a facility, or providing facilities for their optical sensor solutions to previous clients.

6.4.3 Respondents are requested to provide the estimated timeline to construct the GBO Sensor Facility.

## 6.5 GBO Data Processing Requirements to be addressed by Respondents

- 6.5.1 Respondents are requested to provide a description of their GBO Data Processing solution, including:
- a. A description of the processing steps of their system;
  - b. A description of the bandwidth requirements for transmission of data from the GBO Sensor to the GBO Data Processing System and from the GBO Data Processing System to the STARS.
  - c. Whether their GBO Data Processing solutions are expected to be located at the GBO Sensor sites or the SSOC;

## 6.6 STARS Requirements to be addressed by Respondents

- 6.6.1 Respondents are requested to provide a description of their proposed STARS solution.

## 6.7 Schedule Elements to be addressed by Respondents

- 6.7.1 Respondents are requested to provide:
- a. An estimated timeline which includes design, development, assembly, installation, integration, and testing of the solution; and
  - b. Details on Respondent-managed issues that would significantly impact the Project in terms of cost and schedule (e.g.: export permits and certifications to standards acceptable by Canada).

## 6.8 Indicative Cost Elements to be addressed by Respondents

- 6.8.1 Respondents are requested to complete the Costing Structure Table found in “SofS 2 GBO RFI Annex C - GBO System Cost Structure Table” uploaded as a separate Excel document on buyandsell.gc.ca for the proposed solution. Note that the costing submission is for DND planning purpose only. The following details should be included:
- a. Total acquisition cost and the costs by sub-system;
  - b. Identification of key cost drivers and risks. Risks may be captured using a multi-point estimate with the best and worst case scenario costs;
  - c. Description of any underlying assumptions (i.e. inflation, type of contract, the basis of payment, mark-up, and fees) used to establish these cost estimates;
  - d. Currency exchange considerations should be highlighted where used; and
  - e. Costs should reflect Nominal Dollars (\$Current Year), which is defined as the dollar value of a product at the time it was produced.

## 6.9 Recommendations, Suggestions, and Comments

- 6.9.1 As much as possible, the GBO System requirements are not intended to impose unnecessary restrictions on potential solutions. Should any requirement impose a limitation on a Respondent's optimal solution, it should be identified to Canada. Respondents should also specify any additions or amendments they would propose to the Business Outcomes in order to provide or ensure a more optimal solution. Respondents are highly encouraged to offer alternatives to any of the concepts outlined in this RFI. These alternatives should be accompanied by a comprehensive analysis that articulates how the proposed amendment is more advantageous to Canada with regard to operational suitability, effectiveness, schedule, cost, and risk.

## 6.10 Acquisition Model

- 6.10.1 Respondents are to assume Canada will be acquiring the GBO System through a major crown acquisition with government-owned & operated, contractor-maintained equipment. If a different acquisition model is proposed, such as contractor-operated or contractor-owned, respondents are requested to describe their approach in detail, and respondents are requested to address the following considerations:
- a. How would data ownership and licensing be defined to allow unrestricted use by Canada?; and
  - b. How would Canada unique data be protected?

## 6.11 Economic Benefits

- 6.11.1 The Canadian Space Systems industry generates valuable economic impacts to the Canadian economy in its roles as an innovation leader. With a Research & Development (R&D) intensity over 10 times higher than that of total Canadian manufacturing, it plays a vital role in developing and supporting a highly skilled workforce. The Canadian space systems industry is commercially oriented and export-intensive, and with significant capabilities within the Key Industrial Capability areas of Space Systems and Earth Observation, the industry is well-positioned growth opportunities.
- 6.11.2 Canada's Defence Policy Strong, Secure, Engaged, identifies space capabilities of critical importance to national security, sovereignty, and defence. Through SofS 2, DND will procure key SSA technologies of strategic importance for Canada's national security. These activities fall across key space domains that have the potential to grow Canada's Space Systems Industry and provide opportunities to support future Canadian industrial growth.
- 6.11.3 Accordingly, Canada is seeking information on economic leveraging opportunities related to SofS 2. Respondents should be aware that any contracts entered into as a result of any subsequent RFP that may follow this RFI may contain socio-economic benefit requirements such as the ITB Policy. Under the ITB Policy, companies awarded

defence procurement contracts are required to undertake business activities in Canada, equal to the value of the contract. In addition, a core element of the ITB Policy is a rated and weighted Value Proposition. Further information regarding the ITB Policy can be found at <http://www.ic.gc.ca/eic/site/086.nsf/eng/home>.

