

Project no.: *CfP08-AIR-03-02-831882*

Project acronym: **SealedwithoUTaKiss- SWAK**

Project title: *Non-destructive testing (NDT) of bonded assemblies*

Instrument: *Cleansky 2 JTI*



Listing of Dissemination Activities from M19-M36

Start date of project: *01 April 2019*

Duration: *36 Months*

Deliverable Lead Partner: **GMI**

Contributions made by: **TWI, BRU**

Revision **Final**

Dissemination Level		
PU	Public	X
PP	Restricted to other programme participants (including the Commission Services)	
RE	Restricted to a group specified by the consortium (including the Commission Services)	
CO	Confidential, only for members of the consortium (including the Commission Services)	

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1. Introduction

As detailed in SealedwithoUTaKiss (SWAK) Description of Work (DoW), **WP6** encompasses the dissemination and exploitation activities of the project as well as actions related to maximisation of its impact. Task 6.1 addresses dissemination of outputs in the specialist industrial and academic communities that can benefit from the developments in SealedwithoUTaKiss project. The exploitation potential of the NDT solutions will be examined. The task will run as soon as WP1 is completed when the specifications are established. GMI has been assigned responsibility for project dissemination, exploitation and IP management. Activities will be in line with the outcome of IP management (Task 6.2) focusing on market potential and future actions required. The Innovation manager will coordinate the definition of the exploitation plans and will streamline activities with the help and agreement of the Topic Manager.

The outcomes of this task will be summarized in two deliverables: D6.1 which will list the publications and conference presentations and Deliverable 6.2 which will report the market potential and potential commercialization actions related to developments in WPs 1-5.

In a similar manner, Task 6.2 deals with Intellectual Property generated in the technical WPs. The IP team will perform preliminary steps to identify and capture any IP produced in these work packages (foreground IP). The patent searches and review will take place at month 9 and at the end of the project. The results of these searches will be reported in project meetings.

GMI will appoint an Innovation Manager who will lead the task. The Innovation Manager will:

- Review any project results as potential protectable foreground IP capable of commercial exploitation.
- Be responsible for drafting agreements that safeguard the consortium partners rights when a decision is made to proceed with protection of foreground IP.

The outcome of this work package will be reported in deliverable ‘D6.2. IPR assessment and management of knowledge’ and will be fed to the exploitation activities within Task 6.1. In addition, Deliverables 6.3 and 6.4 will summarize the dissemination activities performed from M1-M18 and M19-M36, respectively.

During RP1 evaluation by the CSJU and due to COVID-19 outbreak, Deliverable 6.1 has been updated, as several things have changed and numerous restrictions in travelling and in the organization of various events have been imposed.

More specifically, participating in conferences in the related fields was planned however due to the prolonged COVID-19 restrictions it was not possible during RP1. In addition, as a result of COVID-19, conference visits have been put on hold. However, future events have been considered as soon as travel restrictions would be lowered. In addition, as requested by the CSJU during RP1 review, a new Paragraph, including a Table with quantified dissemination goals has been added within Deliverable 6.1, as follows:

Dissemination Activity	Quantified Goal	Remarks
SWAK reference on internet sites of Partners	3	<u>SWAK - CLEAN SKY 2 - Research and development (gmi-aero.com)</u> <u>Non-destructive testing of bonded assemblies (brunel.ac.uk)</u>
Project material (leaflets/brochures/audio-visual publications that will be distributed at topical events)	2	Under development
Scientific Publications	2	Under development
Participation in topical national/international scientific conferences, technical workshops, industrial fairs, Greener Aviation: Clean Sky and other relevant events	5	Action delayed due to COVID-19 related restrictions. Updated planning includes: <ul style="list-style-type: none"> • MRO Europe (Amsterdam, 20-21/10/21) • Singapore Airshow (Singapore, 15-20/2/22) • JEC World (Paris, 8-10/3/22)
General audience articles (EU portal news, specialised magazines, etc.)	2	Under development
Linkedin	1	A linked-in post is being prepared. Soon after preliminary results are available from Guided wave NDT, the post will be put on the linked-in page of Brunel Innovation Center.
Webinars	2	To be considered alternatively to participation in conferences / workshops / exhibitions, according to the evolution of the pandemic.

