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LETTER OF INTEREST
LETTRE D'INTÉRÊT

Comments - Commentaires

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Montréal
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H5A 1L6

Title - Sujet MSS RCAM (RFI)	
Solicitation No. - N° de l'invitation 9F052-130408/B	Date 2013-09-23
Client Reference No. - N° de référence du client 9F052-13-0408	GETS Ref. No. - N° de réf. de SEAG PW-\$MTB-690-12429
File No. - N° de dossier MTB-3-36224 (690)	CCC No./N° CCC - FMS No./N° VME
Solicitation Closes - L'invitation prend fin at - à 02:00 PM on - le 2013-10-18	
F.O.B. - F.A.B. Plant-Usine: <input type="checkbox"/> Destination: <input checked="" type="checkbox"/> Other-Autre: <input type="checkbox"/>	
Address Enquiries to: - Adresser toutes questions à: Paquin, Esther	Buyer Id - Id de l'acheteur mtb690
Telephone No. - N° de téléphone (514) 496-3889 ()	FAX No. - N° de FAX (514) 496-3822
Destination - of Goods, Services, and Construction: Destination - des biens, services et construction: AGENCE SPATIALE CANADIENNE 6767 ROUTE DE L AEROPORT 9F052-Exploration Spatiale ST HUBERT Québec J3Y8Y9 Canada	

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Signature	Date

Solicitation No. - N° de l'invitation

9F052-130408/B

Amd. No. - N° de la modif.

File No. - N° du dossier

MTB-3-36224

Buyer ID - Id de l'acheteur

mtb690

CCC No./N° CCC - FMS No/ N° VME

9F052-13-0408

**Request for Information (RFI) regarding
Replacement of Mobile Servicing System Cameras on the ISS**

SEE ATTACHED DOCUMENT

REQUEST FOR INFORMATION (RFI)

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Request for Information (RFI) regarding Replacement of Mobile Servicing System Cameras on the ISS

1. BACKGROUND AND PURPOSE OF THE RFI

Public Works and Government Services Canada (PWGSC), on behalf of the Canadian Space Agency (CSA), is releasing this Request for Information (RFI) to obtain comments, concerns and where applicable, alternative recommendations from interested parties regarding how the requirements or objectives described in this RFI could be satisfied. Respondents are also invited to provide comments regarding the content, format and/or organization of any draft documents included in this RFI. Respondents should explain any assumptions they make in their responses. The objective for this possible procurement for additional spare cameras for the current Mobile Servicing System (MSS) is to solicit information from the Canadian industry that will help PWGSC and the CSA to refine our procurement strategy.

The CSA is responsible for the MSS which was used to assemble the International Space Station (ISS) on-orbit. As part of its sustaining operations and ISS inspection tasks, the MSS is now playing a key role in the logistics and maintenance of the ISS, Free Flyer and/or Visiting Vehicle robotic capture, installation, removal and operation of science and technical demonstrations existing and planned for the ISS.

The MSS is consisting of three robotics systems commonly known as DEXTRE, CANADARM2 and the Mobile Base System, which is equipped with nine (9) color TV cameras as part of a Camera/Light Assemblies (CLAs) and Camera/Light Pan/Tilt Unit (PTU) Assemblies (CLPAs) to aid the robotic controllers in achieving their tasks. These cameras have been on-orbit for approximately ten (10) years, which is the life for which they have been designed for. With the life extension of the ISS, the available CLA/CLPA spare units and the actual failure rate of the current camera/lights, there is a requirement to initiate the procurement of new units. As such, the primary objective of the possible procurement is to achieve a functional set of operationally critical MSS cameras along with a statistically sufficient number of spare cameras.

This RFI contains a draft of Statement of Work. This document remains a work in progress and respondents should not assume that new clauses or requirements will not be added to any bid solicitation that is ultimately published by Canada. Nor should respondents assume that none of the clauses or requirements will be deleted or revised. Comments regarding any aspect of the draft document are welcome.

This RFI follows an initial RFI issued in 2012 (9F054-12-0083). As a result of a number of considerations following the initial RFI, including schedule, risk, and budget, CSA and PWGSC refined its procurement strategy and approach with respect to the MSS replacement camera.

The approach is summarized as follows:

- a. Meet current camera and light functional and performance requirements. The previous RFI invited solutions for enhancements.
- b. Focus the CLA and CLPA replacement solely on the failed units, that is, cameras and lights. The previous RFI invited solutions to replace entire CLA and CLPA as complete Orbital Replaceable Unit (ORU) units. The solutions thus involved replacing functional hardware and structure.
- c. Re-use existing functional units and mounting structure, at the camera and light level.

The procurement strategy has also been refined. In short, the current plan is to separate the procurement into two parts:

- a. Under a new fixed price contract: Design, development, test of camera unit and light unit replacement,
- b. Under the existing Logistics and Sustaining Engineering contract (9F054-110545): Integration of camera unit and light unit with existing CLA and CLPA mounting structure, and to the MSS.

As a result, the camera/light contractor will need to work closely with CSA and the Contractor of the Canadian Space Station Program Logistics and Sustaining Engineering activities.

With these considerations, the technical and product assurance requirements were developed and detailed out. These documents are provided under **Annex 1** of this document. They may form an integral part of possible RFP.

In addition, a possible RFP would contain the following elements:

- a. A potential start date in June 2014 and delivery of a flight certified CLA and CLPA ORU by March 2017.
- b. Requirement to provide a bid for 7 cameras and 7 lights, including recurring and non-recurring costs, as well as unit costs. This corresponds to what CSA has assessed as statistically required number of cameras and lights in order to have sufficient sparing capability for 5 CLPA's and 2 CLA's to support operation until 2020.
- c. The bidder will be requested to provide costing for several options:
 - I.5 cameras and 5 lights
 - II.3 cameras and 3 lights
 - III.1 camera and 1 light
 - IV. Potential Evaluation criteria as provided in **Annex 1** of this document

Technical information on the current camera system is summarized under the **Annex 1** of this document. The Statement of Work, Specification document, and Product Assurance requirements are available at the following FTP site:

ftp://ftp.asc-csa.gc.ca/users/MSS_RCAM_RFI_2013/pub

These documents are available in English only as the working language of the Space Station program is English. A listing of the documents is provided in **Annex 1**.