## 6.12 ITB Policy

6.12.1 The ITB policy has five main objectives:

- a. Support the long-term sustainability and growth of Canada's defence sector;
- b. Support the growth of prime contractors and suppliers in Canada, including small and medium-sized enterprises in all regions of the country;
- c. Enhance innovation through R&D in Canada;
- d. Increase the export potential of Canadian-based firms; and
- e. Identify skills development and training opportunities for Canadians.

## 6.13 Industry Response to Leveraging Canadian Content

6.13.1 The industrial analysis conducted to date has revealed that there is a capability for the Canadian industry to provide significant contributions to the GBO System solution. It is therefore important for Respondents to consider how they might engage Canadian capability within their solution for SofS 2 GBO System. Proposed economic benefits through the ITB Policy should respond to any of the procurement options currently under consideration by Canada.

6.13.2 Respondents are asked to provide as much detail as possible to the following:

- a. General:
  - i. What are the key issues your company faces within the current global space market?
  - ii. How is your company positioning for future opportunities in the space sector?
  - iii. What role does this procurement play in positioning your company/team for long-term growth?
- b. Direct Canadian Content: What direct Canadian content do you consider is applicable to delivering SofS 2? What partnerships with Canadian industry/academia does your team have that could be leveraged?
- c. Supplier Development: How can this procurement be used to leverage opportunities for Canadian suppliers and small and medium-sized businesses?

- d. Research & Development: What opportunities for R&D do you see in relation to SofS 2 directly? Are there other potential R&D opportunities in the broader space sector that are of value to leverage?
- e. Export: Do you see opportunities for growth that can position your company and Canadian suppliers for future exports? Please explain.
- f. Skills Development and training: The space systems industry in Canada supports a highly skilled workforce. How does your solution contribute to the sustainment of this workforce? What challenges does your company currently face regarding skills development and what strategies could be used to ensure a sustained workforce in Canada?

## 7.0 CONFIDENTIALITY

- 7.1.1 Respondents are advised that any information submitted to Canada in response to this RFI may be used by Canada in the development of a subsequent competitive Request for Qualification and/or RFP; and
- 7.1.2 As such, respondents responding to this RFI should identify any submitted information that is to be considered as either company confidential or proprietary.

## 8.0 CONTRACTING AUTHORITY

- 8.1.1 Enquiries are to be made in writing (preferably by e-mail) exclusively to the Contracting Authority indicated below;
- 8.1.2 Enquiries should be received no less than 10 working days prior to the RFI closing date to allow sufficient time to provide a response or to prepare a meeting. Enquiries received after that time might not be answered prior to the RFI closing date.
- 8.1.3 To ensure consistency and quality of information provided to Respondents, the replies to enquiries will be provided on buyandsell.gc.ca, without revealing the sources of the enquiries.
- 8.1.4 It should be noted that any information provided in relation to this RFI will not be binding upon Canada under any circumstances; and
- 8.1.5 Requests for clarification or meetings should be sent to the Contracting Authority:

**Alan Chan**

Supply Team Leader

Services and Technology Acquisition Management Sector  
Acquisitions Branch  
Public Services and Procurement Canada (PSPC)  
Telephone Number: 613-858-9358  
E-mail address: [alan.chan@tpsgc-pwgsc.gc.ca](mailto:alan.chan@tpsgc-pwgsc.gc.ca)

## 9.0 ENGAGEMENT PROCESS

9.1.1 The Industry Engagement Process will begin with the publication of this RFI on [buyandsell.gc.ca](http://buyandsell.gc.ca). The Industry Engagement Process may consist of the following events:

- a. Release of one or more RFIs;
- b. One-on-One Industry Day Meetings and a general briefing to respondents;
- c. Submission of the RFI Responses;
- d. Release of the RFI Summary of Feedback and Outcomes; and
- e. Release of draft RFP documents, including the SOW and evaluation criteria, at a later date.

