


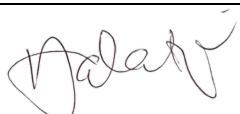
# PROJECT CHARTER FOR THE CAS READINESS PHASE

(I.E., WORK PACKAGES 8, 9, 10 & 11) OF THE

INDUSTRY ALIGNMENT ON TMM REGULATIONS; SPECIAL PROJECT OF THE  
MINERALS COUNCIL SOUTH AFRICA

**Service Agreement No 21/001**

**REV 6**

| Project Charter Acceptance |   |                  |              |
|----------------------------|---|------------------|--------------|
| Name                       | Signature   | Organisation     | Date         |
| Kobus Blomerus             |  | SECDI            | 26 July 2021 |
| Stanford Malatji           |  | Minerals Council | 20 June 2022 |

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## 1. Purpose of this document

This charter is the output of the detail planning and sets out the project framework for the interaction between the Minerals Council South Africa, SECDI, and the organisations and individuals that support SECDI.

It defines the project management controls and other governance aspects that will be implemented to ensure a common understanding of the contracted outcomes and deliverables by defining:

- Who the project stakeholders are,
- What the objectives of the project are.
- The project communication and reporting structures and processes,
- The project deliverable scope and key methodologies,
- The project deliverable structures
- Deliverable review and acceptance process

The document is a working document that will be updated as needed to fulfil its purpose. It will be updated at least every time a new project deliverable structure is finalised.

## 2. Definitions and abbreviations

The following definitions and abbreviations will be used to create a common approach for all deliverables: (Note: The rationale for some of the terms and definitions is set out in the Specification Guideline Review Report)

|             |  |
|-------------|--|
| CMS         | Collision Management System – The overall combination of preventative controls, mitigation, recovery and supporting controls implemented by a mine site to prevent TMM collisions.   |
| CPS         | Collision Prevention System: The product system that complies with the regulatory (8.10.1 and 8.10.2) and user requirements.   |
| CWAS (CxD)* | <p>Collision Warning and Avoidance System device (CxD) - Device with sensors providing collision warning and avoidance functions to detect objects in the vicinity of the machine, assess the collision risk level, effectively warn the operator of the presence of object(s), and/or provide signals to the machine control system to initiate the appropriate interventional collision avoidance action on the machine to prevent the collision.</p> <p><b>Note:</b> Proximity Detection System (PDS) is a colloquial industry term for a physical device providing effective warning or collision avoidance functionality.</p> |

|                           |   |
|---------------------------|---|
| Ecosystem                 | A <b>business ecosystem</b> is the network of organizations—including suppliers, distributors, customers, competitors, government agencies, and so on—involved in the delivery of a specific product or service through both competition and cooperation.   |
| Element/Sub System        | A member of a set of elements that constitutes a system. A system element is a discrete part of a system that can be implemented to fulfil specified requirements. A system element can be hardware, software, data, humans, processes (e.g., processes for providing service to users), procedures (e.g., operator instructions), facilities, materials, and naturally occurring entities (e.g., water, organisms, minerals), or any combination. (ISO/IEC 15288:2015) |
| Emergency stopping        | In the case of an emergency situation, the machine needs to slow down and stop as quickly as possible, without losing control (meaning directional stability) and without any immediate negative health and safety impact on the operator.  |
| EMESRT                    | Earth Moving Equipment Safety Round Table   |
| EMI                       | Electromagnetic interference (EMI) is a phenomenon that may occur when an electronic device is exposed to an electromagnetic (EM) field.  |
| EMC                       | Electromagnetic Compatibility, also known as EMC, is the interaction of electrical and electronic equipment with its electromagnetic environment, and with other equipment. All electronic devices have the potential to emit electromagnetic fields.   |
| Functional Specification: | Specifications that define the function, duty or role of the product. Functional specifications define the task or desired result by focusing on what is to be achieved rather than how it is to be done.   |

|                   |  |
|-------------------|--|
| Interface         | <p>A boundary across which two independent systems meet and act on or communicate with each other. Four highly relevant examples:</p> <ol style="list-style-type: none"> <li>1. CxD-machine interface – the interface between a Collision Warning and Avoidance System Device (CxD) and the machine. This interface is described in ISO/PRF TS 21815-2.</li> <li>2. The user interface – Also sometimes referred to as the Graphic User Interface (GUI) if an information display is used. This is the interface between the user (TMM operator or pedestrian) and the CxD or pedestrian warning system.</li> <li>3. V2X interface – the interface between different CxD devices. V2X is a catch-all term for vehicle-to-everything. It may refer to vehicle-to-vehicle (V2V), vehicle-to-pedestrian (V2P) or vehicle-to-infrastructure (V2I).</li> <li>4. CxD-peripheral interface – This is an interface between the CxD and other peripheral systems that may be present on the TMM. Examples include a fleet management system, machine condition monitoring system, fatigue management system.</li> </ol> <p><b>Note:</b> An interface implies that two separate parties (independent systems) are interacting with each other, which may present interoperability and/or EMI/EMC challenges.</p> |
| Loss of control   | <p>The uncontrolled movement of a TMM due to operator, machine or environmental reasons. Note: Section 8.10.3 pf MHS Act. Loss of control may result in several scenarios:</p> <ul style="list-style-type: none"> <li>• Machine failure – park brake or service brake, tyre blowout or</li> <li>• Operator disabled – fatigue, medical condition, inattention, distraction, non-compliance with TMP rules (e.g. over speeding on decline, overloading).</li> </ul>   |
| MHS Act           | Mine Health and Safety Act No. 29 of 1996 and Regulations  |
| MOSH              | Mining Industry Occupational Safety and Health   |
| PDS*              | Proximity Detection System – see CxD. *  |
| Project           | Industry Alignment on TMM Collision Management Systems Project: <b>CAS READINESS PHASE</b>   |
| Quality Assurance | Verifying a process, product or service; usually conducted by a person experienced in the specific field.  |