2. General

Dissemination, communication and exploitation activities are of paramount importance in SealedwithoUTaKiss project, to maximize its impact and trigger effects across the project's entire range of target audiences, the SealedwithoUTaKiss consortium, by fully recognizing the above, will implement a dedicated dissemination and exploitation strategy, predominantly aiming at ensuring:

- The effective and sustainable dissemination of the SealedwithoUTaKiss project generated knowledge and technologies within the entire community, and through the implementation of *suitable* and *specialized* dissemination and communication activities for each of the project's identified target groups and end users.

- The exploitation of the project's results by the European Aerospace Industry to maintain and reinforce technological advantage over the competition from outside Europe.

- The interconnection with other industrial sectors with the potential to exploit the findings and outcomes of the project.

- The conveyance of new knowledge into the engineering education base provided by the University partners to meet the evolving skill needs of the sector.

- The possible exploitation of the SealedwithoUTaKiss project results and foregrounds in other sectors, e.g. electronics, communication and industrial systems.

The dissemination of the SealedwithoUTaKiss project results will be made through the classical methods: publication in specialized magazines like Aeronautical, Advanced Avionics systems, Aerospace Journals, Aviation Week, Aviation Safety Magazine, etc. and through participation in aeronautic events like: Aero days, Paris Air Show, Toulouse Air Show, JEC, Singapore Airshow, MRO Dubai, RO Uk etc. Partners will take advantage of the periodical project reunion uniting representatives of the European Aeronautic Industry, to present the progress made within SealedwithoUTaKiss project. It could be also being exploited the existing e-dissemination channels and web platforms of relevant organizations for the use and spreading of the research results, as the existing aeronautic clusters.

The results of the project SealedwithoUTaKiss will be also presented at different events (workshops, technical conferences, fairs and exhibitions) organized by the members of the consortium and in other potentially interesting events that could be aeronautical sector, advanced materials bonding and manufacturing and in relation to the dissemination workshops organized by the consortium members, the aim will be to spread the goals, expected results and achieved progress to the scientific and industrial communities.

A dedicated SealedwithoUTaKiss dissemination seminar (in WP6) has been planned at the end of the project for the stakeholder and industries which are dealing with aircraft bonded structures and NDT to present the achievements of SealedwithoUTaKiss.

At the end of the project, information about the major technical achievements and outcomes will be presented and will be sent to the relevant organizations and trade associations. Partners will take advantage of the provided possibilities of EASN platform (where consortium members have associated member) for the dissemination of the project. The technology generated within the project scope will also be available for dissemination using relevant case studies.

3. Plan for the dissemination and exploitation of the project's results

The primary objective of the SealedwithoUTaKiss dissemination and exploitation plan is to prudently and timely identify and organize the activities to be performed (during and after the project), in order to maximize its influence and while taking into account the dissemination needs of the project at each stage of its lifecycle, as well as the specific technical, market, organizational issues and interests of each of the various pre-defined SealedwithoUTaKiss target groups/end users. Consequently, the **main aims** of the planned dissemination and exploitation approach can be summarized as follows:

- **Inform** about the SealedwithoUTaKiss activities to stimulate the participation of SMEs, academia, industry, research establishments, civil society and their networks. Organization of (and participation in) events, workshops and seminars;
- **Raise Awareness** - Present the project, its main objectives and expected impact (e.g. SealedwithoUTaKiss public website, project leaflet, poster and newsletter, etc.)
- **Networking** - Exchange experience with other projects related to SealedwithoUTaKiss to join efforts, minimize duplication and maximize exploitation potential
- **Disseminate Knowledge** - Regularly provide information about the SealedwithoUTaKiss outputs through several channels (e.g. Horizon the EU Research and Innovation Magazine, Clean Sky 2 newsletter, etc.)
- **Support SealedwithoUTaKiss Exploitation** - Pave the way for a successful exploitation of the project results by addressing the full range of potential users and uses, including research, commercial, investment, social, environmental, policy making, setting standards, skills and educational training.

