Reference:

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Author affiliation:

A. Coello-Vera, Senior Advisor, REACHLaw

REACHLAW

COMPLIANCE. SUSTAINABILITY.

5th ESA REACH Workshop – 19th June 2024
ESTEC, Noordwijk, the Netherlands

Lead-free Transition for the European Space Sector (LETTERSS): a new EU-funded R&D project

Agustin Coello-Vera, Senior Advisor

Funded by the European Union

Content:

1. Background
2. LETTERSS Project
3. Main results expected

LETTERSS BACKGROUND

- **2003**: The RoHS directive was approved and took effect on 1 July 2006. The Space Industry was 'Out of Scope'
- **2006-2018**:
  - The European Space Sector (TESS) understood there could be an obsolescence risk for leaded solder paste.
  - In addition the strong and growing interest in COTS, where the finishes are Pb-free, added urgency for TESS to act.
  - But the actions were uncoordinated and the budgets wholly insufficient, many were waiting for others to solve the problem and then use the results
- **2018**: Inclusion of **Pb-metal** in the **REACH Candidate List** of SVHCs for Authorisation and here the Space Industry has to comply

LETTERSS BACKGROUND

- **2018**: **:** TESS finally addressed the issue at the SCSB, and agreed that a coordinated approach was needed. It launched a Task Force with the mission of delivering a consensual Roadmap for the Lead Free Transition for TESS. All TESS stakeholders were represented including an EDA observer.
- **2018-2020**: The Task Force delivered the Roadmap which was widely distributed to all funding bodies, including the EC.
- **2020-2023**:
  - ESA, CNES, and perhaps others, funded some activities with small budgets vs. the estimated cost for the transition.
  - The EC retained the subject in the 2022 Horizon call, but no projects retained, and then again in 2023 when LETTERS was retained and funded.

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LETTERSS PROJECT
ID Card

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ACRONYM	LETTERSS
HORIZON EUROPE CALL	HORIZON-CL4-2023-SPACE601
IMPLEMENTING AGENCY	Health and Digital Executive Agency
FUNDING INSTITUTION	European Commission, EU Space R&D Programme
HORIZON EUROPE SPACE TOPIC	Critical Space Technologies for EU non-dependence
TYPE OF ACTION	RIA
START DATE	01 January 2024
DURATION	36 months
FUNDING	2.7 million €
COORDINATOR	SCALIAN OP
CONSORTIUM	11 Partners

LETTERSS PROJECT

Consortium

The Consortium is built around **11 partners from 4 different countries** selected for their high quality and expertise in the field of space-based systems, components procurement and testing and materials research with:

- **Two major industrials end-users**: ADS-FR and TAS-FR
- **Three equipment manufacturers**: TESAT, TAS-ES, SODERN
- **One service provider in engineering**: ALTER
- **One electronic test house** : HTV
- **One research institute** : IRT
- **One university**: TU-DA
- **One expert in EU regulations** : REACH
- **One expert in Project Management** : SCALIAN OP

#	Short Name	Participant Organization Name	Coun
1 (COO)	SCALIAN	**SCALIAN OP**	FR
2	ADS-FR	**AIRBUS DEFENCE AND SPACE SAS**	FR
3	ALTER	**ALTER TECHNOLOGY TUV NORD SAU**	ES
4	IRT	**IRT ANTOINE DE SAINT EXUPERY**	FR
5	SODERN	**SODERN SA**	FR
6	TAS-FR	**THALES ALENIA SPACE FRANCE SAS**	FR
7	TAS-ES	**THALES ALENIA SPACE ESPANA SA**	ES
8	TESAT	**TESAT SPACECOM GMBH & CO.KG**	DE
9	TU-DA	**TECHNISCHE UNIVERSITAT DARMSTADT**	DE
10	HTV	**HTV CONSERVATION GMBH**	DE
11	REACH	**REACHLaw**	FI

LETTERSS PROJECT
Advisory Board

- The project also established an Advisory Board.
- The Board is composed by other Space stakeholders, mainly Space Agencies, which complete the overall project vision and aims, providing guidance as needed.
- Their support will be instrumental for a wide acceptability of the results of the Project.

