

Institute of Electrical and Electronics Engineers (IEEE) Electromagnetic Compatibility (EMC) Society Technical Committee on Aeronautics & Space EMC (TC8)

Meeting of July 29, 2021

Chair: James Lukash, Lockheed Martin Space Systems

Vice Chair: Jen Dimov, Jacobs Technology / Goddard Space Flight Center

Secretary Manny Soriano, Jet Propulsion Laboratory

Officers at Large;

**Katherine Dang (JPL), Adrian Sun (Aerospace), Ed Gonzales(JPL), Melissa Schwager (Ford) Pablo Narvaez (JPL), Randy Jost (Ball-Retired), Ray Perez(JPL), Paul Edwards(KSC), Nika Amralah (SSSOC), Bob Scully (JPL)
Paul Edwards (KSC)**

IEEE EMC Society Virtual Symposium July 26 - August 20, 2021



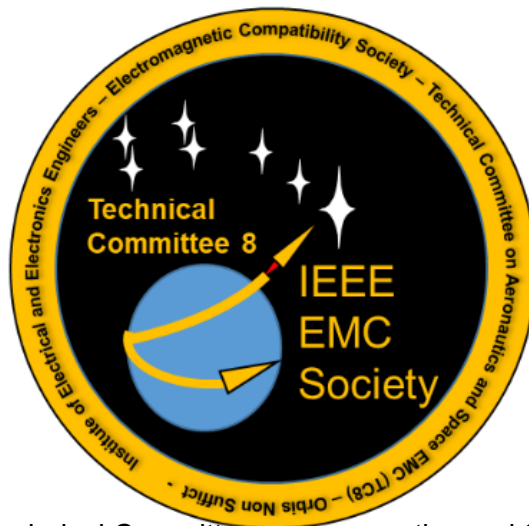
Agenda



- Welcome
- Introductions (Officers and Membership around the virtual room)
- Virtual Meeting mechanics (Virtual roster, chat window, how to ask for the floor (voice), how to ask questions, etc.)
- Officer Election
- Scope of TC8
 - Review of the Charter
 - Roles & Responsibilities of Technical Committee 8 (TC8)
- TC8 Activity & News for 2020-2021
- Long Range Planning – Future years
- Old Business– Proposed New Standard Lightning Test - Fred Heather
- New Business
- Closing Remarks
- Adjourn

Welcome

- “Around the table” introductions (Name & Organization)
 - Since it is a virtual table, we are going to skip this tradition until we return to face to face meetings
 - Please rename your Zoom participant name to reflect your name and organization (Wizard/Oz INC)
 - Please E-mail Secretary at manuel.martin.s.soriano@jpl.nasa.gov to sign our virtual roster





Virtual Meeting Mechanics



- **A virtual TC8 meeting is challenging for all of us, please be patient & professional with each other as we function in this virtual environment**
- **Please [mute](#) your microphone if you are not speaking, only have it on while you are speaking**
- **Worst case – you can always E-mail any of the listed officers directly and your concerns will be addressed during this meeting if possible, or after the meeting. The officers names and E-mails are on the next slide.**



Membership and Officers



- James A. Lukash (Lockheed Martin)
 - Founding Chair: James.A.Lukash@lmco.com
- Jen Dimov (Jacobs Technology / NASA Goddard Space Flight Center)
 - Vice Chair: - jennifer.dimov@nasa.gov
- Manny Soriano (Jet Propulsion Laboratory)
 - Secretary manuel.martin.s.soriano@jpl.nasa.gov
- Officers At Large
 - Katherine Dang (JPL), Adrian Sun (Aerospace), Ed Gonzales(JPL), Melissa Schwager (Ford), Pablo Narvaez (JPL), Randy Jost (Ball-Retired), Ray Perez(JPL), Paul Edwards(KSC), Nika Amralah (SSSOC) , Bob Scully (JPL)
- Reminder: Please e-mail Manny Soriano for attendance.

Election of Officers

- It is a normal for the EMC society and our TC8 committee to have periodic elections for officers
 - Officers (Chair, Vice Chair, Secretary) serve for two years, and may stand for re-election
 - Elections were last held for officers during 2020 Symposium meeting, so we will select officers for this technical committee again next year (2022)
- However if there is someone who wishes to nominate (Or self nominate) an individual for an officer at large slot, the chair will entertain such nominations
 - We presently have several individuals in the role of “Officer at Large”, and we remain open to additional persons for the position of “Officer in Training”/ “Officer at Large”
 - “Officers at large” participate in officers meetings in a non-voting capacity
 - Great opportunity to learn about the roles of the officer slots if you have interest without making a large commitment of time (Leadership Training)
 - Intended to allow people to learn about and “Test Drive” the functions of committee leadership with no actual responsibilities
 - Also excellent role for people to more fully participate w/o commitment
 - Officers at large speak and debate issues at officer meetings, but only the chair, vice chair, and secretary vote at those meetings