9.1.2 At any point within the Industry Engagement Process, the above-listed Industry Engagement events or their scheduling may change. Except for changes brought about by unforeseen events or adverse weather, Canada will endeavour to provide a minimum of five calendar days' notice to respondents of any planned change. Industry Day, as well as all one-on-one meetings, will be held at a location within the National Capital Region.

9.1.3 Proceedings from all of the consultation workshops, such as one-on-one meetings will be recorded. A summary of information gathered during these workshops, excluding information related to Controlled Goods or industry proprietary or commercially sensitive information, will be published on [buyandsell.gc.ca](http://buyandsell.gc.ca).

## 9.2 Industry Day Information Session

9.2.1 An Industry Day and subsequent one-on-one sessions with vendors are tentatively planned for 8-10 October 2019. These sessions, to be held in the National Capital Region, will serve as an opportunity for participants to present relevant technical information and to pose and address questions related to this RFI.

9.2.2 Registration for the above events will be required. Upon registration, a meeting time will be allocated to each participant, on a first-come-first-served basis. To register, please contact the Contracting Authority listed in section 8.1.5.



- 9.2.3 Attendance at these sessions is not required in order to submit a response to the RFI nor any follow-on RFP.
- 9.2.4 Questions should be submitted to PSPC at least 10 working days before the event. At this information session, there will be an opportunity for participants to seek clarifications from representatives from Canada concerning requirements;
- 9.2.5 Information gathered during the Industry Day information sessions, excluding proprietary or commercially sensitive information, will be summarized and published on [buyandsell.gc.ca](http://buyandsell.gc.ca).
- 9.2.6 Please note that all participants participating in the Industry Day or one-on-one sessions must have:
  - a. completed and submitted a signed Rules of Engagement form to the Contracting Authority referenced in section 8.1.5; and
  - b. registered at least five days in advance of the session date by contacting the Contracting Authority referenced in section 8.1.5.

## 10.0 ANNEX A – RULES OF ENGAGEMENT

- 10.1.1 An overriding principle of the industry consultation is that it be conducted in a fair and equitable manner between all parties. No one person or organization must receive nor be perceived to have received any unusual or unfair advantage over the others.
- 10.1.2 All Crown documentation provided throughout the industry consultative process, which begins with the publication of this RFI, will be made available on [www.buyandsell.gc.ca](http://www.buyandsell.gc.ca).
- 10.1.3 The Consultative Process may consist of the following events:
  - a. Release of one or more RFIs;
  - b. Industry Day(s) if required;
  - c. One-on-One Industry Day Meetings upon request;
  - d. Submission of the RFI Responses;
  - e. Release of vendors questions and answers, as well as the RFI Summary of feedback and outcomes; and
  - f. Release of the Draft RFP documents.

10.1.4 A number of consultations will be conducted on various topics to solicit industry feedback/comments. Initially, Canada will hold an Industry Day information session for the SofS 2 GBO System.

10.1.5 Canada will not disclose proprietary or commercially sensitive information concerning a Participant to other Participants or third parties, except and only to the extent required by law.

## 10.2 Terms and Conditions

10.2.1 The following terms and conditions apply to the Consultative Process. In order to encourage open dialogue, Participants agree to:

- a. Discuss their views concerning the SofS 2 GBO requirement and to provide positive resolutions to the issues in question. Everyone will have equal opportunity to share their ideas and suggestions;
- b. Not reveal or discuss any information to the media regarding the SofS 2 GBO requirement during this Consultative Process. Any media questions will be directed to the PSPC Media Relations Office at 819-420-5501;
- c. Industry will direct inquiries and comments to the Contracting Authority unless advised otherwise. Please note that any communication to unauthorized representatives of Canada may be subject to full disclosure by Canada on [buyandsell.gc.ca](http://buyandsell.gc.ca);

10.2.2 In reference to the RFI consultative process, Canada:

- a. Is not obligated to issue any RFP, or to negotiate any contract for the SofS 2 GBO System;
- b. Will provide a Draft RFP to Industry for comment, if Canada proceeds with the project;
- c. Will have absolute discretion over the terms and conditions of an RFP, if released; Canada will not reimburse any person or entity for any cost incurred in participating in this Consultative Process; and
- d. Will not reimburse any person or entity for any cost incurred in participating in this consultative process.

