DEFENCE SPACE SAFETY PROGRAM MANUAL OF STANDARDS (DSSP MOS)

SECTION 1:

APPLICATION OF THE DEFENCE SPACE SAFETY PROGRAM MANUAL OF STANDARDS

(SECTION 1 CHAPTER 1)

APPLICATION OF THE DEFENCE SPACE SAFETY PROGRAM MANUAL OF STANDARDS

INTRODUCTION

1. The Defence Space Safety Regulations (DSSR) present regulations for the following Defence space activities:

a. launch facilities, via DSSR Launch Facility Licence (DSSR.LFL)

b. launches and/or returns, via DSSR Launch and/or Return Permit (DSSR.LRP),

c. payloads and orbital operations, via DSSR Payloads and Orbital Permit (DSSR.POP).

2. These regulations are accompanied by Acceptable Means of Compliance (AMC), which is information published by the Defence Space Safety Regulator to identify a means of meeting one or more requirements of the regulation. This AMC can become sizeable, particularly where detailed information on specifications and standards, including their tailoring, forms part of the AMC. Mindful that sizeable AMC can reduce its comprehensibility for a non-expert audience, the Regulator consigns much of the detailed compliance information to this Defence Space Safety Program (DSSP) Manual of Standards (MOS).

3. This chapter describes the purpose, application and structure of the MOS.

STRUCTURE OF THE MANUAL

4. This manual comprises the following four sections:

a. **Section 1 – Application of the DSSP MOS.** This section defines the purpose and application of the MOS

b. **Section 2 – Launch Facility Requirements. (**RESERVED - this section will be published concurrently with the 'Launch Facility Licence (LFL)' regulations)

c. **Section 3 – Launch and Return Requirements.** (RESERVED - this section will be published concurrently with the 'Launch and/or Return Permit (LRP)' regulations),

d. **Section 4 – Payloads and Orbital Operations Requirements.** This section prescribes space safety requirements for Defence payloads and orbital operations.

PURPOSE OF THE MOS

5. The MOS supports the DSSR by providing detailed technical and operational material. It may include standards (tailored to Defence's context) for the design and manufacture of space systems, detailed descriptions of the way in which a space service or facility should operate, and other detailed material that contributes to Defence space safety.

6. Compliance with the MOS is directed from within the AMC. In general, the AMC will prescribe what is needed for compliance with the regulation, and will refer to the MOS for detailed information on how it is to be demonstrated. For example, AMC might require a particular test to show compliance with a regulation, while the MOS might prescribe the specifications and/or standards for conducting the test.

MOS CONTENT

7. The MOS content is derived, where practicable, from international good practice, specifications, and standards adapted to Defence's context where applicable. To promote a consistent approach across Government, alignment with the relevant policies and practices of the Australian Space Agency (ASA) is preferred.

8. The MOS may include tailoring to specifications and standards to account for:

a. Australia's unique legislative and geographic environment

b. Defence's military-unique roles and operational environment

c. known deficiencies in the level of safety provided by the specifications and standards, as detected by the Regulator through local research or experience (eg through accident investigations),

d. intentional ambiguities within the specifications or standards, where it is assumed that tailoring will be required to meet the needs of the specific application.

9. In the absence of applicable ASA or international specifications and standards, the Regulator may create, in collaboration with the Defence space community, a bespoke specification.

MOS COMPLIANCE

10. Since the MOS expands on AMC, non-compliance with the MOS constitutes a non-compliance with AMC, and consequently failure to meet a regulation. However, as with AMC, applicants for a Space Safety Authorisation (SSA) are entitled to propose an alternative way of meeting MOS requirements, as follows:

a. If the alternative way presents an equivalent level of safety to the MOS requirement, General Requirement (GR) GR.130(a) makes provision for the

Regulator to approve this as ‘Alternative Means of Compliance (AltMoC)’ to the MOS requirement,

b. GR.130(b) makes provision for the Regulator to approve an ‘Exception’ to the MOS requirement when an alternative way does not present an equivalent level of safety to the MOS requirement. However, this exception is only available when the departure is justified by a military capability imperative and sound risk management principles are applied to the elevated risk.

REQUIREMENTS, GUIDANCE AND RECOMMENDATIONS

11. The primary purpose of the MOS is to prescribe requirements for compliance with the DSSR. The MOS may also provide guidance on how to achieve those requirements, although adherence to that guidance is discretional. The MOS will clearly delineate between requirements and guidance through the use of modal verbs such as ‘must’ and ‘may’.