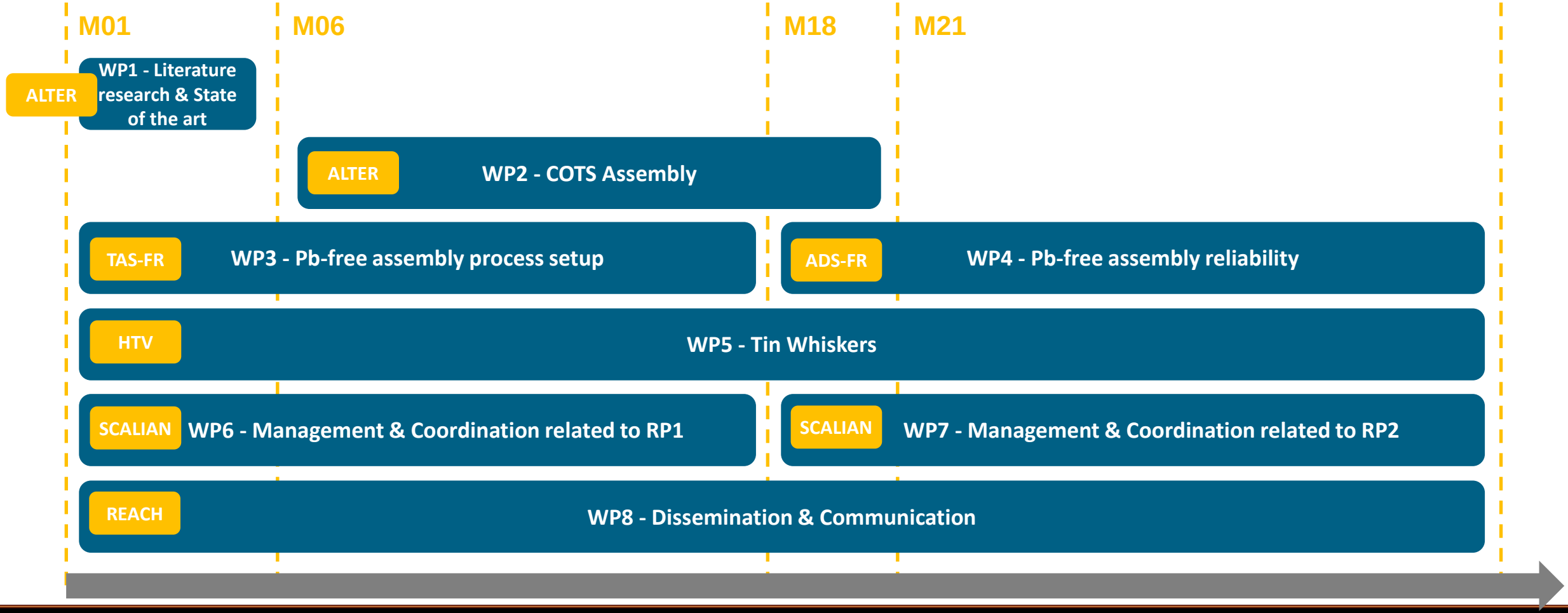
EEAB	Advisory Expert	
ESA	Gianni COROCHER	
CNES	Pierre ROUMANILLE	
DLR	Hans-Dieter HERRMANN	
EDA	Benoit MICHEL	Discussion ongoing
JAXA	Suzuki KOICHI	

LETTERSS PROJECT
Objectives

Objectives:

- Find solutions to the issues that slow down using COTS with existing SnPb Assembly Technology (WP2)
- Finding and validating suitable replacement(s) for the SnPb solder, workhorse of the Space Electrical Assembly for 60 years (WPs 3 and 4)
- Reducing the risks of the Pb-free transition by advancing the state-of-the- art in our understanding of Tin-whisker formation and growth. (WP5)