|                                 |  |
|---------------------------------|--|
| Reasonably practicable measure  | Reasonably practicable means practicable having regard to:<br>(a) the severity and scope of the hazard or risk concerned;<br>(b) the state of knowledge reasonably available concerning that hazard or risk and of any means of removing or mitigating that hazard or risk;<br>(c) the availability and suitability of means to remove or mitigate that hazard or risk; and<br>(d) the costs and the benefits of removing or mitigating that hazard or risk; (from MHS Act)  |
| SAMI                            | South African Mining Industry  |
| Safe speed                      | The speed that will ensure the controlled stopping of a TMM without any immediate negative impact on the operator or machine. Note: This is a conditional variable value, depending on multiple input variables.   |
| Significant risk (of collision) | The reasonable possibility of a TMM collision <b>given</b> all the controls that a mine has put in place to prevent a TMM collision.   |
| Slow down*                      | ISO/PRF TS 21815-2 defines slow down as:<br>The SLOW_DOWN action is sent by the CxD to reduce the speed of the machine in a controlled / conventional manner as defined by the machine control system. The intent of this command is to slow down the machine when the CxD logic determines that a collision / interaction can be avoided by reducing speed.   |
| Stop*                           | ISO/PRF TS 21815-2 provides for two definitions, an emergency stop and a controlled stop, both of which are considered to be a 'Stop'. The definitions are:<br>1. The EMERGENCY_STOP action is sent by CxD to instruct the machine to implement the emergency stop sequence defined by the machine control system. The intent of this command is to stop the machine motion as rapidly as possible to reduce the consequence level, if the CxD logic determines that a collision is imminent. The equivalent of an emergency stop is the operator slamming on the brakes in an emergency situation.<br>2. The CONTROLLED_STOP action is sent by CxD to instruct the machine to implement the controlled stop sequence defined by the machine control system. The intent of this command is to stop the machine motion in a controlled / conventional manner when the CxD logic determines that a collision / interaction can be avoided by slowing down and stopping. The equivalent of a controlled stop is slowing down and stopping when approaching a red traffic light. |

|                         |   |
|-------------------------|---|
| Sub-system              | See Element.  |
| System                  | A combination of interacting elements organized to achieve one or more stated purposes (ISO/IEC/IEEE 2015).   |
| Systems Engineering     | Interdisciplinary approach and means to enable the realization of successful systems. Expanded definition: Interdisciplinary approach governing the total technical and managerial effort required to transform a set of user needs, expectations, and constraints into a solution and to support that solution throughout its life.  |
| Technical specification | Specifications that define the technical and physical characteristics and/or measurements of a product, such as physical aspects (e.g. dimensions, colour, and surface finish), design details, material properties, energy requirements, processes, maintenance requirements and operational requirements.   |
| This document           | Collision Management Systems Technical Specification Guideline SME and UME REV 5 – Review Report.   |
| TMM                     | Trackless Mobile Machine. (Machine, vehicle, etc.)  |
| TMM COP                 | Guideline for the compilation of a Mandatory Code of Practice for Trackless Mobile Machines.  |
| TMM OEM                 | Original Equipment Manufacturer of TMMs. Original Equipment Manufacturer of a TMM may be the organisation which originally supplied, or last rebuilt or modified the TMM or the supplier per section 21 of the Mine Health and Safety Act, 1996 (Act No. 29 of 1996)  |
| Vicinity (Surface TMMs) | The distance/time/ of two TMMs from the point of a potential collision, such that if the operators of both machines are instructed to take action to prevent a potential collision, then and one or both does not take action then the CPS will be able to prevent the potential collision.<br><b>Note:</b> Vicinity is a conditional, variable value, depending on multiple input variables. It is smaller than any value that is within the range of normal operation |

|   |   |
|---|---|
| <p>Vicinity<br/>(Underground<br/>TMM and<br/>pedestrians)</p> | <p>The distance of a TMM from a pedestrian, such that if the operator of the TMM and the pedestrian does not take action to prevent a potential collision then emergency slow down and stopping of the TMM can successfully be executed to prevent a potential collision between the TMM and the pedestrian.</p> <p><b>Note:</b> Vicinity is a conditional, variable value, depending on multiple input variables. It is smaller than any value that is within the range of normal operation.</p> |
|---|---|

### 3. Project title

Industry Alignment on TMM Collision Management Systems: **CAS READINESS PHASE**

### 4. Objectives of the project

The objectives of the project are:

- To ensure technology functionality that will comply to the RSA TMM regulations by ensuring complete and unambiguous requirements. The primary purpose of the work is to ensure alignment of mining industry stakeholders with the regulations, its direct requirements and its implications.
- To enable large scale rollout of the CAS technology to enable timeous compliance as per the regulatory requirements.
- To enable mines to purchase systems that have been proven to comply with the regulatory requirements in the RSA.
- To ensure technology that will have a minimum disruption of production on mines due to shortcomings in the Life Cycle System (Eco system)
- To ensure a complete set of user, functional and technical requirements to achieve above. To ensure that the CAS readiness requirements related to the technology are defined, documented, and agreed by tri partite stakeholders.
- To ensure that important functional and system requirements are translated into test protocols. To ensure an industry integrated test and demonstration program that minimises time to test, cost of testing and disruption at operations.
- To ensure that technology solution conformance to functional requirements and readiness are independently witnessed and confirmed on behalf of mines.
- To ensure that technology readiness requirements for successful introduction of the regulations are independently verified and confirmed.



## 5. Overall Industry Alignment on TMM Collision Management Systems Project

The CAS Readiness Phase “project” is a sub project of the **Minerals Council Industry Alignment on TMM Collision Management Systems Special Project**. The bigger project’s work breakdown structure is shown below.