2. NATURE OF REQUEST FOR INFORMATION

This is not a bid solicitation. This RFI will not result in the award of any contract; therefore, potential suppliers of any goods or services described in this RFI should not earmark stock or facilities, nor allocate resources, as a result of any information contained in this RFI. Nor will this RFI result in the creation of any source list; therefore, whether or not any potential supplier responds to this RFI will not preclude that supplier from participating in any future procurement. Also, the procurement of any of the goods and services described in this RFI will not necessarily follow this RFI. This RFI is simply intended to solicit feedback from industry with respect to the matters described in this RFI.

This RFI is not a pre-selection process. There will be no short listing of firms for purposes of undertaking any future works, as a result of this RFI. Similarly, participation in this process is not a condition or prerequisite for participation in an eventual RFP.

This RFI is neither a Call for Tenders, nor a Request for Proposal, and no agreement or contract will be entered into with any contractor, based on responses to this RFI. The issuance of this RFI is not to be considered in any way as a commitment by Canada, or as authority for the respondent to undertake any work which could be charged to Canada, nor is this RFI to be considered a commitment to issue eventual RFP's or award eventual contracts in relation to this project.

Canada shall not be bound by anything stated in this RFI. Canada reserves the right to change all or any parts of this RFI as deemed necessary.

3. NATURE AND FORMAT OF RESPONSES REQUESTED

Respondents are requested to provide their comments, concerns and, where applicable, alternative recommendations regarding how the requirements or objectives described in this RFI could be satisfied. Respondents are also invited to provide comments regarding the content, format and/or organization of any draft documents included in this RFI. Respondents should explain any assumptions they make in their responses.

4. RESPONSE COSTS

Canada will not reimburse any respondent for expenses incurred in responding to this RFI.

5. TREATMENT OF RESPONSES

- (a) **Use of Responses:** Responses will not be formally evaluated. However, the responses received may be used to develop or modify procurement strategies or any draft documents contained in this RFI. Canada will review all responses received by the RFI closing date.
- (b) **Review Team:** A review team composed of representatives of CSA and PWGSC will review the responses on behalf of Canada. Canada reserves the right to hire any independent consultant, or use any Government resources that it deems necessary to review any response. Not all members of the review team will necessarily review all responses.
- (c) **Confidentiality:** 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 RFP. Respondents should mark any portions of their response that they consider proprietary or confidential. Canada will treat those portions of the responses as confidential to the extent permitted by the *Access to Information Act*.
- (d) **Activity:** Canada may, in its discretion, contact any respondents to follow up with additional questions or for clarification of any aspect of a response.
- (e) **Follow-up Activity: INDIVIDUAL PRESENTATION TO CSA**

It is CSA's intention to invite respondents to this RFI to make a presentation to the CSA project team about their proposed solution. Such presentations would be held after the RFI closing.

Respondents that are interested in making such a presentation should write a statement to that effect in their response to this RFI. The CSA will then make the necessary arrangements with the interested parties for the presentation to be held in person, at CSA's headquarters in Longueuil, Quebec or via Video conferencing or Web conference.

It should be noted that, as for the participation to the Industry information session, Canada will not be responsible for any costs associated with attendance or participation to those individual presentations.

(f) Follow-up Activity: INDUSTRY INFORMATION SESSION

Canada will hold an Industry information session on this project. All parties having an intention to reply to this RFI are invited to attend. This will be a good opportunity for any interested respondent to seek clarifications with the CSA's Project Team about the requirements.

The Industry information session will be held in both official languages (English and French).

Date: **Thursday, October 3rd, 2013**
Time: 1:00 pm, Eastern Daylight Time (EDT)
Location: At the CSA in Longueuil and by Video conferencing / Web conference (details will be provided upon registration)

Respondents interested in attending the information session must register no later than **October 1st, 2013**, noon, indicating whether they plan to attend in person or by Video conferencing / Web conference.

To register, please provide the following information by e-mail it to the PWGSC representative identified under **Section "7"** of this RFI:

1. Company name;
2. Complete company mailing address;
3. Names, titles, phone numbers and e-mail addresses of each of the company representatives that will be attending the session;
4. Please specify what is the official language (English or French) of choice of each of the attending representatives (for planning purposes).

Only registered participants will be allowed to participate to the information session.

Information Session Costs - Canada will not be responsible for any costs associated with attendance or participation at the Industry information session. Attendance or participation at the Industry information session is not mandatory and will not prevent any potential respondents from bidding on a possible future solicitation.

(g) Canadian Company

"Respondents" to this RFI must be defined as a "Canadian company".

A "Canadian company" means a legal person that or was incorporated in Canada, with a place and address of its head office in Canada, a place of business in Canada that employs individuals in Canada and owns assets in Canada

6. CONTENTS OF THIS REQUEST FOR INFORMATION

These respondents are invited to submit a reply to the RFI that addresses any or all of the topics listed below.

To facilitate the review of the responses to this RFI, respondents are asked to please address and present the requested information in the order in which the topics are presented. Such topics are:

6.1 Respondent Information

To those respondents who participated in the 2012 RFI, this section is not required, unless there are updates that your company feels would be useful to highlight.

- a) Please provide background information on your company (or consortium members that would be created for such a project), company/consortium management team and company/consortium experience with similar projects in the area of optics or visual systems or in the development and delivery of space-qualified hardware or software.
- b) Please provide the name, telephone number, and e-mail address of a representative who may be contacted for clarification or other matters related to the response.

6.2 Understanding of Systems and Product Assurance Requirements

Please provide feedback regarding the requirements:

- a) Do the requirements provide sufficient information and clarity in the context of a Fixed Price procurement approach?
- b) Are the requirements complete?
- c) Do you view any of the requirements problematic?
- d) Is there anything in the requirements that would preclude a technical solution?
- e) Could you identify areas which require clarification or which appear to be incomplete and explain why?

6.3 Understanding of Statement of Work

Please provide feedback regarding the Statement of Work:

- a) Does the Statement of Work provide sufficient information and clarity in the context of a Fixed Price procurement approach?
- b) Do you view any of the requirements as stated in the Statement of Work problematic?
- c) Is there anything in the SOW that would preclude you from bidding?
- d) Could you identify areas in the Statement of Work which require clarification or which appear to be incomplete and explain why?

