Note: This document is intended to act as a guide and the format provided is not strictly enforced. The response should be provided based on industry best practice and comply with the Project Execution Plan (PEP) requirements

The PEP is the proposal statement of work and should therefore provide sufficient information to allow Defence to have confidence in the intended achievement and how it will be accomplished

Defence Innovation Hub
Innovation Proposal

P20-00002
Gallium Arsenide Photocathode for Night Vision Goggles

Project Execution Plan (PEP)

IMAGE OF TECHNOLOGY

Night Owl Vision Systems Pty Ltd
123 Canberra Street,
Albury
NSW, Australia 2640

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Approvals

Document Owner	Role	Signed Date
Jane Smith	Project Manager	

Document Approval	Organisation Role	Signed Date

Version Control

Revision	Date	Author	Change Description
0.1	XX XXX 20	Jane Smith	Initial draft for Defence Innovation Hub
0.2	XX XXX 20	Jane Smith	Updated for Defence Innovation Hub

List of Acronyms

ADF	Australian Defence Force
ADFA	Australian Defence Force Academy
CAD	Computer-Aided Design / Computer-Aided Drafting
CCG	Change Control Group
CEO	Chief Executive Officer
CoA	Commonwealth of Australia
CONOPS	Concept of Operations
COTS	Commercial Off the Shelf
CRADA	Collaborative Research and Development Agreement
DCAC	Defence Common Access Card
DIH	Defence Innovation Hub
DIP	Defence Innovation Partnership
DISP	Defence Industry Security Program
DPN	Defence Protected Network
DSN	Defence Secret Network
DST	Defence Science & Technology
DT&E	Developmental Test & Evaluation
EMS	Engineering Management System
FIC	Fundamental Inputs to Capability
GFX	Government Furnished Assets
IAW	in accordance with
ICT	Information and Communications Technology
IOC	Initial Operating Capability
IP	Intellectual Property
IPT	Integrated Project Team
IRaD	Internal Research and Development
NVG	Night Vision Goggles
NVIS	Night Vision Imaging System
PM	Project Manager
PMT	Project Management Tool
PPMS	Project Performance Management System
PRN	Protected Research Network
PSPF	Protective Security Policy Framework
QA	Quality Assurance
QC	Quality Control
QMS	Quality Management System
R&D	Research & Development

RAAF	Royal Australian Air Force
RMP	Risk Management Plan
SDR	Software-Defined Radio
SRA	Systems Requirement Analysis
SRN	Secret Research Network
SWaP	Size, Weight and Power
T&E	Testing and Evaluation
TD	Technical Data
TMP	Technology Maturity Plan
TPM	Technical Performance Measure
V&V	Verification & Validation
WBS	Work Breakdown Structure

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1 Achievement of Phase Objectives

Night Owl Vision Systems Pty Ltd is proposing to develop a Generation III Gallium Arsenide Photocathode for Night Vision Goggles (NVG) to increase visibility during low-light operations. The design is for the Army, Navy and Air Force, with the initial development focusing on helicopter pilots. When mature, the system will allow for increased light sensitivity, better image quality, lower image distortion and greater reliability. These improvements will provide pilots with greater visibility that they need for safe and effective night operations, which is not offered by any systems currently available.

The NVG capability development is scheduled to run over several phases. The intent of each phase is to incrementally mature the technology in order to identify and mitigate risk. The outputs from each will assist with progressing the technology in the next phase. The scope of each phase may evolve as the technology matures, risks are identified and further opportunities for innovation are highlighted. The phases are broken out as follows:

1. Phase 1 (current phase) - This phase of the project will advance the innovation from technical readiness level (TRL) 1 to TRL 3 by initiating concept exploration work and building on our prior research. The other objectives of this phase are:

    a. Work with Defence to further articulate and quantify the claimed benefits and enhancements in adopting the proposed innovation;

    b. Roadmap the path to proof-of-concept and greater technical maturity in a Defence context;

    c. Determine a possible integration pathway into Defence; and

    d. Further explore the feasibility of the innovation including development schedule.

2. Phase 2 - The phase will be initiated to provide a demonstration of the technology to Defence. This will require the construction of an immature prototype for demonstration in a laboratory environment. The performance characteristics will be demonstrated to showcase the capability of the device; and

3. Phases 3 and 4 will focus on prototyping the devices and will include more involvement from our partner in construction of the headset unit.

This document details the plan to realise the Phase 1 outcomes and objectives. This document is drafted in accordance with the Commonwealth's Project Execution Plan (PEP) requirements and in response to RFP P20-000002.

This PEP is intended to be the main management document for the innovation contract. The PEP will form part of the Contract Phase Statement (CPS) and is a living document that will need to be negotiated and amended as the project and technology advances.

2 Work Plan

2.1 Achieving Phase Requirements

In this section you should outline the planned project and engineering activities to meet the Phase Objectives.

Information: You may wish to present each of the Phase Objectives and the detailed engineering activities that you intend to perform that contribute to meeting these objectives.

This proposal has been developed by Night Owl Vision Systems to address the requirements from the Commonwealth of Australia (CoA) for a Phase 1 Concept Exploration. The project is based upon demonstrating the concept of NVG capabilities. Our approach is to achieve the project objectives described below. Night Owl Vision Systems has also developed milestones and Technical Performance Measures (TPMs) that are linked to completing these objectives.

Phase Objective 1: Work with Defence to further articulate and quantify the claimed benefits and enhancements in adopting the proposed innovation.

We will achieve this objective by engaging Defence in developing the Concept of Operations (CONOPS) through a series of systems engineering workshops lead by ExtraVision Defence Consulting. We expect clear outcomes for:

- Critical mission scenarios;
- Essential and desired benefits for helicopter pilots using Generation III NVG;
- Essential and desired improvements to existing NVG technology; and
- Common cockpit operational environment for NVG use.

Phase Objective 2: Roadmap the path to proof-of-concept and greater technical maturity in a Defence context.

We will achieve this objective through meetings with Defence personnel to understand the required testing structure for the NVG capability. We will also obtain input and feedback from other companies, suppliers and research organisations who have worked on developing helicopter products and headsets for Defence.

Phase Objective 3: Determine a possible integration pathway into Defence

As a part of the developmental and planning work, we believe that the Generation III NVG technology is primarily targeted towards helicopter pilots under the AIR 15 project, with integration in to the UH-1D helicopter. To support this, several integration activities are anticipated to be required before they are fully adopted. These integrations include:

1. Cockpit lighting – Compatibility of Generation III NVG data feeds with nominal Night Vision Imaging System (NVIS) used in AIR 15 vehicle cockpits. Specifically, the impact of the cockpit compatible lighting on the quality of the NVG image must be investigated. The aim is to ensure that the cockpit lighting does not decrease the quality of the NVG image but remains bright enough to enable the pilot to clearly see helicopter instruments and panel;

2. External lighting – Resilience of the NVG image when there are events of strobe lighting. The aim is to ensure that any strobe lighting does not cause the NVG to rapidly modify its gain and consequently distract the pilot; and
3. Training – Visual perception will vary based on the operating conditions and we would work with users to understand common issues with the new viewing power. In addition, using the goggles in conjunction with avionics will require training for pilots.