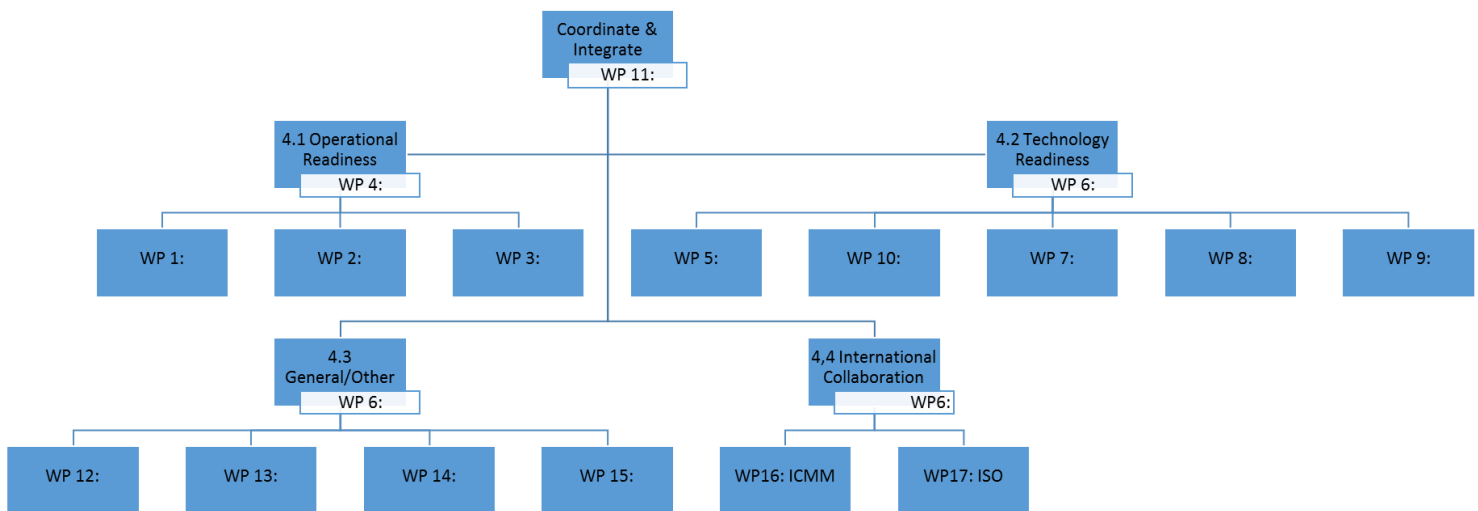


Figure 1: Minerals Council Industry Alignment on TMM Collision Management Systems Project structure

### Operational Readiness

- Work Package 1: Effective Traffic Management Planning and Implementation
- Work Package 2: Data analysis of vehicle interactions to enhance traffic management
- Work Package 3: Effective change management
- Work Package 4: Coordinate/Project Manage

### Technology (Holistic) Readiness:

- Work Package 5: Collision Management Project Implementation Management
- Work Package 6: Technology Readiness Project Management/Coordination

### CAS Readiness

- Work Package 8: Holistic Readiness Criteria
- Work Package 9: Testing protocols
- Work Package 10: Testing Capability and Capacity
- Work Package 11: Testing Capability, Capacity and Tests Coordination

### General/Other:

- Work Package 12: Provide Detailed Sec 21 Guidance

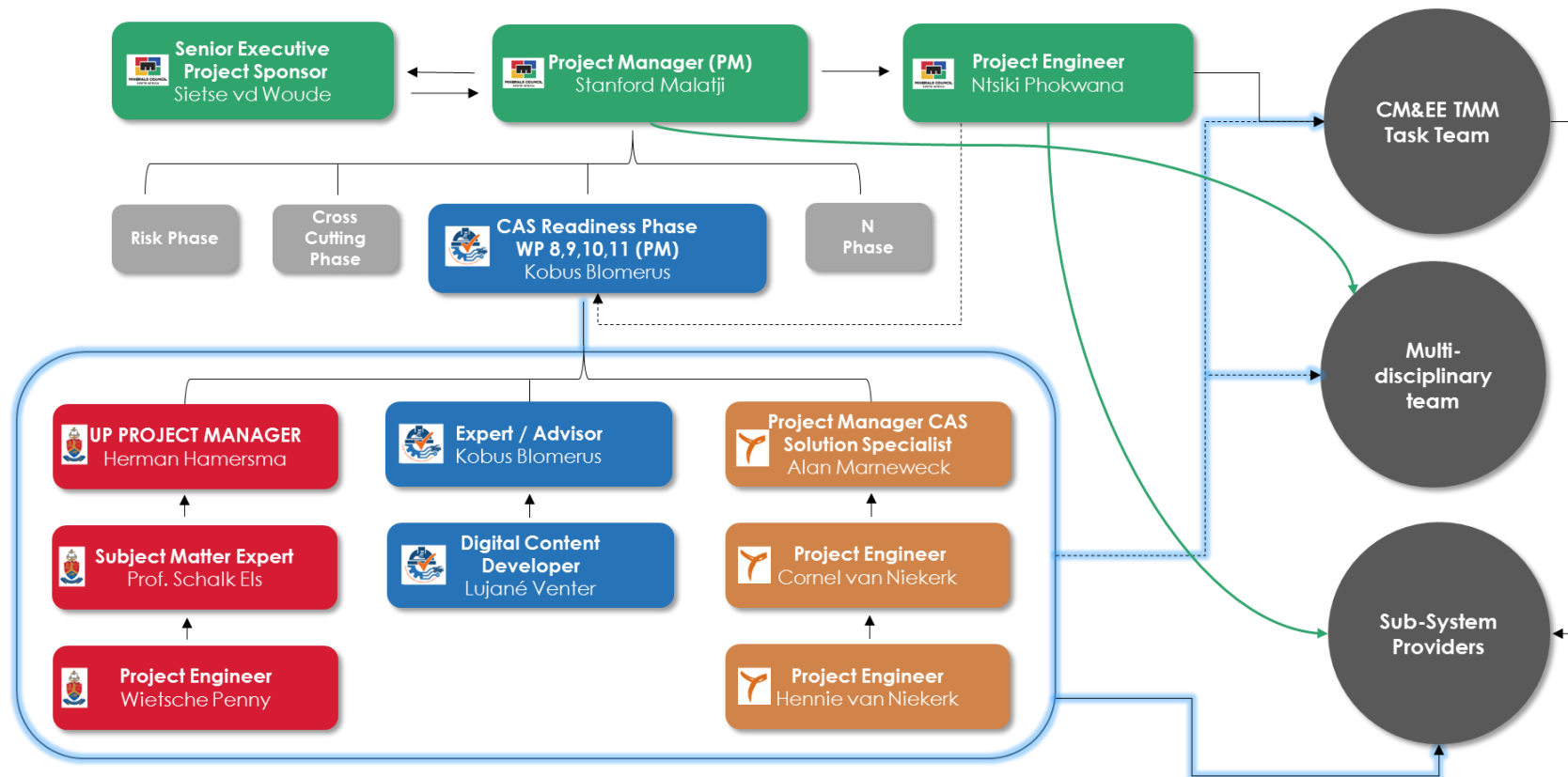
- Work Package 13: Quantify Unintended Consequences (Operators)
- Work Package 14: Provide Detailed Guidance for Technology Management Implications for CAS Technology
- Work Package 15: Facilitate Formal Vendor Alignment (PDS and OEM) on Legal Liability

