Canadian Space Agency | Agence spatiale canadienne

CSA-PIP-GDL-0001

Canadian Space Agency

Project Risk Class Selection Guidelines

Initial Release - Final Draft

June 14, 2021

Canada

This Page Intentionally Left Blank

APPROVAL

Proposed changes to the currently approved version of this document shall be forwarded to the CSA Configuration Management Receipt Desk for evaluation and submission for approval. Approved changes shall be incorporated in the next revision.

Prepared by:

Nicodemo Giurleo
Acting Manager , Safety and Mission Assurance
Programs and Integrated Planning

Date

Reviewed by:

Charles Lemoine
Senior Engineer, Safety and Mission Assurance
Programs and Integrated Planning

Date

Recommended by:

Stéphane Beaudry
Acting Manager, Project/Program Portfolio
Programs and Integrated Planning

Date

Réjean Fortier
Manager, Project/Programs Portfolio
Space Utilization

Date

Karl Saad
Manager, Project/Programs Portfolio
Space Exploration

Date

Stéphane Routhier Acting Senior Engineer (Projects Management) Space Science and Technology	Date

Approved by:

Erick Dupuis Acting Executive Director, Programs and Integrated Planning Programs and Integrated Planning	Date
Eric Laliberté Director General, Space Utilization Space Utilization	Date
Gilles Leclerc Director General, Space Exploration Space Exploration	Date
Marie-Claude Guérard Director General, Space Science and Technology Space Science and Technology	Date
Jean-Claude Piedboeuf Chief Financial Officer & Director General, Corporate Services Finance and Corporate Services	Date

Luc Brûlé Vice-President, Science and Technology President Office	Date
Mary Preville Vice-President, Space Program Policy VP Space Program Policy	Date
Lisa Campbell President President Office	Date

This Page Intentionally Left Blank

REVISION HISTORY

Rev.	Description	Initials	Date
IR	Initial Release Released by the approval of Draft	NG	June 14, 2021

TABLE OF CONTENTS

LIST OF TABLES

1 INTRODUCTION

1.1 PURPOSE

In accordance with the Safety and Mission Assurance Practice [AD-01], this document establishes the project class selection guidelines for the Canadian Space Agency (CSA) aerospace projects.

The project class:

- is determined in accordance with a set of pre-defined, high level parameters (Appendix A) resulting from consultations with key CSA stakeholders from programmatic and corporate branches;
- is adopted early during the pre-project options analysis phase (i.e. at R2) as input to develop system and Product Assurance (PA) requirements, project charter, level of verification and overall formality and rigour required on a project;
- will enable the CSA President and Sponsors to communicate their level of risk tolerance to the project teams for them to plan the project and to develop and tailor the Safety and Mission Assurance (S&MA) requirements and functions (Appendix B), and any other related system engineering and project management requirements within an unambiguous, commonly-understood framework; and,
- is not related to the Project Complexity and Risk Assessment (PCRA). The PCRA tools were developed by the Treasury Board in accordance with the Directive on the Management of Projects and Programmes [RD-04]. The PCRA is used to determine the level of expenditure authority and project authority. The PCRA level will not influence the project technical and programmatic requirements. For information, a comparison of PCRA to project class attributes is shown in Appendix C.

1.2 APPLICABILITY

Unless otherwise specified, these guidelines apply to CSA projects in accordance with [AD-02].

The S&MA requirements imposed by International Partners (IP) take precedence over the project class guidelines called out here in this document. The Office of Safety and Mission Assurance (OSMA) in collaboration with the project team will review the IP S&MA requirements to ensure that they are aligned with the CSA policies and practices. As required, alternate requirements may be proposed to the IP for consideration.

1.3 BACKGROUND

Project Classes, also referred to as “Mission Classes” are in place in major space agencies such as NASA, ESA, and JAXA, but to date have never been implemented at CSA.

The need for a CSA project class approach (including definitions and guidelines presented in this document as well as the S&MA Levels Matrix defined in Appendix B), stems from the report “Working Group (WG) 3 Improving Program Delivery”, [RD-02] which recommends that the Canadian Space Project classification system (Appendix A) be integrated to CSA’s Investment Governance and Monitoring Framework (IGMF).