Phase Objective 4: Further explore the feasibility of the innovation including development schedule.

We will clearly articulate in the Technology Maturation Plan how we will progress the feasibility of the NVG technology including the development of a schedule for maturing the technology.

2.2 Work Breakdown Structure

Provide a work breakdown structure, which will provide a framework for Project planning, management and status reporting and for estimating costs, schedule and technical achievements at completion.

Information: The work breakdown structure should outline a hierarchy of subtasks branching from the project concept. The structure should contain at least three levels of division and if appropriate linked to section 1 Phase Objectives:

1. *Project concept/overall system (e.g. Unmanned Aerial System)*
2. *Major elements (e.g. Air Vehicle Design)*
3. *Subordinate components (e.g. Propulsion, Flight Control, and Airframe).*

Additional levels and branches should be included as necessary. An example of a work breakdown structure is provided below.

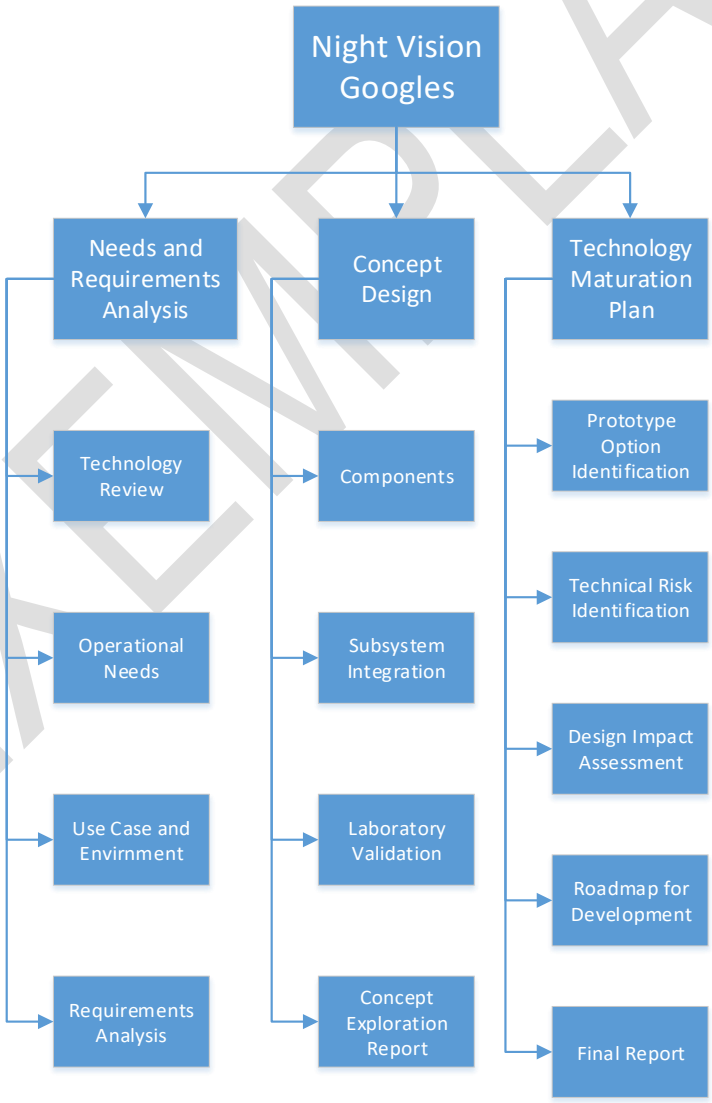
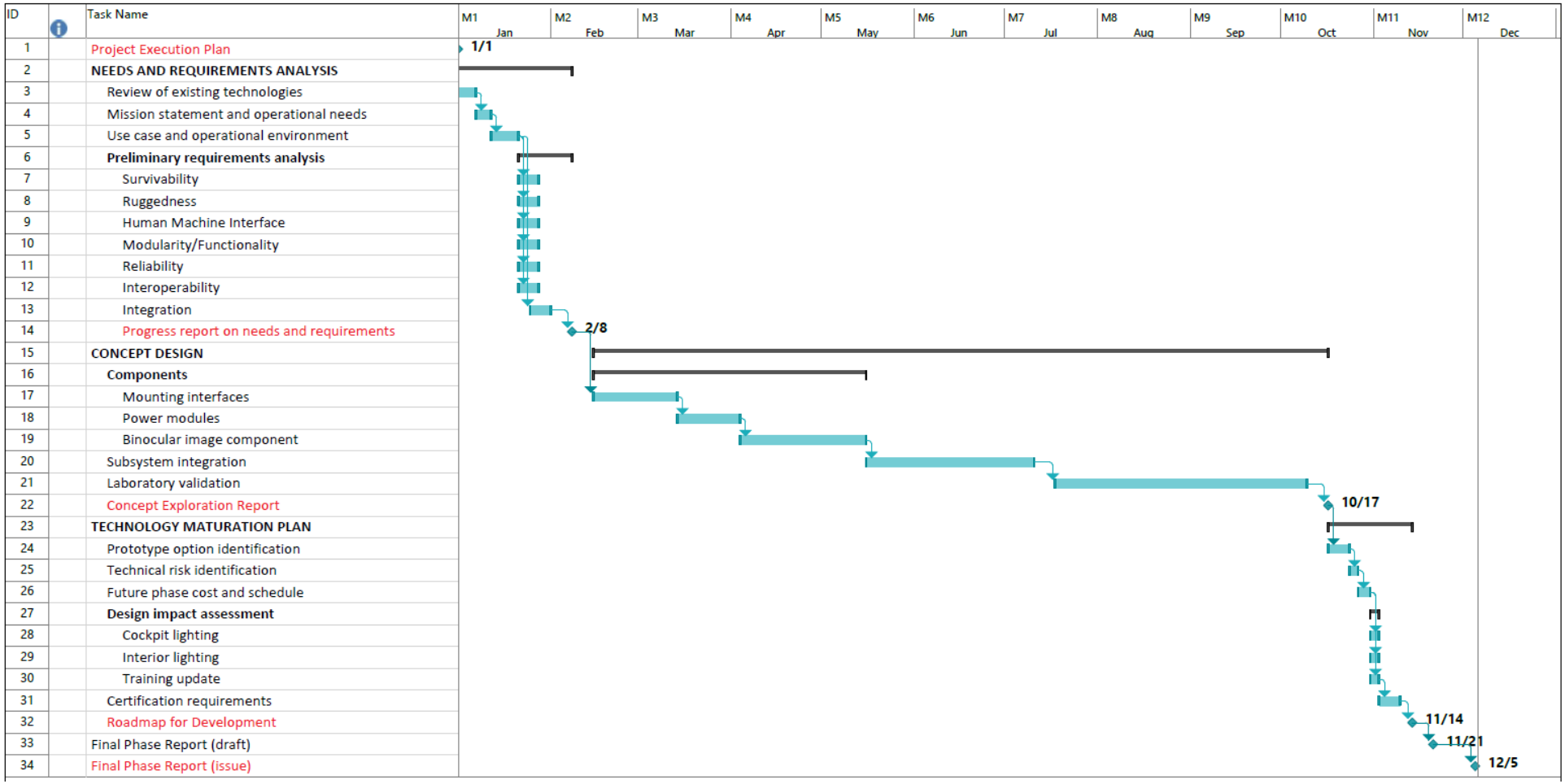


