



RETURN BIDS TO:
RETOURNER LES SOUMISSIONS À:

Bid Receiving - PWGSC / Réception des
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LETTER OF INTEREST
LETTRE D'INTÉRÊT

Comments - Commentaires

Vendor/Firm Name and Address
Raison sociale et adresse du
fournisseur/de l'entrepreneur

Issuing Office - Bureau de distribution
Electronics, Simulators and Defence Systems Div.
/Division des systèmes électroniques et des systèmes de
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11 Laurier St. / 11, rue Laurier
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K1A 0S5

Title - Sujet Letter of Interest for TPS Project Tactical Power System	
Solicitation No. - N° de l'invitation W8476-206276/C	Date 2022-09-02
Client Reference No. - N° de référence du client W8476-206276	GETS Ref. No. - N° de réf. de SEAG PW-\$\$QF-125-28799
File No. - N° de dossier 125qf.W8476-206276	CCC No./N° CCC - FMS No./N° VME
Solicitation Closes - L'invitation prend fin at - à 02:00 PM Eastern Standard Time EST on - le 2022-12-30 Heure Normale du l'Est HNE	
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: Lacoursiere, Paul	Buyer Id - Id de l'acheteur 125qf
Telephone No. - N° de téléphone (343) 551-1529 ()	FAX No. - N° de FAX () -
Destination - of Goods, Services, and Construction: Destination - des biens, services et construction: DEPARTMENT OF NATIONAL DEFENCE 101 COLONEL BY DR. MGen Georges R. Pearkes Building OTTAWA Ontario K1A0K2 Canada	

Instructions: See Herein

Instructions: Voir aux présentes

Delivery Required - Livraison exigée See Herein – Voir ci-inclus	Delivery Offered - Livraison proposée
Vendor/Firm Name and Address Raison sociale et adresse du fournisseur/de l'entrepreneur	
Telephone No. - N° de téléphone Facsimile No. - N° de télécopieur	
Name and title of person authorized to sign on behalf of Vendor/Firm (type or print) Nom et titre de la personne autorisée à signer au nom du fournisseur/ de l'entrepreneur (taper ou écrire en caractères d'imprimerie)	
Signature	Date

TACTICAL POWER SYSTEM (TPS)
Letter of Interest (LOI)
W8476-206276

TACTICAL POWER SYSTEM (TPS)

Letter of Interest (LOI)

W8476-206276

TACTICAL POWER SYSTEM (TPS)
Letter of Interest (LOI)
W8476-206276

TABLE OF CONTENTS

1.	Purpose	2
2.	Background	2
2.1.	Capability Deficiency	3
3.	Project Scope	3
3.1.	High-level Mandatory Requirements	4
3.2.	Selected Capability Option	4
4.	Schedule	4
5.	Industry Day	5
6.	Additional Information Requests	5
7.	Potential Standard Acquisition Clauses and Conditions	6
8.	Comprehensive Land Claim Agreements (CLCA)	6
9.	Enquiries	7
10.	Fairness monitor	7
11.	Notes to Interested Suppliers	8

TACTICAL POWER SYSTEM (TPS)
Letter of Interest (LOI)
W8476-206276

1. 1. Purpose

The Department of National Defence has a requirement for the provision of a Tactical Power System comprised of Generators, Power Management Systems, Power Distribution Systems, Synchronization, and Energy Storage.

The objective of this Letter of Interest (LOI) is to:

- Advise industry of this potential forthcoming requirement and provide industry with general information on the TPS project.
- Provide industry with a revised set of high level specifications, and project scope information.
- seek feedback from Industry regarding:
 - potential power generation configuration to be utilized for testing;
 - the draft equipment specifications
 - a draft schedule to suppliers
 - Any other information that may be useful.

2. Background

Strong, Secure, Engaged (SSE) articulates how the Government of Canada can call upon the CAF to undertake missions for the protection of Canada and Canadians. The policy states that the CAF will be prepared to simultaneously deploy to two different theatres of operation, including one as a lead nation.¹ In addition to deployments, equipment is also needed to support training. Electrical power generation systems are mission critical equipment for land forces to conduct operations in all environments. SSE outlines the approach and methodology for the new direction of Defence priorities. The TPS project supports three SSE initiatives:

- a. Initiative 41. “Improve the Army’s ability to operate in remote regions by investing in modernized communications, shelters, **power generation**, advanced water purification systems, and equipment for austere environments.”²
- b. Initiative 64. “Improve the capabilities of the Joint Deployable Headquarters and Signals Regiment, including the portable structures that house the headquarters when deployed and the **equipment employed** by that headquarters for command, control, and communications.”³

¹ Ibid, p.81.

² *Strong, Secure, Engaged* Canada’s Defence Policy 2017, p.37.

³ Ibid, 41.

TACTICAL POWER SYSTEM (TPS)
Letter of Interest (LOI)
W8476-206276

- c. Initiative 102. “Examine **alternative energy options** and their potential use for operations.”⁴ Reduce carbon footprint through green infrastructure and focus on energy efficiency.

2.1. Capability Deficiency

Current in-service electrical generation equipment is based on old technology, is not interoperable, and is increasingly costly to maintain. There are also insufficient quantities of generators to meet training and domestic operational requirements which has forced many units to purchase or rent Commercial off the Shelf (COTS) equipment that cannot be sustained by National Procurement and the CAF supply system. The in-service power distribution and management system is inadequate for current deployments as the 2008, Central Power Distribution System (CPDS) project provided only a partial, interim solution.

The capability gap that exists today is the inability of current in-service equipment to provide to the CAF adequate, reliable, and sustainable electrical power generation and distribution. Continuing to fill this gap by renting or purchasing generators is not a viable long-term solution. Reliance on host nations, local contractors or service providers in a theatre of operation are also unacceptable solutions.

In particular, the deficiencies are:

- a. The limited adaptability of 1960’s technology;
- b. There are 52 different fleets of generators, each with different output power that are not interoperable; and,
- c. The various fleets of generators do not support today’s Defence Energy and Environment Strategy (DEES) 2017 vision, which states, “National Defence and the Canadian Armed Forces (CAF) will become leaders in contributing to the sustainable development goals of Canada through the effective and innovative integration of energy and environmental considerations into activities supporting the Defence mandate” and through Target 9, “Reduce petroleum-generated electrical energy consumption in deployed camps by 50% by 2030”.

The capability deficiencies impact the five operational functions of; Command, Sense, Act, Shield and Sustain. It also impacts Force Generation. Without adequate electrical power generation, all functions from command headquarters to maintenance to camp services are affected. From training to deployments, reliable power generation is critical to the success of the mission.

3. Project Scope

⁴ Ibid, 76.

TACTICAL POWER SYSTEM (TPS)
Letter of Interest (LOI)
W8476-206276

The CAF will acquire a TPS that can provide consistent and reliable electrical power 24/7, in all weather and in any environment during expeditionary and domestic operations and training. The TPS would be comprised of a battery storage system, new efficient diesel generators, an upgraded distribution system, a computer management system and it will not at this time include renewable generation sources such as wind and solar generators. It will be operated primarily by the CAF and may also be deployed on joint operations with the RCAF, RCN and in coalition with our allies.

The Tactical Power System (TPS) project will replace the current in-service tactical power capability used throughout the Canadian Armed Forces (CAF), in both the Regular and Reserve Forces. This will not be a one for one generator replacement, but the implementation of an entirely new concept of power generation for the CAF. The current generator inventory is not designed to support today's Defence Energy and Environment Strategy (DEES) targets. Based on technology from the late 1960's, the current in-service fleet of power generation systems are built on independent systems that lack interoperability, are resource intensive, and are increasingly difficult and costly to sustain. This power generation equipment, totaling approximately 2982 units, currently consists of generators in more than 50 different fleets, each of which correspond to a different output power capability, that are reaching or have surpassed their life expectancy.

The TPS project will provide a new electrical power generation capability to replace the current in-service 2 Kilowatt (kW) to 70 kW range of diesel generator equipment. This new electrical power generation capability is not constrained to the 2 kW to 70 kW range as it may encompass a narrower or wider range. This capability will be used primarily in short-term expeditionary operations, domestic operations, training and in humanitarian assistance operations where deployments are usually under nine months in duration. This is accomplished by rapidly emplacing power generation systems in areas that have either no electricity, a damaged or destroyed power generator, or a power supply grid that is not capable of safe operation. A deployed TPS will provide the initial power supply to a camp, and if not redeployed, will form the foundation for camp sustainment projects.

The new concept of power generation is designed for efficiency, both in electrical power production and in reducing the logistical and fuel burdens. Technology advancements have enabled the concept of micro-grids. Micro-grids can be modular and comprised of all or selected components of: a fuel fired generation system; a distribution system; energy storage systems; and a management system. Micro-grids can be stand-alone entities, connected together or used with local resources in order to minimize its environmental impact.

The RCE will be the custodians of the operational systems while the Canadian Forces School of Military Engineering (CFSME) will be responsible for operator training. Training of maintenance personnel will be the joint responsibility of the Royal Canadian Electrical and Mechanical Engineers School (EO Techs & Veh. Tech), and the Canadian Forces School of Military Engineering (EGS Techs). It is anticipated that TPS systems will be distributed throughout CAF units with the RCAF and RCN receiving systems as required.

3.1. High-level Mandatory Requirements

TACTICAL POWER SYSTEM (TPS)
Letter of Interest (LOI)
W8476-206276

The project's high-level mandatory requirements are defined in the attached Requirements Verification Matrix below.

3.2. Selected Capability Option

The TPS Project was approved to pursue the capability option based on New Hybrid Generating Systems with Micro-Grid. This option would be comprised of new efficient diesel generators, a battery storage system, a power management system and an upgraded distribution system.

4. Schedule

In providing responses, the following estimated Project schedule milestones should be utilized as a baseline:

- LOI – Fall 2022
- Potential Draft RFP Issue date - 2023
- Potential RFP Issue date - 2023
- Potential Contract award date - 2024
- Potential Full Capability Delivery date - 2026

5. Optional One on One Session

To Be Determined

6. Additional Information Requests

After review of all the information packages, additional information / clarifications may be sought from suppliers by DND via the Public Works and Government Services (PWGSC) Contracting Authority identified in Section 13.

7. Potential Standard Acquisition Clauses and Conditions

If a follow-on Solicitation is issued, the following may apply:

General Conditions

2030 General Conditions - Higher Complexity - Goods:

<http://ccua-sacc.tpsgc-pwgsc.gc.ca/pub/rqqr.do?lang=eng&id=2030&date=2011-05-16&eid=1>

Intellectual Property: 4006 - Contractor to Own Intellectual Property Rights in Foreground Information:

TACTICAL POWER SYSTEM (TPS)
Letter of Interest (LOI)
W8476-206276

[Http://ccua-sacc.tpsgc-pwgsc.gc.ca/pub/rqqr.do?lang=eng&id=4006&date=2010-08-16&eid=40](http://ccua-sacc.tpsgc-pwgsc.gc.ca/pub/rqqr.do?lang=eng&id=4006&date=2010-08-16&eid=40)

Notwithstanding the above, for greater clarity on Canada's intentions on use of IP, suppliers are directed to 4006-04.

- **Financial Capability (SACC A9033T)**

Suppliers are encouraged to review the above SACC at the following link:
<https://buyandsell.gc.ca/policy-and-guidelines/standard-acquisition-clauses-and-conditions-nnannual/5/A/A9033T/8>

NOTE: There is no specific criteria used to evaluate the financial strength of a bidder. It is a professional opinion that is based upon the review and examination of various types of information including, but not limited to, financial statements, details on availability of credit, cash flow projections and any other financial information deemed relevant by Canada. The information requested by Canada is reviewed while taking into account the financial demands that may be placed on a potential contractor in order to successfully enter into and perform the proposed contract.

Security Requirements: There may be a security requirement associated with this requirement. A requirement of this scope could require an Enhanced Reliability to perform the in-service support work.

8. Comprehensive Land Claim Agreements (CLCA)

This procurement may be subject to the Comprehensive Land Claim Agreements (CLCAs) as the final delivery points of the goods and services required may be within the Comprehensive Land Claims Settlements Areas.

9. Enquiries

All inquiries and other communications relating to this LOI should be directed exclusively to the Public Services and Procurement Canada (PSPC) Contracting Authority listed below.

Paul Lacoursiere
Defence and Marine Procurement Branch
Public Services and Procurement Canada / Government of Canada
Paul.Lacoursiere@tpsgc-pwgsc.gc.ca / Tel: 819-420-6361

10. Fairness Monitor

TACTICAL POWER SYSTEM (TPS)
Letter of Interest (LOI)
W8476-206276

Canada has retained the services of an independent third party to act as a Fairness Monitor (FM). The role of the fairness monitor is to attest to the assurance of fairness, openness and transparency of the activities monitored

11. Notes to Interested Suppliers

This is neither a call for tender nor a Request for Proposal (RFP), and no agreement or contract for the procurement of the equipment stated above will be entered into solely as a result of this LOI. This announcement does not constitute a commitment by Canada. Canada does not intend to award a contract on the basis of the notice or otherwise pay for the information solicited. Any and all expenses incurred by industry in pursuing this opportunity, including the provision of information and potential visits, are at industry's sole risk and expense.

Any discussions on this subject with project staff representing DND or PWGSC, or any other Government of Canada representative, or other personnel involved in project activities, shall not be construed as an offer to purchase or as commitment by DND, PWGSC or Government of Canada as a whole.

Although the documents / information / data collected may be provided as commercial-in-confidence and will not be provided to a third party outside of Canada, Canada reserves the right to use the information to assist them in drafting performance specifications and for budgetary purposes. Requirements are subject to change, which may be as a result of information provided in response to this LOI. Suppliers are advised that any information submitted to Canada in response to this LOI may, or may not, be used by Canada in the development of the potential subsequent RFP. The issuance of this LOI does not create an obligation for Canada to issue a subsequent RFP, and does not bind Canada legally or otherwise, to enter into any agreement or to accept or reject any suggestions.

There will be no short-listing of Suppliers for the purposes of undertaking any future work, as a result of this LOI. Similarly, participation in this LOI is not a condition or prerequisite for the participation to any RFP.

12. LOI Closing Date and Submission of Respondent Information Packages

- Suppliers are asked to submit their TPS information package to the PWGSC Contracting Authority identified in Section 9 of this LOI document, on or before the **21 October 2022**
- soft copies of the information packages are requested.

Attachment 001

TACTICAL POWER SYSTEM (TPS)

DRAFT REQUEST FOR PROPOSAL REFERENCE NO:

W8476-206276

TACTICAL POWER SYSTEM REQUIREMENTS VERIFICATION MATRIX (TPS-RVM)

APPENDIX AB TO

ANNEX A

Table of Contents

<u>Para</u>	<u>Title</u>	<u>Page</u>
	GLOSSARY	2
	GENERAL	3
1.	TPS – SYSTEM LEVEL GENERAL REQUIREMENTS	4
2.	TPS – GENERATOR REQUIREMENTS.....	47
3.	TPS – POWER DISTRIBUTION AND MANAGEMENT SYSTEM REQUIREMENTS	64
4.	TPS – POWER STORAGE REQUIREMENTS	74
5.	TPS – PACKAGING REQUIREMENT	78

Means of Compliance: The technique being used to prove compliance with the requirement specification including: Compliance Statement, Tactical Power System (TPS) Verification Plan, Documentation, Certification, Analysis, Inspection, Demonstration and Testing.

Verification Gate: The stage of the project when a requirement must be verified.

TPS Verification Plan: The TPS Verification Plan, in accordance with Appendix xx to Annex yy of Volume xx Specific requirements. (To be issued later)

Documentation: A record demonstrating that the Tactical Power System (TPS) meets the specified standards and requirements. Compliance documentation includes, but is not limited to, data, test reports (including test procedures and test results), analysis, equivalence reports, drawings, certificates, and original equipment manufacturer technical literature. Documentation data must be approved by the Technical Authority. If documentation data is considered inadequate, the Technical Authority reserves the right to invoke test or analysis, at the Contractor's expense.

Certification: Conformance certification documentation from an authorized independent third party.

Analysis: Verification through technical evaluations of calculations, computations, drawings, models, simulations, and analytical solutions, reduced data and representative data to determine if the item conforms to the specified requirements of the specifications. Analysis must not be limited to raw data but must contain justification as to how the data verifies that the requirement will be met. Analysis data must be approved by the Technical Authority. If analysis data is considered inadequate, the Technical Authority reserves the right to invoke test, at the Contractor's expense.

Inspection: Examination using the physical senses, gauges or simple measurements to determine compliance with requirements. It may require moving or partial disassembling of the item to accomplish the examination.

Demonstration: Demonstration is a method of verification whereby the properties, characteristics, and parameters of the item are determined by observation alone, with no or minimal use of instrumentation for quantitative measurements. This method is used when a specification requirement does not contain a specific numerical parameter that must be measured. Pass/fail criteria are simple yes/no indications of functional performance since no quantitative values are specified. Demonstration also includes operation of the system under operational conditions to show that it meets requirements (i.e. Trial).

Test: An action by which the operability, supportability, or performance capability of an item is verified when subjected to controlled conditions that are real or simulated. These verifications may use special test equipment or instrumentation to obtain accurate quantitative data for analysis. Test results, including data analysis, must be provided in a test report. Required tests must be conducted on the TPS equipment. The Technical Authority must be informed of the date and location of all tests conducted. The Technical Authority, including any other Department of National Defence/Canadian Armed Forces representatives, reserves the right to witness all of the tests. Equivalency tests may be proposed and will be subject to Technical Authority approval. In addition to a test report including test results and data analysis, an equivalency test must also include a gap analysis. Combined tests may be proposed and will be subject to Technical Authority approval. Canada reserves the right to conduct their own independent testing to verify requirements.

GENERAL

- 1.1 This document will provide the technical requirements to support the *TPS Concept of Operation Guidance to Industry* issued under a Request for Information letter released by Canada. Further refinements to this document may occur prior to the release of a Request for Proposal (RFP).
- 1.2 Table 1 below shows the Requirement Verification Matrix populated by Canada for each requirement, with mandatory Means of Compliance and Verification Gates.
- 1.3 The Verification Matrix defines the Means of Compliance and Verification Gates that must be followed and met by the Contractor to verify compliance with each requirement.
- 1.4 All Means of Compliance must be executed by the Contractor and approved by the Technical Authority.

Contract No. – N° du contrat W8476-206276	Amd. No. – N° de la modif.	Buyer ID – Id de l'acheteur Rev 0
Client Ref. No. – N° de réf. du client W8476-206276	TPS DRAFT RFP APPENDIX AB TO ANNEX A	

Section #	Requirement Description	Type of Requirement	Compliance to Desirable Yes / No	Means of Compliance Post-Contract Award	Means of Compliance Pre-Contract Award
1.	TPS – SYSTEM LEVEL REQUIREMENTS	Header			
1.1	General	Header			
1.1.1	This specification outlines the requirements of the Department of National Defence (DND) of Canada for the Tactical Power System (TPS).	Information			
1.1.2	This document is referred to as the Tactical Power System - Requirement Verification Matrix (TPS-RVM).	Information			
1.1.3	<p><i>Strong, Secure, Engaged</i> (SSE) Canada's Defence Policy outlines the government level of ambition for the CAF and presents a new strategic vision for defence. This is a vision in which Canada is:</p> <ul style="list-style-type: none"> a. Strong at home, its sovereignty well-defended by a CAF also ready to assist in times of natural disaster, other emergencies, and search and rescue; b. Secure in North America, active in a renewed defence partnership in NORAD and with the United States; and c. Engaged in the world, with the CAF doing its part in Canada's contributions to a more stable, peaceful world, including through peace support operations and peacekeeping. 	Information			

Contract No. – N° du contrat W8476-206276	Amd. No. – N° de la modif.	Buyer ID – Id de l'acheteur Rev 0
Client Ref. No. – N° de réf. du client W8476-206276	TPS DRAFT RFP APPENDIX AB TO ANNEX A	

Section #	Requirement Description	Type of Requirement	Compliance to Desirable Yes / No	Means of Compliance Post-Contract Award	Means of Compliance Pre-Contract Award
	<p>In order to meet these objectives, Canada needs an agile, multi-purpose, combat-ready military, operated by highly trained, well-equipped women and men, secure in the knowledge that they have the full support of their government and their fellow Canadians. SSE presents a new strategic vision and ambition for the CAF. To this end, SSE identifies key investments, through initiatives, in the CA. The initiatives that apply to the TPS project are:</p> <ul style="list-style-type: none"> a. <u>Initiative #41</u>. Improve the Army's ability to operate in remote regions by investing in modernized communications, shelters, power generation, advanced water purification systems, and equipment for austere environments; b. <u>Initiative #64</u>. Improve the capabilities of the Joint Deployable Headquarters and Signal Regiment, including the portable structures that house the headquarters when deployed and the equipment employed by that headquarters for command, control, and communications;¹ and 				

¹ Strong, Secure, Engaged Canada's Defence Policy 2017, p.41.

Contract No. – N° du contrat W8476-206276	Amd. No. – N° de la modif.	Buyer ID – Id de l'acheteur Rev 0
Client Ref. No. – N° de réf. du client W8476-206276	TPS DRAFT RFP APPENDIX AB TO ANNEX A	

Section #	Requirement Description	Type of Requirement	Compliance to Desirable Yes / No	Means of Compliance Post-Contract Award	Means of Compliance Pre-Contract Award
	<p>c. <u>Initiative #102</u>. Examine alternative energy options and their potential use for operations.² Reduce carbon footprint through green infrastructure and focus on energy efficiency.</p> <p>Acquiring a TPS capability would continue to ensure the operational readiness and force protection of the CAF by allowing it to operate in all environments. This investment will continue to ensure interoperability between the RCAF, RCN, other CAF organizations, and allies.</p>				
1.2	Tactical Power System (TPS): Tactical Power System must consist of the following Subsystems:	Information			
1.2.1	• Diesel Generators;	Mandatory		Compliance Statement	Compliance Statement
1.2.2	• Energy Storage;	Mandatory		Compliance Statement	Compliance Statement
1.2.3	• Power Distribution & Management; and	Mandatory		Compliance Statement	Compliance Statement
1.2.4	• Packaging				

² Ibid, p.76.