This report was prepared by the joint Aerospace Industrial Association of Canada (AIAC) – CSA Working Group in 2018. The report documents the work and investigations performed by the

working group to address two of the eight recommendations made by the Emerson 2012 report [RD-03].

1. Recommendation 3 “Disciplined governance and implementation”, the report states:

“Because space projects are complicated and often break new technological ground, they carry an inherent risk of false starts and unexpected detours. Experience illustrates this risk: major space projects in Canada and abroad have been bedeviled by project management issues, cost overruns, and missed deadlines. In such a context, rigorous governance and planning are a must. Once Cabinet has pointed the way, government departments and agencies must be properly organized to follow through.”

2. Recommendation 5 “Early project scoping,” the report provides the following elaboration:

“The project scope should be set at a level specific enough to ensure that the asset delivers required services, but general enough to give bidders flexibility to propose a range of approaches to meeting those requirements – in practice, this will mean specifications that are more performance-based and less detailed than those that have typically been used to date.”

The project class and guidelines herein are a spinoff from the AIAC recommendation to establish the project scope and high level performance based requirements early during the investment lifecycle (i.e. during the Project Planning sub-phase).

The CSA Investment Governance and Monitoring Framework (IGMF) document [AD-02], provides the high-level requirements (including S&MA) for investment stage-gate approval and continuous project monitoring and reporting. The CSA S&MA Practice document [AD-01] defines the roles and responsibilities and the S&MA approach which is aligned with the IGMF for the early assignment of a project class, commensurate with the level of project risk tolerance.

The project class selection is a key requirement of the pre-project, Option Analysis and Planning phase per the IGMF.

2 APPLICABLE AND REFERENCE DOCUMENTS

2.1 APPLICABLE DOCUMENTS

Documents in Table 2-1 form part of the requirements to the extent specified herein. Unless otherwise specified, the latest issue in effect is applicable.

TABLE 2-1 – APPLICABLE DOCUMENTS

AD	Document Number	Revision	Title
[AD-01]	CSA-SMA-DIR-0002		Safety and Mission Assurance Practice http://livelink/livelink/llisapi.dll/link/41427714
[AD-02]	CSA-PM-GG-0010		Investment Governance and Monitoring Framework (IGMF) http://livelink/livelink/llisapi.dll?func=ll&objid=39489857&objAction=browse&sort=name
[AD-03]	CSA-SE-GDL-0001		Systems Engineering Mission Tailoring Guidelines http://livelink/livelink/llisapi.dll?func=ll&objId=47537493&objAction=browse&viewType=1
[AD-04]	CSA-SMA-FORM-0005		Aerospace Project class Assessment http://livelink/livelink/llisapi.dll?func=ll&objId=46997224&objAction=viewheader

2.2 REFERENCE DOCUMENTS

Reference documents in Table 2-2 provide background and/or supplementary information relevant to the contents of this document.

TABLE 2-2 – REFERENCE DOCUMENTS

RD	Document Number	Revision	Title
[RD-01]	CSA-PM-TOR-0001		Program Investment Steering Committees Terms of Reference http://livelink/livelink/llisapi.dll?func=ll&objId=30144357&objAction=browse
[RD-02]	N/A	NR, Date: 2018	WG 3 Improving Program Delivery
[RD-03]	N/A		Emerson 2012 Report Volume 2 http://aerospacereview.ca/eic/site/060.nsf/eng/h_00034.html
[RD-04]	N/A		TBS Directive on the Management of Projects and Programmes https://www.tbs-sct.gc.ca/pol/doc-eng.aspx?id=32594
[RD-05]	N/A		CSA Departmental Results Framework http://intranet.csa.space.gc.ca/en/pip/departmental-results-framework-drf

3 AEROSPACE PROJECT CLASS SELECTION GUIDELINES

3.1 UNDERSTANDING CLASSES

3.1.1 Class Definitions

At CSA, there are four (4) project classes, A, B, C, and D, which are established against a set of project parameters shown in Appendix A and described in more details in section 3.1.2. The project class, once selected, provides the project team with the organization's risk tolerance, thereby allowing them to proceed with enhanced clarity for project planning, definition, and decision making.

