Jet Propulsion Laboratory
California Institute of Technology

ISO TC20/SC14/WG1 Design Engineering Working Group 1 Presentation – Pablo Narvaez

RE: Splinter Group Discussions on Upcoming Updates to Revision of ISO 14302

Space Systems Electromagnetic Compatibility Requirements

Presented by: Pablo Simon Narvaez, JPL EMC Group Supervisor, Mission Environments Section,

London, United Kingdom

June 10-14, 2019

ISO 14302 History

- ISO 14302 (49 pages) required updating
  - First published in 2002 after an intense 5-year effort.
- ISO 14302 is the top-tier document for EMC within SC14, and is a normative reference in other SC14 standards
  - Five countries participated always face-to-face
  - **Need same countries to provide SME's for review/updating cycle**

Supporting EMC Documents

- Remove Old and Obsolete References:
  - ISO 7136-1995, applies to commercial aircraft
  - MIL-STD-461E, applies to military platforms, 254 pages
  - IEC 61000-4-2, Electrostatic discharge
- Add Newly Updated References:
  - ISO 24637 – Test reporting requirements 10 pages
  - AIAA-S-121 – Space system EMI requirements 82 pages
  - ECSS-20-07C – EMI requirements 89 pages
  - SMC –S-008 – EMC requirements 111 pages
  - ESA EMC Handbook 224 pages
  - MIL-STD-461G 266 pages

Go-forward plan, prior to re-write of ISO 14302

- **Delegations requested to vote February 2018 5-year review ballot to "revise".**
- Use present version of 14302 as template
  - **Do NOT throw out 5-years of good internationally negotiated work**
- **Produce a revised top-tier EMC document that has lasting qualities, such that it does not easily become obsolete with ever-changing EMI measurement technology improvements**

Proposed WG-1 EMC

- Review Scope statement
- Discuss adding purpose statement
- **Update reference standards and bibliography**
- Review Terms and Definitions
- Review Tables – move normative Tables 1 and 2 to Annex?
- Clarify usage of terms ‘space system’ versus ‘spacecraft’
- **Discuss adding ‘signal integrity’ requirement, similar to power quality requirement**
- **Consider new topics: ESD, PIM, Multipaction, etc. Added wiring, enclosure standards.**
- **Specific limits and test methods in revised ISO standard tailored by reference to mainly ECSS-20-06C and AIAA-S-121**.

Actions from Fall 2018 WG1 meeting

- **1) WG-1 Chair to assist in securing "Revise" vote for upcoming February 2018 5-year ballot**
- **2) Reaffirm commitment of EMC expert participants (Japan, Brasil, ESA etc. to aid in "mark-up" discussion of existing 14302:2002 document**
- **Draft will be issued to each p-member countries' Subject Matter Experts and the review of this draft will be discussed at the coming fall WG1 meeting.**

Additional Inputs

- **1) Include Multipaction requirements**
  - **Use AIAA/TOR and ECSS Multipaction Standards**
- **2) Recommend adding Passive Intermodulation (PIM) requirements**
  - **Spacecraft with multiple number of sensitive receivers as high powered transmitters are susceptible to PIM**
  - **Use AIAA PIM requirements as starting point.**