Contract No. – N° du contrat W8476-206276	Amd. No. – N° de la modif.	Buyer ID – Id de l'acheteur Rev 0
Client Ref. No. – N° de réf. du client W8476-206276	TPS DRAFT RFP APPENDIX AB TO ANNEX A	

Section #	Requirement Description	Type of Requirement	Compliance to Desirable Yes / No	Means of Compliance Post-Contract Award	Means of Compliance Pre-Contract Award
1.3	High-level Mandatory Requirement	Heading			
	The project has the following high-level mandatory requirements:				
1.3.1	<ul style="list-style-type: none"> <i>Responsiveness:</i> Must control the production and distribution of electrical power to users. 	Mandatory		Analysis	Analysis
1.3.2	<ul style="list-style-type: none"> <i>Flexibility:</i> Must be mobile, scalable, and configurable in terms of system components, and scalable in terms of power output. Must reduce visual, noise, and heat signatures (compared to current fleets). Must be set-up and dismantled by hand or with common hand tools, utilizing a plug and play concept of design in system equipment. 	Mandatory		Testing / Analysis	Testing / Analysis

Contract No. – N° du contrat W8476-206276	Amd. No. – N° de la modif.	Buyer ID – Id de l'acheteur Rev 0
Client Ref. No. – N° de réf. du client W8476-206276	TPS DRAFT RFP APPENDIX AB TO ANNEX A	

Section #	Requirement Description	Type of Requirement	Compliance to Desirable Yes / No	Means of Compliance Post-Contract Award	Means of Compliance Pre-Contract Award
1.3.3	<ul style="list-style-type: none"> <i>Sustainability:</i> Must use NATO common or commercially available replacement parts, and hardware and software components must be upgradable. Must use commercially available generator fuel which does not require special handling or storage beyond standard fuel requirements. 	Mandatory			
1.3.3.1	The electrical power system must achieve maximum productivity with minimum waste or expense. The efficiency must be improved by 20% from the existing system.	Mandatory		Testing / Analysis	Testing / Analysis
1.3.3.2	The electrical power system should achieve maximum productivity with minimum waste or expense. The efficiency should be improved by 30% from the existing system.	Desirable		Testing / Analysis	Testing / Analysis
1.3.4	<ul style="list-style-type: none"> <i>Survivability:</i> Must continue to provide power during sustained operations with demanding environmental, weather and threat conditions. 	Mandatory		Testing /Demonstration	Testing /Demonstration

Contract No. – N° du contrat W8476-206276	Amd. No. – N° de la modif.	Buyer ID – Id de l'acheteur Rev 0
Client Ref. No. – N° de réf. du client W8476-206276	TPS DRAFT RFP APPENDIX AB TO ANNEX A	

Section #	Requirement Description	Type of Requirement	Compliance to Desirable Yes / No	Means of Compliance Post-Contract Award	Means of Compliance Pre-Contract Award
1.3.5	<ul style="list-style-type: none"> <i>Interoperability</i> Must provide compatible power to ally or coalition partners while conducting joint (including RCAF and RCN) operations in a hostile environment 	Mandatory		Analysis / Endurance Testing	Analysis / Endurance Testing
1.3.6	<ul style="list-style-type: none"> <i>Training</i> Must be operated by a soldier in any Military Occupational Structure Identification (MOSID), relying on Operator Manuals and unit level training, (no formal national level operator training course beyond Initial Cadre Training (ICT)). 	Mandatory		Demonstration / Analysis	Demonstration / Analysis
1.4	Applicable Documents	Information			
1.4.1	The documents listed in this section form part of this TPS-RVM to the extent specified herein, and are supportive of the requirement specification.	Information			
1.4.2	Unless otherwise specified, the issue, revision or amendment of documents effective for this Contract must be those in effect on the date of bid closing.	Information			

Contract No. – N° du contrat W8476-206276	Amd. No. – N° de la modif.	Buyer ID – Id de l'acheteur Rev 0
Client Ref. No. – N° de réf. du client W8476-206276	TPS DRAFT RFP APPENDIX AB TO ANNEX A	

Section #	Requirement Description	Type of Requirement	Compliance to Desirable Yes / No	Means of Compliance Post-Contract Award	Means of Compliance Pre-Contract Award
1.4.3	In the event of a conflict between the documents referenced herein and the contents of the TPS-RVM, then the contents of the TPS-RVM will take precedence.	Information		Compliance Statement	Compliance Statement
1.5	Deployment	Header			
1.5.1	All Sub-systems and components of the TPS must be:	Mandatory		Demonstration / Testing	Demonstration / Testing
1.5.1.1	Unloaded by hand from a Standard Military Pattern (SMP) Cargo Trailer / Truck in accordance with section 1.10.4 with simple handles and grasp areas integrated into the TPS sub-systems and components in accordance with section 1.8.1;				
1.5.1.2	Moved by TPS sub-systems and component on terrain in accordance with section 1.22.11 for a distance of at least 10 m to the setup site with simple, handles and grasp areas integrated into the TPS sub-systems in accordance with section 1.8.1, and with any protective cover for components in accordance with section 1.7;				

Contract No. – N° du contrat W8476-206276	Amd. No. – N° de la modif.	Buyer ID – Id de l'acheteur Rev 0
Client Ref. No. – N° de réf. du client W8476-206276	TPS DRAFT RFP APPENDIX AB TO ANNEX A	

Section #	Requirement Description	Type of Requirement	Compliance to Desirable Yes / No	Means of Compliance Post-Contract Award	Means of Compliance Pre-Contract Award
1.5.1.3	Unpacked, assembled and connected to TPS sub-systems and components to fully operate on terrain in accordance with section 1.22.11	Mandatory		Demonstration / Testing	Demonstration / Testing
1.5.2	Operated in all environmental conditions specified under section 1.22 without any degradation of its original performance.	Mandatory		Demonstration / Testing	Demonstration / Testing
1.5.3	Moved by hand wearing Personal Protective Equipment (PPE) and Improved Environmental Clothing System (IECS);	Mandatory		Demonstration / Testing	Demonstration / Testing
1.5.4	Deployed safely by a maximum of 6 soldiers of any MOC with only 1 of the 6 persons trained on the TPS and the remaining 5 with no TPS training without any injury to any personnel or any damage to the TPS equipment;	Mandatory		Demonstration / Testing	Demonstration / Testing
1.5.5	Exception to section 1.5.1.2: TPS equipment weighing 130 kg (286 lb.) and over must be permanently mounted on dedicated standard military cargo trailer, Skids, ISO Containers	Mandatory		Compliance Statement	Compliance Statement
1.5.6	The TPS for HQSS Brigade Medical Station (BMS) must be deployed within 20 minutes by a maximum of 4 soldiers from any MOC with only 1 of the 4 persons trained on the TPS and the remaining 3 with no TPS training.	Mandatory		Demonstration / Testing	Demonstration / Testing

Contract No. – N° du contrat W8476-206276	Amd. No. – N° de la modif.	Buyer ID – Id de l'acheteur Rev 0
Client Ref. No. – N° de réf. du client W8476-206276	TPS DRAFT RFP APPENDIX AB TO ANNEX A	

Section #	Requirement Description	Type of Requirement	Compliance to Desirable Yes / No	Means of Compliance Post-Contract Award	Means of Compliance Pre-Contract Award
1.5.7	The TPS for a HQSS Type 4 must be deployed within 30 minutes by a maximum of 6 soldiers from any MOC with only 1 of the 6 persons trained on the TPS and the remaining 5 with no TPS training.	Mandatory		Demonstration / Testing	Demonstration / Testing
1.5.8	The TPS for a HQSS Type 4 should be deployed within 20 minutes by maximum of 6 soldiers from any MOC trained on the TPS.	Desirable		Demonstration / Testing	Demonstration / Testing
1.5.9	The TPS for a HQSS Type 2 must be deployed within 40 minutes by a maximum of 8 soldiers from any MOC with only 1 of the 8 persons trained on the TPS and the remaining 7 with no TPS training.	Mandatory		Demonstration / Testing	Demonstration / Testing
1.6	Withdrawal	Header			
1.6.1	All Sub-systems and components of the TPS must be :	Mandatory		Compliance Statement	Compliance Statement
1.6.2	Disconnected, packed up, and moved by hand on terrain in accordance with section 1.22.11;	Mandatory		Demonstration / Testing	Demonstration / Testing
1.6.3	Loaded from ground into Cargo Containers or standard military cargo trailers dedicated for TPS with handles and grasp areas integrated into the TPS Sub-systems and components (or protective cover in accordance with section 1.7);	Mandatory		Demonstration / Testing	Demonstration / Testing

Contract No. – N° du contrat W8476-206276	Amd. No. – N° de la modif.	Buyer ID – Id de l'acheteur Rev 0
Client Ref. No. – N° de réf. du client W8476-206276	TPS DRAFT RFP APPENDIX AB TO ANNEX A	

Section #	Requirement Description	Type of Requirement	Compliance to Desirable Yes / No	Means of Compliance Post-Contract Award	Means of Compliance Pre-Contract Award
1.6.4	Recovered by maximum of 6 soldiers of any MOC with only 1 of the 6 persons trained on the TPS and the remaining 5 with no TPS training;	Mandatory		Demonstration / Testing	Demonstration / Testing
1.6.5	Operable in all environmental conditions specified under section 1.22 without any degradation of its original performance;	Mandatory		Demonstration / Testing	Demonstration / Testing
1.6.6	Operable safely without any injury to any personnel; and	Mandatory		Demonstration / Testing	Demonstration / Testing
1.6.7	Operable safely without any damage to the TPS equipment.	Mandatory		Demonstration / Testing	Demonstration / Testing
1.6.8	The TPS for a HQSS UMS must be recovered and stowed back to original condition within 40 minutes by a maximum of 4 soldiers from any MOC with only 1 of the 4 persons trained on the TPS and the remaining 3 with no TPS training.	Mandatory		Demonstration / Testing	Demonstration / Testing
1.6.9	The TPS for a HQSS Type 4 must be recovered and stowed back to original condition within 60 minutes by a maximum of 6 soldiers from any MOC with only 1 of the 6 persons trained on the TPS and the remaining 5 with no TPS training.	Mandatory		Demonstration / Testing	Demonstration / Testing
1.6.10	The TPS for a HQSS Type 4 should be recovered by hand and stowed back to original condition within 40 minutes by a maximum of 6 soldiers from any MOC trained on the TPS; and	Desirable		Demonstration / Testing	Demonstration / Testing
1.6.11	The TPS for a HQSS Type 2 must be recovered and stowed back to original condition within 90 minutes by maximum of 8 soldiers from any	Mandatory		Demonstration / Testing	Demonstration / Testing

Contract No. – N° du contrat W8476-206276	Amd. No. – N° de la modif.	Buyer ID – Id de l'acheteur Rev 0
Client Ref. No. – N° de réf. du client W8476-206276	TPS DRAFT RFP APPENDIX AB TO ANNEX A	

Section #	Requirement Description	Type of Requirement	Compliance to Desirable Yes / No	Means of Compliance Post-Contract Award	Means of Compliance Pre-Contract Award
1.7	MOC with only 1 of the 8 persons trained on the TPS and the remaining 7 with no TPS training. Protective Hard Cover	Header			
1.7.1	The Sub-systems and components of the TPS such as the Micro-grid controller and Special Tools and Test Equipment (STTE) must have a hard cover to protect against climatic and environmental elements when in stored outdoors and in transit.	Mandatory		Demonstration / Testing	Demonstration / Testing
1.7.2	TPS sub-systems and components deployed outdoor must be capable to withstand climatic and environmental elements specified under section 1.5.2 without any performance degradation.	Mandatory		Demonstration / Testing	Demonstration / Testing
1.7.3	Any Protective Cover solution must be simple and easy to use with limited digital dexterity required in the following conditions:	Definition		Compliance Statement	Compliance Statement
1.7.3.1	Wet;	Mandatory		Demonstration / Testing	Demonstration / Testing
1.7.3.2	Snow;	Mandatory		Demonstration / Testing	Demonstration / Testing
1.7.3.3	Sleet;	Mandatory		Demonstration / Testing	Demonstration / Testing
1.7.3.4	Blowing Sand and dust;	Mandatory		Demonstration / Testing	Demonstration / Testing
1.7.3.5	Cold temperature in accordance with section 1.22.3;	Mandatory		Demonstration / Testing	Demonstration / Testing

Contract No. – N° du contrat W8476-206276	Amd. No. – N° de la modif.	Buyer ID – Id de l'acheteur Rev 0
Client Ref. No. – N° de réf. du client W8476-206276	TPS DRAFT RFP APPENDIX AB TO ANNEX A	

Section #	Requirement Description	Type of Requirement	Compliance to Desirable Yes / No	Means of Compliance Post-Contract Award	Means of Compliance Pre-Contract Award
1.7.3.6	High temperature in accordance with section 1.22.4;	Mandatory		Demonstration / Testing	Demonstration / Testing
1.8	<i>Handling</i>	Header			
1.8.1	<i>Carrying Handles and Grasp Areas</i>	Header			
1.8.1.1	The quantity of lifting handles on each TPS Component must accommodate the recommended number of persons to safely push/pull/lift the equipment.	Mandatory		Demonstration / Testing	Demonstration / Testing
1.8.1.2	Persons handling the equipment must be allotted sufficient space around the perimeter of the object to accommodate them physically and to permit each member to move forward safely without interference from adjacent team members or with the equipment being moved.	Mandatory		Demonstration / Testing	Demonstration / Testing
1.8.1.3	The location of handles must not interfere with installing, removing, operating, maintaining, or repairing the equipment.	Mandatory		Demonstration / Testing	Demonstration / Testing
1.9	<i>Weight Limit</i>	Header			
1.9.1	TPS equipment weighing 130 kg (286 lb.) and over must be permanently mounted on a standard military cargo trailer dedicated for TPS;	Mandatory		Compliance Statement	Compliance Statement
1.9.2	Except for 12 to 70 kW generators, the heaviest component of the TPS must weigh less than 130 kg (286 lb.).	Mandatory		Testing	Testing

Contract No. – N° du contrat W8476-206276	Amd. No. – N° de la modif.	Buyer ID – Id de l'acheteur Rev 0
Client Ref. No. – N° de réf. du client W8476-206276	TPS DRAFT RFP APPENDIX AB TO ANNEX A	

Section #	Requirement Description	Type of Requirement	Compliance to Desirable Yes / No	Means of Compliance Post-Contract Award	Means of Compliance Pre-Contract Award
1.9.3	The heaviest power distribution box in the TPS must weigh less than 54.5 kg (120 lb).	Mandatory		Testing	Testing
1.9.4	The heaviest cable in the TPS must weigh less than 34 kg (75 lb).	Mandatory		Testing	Testing
1.10	Transportability	Header			
1.10.1	The TPS must have the same mobility including setup and tear down times as the Canadian Forces sub-units of sections it supports and be transportable by trucks and trailers.	Mandatory		Demonstration / Testing	Demonstration / Testing
1.10.2	Cargo Containers	Header			
1.10.2.1	TPS components must be able to be securely stowed, stored and transported in Standard CAF ISO containers, NSN 8145-21-914-4367	Mandatory		Demonstration / Testing	Demonstration / Testing
1.10.2.2	The cargo containers carrying the TPS must be able to be secured and moved using in-service Canadian Armed Forces (CAF) Material Handling Equipment (MHE) assets to load the ISO containers onto logistics vehicles in accordance with section 1.10.4, train flatbed, ships, or aircraft in accordance with sections 1.10.2, 1.10.3, 1.10.5, and 1.10.7 without damage to the TPS (during and after exposure), and without any equipment degradation and fully serviceable after movement.	Mandatory		Demonstration / Testing	Demonstration / Testing
1.10.2.3	The components of the TPS (including any protective cover in accordance with section 1.7) must be able to be secured inside the cargo containers without damage to the component or degradation in performance during and after transportation.	Mandatory		Demonstration / Testing	Demonstration / Testing

Contract No. – N° du contrat W8476-206276	Amd. No. – N° de la modif.	Buyer ID – Id de l'acheteur Rev 0
Client Ref. No. – N° de réf. du client W8476-206276	TPS DRAFT RFP APPENDIX AB TO ANNEX A	

Section #	Requirement Description	Type of Requirement	Compliance to Desirable Yes / No	Means of Compliance Post-Contract Award	Means of Compliance Pre-Contract Award
1.10.3	<i>Aircraft Pallets</i>	Header			
1.10.3.1	Each component of the TPS (including any protective cover in accordance with section 1.7) must fit on the HCU-6/E 88 X 108" – 463-L Dual Rail pallet (NSN 1670-00-820-4896) in accordance with CFTO B-GA-007-002/AF-001 for secure stowage, storage, and transportation by air, inside aircraft without damage to the TPS (during and after exposure), without any equipment degradation and fully serviceable after transportation.	Mandatory		Demonstration / Testing	Demonstration / Testing
1.10.3.2	The Components of the TPS (including any protective cover in accordance with section 1.7) must be able to be secured to the pallet in accordance with section 1.10.3 without damage to the component or degradation in performance during and after transportation.	Mandatory		Demonstration / Testing	Demonstration / Testing
1.10.4	<i>Land Transportation</i>	Header			
1.10.4.1	Each component of the TPS (including any protective cover in accordance with section 1.7) when stowed in an ISO containers in following logistics vehicles, while traversing sloped, rough roads, trails, and cross country terrain, without damage to the TPS (during and after exposure), and without any equipment degradation and fully serviceable after transportation:	Mandatory		Demonstration / Testing	Demonstration / Testing

Contract No. – N° du contrat W8476-206276	Amd. No. – N° de la modif. Rev 0	Buyer ID – Id de l'acheteur Rev 0
Client Ref. No. – N° de réf. du client W8476-206276	TPS DRAFT RFP APPENDIX AB TO ANNEX A	

Section #	Requirement Description	Type of Requirement	Compliance to Desirable Yes / No	Means of Compliance Post-Contract Award	Means of Compliance Pre-Contract Award
1.10.4.1.1	Logistic Vehicle Modernization (LVM-L) Light variant.	Mandatory		Demonstration / Testing	Compliance Statement
1.10.4.1.2	Medium Support Vehicle System (MSVS).	Mandatory		Demonstration / Testing	Compliance Statement
1.10.4.1.3	Logistic Vehicle Modernization (LVM-H) Heavy variant.	Mandatory		Demonstration / Testing	Compliance Statement
1.10.4.2	Each component of the TPS (including any protective cover in accordance with section 1.7) must be land transportable on the following logistics vehicles as weather deck cargo, while traversing sloped, rough roads, trails, and cross country terrain, without damage to the TPS (during and after exposure), and without any equipment degradation and fully serviceable after transportation:	Mandatory		Demonstration / Testing	Demonstration / Testing
1.10.4.2.1	Logistic Vehicle Modernization (LVM-L) Light variant.	Mandatory		Demonstration / Testing	Compliance Statement
1.10.4.2.2	Medium Support Vehicle System (MSVS).	Mandatory		Demonstration / Testing	Compliance Statement
1.10.4.2.3	Logistic Vehicle Modernization (LVM-H) Heavy variant.	Mandatory		Demonstration / Testing	Compliance Statement

Contract No. – N° du contrat W8476-206276	Amd. No. – N° de la modif.	Buyer ID – Id de l'acheteur Rev 0
Client Ref. No. – N° de réf. du client W8476-206276	TPS DRAFT RFP APPENDIX AB TO ANNEX A	

Section #	Requirement Description	Type of Requirement	Compliance to Desirable Yes / No	Means of Compliance Post-Contract Award	Means of Compliance Pre-Contract Award
1.10.4.3	Each component of the TPS (including any protective cover in accordance with section 1.7) must be land transportable by the following logistic vehicles, while traversing sloped, rough roads, trails, and cross country terrain, without damage to the TPS (during and after exposure), and without any equipment degradation and fully serviceable after transportation:	Mandatory		Demonstration / Testing	Demonstration / Testing
1.10.4.3.1	Logistic Vehicle Modernization (LVM-L) Light variant: <ul style="list-style-type: none"> Dimensions TBD 	Mandatory		Demonstration / Testing	Compliance Statement
1.10.4.3.2	Medium Support Vehicle System (MSVS) Cargo: <ul style="list-style-type: none"> Ingress opening dimensions: 1,780mm height; 1,917mm width Cargo space dimensions: 1,780mm height; 1,917mm width; 2,578mm length 	Mandatory		Demonstration / Testing	Compliance Statement
1.10.5	<i>Train Transport</i>	Header			
1.10.5.1	Each component of the TPS (including any protective cover in accordance with section 1.7) when stowed in an ISO containers in flatbed without damage to the TPS (during and after exposure), and without any equipment degradation and fully serviceable after transportation.	Mandatory		Demonstration / Testing	Demonstration / Testing

Contract No. – N° du contrat W8476-206276	Amd. No. – N° de la modif.	Buyer ID – Id de l'acheteur Rev 0
Client Ref. No. – N° de réf. du client W8476-206276	TPS DRAFT RFP APPENDIX AB TO ANNEX A	

Section #	Requirement Description	Type of Requirement	Compliance to Desirable Yes / No	Means of Compliance Post-Contract Award	Means of Compliance Pre-Contract Award
1.10.6	<i>Sea Transportation</i>	Header			
<i>1.10.6.1</i>	Each component of the TPS (including any protective cover in accordance with section 1.7) when stowed in the ISO containers in accordance with section 1.10.2 must be sea transportable on vessels without damage to the TPS (during and after exposure), and without any equipment degradation and fully serviceable after transportation.	Mandatory		Demonstration / Testing	Demonstration / Testing
1.10.7	<i>Air Transportation</i>	Header			
<i>1.10.7.1</i>	Each component of the TPS (including any protective cover in accordance with 1.7) when stowed in the ISO containers in accordance with section 1.10.2 must be air transportable inside the following aircraft without damage to the TPS (during and after exposure), without any equipment degradation and fully serviceable after transportation:	Mandatory		Demonstration / Testing	Demonstration / Testing
<i>1.10.7.1.1</i>	CC-177 Globemaster III; and	Mandatory		Compliance Statement	Compliance Statement
<i>1.10.7.1.2</i>	CC-130 Hercules (J-variant).	Mandatory		Compliance Statement	Compliance Statement

Contract No. – N° du contrat W8476-206276	Amd. No. – N° de la modif.	Buyer ID – Id de l'acheteur Rev 0
Client Ref. No. – N° de réf. du client W8476-206276	TPS DRAFT RFP APPENDIX AB TO ANNEX A	

Section #	Requirement Description	Type of Requirement	Compliance to Desirable Yes / No	Means of Compliance Post-Contract Award	Means of Compliance Pre-Contract Award
<i>1.10.7.2</i>	Each component of the TPS (including any protective cover in accordance with section 1.7) when stowed within an ISO containers in accordance with section 1.10.2 must be air transportable, slung under the CH-147 Chinook without damage to the TPS (during and after exposure), without any equipment degradation and fully serviceable after transportation.	Mandatory		Demonstration / Testing	Demonstration / Testing
<i>1.10.7.3</i>	Each component of the TPS (including any protective cover in accordance with section 1.7) when stowed on the pallet in accordance with section 1.10.3 must be air transportable inside the following aircraft without damage to the TPS (during and after exposure), without any equipment degradation and fully serviceable after transportation:	Mandatory		Demonstration / Testing	Demonstration / Testing
1.10.7.3.1	CC-177 Globemaster III; and	Mandatory		Compliance Statement	Compliance Statement
1.10.7.3.2	CC-130 Hercules (J-variant).	Mandatory		Compliance Statement	Compliance Statement
<i>1.10.7.4</i>	Each component of the TPS (including any protective cover in accordance with section 1.7) must be air transportable, slung under the CH-147 Chinook without damage to the TPS (during and after exposure), without any equipment degradation and fully serviceable after transportation.	Mandatory		Demonstration / Testing	Demonstration / Testing
1.10.7.4.1	Under slung loads are defined in accordance with DEF STAN 00-35 Defence Standard: Environmental Handbook for Defence Materiel, (Part5)/3 Induced Mechanical Environments.	Information		Demonstration / Testing	Demonstration / Testing

Contract No. – N° du contrat W8476-206276	Amd. No. – N° de la modif.	Buyer ID – Id de l'acheteur Rev 0
Client Ref. No. – N° de réf. du client W8476-206276	TPS DRAFT RFP APPENDIX AB TO ANNEX A	