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- Our Charter
 - This committee is concerned with EMI/EMC issues in aircraft, spacecraft & space launch vehicles, robotic and crewed
 - The aerospace environment provides unique challenges in the design, development, test and operation of space systems to avoid EMI and achieve EMC
 - Aeronautics & Space EMC covers a wide range of topics on the part, board, box, system, multi-system, planetary and interplanetary levels
 - The harshness of the atmospheric, launch and space environments necessitates a broader view of EMC issues than traditional terrestrial projects, often leading to creative methods and solutions that can benefit our society's efforts elsewhere on Earth

- This committee serves as a resource for the Board of Directors of the EMC society on all matters associated with Aeronautics and Space EMC
- This committee helps recruit authors for papers, poster papers at the annual symposium as well as articles for our society's journal and newsletter
- This committee initiates and/or contributes to standards activity in our technical area
- This committee helps to organize special sessions of invited papers and workshops for the annual symposium
- This committee provides subject matter experts to review papers submitted for publication at the annual symposium
- This committee provides subject matter experts for discussion panel sessions at the annual symposium
- Monitors and informs the larger membership of new developments in our technical area



TC8 Diversity & GOLD Commitment



- TC8 is committed to the participation and support of Graduates of the Last Decade (GOLD) and all other groups wishing to expand their participation
- Our committee would not function nearly as well without the many contributions of GOLD & various Diversity group participants
 - Most TC8 officers are diversity/GOLD (TC Vice Chair & Secretary)
 - Our GOLD “Officers at Large” participate in all TC 8 officer meetings
 - TC8 could not function without GOLD /Diversity members
- We actively encourage people from all backgrounds to participate in the activities of our committee and society
- TC8 and its officers remain committed to diversity and are happy to assist you in expressing your unique voice in the IEEE EMC Society and the committee on Aeronautics and Space – and have been since this committee was formed
- Need help or guidance? Just ask!

TC 8 remains committed to diversity and GOLD participation

- TC8 currently has no subcommittees
 - Aeronautics and Space EMC is sufficiently broad area of work to envision the creation of subcommittees
 - During the discussions of the SC6/SC7 merger and creation of TC8 the question of a subcommittee within TC8 on Drones was discussed
- TC8 officers are open to the formation of subcommittees if they meet some basic conditions;
 - Sufficient interest lies within the area of interest proposed for a subcommittee (Measured via papers published, sessions/workshops held, etc.)
 - Leadership is available & committed to leading a subcommittee
 - Subcommittee(s) will report to the TC8 officers
 - Subcommittee(s) will exist so long as they maintain leadership and interest, and will be phased out if they lose either
- The TC8 officers welcome any and all proposals to form a subcommittee
 - At TC8 meetings
 - Via communications outside the meeting (Phone, Email, etc.)
- We have one request to form a TC8 Subcommittee to evaluate at this time

- **Dr. Charles Jullien has proposed the formation of a subcommittee to work in the area of commercial Aircraft power systems**
 - **Concern area is the changes in voltages and frequencies**
 - *“In aeronautics, we have a big new challenge It’s a challenge because we change the level of voltage/current (passage from 230V to 1000V) and we will find higher frequency power network (passage from 400Hz to 20-150kHz). So we need to work with these new constraints to size and design the EWIS and its components. All equipment and aircraft manufacturers have these problems to answer”*
- **If interested in this area of work, or have a desire to help him form a subcommittee within TC8 you may contact Dr. Jullien at:**

Dr. Charles JULLIEN
EMC Engineer
Expert EMC electrical harness modelling
Department EWISe R&T

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- Symposia
 - 2020 ~~René~~ Virtual Symposium
 - 2021 IEEE Aerospace Conference, Big Sky, Montana
 - 2021 ~~Raleigh, no wait Edinburgh~~ Virtual Symposium
- Standards Activity
 - MIL-STD-464 D was released
 - AIAA-S-121A-2017 (Tailoring of MIL-STD-461 for Space Systems)
 - Will begin a Re-affirm/Revise/Revoke cycle in 2021-2022
 - ISO
 - ISO TC20 SC14 54th Working Group Virtual Meeting held via e-mail and Zoom meetings from October 26 - 30, 2020
 - ISO TC20 SC14 55th Working Group 1 meeting held virtually via e-mail with TC8 Participation on May 10-13, 2021
 - ISO14302 EMC Standards Document elevated to international voting for approval of updated standards.
 - ISO Draft International Standard 14302 will be circulated by ISO on 27 July 2021 with a ballot deadline of 19 October 2021