6.4 Technical Solution

Please provide a description of the solution that you would put forward to address these requirements. This description should provide a first elaboration, detailed as far as practical, of the technical evidence that the proposed solution would meet CSA's minimal performance requirements as described in System Specification and the Product Assurance Requirements documents, available on the FTP site referenced in **Section 1**.

6.5 Canadian Content

As such, it is the intention of Canada to limit this procurement to Canadian goods and Canadian services as defined in SACC Clause A3050T (2010-01-11).

6.6 Technological Readiness Levels (TRLs)

Could you please provide information as to what would be the *Technological Readiness Level* of your proposed solution?

Technological Readiness Levels are a set of management metrics that enable the assessment of the maturity of a particular technology. TRLs levels are:

- 1) Basic principles observed and reported;
- 2) Technology concept and/or application formulated;
- 3) Analytical and experimental critical function and/or characteristic proof of concept;
- 4) Component and/or breadboard validation in laboratory environment;
- 5) Component and/or breadboard validation in relevant environment;
- 6) System/subsystem model or prototype demonstration in a relevant environment (ground or space);
- 7) System prototype demonstration in a space environment;
- 8) Actual system completed and flight qualified through test and demonstration (ground or space);
- 9) Actual system is flight proven through successful mission operations.

6.7 Risks

Could you please provide us with information as to what are the foreseen risks associated with your technical solution? What would be the potential actions that you would take to mitigate those risks?

In the context of a fixed price procurement approach, could you please provide the main areas of risk, both technical and programmatic, that you foresee? What would be the potential actions that you would suggest to mitigate those risks?

In the context of the camera and light units procurement approach and ORU integration approach, could you please provide the main areas of risk and challenges, both technical and programmatic, that you foresee? What would be the potential actions that you would suggest to mitigate those risks and meet those challenges?

6.8 Recommendations, suggestions or comments

Could you please provide general feedback and/or any recommendations, inputs or comments (including technical information) that could assist Canada in developing the future *Request for Proposals* (RFP) documents?

Could you please provide general feedback and/or any recommendations, inputs or comments that could assist Canada in minimizing the costs and risks?

7. SUBMISSION OF RESPONSES

(a) **Place for Submission of Responses:** The Respondent interested in providing a response should send their response to the following location by the time and date indicated in the following paragraph of this solicitation document to:

Esther Paquin

Title: Contracting Authority
Public Works and Government Services Canada
Acquisitions Branch
Quebec Region

Address: Place Bonaventure, South-East Portal
800 de la Gauchetiere Street West
Suite 7300
Montreal, Qc H5A 1L6

Telephone: 514-496-3889

Facsimile: 514-496-3822

E-mail address: esther.paquin@tpsgc-pwgsc.gc.ca

(b) **Time:** The closing date to submit a response is: **Friday, October 18th, 2013, 2:00 pm EDT.**

(c) **Responsibility for Timely Delivery:** Each respondent is solely responsible for ensuring its response is delivered on time to the correct location.

(d) **Identification of Response:** Each respondent should ensure that its name and return address, the solicitation number and the closing date appear legibly on the outside of the response.

(f) **Format of response:**

It would be appreciated if respondents could provide their responses in one printed copy and one electronic copy. The electronic file format of the response must be in either the Adobe *Portable Document Format* (PDF)[™] or in a file format that is readable by the Microsoft Office[™] Suite.

Provision of an electronic copy is required in order to facilitate the distribution of the RFI responses to both PWGSC and CSA representatives. Responses are to be submitted in one of the two Official Languages of Canada (English or French).

i) **Cover Page:** If the response includes multiple volumes, respondents are requested to indicate on the front cover page of each volume the title of the response, the solicitation number, the volume number and the full legal name of the respondent.

ii) **Title Page:** The first page of each volume of the response, after the cover page, should be the title page, which should contain:

- (a) the title of the respondent's response and the volume number;
- (b) the name and address of the respondent;
- (c) the name, address and telephone number of the respondent's contact;
- (d) the date; and

(e) the solicitation number;

iii) Numbering System: Respondents are requested to prepare their response using a numbering system corresponding to the one in this RFI. All references to descriptive material, technical manuals and brochures included as part of the response should be referenced accordingly.

All the documentation submitted must be marked with the following:

Name of Respondent
MSS Cameras RFI Response - Reference # 9F054-13-0408
Date (YYYY-MM-DD)

8. ENQUIRIES

Because this is not a bid solicitation, Canada will not necessarily respond to enquiries in writing or by circulating answers to all potentials suppliers. However, respondents with questions regarding this RFI may direct their enquiries to :

Contracting Authority: Esther Paquin

Telephone: 514-496-3889

Facsimile: 514-496-3822

E-mail address: esther.paquin@tpsgc-pwgsc.gc.ca

---END---

Annex 1

Detailed Information – Requirement for the replacement of MSS Cameras

This Annex 1 is divided into five different sections:

- Section A:** List of Acronyms;
- Section B:** Configuration of the existing system;
- Section C:** Mobile Servicing System (MSS) Video Architecture;
- Section D:** FTP Site File Listing
- Section E:** Example of Evaluation Criteria

Annex 1

SECTION A: LIST OF ACRONYMS

The following is a list of the various acronyms used in this document.

Acronym	Definition
ACDB	Arm Control Data Bus
ACU	Arm Control Unit
BDU	Backup Drive Unit
C&C	Command & Control
CB	Control Bus
CCD	Charged Coupled Device
CCU	Camera Control Unit
CEU	Control Electronics Unit
CHU	Camera Head Unit
CLA	Camera and Light Assembly
CLPA	Camera/Light Pan/Tilt Unit Assembly
CPRCM	Canadian Power Remote Control Module
CSA	Canadian Space Agency, an Agency of the Government of Canada
CSR	Camera Status Reader
CSSP	Canadian Space Station Program
CVIU	Common Video Interface Units
CVT	Current Value Table
DCP	Display and Control Panel
EFL	Effective Focal Length
EVA	Extravehicular Activity
EVSU	External Video Switch
FOV	Field of View
HD	High Definition
IR	Infrared
ISS	International Space Station
IVA	Inter-vehicular Activity
JEM	Japanese External Module
JOTI	Japanese External Module Orbital Replaceable Unit Transfer Interface
LA	Light Assembly
LAB	Laboratory
LB	Local Bus
LED	Light Emitting Diode
LEE	Latching End Effector
M	Meter
MT	Mobile Transporter
MBS	Mobile Base System
MCDB	MBS Control Data Bus
MCU	Mobile Base System Computer Unit
MDM	Multiplexer/Demultiplexer
MSS	Mobile Servicing System
NTSC	National Television System Committee
OCS	Operations Control Software
OEU	OTCM Electronics Unit
ORU	Orbital Replaceable Unit
OTCM	Orbital Replacement Unit Tool Change-Out Mechanism
P/L	Payload
PCB	Printed Circuit Board
PDGF	Power and Data Grapple Fixture
PFM	Pulse Frequency Modulated
POA	Payload and ORU Accommodation
PSU	Power Supply Unit