1) Class A (Typical): Very Low Risk Tolerance (Safety Critical/Mission Critical)
   - Represents a human-rated space flight mission or a significant national/strategic operational asset.
   - Failure or loss would result in death or injury to human or very high consequences to public safety or national operational capabilities.
2) Class B (Typical): Low Risk Tolerance
   - Represents an operational asset.
   - Failure or loss would result in high consequences to the operational/mission objectives and the stakeholders needs and capabilities.
3) Class C (Typical): Moderate Risk Tolerance
   - Represents an instrument, payload or spacecraft.
   - Failure or loss would result in loss of some key operational/science objectives.
4) Class D (Typical): High Risk Tolerance
   - Represents a technology research and development and demonstration project which, purpose is the development of Highly Qualified Personnel (HQP), and/or science level payloads for projects providing development payloads on the International Space Station (ISS) for example.
   - Some level of failure at project level is expected, failure prior to project lifetime is an accepted risk.

3.1.2 Class Parameters

A project class is determined by evaluating the impact of a parameter in accordance with Table A-1 in Appendix A The following parameter definitions apply.

1) Outcomes & Policy: The purpose and result of the project or mission with consideration of the Department Results Framework (DRF) [RD-05], partners, and arrangements. Defined in the Project Business case and Mission Requirement Document (MRD).
2) Environment & Technology: Considers the operating environment, the level of technologies maturity and heritage of major subsystems.
3) Perception & Reputations: Based on the Business Case, considers impacts to existing Canadian space heritage in terms of maintaining world class expertise and leadership.

4) Technical & Operational Complexity: Considers the expected level of engineering complexity to develop the flight and ground systems, the level of developmental work, the operational complexity and user needs.
5) Life Cycle Cost: Overall life cycle cost Phase 0 to F for all government departments.
6) Design Life: Operational life expectancy including the commissioning phase required to meet the User Requirement Document (URD) and MRD requirements.
7) Availability: Tolerance to down-time and off-nominal operations from the user`s needs (e.g. Other Government Departments (OGDs)) and requirements, (e.g. URD, MRD, MOU, etc.).
8) Residual Risk: Addresses ownership of the burden to pay for the resolution of defects and anomalies during operations (e.g. Canadian government, industry or academia, international partner, or a combination thereof).

3.2 APPLYING CLASSES TO PROJECTS

A project classification may be performed and selected for an entire project or it may be separately selected for any equipment which is a payload or sub-system of a payload. For example, a satellite may be classified as Class A with individual payload instruments or units classified as Class A to D (except for the mechanical and electrical interfaces which should be the same class).

3.3 CLASS SELECTION

3.3.1 Generalities

In accordance with [AD-02], Project Class selection involves formal decisions at IGMF milestones. It is first conducted at IGMF Review R2 for project planning purposes, and again at Gate 2 prior to project start, to address any contextual changes. Decision-making is covered in section 3.3.2. The project class selection assessment process involves the following individuals and is led by the OSMA:

1) Proposed (for R2 assessment) or confirmed (for G2 assessment) Project Manager;
2) Mission Manager or equivalent;
3) Systems Engineering Manager or delegate;
4) Policy representative;
5) Flight & Systems Operations representative; and,
6) Program Integrated Planning (Governance and Performance) representative.

3.3.2 Decisions

Project Class decisions are made at the following IGMF milestones:

1) Review R2 (Pre-Project Option analysis and Planning/Option Recommendation) project phase during the business case and options sub-phase.
   - The sponsor makes a preliminary Project Class decision based on advice and recommendations from steering committee members (using standard tool, see 3.3.3);

- The preliminary Project Class is used as an input to project planning and development of preliminary requirements (e.g. S&MA, Systems) for Gate 2.

2) Gate 2 (Pre-Project/Option Analysis and Planning/Project Planning and functional requirements) project phase during the planning of the project preliminary functional requirements.
   - The final Aerospace Project Class is selected by the Gate Decision Authority (note: refer to IGMF for authority levels), based on Sponsor recommendation (using standard tool, see 3.3.3).
   - The final Aerospace Project Class is used as an input to the project definition phase and finalization of detailed project requirements (e.g. S&MA, Systems).

