



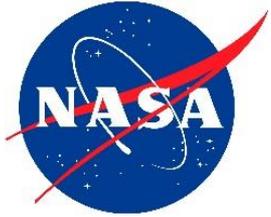
**Jet Propulsion Laboratory**  
California Institute of Technology

# **Design Engineering Working Group 1 Presentation – Pablo Narvaez/Noel Sargent RE: Upcoming Updates to Revision of ISO 14302**

**Space Systems Electromagnetic Compatibility Requirements**

Presented by: Pablo Simon Narvaez, JPL EMC Group Supervisor, Mission Environments Section, and  
Noel Sargent NASA Glenn Research Center (retired)

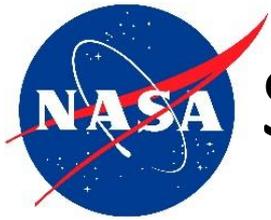
**June 11-15, 2018**



# ISO 14302 History



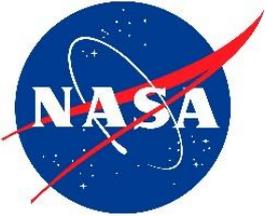
- ISO 14302 (49 pages) required updating
  - First published in 2002 after an intense 5-year effort.
- ISO 14302 is the top-tier document for EMC within SC14, and is a normative reference in other SC14 standards
  - Five countries participated always face-to-face
  - **Need same countries to provide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



# Supporting EMC Documents



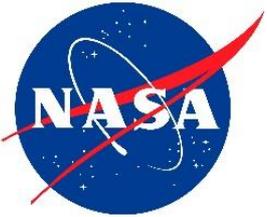
- Remove Old and Obsolete References:
  - ISO 7136-1995, applies to commercial aircraft
  - MIL-STD-461E, applies to military platforms, 254 pages
  - IEC 61000-4-2, Electrostatic discharge
- Add Newly Updated References:
  - ISO 24637 – Test reporting requirements 10 pages
  - AIAA-S-121 – Space system 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



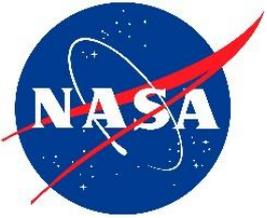
- **Delegations requested to vote February 2018 5-year review ballot to “revise”.**
- Use present version of 14302 as template
  - Do NOT throw out 5-years of good internationally negotiated work
- **Produce a revised top-tier EMC document that has lasting qualities, such that it does not easily become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



# Proposed WG-1 EMC



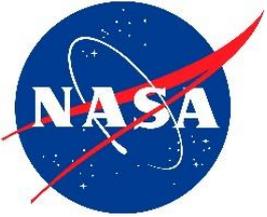
- Review Scope statement
- Discuss adding purpose statement
- **Update reference standards and bibliography**
- Review Terms and Definitions
- Review Tables – move normative Tables 1 and 2 to Annex?
- Clarify usage of terms ‘space system’ versus ‘spacecraft’
- **Discuss adding ‘signal integrity’ requirement, 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 Spring 2017 WG1 meeting



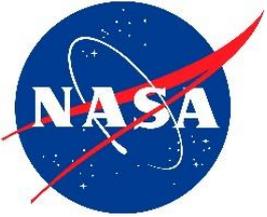
- **1) WG-1 Chair to assist in securing “Revise” vote for upcoming February 2018 5-year ballot**
- **2) Reaffirm commitment of EMC expert participants (Japan, Brasil, ESA etc. to aid in “mark-up” discussion of existing 14302:2002 document**
- **Draft will be issued to each p-member countries’ Subject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



# Additional Inputs



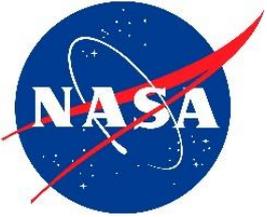
- **1) Include Multipaction requirements**
  - **Use AIAA/TOR and ECSS Multipaction Standards**
- **2) Recommend adding Passive Intermodulation (PIM) requirements**
  - **Spacecraft with multiple number of sensitive receivers as high powered transmitters are susceptible to PIM**
  - **Use AIAA PIM requirements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



# Additional Inputs



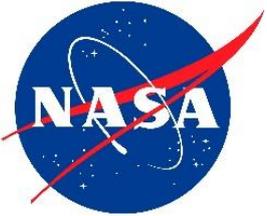
- Ensure ISO 14302 clearly defines Immunity and Susceptibility, Suppression in document
  - Document will include these definitions more accurately to reflect each of these items.
  - Document will have a glossary of terms to make it clear what is being discussed.