Annex 1

Acronym	Definition
PTU	Pan/Tilt Unit
PWGSC	Public Works and Government Services Canada, a Department of the Government of Canada
RFI	Request for Information
RFP	Request for Proposals
RGB	Red, Green and Blue
RMCT	Robot Micro-Conical Tool
ROST	Robotic Offset Tool
RWS	Robotic Workstation
SACU	Synchronization and Control Unit
SCU	Sync & Control Unit
SET	Socket Extension Tool
SGS	Space to Ground Subsystem
SJEU	SPDM Joint Electronics Unit
SMI	Shared Memory Interface
SPDM	Special Purpose Dexterous Manipulator
SSP	Space Station Program
SSRMS	Space Station Remote Manipulator System
TBC	Time Base Corrector
TDRS	Tracking and Data Relay Satellite
TUS	Trailing Umbilical System
TVC	TV Camera
VBSP	Video Baseband Signal Processor
VCS	Video Control Software
VDC	Volts, Direct Current
VDU	Video Distribution Unit
VGC	Video Graphic Card
VGS	Video Graphic Software
VSC	Video Signal Converter
VSU	Video Switching Units
VTR	Video Tape Recorder
WHS	Workstation Host Software
Wi-Fi	Technology that allows an electronic device to exchange data wirelessly
ZLA	Zoom Lens Assembly

Annex 1

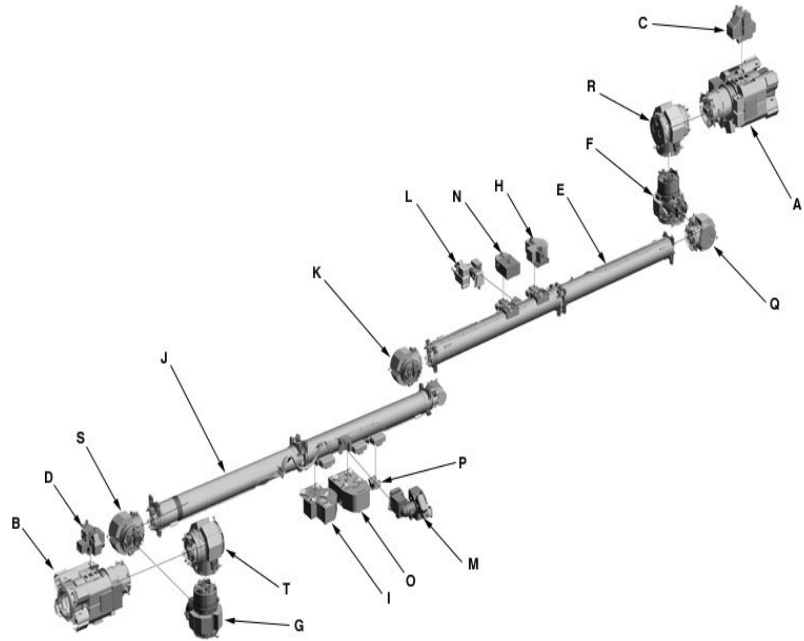
SECTION B: CONFIGURATION OF THE EXISTING SYSTEM

Mobile Servicing System (MSS) Camera Locations

The Space Station Remote Manipulator System (SSRMS) (**Figure 1**) has two Camera/Light Pan/Tilt Unit Assemblies, (CLPAs) one on each boom, and two Camera and Light Assemblies (CLAs), one on each Latching End Effector (LEE).