**International Collaboration:**

- Work Package 16: ICMM
- Work Package 17: ISO

## 6. CAS Readiness Phase Project Organogram

# CAS READINESS PHASE PROJECT ORGANOGRAM AND COMMUNICATION MODEL



## 7. Project Team contact details

| Minerals Council       |  |              |                                  |
|------------------------|--|--------------|----------------------------------|
| Sietse van der Woude   | Project Sponsor  |              | svdwoude@mineralscouncil.org.za  |
| Stanford Malatji       | Project Manager  | 079 890 2259 | smalatji@mineralscouncil.org.za  |
| Ntsiky Phokwana        | Project Engineer   | 082 818 2481 | nphokwana@mineralscouncil.org.za |
| SECDI                  |  |              |                                  |
| Kobus Blomerus         | Project Manager  | 084 233 1671 | Kobus@secdi.co.za                |
| University of Pretoria |  |              |                                  |
| Herman Hamersma        | Project Manager  | 012 420 2926 | hermanh@up.ac.za                 |
| Prof. Schalk Els       | SME  | 012 420 2045 | Schalk.els@up.ac.za              |
| Wietsche Penny         | Project Engineer   | 012 420 2932 | wc.penny@up.ac.za                |
| TerreSaver             |  |              |                                  |
| Dr Anita Jordaan       | TerreSaver Project director<br>Risk Management   | 083 633 1506 | anitaj@terresaver.com            |
| Alan Marneweck         | CMS specification and testing (underground)<br>TerreSaver Project Manager<br>Mechanical engineer | 082 333 1905 | alanm@terresaver.com             |
| Cornel van Niekerk     | CMS specification and testing (underground)<br>Mechanical engineer                               | 082 787 5280 | comelvn@terresaver.com           |

## 8. Scope of the project

The project is limited to "regulatory compliance" of the TMM CAS regulations. It addresses therefore the smallest subset of user requirements and technology that will ensure regulatory requirements. Figure 2 below depicts the concept.



Fig 2: CAS systems functionality concept

## 9. Scope of Work

### **Work Package 8: CAS Readiness Criteria**

**Purpose: To develop an industry-agreed criterion to approve the readiness of potential CAS solutions for both underground and surface systems.**

Application of recognised models to structure the criteria for all the phases of CAS Readiness, including:

- Functional readiness
- Manufacturing readiness
- Operational readiness (Readiness to install, commission and support the technology)
- Commercial readiness

The work package also includes verification work.

### **Work Package 9: Testing protocols**

**Purpose: Improved testing protocols for specific aspects of the systems and testing more complex vehicle interaction scenarios and challenges.**

**... and align with all tri partite stakeholders.**

*This work package is the heart of the project and the bulk of the effort required. The work is aimed at enhancing the existing specification guidelines to a level of completeness in line with acknowledged systems engineering practice. The work is focussed on:*

- Complete and unambiguous user requirements.
- Complete and unambiguous technical and functional requirements including specific attention to high technology risk aspects:
  - Interoperability of all CAS subsystems with reference to different TMM types, brands and models.
  - Electromagnetic interference from other sources (rock type, electricity, other radio frequency and electromagnetic wave technology) and EMI shielding requirements.
  - Proximity zone functionality – Zone flexibility and dynamic zoning, zone accuracy and sensitivity, Zone repeatability.
  - Sensor fusion – complex algorithms to collect and interpret multiple detection technology signals and data to be interpreted and processed to enable the correct message(s) and instruction(s) to TMM operators and other CAS sub systems.
- An overall test regime and plan.