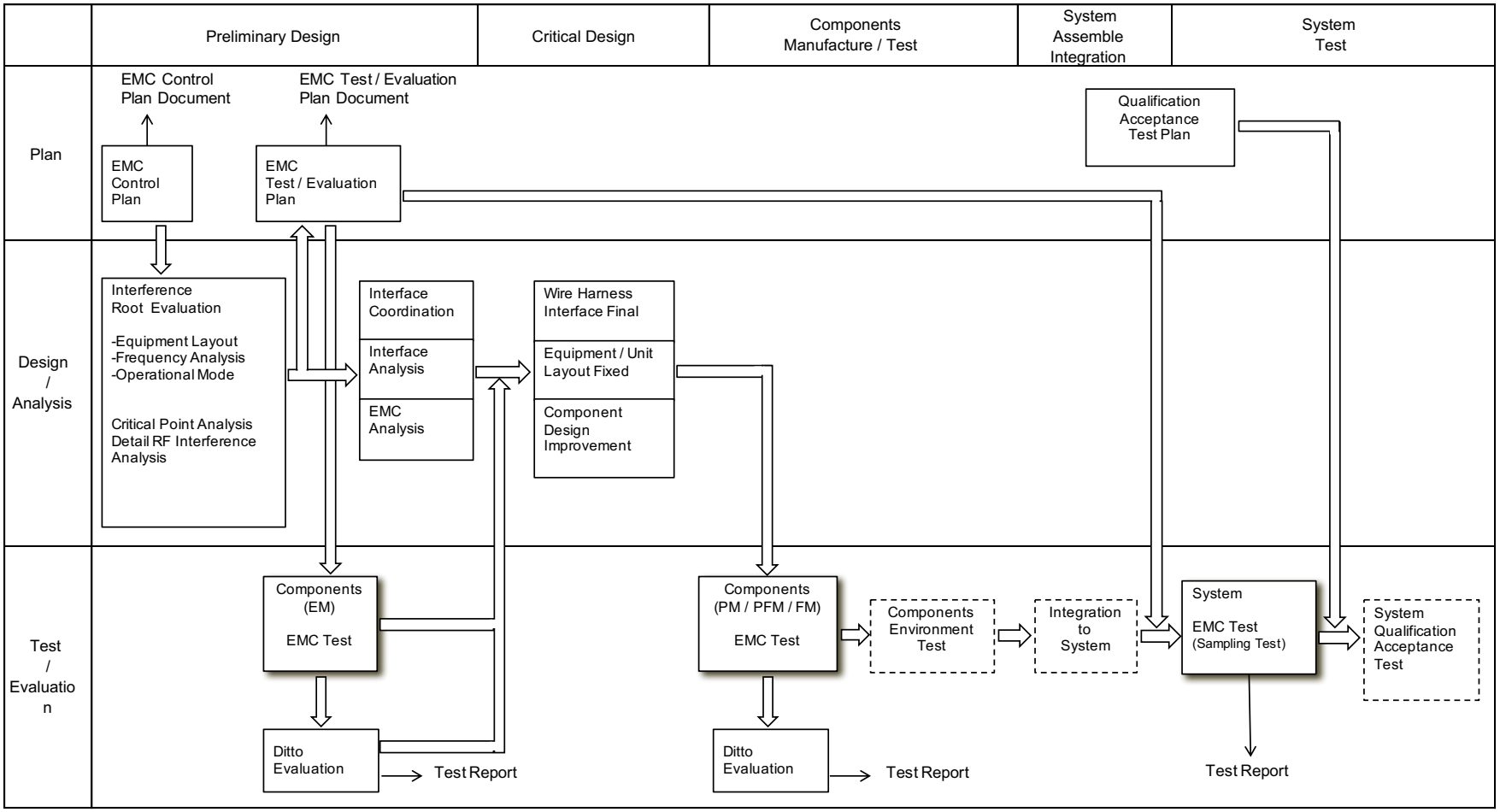
Additional Inputs

- Ensure ISO 14302 clearly defines Immunity and Susceptibility, Suppression in document
  - Document will include these definitions more accurately to reflect each of these items.
  - Document will have a glossary of terms to make it clear what is being discussed.

Additional Inputs

- ISO 14302 will include an EMC flow chart
  - Clearly defines timeline for EMC plan, design/analysis and then test/evaluation phase of a project.
  - It is believed that the flow chart is needed in the ISO updated EMC document to further provide a clarification of EMC involvement and sequence of events.
  - The flow chart is useful for document readers as it provides a spacecraft unit's or system's overall lifecycle from preliminary design to launch and provides key decision making steps and milestones.

Additional Inputs



Additional Inputs

- Comparison with ECSS and AIAA EMC Documents
  - http://everyspec.com/ESA/download.php?spec=ECSS-E-ST-20-07C_REV-1_07FEB2012.047904.pdf
  - Member nations and their respective review teams will need to do a thorough review of the ECSS and AIAA updated documents and ensure consistency with the ISO document.

Additional Inputs

- It is highly recommended that Space Charging and Electrostatic Discharge as well as Internal Electrostatic Discharge references be made in the updated ISO EMC document.
  - Reference NASA-Handbook 4002A and other pertinent documentation.
  - Static charging is an EMC issue as well. Static charging causes damage to components if the discharge is significant. It can also cause noise issues due to broad band noise.
  - It is recommended to mention it, but not in-depth as it is not the intent of the document.