3.3.3 Class Selection and Documentation

The Project Class selection will be performed in accordance with [AD-04], with CSA representatives per section 3.3.1. The R2 and Gate 2 Aerospace Project Class selection will be documented, using the [AD-04] form. The R2 and G2 project class must be documented in accordance with standard Steering Committee or IIRB practices.

3.4 IMPACT OF CLASS SELECTION

The determination of a project class will be used as input to the following project activities, such that their output is commensurate with the selected Project Class:

- Developing S&MA generic Product Assurance requirements (using the tailored approach of Appendix B as starting point for each class), and Systems Engineering requirements as per AD-03;
- Developing a tailored Project Management approach, oversight, and reporting;
- Determining the level of project technical oversight, technical reviews, and process inspections and verifications, per AD-03 ;
- Assisting Systems Engineers and others to select, interpret, and implement appropriate CSA system engineering practices; and,
- Establishing the suite of document deliverables (Contract Deliverable Requirements List (CDRLs)) for the project.

3.5 CHANGING A SELECTED CLASS

As a general principle: changing the preliminary or final Project Class is a prerogative of the authority that established the class (i.e. Sponsor for the preliminary class (R2), and Gate Decision Authority for the final class (G2)). Any proposed change to the current class must be processed through the steering committee.

The project class selection may be revised during the detailed project requirements definition sub-phase. In the case of a change, the decision and approval of the new project class shall be endorsed by the Sponsor through the steering committee, and as a formal and documented decision, no later than at the R3 Review (i.e. prior to start of the preliminary definition sub-phase).

4 ROLES AND RESPONSIBILITIES

In accordance with the IGMF [AD-02] and S&MA Practice [AD-01], the following are the roles and responsibilities for the purpose of the project class selection, documentation and risks.

4.1 PROJECT MANAGEMENT SENIOR DESIGNATED OFFICIAL

The Project Management Senior Designated Official (PM SDO) is the Executive Director, Programs and Integrated Planning (ED PIP). Per the IGMF, the PM SDO is responsible to establish and maintain an Office of Safety and Mission Assurance (OSMA), and implement S&MA practices [AD-01] for applicable investments managed under the IGMF. The present guideline constitutes one of those practices.

4.2 BUSINESS MANAGER

In accordance with the IGMF[1], depending on a project investment tier, the BM is the Director General or a delegate. The BM is responsible for: 1) the pre-project phase investment lifecycle up to and including R2 where the business case is finalized and an investment option is selected, and 2) the post-project phases commencing after Gate 4.

BM Aerospace Project Class responsibilities:

- Involving the proposed[2] Sponsor in Aerospace Project Class discussions prior to R2;
- Chairing the R2 review; and,
- Ensuring and verifying that R2 decisions are documented, controlled, include mission class selection rationale (if different from recommended class) and dissensions, and are traceable to supporting materials (e.g. analyzes, presentations, actual project class assessment, etc.).

4.3 MISSION MANAGER

The MM typically develops the Business Case on behalf of the BM, and is responsible for the MRD.

MM Aerospace Project Class responsibilities:

- Represent clients, partners, and interests of the mission through the provision of advice during Project Class discussions, and for related recommendations, and decisions;
- Initiate contact with the OSMA at least one (1) month prior to R2 in order to initiate the project class process; and,
- Invite the proposed Project Manager[3] during pre-R2 Aerospace Project Class discussions.

4.4 SPONSOR

The Sponsor is responsible for the investment lifecycle starting at R2. The Sponsor is formally named at R2 by the President/IIRB.

Sponsor Project Class responsibilities:

[1] Per the IGMF, the BM and Sponsor may be the same person.

[2] Although formally named at R2, the proposed Sponsor will have been involved in Aerospace Project Class discussions by the Business Manager (see 3.1.1) prior to R2 in order to make an informed decision at R2.