Section #	Requirement Description	Type of Requirement	Compliance to Desirable Yes / No	Means of Compliance Post-Contract Award	Means of Compliance Pre-Contract Award
1.10.7.5	Each component of the TPS (including any protective cover in accordance with section 1.7) must be air transportable inside the CH-147 Chinook without damage to the TPS (during and after exposure), without any equipment degradation and fully serviceable after transportation.	Mandatory		Demonstration / Testing	Demonstration / Testing
1.10.7.5.1	The maximum cargo space of the CH-147 Chinook is the following: 193 cm height; 228 cm width; 929 cm length.	Information			
1.11	Stacking	Header			
1.11.1	Like components of the TPS (including any protective cover in accordance with section 1.7), without being packaged in industrial crates in accordance with the ISS SOW, must be securely stackable (nest on top of each other) up to a height of 182.9 cm (6 ft), without damage to the equipment (during and after exposure), without any equipment degradation and fully serviceable after transportation.	Mandatory		Demonstration	Demonstration
1.11.2	The components of the power distribution units in accordance with section 3 must be securely stackable for maximum of 3 levels high.	Mandatory		Demonstration	Demonstration
1.11.3	Service Life and Sustainability				
1.11.4	The TPS must have the same mobility including setup and tear down times as the Canadian Forces sub-units of sections it supports and be transportable by trucks and trailers.	Mandatory		Compliance Statement	Compliance Statement

Contract No. – N° du contrat W8476-206276	Amd. No. – N° de la modif.	Buyer ID – Id de l'acheteur Rev 0
Client Ref. No. – N° de réf. du client W8476-206276	TPS DRAFT RFP APPENDIX AB TO ANNEX A	

Section #	Requirement Description	Type of Requirement	Compliance to Desirable Yes / No	Means of Compliance Post-Contract Award	Means of Compliance Pre-Contract Award
1.11.5	The TPS must have a service life (starting at the date of first usage of the TPS) and sustainability of at least 20 years when used in any combination of the climatic and environmental conditions in accordance with section 1.22.	Mandatory			Compliance Testing
1.11.6	The TPS will be expected to be deployed for 26 weeks (1 week = 7 days) per year (i.e. annual usage).	Definition			
1.11.7	The TPS will be expected to operate 168 hours per week.	Definition			
1.11.8	The TPS will be expected to be moved and set up 36 times per year, and stricken and moved 36 times per year.	Definition			
1.12	Corrosion Protection	Header			
1.12.1	The TPS components must be designed, and material selected and/or treated to resist corrosion over the entire service life of the TPS in accordance with section 1.13 and section 1.22.5.3 in the climatic and environmental conditions in accordance with section 1.22.	Mandatory			Compliance Statement
1.13	Materials and/or Surface Treatment	Header			
1.13.1	The TPS must have a non-reflective, dull matte surface finish.	Mandatory			Demonstration
1.13.2	Except for cable assemblies, components of the TPS exposed to the exterior climate must be of colour 34094 (flat green 383) in accordance with Federal Standard 595C or Technical Authority approved equivalent.	Mandatory			Compliance Statement

Contract No. – N° du contrat W8476-206276	Amd. No. – N° de la modif.	Buyer ID – Id de l'acheteur Rev 0
Client Ref. No. – N° de réf. du client W8476-206276	TPS DRAFT RFP APPENDIX AB TO ANNEX A	

Section #	Requirement Description	Type of Requirement	Compliance to Desirable Yes / No	Means of Compliance Post-Contract Award	Means of Compliance Pre-Contract Award
1.14	Modularity and Flexibility	Header			
1.14.1	The TPS must be deployable and modular.	Mandatory		Compliance Statement	Compliance Statement
1.14.2	The TPS must be flexible in its interconnectivity and not limit or restrict deployment scenarios.	Mandatory		Compliance Statement	Compliance Statement
1.14.3	The TPS must be flexible and modular to enable a Commander to individually tailor the configuration of the TPS over the course of the equipment life to meet mission requirements	Mandatory		Compliance Statement	Compliance Statement
1.15	Interchangeability	Header			
1.15.1	All Sub-Systems equipment, components, parts, and consumables of the TPS must be completely interchangeable within the same like items without any adjustment or degradation of performance:	Mandatory		Compliance Statement	Compliance Statement
1.15.2	All Sub-Systems equipment, components, parts, and consumables of the TPS should be completely interchangeable within the family of like items without degradation of performance as listed below:	Desirable		Demonstration	Demonstration
<i>1.15.2.1</i>	All fleets of tactical generators should have common Air filters, Fuel/water separator filters, Oil filters, Temperature sensors, Oil Pressure sensors, Speed Sensors, fuel sensors, fuel pickup pumps, fuel pumps and Electrical control panels;	Desirable		Demonstration	Demonstration

Contract No. – N° du contrat W8476-206276	Amd. No. – N° de la modif.	Buyer ID – Id de l'acheteur Rev 0
Client Ref. No. – N° de réf. du client W8476-206276	TPS DRAFT RFP APPENDIX AB TO ANNEX A	

Section #	Requirement Description	Type of Requirement	Compliance to Desirable Yes / No	Means of Compliance Post-Contract Award	Means of Compliance Pre-Contract Award
<i>1.15.2.2</i>	Fleets of 2 to 3.5 kW generators should have common Air filters, Fuel/water separator filters, Oil filters, Temperature sensors, Oil Pressure sensors, Speed Sensors, fuel sensors, fuel pickup pumps, fuel pumps and Electrical control panels;	Desirable		Demonstration	Demonstration
<i>1.15.2.3</i>	Fleets from 4 to 6 kW Generators should have common Air filters, Fuel/water separator filters, Oil filters, Temperature sensors, Oil Pressure sensors, Speed Sensors, fuel sensors, fuel pickup pumps, fuel pumps and Electrical control panels;	Desirable		Demonstration	Demonstration
<i>1.15.2.4</i>	Fleets from 12 to 70 kW Generators should have common Air filters, Fuel/water separator filters, Oil filters, Temperature sensors, Oil Pressure sensors, Speed Sensors, fuel sensors, fuel pickup pumps, fuel pumps and Electrical control panels; and	Desirable		Demonstration	Demonstration
1.16	Reliability	Header			
1.16.1	The TPS in accordance with section 1.2 must have a minimum Mean Time Between Failure (MTBF) of 3000 hours 95% of the time in any deployed configuration, including set-ups, recovery and in-transit.	Mandatory		Analysis	Analysis
1.16.2	TPS failure in this context is defined as any condition that cannot be repaired at first line of maintenance performing a first, second and limited third level of repairs or unscheduled maintenance.	Definition			
1.16.3	No component of the TPS must exhibit one type of repetitive failure occurring on a regular basis and become a common equipment failure.	Mandatory		Endurance testing	Analysis
1.17	Availability	Header			

Contract No. – N° du contrat W8476-206276	Amd. No. – N° de la modif.	Buyer ID – Id de l'acheteur Rev 0
Client Ref. No. – N° de réf. du client W8476-206276	TPS DRAFT RFP APPENDIX AB TO ANNEX A	

Section #	Requirement Description	Type of Requirement	Compliance to Desirable Yes / No	Means of Compliance Post-Contract Award	Means of Compliance Pre-Contract Award
1.17.1	The TPS must maintain an operational availability, A_0 of not less than 98%. Operational Availability refers to the time that the TPS in accordance to section 1.2 is available for operation including the time of which the TPS is not in service and ready to complete the mission. Availability is calculated as: $A_0 = \text{MTBF} / (\text{MTBF} + \text{MTTR})$ Where MTBF is Mean Time Between Failure; and Where MTTR is Mean Time To Repair which is equal to the time needed to diagnose the equipment, order and receive spare parts, and the time to repair or replace any parts.	Mandatory		Compliance Statement	Compliance Statement
1.18	Maintenance and Repair	Header			
1.18.1	The TPS must not degrade in performance when stored for extended periods of at least 6 months.	Mandatory		Analysis	Analysis
1.18.2	The TPS must be capable of being maintained and repaired (i.e. first and second level of repairs including limited third level) in climatic and environmental conditions in accordance with section 1.22.	Mandatory		Demonstration	Demonstration
1.18.3	Lines of Maintenance:	Header			
1.18.3.1	1 st (First) Line: In land combat operations, the line of maintenance is the echelon at which a combat services support function is performed. The “1 st (First) Line” is the support organic to a unit such as an Administration Company deployed	Definition			

Contract No. – N° du contrat W8476-206276	Amd. No. – N° de la modif.	Buyer ID – Id de l'acheteur Rev 0
Client Ref. No. – N° de réf. du client W8476-206276	TPS DRAFT RFP APPENDIX AB TO ANNEX A	

Section #	Requirement Description	Type of Requirement	Compliance to Desirable Yes / No	Means of Compliance Post-Contract Award	Means of Compliance Pre-Contract Award
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	with the unit. This includes Mobile Repair Teams (MRTs) and deployed workshops for General Support.				
1.18.3.2	2 nd (Second) Line: The “2 nd (Second) Line” is the support organic to a brigade (ie: Service Battalion) and division. The Garrison at which the unit belongs to.	Definition			
1.18.3.3	3 rd (Third) Line: The “3 rd (Third) Line” is the national base support level such as 202 Workshop or Repair and Overhaul (R&O) Facility established for the equipment.	Definition			
1.18.4	Maintenance Levels:	Header			
1.18.4.1	1 st (First) Level: Technician’s first level maintenance tasks generally involve preventive maintenance, faultfinding, limited corrective maintenance, and initial recovery tasks. These tasks must take no longer than 1 hour, 99% of the time. Technicians will have access to the necessary common tools available at Direct Support, as defined in B-GL-342-001/FP-000 Land Equipment Management System.	Definition			

Contract No. – N° du contrat W8476-206276	Amd. No. – N° de la modif.	Buyer ID – Id de l'acheteur Rev 0
Client Ref. No. – N° de réf. du client W8476-206276	TPS DRAFT RFP APPENDIX AB TO ANNEX A	

Section #	Requirement Description	Type of Requirement	Compliance to Desirable Yes / No	Means of Compliance Post-Contract Award	Means of Compliance Pre-Contract Award
-----------	-------------------------	---------------------	-------------------------------------	---	--

1.18.4.2	<p>2nd (Second) Level: Second level maintenance will be performed by CAF technicians and will involve intermediate corrective maintenance and recovery tasks. These tasks must take no longer than 4 hours, 99% of the time. Technicians will have access to the necessary common tools available at Direct Support, as defined in B-GL-342-001/FP-000 Land Equipment Management System. If the task is performed at a General Support Workshop, then the technician will have access to tools and test equipment and limited fabrication equipment.</p>	Definition			
1.18.4.3	<p>3rd (Third) Level: Third level maintenance will involve corrective maintenance and repair and overhaul maintenance tasks. The corrective maintenance tasks must take no longer than 4 to 20 hours, 99% of the time. Third level maintenance will be done at Garrison General Support Units or 202 Workshop or Repair & Overhaul (R&O) Workshops. Technicians will have access to the necessary common & special tools available at General Support, as defined in B-GL-342-001/FP-000 Land Equipment Management System. If the task is performed at a General Support Workshop, then the technician will have access to Special Tools and Test Equipment (STTE) and fabrication equipment.</p>	Definition			

Contract No. – N° du contrat W8476-206276	Amd. No. – N° de la modif.	Buyer ID – Id de l'acheteur Rev 0
Client Ref. No. – N° de réf. du client W8476-206276	TPS DRAFT RFP APPENDIX AB TO ANNEX A	

Section #	Requirement Description	Type of Requirement	Compliance to Desirable Yes / No	Means of Compliance Post-Contract Award	Means of Compliance Pre-Contract Award
-----------	-------------------------	---------------------	-------------------------------------	---	--

1.18.5	Repair: Corrective maintenance activity which restores an item to serviceable condition by identifying and correcting faults or replacing pieces of the item with new, reconditioned, overhauled or rebuilt components. Repair work will be initiated by the unit/end user.	Definition			Demonstration / Analysis			
1.18.6	Overhaul: The restoration of an item to its original condition and life expectancy. It includes the replacement of worn, damaged or life expired parts, the incorporation of approved modifications, and refurbishment as necessary.	Definition				Demonstration / Analysis	Demonstration / Analysis	Demonstration
1.18.7	First level scheduled maintenance tasks must take no longer than 30 minutes, 99% of the time.	Mandatory.						
1.18.8	Third level scheduled maintenance tasks must take no longer than thirty 30 minutes, 99% of the time.	Mandatory.						
1.18.9	First line scheduled maintenance must be conducted on the TPS with no power interruption to the users.	Mandatory.				Demonstration		
1.19	Safety and Human Engineering:	Header						
1.19.1	Personnel.	Header						

Contract No. – N° du contrat W8476-206276	Amd. No. – N° de la modif.	Buyer ID – Id de l'acheteur Rev 0
Client Ref. No. – N° de réf. du client W8476-206276	TPS DRAFT RFP APPENDIX AB TO ANNEX A	

Section #	Requirement Description	Type of Requirement	Compliance to Desirable Yes / No	Means of Compliance Post-Contract Award	Means of Compliance Pre-Contract Award
-----------	-------------------------	---------------------	-------------------------------------	---	--

1.19.1.1	Any reference to the words 'person(s)', 'people', 'personnel', 'occupant(s)', 'staff', 'operator(s)', 'technician(s)', 'soldier(s)', or "troops" in this TPS-RVM must be considered as a person with a stature and weight between the 95th percentile male and the 5th percentile female of the Canadian Land Forces population in accordance with Defence and Civil Institute of Environmental Medicine (DCIEM) 98-CR-15.	Definition			
1.19.1.2	The TPS design must allow handling by persons wearing Personal Protective Equipment (PPE) and Improved Environmental Clothing System (IECS). Note: The mitten is a large, bulky mitten which reduces dexterity.	Mandatory			Demonstration
1.19.1.3	The TPS must be designed in accordance with MIL-STD-1472G sections 4 and 5 (as applicable) to not present any safety or health hazards to any person in contact with the TPS during its service life.	Mandatory			Compliance Statement
1.19.1.4	The TPS design must comply with MIL-HDBK-454, Guideline 1 Safety Design Criteria- Personnel Hazards.	Mandatory			Compliance Statement
1.19.1.5	The TPS must not have any inherent safety hazards associated with, but not limited to, its stowage, storage, transportation, assembly/disassembly, deployment, connection, start-up, operation, packing/unpacking, maintenance, or repair.	Mandatory			Demonstration

Contract No. – N° du contrat W8476-206276	Amd. No. – N° de la modif.	Buyer ID – Id de l'acheteur Rev 0
Client Ref. No. – N° de réf. du client W8476-206276	TPS DRAFT RFP APPENDIX AB TO ANNEX A	

Section #	Requirement Description	Type of Requirement	Compliance to Desirable Yes / No	Means of Compliance Post-Contract Award	Means of Compliance Pre-Contract Award
1.19.1.6	The TPS and the materials used in its fabrication must not create safety, health hazards and negative environmental impact.	Mandatory		Demonstration / Analysis	Demonstration / Analysis
1.19.1.7	The TPS must incorporate a fail-safe design in those areas where failure can cause catastrophic through-damage to equipment, injury to personnel, or inadvertent operation of critical equipment, or an environmental hazard.	Mandatory		Compliance Statement	Compliance Statement
1.19.1.8	The TPS connector must incorporate a fail-safe design to prevent inadvertent human error while connecting the equipment together.	Mandatory		Demonstration / Analysis	Demonstration / Analysis
1.19.1.9	All rotating and moving surfaces must be enclosed to prevent injury from accidental contact, and marked with warning or caution signs visible to any person in contact with the equipment.	Mandatory		Demonstration	Demonstration
1.19.1.10	All surfaces and edges that are likely to be in contact with personnel at any time during the life of the equipment must not be sharp or abrasive; they must be smooth or protected to prevent injury.	Mandatory		Demonstration	Demonstration
1.19.1.11	Any surface that may come into contact with unprotected human skin must adhere to precautions in accordance with MIL-STD-1472G, Section 5.7.6.9, Thermal Contact Hazards.	Mandatory		Demonstration	Demonstration
1.19.1.12	All surfaces that may be in contact with personnel during the life of the equipment must not cause electrical shock.	Mandatory		CSA Certification	CSA Certification

Section #	Requirement Description	Type of Requirement	Compliance to Desirable Yes / No	Means of Compliance Post-Contract Award	Means of Compliance Pre-Contract Award
1.19.1.1.13	The design of the TPS must minimize the likelihood of pinch injuries to hands or any other body part.	Mandatory		Demonstration	Demonstration
1.19.1.1.14	The design of the TPS must not cause personnel a head hazard.	Mandatory		Demonstration	Demonstration
1.19.1.1.15	The design of the TPS must not create a tripping hazard for personnel.	Mandatory		Demonstration	Demonstration
1.19.1.1.16	Any hazard associated with the TPS must be identified and indicated with a warning or caution sign visible to any person in contact with the equipment.	Mandatory		Demonstration	Demonstration
1.19.1.1.17	The TPS must comply with all the safety labeling requirements of MIL-STD-1472G, section 5.7.2.	Mandatory		Demonstration	Demonstration
1.19.1.1.18	In addition to section 1.19.1.17 labeling requirements, TPS components must be labeled with their maximum stacking capability.	Mandatory		Demonstration	Demonstration
1.19.1.1.19	The TPS must not expose personnel and equipment to fire hazards, exhaust and toxic gas accumulation in the supply ducting, electrical shock hazards, health hazards and noise hazards	Mandatory		Demonstration	Demonstration
1.19.1.1.20	Mercury, asbestos and polychlorinated (PCBs) must not be incorporated into the design, operation and maintenance of the TPS.	Mandatory		Compliance Statement	Compliance Statement
1.19.1.1.21	The TPS must not expose personnel to back injury during deployment, movement and recovery of equipment.	Mandatory		Compliance Statement	Compliance Statement

Contract No. – N° du contrat W8476-206276	Amd. No. – N° de la modif.	Buyer ID – Id de l'acheteur Rev 0
Client Ref. No. – N° de réf. du client W8476-206276	TPS DRAFT RFP APPENDIX AB TO ANNEX A	

Section #	Requirement Description	Type of Requirement	Compliance to Desirable Yes / No	Means of Compliance Post-Contract Award	Means of Compliance Pre-Contract Award
1.20	Codes, Acts, Regulations, Policy, and Certifications:	Header			
1.20.1	The TPS must meet applicable Canada Labour Code and its associated Occupational Health and Safety Acts and Regulations, and federal and provincial Environmental Acts and associated Regulations.	Mandatory		Compliance Statement	Compliance Statement
1.20.1.1	The TPS must meet all applicable federal and provincial safety standards.	Mandatory		Compliance Statement	Compliance Statement
1.20.1.2	The TPS must comply with applicable CSA standards.	Mandatory		Certification	Certification
1.20.1.3	All electrical, mechanical, plumbing and fuel related components of the TPS must be certified by the Canadian Standards Association (CSA) or by a certification body accredited by the CSA or the Standards Council of Canada (SCC).	Mandatory		Certification	Certification
1.20.1.4	The portable diesel generator must comply with CSA Standard C22.2-No 100.	Mandatory		Certification	Certification
1.20.1.5	The Power Distribution Panel must comply with CSA Standards C22.2-No 29.	Mandatory		Certification	Certification
1.20.1.6	The wires and cables must comply with CSA Standard C.22.2 No 49	Mandatory		Certification	Certification
1.20.1.7	The wires and cables must comply with CSA Standard C.22.2 No 96.1-04	Mandatory		Certification	Certification
1.20.1.8	The wires and cables must comply with CSA Standard C.22.2 No 0.3-01.	Mandatory		Certification	Certification

Contract No. – N° du contrat W8476-206276	Amd. No. – N° de la modif.	Buyer ID – Id de l'acheteur Rev 0
Client Ref. No. – N° de réf. du client W8476-206276	TPS DRAFT RFP APPENDIX AB TO ANNEX A	

Section #	Requirement Description	Type of Requirement	Compliance to Desirable Yes / No	Means of Compliance Post-Contract Award	Means of Compliance Pre-Contract Award
1.20.1.9	Optical fibre cables and electrical wires and cables with combustible insulation, jackets or sheaths that are installed must not convey flame or continue to burn for more than 1 minute when tested in conformance with the Vertical Flame Test in Clause 4.11.1 of CSA C22.2 No. 0.3, "Test Methods for Electrical Wires and Cables," (FTI rating).	Mandatory		Certification	Certification
1.20.1.10	Any airborne chemical agent emitted by the TPS must conform to acceptable limits in accordance with the Canada Labour Code, Part II, Occupational Health and Safety Regulations, Part 10 Hazardous Substances, Section 10.19 (1) Control of Hazards.	Mandatory		Certification / Testing	Certification / Testing
1.20.1.11	Non-current-carrying metal parts of the TPS must be bonded in accordance with CSA C22.2 No. 41-13 Ground and bonding equipment (Tri-national standard, with NMX-J-590-ANCE and UL 467), and CSA C22.1-10 Grounding and Bonding.	Mandatory		Certification	Certification
1.20.1.12	All conductive objects of the TPS must be grounded and bonded together in accordance with CSA C22.2 No. 41-13 ground and bonding equipment (Tri-national standard, with NMX-J-590-ANCE and UL 467), and CSA C22.1-10 Grounding and Bonding, to protect against electrical malfunction or lightning strike.	Mandatory		Certification	Certification
1.21	Signature:	Header			
1.21.1	Visual Signature	Header			

Contract No. – N° du contrat W8476-206276	Amd. No. – N° de la modif.	Buyer ID – Id de l'acheteur Rev 0
Client Ref. No. – N° de réf. du client W8476-206276	TPS DRAFT RFP APPENDIX AB TO ANNEX A	

Section #	Requirement Description	Type of Requirement	Compliance to Desirable Yes / No	Means of Compliance Post-Contract Award	Means of Compliance Pre-Contract Award
1.21.1.1	When required, the TPS must not emit any visible light.	Mandatory		Demonstration	Demonstration
1.21.1.2	The TPS must have no shiny surfaces that makes the equipment visible beyond 100 m.	Mandatory		Demonstration	Demonstration
1.21.2	<i>Acoustic Signature</i>				
1.21.2.1	The maximum noise level generated by the TPS must not exceed 72 dBA Sound Pressure Level at a distance of 7 m in any direction from the unit.	Mandatory		Demonstration/ Testing	Demonstration/ Testing
1.21.2.2	The maximum noise level generated by the TPS should not exceed 60 dBA Sound Pressure Level at a distance of 7 m in any direction from the unit.	Desirable		Demonstration/ Testing	Demonstration/ Testing
1.21.3	<i>Electromagnetic Signature</i>				
1.21.3.1	The TPS must comply with electromagnetic emission and susceptibility requirements for army ground systems in accordance with the following MIL-STD-461G frequency bands:	Mandatory		Demonstration/ Testing	Demonstration/ Testing
1.21.3.1.1	RE 102 from 2 MHz to 18 GHz, Navy Mobile and Army;	Mandatory		Demonstration/ Testing	Demonstration/ Testing
1.21.3.1.2	CE 102 from 10 KHz to 10 MHz; and	Mandatory		Demonstration/ Testing	Demonstration/ Testing
1.21.3.1.3	RS 103 from 2 MHz to 40 GHz.	Mandatory		Demonstration/ Testing	Demonstration/ Testing
1.22	Climatic and Environmental Conditions:	Header			

Contract No. – N° du contrat W8476-206276	Amd. No. – N° de la modif.	Buyer ID – Id de l'acheteur Rev 0
Client Ref. No. – N° de réf. du client W8476-206276	TPS DRAFT RFP APPENDIX AB TO ANNEX A	