Figure 3 – Work Breakdown Structure

2.3 Project Schedule

Our Project Schedule, including milestone deliverables (highlighted in red), is illustrated in the Gantt Chart below:



2.4 Performance Management

Provide a description of how the Participant will monitor and manage their own performance of the work under the contract.

Information: Performance Management is a business practice to measure, analyse and manage performance in order to manage risk, monitor cost and schedule and identify areas for improvement. You may wish to describe any approaches adopted by your business, including Earned Value Management or monitoring cost and time through a master schedule. At a minimum, a list of Key Performance Indicators should be provided (e.g. on time delivery, completion within or up to target cost and scope and quality) that demonstrate how the participant will manage their own performance. The participant may also wish to describe their overall project management approach for the innovation, including identification of how and when project performance is reviewed, who is involved in those reviews and how the outcomes of those reviews are implanted/tracked and communicated to Defence as required.

The progress of the project work will be monitored and managed with the main items being:

a. Project Schedule;

b. Project Management principles and Earned Value Management techniques;

c. Meetings (project, technical, risk and financial);

d. Project Status Reports (Progress Reports);

e. Technical Performance Measures (TPMs);

f. Risk and Hazard Logs; and

g. Finance Systems.

ExtraVision has developed a Project Schedule using Microsoft Project 2016 for the Generation III NVG Project. The schedule will be the primary tool used to monitor and manage performance of work.

The Project Manager (PM) will liaise with the team to track progress against activities and TPMs. The PM will update the schedule weekly. Night Owl Visions' finance system (ERP) is used to track cost actuals and is updated fortnightly. The updated schedule together with the ERP data will be used to track the planned progress against actuals for schedules and costs. Earned Value Management (EVM) techniques will be used to monitor and control the performance of the project.

There are different levels of authority to deal with variance in the EVM score in terms of the budget and schedule. The PM has authority to deal with a 5% variance but if it is outside of this variance then it is escalated to the next authority level; the Project Director.

The Project Director is an important part of Night Owl Visions' assurance activities. The Project Director receives routine reports and attends Status Meetings on a monthly basis to ensure the project and risks are reviewed and active measures are

applied to managing issues. The Project Director can also apply more resources to the project as required.

We will appoint a Project Manager full time on this project. The Project Manager will be supported by a project team.

2.5 Configuration Management

Describe how you will establish and manage the configuration of technology and documentation.

Information: configuration management establishes and maintains consistency for project documentation. This is achieved through a management approach which outlines the organisational system for documentation including how it is labeled, stored, updated and released. The configuration management approach should identify the items (technology and documents) to be managed, outline the methods by which they are managed and the control processes necessary for coordination and control. The following items may be considered when describing the configuration management approach:

- *The labeling and numbering scheme for documents and files*
- *How the identification scheme addresses versions and releases*
- *How will items be released*
- *Number of libraries and the types*
- *Details of backup and disaster plans and procedures*
- *The recovery process for any type of loss*
- *How the information is retained: i.e. on-line, off-line, media type and format*

Night Owl Vision Systems maintains templates and configuration control of all documents in a Document Management System (DMS). The DMS is used to receive, track, manage and store documents and reduce paper. The system automatically keeps a record of the various versions created and modified by different users (history tracking). Emails are also stored within the system too.

The DMS contains all the templates and document history (up to 100 draft versions), as well as a unique registration identification number.

To assist finding and retrieving document, each document is labelled in the format [yyyymmmdd_v_a_b-Project_Number-Description]. The elements of these format are shown at Table *1*.

Table 1 - Document Naming Convention

Data element	Format
yyyy	4-digit year
mm	2-letter month
dd	2-digit day
v	Version
a	Major
b	Minor

For emails, a similar label format is used but includes the time that the email was sent (in 24-hour format), who the email was from, who the email was to and a description of the email.

We have a Quality Management System (QMS) in place that is ISO accredited. The QMS outlines the approval process (including versions and authorization to release documents), the backup of records and documents, disaster plans, all procedures (including security) and how the information is retained (including destroying of records and documents).

2.6 Risk Management

Provide details of a risk management process – which you will use for continued monitoring and management of technology risk profile (technological, developmental, production and market risks). Describe how you will identify, assess, mitigate, document and report Project risks and issues (relating to cost, scope, schedule, resources etc.)

Information: Risk management is an organisational process involving identification and classification of risks, and then development and implementation of risk mitigation strategies.

Identification of risks requires knowledge and understanding of both the project and the key stakeholders involved. A risk is any event that would result in negative consequences to the project if it were to occur. An example high level risk management process flow is shown below.

Figure 4 - Process Flow Risk Management

A risk register is a useful tool to identify and categorise key risks associated with the project. Risk mitigation strategies can be developed depending on the grading of risk, and their associated costs analysed. A risk register is also useful for communication regarding risk management for the project and mitigation strategies. The proposal would greatly benefit from the inclusion of a risk register.

An example risk register with corresponding risk scoring criteria is shown on the following pages.