[3] Although formally named at R2, the proposed Project Manager will have been involved in Aerospace Project Class discussions by the Business Manager or Mission Manager prior to R2 in order to understand the context prior to initiating project planning at R2

- Prior to being formally named at R2, participating in Project Class discussions;
- During R2, endorsing a preliminary Project Class after having considered recommendations from the project steering committee members;
- Accepting risk associated with the selected Project Class at R2, and ensuring that adequate risk responses are developed during subsequent project planning activities; and,
- Between R2 and Gate 2, chairing steering committee discussions related to the determination of a final Project Class for Gate 2, and issuing a final Aerospace Project Class recommendation to the Gate 2 Decision Authority including supporting rationale and any dissention.

4.5 PROJECT MANAGER

The PM is formally named at R2.

PM Aerospace Project Class responsibilities:

- Prior to being formally named at R2, participating in Project Class discussions upon Mission Manager request; and,
- Initiating contact with the OSMA at least one (1) month prior to G2 in order to initiate the project class process.

4.6 GATE DECISION AUTHORITY

The Gate Decision Authority is the authorized person identified in the IGMF for Gate-level decision-making. Depending on the project Tier, decisions are made at the Integrated Investment Review Board (IIRB) or at a Steering Committee.

Gate Decision Authority responsibilities for Aerospace Project Class:

- During Gate 2, endorsing a final Aerospace Project Class after having considered recommendations from the IIRB or project steering committee members;
- Ensure and verify that G2 decisions are documented, controlled, include project class selection rationale (if different from the recommended class) and dissensions, and are traceable to supporting materials (e.g. analyzes, presentations, etc.).

4.7 OFFICE OF SAFETY AND MISSION ASSURANCE (OSMA) MANAGER OR DELEGATE

The OSMA Manager is responsible for providing the S&MA support and SMEs to support the project phases, including Aerospace Project Class matters.

OSMA Aerospace Project Class responsibilities:

- Provide guidance, and independent technical expertise in S&MA disciplines (per S&MA practice) in support of Project Class discussions;
- Provide advice to the BM, Sponsor, and PM concerning S&MA risks associated with proposed Project Class, ensuring that this advice and supporting information are properly documented and characterized.

- Identify and develop tailored S&MA requirements[4], standards, documentation, and level of oversight commensurate with the selected Project Class in collaboration with Industry partner(s);
- Identify and elevate to the PM SDO any risk which may result in a hazard to human life, public and private property, and the environment;
- At R3, present to the Sponsor (through steering committee): finalized Product Assurance (PA) requirements, and any resulting actual or foreseen changes (e.g. increases) to the project risk profile with respect to the previously approved Aerospace Project Class at Gate 2; and,
- Under the direction and authority of the PM SDO the OSMA Manager shall oversee the implementation of this guideline, perform general oversight, and in case of dissension, escalate issues in accordance with section 6.1 of [AD-01].

4.8 SYSTEM ENGINEERING MANAGER OR DELEGATE

The System Engineering Manager is responsible for providing the PM and team with technical input and advice and to identify the technical risks and impacts associated with the scope or simplification of system engineering standards, technical project requirements, documentation and reviews in accordance with the project class.

[4] Preliminary requirements for Gate 2, and final requirements for R3, per the IGMF.

5 ACRONYMS AND ABBREVIATIONS

AD	Applicable Document
AIAC	Aerospace Industrial Association of Canada
BM	Business Manager
CADM	Configuration and Data Management
CDR	Critical Design Review
CDRL	Contract Deliverable Requirements List
CIL	Critical Item List
CSA	Canadian Space Agency
DCL	Declared Components List
DID	Data Item Description
ED PIP	Executive Director, Program and Integrated Planning
EEE	Electronic, Electrical and Electromechanical
EM	Engineering Model
EPMO	Enterprise Project Management Office
EQM	Engineering Qualification Model
ESA	European Space Agency
FM	Flight Model
FMECA	Failure Mode, Effect, Criticality Analysis
FPGA	Field Programmable Gate Array
HQP	Highly Qualified Personnel
IGMF	Investment Governance and Monitoring Framework
IIRB	Integrated Investment Review Board
IP	International Partners
ISS	International Space Station
IV&V	Independent Validation and Verification
JAXA	Japan Aerospace Exploration Agency
MM	Mission Manager
MRD	Mission Requirements Document
MRR	Mission Requirements Review
N/A	Not Applicable
NASA	National Aeronautics and Space Administration
NSPAR	Non-Standard Part Approval Request
OGD	Other Government Departments
OSMA	Office of Safety and Mission Assurance
PA	Product Assurance
PAIP	Product Assurance Implementation Plan
PAR	Product Assurance Requirements