### **Work Package 10: Testing Capability and Capacity**

*Purpose: Sufficient testing facilities and testing entities must be established to timeously support the CAS readiness initiative.*

*This work package to determine needs, costs and risks as well as opportunities for future use of these facilities.*

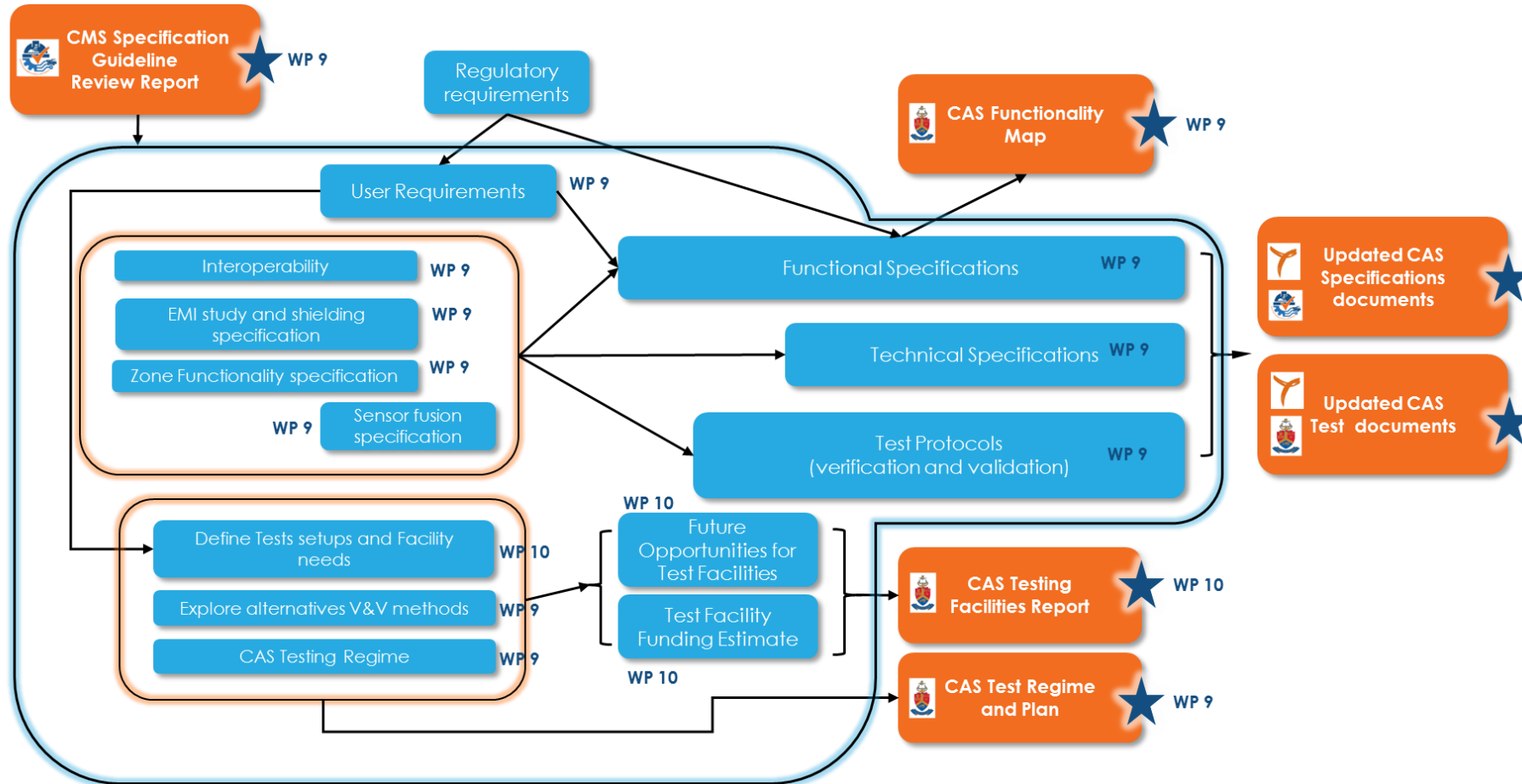
### **Work Package 11: Testing Capability, Capacity and Tests Coordination**

*SECDI's proposal includes the establishment of an August 2021 baseline to provide a snapshot of the status at that time and from where co-ordination can start.*

#### **10. Work integration**

The work integration diagram below shows the logical integration of tasks in the work packages.

# WP 9,10, WORK INTEGRATION DIAGRAM



## 11. Up and downstream inter dependencies (CAS Readiness Phase)

- CAS readiness verification can only start after the readiness document have been released and suppliers comply with the elements thereof
- Verification of functional and technical requirements can only start once the specifications are released, protocols are available, testing arrangements and/or testing facilities are available.

## 12. Interdependency Management

The Minerals Council South Africa will develop an interdependency milestone schedule to manage all the project interdependencies in a coordinated manner by middle May 2021. The following dates are important for finalisation of the detail project planning. **Minerals Council to provide**

| Project Interdependency Milestones |  |                                |
|------------------------------------|--|--------------------------------|
| Project Phase                      | Deliverable  | Interdependency Milestone Date |
| Low hanging fruit                  | b) Data usage reports from vehicle interactions.   |                                |
|                                    | e) Industry data management guide by end of June 2021.                                     |                                |
|                                    | f) Technology development and enhancement needs report.                                    |                                |
| Risk Quantification                | a) TMM Population information analytics.   |                                |
|                                    | d) Health and safety risks determined.   |                                |
|                                    | e) Mining processes and equipment type maps.   |                                |
|                                    | f) Technology availability evaluation report including readiness risks.                    |                                |
| Cross-Cutting                      | g) Digital twin model.   |                                |
|                                    | Updated CMS Technical Specification Guideline (Section 21 file requirements).              |                                |
|                                    | Outcome of the consensus amongst role-players and stakeholders of how risks are mitigated. |                                |
|                                    | Outcomes of the quantification of the unintended consequences on Operators                 |                                |
|                                    | Outcomes of engagements with PDS Suppliers, Interface Suppliers and OEMs by end June 2021. |                                |
|                                    | Relevant aspects of the ICMM developments  |                                |



### 13. Project Meetings

Unless specifically required meetings will be held using Microsoft Teams. Participants will depend on the agenda items but will always comprise of members from SECDI and the Minerals Council.