Risk Scoring Criteria				
Likelihood of Impact:	**Level**	**Score**	**Description**	**Percentage**
	High (H)	6	More Likely to Happen Than Not	> 50%
	Medium (M)	4	Fairly Likely to Occur	20% - 50%
	Low (L)	2	Not Expected to Occur	< 20%

Severity of Impact:	**Level**	**Score**	**Description**	**Percentage**
	High (H)	3	Major effect on project	> 10%
	Medium (M)	2	Significant effect on project	5% - 10%
	Low (L)	1	Minimal effect on project	< 5%

Table 1 - Risk Scoring Criteria

Risk Identification Guidance	
Risk Score	The overall risk score is defined as the following: "Likelihood Value" x "Severity Value" The maximum risk score possible will be: 6 x 3 = 18.
Risk Identification:	Methods: Brain storming with team, individual interviews, design review, checklists, commercial review, review of assumptions list / issues list, FMEA analysis, etc.
Risk Description:	A description of the uncertain event that might happen during the programme.
Risk Cause:	A description of the likely cause of the uncertain event.
Risk Impact:	If the event occurs, describe the impacts of the risk on the project in terms of time or delivery delay, project cost increase, performance of the equipment / service. Not all of the risks will impact in all three areas.
Scoring Criteria:	Check guidance % against actual total project cost and time and enter actual cost and time values for judging H, M, L.
Risk Priority	Select all risks and sort data on Risk Score. This is one method of determining risk priority. You need to check the validity of risk priority by reviewing the risks with the team. Look for perceived important risks low in the register and perceived unimportant risks high in the risk register.

Table 2 - Risk Identification Guidance

Risk ID		Risk Description		Impact Description			Risk Score	Risk Owner	Risk Reduction / Mitigation Measures		Category	Date Raised
Guidance	Use unique 2 or 3 word concise title.	Describe the event that has a probability of effecting the project e.g. If 'X' happens…..	Describe the cause behind the risk.	If 'X' happens then describe the effect 'Y' here.	Likelihood of Impact	Severity of Impact	Likelihood x Severity	Named individual (or a company – see note 1)	What are you going to do about it?' List possible mitigation actions	Either an individual (preferable) or a company.	Project specific categories where appropriate.	What date was the risk raised/closed?
e.g.	Loss of key personnel	SME leaves	Staff turnover	We lose the technical direction of our resident expert	L	H	6	PM	Create a resilient team - identify alternatives for all key positions; if no credible alternative exists internally, identify external options. Create a culture of knowledge transfer so not reliant on key individuals. Work with line managers to make sure staff are fulfilled and happy with their work	PM	Please enter any specific categories e.g. resources, scope, schedule, cost.	Raised: 01/01/2019
e.g.	Subcontractor Availability	Key subcontractors are unavailable	Commitments to other Defence projects LAND123.	We lose the ability to complete design of X	L	M	4	PM	Identify alternate subcontracts that are able to complete the work. Ensure weekly project meetings with subcontractor with an outline of progress to time, cost and schedule.	PM	Resources	01/01/2019
1	…						0					
2							0					
3							0					
4							0					

Table 3 - Example Risk Register

Note 1: If team members have not yet been identified then a position should be input temporarily and updated once individuals have been appointed. The use of a company name is not acceptable contractually and will need to be replaced with an individual's name before a contract can be agreed.

2.7 Project Location

Provide details of the location of work being undertaken to develop the Technology and deliver the Project.

Indicate what and how much work is being done where.

All prior research on Gallium Arsenide cathodes has been performed in Australia by Night Owl Vision Systems Pty Ltd. Future manufacturing and development will occur in Night Owl Vision Systems' manufacturing facilities in Albury, NSW.

We will engage ExtraVision Defence as a sub-contractor for the purposes of managing the project as well as leading the systems engineering activities and engagement with Defence. ExtraVision is a Sydney based professional services firm with experience in supporting organisations in conducting projects through the provision of staff with Project Management (PM) and Systems Engineering (SE) experience and skills.

Concept development, design and prototype development will all be performed in Australia. Support will be provided by US Optics Headsets Pty Ltd, in the United States, for the development of the head mount unit. Night Owl Vision Systems has an established partnership with US Optics Headsets Pty Ltd. All remaining work (including the design and manufacture of the binocular units) will be performed in Australia.

Additionally, the use and operation of NVG headsets for helicopter pilots will generate a unique training requirement, resulting in the upskilling and training of a large group of Defence personnel.

2.8 Security Management

Describe the Participant's approach to security management.

Information: Security management describes the policies for identification and protection of an organisation's assets. You may wish to consider the following:

- *DISP Accreditation - the Defence Industry Security Program (DISP) is a program which ensures the Defence industry maintains its security responsibilities and safeguards the supply chain. A business may be required to maintain a DISP membership under certain circumstances.*
- *Security Clearance - A security clearance is a status granted to individuals allowing them access to classified information and resources after completion of a series of thorough background checks.*
- *Office Access - provide details of all personnel with office access for the duration of the project, or of how access to office premises is managed.*

- *Security of Documentation - provide details on the storage of secure documents during the project, and the process for the disposal of secure documents.*
- *Indicate what security measures you consider necessary to deliver the project and how you will put the required security measures in place.*

Note: Defence will advise if DISP Accreditation and Security Clearance are required. Respondents should advise if either are held for another Defence contract, quoting applicable references. Here is a link to the DISP website

Night Owl Vision is aware of the clearance process and the associated timescales. The work scope for the current phase is specifically designed to minimise the need for handling any information above this classification. We are conscious that as the project will progress beyond Phase 2 development, the use of classified information, currently expected to be up to SECRET, will become inevitable.

Our office in Albury is accredited to the storage and processing of information up to FOUO, as we have needed for large Government projects. Three of our recent hires are ex-Defence personnel, and our intention in hiring these personnel is to capture more Defence activity. We will select support team members with at least basic clearance for this phase, with the intention to progress their NV1 clearance applications (as necessary) to coincide with the next phase of development.

Our sub-contractor, ExtraVision has an Australian workforce that is fully cleared to at least NV1.

Our company Security Officer, Mr. Adam Watson, is highly conversant with the physical and procedural requirements. Upon award of this contract, Night Owl Vision Systems will initiate discussions with DISP to ensure our facility will be ready for future work on completion of the current phase of work.

3 Resources

The PEP must identify the resources that the Participant will deploy to deliver the Project and develop the Technology during this phase.

3.1 Personnel (including subcontractors)

Provide details of all personnel involved including third party involvement.

You may wish to provide an organisational chart, showing the members that will be involved in the project. Details of their experience and role within the project should also be provided. Note that Defence Personnel should not be listed here and any collaboration with Defence should be indicated at section 5.

We will institute a PMO that will host the following key roles. These roles are yet to be filled but personnel are to be nominated from both Night Owl Vision and ExtraVision Defence.