Figure 1 – Space Station Remote Manipulator System (SSRMS) Configuration

Summary of SSRMS

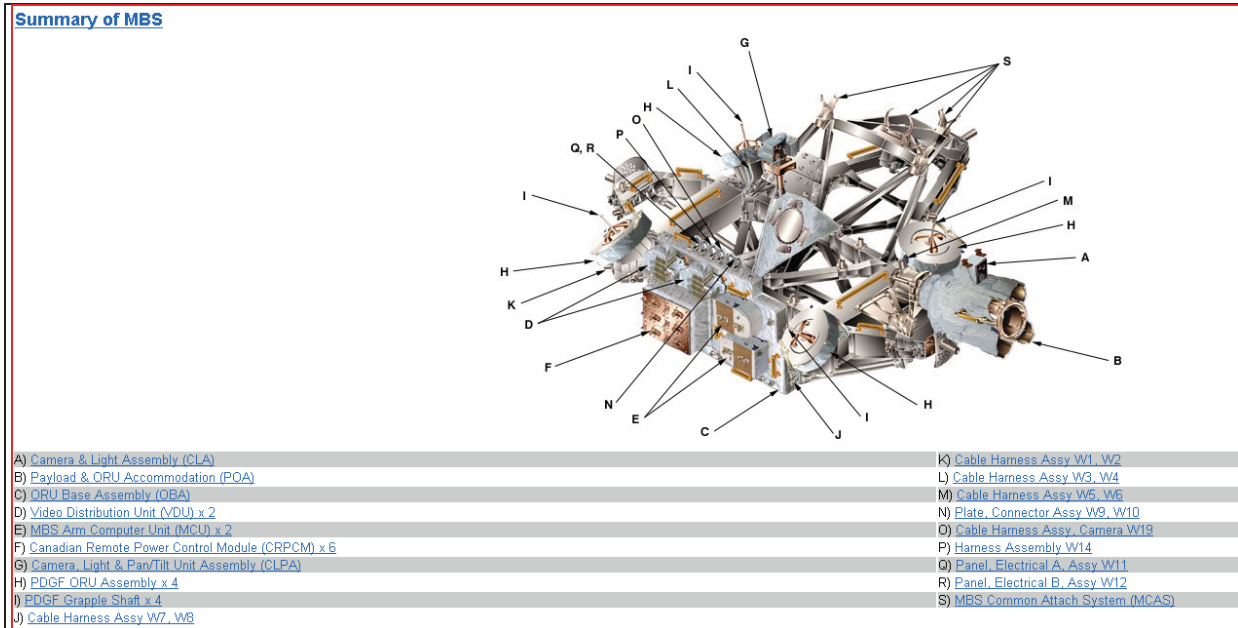


A) LEE - Latching End Effector (End A)	K) EJOD - Elbow Joint - Joint ORU #4
B) LEE - Latching End Effector (End B)	L) CLPA #1 - Camera, Light & Pan/Tilt Assembly (Boom B / End A)
C) CLA #1 - Camera & Light Assembly (End A)	M) CLPA #2 - Camera, Light & Pan/Tilt Assembly (Boom A / End B)
D) CLA #2 - Camera & Light Assembly (End B)	N) ACU - Prime - Arm Computer Unit (Boom Segment B2)
E) Boom Assembly B1/B2 (End A)	O) ACU - Redundant - Arm Computer Unit (Boom Segment A2)
F) EJOD - Yaw Joint - Joint ORU #2 (End A)	P) BRA - BDU Replacement Assembly (Boom Segment A2)
G) EJOD - Yaw Joint - Joint ORU #6 (End B)	Q) EJOD - Pitch Joint - Joint ORU #3 (End A)
H) VDU #2 - Video Distribution Unit (Boom Segment B2 / End A)	R) EJOD - Roll Joint - Joint ORU #1 (End A)
I) VDU #3 - Video Distribution Unit (Boom Segment A2 / End B)	S) EJOD - Pitch Joint - Joint ORU #5 (End B)
J) Boom Assembly A1/A2 (End B)	T) EJOD - Roll Joint - Joint ORU #7 (End B)

Annex 1

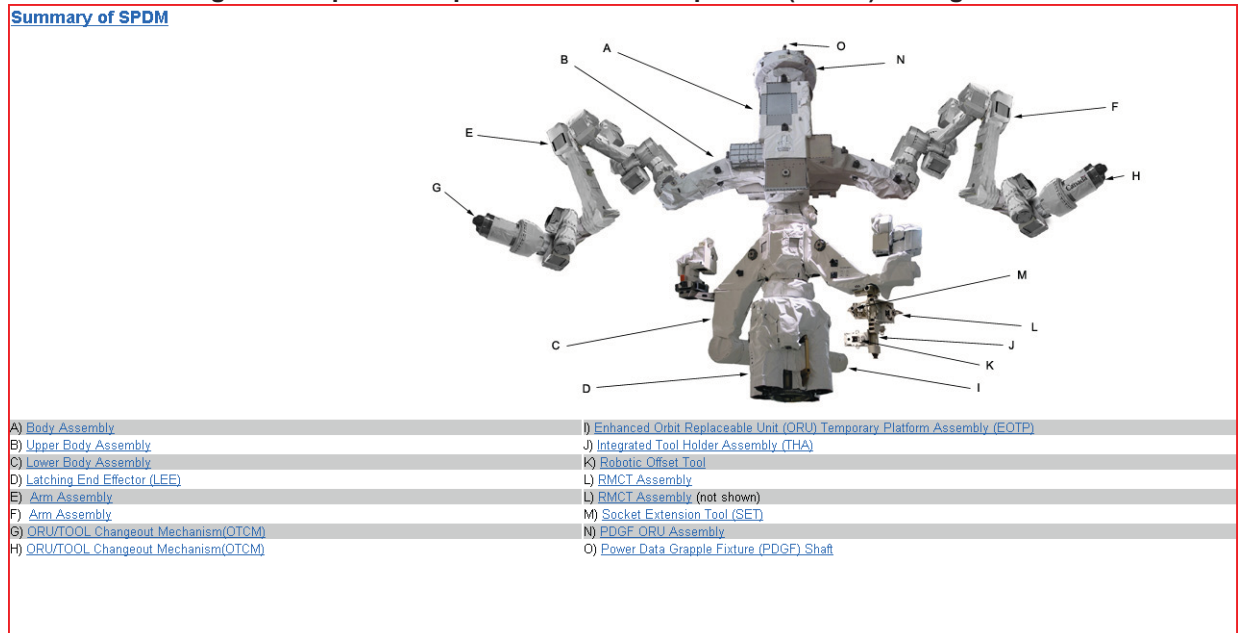
The Mobile Base System (MBS) (**Figure 2**) has one CLPA positioned on a mast in the center of the MBS and one CLA on the Payload and ORU Accommodation (POA).