Section #	Requirement Description	Type of Requirement	Compliance to Desirable Yes / No	Means of Compliance Post-Contract Award	Means of Compliance Pre-Contract Award
1.22.1	The TPS must be stowed, stored, transported, deployed/withdrawn, unpacked/packed, assembled/disassembled, connected/disconnected, started and operated to complete tactical missions and training, day and night, throughout the wide range of global environments and weather conditions found all year round within the geographic regions identified in the TPS-RVM.	Mandatory		Demonstration / Testing	Demonstration/ Testing
1.22.2	The TPS must meet all performance requirements without physical damage to the TPS or personnel, during and after exposure (e.g. deployment, withdrawal, unpacked/packed, assembly/disassembly, connected/disconnected, start-up, operation, stowage, storage, or in-transit) to any combination of the ambient and induced climatic and environmental conditions identified in the TPS-RVM.	Mandatory		Demonstration / Testing	Demonstration/ Testing
1.22.3	Low Temperature:				
1.22.3.1	The TPS must be unpacked/packed, assembled/disassembled, set connected/disconnected, started, and operated, without damage and meet all performance requirements (during and after exposure), in all environments associated with climatic categories C0 Mild Cold, C1 Intermediate Cold, C2 Cold, and C3 Severe Cold, in accordance with NATO STANAG 4370- Allied Environmental Conditions Testing Publications (AETCP) 230 Ed 1, Leaflet 2311/1.	Mandatory		Demonstration / Testing	Demonstration/ Testing

Contract No. – N° du contrat W8476-206276	Amd. No. – N° de la modif.	Buyer ID – Id de l'acheteur Rev 0
Client Ref. No. – N° de réf. du client W8476-206276	TPS DRAFT RFP APPENDIX AB TO ANNEX A	

Section #	Requirement Description	Type of Requirement	Compliance to Desirable Yes / No	Means of Compliance Post-Contract Award	Means of Compliance Pre-Contract Award
1.22.3.2	Exception to section 1.22.2. above: The Micro-grid controller must be unpacked/packed, assembled/disassembled, connected/disconnected, started, and operated, without damage and meet all performance requirements (during and after exposure), in all environments associated with climatic categories C0 Mild Cold, C1 Intermediate Cold, and C2 Cold (modified to -37°C), in accordance with NATO STANAG 4370- Allied Environmental Conditions Testing Publications (AETCP) 230 Ed 1, Leaflet 2311/1.	Mandatory		Demonstration/ Testing	Demonstration/ Testing
1.22.3.3	The TPS must be stored and transported without damage, and meet all performance requirements (during and after exposure), in all environments associated with climatic categories C0 Mild Cold, C1 Intermediate Cold, C2 Cold, and C3 Severe Cold, in accordance with NATO STANAG 4370- Allied Environmental Conditions Testing Publications (AETCP) 230 Ed 1, Leaflet 2311/1.	Mandatory		Demonstration/ Testing	Demonstration/ Testing
1.22.3.4	The TPS must be stored and transported without damage, and meet all performance requirements (during and after exposure), in low temperature as described in MIL-STD-810G, Method 502.5 Low Temperature, Procedure I (Storage) at -51°C temperature.	Mandatory		Demonstration/ Testing	Demonstration/ Testing
1.22.3.5	The TPS must be operated, without damage and meet all performance requirements (during and after exposure), in low temperature as described in MIL-STD-810G, Method 502.5 Low Temperature, Procedure II (Operation) at -37°C temperature.	Mandatory		Demonstration/ Testing	Demonstration/ Testing

Contract No. – N° du contrat W8476-206276	Amd. No. – N° de la modif.	Buyer ID – Id de l'acheteur Rev 0
Client Ref. No. – N° de réf. du client W8476-206276	TPS DRAFT RFP APPENDIX AB TO ANNEX A	

Section #	Requirement Description	Type of Requirement	Compliance to Desirable Yes / No	Means of Compliance Post-Contract Award	Means of Compliance Pre-Contract Award
1.22.3.6	The TPS should operate within 20 minutes in low temperature conditions without damage and meet all performance requirements (during and after exposure) as described in MIL-STD-810G, Method 502.5 Low Temperature, Procedure II (Operation) at -51°C temperature.	Desirable		Demonstration/ Testing	Demonstration/ Testing
1.22.3.7	The TPS must be manipulated without damage and without a decrease in handling performance in low temperature as described in MIL-STD-810G, Method 502.5 Low Temperature, Procedure III (Manipulation) at -51°C temperature.	Mandatory		Demonstration/ Testing	Demonstration/ Testing
1.22.3.8	For cables and wires, manipulation at -51°C temperature means all cables and wires must be able to bend to radius equal to five times the diameter of the cable or wire without damage to the insulation material. Assume personnel wearing PPE	Information			
1.22.4	High Temperature.	Header			
1.22.4.1	The TPS must be unpacked/packed, assembled/disassembled, connected/disconnected, started, and operated, without damage and meet all performance requirements (during and after exposure), in all environments associated with climatic categories A1 Extreme Hot Dry, A2 Hot Dry, and A3 Intermediate, in accordance with NATO STANAG 4370- Allied Environmental Conditions Testing Publications (AETCP) 230 Ed 1, Leaflet 2311/1.	Mandatory		Demonstration/ Testing	Demonstration/ Testing
1.22.4.2	The TPS must be stored and transported without damage, and meet all performance requirements (during and after exposure), in all	Mandatory		Demonstration/ Testing	Demonstration/ Testing

Contract No. – N° du contrat W8476-206276	Amd. No. – N° de la modif.	Buyer ID – Id de l'acheteur Rev 0
Client Ref. No. – N° de réf. du client W8476-206276	TPS DRAFT RFP APPENDIX AB TO ANNEX A	

Section #	Requirement Description	Type of Requirement	Compliance to Desirable Yes / No	Means of Compliance Post-Contract Award	Means of Compliance Pre-Contract Award
-----------	-------------------------	---------------------	-------------------------------------	---	--

	environments associated with climatic categories A1 Extreme Hot Dry, A2 Hot Dry, and A3 Intermediate, in accordance with NATO STANAG 4370- Allied Environmental Conditions Testing Publications (AETCP) 230 Ed 1, Leaflet 2311/1.				
1.22.4.3	The TPS must be stored and transported without damage, and meet all performance requirements (during and after exposure), in high temperature as described in MIL-STD-810G, Method 501.5 High Temperature, Procedure I (Storage) at +71°C temperature.	Mandatory		Demonstration/ Testing	Demonstration/ Testing
1.22.4.4	The TPS must be operated without damage, and meet all performance requirements (during and after exposure), in high temperature as described in MIL-STD-810G, Method 501.5 High Temperature, Procedure II (Operation) at +49 °C temperature.	Mandatory		Demonstration/ Testing	Demonstration/ Testing
1.22.4.5	The TPS must comply with MIL-STD-810G, Method 501.5 High Temperature, Procedure III (Tactical-Standby to Operational) for immediate assembly at +49 °C after storage and transportation at +71°C, without damage and meeting all performance requirements.	Mandatory		Demonstration/ Testing	Demonstration/ Testing
1.22.5	<i>Humidity</i>	Header			
1.22.5.1	The TPS must be unpacked/packed, assembled/disassembled, connected/disconnected, started, operated, stored, and transported, without damage and meet all performance requirements (during and after exposure), in all environments associated with climatic categories: B3 Humid Hot Coastal Desert, B2 Wet Hot, and B1 Wet Warm, in	Mandatory		Demonstration/ Testing	Demonstration/ Testing

Contract No. – N° du contrat W8476-206276	Amd. No. – N° de la modif.	Buyer ID – Id de l'acheteur Rev 0
Client Ref. No. – N° de réf. du client W8476-206276	TPS DRAFT RFP APPENDIX AB TO ANNEX A	

Section #	Requirement Description	Type of Requirement	Compliance to Desirable Yes / No	Means of Compliance Post-Contract Award	Means of Compliance Pre-Contract Award
	accordance with NATO STANAG 4370- Allied Environmental Conditions Testing Publications (AETCP) 230 Ed 1, Leaflet 2311/1.				
1.22.5.2	The TPS must comply with MIL-STD-810G, Method 507.5 Humidity, Procedure II (Aggravated).	Mandatory		Demonstration/ Testing	Demonstration/ Testing
1.22.5.3	The TPS must show no evidence of material swelling due to moisture absorption, degradation of electrical properties in insulating material, electrical shorts, oxidation, galvanic corrosion, failure to operate safely, or other defects which are detrimental to the intended function when exposed to humidity as described in MIL-STD-810G, Method 507.5, Humidity, Procedure II.	Mandatory		Demonstration/ Testing	Demonstration/ Testing
1.22.6	<i>Solar Radiation (Sunshine)</i>	Header			
1.22.6.1	The TPS must be unpacked/packed, assembled/disassembled, set up/truck down, started, operated, stored, and transported, without damage and meet all performance requirements (during and after exposure), under full solar loading as described in MIL-STD-810G, Method 505.5 Solar Radiation, Procedure I – Cycling (heating and/or minimal actinic effects) which includes the combination of solar radiation and high ambient temperature environments.	Mandatory		Demonstration/ Testing	Demonstration/ Testing
1.22.7	Rain	Header			

Contract No. – N° du contrat W8476-206276	Amd. No. – N° de la modif.	Buyer ID – Id de l'acheteur Rev 0
Client Ref. No. – N° de réf. du client W8476-206276	TPS DRAFT RFP APPENDIX AB TO ANNEX A	

Section #	Requirement Description	Type of Requirement	Compliance to Desirable Yes / No	Means of Compliance Post-Contract Award	Means of Compliance Pre-Contract Award
1.22.7.1	The TPS must safely operate and withstand without damage, (short-circuit, or breaker tripping, or malfunctioning, or wire swelling, or accumulation of rain water inside the TPS equipment), during and after exposure to blowing rain as described in MIL-STD-810G, Method 506.5 Rain, Procedure I (Rain and Blowing Rain).	Mandatory		Demonstration/ Testing	Demonstration/ Testing
1.22.7.2	The TPS must safely operate and withstand without damage, (short-circuit, or breaker tripping, or malfunctioning, or wire swelling, or accumulation of rain water inside the TPS equipment), during and after exposure to blowing rain as described in MIL-STD-810G, Method 506.5 Rain, Procedure II (Exaggerated).	Mandatory		Demonstration/ Testing	Demonstration/ Testing
1.22.8	<i>Icing and Freezing Rain</i>	Header			
1.22.8.1	The TPS must operate and withstand, without damage and meet performance requirements, during exposure, after exposure, and after removal of an accumulation of up to 13mm of ice/freezing rain as described in MIL-STD-810G, Method 521.3 Icing/Freezing Rain.	Mandatory		Demonstration/ Testing	Demonstration/ Testing
1.22.8.2	Exception to section 1.22.8.1 This requirement is not applicable to the micro-grid controller.	Information			
1.22.9	<i>Sand and Dust</i>	Header			
1.22.9.1	The TPS must operate without damage or dust ingress and meet all performance requirements during and after exposure to blowing dust conditions as described in MIL-STD-810G Method 510.5 Sand and Dust, Procedure I - Blowing Dust.	Mandatory		Demonstration/ Testing	Demonstration/ Testing

Contract No. – N° du contrat W8476-206276	Amd. No. – N° de la modif.	Buyer ID – Id de l'acheteur Rev 0
Client Ref. No. – N° de réf. du client W8476-206276	TPS DRAFT RFP APPENDIX AB TO ANNEX A	

Section #	Requirement Description	Type of Requirement	Compliance to Desirable Yes / No	Means of Compliance Post-Contract Award	Means of Compliance Pre-Contract Award
1.22.9.2	The TPS must operate without damage or sand ingress and meet all performance requirements during and after exposure to blowing sand conditions as described in MIL-STD-810G Method 510.5 Sand and Dust, Procedure II - Blowing Sand.	Mandatory		Demonstration/ Testing	Demonstration/ Testing
1.22.10	<i>Altitude</i>	Header			
1.22.10.1	The TPS must start and operate to meet all performance requirements, without any manual adjustments, for an altitude range from sea level to 1,200 m above sea level.	Mandatory		Compliance Statement	Compliance Statement
1.22.10.2	The TPS should start and operate to meet all performance requirements without any manual adjustments for an altitude range above 1,200 m to 3000 m above sea level.	Desirable		Analysis	Analysis
1.22.11	<i>Terrain/Ground</i>	Header			
1.22.11.1	The TPS must be moved, assembled/disassembled, connected/disconnected, started, and operated, without damage and meet all performance requirements, on terrain that:	Mandatory		Demonstration/ Testing	Demonstration/ Testing
1.22.11.1.1	Has minor fixed obstacles of up to 12 cm or mounds/depressions that are unlimited in their length;	Mandatory		Demonstration/ Testing	Demonstration/ Testing
1.22.11.1.2	Is uneven;	Mandatory		Demonstration/ Testing	Demonstration/ Testing
1.22.11.1.3	Is covered with snow, ice or mud;	Mandatory		Demonstration/ Testing	Demonstration/ Testing
1.22.11.1.4	Is flat;	Mandatory		Demonstration/ Testing	Demonstration/ Testing

Contract No. – N° du contrat W8476-206276	Amd. No. – N° de la modif.	Buyer ID – Id de l'acheteur Rev 0
Client Ref. No. – N° de réf. du client W8476-206276	TPS DRAFT RFP APPENDIX AB TO ANNEX A	

Section #	Requirement Description	Type of Requirement	Compliance to Desirable Yes / No	Means of Compliance Post-Contract Award	Means of Compliance Pre-Contract Award
1.22.11.1.5	Is hard (e.g. concrete, cement, asphalt);	Mandatory		Demonstration/ Testing	Demonstration/ Testing
1.22.11.1.6	Is soft (e.g. sand, gravel);	Mandatory		Demonstration/ Testing	Demonstration/ Testing
1.22.11.1.7	Is wet/moist soft, shapeless mass of matter (i.e. mushy); and/or	Mandatory		Demonstration/ Testing	Demonstration/ Testing
1.22.11.1.8	Is inclined up to 15 degrees in any direction.	Mandatory		Demonstration/ Testing	Demonstration/ Testing
1.22.12	Vibration	Header			
1.22.12.1	The TPS must fully operate without damage and meet all performance requirements during and after exposure to ground transport vibration environment as described in MIL-STD-810G, Method 514.6 Vibration, Procedure I - General Vibration, Category 4 Secured Cargo - Composite Wheeled Vehicle:	Mandatory		Demonstration/ Testing	Demonstration/ Testing
1.22.12.1.1	Vibration Profile described in Table 514.6C-VI; and	Mandatory		Demonstration/ Testing	Demonstration/ Testing
1.22.12.1.2	Exposure Duration described in section 2.1.4 b. Two-wheeled trailer and wheeled vehicles.	Mandatory		Demonstration/ Testing	Demonstration/ Testing

Contract No. – N° du contrat W8476-206276	Amd. No. – N° de la modif. Rev 0	Buyer ID – Id de l'acheteur Rev 0
Client Ref. No. – N° de réf. du client W8476-206276	TPS DRAFT RFP APPENDIX AB TO ANNEX A	

Section #	Requirement Description	Type of Requirement	Compliance to Desirable Yes / No	Means of Compliance Post-Contract Award	Means of Compliance Pre-Contract Award
1.22.12.2	The TPS must fully operate without damage and meet all performance requirements, during and after exposure to air transport vibration environment as described in MIL-STD-810G, Method 514.6 Vibration, Procedure I - General Vibration, Category 7 Aircraft –Jet:	Mandatory		Demonstration/ Testing	Demonstration/ Testing
1.22.12.2.1	Vibration Profile described in Table 514.6C-VII, C-17 Platform; and	Mandatory		Demonstration/ Testing	Demonstration/ Testing
1.22.12.2.2	Exposure Duration: 1 hour per axis.	Mandatory		Demonstration/ Testing	Demonstration/ Testing
1.22.12.3	While stowed inside an ISO container in accordance with section 1.10.2, the TPS must fully operate without damage and meet all performance requirements, during and after exposure to air transport vibration environment as described in MIL-STD-810G, Method 514.6 Vibration, Procedure I - General Vibration, Category 7 Aircraft –Jet:	Mandatory		Demonstration/ Testing	Demonstration/ Testing
1.22.12.3.1	Vibration Profile described in Table 514.6C-VII, C-17 Platform; and	Mandatory		Demonstration/ Testing	Demonstration/ Testing
1.22.12.3.2	Exposure Duration: 1 hour per axis.	Mandatory		Demonstration/ Testing	Demonstration/ Testing
1.22.12.4	While stowed inside an ISO container in accordance with section 1.10.2, the TPS must remain fully operable, without damage and meet all performance requirements, during and after exposure to ground transport vibration environment as described in MIL-STD-810G, Method 514.6 Vibration, Procedure III - Large Assembly Transportation:	Mandatory		Demonstration/ Testing	Demonstration/ Testing
1.22.12.4.1	Annex C - Section 2.3 Category 6 Truck/trailer - large assembly transport;	Mandatory		Demonstration/ Testing	Demonstration/ Testing

Contract No. – N° du contrat W8476-206276	Amd. No. – N° de la modif.	Buyer ID – Id de l'acheteur Rev 0
Client Ref. No. – N° de réf. du client W8476-206276	TPS DRAFT RFP APPENDIX AB TO ANNEX A	

Section #	Requirement Description	Type of Requirement	Compliance to Desirable Yes / No	Means of Compliance Post-Contract Award	Means of Compliance Pre-Contract Award
1.22.12.4.2	Refer to TOP 1-1-011, Section 7.28 Load Vibration Course for description of terrain types.	Mandatory		Demonstration/ Testing	Demonstration/ Testing
1.22.13	<i>Shock</i>	Header		Demonstration/ Testing	Demonstration/ Testing
1.22.13.1	The TPS (in Protective Cover in accordance with section 1.7 or Hard-Sided Storage, as applicable) must fully and safely operate without damage and meet all performance requirements, during and after subjection to infrequent, non-repetitive shocks as described in MIL-STD-810G, Method 516.6 Shock, Procedure I Functional Shock of 20g, Table 516.6-II.	Mandatory		Demonstration/ Testing	Demonstration/ Testing
1.22.13.2	The TPS (in Protective Cover in accordance with section 1.7 or Hard-Sided Storage, as applicable) must fully and safely operate without damage and meet all performance requirements, during and after subjection to infrequent, non-repetitive shocks as described in MIL-STD-810G, Method 516.6 Shock, Procedure VI Bench Handling.	Mandatory		Demonstration/ Testing	Demonstration/ Testing
1.22.13.3	The TPS (in Protective Cover in accordance with section 1.7 or Hard-Sided Storage, as applicable) must fully and safely operate without damage and meet all performance requirements, during and after subjection to infrequent, non-repetitive shocks as described in MIL-STD-810G, 516.6 Procedure IV Transit Drop, Table 516.6-VI.	Mandatory		Demonstration/ Testing	Demonstration/ Testing
1.22.13.4	While stowed inside a cargo container in accordance with section 1.7, the TPS must fully and safely operate without damage and meet all performance requirements, during and after the cargo container is subject to shock as described in MIL-STD-810G, Method 516.6 Shock,	Mandatory		Demonstration/ Testing	Demonstration/ Testing

Contract No. – N° du contrat W8476-206276	Amd. No. – N° de la modif.	Buyer ID – Id de l'acheteur Rev 0
Client Ref. No. – N° de réf. du client W8476-206276	TPS DRAFT RFP APPENDIX AB TO ANNEX A	

Section #	Requirement Description	Type of Requirement	Compliance to Desirable Yes / No	Means of Compliance Post-Contract Award	Means of Compliance Pre-Contract Award
	Procedure IV Transit Drop, Table 516.6-VI (Note C), and tailored condition drop height of 15 cm.				
1.22.13.5	While stowed inside a cargo container in accordance with section 1.7, the TPS must fully and safely operate without damage and meet all performance requirements, during and after the cargo container is subject to shock as described in MIL-STD-810G, Method 516.6 Shock, Procedure VII - Pendulum Impact.	Mandatory		Demonstration/ Testing	Demonstration/ Testing
1.22.14	<i>Fungus & Salt Spray</i>	Header			
1.22.14.1	The TPS must withstand, without damage or accumulation and meet all performance requirements, exposure to fungus as described in MIL-STD-810G, Method 508.6 Fungus.	Mandatory		Demonstration/ Testing	Demonstration/ Testing
1.22.14.2	The TPS equipment in accordance with Para 1.2 must meet ASTM C1338 for fungus growth.	Mandatory		Demonstration/ Testing	Demonstration/ Testing
1.22.15	<i>Freeze/thaw</i>	Header			

Contract No. – N° du contrat W8476-206276	Amd. No. – N° de la modif.	Buyer ID – Id de l'acheteur Rev 0
Client Ref. No. – N° de réf. du client W8476-206276	TPS DRAFT RFP APPENDIX AB TO ANNEX A	

Section #	Requirement Description	Type of Requirement	Compliance to Desirable Yes / No	Means of Compliance Post-Contract Award	Means of Compliance Pre-Contract Award
1.22.15.1	The TPS must withstand, without damage and meet all performance requirements, freeze thaw conditions as described in MIL-STD-810G Method 524 Freeze/ Thaw, Procedure I, Diurnal Cycling Effects.	Mandatory		Demonstration/ Testing	Demonstration/ Testing
1.22.16	Limited Visibility	Header			
1.22.16.1	The TPS must be handled (e.g. loaded/unloaded into/from cargo container, moved, packed/unpacked, assembled/disassembled, erected/stricken, started-up, operated, maintained, and repaired) by personnel, without damage, in low light conditions defined by an illumination intensity of 10 lux.	Mandatory		Demonstration / Testing	Demonstration/ Testing
2	GENERATOR REQUIREMENTS	Header			
2.1	General	Header			
2.1.1	The generators must meet all requirements specified under article 1 above, TPS System Level Requirement.	Mandatory		Demonstration / Testing	Demonstration/ Testing
2.1.2	Family of Generators must consist of the following:	Header			
2.1.2.1	2 KW to 3.5 KW Generator 120/240 VAC 1 phase;	Mandatory		Compliance Statement	Compliance Statement
2.1.2.2	4 KW to 6 KW Generator skid mounted;	Mandatory		Compliance Statement	Compliance Statement

Section #	Requirement Description	Type of Requirement	Compliance to Desirable Yes / No	Means of Compliance Post-Contract Award	Means of Compliance Pre-Contract Award
2.1.2.3	12 KW to 18KW Generator skid mounted;	Mandatory		Compliance Statement	Compliance Statement
2.1.2.4	25 KW to 35KW Generator skid mounted; and	Mandatory		Compliance Statement	Compliance Statement
2.1.2.5	50 KW to 70 KW Generator skid mounted;	Mandatory		Compliance Statement	Compliance Statement
2.1.3	The generator must comply with Mil-Std-633G for family of Mobile Electrical Power Generating source, general description information and characteristic data;	Mandatory		Compliance Statement	Compliance Statement
2.1.4	The generator must comply with Mil-Std-705 for military standard generator sets, engine driven, method of tests and instructions.	Mandatory		Compliance Statement	Compliance Statement
2.1.5	The 2 KW to 3.5 KW Generator must be man portable by a maximum of two soldiers from 5 to 95 percentile as defined in Canadian Forces Anthropometric survey DRDC-2015-R186.	Mandatory		Demonstration/ Testing	Demonstration/ Testing
2.1.6	The 4 KW to 6 KW Generator should be man portable by maximum of 4 soldiers from 5 to 95 percentile as defined in Canadian Forces Anthropometric survey DRDC-2015-R186	Desirable		Demonstration/ Testing	Demonstration/ Testing
2.2	Engine:	Header			
2.2.1	The engine must be 4 cycle diesel engine;	Mandatory		Compliance Statement	Compliance Statement