PCRA	Project Complexity and Risk Assessment
PDR	Preliminary Design Review
PFM	Proto Flight Model
PIP	Program and Integrated Planning
PM	Program Manager
PM SDO	Program Management Senior Designated Official
PMP	Program Management Plan
PSPC	Public Services and Procurement Canada
QMS	Quality Management System
RCM	RADARSAT Constellation Mission
RD	Reference Document
RFD	Request for Deviation
RID	Review Item Discrepancy
S&MA	Safety and Mission Assurance
SME	Subject Matter Expert
SPF	Single Point of Failure
SRP	Safety Review Panel
SRR	System Requirements Review
TIM	Technical Interchange Meeting
TRR	Test Readiness Review
TRRB	Test Readiness Review Board
URD	User Requirement Document
WG	Working Group
WoG	With Other Government

APPENDICES

A PROJECT CLASS ATTRIBUTES[5]

TABLE A-1 – TYPICAL PROJECT CLASS ATTRIBUTES

Parameter	Class A (Typical)	Class B (Typical)	Class C (Typical)	Class D (Typical)
Outcomes & Policy [6]	Data services, OGD Operations, Quality of Life to Canadians, International Partnerships	Same as for Class A or C	Technology demonstration (with operations), scientific research.	HQPs, characterization, technology demonstration (non-operational).
Environment & Technology	Harsh environment (GEO, Deep-Space, Human spaceflight). New technologies with a low TRL. Minimum availability of technical skillsets.	Same as for A or C	Medium environment (LEO). Heritage exists. High TRL.	Short duration space missions, benign environment, suborbital or ground based equipment. Technology is for demonstration purposes.
Perceptions and Reputation	Very high risk of adversely impacting Canadian heritage or leadership in case of major or unrecoverable failure	High risk of adversely impacting Canadian heritage or leadership in case of major or unrecoverable failure	Moderate risk of adversely impacting Canadian heritage or leadership in case of major or unrecoverable failure	Low risk of adversely impacting Canadian heritage or leadership in case of major or unrecoverable failure
Technical & Operational Complexity	Very High to High	High to Medium	Medium to Low	Medium to Low
Lifecycle Costs	>$150M	$50M to $150M	$10m to $50M	<$10M
Design Life	>5 years	3-5 years	1-3 years	< 1 year
Availability	High, linked to mission success	Same as A or C	Medium to High downtime tolerance	High downtime tolerance or undefined
Residual Risk	Mostly or all Government	Mostly Government	Mostly Industry (or Academia)	N/A

[5] These are not rigid definitions, but should be used as a guide. Appendix A is provided as an indicative reference only; aerospace project class is officially determined using [AD-04]. Also refer to section 3.1.2.
[6] As identified in CSA's pre-project business case.