Figure 2 – Mobile Base System (MBS) Configuration



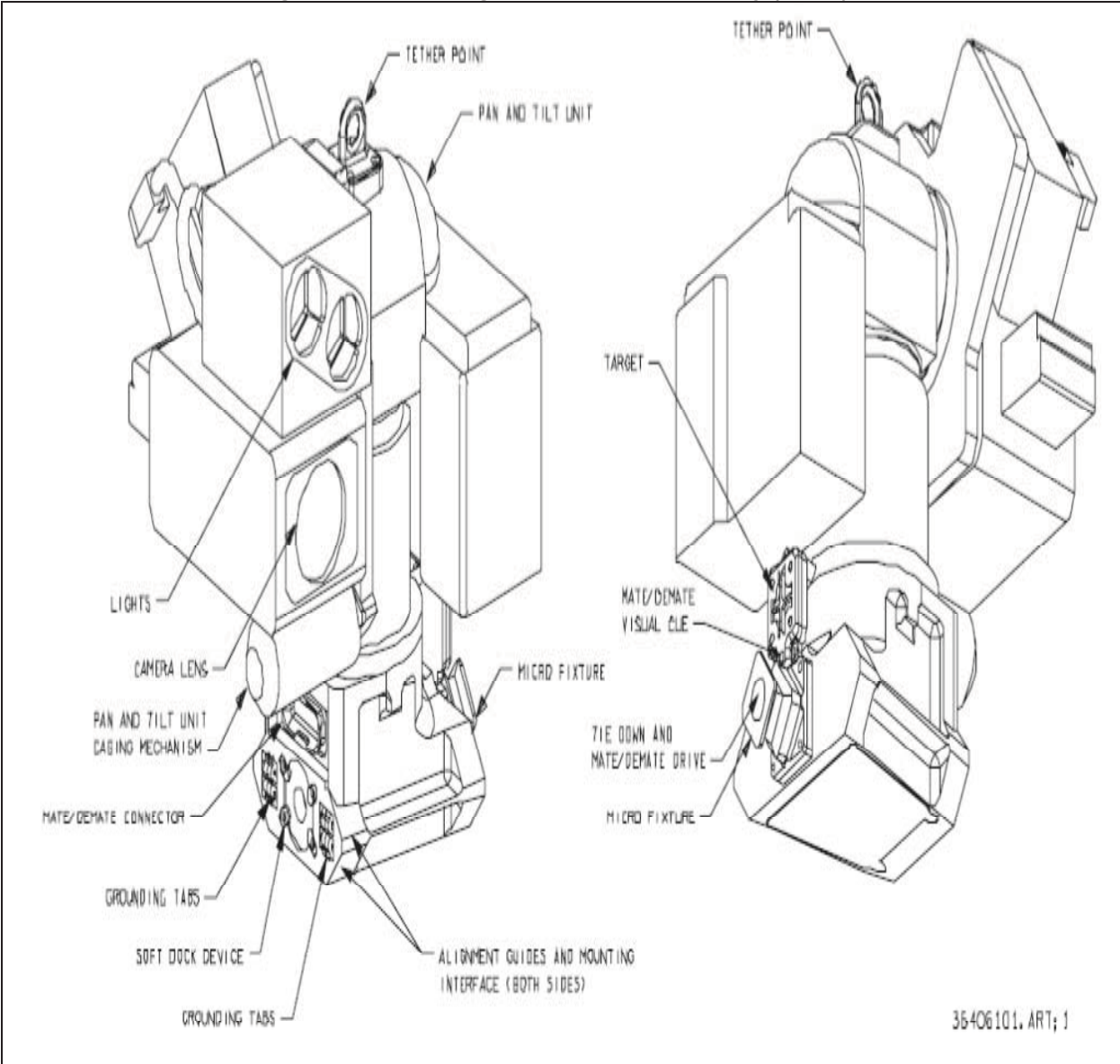
The Special Purpose Dexterous Manipulator (SPDM) (**Figure 3**) has two CLPAs on outriggers and one CLA on the SPDM Latching End Effector (LEE).

Figure 3 – Special Purpose Dexterous Manipulator (SPDM) Configuration



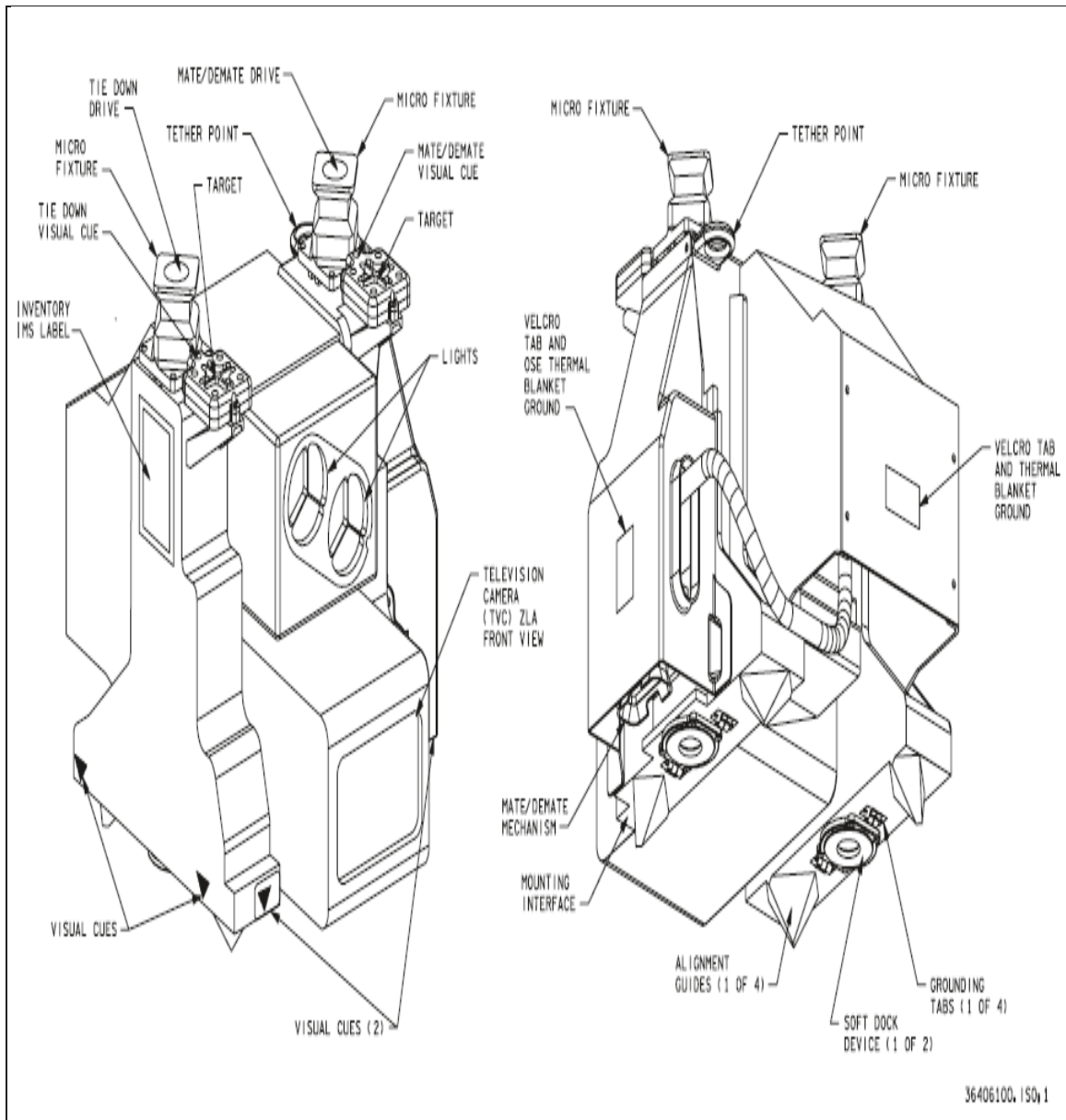
There are two MSS camera Orbital Replaceable Unit (ORU) configurations. One configuration is the CLPA (**Figure 4**). The other configuration is the CLA (**Figure 5**).