Contract No. – N° du contrat W8476-206276	Amd. No. – N° de la modif.	Buyer ID – Id de l'acheteur Rev 0
Client Ref. No. – N° de réf. du client W8476-206276	TPS DRAFT RFP APPENDIX AB TO ANNEX A	

Section #	Requirement Description	Type of Requirement	Compliance to Desirable Yes / No	Means of Compliance Post-Contract Award	Means of Compliance Pre-Contract Award
2.2.2	The engine must be capable to burn diesel fuels such as Diesel DL-1, DL-2; Jet Fuel including JP5, JP-8, Jet-A1 and Jet-A in compliance with STANAG 4362 and LFCO 21-19;	Mandatory		Demonstration / Testing	Demonstration/ Testing
2.2.3	The engine should meet all performance requirements, without performance degradation or the need for adjustment and calibration to accommodate changes in the fuel used, using fuels in accordance with: STANAG 4362 and CAN/CGSB-3.517 for fuels consisting of up to 5% vol/vol of Biodiesel, conforming to ASTM D-6751, Standard Specification for Biodiesel Fuel Blend Stock (B100) for Middle Distillate Fuels	Desirable		Compliance Statement	Compliance Statement
2.2.4	The engine must provide maximum torque output at 1800 rpm;	Mandatory		Compliance Statement	Compliance Statement
2.2.5	Except for 2 KW to 3.5 KW Generators, the engine speed controller (Governor) must be electronic governor, dual setting at 1800 and 1500 rpm to provide alternating current of 60 and 50 Hz;	Mandatory		Compliance Statement	Compliance Statement
2.2.6	Except for 2 KW to 3.5 KW Generators, the engine speed controller (Governor) should be electronic governor, dual setting at 1800 and 1500 rpm to provide alternating current of 60 and 50 Hz;	Desirable		Compliance Statement	Compliance Statement
2.2.7	The engine speed must be manually adjustable for changing the output frequency to $\pm 5\%$;	Mandatory		Demonstration	Demonstration
2.2.8	The engine must be equipped with a priming pump lever manually operated and electrical fuel injection self-priming pump;	Mandatory		Demonstration	Demonstration

Contract No. – N° du contrat W8476-206276	Amd. No. – N° de la modif.	Buyer ID – Id de l'acheteur Rev 0
Client Ref. No. – N° de réf. du client W8476-206276	TPS DRAFT RFP APPENDIX AB TO ANNEX A	

Section #	Requirement Description	Type of Requirement	Compliance to Desirable Yes / No	Means of Compliance Post-Contract Award	Means of Compliance Pre-Contract Award
2.2.9	The engine must be equipped with an auxiliary fuel pump 24 VDC;	Mandatory		Demonstration	Demonstration
2.2.10	The engine must be equipped with a fuel water separator filter;	Mandatory		Demonstration	Demonstration
2.2.11	The engine electrical starter must be 24 VDC;	Mandatory		Demonstration	Demonstration
2.2.12	The engine for the 2 to 3.5 KW generators family must have self-recoil pull cord start capability;	Mandatory		Demonstration	Demonstration
2.2.13	The engine must have a standard NATO 24VDC receptacle to jump start the engine when needed;	Mandatory		Demonstration	Demonstration
2.2.14	The engine must be EPA Certified to Tier 3 Engine or higher;	Mandatory		Demonstration	Demonstration
2.2.15	The engine should be EPA Certified to Tier 4 Engine or higher;	Desirable		Demonstration	Demonstration
2.2.16	The engine exhaust pipe must be equipped with a silencer, spark arrestor and rain cap.	Mandatory		Demonstration	Demonstration
2.2.17	The engine exhaust pipe should be equipped with a silencer, spark arrestor, rain cap and should have a minimum of two 90 degrees angle bends; and	Desirable		Demonstration	Demonstration
2.2.18	The engine air-intake filter should be washable.	Desirable		Demonstration	Demonstration
2.3	Engine fuel tank:	Header		Demonstration	Demonstration

Contract No. – N° du contrat W8476-206276	Amd. No. – N° de la modif.	Buyer ID – Id de l'acheteur Rev 0
Client Ref. No. – N° de réf. du client W8476-206276	TPS DRAFT RFP APPENDIX AB TO ANNEX A	

Section #	Requirement Description	Type of Requirement	Compliance to Desirable Yes / No	Means of Compliance Post-Contract Award	Means of Compliance Pre-Contract Award
2.3.1	Except for the 2 to 3.5 KW generators, the engine internal fuel tank must be large enough to support full load operation for a minimum of 12 hours;	Mandatory		Demonstration	Demonstration
2.3.2	The engine internal fuel tank for the 2 to 3.5KW generators must be large enough to support full load operation for a minimum of 6 hours;	Mandatory		Demonstration	Demonstration
2.3.3	The engine internal fuel tank for 2 to 3.5KW generators should be large enough to support full load operation for a minimum of 8 hours	Desirable		Demonstration	Demonstration
2.3.4	The engine internal fuel tank must be capable to be connected to an external fuel source using auxiliary fuel line NSN 4720-00-021-3320;	Mandatory		Demonstration	Demonstration
2.3.5	Except for family below 5 kW generators, the auxiliary fuel line must be supplied and stored inside the generator enclosure.	Mandatory		Demonstration	Demonstration
2.4	Engine Safety Requirement and Sensor Indicators:	Header		Demonstration	
2.4.1	The engine must have built-in safety sensors to provide self-diagnostic indication on the Generator Control Panel, pre-warning alarm, and to safely shut-down the engine in the following events:	Mandatory		Demonstration	Demonstration
2.4.1.1	Engine Over Temperature;	Mandatory		Demonstration	Demonstration
2.4.1.2	Engine Over Speed;	Mandatory		Demonstration	Demonstration
2.4.1.3	Low Engine Oil Pressure;	Mandatory		Demonstration	Demonstration
2.4.1.4	Low Engine Fuel;	Mandatory		Demonstration	Demonstration

Contract No. – N° du contrat W8476-206276	Amd. No. – N° de la modif.	Buyer ID – Id de l'acheteur Rev 0
Client Ref. No. – N° de réf. du client W8476-206276	TPS DRAFT RFP APPENDIX AB TO ANNEX A	

Section #	Requirement Description	Type of Requirement	Compliance to Desirable Yes / No	Means of Compliance Post-Contract Award	Means of Compliance Pre-Contract Award
2.4.2	Except for the 2-3.5 KW generators, the engine must be equipped with a dead-crank safety switch for use during maintenance;	Mandatory		Demonstration	Demonstration
2.4.3	All engine rotating parts must be shielded;	Mandatory		Demonstration	Demonstration
2.4.4	The engine alternator must charge the 24 VDC battery and provide power for the generator control;	Mandatory		Demonstration	Demonstration
2.4.5	The alternator must be protected by a DC Circuit Breaker;	Mandatory		Demonstration	Demonstration
2.4.6	The Generator must be equipped with a Selector-Switch, Auto-Off-Local, for controlling the operation of the engine and the generator.	Mandatory		Demonstration	Demonstration
2.4.7	The Generator must be equipped with a Battle-Short-Switch to override the engine and generator safety controller. The Battle-Short-Switch must be used only when the electrical power output is operational critical.	Mandatory		Demonstration	Demonstration
2.4.8	The control panel must be equipped with switchable tactical panel light to allow night operation.	Mandatory		Demonstration	Demonstration
2.4.9	The control panel must be equipped with an access door cover to prevent any visible light from escaping the generator.	Mandatory		Demonstration	Demonstration
2.5	Generator Enclosure:	Header			

Contract No. – N° du contrat W8476-206276	Amd. No. – N° de la modif. Rev 0	Buyer ID – Id de l'acheteur Rev 0
Client Ref. No. – N° de réf. du client W8476-206276	TPS DRAFT RFP APPENDIX AB TO ANNEX A	

Section #	Requirement Description	Type of Requirement	Compliance to Desirable Yes / No	Means of Compliance Post-Contract Award	Means of Compliance Pre-Contract Award
2.5.1	The generator environmental protection enclosure must be designed for outdoor and must meet NEMA 4;	Mandatory		Demonstration	Demonstration
2.5.2	The generator acoustic enclosure must reduce the engine noise to a maximum of 72 dBA @ 7 meters (23 feet) when the engine access doors are closed;	Mandatory		Demonstration	Demonstration
2.5.3	The generator acoustic enclosure must be capable to support Speech Interference Level (SIL-4 Limit) of Category E as defined in Mil-Std-1474D-Design criteria Standard for noise limit.	Mandatory		Demonstration	Demonstration
2.5.4	The enclosure must be designed for maximum accessibility to different engine and generator parts including batteries and storage compartments without the need to remove panels using tools.	Mandatory		Demonstration	Demonstration
2.5.5	Generator enclosure air intake and discharge must be designed to provide low infrared and heat signatures	Mandatory		Demonstration	Demonstration
2.6	Electrical Generator:	Header			
2.6.1	The electrical generator must be designed for continuous output rating;	Mandatory		Demonstration	Demonstration
2.6.2	Electrical generator must be capable to carry an additional 15% of the rated load for period of 1 hour without overheating;	Mandatory		Demonstration	Demonstration
2.6.3	Electrical generator should be capable to carry an additional 15% of the rated load for period of 2 hour without overheating;	Desirable		Demonstration	Demonstration
2.6.4	The electrical generator must be brushless	Mandatory		Demonstration	Demonstration

Contract No. – N° du contrat W8476-206276	Amd. No. – N° de la modif.	Buyer ID – Id de l'acheteur Rev 0
Client Ref. No. – N° de réf. du client W8476-206276	TPS DRAFT RFP APPENDIX AB TO ANNEX A	

Section #	Requirement Description	Type of Requirement	Compliance to Desirable Yes / No	Means of Compliance Post-Contract Award	Means of Compliance Pre-Contract Award
2.6.5	The electrical generator must be double winding and capable to be configured to 120/208 or 240/416 three phase AC output;	Mandatory		Demonstration	Demonstration
2.6.6	The temperature rise for generator winding must be class H or higher	Mandatory		Demonstration	Demonstration
2.6.7	The electrical generator must be equipped with an electronic Automatic Voltage Regulator (AVR)	Mandatory		Demonstration	Demonstration
2.6.8	The electrical generator must be equipped with an electronic synchronizing relay to automatically synchronize two electrical generators for parallel operation as Master and Slave generators;	Mandatory		Demonstration	Demonstration
2.6.9	The generator controller must be equipped with a master selector switch Auto-Off-Local to provide a capability of auto-start for micro-grid or standalone operations	Mandatory		Demonstration	Demonstration
2.6.10	The generator must be capable of operating continuously at any load between 25% and 100% of the rated load.	Mandatory		Demonstration	Demonstration
2.6.11	The generator should operate effectively when loaded to as low as 10% of the rate load (at an ambient temperature of 40°C and an altitude of 1000m).	Desirable		Demonstration	Demonstration
2.6.12	The generator must be equipped with a Miniature Circuit Breaker MCB in compliance with CSA C22.2 No.5.1, and of a quick-make, quick-break type designed to open or close a circuit by non-automatic means and to automatically disconnect the generator output terminals in the event of an over current or short-circuit, capable to carry the full load current at an	Mandatory		Demonstration	Demonstration

Contract No. – N° du contrat W8476-206276	Amd. No. – N° de la modif.	Buyer ID – Id de l'acheteur Rev 0
Client Ref. No. – N° de réf. du client W8476-206276	TPS DRAFT RFP APPENDIX AB TO ANNEX A	

Section #	Requirement Description	Type of Requirement	Compliance to Desirable Yes / No	Means of Compliance Post-Contract Award	Means of Compliance Pre-Contract Award
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	ambient of 40 °C, and must have minimum 3,000 KA SYM RMS interrupting current @ 240 VAC without damage to itself when properly applied within its ratings.				
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Section #	Requirement Description	Type of Requirement	Compliance to Desirable Yes / No	Means of Compliance Post-Contract Award	Means of Compliance Pre-Contract Award
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2.6.13	The Generator must meet STANAG 4135 electrical Steady State with transient power output characteristics as follows:				
	Electric Power Quality	Frequency	Voltage	Mandatory	Testing
	Manual Regulation	± 5%	+ 10% / -5%		
	Regulation	0.25%	1%		
	Voltage Modulation	-	1%		
	Short term steady state stability (30 Sec)	0.5% bandwidth	1% bandwidth		
	Short term steady state stability (4 hr)	1% bandwidth	2% bandwidth		
	Application of rated load	Transient	4% Under		
		Recovery time	2 Sec		
	Rejection of rated load	Transient	4% Over		
		Recovery time	2 Sec		
	Max waveform deviation factor		5%		

Contract No. – N° du contrat W8476-206276	Amd. No. – N° de la modif.	Buyer ID – Id de l'acheteur Rev 0
Client Ref. No. – N° de réf. du client W8476-206276	TPS DRAFT RFP APPENDIX AB TO ANNEX A	

Section #	Requirement Description	Type of Requirement	Compliance to Desirable Yes / No	Means of Compliance Post-Contract Award	Means of Compliance Pre-Contract Award
2.7	Generator Controls and Indicators:	Header			
2.7.1	Generator control panel must have the following controls:	Mandatory		Compliance Statement	Compliance Statement
2.7.1.1	Master control switch Auto-Off-Local:	Header			
2.7.1.1.1	2 to 3.5 KW Generators	Mandatory		Compliance Statement	Compliance Statement
2.7.1.1.2	4 to 6 KW Generators	Mandatory		Compliance Statement	Compliance Statement
2.7.1.1.3	12 KW and above Generators	Mandatory		Compliance Statement	Compliance Statement
2.7.1.2	Output power ON/OFF switch;	Header			
2.7.1.2.1	2 to 3.5 KW Generators	Mandatory		Compliance Statement	Compliance Statement

Contract No. – N° du contrat W8476-206276	Amd. No. – N° de la modif.	Buyer ID – Id de l'acheteur Rev 0
Client Ref. No. – N° de réf. du client W8476-206276	TPS DRAFT RFP APPENDIX AB TO ANNEX A	

Section #	Requirement Description	Type of Requirement	Compliance to Desirable Yes / No	Means of Compliance Post-Contract Award	Means of Compliance Pre-Contract Award
2.7.1.2.2	4 to 6 KW Generators	Mandatory		Compliance Statement	Compliance Statement
2.7.1.2.3	12 KW and above Generators	Mandatory		Compliance Statement	Compliance Statement
2.7.1.3	Output voltage manual adjustment;	Header			
2.7.1.3.1	2 to 3.5 KW Generators	Desirable		Compliance Statement	Compliance Statement
2.7.1.3.2	4 to 6 KW Generators	Mandatory		Compliance Statement	Compliance Statement
2.7.1.3.3	12 KW and above Generators	Mandatory		Compliance Statement	Compliance Statement
2.7.1.4	Output frequency manual adjustment;	Header			
2.7.1.4.1	2 to 3.5 KW Generators	Desirable		Compliance Statement	Compliance Statement

Contract No. – N° du contrat W8476-206276	Amd. No. – N° de la modif.	Buyer ID – Id de l'acheteur Rev 0
Client Ref. No. – N° de réf. du client W8476-206276	TPS DRAFT RFP APPENDIX AB TO ANNEX A	

Section #	Requirement Description	Type of Requirement	Compliance to Desirable Yes / No	Means of Compliance Post-Contract Award	Means of Compliance Pre-Contract Award
2.7.1.4.2	4 to 6 KW Generators	Mandatory		Compliance Statement	Compliance Statement
2.7.1.4.3	12 KW and above Generators	Mandatory		Compliance Statement	Compliance Statement
2.7.1.5	Battle-short switch;	Header			
2.7.1.5.1	2 to 3.5 KW Generators	Not Applicable			
2.7.1.5.2	4 to 6 KW Generators	Mandatory		Compliance Statement	Compliance Statement
2.7.1.5.3	12 KW and above Generators	Mandatory		Compliance Statement	Compliance Statement
2.7.1.6	Cold weather start switch,	Header			
2.7.1.6.1	2 to 3.5 KW Generators	Desirable		Compliance Statement	Compliance Statement
2.7.1.6.2	4 to 6 KW Generators	Mandatory		Compliance Statement	Compliance Statement

Contract No. – N° du contrat W8476-206276	Amd. No. – N° de la modif.	Buyer ID – Id de l'acheteur Rev 0
Client Ref. No. – N° de réf. du client W8476-206276	TPS DRAFT RFP APPENDIX AB TO ANNEX A	

Section #	Requirement Description	Type of Requirement	Compliance to Desirable Yes / No	Means of Compliance Post-Contract Award	Means of Compliance Pre-Contract Award
2.7.1.6.3	12 KW and above Generators; and	Mandatory		Compliance Statement	Compliance Statement
2.7.1.7	Emergency Shut-down switch.	Header			
2.7.1.7.1	2 to 3.5 KW Generators	Mandatory		Compliance Statement	Compliance Statement
2.7.1.7.2	4 to 6 KW Generators	Mandatory		Compliance Statement	Compliance Statement
2.7.1.7.3	12 KW and above Generators	Mandatory		Compliance Statement	Compliance Statement
2.7.2	The generator must have a digital control panel display to provide a status indicator for the following:	Mandatory		Compliance Statement	Compliance Statement
2.7.2.1	Output Voltage for phase and line voltages;	Mandatory		Compliance Statement	Compliance Statement
2.7.2.2	Output frequency;	Mandatory		Compliance Statement	Compliance Statement

Contract No. – N° du contrat W8476-206276	Amd. No. – N° de la modif.	Buyer ID – Id de l'acheteur Rev 0
Client Ref. No. – N° de réf. du client W8476-206276	TPS DRAFT RFP APPENDIX AB TO ANNEX A	

Section #	Requirement Description	Type of Requirement	Compliance to Desirable Yes / No	Means of Compliance Post-Contract Award	Means of Compliance Pre-Contract Award
2.7.2.3	Output power per phase and total three phase power	Mandatory		Compliance Statement	Compliance Statement
2.7.2.4	Engine Oil Pressure	Mandatory		Compliance Statement	Compliance Statement
2.7.2.5	Engine Coolant Temperature;	Header			
2.7.2.5.1	2 to 3.5 KW Generators	Not Applicable			
2.7.2.5.2	4 to 6 KW Generators	Not Applicable			
2.7.2.5.3	12 KW and above Generators	Mandatory		Compliance Statement	Compliance Statement
2.7.2.6	Battery charging current;	Mandatory		Compliance Statement	Compliance Statement
2.7.2.7	Battery Voltage;	Mandatory		Compliance Statement	Compliance Statement
2.7.2.8	Power output circuit breaker status ON/OFF/TRIPPED;	Mandatory		Compliance Statement	Compliance Statement

Contract No. – N° du contrat W8476-206276	Amd. No. – N° de la modif.	Buyer ID – Id de l'acheteur Rev 0
Client Ref. No. – N° de réf. du client W8476-206276	TPS DRAFT RFP APPENDIX AB TO ANNEX A	

Section #	Requirement Description	Type of Requirement	Compliance to Desirable Yes / No	Means of Compliance Post-Contract Award	Means of Compliance Pre-Contract Award
2.7.2.9	Battle-Short switch ON/OFF;	Mandatory		Compliance Statement	Compliance Statement
2.7.2.10	Engine Speed in rpm;	Mandatory		Compliance Statement	Compliance Statement
2.7.2.11	Synchronization relay or Parallel operation ON/OFF including the power consumption for the Master and Slave generators;	Mandatory		Compliance Statement	Compliance Statement
2.7.2.12	Generator fuel level indicator;	Mandatory		Compliance Statement	Compliance Statement
2.7.2.13	Generator Low Level warning indicator; and	Mandatory		Compliance Statement	Compliance Statement
2.7.2.14	Generator Overload warning indicator.	Mandatory		Compliance Statement	Compliance Statement
2.7.3	The generator must be equipped with a self-diagnostic fault indicator for the following:	Header			
2.7.3.1	Short circuit or electrical overload;	Mandatory		Compliance Statement	Compliance Statement

Contract No. – N° du contrat W8476-206276	Amd. No. – N° de la modif.	Buyer ID – Id de l'acheteur Rev 0
Client Ref. No. – N° de réf. du client W8476-206276	TPS DRAFT RFP APPENDIX AB TO ANNEX A	

Section #	Requirement Description	Type of Requirement	Compliance to Desirable Yes / No	Means of Compliance Post-Contract Award	Means of Compliance Pre-Contract Award
2.7.3.2	Reverse Power;	Mandatory		Compliance Statement	Compliance Statement
2.7.3.3	Over Voltage;	Mandatory		Compliance Statement	Compliance Statement
2.7.3.4	Low engine Oil pressure;	Mandatory		Compliance Statement	Compliance Statement
2.7.3.5	High coolant temperature;	Mandatory		Compliance Statement	Compliance Statement
2.7.3.6	Low battery voltage; and	Mandatory		Compliance Statement	Compliance Statement
2.7.3.7	Low fuel.	Mandatory		Compliance Statement	Compliance Statement
3	Power Distribution and Power Management System:	Header			
3.1	The Power Distribution and Power Management System must meet all requirements specified under article 1 above, TPS System Level Requirement.	Mandatory		Compliance Statement	Compliance Statement

Contract No. – N° du contrat W8476-206276	Amd. No. – N° de la modif.	Buyer ID – Id de l'acheteur Rev 0
Client Ref. No. – N° de réf. du client W8476-206276	TPS DRAFT RFP APPENDIX AB TO ANNEX A	

Section #	Requirement Description	Type of Requirement	Compliance to Desirable Yes / No	Means of Compliance Post-Contract Award	Means of Compliance Pre-Contract Award
3.2	2 to 3.5 KW and 4 to 6 KW Generators: The following distribution requirements apply:	Header			
3.2.1	The 2 to 3.5 KW and 4 to 6 KW Generators along with any associated ESU(S) must use common extension cords.	Mandatory		Compliance Statement	Compliance Statement
3.2.2	The 4 to 6 kW generators must have a 25m connection cable to allow a connection between the highest current 120 V output on the generator and the W5 connector input of most command post vehicles	Mandatory		Compliance Statement	Compliance Statement
3.2.3	The 2 to 3.5 KW and 4 to 6 KW Generators must have a simple weatherproof device which can plug into the generator/ESU receptacles to measure instantaneous power (up to 6kW, single phase) of connected loads and the peak load	Mandatory		Compliance Statement	Compliance Statement
3.2.4	The 2 to 3.5 KW and 4 to 6 KW Generators monitoring device should allow strip-recording of data to allow better analysis of a battle-day/exercise/operation. The device should store data when unplugged/removed until cleared or over-written.	Desirable		Compliance Statement	Compliance Statement
3.3	The following will apply to the distribution systems associated with the Family of 12 KW and above Generators:	Header			

Contract No. – N° du contrat W8476-206276	Amd. No. – N° de la modif.	Buyer ID – Id de l'acheteur Rev 0
Client Ref. No. – N° de réf. du client W8476-206276	TPS DRAFT RFP APPENDIX AB TO ANNEX A	