Additional Inputs

- It is believed that Single Event Upsets should not be included in the ISO EMC updated document as this subject belongs in reliability or radiation ISO standards.

Additional Inputs

- Electrical Propulsion Systems are becoming more commonplace in interplanetary systems.
  - It is a high powered system that produces interference due high power, large strong magnets and high current coil systems.
- EPS is an issue for EMI if science instruments are included in a spacecraft package.
  - The EPS produces noise that encompasses a broadband spectrum profile.
  - Recommend ISO EMC updates include a description of its impact to spacecraft instrument and mitigations to minimize EMI.

Summary of WG 1 Splinter Meeting

- ISO 14302 has been updated with the changes described in Tuesday's presentation.
  - Updated new standards AIAA, ECSS, MIL-STD etc.
  - New requirements included such as multipaction, product intermodulation, electrostatic discharge.
  - New and updated definitions included.
- Committee Draft (CD) Document will be undergoing review by p-member countries
  - Will be obtaining feedback and comments from Japanese SME.
  - Final document draft to be completed by January 2019.

Summary of WG 1 Splinter Meeting

The ISO ballot closes on 3 December 2018.

The US TAG ballot, which closes on 29 October, will be to Revise the standard (see US comments below).
The US position and rationale should be conveyed at the November meeting to urge other countries to vote to Revise as well.

Submitter	Vote	Comment
Kirschbaum, Alan Independent Consultant	Revise	Considerable new work has been accomplished over the past 10 years in this field.
Zucker, HR HR-ZTECH Holdings Inc	Revise	Revision needed as 14302 has not been revised since its original issue in 2002. Considerable new work has been accomplished over the past 10 years in this field within the US AIAA and ECSS.
Frick, Warren Orbital Sciences Corporation	Revise	Electronics have changed massively since 2002 and this standard needs revisions to reflect currency.
Sargent, Noel Consultant	Revise	The (US) project leader has been waging support for this revision over the past few years within WG1, and a marked-up revision has been internally circulated with Japan including significant new content. Past meeting WG1 minutes contain that discussion content. The WG1 Convener also has been encouraging fellow HODs to vote for revision during his Plenary remarks. This revision is something that has needed as 14302 has not been revised since its original issue in 2002. Considerable new work has been accomplished over the past 10 years in this field within the US AIAA and ECSS.
Oltrogge, Daniel AGI	Revise	The (US) project leader has been waging support for this revision over the past few years within WG1, and a marked-up revision has been internally circulated with Japan including significant new content. Past meeting WG1 minutes contain that discussion content. The WG1 Convener also has been encouraging fellow HODs to vote for revision during his Plenary remarks. This revision is something that has needed as 14302 has not been revised since its original issue in 2002. Considerable new work has been accomplished over the past 10 years in this field within the US AIAA and ECSS.

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ISO Development of an International Standard

Stage name	Product name	Acronym	
Preliminary stage	Preliminary work item (project)	PWI	Preparation from a Preliminary work item to a new work item proposal by a member, TC/SC secretariat, TC/SC, Liaison organization, technical office, General secretary
Proposal stage	New proposal for a work item	NP	From new work item proposal (NP) to approval of a new standard project (Proposed by a Working Group but authorized only through the Subcommittee)
Preparatory stage	Working draft(s)	WD	From approval of a standards project to adoption for registration as a committee draft (Completely within the Working Group until advanced on WG recommendation to a CD.
Committee stage	Committee draft(s)	CD	From committee draft (CD, possibly several) to adoption for enquiry (draft international standard). Comments submitted by national delegations and dispositioned by WG.
Enquiry stage	Draft International Standard	DIS	From adoption for enquiry (Draft International Standard (DIS or CDV)) to approval of final draft. Advanced to this stage by SC ballot. WG dispositions comments subject to SC approval.
Approval stage	Final draft International Standard	FDIS	From approval of final draft (FDIS) to adoption as International Standard. Mandatory public review and comment period.
Publication stage	International Standard	IS	From adoption as International Standard to publication as ISO, IEC or ISO/IEC Standard

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