This TC is actively working in the areas within its scope

- TC8 Organized and presented a track of papers at at the IEEE Aerospace Conference in 2021 (Also known as the Big Sky Conference, <https://www.aeroconf.org>)
 - The TC8 officers considered this outreach opportunity to be of great importance to the EMC profession
 - Instead of talking among EMC professionals, it is an opportunity to spread the importance of EMC to Avionics designers, systems engineers, mission planners, etc.
- Pablo Narvaez was the Session chair for 2020 & 2021 and will be for 2022
- Pablo is Soliciting contributors for 2022

TRACKS, SESSIONS, AND ORGANIZERS

07.10	COTS Utilization for Reliable Space Applications, Douglas Carsow (Naval Research Laboratory), Eric Bradley (Naval Research Lab), Harald Schone (Jet	09.01	Air Vehicle Flight Testing, Christopher Gavin (AIRTEVRON TWO ONE), Brian Kish (Florida Institute of Technology), Daniel Short (HX-21),
07.11	Designing Spacecraft Hardware for Electromagnetic Compatibility, Signal Integrity, and Power Integrity in Space Applications, James Lukash (Lockheed Martin Space), Pablo Narvaez (Jet Propulsion Lab), Jeffrey Boye (Johns Hopkins University/Applied Physics Laboratory), Paul Edwards (a.i solutions),	09.02	UAV Systems & Autonomy, Luis Gonzalez (Queensland University of Technology), Frances Zhu (Cornell University), Will Goins (dynamics),
	Robert Gershman (Jet Propulsion Laboratory), Bret Drake (The Aerospace Corporation),	09.03	Aircraft Systems & Avionics, Andrew Anderson (Navair),
08.01	Human Exploration Beyond Low Earth Orbit, Kevin		



So successful that we have been invited back in 2022

- 5 papers submitted, 5 accepted (one of was 5 shifted to special session)
 - TC8 “Aeronautics and Space EMC” Paper Session: 4 papers
 - **Lessons Learned in Aerospace EMC: Innovations, Findings, Technologies, Business** - Special Session – Organized by Ray Perez: 3 Papers
 - Best Paper Nominee: **Magnetic Shielding Concepts for Reaction Wheel Assembly on NASA Europa Clipper Spacecraft** – Katherine Dang, JPL
- Workshops
 - **Shielding** – Pablo Narvaez, Jet Propulsion Laboratory
- Demonstrations
 - **Impedance Demonstration** - Manny Soriano, Jet Propulsion Laboratory
 - **Radiated Emissions as a Function of Common Mode Current** - John McCloskey, Jen Dimov, NASA/Goddard Space Flight Center,
 - **Control of Electric and Magnetic Radiated Emissions at Low and High Frequencies** - Pablo Narvaez and Katherine Dang, Jet Propulsion Laboratory
 - Three (3) of the eight (8) demonstrations were from TC8 – 37% of all demonstrations

TC8 has contributed to the success of the virtual symposium

- Manny Soriano's Impedance Demonstration was the most watched



Conference Resources

- 2020 EMC+SIPI Virtual Symposium Final Program
- Technical Committee and EdCom Meetings
- Breakout Rooms

Experiment - Impedance Demonstration

Presentation

Background (cont.)

- Spacecraft bus distributes power across N-many loads/subsystems
- Stability between loads and source(s) is crucial, especially at constant power
- Key Example: International Space Station

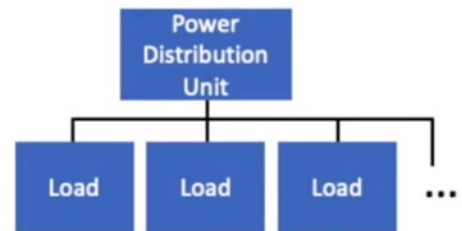


Image courtesy of Scientific American

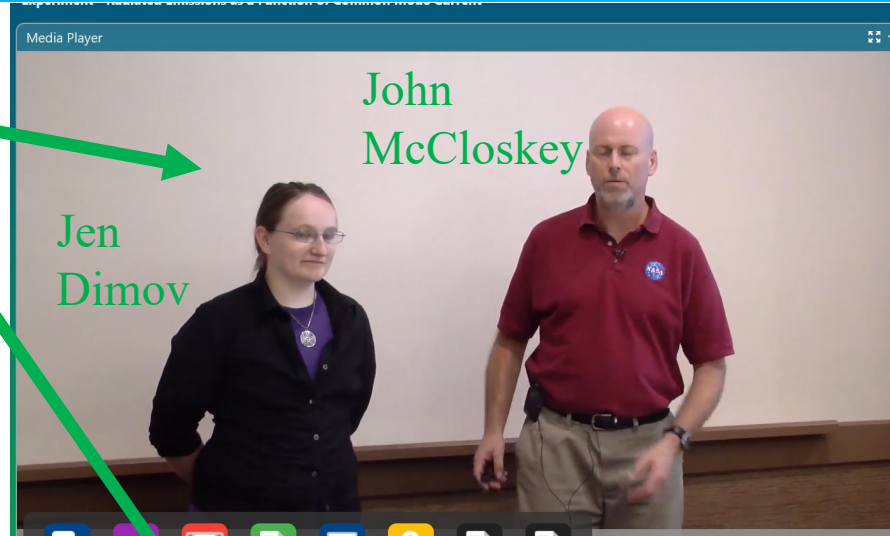
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NASA Jet Propulsion Laboratory
California Institute of Technology