Section #	Requirement Description	Type of Requirement	Compliance to Desirable Yes / No	Means of Compliance Post-Contract Award	Means of Compliance Pre-Contract Award
3.3.1	The distribution concept must be a series of cables and distribution boxes beginning at the three-phase generator/ESU which terminates in (single-phase) receptacles for users and three-phase pin/sleeve connectors.	Mandatory		Compliance Statement	Compliance Statement
3.3.2	The normal distribution system must only accommodate North American voltages/frequencies.	Mandatory		Compliance Statement	Compliance Statement
3.3.3	TPS cables must be compatible with the in-service Central Power Distribution System (CPDS)	Mandatory		Compliance Statement	Compliance Statement
3.3.4	The Terminal Box must be the last/smallest box in the system to be used to plug in 120V equipment.	Mandatory		Compliance Statement	Compliance Statement
3.3.5	Boxes must be olive drab or desert tan in colour.	Mandatory		Compliance Statement	Compliance Statement
3.3.6	Any shiny or reflective surface must have the ability to be covered.	Mandatory		Compliance Statement	Compliance Statement
3.3.7	Cable colour must be industry standard (dark)	Mandatory		Compliance Statement	Compliance Statement
3.4	<i>Distribution Support Equipment</i>	Header		Compliance Statement	Compliance Statement

Contract No. – N° du contrat W8476-206276	Amd. No. – N° de la modif. Rev 0	Buyer ID – Id de l'acheteur Rev 0
Client Ref. No. – N° de réf. du client W8476-206276	TPS DRAFT RFP APPENDIX AB TO ANNEX A	

Section #	Requirement Description	Type of Requirement	Compliance to Desirable Yes / No	Means of Compliance Post-Contract Award	Means of Compliance Pre-Contract Award
3.4.1	Grounding rods/plates must be included for each box (except terminal boxes).	Mandatory		Compliance Statement	Compliance Statement
3.4.2	Grounding rod/plate installation and removal tools must be included (scaled one per distribution system). If the same tools are used for the generator/ESU, only one set is required per skid, not two).	Mandatory		Compliance Statement	Compliance Statement
3.4.3	Cables over 10m which exceed a two-person lift (74.4kg) must have a means to allow easier transport, laying, and recovery over longer distances.	Mandatory		Compliance Statement	Compliance Statement
3.4.4	Heavy duty interlocking cable protectors must be provided to permit vehicles to drive over cables safely.	Mandatory		Compliance Statement	Compliance Statement
3.4.5	Cable protectors overall length must be at least 4m, with a high visibility band/colour and be anchorable into the ground.	Mandatory		Compliance Statement	Compliance Statement
3.4.6	Cables and boxes must have appropriate storage on/within the quadcon skids to protect them from the environment, theft, and damage when not in use	Mandatory		Compliance Statement	Compliance Statement
3.5	Cables	Header			

Contract No. – N° du contrat W8476-206276	Amd. No. – N° de la modif.	Buyer ID – Id de l'acheteur Rev 0
Client Ref. No. – N° de réf. du client W8476-206276	TPS DRAFT RFP APPENDIX AB TO ANNEX A	

Section #	Requirement Description	Type of Requirement	Compliance to Desirable Yes / No	Means of Compliance Post-Contract Award	Means of Compliance Pre-Contract Award
3.5.1	Cables must come in no more than 4 different lengths to assist with layout planning, minimize confusion in the field, and allow easier inventory management/mixing of kits.	Mandatory		Compliance Statement	Compliance Statement
3.5.2	The longest cable must be no more than 30m.	Mandatory		Compliance Statement	Compliance Statement
3.5.3	Cables must have quick-connect pin and sleeve connector fittings at each end.	Mandatory		Compliance Statement	Compliance Statement
3.5.4	Fittings must be chosen to alert and prevent operators from mismatching amperages and voltages	Mandatory		Compliance Statement	Compliance Statement
3.5.5	Cables must remain flexible (1:5 bend ratio) from A2 to C2 conditions.	Mandatory		Compliance Statement	Compliance Statement
3.5.6	Cables should remain flexible (1:5 bend ratio) in A3 to C3 conditions.	Desirable		Compliance Statement	Compliance Statement
3.6	<i>Distribution Boxes</i>	Header			
3.6.1	The base of all boxes must stand clear of the ground (at least 100mm) to prevent water, sand, etc. from entering or covering it and to be more visible to personnel and vehicles.	Mandatory		Compliance Statement	Compliance Statement
3.6.2	Boxes should have folding or retractable legs to stand clear of the ground.	Desirable		Compliance Statement	Compliance Statement

Contract No. – N° du contrat W8476-206276	Amd. No. – N° de la modif.	Buyer ID – Id de l'acheteur Rev 0
Client Ref. No. – N° de réf. du client W8476-206276	TPS DRAFT RFP APPENDIX AB TO ANNEX A	

Section #	Requirement Description	Type of Requirement	Compliance to Desirable Yes / No	Means of Compliance Post-Contract Award	Means of Compliance Pre-Contract Award
3.6.3	Boxes must not tip over in windy conditions.	Mandatory		Compliance Statement	Compliance Statement
3.6.4	Termination boxes must include a loop/hole near the edge to allow hanging by a carabineer, cord/rope, or bolt/screw on supports such as tent frames, trees/beams, plywood, side of vehicles, etc.	Mandatory		Compliance Statement	Compliance Statement
3.6.5	All boxes must have a weatherproof means to insert a temporary identifier (index card, etc.) to allow the operator to temporarily identify it.	Mandatory		Compliance Statement	Compliance Statement
3.6.6	All boxes must have a green indicator light or a digital display showing when power is present at the input (one indicator per phase).	Mandatory		Compliance Statement	Compliance Statement
3.6.7	All boxes which include 120V AC receptacles (including all terminal boxes) must have a green indicator light or digital display showing when power is present at each receptacle/duplex receptacle	Mandatory		Compliance Statement	Compliance Statement
3.6.8	Termination boxes must come in two styles.	Header			
3.6.8.1	Exterior Termination Box, which must have at least three 120V duplex receptacles (NEMA 5-15 or 5-20) including GFCI protection and rated for outdoor use.	Mandatory		Compliance Statement	Compliance Statement
3.6.8.2	Interior/dry Termination Box, which must have at least three 120V duplex receptacles (NEMA 5-15 or 5-20), including GFCI protection plus at least two USB and two USB-C charging ports.	Mandatory		Compliance Statement	Compliance Statement

Contract No. – N° du contrat W8476-206276	Amd. No. – N° de la modif.	Buyer ID – Id de l'acheteur Rev 0
Client Ref. No. – N° de réf. du client W8476-206276	TPS DRAFT RFP APPENDIX AB TO ANNEX A	

Section #	Requirement Description	Type of Requirement	Compliance to Desirable Yes / No	Means of Compliance Post-Contract Award	Means of Compliance Pre-Contract Award
3.6.8.2.1	These boxes must be prominently marked for interior/dry use only.	Mandatory		Compliance Statement	Compliance Statement
3.7	Power Management Module (PMM)	Header			
3.7.1	General: The PMM may not be required as a stand-alone device depending on how vendors design the generator/ESU combination. The PMM provides the management and control of a micro-grid when two or more generators and at least one ESU are connected together. The PMM acts as the interface to the human operator who monitors, controls and makes adjustments to the system as required.	Information			
3.7.2	If the PMM is a laptop device or tablet, it must be based on commonly available operating systems which allow routine upgrades.	Mandatory		Compliance Statement	Compliance Statement
3.7.3	The PMM must include the following functions:				
3.7.3.1	The PMM must control which power sources are active to meet the current loading.	Mandatory		Compliance Statement	Compliance Statement
3.7.3.2	The PMM must control up to six sources at one time.	Mandatory		Compliance Statement	Compliance Statement

Section #	Requirement Description	Type of Requirement	Compliance to Desirable Yes / No	Means of Compliance Post-Contract Award	Means of Compliance Pre-Contract Award
3.7.3.3	The PMM must designate one generator as the main power source, and another as the backup that will come on line if the main system fails.	Mandatory		Compliance Statement	Compliance Statement
3.7.3.4	With all power sources active, and loads exceeding capacity, the PMM must shed lower priority loads until loads return to generator/ESU capacity.	Mandatory		Compliance Statement	Compliance Statement
3.7.3.5	The PMM must indicate to what degree loads are balanced between phases to allow corrective action by the operator.	Mandatory		Compliance Statement	Compliance Statement
3.7.3.6	The PMM should have automatic load adjustment to balance between phases.	Desirable		Compliance Statement	Compliance Statement
3.7.3.7	If laptop/tablet based, the PMM must have a training or demonstration mode to allow operators to train in a simulated environment before connecting to actual equipment	Mandatory		Compliance Statement	Compliance Statement
3.7.3.8	The PMM must receive data from a sensor connected to an external grid to allow the automatic switchover to host nation power if TPS assets fail.	Mandatory		Compliance Statement	Compliance Statement
3.7.3.9	The PMM software and firmware must download diagnostics and strip-records by a removable (type TBD) memory device or hardware connection to a computer.	Mandatory		Compliance Statement	Compliance Statement
3.7.3.10	The PMM must not transmit through Wi-Fi, Bluetooth, or other wireless transmission.	Mandatory		Compliance Statement	Compliance Statement

Contract No. – N° du contrat W8476-206276	Amd. No. – N° de la modif.	Buyer ID – Id de l'acheteur Rev 0
Client Ref. No. – N° de réf. du client W8476-206276	TPS DRAFT RFP APPENDIX AB TO ANNEX A	

Section #	Requirement Description	Type of Requirement	Compliance to Desirable Yes / No	Means of Compliance Post-Contract Award	Means of Compliance Pre-Contract Award
3.7.3.11	The PMM must use a removable (type TBD) memory device or hardware connection to a computer to allow upgrades to software and firmware.	Mandatory		Compliance Statement	Compliance Statement
3.7.4	<u>Controller and HMI</u>	Header			
3.7.4.1	The PMM must detect all TPS components within the micro-grid.	Mandatory		Compliance Statement	Compliance Statement
3.7.4.2	Incoming data must include device ID/type of device and various operating parameters about the device including: on/off, current, voltage, frequency, power produced, and actual power load/demand.	Mandatory		Compliance Statement	Compliance Statement
3.7.4.3	Other parameters such as engine temperature, oil and fuel levels, etc to reduce physical visits to generators should be included.	Desirable		Compliance Statement	Compliance Statement
3.7.4.4	Faults or warnings must be visibly and audibly alerted.	Mandatory		Compliance Statement	Compliance Statement
3.7.4.5	Other functions, screens, or sub-menus must allow further investigation once acknowledged.	Mandatory		Compliance Statement	Compliance Statement
3.7.5	Survivability	Header			
3.7.5.1	If not laptop/tablet based, PMM equipment must be protected from weather to allow outdoor operation.	Mandatory		Compliance Statement	Compliance Statement

Contract No. – N° du contrat W8476-206276	Amd. No. – N° de la modif.	Buyer ID – Id de l'acheteur Rev 0
Client Ref. No. – N° de réf. du client W8476-206276	TPS DRAFT RFP APPENDIX AB TO ANNEX A	

Section #	Requirement Description	Type of Requirement	Compliance to Desirable Yes / No	Means of Compliance Post-Contract Award	Means of Compliance Pre-Contract Award
3.7.5.2	All plugs and sockets must have weather resistant covers.	Mandatory		Compliance Statement	Compliance Statement
3.7.5.3	PMM hardware must meet environmental requirements of section 4.3.	Mandatory		Compliance Statement	Compliance Statement
3.7.5.4	PMM electromagnetic emissions must comply with applicable Industry Canada, FCC, and NATO emission standards.	Mandatory		Compliance Statement	Compliance Statement
3.7.5.5	PMM modules (if not DND laptops) must pass the NATO Road/Cross Country Vibration Test Mil Std 810E.	Mandatory		Compliance Statement	Compliance Statement
3.7.5.6	During a PMM failure or loss of connection, the micro-grid must revert to a fail-safe state where generators/ESU will continue to provide power.	Mandatory		Compliance Statement	Compliance Statement
3.8	Maintainability	Header			
3.8.1	DND maintenance of the PMM must be limited to conducting updates to software and firmware.	Mandatory		Compliance Statement	Compliance Statement
3.8.2	If required, routine operator inspections and maintenance must be 3 minutes or less.	Mandatory		Compliance Statement	Compliance Statement

Contract No. – N° du contrat W8476-206276	Amd. No. – N° de la modif.	Buyer ID – Id de l'acheteur Rev 0
Client Ref. No. – N° de réf. du client W8476-206276	TPS DRAFT RFP APPENDIX AB TO ANNEX A	

Section #	Requirement Description	Type of Requirement	Compliance to Desirable Yes / No	Means of Compliance Post-Contract Award	Means of Compliance Pre-Contract Award
3.8.3	As no first line maintenance is anticipated for the PMM, any repairs must be executed under the established In-Service Support contract.	Mandatory		Compliance Statement	Compliance Statement
3.8.4	The PMM must be designed with enough flexibility so changes (including software/firmware updates) in generators, ESU, or future renewable energy components from other manufacturers can be incorporated with minimal software upgrades/conversions. <u>Availability:</u> PMM availability must be at least 99.90 %	Mandatory		Compliance Statement	Compliance Statement
3.8.5	<u>Reliability:</u> the PMM must have a MTBF of at least 50,000 hours	Mandatory		Compliance Statement	Compliance Statement
4	POWER STORAGE REQUIREMENTS:	Header			
4.1	The Power Storage System must meet all requirements specified under article 1 above, TPS System Level Requirement.	Mandatory		Compliance Statement	Compliance Statement
4.2	The Energy Storage System (ESU) must consist of the following:	Mandatory		Compliance Statement	Compliance Statement
4.2.1	Battery Bank;	Mandatory		Compliance Statement	Compliance Statement
4.2.2	Battery Charging System; and	Mandatory		Compliance Statement	Compliance Statement

Contract No. – N° du contrat W8476-206276	Amd. No. – N° de la modif.	Buyer ID – Id de l'acheteur Rev 0
Client Ref. No. – N° de réf. du client W8476-206276	TPS DRAFT RFP APPENDIX AB TO ANNEX A	

Section #	Requirement Description	Type of Requirement	Compliance to Desirable Yes / No	Means of Compliance Post-Contract Award	Means of Compliance Pre-Contract Award
4.2.3	DC/AC Two-Way Inverter System.	Mandatory		Compliance Statement	Compliance Statement
4.3	Battery Banks	Header			
4.3.1	The battery bank must be portable by maximum of 2 soldiers from 5 to 95 percentile as defined in the Canadian Forces Anthropometric Survey DRDC-2015-R186.	Mandatory		Compliance Statement	Compliance Statement
4.3.2	The battery power pack must be scalable. The capacity of the battery bank must be increased by adding additional power pack using plug and play connectors for a maximum battery bank capacity of ten (10) KWhr.	Mandatory		Compliance Statement	Compliance Statement
4.3.3	The battery bank must comply with A-LM-158-004/AG-001 - TRANSPORTATION MANUAL VOLUME 4 MOVEMENT OF MATERIEL, Ch. 15 TRANSPORTATION OF DANGEROUS GOODS; and A-LM-117-001/FP-001 – TRANSPORTATION OF DANGEROUS GOODS BY CANADIAN FORCES AIRCRAFT for air transportation.	Mandatory		Compliance Statement	Compliance Statement
4.3.4	The Battery Power Pack must be designed for outdoor use and meet the climatic conditions specified under section 1.22 above.	Mandatory		Compliance Statement	Compliance Statement
4.3.5	The Battery Power Pack must withstand 2500 charge/discharge cycles.	Mandatory		Compliance Statement	Compliance Statement
4.3.6	The Battery Bank must communicate with the RTU to provide the status of charge, available power and the capacity.	Mandatory		Compliance Statement	Compliance Statement

Contract No. – N° du contrat W8476-206276	Amd. No. – N° de la modif.	Buyer ID – Id de l'acheteur Rev 0
Client Ref. No. – N° de réf. du client W8476-206276	TPS DRAFT RFP APPENDIX AB TO ANNEX A	

Section #	Requirement Description	Type of Requirement	Compliance to Desirable Yes / No	Means of Compliance Post-Contract Award	Means of Compliance Pre-Contract Award
4.4	<i>Battery Charging System:</i>	Header			
4.4.1	The battery charger must be portable by maximum of 2 soldiers from 5 to 95 percentile as defined in the Canadian Forces Anthropometric Survey DRDC-2015-R186.	Mandatory		Compliance Statement	Compliance Statement
4.4.2	The battery charger must use the excess energy available from the grid to charge the battery bank.	Mandatory		Compliance Statement	Compliance Statement
4.4.3	The battery charger system must be capable to fast charge a 10 KW battery Pack within 3 hours.	Mandatory		Compliance Statement	Compliance Statement
4.4.4	The battery charger system should be capable to fast charge a 10 KW battery Pack within 2 hours.	Desirable		Compliance Statement	Compliance Statement
4.4.5	The battery charger must self-adjust charging current without raising battery temperature to safety limit.	Mandatory		Compliance Statement	Compliance Statement
4.4.6	The battery charger must communicate with the RTU to provide the status of charging current and battery temperature.	Mandatory		Compliance Statement	Compliance Statement
4.4.7	The battery charger must be designed for outdoor use and meet the climatic conditions specified under Para 1.22 above.	Mandatory		Compliance Statement	Compliance Statement
4.5	DC to AC Inverter System	Header			
4.5.1	The DC/AC inverter system must be portable by maximum of 2 soldiers from 5 to 95 percentile as defined in the Canadian Forces Anthropometric Survey DRDC-2015-R186.	Mandatory		Compliance Statement	Compliance Statement

Contract No. – N° du contrat W8476-206276	Amd. No. – N° de la modif.	Buyer ID – Id de l'acheteur Rev 0
Client Ref. No. – N° de réf. du client W8476-206276	TPS DRAFT RFP APPENDIX AB TO ANNEX A	

Section #	Requirement Description	Type of Requirement	Compliance to Desirable Yes / No	Means of Compliance Post-Contract Award	Means of Compliance Pre-Contract Award
4.5.2	The input voltage of the DC/AC inverter system must be 28 VDC.	Mandatory		Compliance Statement	Compliance Statement
4.5.3	The inverter must have at least two USB Type A and two USB Type C charging ports.	Mandatory		Compliance Statement	Compliance Statement
4.5.4	The DC/AC inverter system must be designed for outdoor use and meet the climatic conditions specified under Para 1.22 above.	Mandatory		Compliance Statement	Compliance Statement
4.5.5	ESU(S): The output of the DC/AC inverter system must be 120V, Single phase 60 Hz, and 240V, Single phase 50/60 Hz	Mandatory		Compliance Statement	Compliance Statement
4.5.6	ESU(S): The output of the DC/AC inverter system should include 240V, Single phase 50/60 Hz.	Desirable		Compliance Statement	Compliance Statement
4.5.7	The ESU(S) must include a 12V port rated at 20 A.	Mandatory		Compliance Statement	Compliance Statement
4.5.8	ESU(L): The output of the DC/AC inverter system must be 208V, 3 phase 60 Hz, and 216V, 3 phase 50/60 Hz	Mandatory		Compliance Statement	Compliance Statement
4.5.9	The output of the DC/AC inverter system should be able to be configured/selected as 50 or 60 Hz.	Desirable		Compliance Statement	Compliance Statement
4.5.10	The output of the DC/AC inverter system should be able to be configured/selected as 120/208 or 240/416 VAC, three phase.	Desirable		Compliance Statement	Compliance Statement

Contract No. – N° du contrat W8476-206276	Amd. No. – N° de la modif.	Buyer ID – Id de l'acheteur Rev 0
Client Ref. No. – N° de réf. du client W8476-206276	TPS DRAFT RFP APPENDIX AB TO ANNEX A	

Section #	Requirement Description	Type of Requirement	Compliance to Desirable Yes / No	Means of Compliance Post-Contract Award	Means of Compliance Pre-Contract Award
4.5.11	The DC/AC inverter must communicate with the RTU to provide the status of voltage and current fed into the grid.	Mandatory		Compliance Statement	Compliance Statement
4.5.12	The DC/AC inverter should be packaged with the Energy Storage Unit.	Desirable		Compliance Statement	Compliance Statement
5	PACKAGING REQUIREMENT	Header			
5.1	Skids and Containers	Header			
5.1.1	General Requirements	Header			
5.1.1.1	The of 2 to 3.5 KW and 4 to 6 KW Generators (Gasoline), and ESU(S), can be carried by any land based vehicle in the CAF including lighter vehicles such as civilian pickup-trucks and vans, snowmobiles (LOSV), quad-runners, and even pack-animals or by hand for short distances. They may also be moved by helicopter or fixed wing air transport, or various ships. Given the relatively low weight and volume of small generators, there are no specific requirements for packaging.	Information			
5.1.1.2	The 4 to 6 KW Generators (Diesel) and 12 to 70 kW generators, ESU(L), and distribution system equipment will almost exclusively be mounted to skids based on a quadcon footprint (approximately 8' x 5', or	Information			

Contract No. – N° du contrat W8476-206276	Amd. No. – N° de la modif.	Buyer ID – Id de l'acheteur Rev 0
Client Ref. No. – N° de réf. du client W8476-206276	TPS DRAFT RFP APPENDIX AB TO ANNEX A	

Section #	Requirement Description	Type of Requirement	Compliance to Desirable Yes / No	Means of Compliance Post-Contract Award	Means of Compliance Pre-Contract Award
	¼ of an 20' ISO container). Further guidance is available as noted at Sect 1.1 This will enable handling and movement by most forklifts and heavy equipment, and fits the decks of many vehicles and trailers.				
5.1.1.3	Quadcon containers will be used for TPS repair and spares kit for maintenance personnel.	Information			
5.1.1.4	Skids and quadcons will lock onto a TPS-supplied trailer frame (or other similar trailers) as described later in this section to allow towing.	Mandatory		Compliance Statement	Compliance Statement
5.1.2	Skids	Header			
5.1.2.1	Skids must conform to the MIL-Std-3037 for ISO containers, maintaining the capabilities of the standard ISO 20ft intermodal footprint for commonality and be compatible with the standard SeaLock connector(s).	Mandatory		Compliance Statement	Compliance Statement
5.1.2.2	Equipment mounted to a quadcon skid must be removable by maintenance staff using common hand tools.	Mandatory		Compliance Statement	Compliance Statement
5.1.2.3	Skids must have forklift pockets in all four directions, remaining accessible if the ground compresses 50 mm.	Mandatory		Compliance Statement	Compliance Statement

Contract No. – N° du contrat W8476-206276	Amd. No. – N° de la modif.	Buyer ID – Id de l'acheteur Rev 0
Client Ref. No. – N° de réf. du client W8476-206276	TPS DRAFT RFP APPENDIX AB TO ANNEX A	

Section #	Requirement Description	Type of Requirement	Compliance to Desirable Yes / No	Means of Compliance Post-Contract Award	Means of Compliance Pre-Contract Award
5.1.2.4	Skids must have lifting point attachments to allow movement by a crane, hoist, HIAB, helicopter, or other similar equipment. The use of spreader bars is acceptable.	Mandatory		Compliance Statement	Compliance Statement
5.1.2.5	The skid holding the Family of 4 to 6 kW generator (Diesel) system must have brackets for one diesel jerry can.	Mandatory		Compliance Statement	Compliance Statement
5.1.2.6	Skids must have appropriate locations to store and secure smaller TPS specific operator tools and equipment (wrenches, testers, common consumables, etc	Mandatory		Compliance Statement	Compliance Statement
5.1.2.7	Boxes must withstand the weight of a 130kg person if stepped on.	Mandatory		Compliance Statement	Compliance Statement
5.1.3	<i>Quadcon Containers</i>	Header			
5.1.3.1	Containers must conform to MIL-Std-3037 for ISO containers, maintaining the capabilities of the standard ISO 20ft intermodal footprint for commonality and be compatible with the standard Sealock connector(s).	Mandatory		Compliance Statement	Compliance Statement
5.1.3.2	Each containers must allow separate access when two or more containers are connected together.	Mandatory		Compliance Statement	Compliance Statement