12. As a service to the Defence space community, the MOS may occasionally make recommendations to the community, for example to identify:

a. emerging ‘good practice’ that is not yet widely accepted/implemented, but could increase the level of safety beyond DSSR safety benchmarks. An example may be guidelines promulgated by the United Nations for space sustainability,

b. suggestions for expanding a MOS requirement to better achieve Defence’s capability needs. An example might be to apply the MOS payload technical integrity requirements to mission systems, to improve their resilience.

13. Applicants will use their judgement whether or not to adopt or adapt recommendations, without needing to inform and/or consult the Regulator.

DEFENCE SPACE SAFETY PROGRAM MANUAL OF STANDARDS (DSSP MOS)

SECTION 4:

PAYLOADS AND ORBITAL OPERATIONS REQUIREMENTS

SECTION 4 CHAPTER 1

APPLICATION OF PAYLOADS AND ORBITAL OPERATIONS REQUIREMENTS

1. The DSSP Manual presents the DSSR for payloads and orbital operations at Volume 2, DSSR.POP. Compliance with these regulations is required to attain and maintain a Payloads and Orbital Permit (POP).

2. Some DSSR.POP regulations include Acceptable Means of Compliance (AMC), which is information published by the Defence Space Safety Regulator (the Regulator) to identify a means of meeting one or more requirements of the regulations. The MOS supplements that AMC by providing detailed technical and operational material.

3. The structure of this MOS Section aligns with the principal DSSR.POP sections as follows:

a. Chapter 2: Technical Integrity (POP.200)

b. Chapter 3: Orbital Safety (POP.300)

c. Chapter 4: Operations (POP.400),

d. Chapter 5: Safety Management (POP.500)

4. The Defence space safety community is required to comply with the specifications, standards and procedures in this MOS Section, or propose an Alternative Means of Compliance (AltMoC) to the Regulator, as explained in General Requirement (GR) GR.130(a). In the event that either of these approaches will impede a military capability imperative, GR.130(b) makes provision for a departure from the MOS safety benchmark provided sound risk management principles are applied to the elevated risk.

SECTION 4 CHAPTER 2

TECHNICAL INTEGRITY (POP.200)

INTRODUCTION

1. The POP.200 series regulates the technical integrity of the Space Segment, Link Segment and Ground Segment elements of the Space System. The regulations require:

a. sound engineering management practices to be applied in their design, construction and maintenance

b. systems to be designed to a level of technical integrity commensurate with the safety consequences of their failure (with additional attention paid to high safety-consequence components)

c. verification and validation against safety specifications

d. the implementation of measures to protect safety-critical systems from cyber security threats.

2. This chapter presents specifications, standards and/or procedures for several of these elements.

ENGINEERING MANAGEMENT (POP.210)

3. The MOS does not present requirements related to engineering management.

DESIGN (POP.220)

Satellite and/or satellite payload systems design

4. The regulations require all satellite and/or satellite payload systems for which correct operation is critical to safety to be designed to an appropriate level of technical integrity.

5. Once identified, the MOS will present requirements related to satellite and/or payload systems design, to supplement the AMC. In the meantime, designers must identify specifications and/or standards for the design based on industry good practice, and present them to the Regulator for approval.

6. The Regulator expects the proposed approach will, at a minimum:

a. identify the Functional and Performance Specification (or equivalent) elements that will feed into the design process

b. employ systematic techniques from a recognised system safety standard to identify credible hazards attributable to hardware, software and human system integration. For example, the Functional Hazard Analysis in MIL-STD-882E may be used to identify and classify the system functions and the safety consequences of functional failure or malfunction

c. apply formal hazard analysis techniques to identify potential safety controls commensurate with the scope of the design and potential impact on space safety. Example techniques might include Fault Tree Analyses, Common Cause Analyses, Zonal Safety Analyses, Particular Risk Analyses and so on. Safety controls should be selected in accordance with a common hierarchy of risk controls,

d. identify industry good practice, standards, or specifications for the design of each identified system whose correct operation is critical to safety. The standards or specifications must cover (where applicable), the hardware, software and human system integration elements of the design.

High safety consequence components

7. The regulations require that special consideration must be given to high safety consequence components (eg pressurised tanks, lasers and nuclear energy) which are inherently hazardous and can present an elevated safety risk.

8. **Pressurised tanks**. Designers must employ a space industry good practice, specification, or standard in the design of pressurised tanks. Where such a specification/standard cannot be identified, or is unsuited to the particular purpose, the designer is to propose a bespoke design specification, for approval by the Regulator.

9. **Lasers.** Designers must employ a space industry good practice, specification, or standard in the design of laser safety systems, including safety interlocks. Each of the design-related standards, analyses and risk controls identified in the Defence Radiation Safety Manual (DRSM), Chapter 6, must be achieved by the selected specification/standard.