LETTERSS PROJECT
Project Organization



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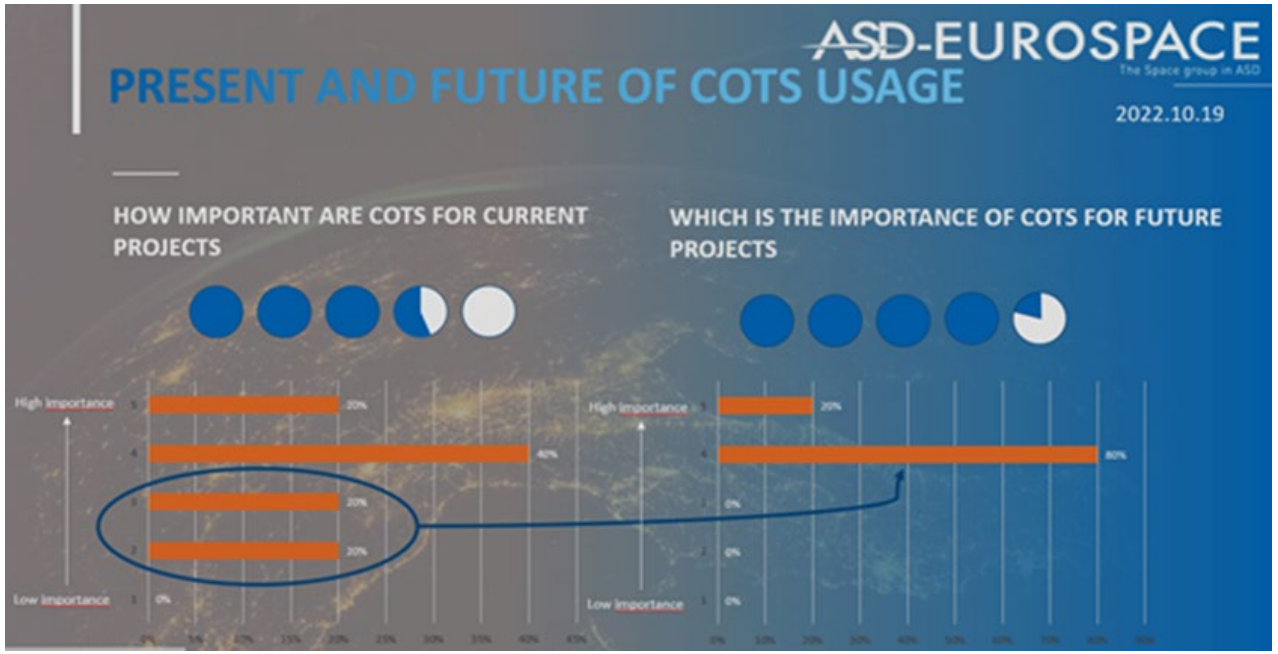
LETTERSS PROJECT

Work Package 2, COTS Assembly

- The results from this Workpackage will have the most short term impact with wide exploitation expected
- Main challenge will be to find broad agreement that the data (available or generated in LETTERS) for a given lead finish is sufficient to implement the necessary update of the relevant ESCC/ECSS standards. The Advisory Board will be contributory on this



LETTERSS PROJECT

Work Packages 3 & 4, Pb-free assembly

- These WPs represent the core of the Project and its results will have the most impact in the European Space Sector
- Key challenges will include test vehicle and test plan designs.
- The most important result will include the understanding of the behaviour, degradation and failure mechanisms of the solder alloys in the operative environment for space applications. This has not been published yet.

LETTERSS PROJECT

Work Package 5, Whisker formation and growth

- There is no consensus within the Space Sector on the risk due to whiskers. Some people think that today the risk is low/acceptable while others don't agree. It also depends on the type of program.
- The debate is not settled since we do not know the activation energies in order to design accelerated tests that will help to close the debate.
- There was a lot of research in 2000-2010 when most industrial sectors transitioned to Pb-free. Today only Space and other HiRel sectors are interested.
- LETTERS aims to advance our understanding on the whisker formation and growth in order to establish an accelerated test approach for whiskers formation in space application.