B SAFETY AND MISSION ASSURANCE LEVELS MATRIX

B.1 S&MA LEVELS MATRIX TABLE

TABLE B-1 – S&MA LEVELS MATRIX

S&MA Element	S&MA Sub-Element	Class A (Typical)	Class B (Typical)	Class C (Typical)	Class D (Typical)
Pre-contract CSA Verifications[1]	ISO 9001 or AS-9100 Quality Management System (QMS)	Third-party certification for full[2] supplier chain	Third-party certification for Prime and Tier 1 Subs	Third-party certification for Prime only	N/A
	Process and capability audit by CSA	Prime Contractor and Tier 1 Sub-Contractors	Prime Contractor and Tier 1 Sub-Contractors	Prime Contractor only	N/A
	Audit action plan	Binding Contractor action plan and timeline to address CSA audit observations			N/A
Product Assurance Requirements (PAR)	CSA Baseline PAR	Required (Generic Class A ISS/RCM PAR)	Required (Generic Class B Science Mission PAR)	Required (Generic Class C Microsat PAR)	Recommend use of Generic Class D PAR or PA and Safety requirements as part of system specifications
	PAR approval and change authority	CSA	CSA	CSA	CSA
PA CDRLs	PA CDRLs	Full[3] set	Full set	Reduced[3] set	Minimum, Safety + test reports
Technical[11] Reviews	SRR	Yes	Yes	Yes	As necessary
	PDR, CDR, MRR, TRR, TRRB	Unit, sub-system, system	Unit, system	System, TIMs @ lower-level	TIMs
	Acceptance review	Unit, sub-system, system	Unit, system	System only	System only
	Review approval right	CSA	CSA	CSA	CSA
	RIDs	Classification, resolution plan, and closure subject to approval of CSA RID owner			
Model Philosophy	New or Modified Designs	EM + PFM or EQM + FM	EM + PFM or EQM + FM	EM + EQM/PFM	FM or Production Model
	Flight Heritage[4] Designs	FM	FM	FM	FM or Production Model
Single String Design	Single string design/SPF	Prohibited	Prohibited	Prohibited in critical[6] apps.	Discouraged
Test Program	Acceptance testing	Unit, sub-system, system	Unit, sub-system, system	System	System level Interface check and safety verification
	Qualification testing	Unit, sub-system, system	Unit, sub-system, system	System	
Reliability Analysis	Numerical analysis FMECA & CIL	Yes Yes	Yes Yes	Optional[12]. Simplified	No Optional
EEE Parts[13]	Quality Level[5] (For SPF and critical[6] apps.)	NASA Level 1	NASA Level 2	NASA Level 2	Industrial or automotive grade
	Quality Level[5] (For non-critical[6] apps.)	NASA Level 2	NASA Level 3	NASA Level 3 preferred, minimum is Industrial or automotive grade	
	DCL	Yes, for CSA approval	Yes, for CSA approval	Yes, for CSA approval	Yes, for CSA approval
	Screening and Qualification data for Non Standard Parts	Yes, for CSA approval	Yes, for CSA approval	Recommended for CSA approval	No
	Parts Control Boards	Yes	Yes	Yes	No

S&MA Element	S&MA Sub-Element	Class A (Typical)	Class B (Typical)	Class C (Typical)	Class D (Typical)
Materials	Selection	Space-Qualified	Space-Qualified	Space-Qualified	Space-Qualified[7]
	Pure[8] Tin	Prohibited[9]	Prohibited[9]	Prohibited in critical[6] apps.	Discouraged
	Printed Wiring Boards	IPC-6012XS	IPC-6012XS	IPC-6012XS	IPC-6012XS recommended Class 3 (minimum for space applications) IPC-6012 Class 2 (ground use and controlled environment)
Processes	Selection	Space-Qualified	Space-Qualified	Space-Qualified	Space-Qualified [7]
	Workmanship	NASA 8739[10]	NASA 8739[10]	NASA 8739[10]	Best practices[7]
CADM	CADM Plan + System	Yes	Yes	May be part of PMP or PAIP	No
	Requirement Traceability	Yes	Yes	Yes	Yes
	Revision Control	Yes	Yes	Yes	Yes
Safety	Safety Assessment	Yes	Yes	yes	Yes
	Hazard Analysis Report	Yes	Yes	Yes	Yes
	Safety Review Panel (SRP)	Yes	Optional	No	No
	Space Debris and Mitigation	Yes	Yes	Yes	Yes (Space Mission)
Software/FPGA PA	Criticality Analysis	Yes	Yes	Optional	Optional
	Timing/Sizing/Sequencing/ Complexity analysis	Yes	yes	Optional	Optional
	Processor/Memory Utilization Analysis	Yes	Yes	Optional	Optional
	IV&V	Yes	Optional	No	No

B.2 S&MA ELEMENTS AND SUB-ELEMENTS - NOTES

The following notes apply to the S&MA elements and sub-elements by project class.