10. **Nuclear energy.** Designers must employ a space industry good practice, specification, or standard in the design of nuclear energy systems. Where such a specification/standard cannot be identified, or is unsuited to the particular purpose, the designer is to propose a bespoke design specification, for approval by the Regulator. In either case, the specification/standard must have been recommended as suitable by a person with relevant qualifications and competency. The specification/standard must require, amongst other things, a nuclear energy safety analysis, including safety risk assessment and mitigation strategies. The following document presents USAF guidance on the conduct of a nuclear energy safety analysis, that may contribute to the proposed specification/standard:

a. *DAFMAN91-110, Nuclear Safety Review and Launch Approval for Space or Missile Use of Radioactive Material*.

VERIFICATION AND VALIDATION (POP.230)

11. The regulations require confirmation that the Space Segment, Link Segment and Ground Segment elements of the satellite and/or satellite payload system meet the FPS (or equivalent documents) verification and validation requirements for safe launch and operation. Verification testing confirms a product is built according to specified design requirements. Validation testing ensures the built product meets the intended purpose.

12. The regulations identify the requirement for qualification testing, integration testing and end-to-end testing.

Qualification Testing

13. The AMC lists a range of qualification tests that must be conducted. The Regulator is yet to prescribe particular standards and/or specifications for vibration testing, electromagnetic compatibility testing, mass properties measurements, magnetic dipole testing and functional testing pre-launch. In the meantime, designers must identify specifications and/or standards for the design based on industry good practice, and present them to the Regulator for approval. The following documents may assist the designer in identifying suitable standards/specifications:

a. *ECSS-E-ST-10-03C Rev.1, Space engineering – Testing*.

14. Shock testing, including pyro-shock, must employ the following:

a. *ECSS-E-ST-10-03C Rev.1, Space engineering – Testing, and*

b. *NASA-STD-7003A, Pyroshock Test Criteria.*

15. Thermal vacuum testing including thermal cycling, and thermal bakeout testing (if applicable), must employ the following:

a. *ECSS-E-ST-10-03C Rev.1, Space engineering – Testing, and*

b. *ECSS-Q-ST-70-04C, Space product assurance – Thermal testing for the evaluation of space materials, process, mechanical parts and assemblies, and*

c. *ECSS-Q-ST-70-02C, Space product assurance – Thermal vacuum outgassing test for the screening of space materials, or*

d. *NASA MSFC-SPEC-1238 Rev A, Thermal Vacuum Bakeout Specification for Contamination Sensitive Hardware.*

16. Radiation testing (total ionising dose or single event effect), must employ the following:

a. *ECSS-Q-ST-60-15C, Space product assurance – Radiation hardness assurance EEE components.*

Integration Testing

17. The AMC lists a range of integration tests that must be conducted. The Regulator is yet to prescribe particular standards and/or specifications for achieving integration testing. In the meantime, designers must identify specifications and/or standards for the design based on industry good practice, and present them to the Regulator for approval. Where such a specification/standard cannot be identified, or is unsuited to the particular purpose, the designer is to propose a bespoke approach for approval by the Regulator.

End-to-end Testing.

18. The AMC lists a range of end-to-end tests that must be conducted. The Regulator is yet to prescribe particular standards and/or specifications for achieving integration testing. In the meantime, designers must identify specifications and/or standards for the design based on industry good practice, and present them to the Regulator for approval. Where such a specification/standard cannot be identified, or is unsuited to the particular purpose, the designer is to propose a bespoke approach for approval by the Regulator.

19. The following documents may assist designers in identifying end-to-end system requirements:

b. *ECSS-E-ST-70C, Ground systems and operations, and*

c. *ECSS-E-ST-50C Rev.1, Communications.*

CYBER SECURITY (POP.240)

20. The MOS does not present requirements related to cyber security.

SECTION 4 CHAPTER 3

ORBITAL SAFETY (POP.300)

INTRODUCTION

21. The POP.300 series regulates the orbital safety of the Space System. The regulations require:

a. orbital parameters to be selected that are suitable for safe operations

b. spectrum authorisation(s) to be obtained as required to facilitate safe operations

c. the selection of a Launch Service Provider who has demonstrated a capability to safely deliver the satellite to the specified orbit

d. the implementation of space debris minimisation controls,

e. the provision of space object registration information, for compliance with the UN Registration Convention.

22. This chapter presents specifications, standards and/or procedures for several of these elements.

ORBITAL PARAMETERS (POP.310)

23. The regulations require that intended orbital parameters are suitable for safe operation of the satellite and/or satellite payload.

24. Once identified, the MOS will present requirements related to orbit suitability, to supplement the AMC. In the meantime, applicants must identify specifications and/or standards for selecting suitable orbital parameters based on industry good practice, and present them to the Regulator for approval.