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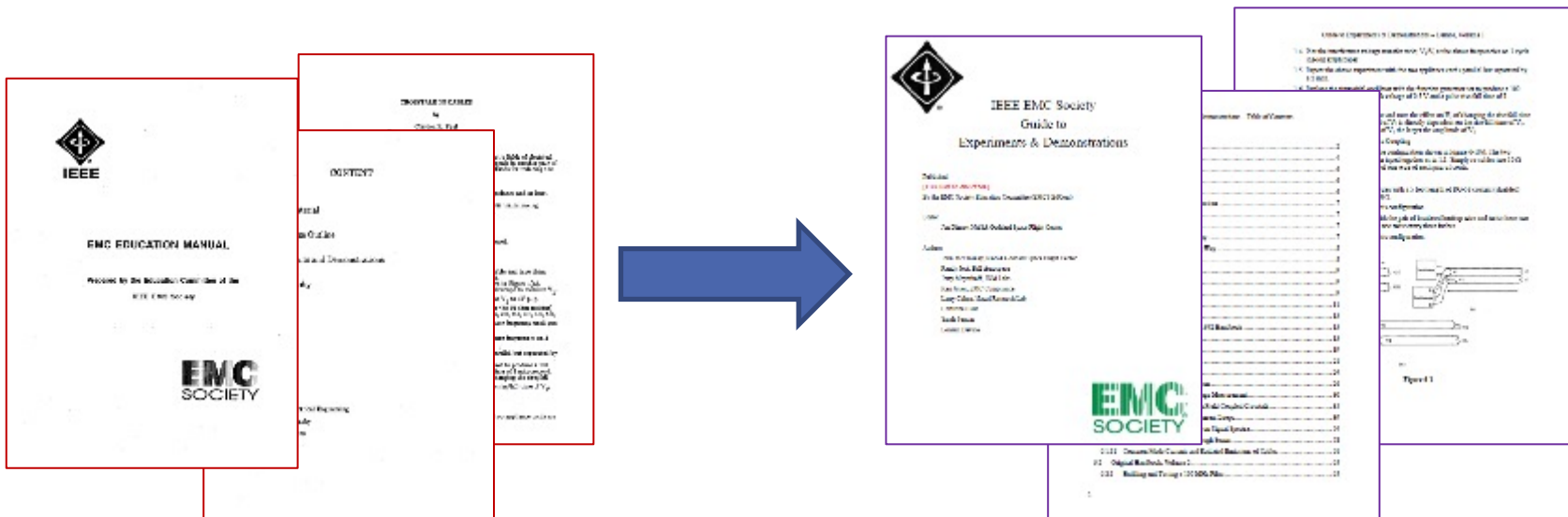
- **Radiated Emissions as a Function of Common-Mode Current** - John McCloskey/ Jen Dimov, Goddard Space Flight Center
- **Control of Electric and Magnetic Radiated Emissions at Low and High Frequencies** - Pablo Narvaez and Katherine Dang, Jet Propulsion Laboratory
 - **Best Paper Nominee: Magnetic Shielding Concepts for Reaction Wheel Assembly on NASA Europa Clipper Spacecraft** – Katherine Dang, JPL
- Special Session 1: **Lessons Learned in Aerospace EMC: Innovations, Findings, Technologies, Business** - Special Session – Organized by Ray Perez
- **TC8 Paper session: EMC Issue in Aircraft, Spacecraft, and Space Launch Vehicles, Robotic and Crewed**