Figure 4 - Camera/Light Pan/Tilt Unit Assembly (CLPA)



36406101, ART; 1

Figure 5 - Camera and Light Assembly (CLA)



An MSS camera consists of three components: a Camera Control Unit (CCU), a Camera Head Unit (CHU), and a Zoom Lens Assembly (ZLA).

Annex 1

Camera Control Unit (CCU)

The CCU contains only avionics. It receives/sends command signals for the CHU/ZLA and PTU from/to the VDU. The commands are sent from the VDU to the CCU in the sync signal. The CCU reads the sync signal for a location code to determine if the commands are meant for its CHU/ZLA or PTU. The CCU strips the commands off the sync signal and sends them on to the appropriate component. The CHU transmits the CCU status information on video settings, temperature limit information, and over/under voltage. The PTU sends the CCU pan and tilt limits, pan and tilt position, and temperature limit information. This information is returned to the VDU in the video signal that originates from the CHU.

The CCU is approximately 16 cm by 8 cm by 9 cm (6 in. by 3 in. by 3.5 in.) in size.

Camera Head Unit (CHU)

The CHU contains a color CCD image sensor. The CCD dimensions are 9.11 mm by 6.96 mm with a used area of 8.8 mm by 6.6 mm.

The CCD size is 770 pixels by 500 pixels. Each pixel has two photodiodes, each 5 μm by 4 μm . Image controls like sharpness and gain, for example, are controlled in the CHU. The CHU is connected to the CCU by a flexible cable.

Zoom Lens Assembly (ZLA)

The ZLA attaches to the front of the CHU and provides the capability for variable iris, zoom, and focus settings. The ZLA with the CHU is approximately 30.5 cm by 13 cm by 11 cm (12 in. by 5 in. by 4.2 in.) in size. The ZLA has a zoom ratio of 9.4:1. The maximum Field of View (FOV) is approximately 51.3 deg horizontal / 39.3deg, which corresponds to an Effective Focal Length (EFL) of approximately 9.0 mm. The minimum FOV is approximately 5.9 deg horizontal / 4.4 deg vertical, which corresponds to an EFL of approximately 84.0 mm.

The minimum viewing distance is 36 cm (14 in.). The lens zoom function has two speed settings, but the rate switch on the Display and Control Panel (DCP) does not set them. At the start of a zoom command, the lens will zoom at the slower rate. After 2 seconds, the zoom rate will increase. There are no details available on the actual rates. However, the rates are set such that end-to-end travel is complete in 13 seconds. The zoom rate resets to the slow speed when the zoom command is terminated. Focus has a range of 0.36 meters to 10 meters (infinity). The commanding speed works in a similar fashion as zoom. The camera will adjust focus automatically when zoom is adjusted. This is done to assist the operator in acquiring optimum focus after a zoom operation is complete. The iris aperture has a range of f/2 to f/16. The commanding speed works in a similar fashion as zoom and focus, but the end-to-end travel for the iris is complete in 9 seconds.

A removable lens cover fitted to the existing camera housing has been added to all MSS cameras.

Light Assembly (LA)

The LA is used to provide illumination for close and distant viewing of MSS operations and inspections. For both the CLPA and CLA configurations, the LA is mounted directly above the camera. LA consists of two components: a lamp module and an electronics module. The lamp module holds two 65-W Tungsten Halogen lamps (2900 \circ K color temperature). The electronics module receives the on/off command from the VDU. The LA has a mass of 2.3 kg (5.1 lb), and is approximately 11 cm by 13 cm by 13 cm (4 in. by 5 in. by 5 in.) in size. Each of the lamps can produce a 52 $^{\circ}$ cone of illumination that provides an illumination level of 3.5 foot-candles at a distance of 10 meters (33 feet).

Camera Lens Cover

Annex 1

More recently, camera lens covers (**Figure 7**) were installed on all MSS cameras to protect against contaminants being generated during attitude control firing of reaction control jets on all free flyers during robotic capture and release of these visiting vehicles. These camera covers were designed to fit the existing camera housings and can be installed by EVA or IVA. There are two (2) spare covers stored on-orbit today.