10.2.3 Additional information pertaining to the RFI consultation is as follows:

- a. If Canada proceeds with the project, a Draft RFP will be provided to Industry for comment;

- b. Participation is not a mandatory requirement. Not participating in this consultative process will not preclude a vendor from submitting a proposal;
- c. Failure to submit a signed copy of the Rules of Engagement to the Contracting Authority identified in section 8.1.5, will result in the exclusion from participation in this Consultative Process; and
- d. A dispute resolution process to manage impasses throughout this Consultative Process will be adhered to as per the dispute resolution process detailed in section 10.3 below.

### 10.3 Dispute Resolution Process

10.3.1 By informal discussion and good faith negotiation, each of the parties will make all reasonable efforts to resolve any dispute, controversy or claim arising out of or in any way connected with this Consultative Process.

10.3.2 Any dispute between the Parties of any nature arising out of or in connection with this Consultative Process will be resolved by the following process:

- a. Any such dispute will first be referred to the Participant's Representative and the PSPC Manager managing the Industry Engagement. The parties will have five Business Days in which to resolve the dispute;
- b. In the event the representatives of the Parties specified in Article 10.3.2a above are unable to resolve the dispute, it will be referred to the Participant's Project Director and the PSPC Senior Director of the Division responsible to manage the Industry Engagement. The parties will have three Business Days to resolve the dispute;
- c. In the event the representatives of the Parties specified in Article 10.3.2b are unable to resolve the dispute, it will be referred to the Participant's President and the PSPC Director General, who will have three Business Days to resolve the dispute;
- d. In the event the representatives of the Parties specified in Article 10.3.2c. above are unable to resolve the dispute, it will be referred to the Participant's Chief Executive Officer and the PSPC Assistant Deputy Minister, Acquisitions Branch who will have five Business Days to resolve the dispute; and
- e. In the event the representatives of the Parties specified in Article 10.3.2d. above are unable to resolve the dispute, the Contracting Authority will, within five Business Days, render a written decision which will include a detailed description of the dispute and the reasons supporting the Contracting Authority's decision. The Contracting Authority will deliver a signed copy thereof to the Participant.

By signing this document, the individual represents that he/she has full authority to bind the company listed below and that the individual and the company agree to be bound by all the terms and conditions contained herein.

**Name of Company:** \_\_\_\_\_

**Name of individual:** \_\_\_\_\_

**Telephone:** \_\_\_\_\_

**E-mail:** \_\_\_\_\_

**Signature:** \_\_\_\_\_

**Date:** \_\_\_\_\_

Correspondence:     French                       English

## 11.0 ANNEX B – TABLE OF ACRONYMS

<b>Term</b>	<b>Description</b>
<b>CANSpOC</b>	Canadian Space Operations Centre
<b>CAF</b>	Canadian Armed Forces
<b>CFB</b>	Canadian Forces Base
<b>CG</b>	Controlled Goods
<b>CGP</b>	Controlled Goods Program
<b>COTS</b>	Commercial Off-the-shelf
<b>CSA</b>	Canadian Space Agency
<b>CSpO</b>	Combined Space Operations
<b>CSpOC</b>	Combined Space Operations Center
<b>CSSS</b>	Canadian Space Surveillance System
<b>DND</b>	Department of National Defence
<b>DRDC</b>	Defence Research and Development Canada
<b>FOC</b>	Full Operational Capability
<b>FOV</b>	Field of View
<b>GBO</b>	Ground Based Optical
<b>GEO</b>	Geosynchronous Orbit
<b>HEO</b>	Highly Elliptical Orbit
<b>HLMR</b>	High-Level Mandatory Requirement
<b>IOC</b>	Initial Operational Capability
<b>ITB</b>	Industrial and Technological Benefits
<b>ILS</b>	Integrated Logistics Support
<b>ISS</b>	In Service Support
<b>LCMM</b>	Life Cycle Materiel Manager
<b>MEO</b>	Medium Earth Orbit
<b>NSE</b>	National Security Exception
<b>OPSEC</b>	Operations Security
<b>PSPC</b>	Public Services and Procurement Canada
<b>R&amp;D</b>	Research and Development
<b>RFI</b>	Request for Information
<b>RFP</b>	Request for Proposal