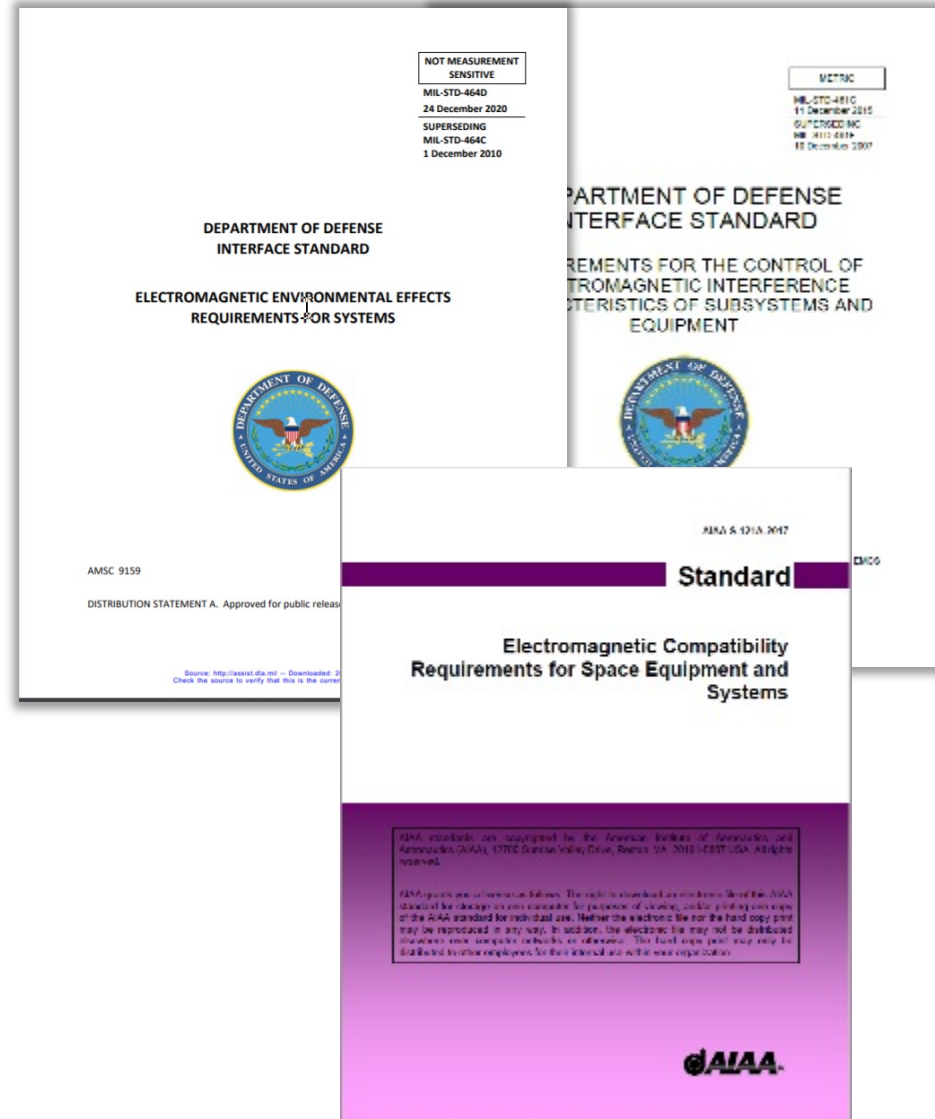
Ray
Perez

- **2 paper sessions, 6 Papers**
 - **TP-TUE-4A • Sponsored by TC-8**
Space EMC
 - **TP-THU-8B • Sponsored by TC-8**
Aeronautics and Space EMC
 - **Best Paper Nominee**
 - **Statistical Field Model for Performance of Localized RF Absorption Blankets in a Payload Fairing by Paul Bremner, et al., Robust Physics**
- **Demonstrations**
 - **Common Mode Conducted Susceptibility Testing – A Simplified Method - John McCloskey – NASA Goddard Space Flight Center**
 - **Frequency and time-domain calibration of vibrating intrinsic reverberation chambers – Charles Jullien and Guillaume Andrieu – Safran Electrical & Power**
- **Workshop**
 - **Ray Perez and Irfan Majid are presenting a tutorial sponsored by TC-8 in EMC+SIPI 2021. It is based on the book IEEE Handbook of Aerospace Electromagnetic Compatibility and titled "EMC Testing and EMI Mitigation for Safety Critical Aerospace Systems"**

- Several TC8 members have been closely involved in the Education Committee's project to revise and republish the old 1992 Experiments & Demonstrations Manual
- Aiming to complete this effort in 2021, but help always welcome
- Jen Dimov & Randy Jost are our liaison officers to this effort



- MIL and AIAA Standards are on a 5 year “Review, Revise & Republish, or Revoke” cycle (COVID may impact)
 - MIL-STD-464 D
 - D released is released
 - MIL-STD-461 G
 - G is published
 - Work has not yet begun on revision MIL-STD-461 H
 - AIAA-S-121A-2017, Electromagnetic Compatibility Requirements for Space Equipment and Systems was
 - “A” Revision (AIAA-S-121A) released in 2017
 - Work has not yet begun on AIAA-S-121B
 - Reaffirm/Revise/Revoke meetings will start in 2021-2022
 - Work remains on coordinating this standard with IEEE