Role	Required skills and experience	Responsibilities
Project Manager	• A Certified Practising Project Manager (CPPM) with over 10 years' experience in project management • Delivered projects worth over $5m	• Project Oversight; • Direct Point of Contact with Defence and subcontractor; • Review of deliverable compliance to QMS; • Risk management; • Commercial matters; and • Project deliverables.
Engineering Manager	• A Certified Practising Engineer (CPEng) with over 20 years' experience in engineering • 10 years' experience managing a team of engineers • PRINCE2 Qualified • Engineering Manager for large projects of $3m	• Designing compliance control; • Participating in design and project reviews; • Reviewing and approving of the design Request for Information; • Reviewing of drawings and design input and output data; and • Reviewing of Verification and Validation (V&V) activities.
Design Engineer	• PhD in material science • CPEng • 15 years of industrial design experience	• Controlling engineering design activities inside and outside of the Albury laboratories;

	• Lead developer of the photocathode and tubes • Lead designer of our Phase 1 work	• Managing the configuration of technical data; • Preparing and implementing Inspection and Test Plans (ITP) and the V&V program; • Preparing and implementing engineering data for and participating in Design Review meetings; and • Supervising the safety engineering aspects of the design.
Production Manager	• over 15 years' experience in production or manufacturing environment • 5 years' experience as a production manager	• Liaise with Engineering and Project managers to generate objectives and understand requirements; • Key input to estimate costs and prepare budgets; • Organise workflow to meet specifications and deadlines, including time sensitive outputs; • Monitor production to resolve issues; • Determine amount of necessary resources including personnel and assets; and • Approve purchasing of equipment and facilities.
Quality and Safety Manager	• Certified in WHS and H&S training • 10 years' experience in supply chain and quality assurance • 8 years' experience in safety systems	• Understanding the customer expectations and needs of the product. • Developing the quality control processes within the project; • Aligning the project quality control processes with the company's Safety and Engineering management systems; • Designing product specifications;

		• Monitoring and evaluating the quality of internal production processes; • Evaluating the final output of products from suppliers and the company to determine their quality; • Rejecting products that fail quality standards; • Quarantining fail products and components so that they are not used in the final system; • Reporting to the PMO on quality standard issues; and • Improving production efficiency and quality.

3.2 Capital

Describe the tools, equipment, machinery, and buildings that will be utilised to deliver the project.

3.3 Financial Resources

Detail the financial resources which will be used for the project.

Full details of how the proposal is to be funded should be listed here. E.g.: what percentage of funding is formed by this innovation bid, financial resources to be contributed by the respondent, financial resources to be committed by partners / other companies. Leverage of resources committed to other projects which will support this proposal could also be referenced.

3.4 Intellectual Property (IP)

Provide details of any IP that is significant in relation to the development of the Technology, but which is not being provided by the Participant or a Subcontractor.

Full details of IP involved in the proposal should be included here. E.g., if there is background IP it should be clearly described. IP to be created as a result of the work undertaken under this proposal should be identified, described in detail and intentions for its treatment listed. IP logging and schedule processes should also be listed, as well as intentions relating to updates in IP development and contractual compliance.

All significant Intellectual Property (IP) in relation to the development of the NVG capability will be made available to the CoA for the purposes of this project. The IP rights will also apply to any subsequent development and commercialisation of the technology.

The IP is currently protected through trade secrets including device concept, design and internal fabrication know-how. The IP created in this work will relate to laboratory (physical) validation of the innovative gallium arsenide photocathode for improved image quality.

3.5 Relevant Third Party Relationships

The PEP must describe any commercial relationships between the Participant and third parties associated with resourcing (including financial), development, distribution or marketing of the innovation. These relationships may include joint ventures, sub-contracting arrangements, and marketing intermediaries or investors with influence over the direction of the innovation. The PEP will describe how these relationships will be managed including with respect to performance and reporting.

There will be two third-party relationships during this phase of the project. Night Owl Vision Systems has a current Non-Disclosure Agreements (NDA) with ExtraVision Defence and US Optics Headsets Pty Ltd.

ExtraVision Defence will be sub-contractor for the purposes of managing the project as well as leading the systems engineering activities and engagement with Defence.

ExtraVision is a Sydney based professional services firm with experience in supporting organisations conduct projects through the provision of staff with PM and SE experience and skills.

Support will be provided by US Optics Headsets Pty Ltd, in the United States, for the development of the head mount unit. US Optics Headsets Pty Ltd is a US based company, specialising in the design, integration and manufacture of head mount units for helicopters. It will be a key subcontractor in the continued development of the NVG capability.

4 Commercialisation Planning

The PEP must describe how the Participant intends to commercialise the proposed innovation and monetise the value created by the Technology. The PEP must contain details of planning for other potential markets and opportunities for both the Participant and Defence to realise returns on investment. The PEP must describe how the Participant will assess and review any cost and schedule drivers that may influence selection of the preferred technology solution.

Note: for Phase 1 and 2 proposals a broad description of the intention to commercialise the final product should be provided. For Phase 3 and 4 proposals a detailed commercialisation approach and plan should be provided.

Factors to consider and detail:

- *Value proposition*
- *Market opportunity*
- *Future investment*
- *Value over time*
- *Competitor analysis*
- *Management capability*

4.1 Development Timeframe / Approach

Note: for Phase 1 and 2 proposals an outline of the overall timeframe with main development phases should be provided. For Phase 3 and 4 proposals a more detailed description of work completed to date and the scope of remaining phases with associated timescales should be provided.

The timeline for the full program to demonstrate the proposed capability is planned as follows:

Phase 1: Concept Exploration Phase is the subject of this current DIH application and aims to explore the NVG concept (Generation III) and build on our prior research. A 12-month program is proposed to establish concepts for a future Phase 2 demonstration project. The work will be undertaken by approximately 2 full-time equivalents staff over this period and the rough-order of magnitude (ROM) costs are $600,000;

Phase 2: Technology Demonstration Phase will provide a demonstration of the technology to Defence. This will require the construction of an immature prototype for demonstration in a laboratory environment. The performance characteristics will be demonstrated to showcase the capability of the device. This phase of work is expected to take 12-months at a cost of $1M.

Phase 3 and 4: will focus on prototyping the devices and will include more involvement from our partner in construction of the headset unit. A phase 3 project is expected to take 18-months at a cost of $1.5M. The phase 4 project will focus on prototyping in an operational environment, with refinement of the design to produce a full working prototype which will be tested and verified against the performance specifications.

4.2 Approach to Certification / Accreditation

Note: Not usually relevant for Phase 1 and 2 proposals but must be addressed for Phase 3 and 4 proposals.

5 Collaboration with Defence

The PEP must detail the Participant's expectations with respect to any involvement by Defence personnel including stakeholder engagement (or use of Defence resources) to help deliver the scope of work for this phase.

Access to Defence personnel, for any kind of engagement including stakeholder engagement, user needs assessments and user trials should be detailed in this section.

For requirements definition we request that helicopter pilots, representatives from AIR15 and Defence commanders and support personnel will be available to attend stakeholder meetings; and attend site visits to our facilities for half day demonstrations.