Figure 7 – Camera Lens Cover



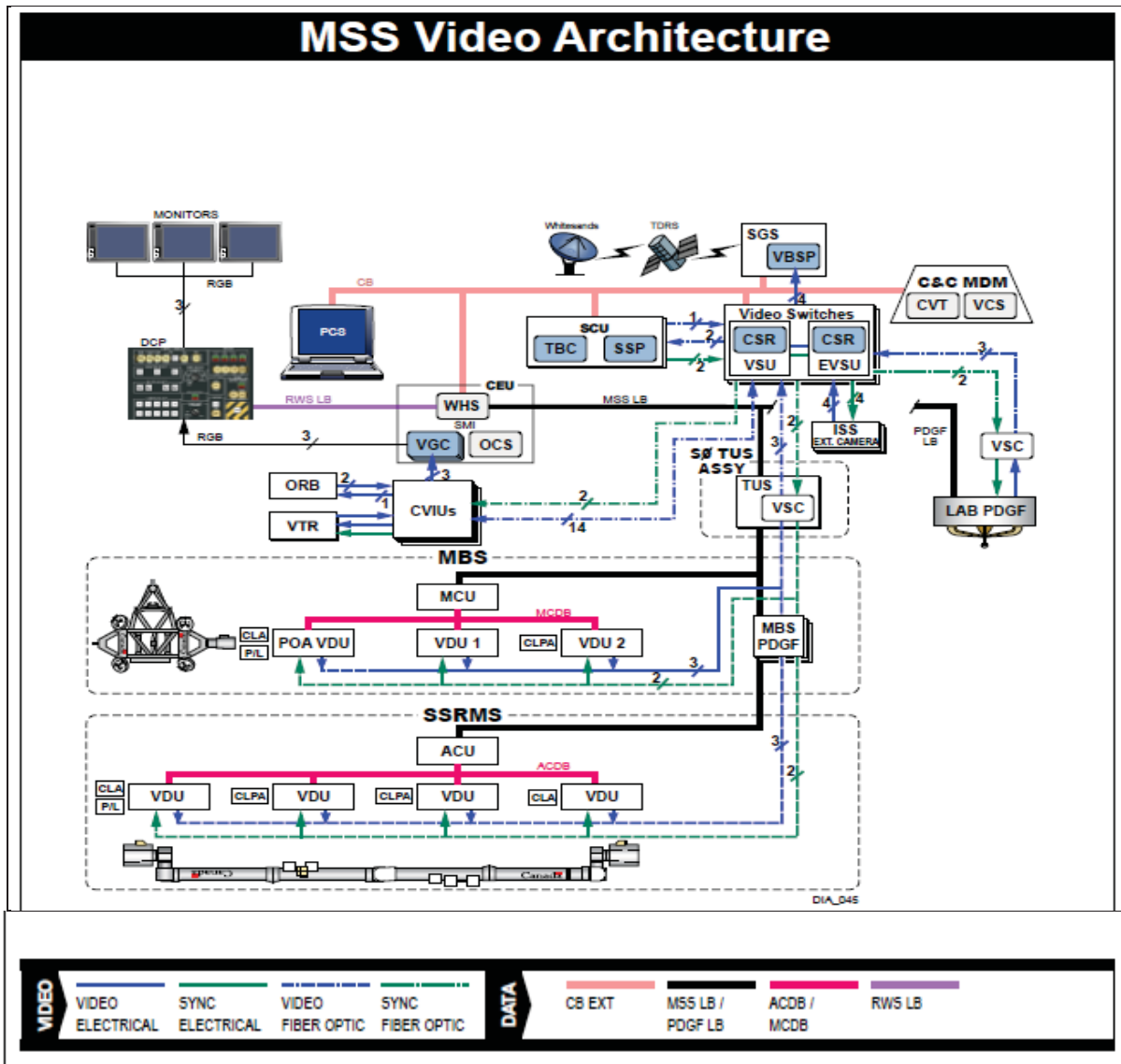
MSS Camera Characteristics and Features Summary

The existing MSS Camera configuration (CCU, CHU, ZLA) function allocation, performance characteristics and features shall be considered as minimum requirements. The Light Assembly and Pan & Tilt Unit are provided as reference because of the nature of their shared dependencies/interfaces. Dimensions identified in detailed sections below should be used as cumulative maximum dimension requirements.

Annex 1

SECTION C: MOBILE SERVICING SYSTEM (MSS) VIDEO ARCHITECTURE

Figure 9 – MSS Video Architecture



Notes:

- Each VSU contains 1 CSR. Each EVSU contains 3 CSRs;
- VSUs interface with SCUs, CVIUs and VBSP;
- CVIUs provide 6 video lines to, and receive 8 from VSUs;
- EVSUs interface with M/T TUS, LAB PDGF VSC and ISS External Cameras;
- Each VGC includes Video graphics software (VGS).

Annex 1

All MSS cameras are located in the space environment, external to the pressurized ISS modules. However, the video must be distributed to the internally located Robotics Workstation. This is done via both the MSS and ISS Video Distribution Systems.

The overall MSS & ISS Video Distribution System is implemented as a complex distributed-switched network employing multiple video signal formats (baseband, PFM-modulation, RGB) and mediums (twisted shielded pair, coax, optical fiber) to interconnect the external cameras to the internally located Robotics Workstations

MSS Camera video (NTSC-RS-170A baseband) is passed to a MSS Video Distribution Unit (VDU), where it is Pulse Frequency Modulated (PFM) and “switched” onto one of three coaxial lines (channels). The video is then fed to a PDGF or along MBS Trailing Umbilical System (TUS) lines to an ISS Video Signal Converter (VSC) for conversion to optical fiber before being presented to a set of Video Switching Units (VSUs).

The VSUs feed Common Video Interface Units (CVIUs) that demodulate and convert to optical fiber to electrical signal format, before for presentation to the MSS Control Electronics Unit (CEU) Video Graphics Card (VGC). The VGC provides an RGB output to the appropriate RWS monitor. Note that the VSUs also provide video output to the ISS Space To Ground Subsystem (SGS) for transmission to the Ground.

MSS Camera commands are embedded into the vertical blanking interval of a centralized sync signal line that is generated by an ISS Sync & Control Unit (SCU) and distributed to all MSS cameras. Each camera location has a unique address that is present in the command header.

A command processor within each camera only executes the commands that are addressed to that specific camera. MSS camera telemetry is encoded into the vertical blanking interval (non-video portion) of the video signal, by the camera, and read by camera status readers within the ISS video switches. The telemetry is then overlaid onto the video image by the VGC.

Annex 1

SECTION D: FTP SITE FILE LISTING

The following table maps the filename with the document title.

Document Title	Document number	Filename
MSS Replacement Cameras & Lights Statement of Work (SOW)	CSA-RCAM-SOW-0001	CSA-RCAM-SOW-0001 Rev draft
System Specification for Mobile Servicing System (MSS) Replacement CAMera and Lights (RCAM)	CSA-SS-SG-0061	SG0061_DRAFT6
MSS Replacement Camera Product Assurance Requirements	CSA-RCAM-RD-0001	CSA-RCAM-RD-0001_Rev_3.0

SECTION E: EXAMPLE OF EVALUATION CRITERIA

The following evaluation criteria are being considered.

Mandatory Criteria

M1: The bidder must have demonstrated experience in design, manufacture and test of systems and software rated for operations in a human space flight program (examples include Space Shuttle, Space Station programs).

M2: The bidder must be ISO 9001 certified.

M3: The bidder must demonstrate that the camera and light solution will meet all mandatory system requirements ("shall" requirements).

M4: The bidder must demonstrate that the camera and light solution will meet all mandatory product assurance requirements ("shall" requirements).

Financial Criteria

F1: Lowest compliant bid

It is intended the criteria would be lowest price/quantity ratio

---END OF ANNEX 1--