- In April of 2019 the Aerospace Corporation released for public comment a draft copy of TOR-2019-00179 (TOR=Technical Operating Report, Aerospace Corporation)
 - **Scope:** *This document is a tailoring of the American Institute of Aeronautics and Astronautics (AIAA) Standard S-121A-2017 to provide an effective space vehicle (SV) program technical baseline for electromagnetic compatibility (EMC) and national security space mission success*
 - **Application:** *This document is intended for use in acquisition and study contracts for SVs.*
- Public Review Period was from April 23 to June 15, 2019
 - AIAA Committee for AIAA-S-121, which has many TC8 members, re-formed on an Ad Hoc basis to
 - Review and provide comments during the month of May 2019
 - Hold several teleconferences with the document's authors providing feedback
- TOR-2019-00178 was being revamped based on the public comments and released 18 March 2019 (With a document stated release date of 6 March 2019 on the front page of the document)



- TC8's ISO representative is Pablo Narvaez
- ISO TC20 SC14 54th and 55th Working Group meeting held virtually via e-mail and Zoom with TC8 Participation on October 26 - 30 2020 and May 10 - 13, 2021.
- Plenary meetings were held via e-mail interactions.
 - ISO14302 EMC Standards Document has been revised for the first time since its first publication in 2002,
 - Teamed up with Japanese Aerospace Exploration Agency (JAXA) Toru Kasai to generate the working Draft International Standard (DIS) draft that is now undergoing international approval.
 - ISO/DIS 14302 will be circulated by ISO on July 27th, 2021 with a ballot deadline of October 19, 2021.

- IEEE Distinguished Lecture Series:
 - IEEE Student Chapter, India Pablo Narvaez, gave a webinar on July 30, 2020 to the Institute of Electrical and Electronic Engineers (IEEE) Student Branch Chapter of the College of Engineering Karunagappally, India on the "Technical Challenges in the Development of Jupiter-Bound Interplanetary Spacecraft". There were over 60 IEEE student participants from different fields of study who were interested in learning about the topic.
 - IEEE EMC Chapter, Germany, on March 29, 2021, Pablo Narvaez, gave a talk on "Mars 2020 Perseverance and Ingenuity – EMI Technical Challenges" to students from the Hamburg University of Technology (TUHH), Germany, and to the German section of the Institute of Electrical and Electronic Engineers (IEEE) Electromagnetic Compatibility Society.
 - IEEE Student Chapter, El Salvador, on February 27, 2021, Pablo Narvaez, gave a webinar on "Radiated Electric and Magnetic Field Emission Shielding Mitigation Techniques" to the Institute of Electrical and Electronic Engineers (IEEE) Student Branch Chapter of the University of Don Bosco in El Salvador

- IEEE Argencon 2020 Key Note Speaker.
 - Pablo Narvaez, gave a Distinguished Lecturer presentation on December 4, 2020 at the Institute of Electrical and Electronics Engineers (IEEE) ARGENCON 2020 Virtual Conference. The title of his talk was “EMI in Deep Space: NASA’s Experience with Jupiter-bound Spacecraft”, and his presentation focused on how the spacecraft design accommodated the harsh environments of Jupiter, including the extremely high magnetic fields present in Jupiter. The IEEE Region 9-sponsored ARGENCON conference covers all of Latin America and the Caribbean.

- “Handbook of Aerospace EMC” was published
- Significant contributions by TC8 Members

List of Contributors

Karen Burnham
GM, USA

Martin Gabrisak
EMCC Germany

Paul Kay
Royal Australian Air Force, Australia

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Kohlberg Associates Inc.

Irfan Majid
Institute of Space Technology

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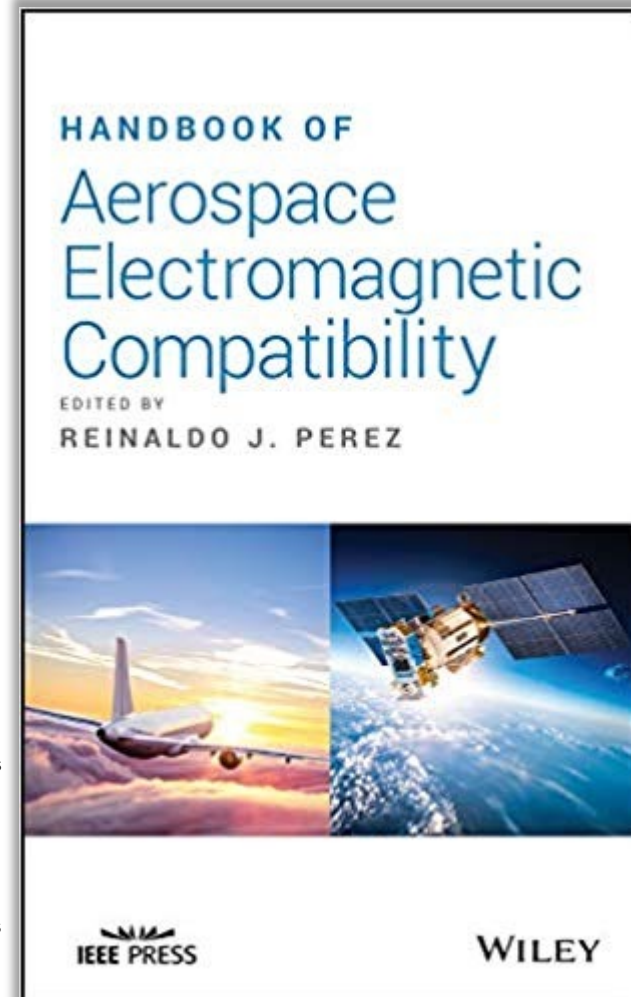
Robert C. Scully
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- **From the back cover**