#### Minerals Council Meetings

- **Project Meetings**

Meetings will be held with the purpose of, but not limited to, report progress, identify challenges and risks. Meeting will take place weekly (Tuesday afternoons) basis starting from 25 May 2021 to 14 December 2021 (Trend to be continued in 2022)

- **Multidisciplinary Meetings**

The Minerals Council Project Manager will arrange regular meetings with the relevant members from all work phases of the bigger project. The CAS Readiness Phase project Manager will attend those meetings and specific members of the execution team will be invited on an ad hock basis.

The meeting dates for the multidisciplinary meetings are:

- 27 May 2021 – 08h00 to 10h00
- 24 June 2021 – 11h30 to 13h30
- 22 July 2021 – 08h00 to 10h00
- 25 August 2021 – 08h00 to 10h00
- 30 September 2021 – 08h00 to 10h00
- 27 October 2021 – 08h00 to 10h00
- 25 November 2021 – 08h00 to 10h00

- **CM&EE Meetings**

The industry representative body that is overseeing the Minerals Council Project is the **Consulting Mechanical and Electrical Engineering Committee** (CM&EE) The committee's TMM Regulatory Task Team are the working committee established for specific focus on the TMM regulations.

Attendance of CM&EE and the TMM task team meetings will be by specific invite.

The meeting dates for the respective meetings are:

Monthly however dates still to be confirmed.

#### SECDI Project Meetings

A project meeting will be held bi-weekly on Fridays at 11:00

### 14. Project Reports

The SECDI project report format is shown below and will be compiled every second week. It will be submitted to the Minerals Council Project Manager by 08:00 on the Monday following.

## SECDI PROJECT PROGRESS REPORT:

PROJECT: CAS Readiness

DATE: 04 – 05 – 2021

COMMENTS:

### CONTRACTUAL



UP contract only awaiting acceptance of the Minerals Council SLA clauses

### SCHEDULE



Based on latest detail planning outcomes

### COST



Minerals Council to agree invoice schedule

### RISK



None identified in this period

#### NEXT DELIVERABLES:

#### DUE DATE:

|                            |                |
|----------------------------|----------------|
| - Project Charter          | 18 - 05 – 2021 |
| - CMS Specification Guide  |                |
| Review Report              | 25 - 05 – 2021 |
| - XXXXXXXXXXXXXXXXXXXXXXXX | XXXX           |
| - XXXXXXXXXXXXXXXXXXXXXXXX | XXXX           |

#### NEXT INPUT/INTEGRATION DELIVERABLES:

#### DUE DATE:

|  |                |
|--|----------------|
| - TMM Population information analytics | xxx            |
| - XXXXXXXXXXXXXXXXXXXXXXXX             | xxx            |
| - XXXXXXXXXXXXXXXXXXXXXXXX             | xxx            |
| - XXXXXXXXXXXXXXXXXXXXXXXX             | xxx            |
| - XXXXXXXXXXXXXXXXXXXXXXXX             | 04 - 05 – 2021 |