SPECTRUM AUTHORISATION (POP.320)

25. The MOS does not present requirements related to spectrum authorisation.

LAUNCH SERVICE PROVIDER (POP.330)

26. The MOS does not present requirements related to the selection of a Launch Service Provider.

DEBRIS MITIGATION (POP.340)

27. The regulations require that planned operations and the end-of-life satellite disposal plan have been assessed for potential safety hazards related to orbital

debris and to confirm that appropriate risk mitigations have been implemented. This is achieved through a two-step process:

a. the creation of a space debris mitigation strategy, which is developed early in the system lifecycle, and

b. the implementation of space debris minimisation controls and the production of a mitigation report, which is update throughout the system lifecycle.

Space debris mitigation strategy

28. The AMC requires the creation of a Space Debris Mitigation Strategy (SDMS) for the satellite and/or satellite payload, which establishes preventative measures to mitigate risks that have been identified through orbital debris assessments, and utilises responsible practices to limit the creation of orbital debris.

29. The Regulator does not prescribe particular specifications or standards for the SDMS; rather, flexibility is afforded in demonstrating that all reasonably practicable measures have been identified and implemented to limit the creation of orbital debris. One or more of the following documents are likely to contribute to the creation of a defensible SDMS:

a. *NASA-STD-8719.14C, Process for Limiting Orbital Debris*

b. *ISO 24113:2023, Space Debris Mitigation Requirements*

c. *ESSB-ST-U-007, ESA Space Debris Mitigation Requirements*

d. *ESSB-HB-U-002, ESA Space Debris Mitigation Compliance Verification Guidelines*

e. *United Nations Office for Outer Space Affairs (UNOOSA) space debris mitigation guidelines*

f. *A/AC.105/2018/CRP.20 – Guidelines for the Long-term Sustainability of Outer Space Activities*

g. *U.S. Government Orbital Debris Mitigation Standard Practices,*

h. *Inter-Agency Debris Coordination (IADC) Space Debris Mitigation Guidelines.*

Space debris minimisation controls and report

30. The AMC requires the production of a Space Debris Mitigation Report (SDMR), which includes a compliance and verification matrix against the SDMS requirements, and details as to why SDMS requirements are not being met.

31. The following document provides guidance for Space Debris Mitigation (SDM) requirements, and must be used to demonstrate compliance against this requirement:

a. *ESSB-ST-U-007, ESA Space Debris Mitigation Requirements.*

COMPLIANCE WITH THE REGISTRATION CONVENTION (POP.350)

32. The MOS does not present requirements related to the Registration Convention.

SECTION 4 CHAPTER 4

OPERATIONS (POP.400)

This chapter is reserved.

SECTION 4 CHAPTER 5

SAFETY MANAGEMENT (POP.500)

INTRODUCTION

33. The POP.500 series regulates the overarching safety management of the Space System. The regulations require:

a. the establishment and maintenance of a Safety Management System (SMS),

b. the investigation, remedial action and reporting of safety occurrences.

34. This chapter presents specifications, standards and/or procedures for the first of these elements.

SAFETY MANAGEMENT SYSTEM (POP.510)

35. The regulations require the establishment and maintenance of an SMS throughout the service life of the satellite and/or satellite payload. The AMC does, however, recognise that the SMS must be proportionate to the safety hazards being managed under the POP. It encourages the implementation of a reduced (tailored) SMS, except where Defence operates a complex satellite capable of orbital manoeuvres and has the ability to control all associated safety hazards.

36. The Regulator does not prescribe particular specifications or standards for the SMS; rather, flexibility is afforded in demonstrating that the SMS is fit for its intended purpose of providing a structured approach to managing safety risks that is iterative and generative.

37. One or more of the following documents are likely to contribute to the creation an SMS that is proportionate to the safety hazards being managed under the POP:

a. *ISO 14620 (1:2018 Space Systems) – Part 1, System Safety*

b. *AFI 91-202, The US Air Force Mishap Prevention Program*

c. *AFI 91-217, Space Safety and Mishap Prevention Program*

d. *NASA/SP-2010-580, System Safety Handbook Volume 1, System Safety Framework and Concepts for Implementation*

e. *NASA/SP-2014-612, System Safety Handbook Volume 2, System Safety Concepts, Guidelines, and Implementation Examples*

f. *ECSS-Q-ST-40-02C, Hazard analysis*

g. *ECSS-Q-ST-40C Rev.1, Safety,*

h. *Defence Aviation Safety Regulation, Aviation Safety Management Systems* (but adapted to the space context).

SAFETY OCCURRENCES AND REPORTING (POP.520)

38. The MOS does not present requirements related to safety occurrences and reporting.