Further engagement of Defence stakeholders will be in quarterly review meetings at our office in Albury. We expect this will include relevant representatives from the Defence Innovation Hub and the AIR15 Program Office.

5.1 Government Furnished Assets (GFX)

Provide details on Government Furnished Equipment, Facilities, Information, Material, Property and/or Software required. Include clear description/specification, as it applies, of the following:

- quantity required;
- justification of need;
- when are they required during the project and for how long;
- how they will be managed and used throughout the project;
- whether there are suitable alternatives not requiring Government Furnishing; and
- impact on project if Government Furnished Material is not available.

Government furnishing describes Equipment, Facilities, Information, Material, Property and/or Software required that the participant requires from Defence for the purposes of achieving the goals of the project. An example includes access to Defence ranges or engineering drawings. It is critical that descriptions/specifications are provided against each; quantity, justification, when are they required during the project and for how long, how they will be managed and used throughout the project, whether there are suitable alternatives not requiring Government Furnishing and impact on the project if Government furnishing is not available. Failure to provide an appropriate level of detail will result in delays throughout the process.

An example Government Furnished Assets table is shown on the next page.

Below in Table 4 are the Government Furnished Assets that will be required for this project.

GFX Description	Quantity	Justification	Period required for	Management and use	Non GFA alternatives	Impact due to non-availability
Extant helicopter pilot head-unit and NVG equipment	1	Inspection of existing asset for understanding and benchmarking.	Jun – Dec 2021	ExtraVision and Night Owl Vision to make note of geometry, dimensions, features / user interface / performance.	Technical manuals	No tangible inspection of existing equipment for understanding. Best information is from word of mouth / documentation.
Helicopter cockpit	2	Inspection of at least two helicopter cockpits for understanding and benchmarking.	Jun – Dec 2021	ExtraVision and Night Owl Vision to make note of geometry, cockpit envelope/ features / user interface / lighting performance.	Technical manuals	No tangible inspection of existing equipment for understanding. Best information is from word of mouth / documentation.

Table 4 - Example Government Furnished Assets Table

6 Australian Industry Capability

The Participant must identify whether and how the Project will help build Australian defence industry capability (including skill development and other opportunities for Australian companies). The Participant must detail any other measures that will:

- Help develop Australian industry capability (detail your definition and/or interpretation);
- Foster innovation in the sector;
- Boost productivity;
- Increase Australian jobs;
- Develop new or existing Australian skills;
- Contribute to sovereign industry capability;
- Increase the capability of industry as a Fundamental Input to Capability.

This project will build Australian defence industry capability by creating an innovative and unique Generation III Gallium Arsenide Photocathode for Night Vision Goggles (NVG) to increase visibility during low-light operations. This is a major R&D opportunity and material science innovation that can instigate a new industry.

To that end Night Owl Vision and our sub-contractor will develop Australian Defence industry capability and capacity through expansion of existing Australian facilities and staff recruitment and training in Australia. Areas of contribution include engineering, design, test and production whereby the companies will focus on developing their core service offering primarily to sustain the existing workforce or grow. The end goal is to create a design and manufacturing capability that can confidently apply this innovation to other platforms within the Australian and allied defence forces.

This project will promote increased collaboration between Night Owl Vision Systems Pty Ltd, ExtraVision and US Optics Headsets Pty Ltd.

Night Owl vision will perform the research on gallium arsenide cathodes. Future manufacturing and development will occur in Night Owl Vision Systems' manufacturing facilities in Albury, NSW. The University of Albury may be called for continued collaboration as extension to the R&D they have already completed with us.

ExtraVision is a Sydney based professional services firm with experience in supporting organisations conduct projects through the provision of staff with PM and SE experience and skills. ExtraVision has experience in the management of R&D projects, having supported Australian industry with the development and delivery of Defence Innovation Hub (DIH) submissions and projects. Its recent clients include: XXX, YYY, and ZZZ.

US Optics Headsets Pty Ltd will provide support for the development of the head mount unit.

Additionally, the use and operation of NVG headsets for helicopter pilots will generate a unique training requirement, resulting in the upskilling and training of a large group of Defence personnel.

7 Technical Performance Measures (TPMs)

Provide a set of TPMs for the proposed scope of work and the commensurate technology maturity and complexity. Describe how the Participant will monitor the TPMs.

Information: Technical Performance Measures (TPMs) are metrics that allow the Participant and Defence to monitor how well a system is satisfying its requirements (especially program critical requirements) or meeting its goals. The key performance measures of the system should be identified and assessed. TPMs may include: power, weight, speed, accuracy, reliability, availability, response time, throughput, and human factors. TPMs are a useful way of tracking the technical health of the project and where trade-offs in system design are required.

TPM	Upper Threshold	Lower Threshold	Target Value	How will it be monitored?
Signal to Noise Ratio	26	19	26	Use phototube method during laboratory tests in Phase 2.
Light gain	85000	20000	80000	Systems verification in Phase 3/4using Radiometer to verify the luminance levels at NVG input and output
Image Resolution	45 lp/mm	72 lp/mm	72 lp/mm	Systems verification in system trials and measured as is within cockpit environment in Phase 3/4
Viewing distance	400m	200m	300m	Projected to full-scale, based on test results at target Light gain, Image Resolution and SNR.
Weight	Weight of existing +0.5kg	Weight of existing - 0.5kg	Weight of existing +0.5kg	Digital scale at every major design gate

Table 5 - Example TPMs

7.1 Reporting of TPMs

Describe how achievement or variation from the TPMs will be reported by the Participant to Defence.

8 User Needs and Requirements

8.1 Understanding of User Needs

Detail the Participant's understanding of the Defence user needs with respect to the proposed innovation.

User needs are not related to potential solutions and should articulate the high level expectations of the system in terms of objectives, environment and constraints, clearly identifying benefits to be delivered. They are normally defined from the perspective of the end-user, however, the respondent should detail any initial understanding of Defence needs through discussions or research with Defence.

An example of a user need for a new backpack may be "The backpack system shall assist in distributing loads evenly around the torso to allow for longer active wear time during deployment".

Australia's allies are swiftly advancing night vision technologies for a changing physical threat environment. These technologies are making headlines as they allow next generation functions for the user. Military operations are increasingly being conducted in low-light and night conditions, involving surveillance and reconnaissance, search and rescue, surgical operations. It is in Australia's interest to maintain operational effectiveness with allies, as well as in the face of adversaries who are seen to be operating across rough terrain and in the dark more regularly.

Night vision technologies have been under development for over five decades and are a critical military advantage for modern warfare. During this time NVG performance has accelerated to provide the user maximum exposure and clarity in low-light conditions. However, it is also noted that equipment has changed with every evolution of head-units, causing disruptions to user training and increasing cognitive loads on pilots in flight. Each iteration has required the pilot to re-learn use of the head-unit and adjust to their mission experience.