LETTERSS PROJECT

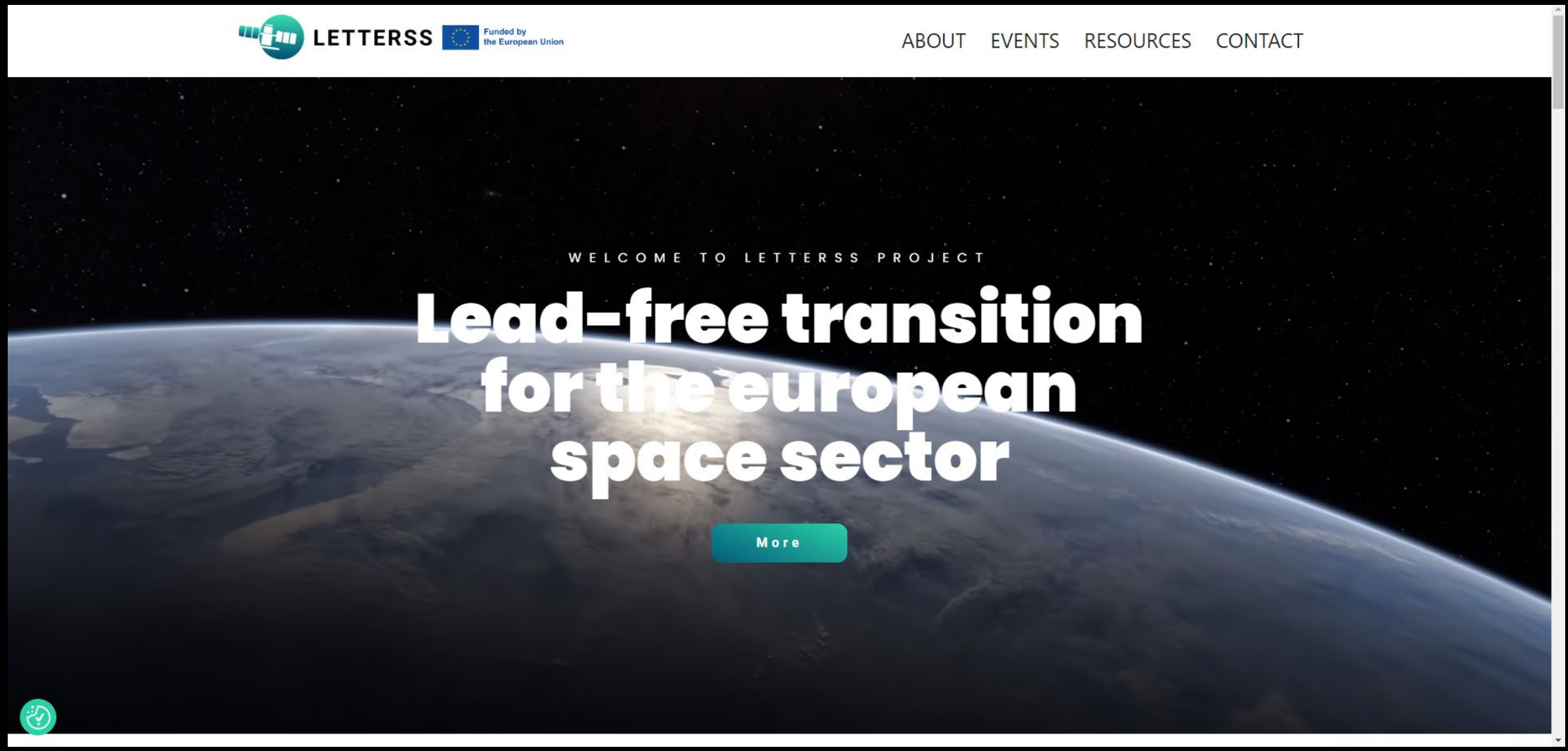
Work Package 5, Whisker formation and growth

Table 1 Accident name and cause of aerospace equipment caused by metal whisker.

Time	Product	Accident
1986	F15 fighter radar	Mixed package short circuit
1988, 1992	US missile	Short circuit
1989	Phoenix air-to-air missile	Mixed package short circuit
1998, 2000	Galaxy VII (Pan American satellite)	MOD10 relay failure
1998	Galaxy IV (Pan American satellite)	Master computer failure
1998, 2002	HS601 satellite	Short circuit
1999, 2000	Solidaridad I satellite	Relay failure
2000	Patriot II missile	Pins short circuit
2000	Mexican satellite	Communication interruption
2001, 2006	Galaxy III R satellite	Relay failure
2001	Rocket engine ignition device	Short circuited with shell and cause explosion
2002	Direc TV3 satellite	Processor failure
2002	Boeing satellite	Processor failure
2002	Military aircraft	Relay failure
2003	GPS enclosure	System failure
2005	OPTUS B1	System failure
2006	Space shuttle engine	Orbital deviation
2007–2010	Rocket armor piercing projectile	Control system short circuit
2013	Boeing 787 Dreamliner	Lithium-ion battery fire
2014	SpaceX Falcon 9	Explosions
2019	Galaxy Note7 mobile	Battery explosion

'Formation and evolution mechanism of metal whiskers in extreme aerospace environments: A review' Zekun WANGa,b, Shiming WANG, *Chinese Journal of Aeronautics*, **(2023), 36(9): 1–13**

https://letterssproject.eu/



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- CONTRACT NUMBER: 101135428

REACHLaw
Aleksanterinkatu 19
FI-00100 Helsinki
FINLAND

www.reachlaw.fi
info@reachlaw.fi

AGUSTIN COELLO-VERA
Senior Advisor
+33 673204152
agustin.coello-vera@reachlaw.fi