1) "Pre-contract CSA verifications", although contractor financial capability is verified prior to contract award by Public Services and Procurement Canada (PSPC), for contracts and contractors of all sizes, there is currently no analogous pre-contract award verification of a contractor's technical capability to deliver upon requirements. This type of verification will set a common understanding of expectations as to targeted areas that need to be resolved early in the project by the contractor in order to retire risk.
2) "Full" supplier chain means the list of suppliers of hardware and software from the prime contractor down to unit-level providers.
3) "Full" set of PA CDRLs corresponds to approximately 30 document types with associated Data Item Descriptions (DIDs), which can each apply to multiple sub-assemblies. "Reduced" set means that some documents are not required (e.g. reliability analysis, NSPARs, CADM plan, etc.) or may be combined with another CDRL. The requirement may also be for the Contractor to perform the work as part of the design phase without having to deliver an associated document to CSA (e.g. the Contractor may have to derate parts and document its work, without having to do so according to a specific format or to produce a document deliverable for CSA review or approval).
4) "Heritage designs" in this context means designs that possess evidence of meeting equally harsh (or harsher) testing and operational requirements (i.e. vibration, shock, radiation, thermal, etc.) than those of the actual project.
5) "Quality Level" means parts quality level as defined in NASA's EEE-INST-002). ESA equivalences are permitted as specified in the CSA PAR.
6) "Critical application" in this context means an application which is required to meet project outcomes as defined in the project's business case.
7) Required for space environments. May be based on best practices as set and documented by partner space agencies, or company-owned best practices with demonstrated successful flight heritage and/or test data. For space applications or items exposed to a vacuum environment, the processes used must meet the project contamination requirements.
8) "Pure tin" means tin alloyed with less than 3% of another metal.
9) Space-qualified mitigations will be entertained on a case-by-case basis with a Request for Deviation (RFD) submitted for CSA approval.

10) The PAR defines acceptable ESA and industry equivalents. Soldering to J-STD-001XS for space missions. J-STD-001 Class 3 may be used for Class D projects exposed to environmental conditions (vibration and temperature cycling). J-STD-001 Class 2 may be used for ground applications or for controlled environments.

11) Technical Reviews, Model Philosophy , and Test Program requirements definition may overlap between the S&MA and Systems Engineering requirements. With respect to S&MA, for technical reviews, the S&MA requirements and plans will address the quality management and risk mitigation requirements (preventive) a contractor or supplier should implement commensurate with the mission class. The level of technical oversight by CSA and document project deliverables will be addressed by the Systems Engineering and Project Management Mission Tailoring Guidelines CSA-SE-GDL-0001 [AD-03].

12) Unless required by performance specifications or to demonstrate availability requirements.

13) EEE parts requirements applicable to new designs. For commercial off the shelf (COTS) assemblies with flight heritage which meets or exceeds the project mission duration or environmental conditions (orbit), The COTS provider design configuration controls, design rules and parts selection plan will be considered for approval as part of the qualification status reviews.

C PCRA AND PROJECT CLASS COMPARISON

TABLE C-1 – PCRA AND PROJECT CLASS COMPARISON

Attribute	PCRA	Project class Assessment	Relatedness
Target Audience	TBS	CSA EX (R2/G2 Authority)	None
Purpose	Enable TBS Project Visibility and Oversight	Enable CSA Risk-Based Project Planning and Requirements Tailoring	None
CSA Specificity	Low, Generalized for WoG	High, Tailored for CSA	Low
Breadth of Inputs	Localized: PM-Centric	Extended: CSA-Wide	Low
Applicability Driver	Value (i.e. Projects > $10M)	Type (i.e. Aerospace Projects)	Low
Relationship to project plans (i.e. scope, schedule, budget)	Follows	Precedes	None
Based On	Detailed Project Plans	Business Case, Concept Studies	Low
Delivery	Initial Version: G2 Update: R3, R4, G3	Initial Version: R2 Update: G2	Low

The PCRA and Project Class Assessment are independent due to their very low overall level of relatedness, and there are no benefits in attempting to synchronize, integrate, or coordinate them.