<b>Term</b>	<b>Description</b>
<b>RSO</b>	Resident Space Object
<b>SBO</b>	Space Based Optical
<b>SofS 2</b>	Surveillance of Space 2
<b>SOW</b>	Statement of Work
<b>18 SPCS</b>	18 Space Control Squadron
<b>SSA</b>	Space Situational Awareness
<b>SSM</b>	Sidereal Stare Mode
<b>SSN</b>	Space Surveillance Network
<b>SSOC</b>	Sensor System Operations Center
<b>STARS</b>	Sensor Tasking and Reporting System
<b>TBS</b>	Treasury Board Secretariat
<b>TRM</b>	Track Rate Mode
<b>US</b>	United States
<b>US SATCAT</b>	United States Satellite Catalogue

## Surveillance of Space 2 Request for Information (RFI) Annex C - GBO System Indicative Cost Structure Table for DND planning purpose only

Instructions: Fill in Columns B, C, D, and F with the requested information. Rows and columns can be resized, and additional rows can be provided. Development, integration, and installation costs are to be included as part of the component costs. Costs should reflect Nominal Dollars (\$Current Year), which is defined as the dollar value of a product at the time it was produced.

State underlying assumptions in the adjacent cell (i.e. inflation, contract type, the basis of payment, mark-up, currency considerations, and fees) used to establish these cost estimates.

<Enter Assumptions Here>

**Enter Total System Acquisition Cost ->**

\$0

The Total System Acquisition Cost in cell B7 should equal the sum of the values in cells E15, E20, E25, E29, and E34 below. The Yearly In-Service Support Cost in cell E39 is not to be added to the Total System Acquisition Cost.

GBO SENSOR COMPONENTS	DESCRIPTION / SPECIFICATIONS	QUANTITY FOR ALL THREE SITES SPECIFIED IN THE RFI	UNIT COST [CAD]	TOTAL	ADDITIONAL COMMENTS / RISKS / COST DRIVERS
	Optical Device			\$0	
	Camera / Sensor			\$0	
	Moving Mount Hardware			\$0	
	Observatory Roof Control Hardware			\$0	
	Weather Sensor System			\$0	
<b>GBO Sensor Sub-system Total</b>				<b>\$0</b>	

GBO SENSOR PROCESSING COMPONENTS	DESCRIPTION / SPECIFICATIONS	QUANTITY	UNIT COST [CAD]	TOTAL	ADDITIONAL COMMENTS / RISKS / COST DRIVERS
	Processing System Hardware			\$0	
	Processing System Software			\$0	
<b>GBO Sensor Processing Sub-system Total:</b>				<b>\$0</b>	

SENSOR TASKING AND REPORTING SYSTEM (STARS) COMPONENTS	DESCRIPTION / SPECIFICATIONS	QUANTITY	UNIT COST [CAD]	TOTAL	ADDITIONAL COMMENTS / RISKS / COST DRIVERS
STARS Hardware				\$0	
STARS Software				\$0	
<b>STARS Total:</b>				\$0	
GBO INFRASTRUCTURE COMPONENTS	DESCRIPTION / SPECIFICATIONS	QUANTITY FOR ALL THREE SITES SPECIFIED IN THE RFI	UNIT COST [CAD]	TOTAL	ADDITIONAL COMMENTS / RISKS / COST DRIVERS
GBO Sensor Facility		3		\$0	
<b>Infrastructure Total:</b>				\$0	
GBO TRAINING COMPONENTS	DESCRIPTION / SPECIFICATIONS	QUANTITY	UNIT COST [CAD]	TOTAL	Additional Comments / Risk Factors / Cost Drivers
Operator Training Cost				\$0	
Training Material				\$0	
<b>Training Total:</b>				\$0	
GBO IN SERVICE SUPPORT COMPONENTS	DESCRIPTION / SPECIFICATIONS	QUANTITY	UNIT COST [CAD]	TOTAL	ADDITIONAL COMMENTS / RISKS / COST DRIVERS
Yearly Sensor Maintenance Fee				\$0	
Yearly Software Licence Fee				\$0	
<b>Yearly In-Service Support Total</b>				\$0	