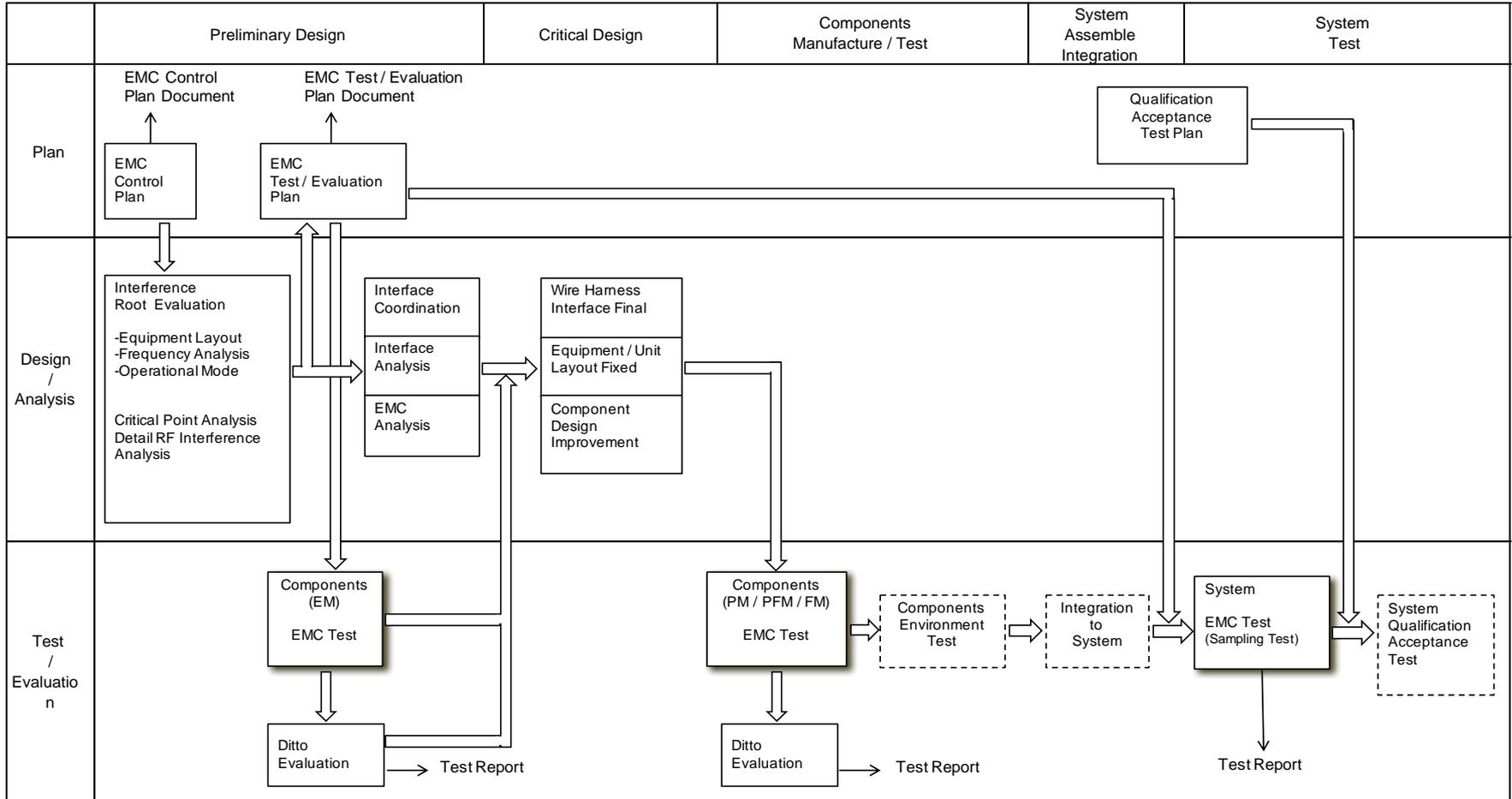
## Additional Inputs

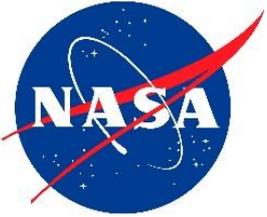


- ISO 14302 will include an EMC flow chart
  - Clearly defines timeline for EMC plan, design/analysis and then test/evaluation phase of a project.
  - It is believed that the flow chart is needed in the ISO updated EMC document to further provide a clarification of EMC involvement and sequence of events.
  - 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

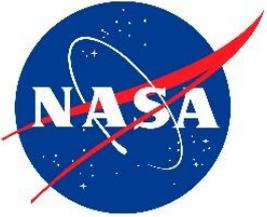




# Additional Inputs



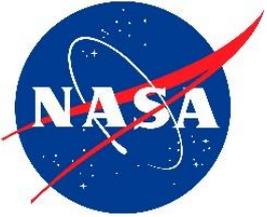
- Comparison with ECSS and AIAA EMC Documents
  - [http://everyspec.com/ESA/download.php?spec=ECSS-E-ST-20-07C\\_REV-1\\_07FEB2012.047904.pdf](http://everyspec.com/ESA/download.php?spec=ECSS-E-ST-20-07C_REV-1_07FEB2012.047904.pdf)
  - Member nations and their respective review teams will need to do a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



## Additional Inputs



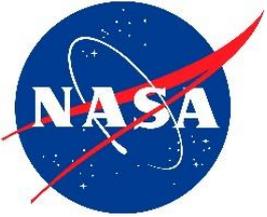
- It is highly recommended that Space Charging and Electrostatic Discharge as well as Internal Electrostatic Discharge references be made in the updated ISO EMC document.
  - Reference NASA-Handbook 4002A and other pertinent documentation.
  - Static charging is an EMC issue as well. Static charging 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



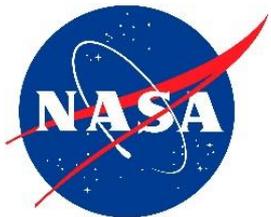
- It is believed that Single Event Upsets should not be included in the ISO EMC updated document as this subject belongs in reliability or radiation ISO standards.



## 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.



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