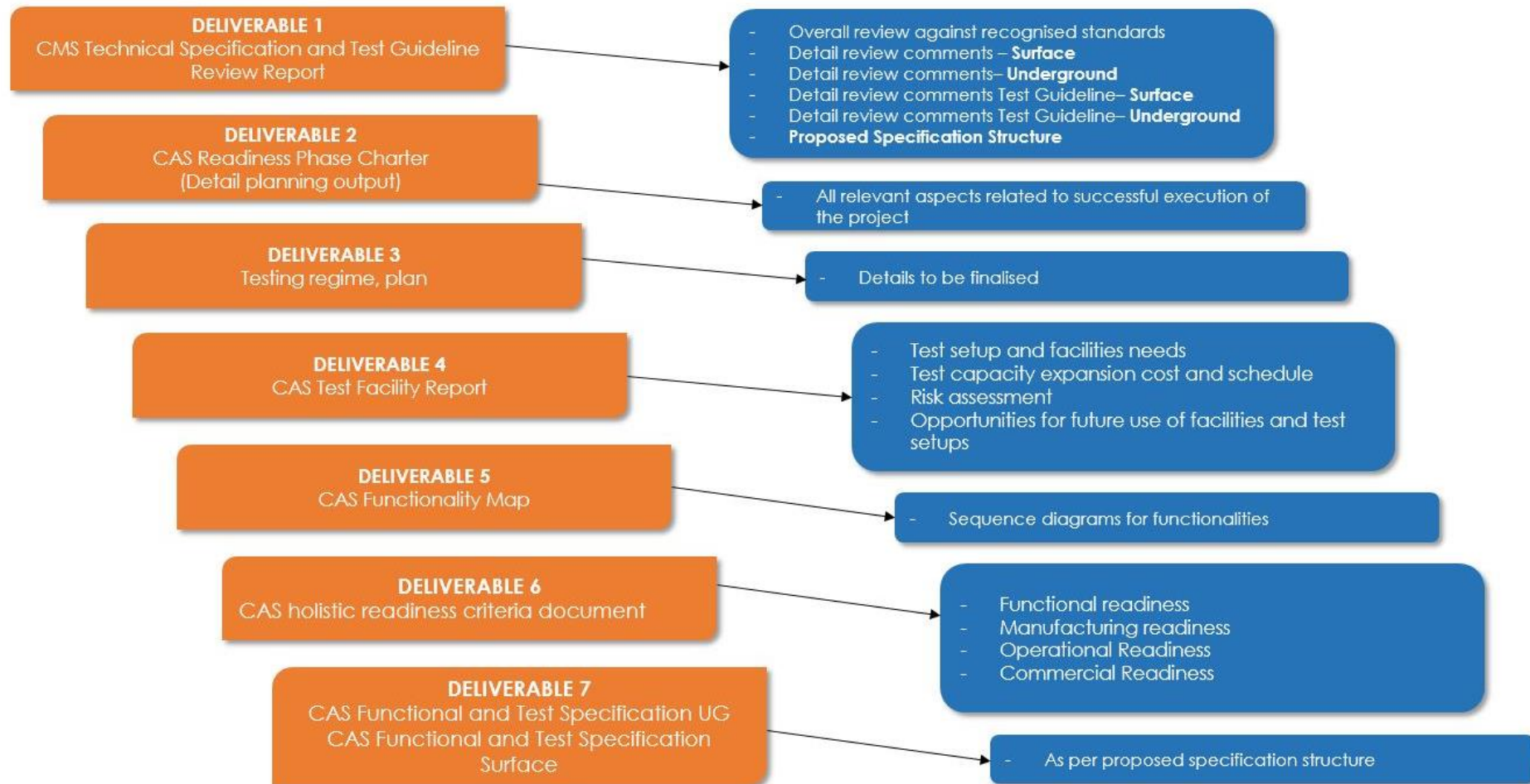
## 15. Project Standards

The technical standards that are applicable to **specific deliverables** will be listed in the specific deliverable. The following engineering management standards applies.

| Aspect  | Standard           |
|---|--------------------|
| System Life Cycle Processes                           | ISO/IEC/IEEE 15288 |
| Specification Practices                               | Mil Std 490A       |
| Engineering Management                                | Mil Std 499B       |
| Technical product documentation, Vocabulary and Terms | ISO 10209:2012     |

## 16. Project Deliverables

The project deliverables and its main contents are shown below.



## 17. Deliverable Structures

| Deliverable                           | Content Structure |
|---------------------------------------|-------------------|
| Specification guideline Review report | See Appendix A    |
| Project Charter                       | This document     |
| TMM CAS Requirements Specifications   | See Appendix B    |
| Testing Regime and Plan               | See Appendix C    |
| CAS Test Facility Report              | See Appendix D    |
| CAS Functionality map                 | See Appendix E    |
| CAS Holistic Readiness Criteria       | See Appendix F    |
| CAS Test Specifications Underground   | See Appendix G    |
| CAS Test Specifications Surface       | See Appendix H    |

## 18. Deliverables Review and Acceptance

The introduction of a “completed work” based invoicing structure as required by the Minerals Council necessitates a two-fold review and acceptance approach.

### Review and Acceptance for invoicing

All deliverables and/or sections thereof as per the invoicing structure will be submitted to the Minerals Council Project manager on or before the last day of the month in which the deliverable or section is due for invoicing. The Minerals Council Project Manager will review and accept the deliverable or section thereof **for invoicing**, within 3 working days and indicate acceptance of the deliverable or section thereof in writing (e-mail) to the SECDI project manager and the Minerals Council financial officer.

### Review and Acceptance of Deliverable content

All deliverables and/or sections thereof as per the invoicing structure will be submitted to the Minerals Council Project manager on or before the last day of the month in which the deliverable or section is due for invoicing.

## 19. Legislation

The following legislation are the external set off requirements for the deliverables of this project:

| Reference | Description  |
|-----------|--|
| MHSA      | Mine Health and Safety Act No. 29 of 1996 and Regulations.                                   |
| TMM COP   | Guideline for the compilation of a Mandatory Code of Practice for Trackless Mobile Machines. |

## 20. Project Schedule

The 2021 project duration is 9 months from April till December 2021

| CAS READINESS PROJECT SCHEDULE 2021 |  |       |     |      |      |        |           |         |          |          |
|-------------------------------------|--|-------|-----|------|------|--------|-----------|---------|----------|----------|
| Task                                | Work Package Description               | April | May | June | July | August | September | October | November | December |
| WP8:                                | <b>Readiness Criteria</b>              |       |     |      |      |        |           |         |          |          |
|                                     | Functional Readiness                   |       |     |      |      |        |           |         |          |          |
|                                     | Manufacturing Readiness                |       |     |      |      |        |           |         |          |          |
|                                     | Operational Readiness                  |       |     |      |      |        |           |         |          |          |
|                                     | Commercial Readiness                   |       |     |      |      |        |           |         |          |          |
|                                     | Detailed Planning                      |       |     |      |      |        |           |         |          |          |
| WP9:                                | <b>Testing protocols underground</b>   |       |     |      |      |        |           |         |          |          |
|                                     | CAS funct specification review         |       |     |      |      |        |           |         |          |          |
|                                     | User requirements defined              |       |     |      |      |        |           |         |          |          |
|                                     | CAS functional requirements            |       |     |      |      |        |           |         |          |          |
|                                     | Tri partite alignment                  |       |     |      |      |        |           |         |          |          |
|                                     | Functionalities journey map            |       |     |      |      |        |           |         |          |          |
|                                     | Testing regime and plan                |       |     |      |      |        |           |         |          |          |
|                                     | Update Test Specification              |       |     |      |      |        |           |         |          |          |
| WP9:                                | <b>Testing protocols Surface</b>       |       |     |      |      |        |           |         |          |          |
|                                     | CAS funct specification review         |       |     |      |      |        |           |         |          |          |
|                                     | User requirements defined              |       |     |      |      |        |           |         |          |          |
|                                     | CAS functional requirements            |       |     |      |      |        |           |         |          |          |
|                                     | Tri partite alignment                  |       |     |      |      |        |           |         |          |          |
|                                     | Functionalities journey map            |       |     |      |      |        |           |         |          |          |
|                                     | Testing regime and plan                |       |     |      |      |        |           |         |          |          |
|                                     | Zone functions                         |       |     |      |      |        |           |         |          |          |
|                                     | Interference                           |       |     |      |      |        |           |         |          |          |
|                                     | Interoperability                       |       |     |      |      |        |           |         |          |          |
|                                     | Update Test Specification              |       |     |      |      |        |           |         |          |          |
| WP10:                               | <b>Testing Capability and Capacity</b> |       |     |      |      |        |           |         |          |          |
|                                     | Define testing facilities.             |       |     |      |      |        |           |         |          |          |
|                                     | Facility sustainability                |       |     |      |      |        |           |         |          |          |
| WP11:                               | <b>Testing Capability and Capacity</b> |       |     |      |      |        |           |         |          |          |
|                                     | Coordinate and report                  |       |     |      |      |        |           |         |          |          |
|                                     | Review reports and certificates        |       |     |      |      |        |           |         |          |          |