- **A comprehensive resource that explores Electromagnetic Compatibility (EMC) for aerospace systems**
- *Handbook of Aerospace Electromagnetic Compatibility* is a groundbreaking book on EMC for aerospace systems that addresses both aircraft and space vehicles. With contributions from an international panel of aerospace EMC experts, this important text deals with the EMC testing of spacecraft components and subsystems, space environmental affects, analysis of crosstalk and field coupling, EMC issues in aircraft communication systems, and much more. The text also includes information on lightning effects and testing, as well as guidance on design principles and techniques for lightning protection.
- The book offers an introduction to Electromagnetic Environmental Effects models and techniques in aerospace systems and explores EMP effects on and technology for aerospace systems. Filled with the most up-to-date information, illustrative examples, descriptive figures, and helpful scenarios, *Handbook of Aerospace Electromagnetic Compatibility* is designed to be a practical information source. This vital guide to electromagnetic compatibility:
 - Provides information on a range of topics including grounding, coupling, test procedures, standards, and requirements
 - Offers discussions on standards for aerospace applications
 - Addresses aerospace EMC through the use of testing and theoretical approaches
- Written for EMC engineers and practitioners, *Handbook of Aerospace Electromagnetic Compatibility* is a critical text for understanding EMC for aerospace systems.



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5 Year Plan for TC 8

- We are in need volunteers to organize & run workshops, demonstrations, technical topic sessions, etc.

IEEE EMCS TC8 Aeronautics and Astronautics 5 Year Plan

Activity	2020	2021	2021	2022	2023	2024	2025
	Reno, NV - Virtual	Virtual - Raliegh	Virtual - Edinburgh	Spokane, WA	Grand Rapids, MI	Phoenix, Az	Not yet Selected
TC Meeting at Symposium	X	"The best laid plans of mice and men" - Robert Burns, Noted Scottish Poet	X	X	X	X	X
Special Session	X						
Workshop Sponsored			X				
Demonstrations	X		X				
Technical Topic Session Sponsored	X		X	X	X	X	X
Recruit for Poster Session	Y		Y	Y	Y	Y	Y
Newsletter Article							
Student Activity Sponsored							
SC Charter Review	Y		Y	Y	Y	Y	Y
Leadership Succession	Y		Y	Y	Y	Y	Y
Leadership Training	Open		Open	Open	Open	Open	Open

Many Opportunities to Participate – What can **YOU** Contribute to our Profession?

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Old Business



- Our “New Orleans/Canadian student” success story
- University Outreach
- Linked In group
- Proposed New Standard Lightning Test - Fred Heather
- Any other old business?

- **At the New Orleans Symposium in 2019 Nika Amralah, a University student, bravely asked for aid in getting involved in Aerospace EMC work during the TC8 “Ask the experts” session**
- **Through 2019 & 2020 TC8 officers and members helped this student to progress in her chosen profession**
 - **Provided mentoring and contacts within the industry**
 - **Student located an internship opportunity & completed her University studies**
- **Now in 2021**
 - **Graduated with a Bachelor of Aerospace Engineering (BEng) with a specialization in space systems**
 - **Had a paper accepted to the IEEE EMC Symposium 2021 (Their first paper)**
 - **Had another paper accepted to the Antenna Measurement Techniques (AMTA) Symposium conference [AMTA 2021](#)**
- **Got accepted into a Master of Aerospace Engineering (MEng) program which they will start this fall**

TC 8 and its members can make a positive difference

- University Outreach?
 - Student papers recruitment?
 - Cubesat Efforts?
- Formation / Curation of a Linked In group?
 - First proposed years ago by Ken Lynch
 - Started by Jen Dimov
- Fred Heather Lightning Standard?
 - Any other old business?



New Business



- Drafting of new EMC Standards and/or aligning standards with the IEEE.
- Other?