Contract No. – N° du contrat W8476-206276	Amd. No. – N° de la modif.	Buyer ID – Id de l'acheteur Rev 0
Client Ref. No. – N° de réf. du client W8476-206276	TPS DRAFT RFP APPENDIX AB TO ANNEX A	

Section #	Requirement Description	Type of Requirement	Compliance to Desirable Yes / No	Means of Compliance Post-Contract Award	Means of Compliance Pre-Contract Award
5.1.3.3	Container height must not exceed 8 feet so it can be carried by all prime movers or on a pallet without causing damages to overpasses, bridges, and other road features.	Mandatory		Compliance Statement	Compliance Statement
5.1.4	Survivability	Header			
5.1.4.1	Skids and containers must pass the rail-impact test as per MIL-STD-810H when loaded in their heaviest configuration	Mandatory		Compliance Statement	Compliance Statement
5.1.4.2	Skids and containers with exposed metal surfaces must be coated with Chemical Agent Resistant Coating (CARC).	Mandatory		Compliance Statement	Compliance Statement
5.1.4.3	Any shiny or reflective surface must have the ability to be covered.	Mandatory		Compliance Statement	Compliance Statement
5.1.4.4	Skids must have appropriate locations to store camouflage nets large enough to cover the skid/container as well as the trailer supporting it.	Mandatory		Compliance Statement	Compliance Statement
5.1.4.5	Containers must have a short removable yardarm which attaches to the top connectors to allow stand-off distance for camouflage nets.	Mandatory		Compliance Statement	Compliance Statement
5.1.4.6	Containers must have appropriate locations to store camouflage nets (and poles if required).	Mandatory		Compliance Statement	Compliance Statement
5.1.4.7	Skids and containers holding generators or ESUs must come equipped with a fire extinguisher(s) and bracket(s), fire blanket(s), and/or other equipment that are accessible from ground level even when the skid is mounted on the trailer to extinguish the appropriate type of fire.	Mandatory		Compliance Statement	Compliance Statement

Contract No. – N° du contrat W8476-206276	Amd. No. – N° de la modif.	Buyer ID – Id de l'acheteur Rev 0
Client Ref. No. – N° de réf. du client W8476-206276	TPS DRAFT RFP APPENDIX AB TO ANNEX A	

Section #	Requirement Description	Type of Requirement	Compliance to Desirable Yes / No	Means of Compliance Post-Contract Award	Means of Compliance Pre-Contract Award
5.1.5	Trailers.	Header			
5.1.5.1	Trailers are not required for the Family of 2 to 3.5 KW and 4 to 6 KW Generators (Gasoline), and ESU(S).	Information			
5.1.5.2	The quadcon skids and containers described in section 5.1 must lock onto a TPS-supplied trailer frame for towing.	Mandatory		Compliance Statement	Compliance Statement
5.1.5.3	The trailer must accept one quadcon skid or one quadcon container.	Mandatory		Compliance Statement	Compliance Statement
5.1.5.4	The trailer must match the cross county mobility of the Logistic Vehicle Modernization - Light (LVM-L) while carrying a full payload.	Mandatory		Compliance Statement	Compliance Statement
5.1.5.5	The trailer must be a 2.2 Tonne trailer modified to carry the extra weight of a Quadcon skid, generator set, ESU(L), and associated hardware.	Mandatory		Compliance Statement	Compliance Statement
5.1.5.6	The trailer must have radial tires compatible with LVM-L truck spare tires;	Mandatory		Compliance Statement	Compliance Statement
5.1.5.7	The trailer break system must be an air to hydraulic break system.	Mandatory		Compliance Statement	Compliance Statement
5.1.5.8	The trailer air hose for the standard and emergency breaking system must be compatible with the towing truck air system;	Mandatory		Compliance Statement	Compliance Statement

Section #	Requirement Description	Type of Requirement	Compliance to Desirable Yes / No	Means of Compliance Post-Contract Award	Means of Compliance Pre-Contract Award
5.1.5.9	The trailer tongue weight must be between 7 and 15% of the total curb weight of the trailer when fully loaded with the generator and associated accessories;	Mandatory		Compliance Statement	Compliance Statement
5.1.5.10	Minimum ground clearance must be no less than 260mm when carrying with the heaviest configuration skid.	Mandatory		Compliance Statement	Compliance Statement
5.1.5.11	Trailer components must have maximum component commonality with the LVM(L) trailer (gladhands, jacks, spare tire mounts, etc)	Mandatory		Compliance Statement	Compliance Statement
5.1.5.12	Minimum fording must be no less than 750mm on a hard-bottomed water obstacle.	Mandatory		Compliance Statement	Compliance Statement
5.1.5.13	Trailers must be a single or double axle.	Mandatory		Compliance Statement	Compliance Statement
5.1.5.14	Trailer tongues must accept different inserts or be adjustable to allow connection to civilian and military prime movers.	Mandatory		Compliance Statement	Compliance Statement
5.1.5.15	Trailers must have safety chains with safety latches.	Mandatory		Compliance Statement	Compliance Statement
5.1.5.16	Trailer tongues must have a manually operated jack system for levelling and connecting to prime movers.	Mandatory		Compliance Statement	Compliance Statement
5.1.5.17	Trailer tongues must not interfere with the LVM(L) tailgate opening to the horizontal position.	Mandatory		Compliance Statement	Compliance Statement

Contract No. – N° du contrat W8476-206276	Amd. No. – N° de la modif.	Buyer ID – Id de l'acheteur Rev 0
Client Ref. No. – N° de réf. du client W8476-206276	TPS DRAFT RFP APPENDIX AB TO ANNEX A	

Section #	Requirement Description	Type of Requirement	Compliance to Desirable Yes / No	Means of Compliance Post-Contract Award	Means of Compliance Pre-Contract Award
5.1.5.18	The trailer must be equipped with a tool box for stowage of the ground rods, ground rod puller and drover, external fuel hoses, ground wires and grounding lugs.	Mandatory		Compliance Statement	Compliance Statement
5.1.5.19	The trailer must be equipped with a grounding split-bolt terminal for bonding of the trailer and the generator chassis to the ground.	Mandatory		Compliance Statement	Compliance Statement
5.1.5.20	The trailer must be equipped with a manual hand-break safety system to prevent the trailer from rolling when deployed on sloped terrain.	Mandatory		Compliance Statement	Compliance Statement
5.1.5.21	The trailer must have an electrical connector compatible with the LVM-L towing connector for the control of the tailgate lighting system including blackout tailgate light;	Mandatory		Compliance Statement	Compliance Statement
5.1.5.22	The trailer should retain the tactical/blackout capability when connected to a 12 V civilian system.	Desirable		Compliance Statement	Compliance Statement
5.1.5.23	Trailers must be equipped with mud flaps behind the wheels, and wheel splash/stone throw protection above the wheels.	Mandatory		Compliance Statement	Compliance Statement

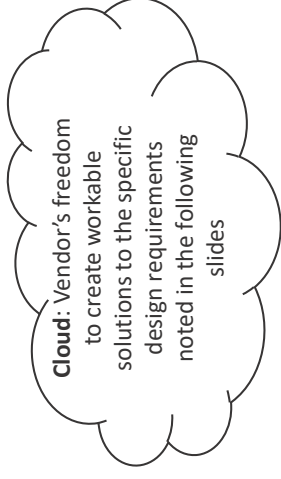
Attachment 001

W8476-206276

TPS Concept of Operation Guidance to Industry

Introduction

- The aim of these slides to outline the TPS equipment operational concept of usage which will allow vendors to tailor their products in terms of power generation and storage, distribution, and transportation.
- Technical guidance will be provided in the project's RVM and SOW as applicable.
- The following unique icons will be used throughout the slides:

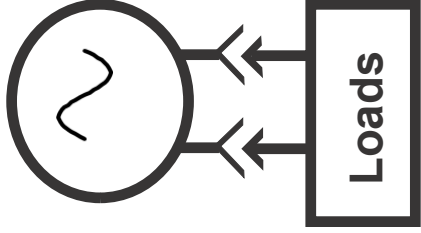


Generator

- Abbreviations:
 - CA – Canadian Army
 - CMBG – Canadian Mechanized Brigade Group
 - CP - Command Post
 - CPDS – Central Power Distribution System
 - ECU – Environmental Conditioning Unit
 - ESU – Energy storage Unit (L – large; S – Small)
 - Gen – Generator (Relative size designated as A to F)
 - HQSS – Headquarters Shelter System
 - LVM – Logistic Vehicle Modernization (L – the light variant)
 - RCAF – Royal Canadian Airforce

Power Generation and Storage Concept

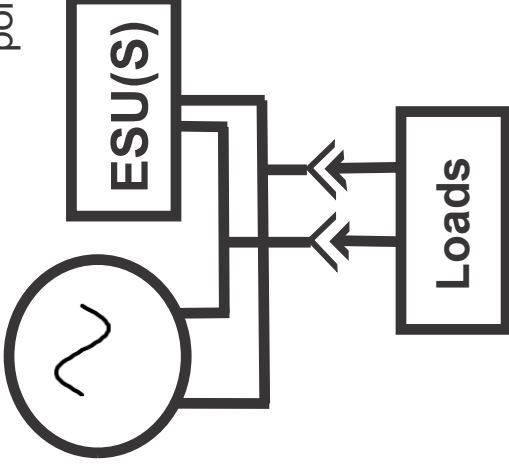
Small
(120V, 1ph, 60Hz) NEMA 5-15
or 5-20 user receptacle



Very Common
Traditional use.

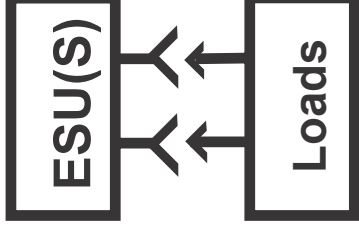
5kW = must have a 20A, 2kW can be
15 or 20A receptacles

The ESU(S) must be a physically separate
component to allow sharing between users and
portability



Very Common

Covers off for Gen during
refueling or low demand periods.
Absorb surges for limited
periods.

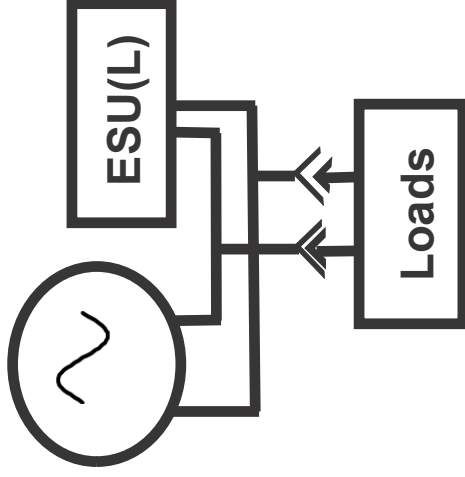


Infrequent

Gen cannot be (or is not)
used. Charged from genset
or shore power earlier.

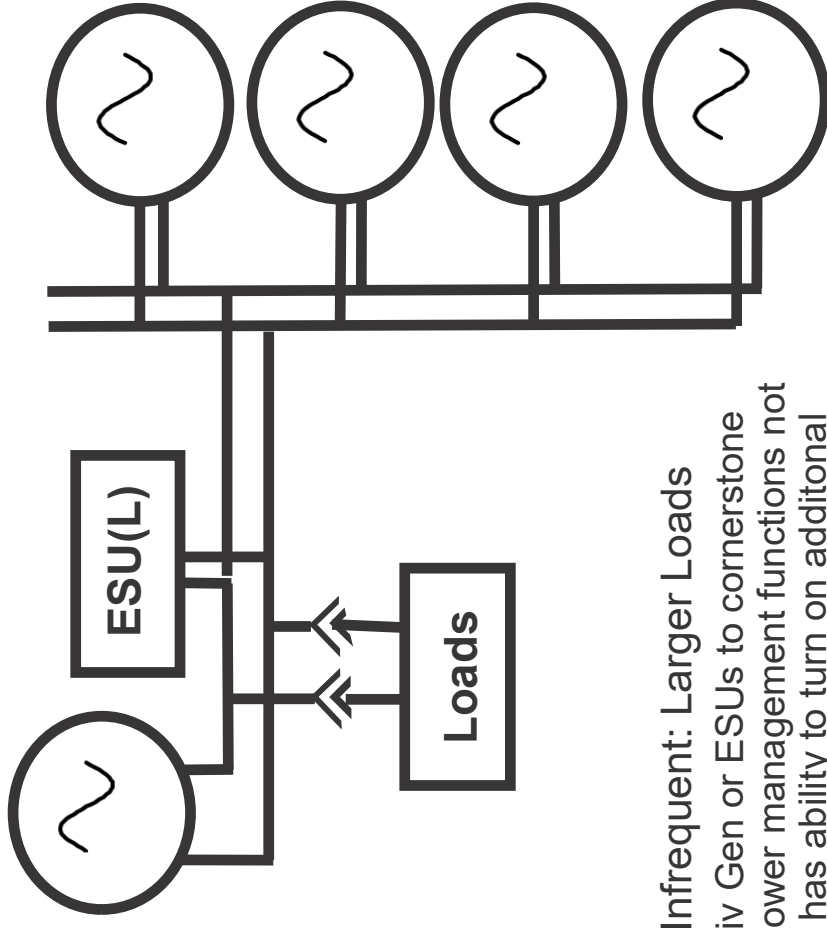
Large (pg 1/2) (120/208V, 3ph, 60Hz plus 220/380V, 3ph, 50Hz) pin/sleeve connectors

The ESU(L) may be stand-alone or integrated into a genset. Diagrams depict where power is supplied from, not a specific physical configuration.



Most common: Cornerstone System

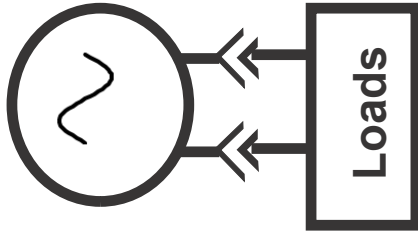
ESU power during low demand periods.
ESU covers off gen during refueling/maint and absorbs surges for limited periods.
Gen power for higher demands and recharging.



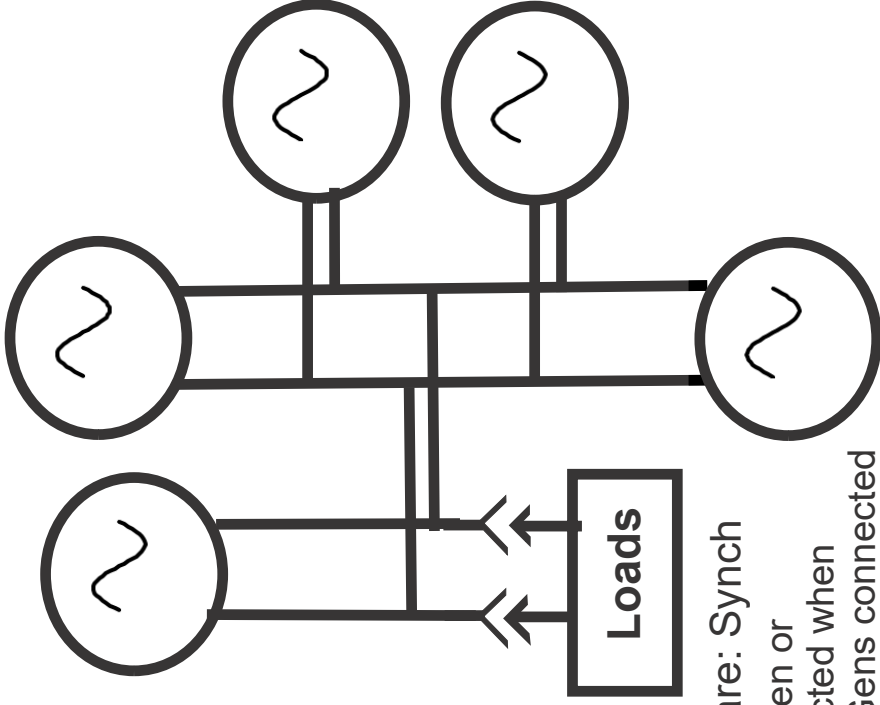
Infrequent: Larger Loads

Adds mil/civ Gen or ESUs to cornerstone system. Power management functions not shown but has ability to turn on additional gensets, shed loads, etc.

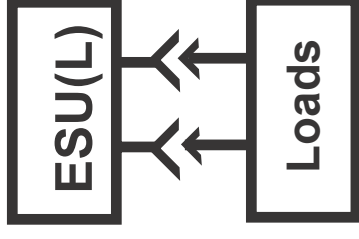
Large (pg 2/2)
(120/208V, 3ph, 60Hz plus 220/380V, 3ph, 50Hz) pin/sleeve connectors



Rare: Traditional
 ESU broken or
 disconnected, or
 possibly Gen F in rare
 cases



Rare: Synch
 ESU broken or
 disconnected when
 multiple Gens connected



Incredibly Rare: ESU only
 Gen broken or disconnected
 without ability to recharge
 ESU. Very short time periods
 only.

Distribution Systems

Introduction

Vendors are requested to provide distribution systems to cover the following gen(s) configuration:

Single Phase Gen Slides:

- Gen A
- Gen B
- Gen C is expected to be removed from the project (nothing shown)

Three Phase Gen Slides:

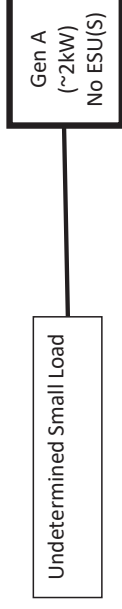
- Gen D Cornerstone components (as a self contained package);
- Gen E Cornerstone components (as a self contained package);
- Gen F Bare (nothing);
- All Cornerstone combinations (D+D, D+E, E+E);
- Gen E Cornerstone + Gen F support
- Gen E Cornerstone + more than one genset

General Notes:

- Gen D and E Cornerstone systems are the building blocks that everything else rests upon. They account for over 80% of individual quantities, and likely more than 2/3 of the various possible configurations.
- The more complicated aspects of micro-gridding are only considerations for the last three slides unless vendors need that capability as part of a cornerstone system.
- Any of the proposed distribution systems must be compatible with CPDS connectors, but it does NOT mean vendors must use CPDS legacy components (for example: different number/types of connectors to a box, different materials or shapes, longer/shorter cables, etc).
- Sizing and quantity of cables and boxes are based on a typical field unit layout with some flexibility to adapt to other scenarios.

Single Phase Distribution Systems

Single Phase Gensets: Gen A



Gen A are hand-portable gensets (diesel and gasoline) normally without an ESU(S).

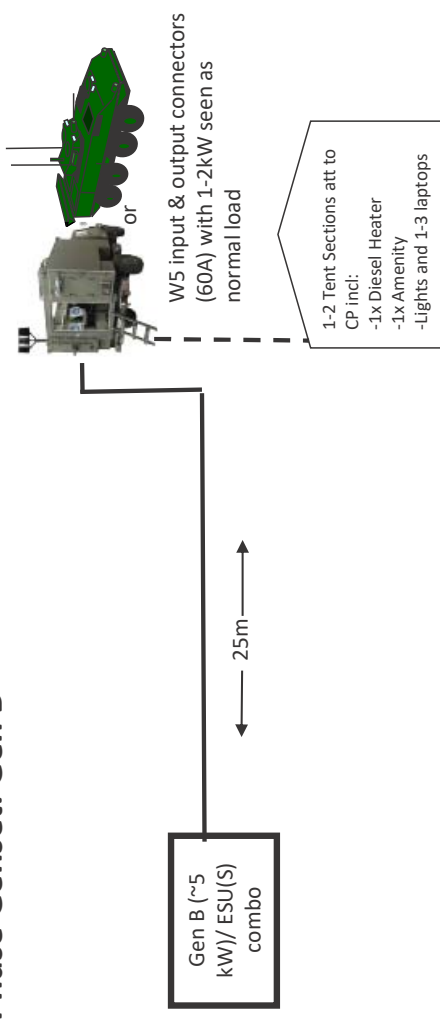
They may run any kind of small load (computers, 1x diesel heater, lighting, recharging of batteries, small tools, etc).

Design Considerations/Preliminary Thoughts

They use COTS extension cords already within the system.

No vendor work or planning is required

Single Phase Genset: Gen B



Most Common Scenario (Sub-unit CP)

- 1x Vehicle CP, possibly with a section of modular tent as a penthouse. W5 (60A pin/sleeve connection) into the Vehicle.
- Loads in the Vehicle estimated at 1-2kW, plus up to 3 kW in the tent (normally a diesel heater and a coffee pot or other small appliance).

Other Common Scenarios

- Using the genset without a CP to power a variety of equipment (diesel heaters, lights, battery rechargers, medical equipment, tools, etc.
- Ordinary extension cords will be utilized.

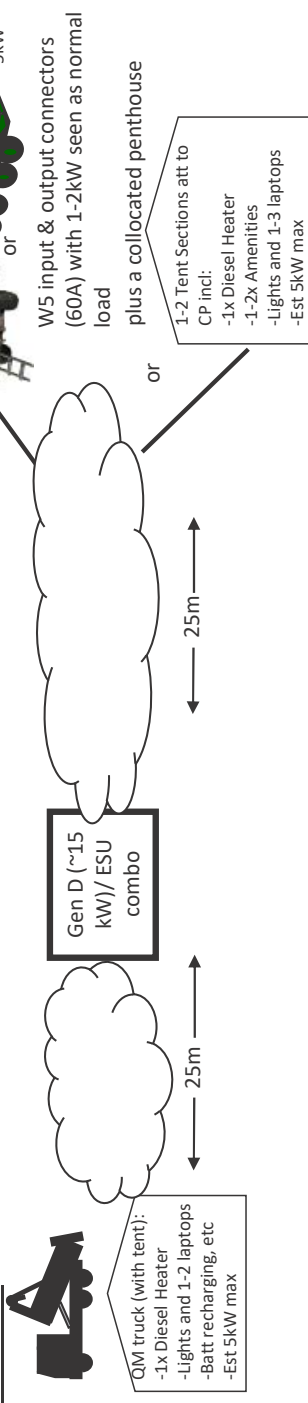
Design Consideration/Preliminary Thoughts

- 1x cheater cord taking the highest current outlet from the genset or genset/ESU(S) combination (dependant on vendor, but likely L5-30 or similar) and terminating as a W5 60A pin/sleeve connector.
- This may be a special-purpose cable or a short adapter/dongle into which a standard 25m W5 cable connects to.
- This will serve the expected majority of CP demands (radios, laptops, LED lighting, small fan) without modifying off-the-shelf generators to incorporate pin/sleeve connectors.
- Most CPs have a power-out connector (W5) which may assist in feeding the tent loads.
- Some load management may be required by users.
- All other scenarios will use existing extension cords to provide power to whatever loads are connected.

Three Phase Distribution Systems

Single Gensets: Gen D Cornerstone distribution Kit When Used as a Stand alone System

Most Common Scenario: Admin Sub-unit



Other Common Scenarios

-Medical staff connecting to a small HQSS shelter (W5 input) with medical equipment inside, including 1x ECU without block heater. Similar for Int staff in an analysis shelter.

Less Common Scenarios

-Creation of a CP or office setup without a Vehicle. Users would need to lay out cables and boxes to allow use inside a canvas tent or adjacent building. Should have at least 3x terminal boxes for users. Some shorter cables may be useful, though (existing) extension cords could also be used to connect low-draw loads from the terminal boxes onwards.