## 21. Project Invoicing

The 2021 project duration is ten months from project start. The invoice frequency with dates for deliverables or sections thereof is shown in the table below.

| CAS READINESS INVOICING SCHEDULE |  |                                  |     |      |      |        |           |         |          |          |  |
|----------------------------------|--|----------------------------------|-----|------|------|--------|-----------|---------|----------|----------|--|
| Task                             | Work Package Description               | April                            | May | June | July | August | September | October | November | December |  |
| WP8:                             | <b>TR Criteria</b>                     |                                  |     |      |      |        |           |         |          |          |  |
|                                  | Functional Readiness                   |                                  |     |      |      |        |           |         |          |          |  |
|                                  | Manufacturing Readiness                |                                  |     |      |      |        |           |         |          |          |  |
|                                  | Operational Readiness                  |                                  |     |      |      |        |           |         |          |          |  |
|                                  | Commercial Readiness                   |                                  |     |      |      |        |           |         |          |          |  |
|                                  | Detailed Planning                      |                                  |     |      |      |        |           |         |          |          |  |
|                                  | Independent verification               |                                  |     |      |      |        |           |         |          |          |  |
| WP9:                             | <b>Testing protocols underground</b>   |                                  |     |      |      |        |           |         |          |          |  |
|                                  | CAS funct specification review         |                                  |     |      |      |        |           |         |          |          |  |
|                                  | User requirements defined              |                                  |     |      |      |        |           |         |          |          |  |
|                                  | CAS functional requirements            |                                  |     |      |      |        |           |         |          |          |  |
|                                  | Tri partite alignment                  |                                  |     |      |      |        |           |         |          |          |  |
|                                  | Functionalities journey map            |                                  |     |      |      |        |           |         |          |          |  |
|                                  | Testing regime and plan (high level)   |                                  |     |      |      |        |           |         |          |          |  |
|                                  | Zone functions                         |                                  |     |      |      |        |           |         |          |          |  |
|                                  | Electromagnetic Interference           |                                  |     |      |      |        |           |         |          |          |  |
|                                  | Interoperability                       |                                  |     |      |      |        |           |         |          |          |  |
|                                  | Update Test Specification              |                                  |     |      |      |        |           |         |          |          |  |
|                                  | WP9:                                   | <b>Testing protocols surface</b> |     |      |      |        |           |         |          |          |  |
|                                  |  | CAS funct specification review   |     |      |      |        |           |         |          |          |  |
| User requirements defined        |  |                                  |     |      |      |        |           |         |          |          |  |
| CAS functional requirements      |  |                                  |     |      |      |        |           |         |          |          |  |
| Tri partite alignment            |  |                                  |     |      |      |        |           |         |          |          |  |
| Functionalities journey map      |  |                                  |     |      |      |        |           |         |          |          |  |
| Testing regime and plan          |  |                                  |     |      |      |        |           |         |          |          |  |
| Zone functions                   |  |                                  |     |      |      |        |           |         |          |          |  |
| Interoperability                 |  |                                  |     |      |      |        |           |         |          |          |  |
| WP10:                            | <b>Testing Capability and Capacity</b> |                                  |     |      |      |        |           |         |          |          |  |
|                                  | Define testing facilities.             |                                  |     |      |      |        |           |         |          |          |  |
|                                  | Facility sustainability                |                                  |     |      |      |        |           |         |          |          |  |
|                                  | Funding requirements.                  |                                  |     |      |      |        |           |         |          |          |  |
| WP11:                            | <b>Testing Coordination</b>            |                                  |     |      |      |        |           |         |          |          |  |
|                                  | Coordinate and report                  |                                  |     |      |      |        |           |         |          |          |  |
|                                  | Review reports and certificates        |                                  |     |      |      |        |           |         |          |          |  |

SECDI will submit its invoice dated for the last day of the specific month on the last working day of that month.

SECDI partners will submit their respective invoices dated for the last day of the specific month on the last working day of that month.

## **22. Competition Law**

It is important that the project participants take note of the importance of the competition law on the project. All of the project deliverables or engagements must at all times ensure that it does not infringe on the rights of any product or service provider to market and sell its services or products. Project participants is to refrain from expressing (verbally on in writing) any utterance that can be interpreted as "If you do not do this or that then mines will not buy your product or service. The project is to deliver a set of requirements and standards that constitute a CAS system that is compliant with the TMM regulations and user requirements. The onus will be on suppliers of products and services to demonstrate that their systems comply.

## **23. Uncertainty, Risk and Mitigation**

The risk diagram is attached as a separate file named:

Risk Table Project Charter Rev 4



Documentation structure for:

Review Report: Collision Management Systems Technical Specification  
Guideline SME and UME

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## **Appendix B**

Documentation structure for: TMM CAS Requirements Specification

**To Be Determined (TBD)**

## **Appendix C**

Documentation structure for: TMM CAS Requirements Specification

**To Be Determined (TBD)**

## **Appendix D**

Documentation structure for: TMM CAS Requirements Specification

**To Be Determined (TBD)**

## **Appendix E**

Documentation structure for: TMM CAS Requirements Specification

**To Be Determined (TBD)**

## **Appendix F**

Documentation structure for: TMM CAS Requirements Specification

**To Be Determined (TBD)**

## **Appendix G**

Documentation structure for: TMM CAS Requirements Specification

**To Be Determined (TBD)**