The Future of TC8 & EMC Society – How to Best Serve our Members?



- In 2020 EMC Society VP Communications Chuck Bunting has asked each Technical Committee to include a “Brainstorming/discussion” during all TC meetings on the future of the society and the future of each technical committee.
- It is no secret that the world is ever changing, and like all organisms Professional Societies must evolve; adapt or die
 - This includes the EMC society
 - A disturbing trend exists looking at the membership and activity levels of the EMC Society in 1980, 1990, 2000, and 2020
 - The purpose of the EMC Society is to serve the EMC community, and TC8 exists to served the Aeronautics and Space EMC community
 - For better or worse, it is an all-Volunteer organization
 - It is what we make of it, for better or worse
- There is no reason that we need to do things the way they have always been done

TC 8 remains committed to serving the membership, but how?

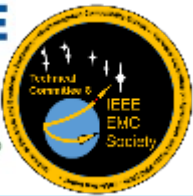


The Future of TC8 and IEEE EMC Society – How do we Best Serve our Members?



- **Challenges we face, in no particular order, include;**
 - **New methods of communications (Linkedin, Websites, Facebook, Webex/zoom/telepresence)**
 - **New mindsets; Generational differences(20th Century thinking vs 21st Century thinking, experience differences, national-to-international business models, New ways to network, new ways to learn, virtual working, aging Membership/“brain drain” concerns, recruiting new members(what exactly do we offer that makes new members want to join?)**
 - **What does it mean to be a professional society in EMC today and in the future(Or is it EMI/EMC, or is it E3, or E3 – and what about SIPI?)**
 - **How do we best interact with members**
 - **More frequent virtual meetings? Fewer meetings?**
 - **Online discussion groups? (Via IEEE, Linked In, etc.)**
 - **Ways as yet unexplored?**

TC 8 remains committed to serving the membership, but how?



What are your thoughts?



- **Any subject, any time – there are no bad questions or comments**
- **TC8 leadership is wide open on any topic**
- **Chair is here to serve you, not the other way around**

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Meeting Closure



- Reminder: Next TC8 general meeting will be at the 2022 Symposium in Spokane, Washington, August 1 - August 5, 2022
- Closing Remarks
- Adjournment

On Turning her up in her Nest, with the Plough, November 1785.

Wee, sleeket, cowran, tim'rous beastie,
 O, what a panic's in thy breastie!
 Thou need na start awa sae hasty,
 Wi' bickerin brattle!
 I wad be laith to rin an' chase thee
 Wi' murd'ring pattle!

I'm truly sorry Man's dominion
 Has broken Nature's social union,
 An' justifies that ill opinion,
 Which makes thee startle,
 At me, thy poor, earth-born companion,
 An' fellow-mortal!

I doubt na, whyles, but thou may thieve;
 What then? poor beastie, thou maun live!
 A daimen-icker in a thrave
 'S a sma' request:
 I'll get a blessin wi' the lave,
 An' never miss 't!

Thy wee-bit housie, too, in ruin!
 It's silly wa's the win's are strewin!
 An' naething, now, to big a new ane,
 O' foggage green!
 An' bleak December's winds ensuin,
 Baith snell an' keen!

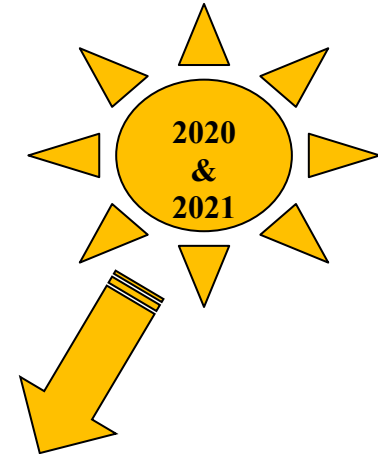
Thou saw the fields laid bare an' waste,
 An' weary Winter comin fast,
 An' cozie here, beneath the blast,
 Thou thought to dwell,
 Till crash! the cruel coulter past
 Out thro' thy cell.

That wee-bit heap o' leaves an' stibble
 Has cost thee monie a weary nibble!
 Now thou's turn'd out, for a' thy trouble,
 But house or hald,
 To thole the Winter's sleety dribble,
 An' cranreuch cauld!

But Mousie, thou art no thy-lane,
 In proving foresight may be vain:

***The best laid schemes o' Mice an' Men
 Gang aft agley,
 An' lea'e us nought but grief an' pain,
 For promis'd joy!***

Still, thou art blest, compar'd wi' me!
 The present only toucheth thee:
 But Och! I backward cast my e'e,
 On prospects drear!
 An' forward tho' I canna see,
 I guess an' fear!



See you in person in Spokane, Washington, USA in 2022

- Thank You for participating today