The innovation aims to significantly advance the viewing power and situational awareness for a pilot, but without the need for any major equipment overhaul nor extensive training changes. We have targeted the photocathode, a single key component of the NVG, and believe that performance can be evolved by employing a bespoke material.

It is our intention to maximise performance and minimise the burden on the pilot but not changing existing head-units. Moreover, it is our intention to ensure that Generation III NVG are compatible with AIR15 helicopter cockpits and avionics systems. Our long-term objective is to integrate the Generation III NVG technology to wider Defence platforms across the services.

8.2 User Communication

Detail how the Participant intends to work with Defence users to continually align the innovation to the user need (this may reference any collaboration with the relevant Defence section).

During our Phase 1 work, we will establish a PMO which will employ key persons from Night Owl Vision and ExtraVision Defence to establish and maintain a relationship with AIR15, DIH representatives and key Defence personnel, whilst overseeing compliance of the project throughout its life. We will continue to offer demonstration bi-annually to exhibit progress and outcomes so that the PMO may understand compliance against changing Defence needs and interests. Monthly progress reports and quarterly progress meetings will be facilitated at our Albury office to include Defence stakeholders.

8.3 Requirements and Specification Artefacts

Identify requirements and specification artefacts that already exist or are otherwise intended for development.

Requirements and specification definition form the first critical Stage 1 of our Phase 1 scope. We understand the importance of this Stage in making sure our bespoke solution is fit for purpose for Defence operations. ExtraVision Defence is highly experienced in this domain and will lead the stakeholder engagement to ensure that the requirements and specifications are relevant, coherent and measurable.

8.4 Requirements Development

Describe how systems requirements and specifications will be adapted as Defence user needs evolve and mature.

Describe the relationship between test planning documents and requirements artefacts.

The PMO will be responsible throughout the project life to ensure that the research, testing, design and development is continuously aligned to the changing Defence needs and interests. The diverse skills and experience within the PMO (engineering, production, design and quality) will enable a holistic approach to the development of the systems requirements and specifications from Defence. The requirements and specifications will be reviewed to ensure that Defence's needs are maintained and that the documents are up to date. As per our document controls, different versions of these documents will be traceable and kept for the life of the project.

9 Systems Engineering Management

To support systems engineering management for this Phase, the PEP must detail the Participant's approach to facilitating the following Systems Reviews: Requirements Reviews, Design Reviews and Test Readiness Reviews. There should be close linkage between the project schedule, work breakdown schedule and systems engineering management.

The PEP must include detail of the Participant's System reviews, including entry and exit criteria, attendees, the Participant's nominated chair, decision makers and corrective action process.

The PEP must identify the Technical Documents and products under Configuration Control and a Configuration Control Board (CCB) (or equivalent) in place (with or without Defence representation as appropriate), which the Participant intends to use for technical decision-making.

Entry and exit criteria for each review must be identified and described.

Guidance can be found at ISO/IEC/IEEE 15288:2015, see https://www.incose.org/about-systems-engineering/se-standards or the

INCOSE Systems Engineering Handbook https://www.incose.org/products-and-publications/se-handbook

Entry criteria are minimum accomplishments that must be achieved prior to initiating the review process.

Exit criteria constitutes a series of accomplishments that must be achieved in order to progress to the next stage of the project. Each review requires different entry/exit criteria in order to progress. An example of criteria is provided at table 2 below.

Note the Innovation Contract includes further guidance on requirements driven by the innovation phase to be undertaken. The examples below should be read in combination with those requirements and tailored accordingly.

Please note, Defence attendance at reviews is subject to operational requirements, and may be by teleconference at Defence's discretion.

The following is required for each review.

Requirement Reviews	
Entry criteria	*Functional requirements identified; Indicative performance measures documented* *Functional requirements linked to Participant's defined User Need*
Exit criteria	*Functional requirements are agreed to by Defence*
Attendees	*Participant personnel as required* *Capability Sponsor (or delegate as appropriate)*

	DI Hub representative
Nominated Chair	*Participant Engineering Manager*
Decision makers	*Participant Engineering Manager* *Capability Sponsor*
Corrective action process	
Technical documents and products for decision making	*Documentation required under the Innovation Contract prior to requirements review.*
Design Reviews	
Entry criteria	*Requirements traceability / verification matrices.* *Hazard analysis contributing to system safety program, including disclosure of design actions undertaken to eliminate or mitigate risks SFARP.* *Evidence that requirements informing procurement or manufacture of supplies are adequately defined and documented.* *Configuration management of design during development.* *Supporting procedures, plans or instructions have been defined – and where necessary – developed and approved.* *Actions from SRR are complete.* *Actions from previous design reviews (if applicable) are complete.*
Exit criteria	*Agreement that the design is in a state to proceed to manufacture / fabrication / build.* *Agreement with the approach to collecting design verification evidence.*
Attendees	*Participant personnel as required* *Capability Sponsor (or delegate as appropriate)* *DI Hub representative* *User representatives* *Test SMEs*
Nominated Chair	*Participant Engineering Manager*
Decision makers	*Participant Engineering Manager* *Capability Sponsor*
Corrective action process	
Technical documents and products for decision making	
Test Readiness Reviews	
Entry criteria	*Test Plan* *Safety Management Plan / Risk Management Plan for test activity*

	Actions from previous reviews completed
Exit criteria	*Agreement with outcomes of planned test* *Agreement with test outline, personnel supporting, method and schedule* *Agreement to provide requested GFM* *Agreement with management of safety risks for planned test*
Attendees	*Participant personnel as required* *Capability Sponsor (or delegate as appropriate)* *DI Hub representative* *Test SMEs – relevant to capability* *Representative users*
Nominated Chair	*Participant Engineering Manager*
Decision makers	*Participant Engineering Manager* *Capability Sponsor*
Corrective action process	
Technical documents and products for decision making	

Table 7 – Requirements Review: An example of criteria

10 Safety Management

This section is focused on understanding the respondents approach to managing system safety during the innovation activity. System safety is a discipline that seeks to identify hazards and assess and mitigate associated risks encountered in the development, test, production, use (including use by the intended operator, storage, transport, actions required to configure the system prior to use), and disposal of defence systems. It considers the hazards to all people who may be affected by the realisation of a safety risk during the systems lifecycle.

10.1 Safety Requirements

Describe the safety requirements and internal safety standards/processes implemented/to be implemented. The PEP must also include an initial Safety Risk Assessment applicable to the proposed activities under this phase. This risk assessment will be used to determine the level of rigour required in the management of safety within this phase.