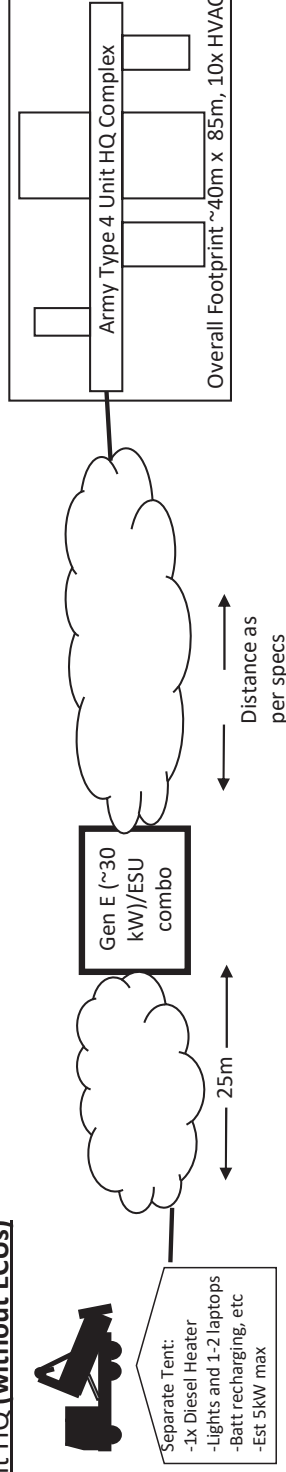
Design Considerations/Preliminary Thoughts

- 1 x cable which connect to a 60A, W5 input (CP Vehicle, HQSS module, ECU, power distribution box, etc).
- 2-3 x Small terminal boxes to allow 3 x 20A circuits per box for users to plug devices into (similar to CPDS TDB which splits the three phase power into three duplex receptacles).
- Other cables and boxes as needed to feed the terminal boxes and complete the system.
- In DOMOPS/peacetime, QM and the CP may be collocated, and genset located further away. Like-cables must connect together to allow longer runs.
- If space on the skid allows it, an extra cable(s) and box(es) can be added for more flexibility.
- Load shedding is not a requirement at this level, but is welcomed if part of the solution.

Solution is a basic, yet flexible package contained with the genset/ESU. At this point, no other gensets are connected to this system.

Single Gensets: Gen E Cornerstone distribution Kit When Used as a Stand alone System

Most Common Scenario: Unit HQ (without ECUs)



Description

-HQ contains up to four Vehicles plugged into the HQSS complex, 30 laptops, projectors/displays, and server equipment, and radios (much of this is contained within the Vehicles). Also includes HQSS lighting, and 2-3 amenities (coffee maker, toaster, etc).

-Up to 10x diesel heaters to provide three+ season comfort (fall, winter, spring, plus cooler summer days).

-Assume HQSS internal lighting and distribution systems can be used for most office equipment .

-Does NOT include any HQSS ECUs.

-There may be an associated nearby tent (~25m) for other users similar to the one shown on the Gen D slide (one diesel heater, a few laptops, lights, recharging of equipment, etc), with a total load of <5kW.

Less Common Scenario

Same loads/users, but not using HQSS. For example, inside ordinary canvas or vacant existing infrastructure. This is more likely for extended periods such as a static location or some DOMOPs. Additional kit may need to be borrowed or power bars/extension cords used to properly fill this scenario, but it is not seen as happening often.

Design Considerations/Preliminary Thoughts

-Enough cable and boxes to feed the (W5 input) internal HQSS lighting/distribution system. Note more than one entry point is required. See other diagrams/specs showing detailed layout of the HQSS complex for distances/locations.

-One other cable (~25m) and a terminal box to feed the separate tent a max of 5kW

-At least 4x terminal boxes for the HQ should the HQSS internal distribution not be used (eg: 'less common scenario' inside an armoury/gymnasium).

-Other cables or boxes as needed to feed the terminal boxes and complete the system.

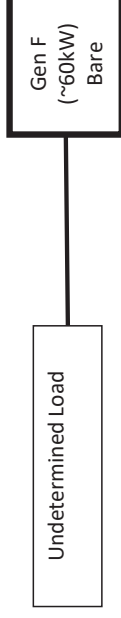
-If space remains on the pallet, more can be carried to allow flexibility.

-Load shedding is desired but not critical at this stage (priority to the Vehicles, then tent-occupant, and finally HVAC).

Solution is a basic, yet flexible package contained with the genset/ESU. At this point, no other gensets are connected to this system.

Single Gensets: Gen F

Seen as a rare scenario



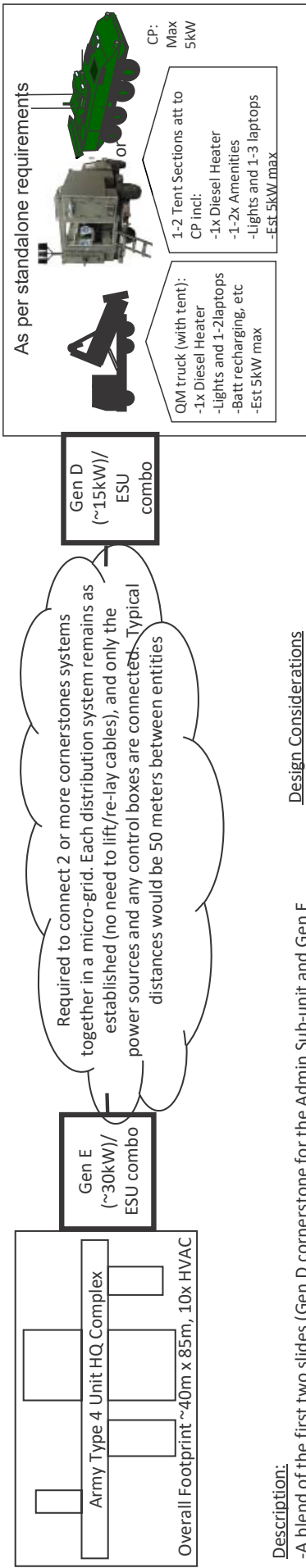
No need for vendors to plan for this since power scenarios involving Gen F are based on cornerstone systems plus additional gensets, vice a Gen F being used solo. This slide is included only to confirm it was not an oversight/omission by DND.

Design Consideration/Preliminary Thoughts

No work or planning required. Distribution reqs for Gen F will be examined only when paired with other Gens.

Dual Gensets: Gen D and E Cornerstones (Using Connection Kit X)

Most Common Scenario: Unit HQ and Admin Sub-unit collocated (Unit HQ not using HQS ECU)



Description:

- A blend of the first two slides (Gen D cornerstone for the Admin Sub-unit and Gen E cornerstone for the Unit HQ) but the tactical situation allows them to collocate.
- This may occur during DOMOPs, or during the administrative portion of a training event. It could also be used during a mission where there is low threat of Arty when collocation allows logistic advantages (for example, starting the nucleus of a camp).
- It will not occur in combat operations or on training events once under a tactical scenario, as there may be several hundred metres or km between the two entities.
- As no ECUs are used, it is still limited to fall, winter, spring, and cooler summer days.
- Load shedding capability is required at this point.

Design Considerations

- Distribution systems to each user remain as per earlier work;
- Issue is how to connect two of them together, and where any required kit is carried.

Ideal solution is the two cornerstone kits connect to each other without needing additional boxes/cables as it allows more collocation opportunities without advance planning. However, if a separate connection kit skid is acceptable if required due to the unique nature/expense/size of equipment.

Dual Gensets: 2x Gen D Cornerstones or 2x Gen E Cornerstones

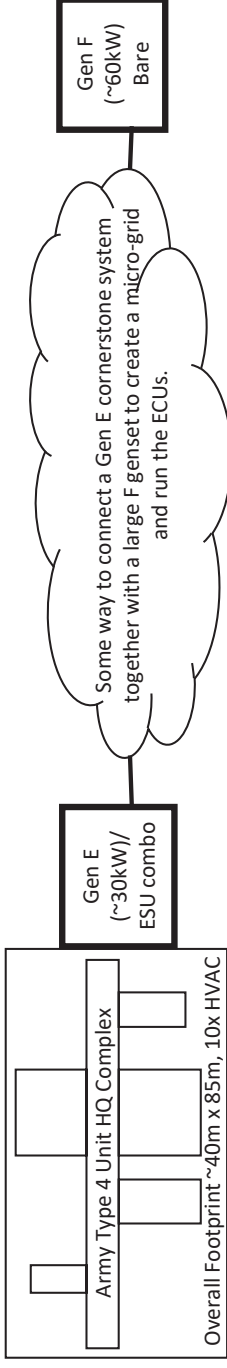
Scenario and Description (Virtually identical to above).

- 2x Gen D (~30kW) could apply when Admin or Medical sub-units collocate. If there is an arty threat or constricted terrain, the entities will remain at different locations.
- 2x Gen E (~60kW) could apply when erecting a CMBG HQ, a Tac Hel site, or the Field Hospital as they have higher power requirements and receive 2x Gen E cornerstones, vice 1x Gen E and 1x Gen D. Still restricted to diesel heaters for three+ season use (no use of ECUs).

As above.

Dual Gensets: Gen E Cornerstone and Gen F

Most Common Scenario: Unit HQ using ECUs in the cooling mode (very hot weather) or mild cold (without the block heaters)



Description:

- Although listed as the most common scenario, it is expected to be infrequent.
- This takes the unit HQ using HQSS from diesel heaters (three+ seasons) and allows it to use ECUs for cooling in hot weather. Most likely in deployed scenarios, but can occur in summer weather.
- On extended deployments where seasons change, the ECUs allow some heating with the same power consumption (10kW each).
- 10x ECU at 10kW = 100kW, but assume 50% demand at any given time, so approx 50kW of additional power needed above the bare HQ loading.
- If very cold temperatures are expected, diesel heaters will be taken (most energy efficient approach), or additional gensets must be connected to allow the ECUs to use their integral block heaters (next slide).

Design Considerations/Preliminary Thoughts

- The HQ basic loads are already well served by the Gen E Cornerstone package described earlier.
- The additional power and distribution is therefore only needed to run the 10x ECUs (which are fed from the HQSS internal distribution system).
- Load shedding is essential at this stage (priority to the Vehicles/tents, then non-HQSS loads, and finally the 10x ECUs).

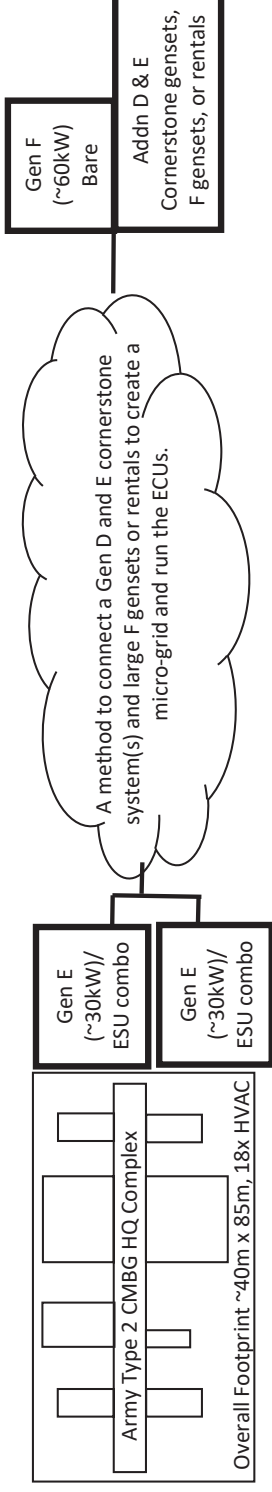
Solution should use the same equipment already found in earlier slides

Less Likely Scenario Description:

- Tac Hel or the Field Hospital setting up 2-3 micro-grids (E+F) when not close enough to form a single, larger one (for example: Tac Hel HQ, flight lines, and accn/dining areas with 100+ metres between them).
- CMBG HQ setting up two adjacent micro-grids (E+F, E+F). In most cases, they will set up one larger one (E+E+F+F).

More than two Gensets: Gen E Cornerstone plus others

Most Common Scenario: CMBG HQ using ECUs in cooling mode (est. 100kW) or heating (without the block heaters)



Description:

- CMBG HQ running one micro-grid of 100-110kW including 18x ECUs to allow cooling in hot weather, or limited heating without block heaters in cool weather.
- The Field Hospital running one large micro-grid of 150-170kW including 27x ECUs to allow cooling in hot weather or limited heating without block heaters in cool weather.
- While the most common, this is still not expected to happen often.

Very Rare Scenarios

- Users running the ECUs with block heaters when very cold, instead of using diesel heaters (a Unit with HQSS Type 4 (10 ECUs) at 105kW, CMBG with HQSS Type 2 (18 ECUs) at 165kW, or Field Hospital with HQSS (27 ECUs) at 250-270kW).

Note: Since ECUs weigh more and consume 10x the power of a diesel heater, these are seen as very rare. However, it could occur in some missions if a cold snap occurs with no diesel heaters present. Alternate arrangement are also possible (addn clothing, locally acquired fuel-fired heaters, etc) which will mitigate this demand. However, they are included for completeness.

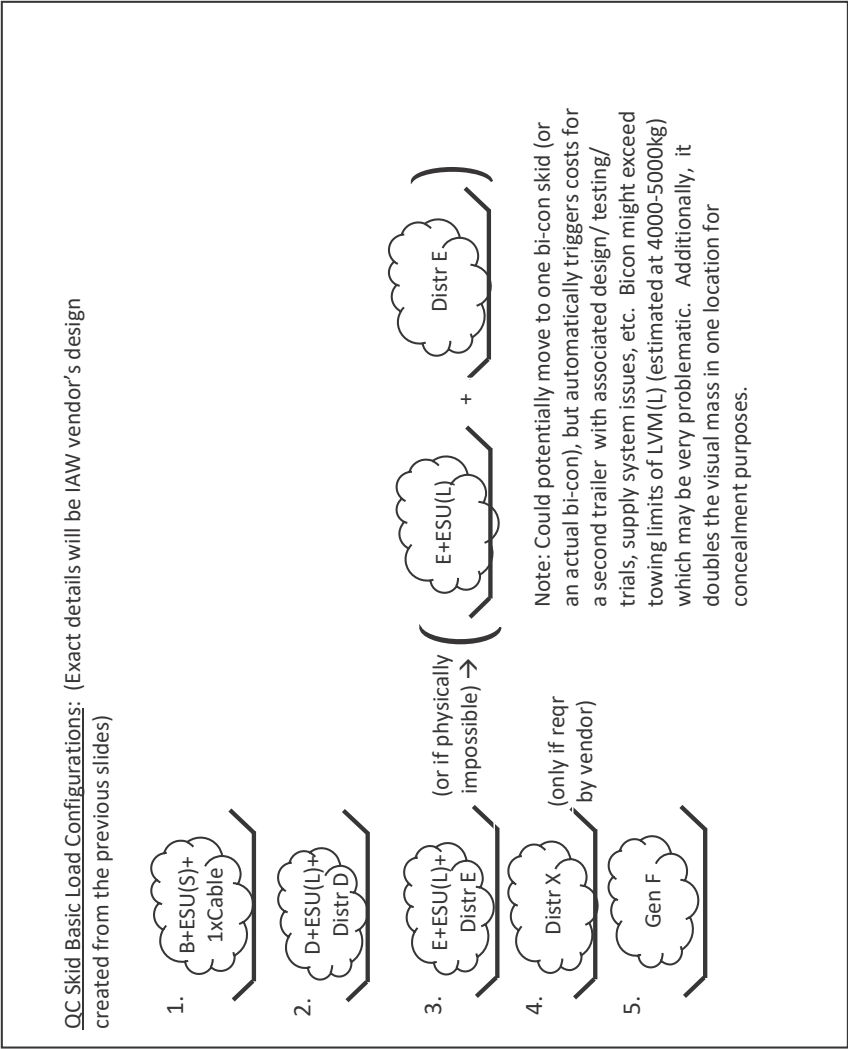
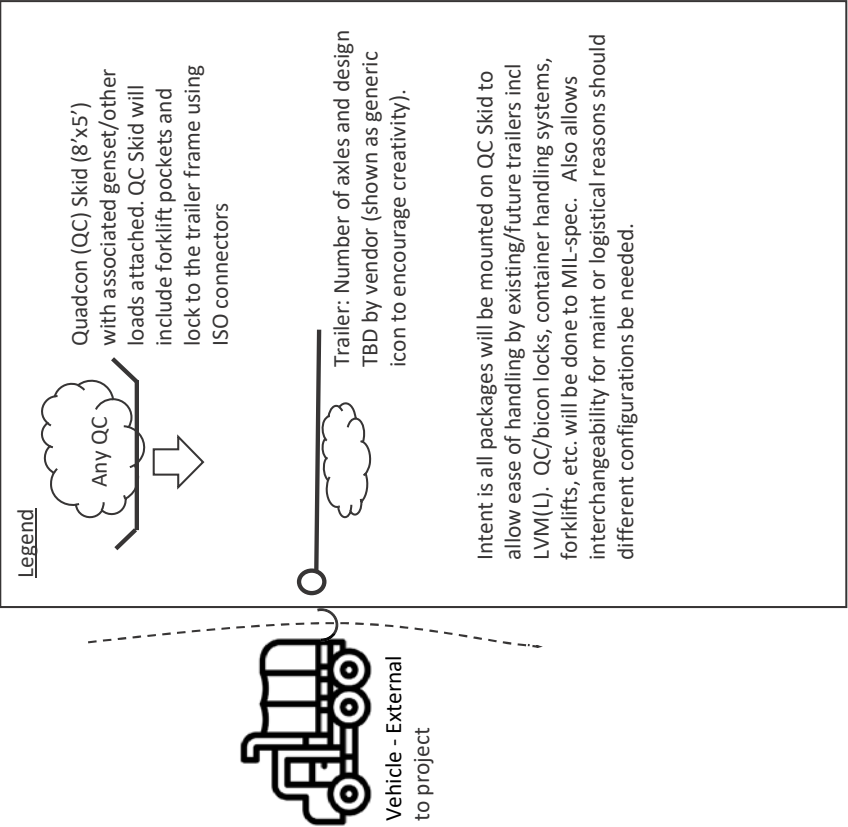
Design Considerations/Preliminary Thoughts

- The CMBG or Fd Hosp basic loads are already well served by the two Gen E Cornerstone packages described earlier.
- Additional power distribution and management is only needed to run the 10, 18, or 27 ECUs.
- While one micro-grid is preferred for the hospital, given its large size, running two smaller micro-grids is acceptable if it capitalizes on an existing solution, vice creating a unique solution that over 95% of other users will never be able to take advantage of.
- Load shedding is essential at this stage given the amount of users.
- The solution must also accept feeds from 'common' brands of rental generators (up to 60kW).

Ideal solution should use the same equipment already found in earlier slides

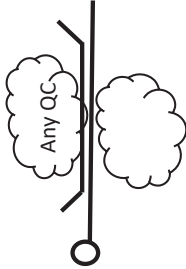
Transportation

Basic Load Configurations



Proposal #1

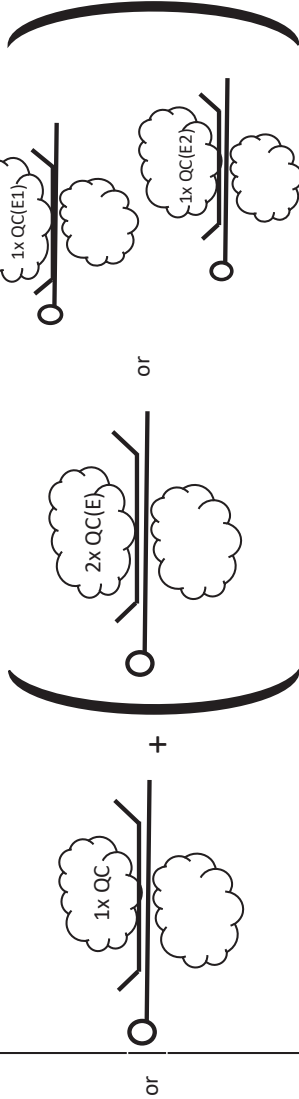
Scenario 1. All configurations can fit onto one QC skid. All trailers are identical.



Note: Distr X and Gen F are more likely to be carried by forklift and truck, vice TPS trailer, but the option does remain to use the trailers if they are empty/enough can be acquired.

Transportation Scenarios

Scenario 2. If Cornerstone E is too heavy or volume exceeds one QC skid (<10m³, though <7m³ is better for stability).
Proposed solution:



In both cases (as with solution #1), Distr X and Gen F are more likely to be carried by forklift and truck, vice TPS trailer, but the option remains to use the trailers if they are empty/enough can be acquired.

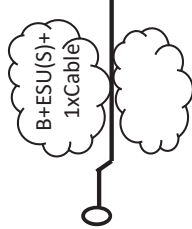
Majority of trailers are still 1x QC skid to haul the Gen B and D systems (no change from Scenario 1).

Some trailers are larger for the Gen E systems. Adv = self contained as one package.

Use 2x QC trailers. Adv = remains as one fleet (no addn design, testing, etc). Dis = If expensive, may force cuts elsewhere.

Proposal #2

Alternative Packaging Option: Put part of the Gen B fleet on commercial/ industrial trailers vice SMP trailers. (ESTIMATE = ABOUT 100 TRAILERS FROM A PROJECT TOTAL OF ABOUT 500)



(Representative Picture only)

Guidance: Primary users will be CA Reserves (est 100+ systems) plus some other users such as the RCAF. This trailer will still allow movement on all roads and limited off-road capability to support training and DOMOPs. A major advantage of hydraulic surge braking over airbrakes is that any pickup truck or the LUV(L) can tow small gensets. This cuts significant training time for the Reserves (no airbrake course, no driver wheeled course, etc) and allows more drivers.

Pricing should address the following two scenarios:

- 1) the Gen B+ESU(S) Combo is attached directly to the trailer; and
- 2) the QC skid with the Gen B+ESU(S) Combo is mounted the trailer

Serial	Equipment Summary Checklist	CONOPS to Industry Slide Reference
1	Generator A: 2-3.5 KW 120/240 V AC, 1 Phase, 60 Hz GAS	4
2	Generator A: 2-3.5 KW 120/240 V AC, 1 Phase, 60 Hz DIESEL	4
3	Generator B: 4-6 KW 120/240 V AC, 1 Phase, 60 Hz GAS	4
4	Generator B: 4-6 KW 120/240 V AC, 1 Phase, 60 Hz DIESEL; with Gen B Power Cable	4, 11
5	Generator D: 12-18 kW, 120/208V, 60Hz and 230/400V, 50Hz, 3Phase.	5, 6
6	Generator E: 25-35kW, 120/208V, 60Hz and 230/400V, 50Hz, 3Phase.	5, 6
7	Generator F: 50-70kW, 120/208V, 60Hz and 230/400V, 50Hz, 3Phase.	5, 6
8	Energy Storage Unit (Small)	4
9	Energy Storage Unit (Large) for Gen Large D	5, 6
10	Energy Storage Unit (Large) for Gen Large E	5, 6
11	D Distribution kit	8, 13
12	E Distribution kit	8, 14
13	X Distribution Kit (Power Distribution Management Module System)	8, 16, 17, 18
14	Proposal 1A - Militarized Quadcon-size framed Trailer	20, 21
15	Proposal 1B - Militarized Bicon-size framed Trailer (if applicable)	20, 21
16	Proposal 2A - Trailer with Gen B+ESU(S) Combo directly attached	20, 21
17	Proposal 2B - Trailer with the mountable QC skid for the Gen B+ESU(S) Combo	20, 21

Blank