10.2 Hazard Analysis

Describe the planned process for hazard analysis.

A hazard is any real or potential condition which could cause harm to any person. Uncontrolled hazards pose a risk of injury and should be identified and controlled accordingly. The hazard management system should consider safety hazards that exist across all activities that will be undertaken during the innovation phase. It should include design related hazards, functional hazards and operational hazards to personnel across the lifecycle.

An example of a hazard register with corresponding risk assessment matrix is shown below. The Severity Categories table, Probability Levels table, and the Risk Assessment Matrix have been taken directly from Military Standard 882E[1] (an industry standard).

Severity Categories			
Description	**Severity Category**	**Mishap Result Criteria**	
Catastrophic	1	Could result in one or more of the following: death, permanent total disability, irreversible significant environmental impact, or monetary loss equal to or exceeding $10M	
Critical	2	Could result in one or more of the following: permanent partial disability, injuries or occupational illness that may result in hospitalisation of at least three personnel, reversible significant environmental impact, or monetary loss equal to or exceeding $1M but less than $10M	
Marginal	3	Could result in one or more of the following: injury or occupational illness resulting in one or more lost work day(s), reversible moderate environmental impact, or monetary loss equal to or exceeding $100K but less than $1M	
Negligible	4	Could result in one or more of the following: injury or occupational illness not resulting in a lost work day, minimal environmental impact, or monetary loss less than $100K	
Probability Level			
Description	**Level**	**Specific Individual Item**	**Fleet or Inventory**
Frequent	A	Likely to occur often in the life of an item	Continuously experienced
Probable	B	Will occur several times in the life of an item	Will occur frequently.
Occasional	C	Likely to occur sometime in the life of an item	Will occur several times.
Remote	D	Unlikely, but possible to occur in the life of an item.	Unlikely, but can reasonably be expected to occur.
Improbable	E	So unlikely, it can be assumed occurrence may not be experienced in the life of an item.	Unlikely to occur, but possible.
Eliminated	F	Incapable of occurrence. This level is used when potential hazards are identified and later eliminated.	Incapable of occurrence. This level is used when potential hazards are identified and later eliminated.

Table 8 – Hazard Categories and Probability Indicators

RISK ASSESSMENT MATRIX				
SEVERITY / PROBABILITY	Catastrophic (1)	Critical (2)	Marginal (3)	Negligible (4)
Frequent (A)	High	High	Serious	Medium
Probable (B)	High	High	Serious	Medium
Occasional (C)	High	Serious	Medium	Low
Remote (D)	Serious	Medium	Medium	Low
Improbable (E)	Medium	Medium	Medium	Low
Eliminated (F)	Eliminated			

Table 9 – Risk Assessment Matrix

Note: This Risk Assessment Matrix has been provided as an example and along with other safety management and hazard analysis guidance in this document is taken directly from Military Standard 882E[1] (an industry standard).

Hazard Register Example*												
ID	**Hazard**	**How might they be harmed?**	**Unmitigated Risk**			**Existing Controls**	**Action Required**	**Mitigated Risk**			**Completion deadline**	**Completion Date**
			Hazard Severity	**Probability**	**Risk Matrix Outcome**			**Hazard Severity**	**Probability**	**Risk Matrix Outcome**		
1	Trips	Potential injury from tripping and falling	3	C	**Medium**	Wear appropriate PPE. Use designated walkways	Inform personnel of potential hazard	3	C	**Medium**	Ongoing	
2	Electricity	Electrocution could occur	2	C	**Serious**	Electrical insulation.		2	C	**Serious**	Ongoing	
3	Chemicals	Skin contact, inhalation or ingestion of toxic chemical may cause harm	4	D	**Low**	Labelling of toxic chemical materials. Requirement to wear PPE.	Brief staff on procedures if contact with chemical occurs	4	D	**Low**	Ongoing	
4	Faulty equipment	An individual using the equipment may be harmed if the fault results in injury	2	B	**High**		Tagging and removal of faulty equipment from site	2	F	**Eliminated**	10/11/18	8/11/18
5	Loss of separation	System physically strikes a member of the test team	2	D	**Medium**	Geo – fencing	Operate behind safety barrier. Increase separation distance.	2	E	**Medium**	Ongoing	

Table 10 - Example of a Hazard Register

**This is one example of a possible method for hazard analysis. Please present the hazard analysis as is appropriate for the specific project.*

10.3 WHS Compliance

Describe the processes and procedures for ensuring compliance with WHS legislation.

10.4 Safety Requirements and Standards

Describe the safety requirements and safety standards implemented/to be implemented

10.5 Reporting

Describe the processes for incident reporting. Describe the processes for safety reporting, including the criteria for reporting the identification of new risks or changes in risk assessments

11 Handling of Deliverables

The PEP must specify the return policy for deliverables, including for disposal.

The standard requirement is that Defence will have the option to return any physical deliverables delivered to Defence, including for disposal, within 12 months of the finalisation of the contract phase. The PEP should indicate adherence to this standard, or explain why a deviation is necessary and how the equipment would be managed in this instance.

12 Technical Data (TD)

The PEP must describe the Participant's general approach to providing TD which will be listed in the TD Schedule (noting that prior to the commencement of work under a resultant contract only currently extant TD should be listed in the TD Schedule, which will be updated as TD is generated during the life of the project). The PEP must also include an overview of all TD that is covered by clause 4.2 of the Innovation Contract. In the final PEP, Defence may identify any Technical Data (which does not fall into the categories set out in clauses 4.2(a) to (d) of the Innovation Contract) that will otherwise need to be included in the TD Schedule.

13 Intellectual Property (IP)

The PEP must detail how the Participant intends to monitor and identify all IP used or created under or in connection with the Innovation Contract. The PEP must also describe the Participant's overall approach to ensuring compliance with its obligations under the Innovation Contract in respect of IP.

Note:

An example of monitoring and identifying all IP is to maintain an IP register throughout the course of the project.

All Background IP, Foreground IP and Third-Party IP shall be defined and registered in accordance with DIH IP Management procedures.

To manage all relevant IP records:

a. An IP register will be kept identifying the use of IP throughout the course of the project.

b. This will track and categorised into three types of IP: external, background, and novel. When novel IP is found then it will be further described through the use of the standard IP Disclosure Form,

We and the Defence Innovation Hub shall:

a. Register the Background IP in the IP Register within 60 days of it being provided under the Contract; and

b. Participate in meetings (as required) in which Background IP that is not already recorded will be reviewed, agreed and recorded.

The focus area is the creation of novel and the Project Manager is responsible for the management of IP associate with this Project.

Reference

[1] US Department of Defence Standard Practice. *MIL-STD-882E: System Safety*. 11 May 2012