Proposed events for dissemination	Proposed journals for publications
<ul style="list-style-type: none"> <input type="checkbox"/> Greener Aviation Clean Sky 2 Conference <input type="checkbox"/> ECOMONDO fair and Conference <input type="checkbox"/> 255th ACS National Meeting & Exposition <input type="checkbox"/> Aero days 2021 <input type="checkbox"/> Paris Air Show <input type="checkbox"/> Toulouse Air Show <input type="checkbox"/> EASN Platform public events <input type="checkbox"/> Aviation Electronics Europe (AEE) <input type="checkbox"/> Avionics & Space Testing Expo (AST) <input type="checkbox"/> ARC-Digital Avionics Systems Conference 	<ul style="list-style-type: none"> <input type="checkbox"/> Journal of Aeronautics & Aerospace Engineering <input type="checkbox"/> Aerospace Science and Technology <input type="checkbox"/> IEEE Transactions on Aerospace and Electronic Systems <input type="checkbox"/> International Journal of Aerospace Engineering <input type="checkbox"/> International Journal of Aerospace System Science and Engineering

4. Communication activities

Activities to disseminate information and exploit research and innovation results as well as carry out communication activities will be an important and integral part of Clean Sky 2. The following communication measures and strategies will be adopted for promoting the project at European level and to reach the largest possible audience, including groups beyond the project's own community. Communicating relevant knowledge about the project's latest activities and achievements to the relevant identified SealedwithoUTaKiss target audiences is certainly a way to keep all partners actively involved in the project and the SealedwithoUTaKiss consortium accordingly realizes that communication is not something that should be dealt as a side task; on the contrary, it is one of the topmost aspects, priorities, and prerequisites of running a successful research project. In this context, the draft communication plan for promoting this project and its results, include an efficient and effective mix of both interpersonal and mass communication tools. Moreover, it shall be strongly emphasized, that for each targeted audience, a distinct strategy using targeted messages, means and language has been planned.

Direct proactive communications and physical demonstrators: *Attendance at seminars and conferences, one-to-one communication, e-mailing stakeholders, periodic newsletters, etc.;*

- **Clustering activities:** *Contacting parallel related projects, cross-field events;*
- **Mass and general communication:** *Project website, press releases, posters and leaflets;*
- **Scientific excellence:** *Publications in highly-ranked journals, presentations at conferences;*
- **Academic:** *Conveyance of the new knowledge into University curriculums, publications of MSc and Ph.D. theses.*

Below, specific audiences and communication methods have been defined for promoting SealedwithoUTaKiss and its main results:

Dissemination Tools	Target Audience		
	Scientific Community	Industry and SMEs	Public at large
Project page in coordinator website	X	X	X
Project material (leaflets/brochures/audio-visual publications that will be distributed at topical events)	X	X	X
Newsletters (via project webpage)	X	X	X
Scientific Publications	X	X	-
Participation in topical national/international scientific conferences, technical workshops, industrial fairs, Greener Aviation: Clean Sky and other relevant events	X	X	-
General audience articles (EU portal news, specialized magazines, etc.)	-	X	X

5. Participation in Industrial Events

The main industrial events where SealedwithoUTaKiss concept and scope of work together with some preliminary results have been presented or are going to be presented are listed below:

- MRO Europe, 20-21/10/2021, Amsterdam, The Netherlands

Anita 4.0
THE SYNONYM OF HOT BONDING

GMI AERO

AVIATION WEEK
MRO
EUROPE

GMI Aero will present the brand new Anita 4.0
in GoLive! Theater
13:30 : Digitalization of Aircraft Maintenance

Visit us at Booth# 3074 October 19-20th, 2021 in Amsterdam
On the French Pavilion





- MRO Americas, 26-28/4/2022, Dallas, USA



April 26-28, 2022
Dallas, TX, USA
#MROAM

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MRO Americas 2022 – Accelerate!
Empowering, Advancing, and Innovating the Aftermarket

Attend the largest aviation MRO event in the world!

800+ solution providers in the exhibition!

As the industry focuses on accelerated ramp-up, learn the hottest trends, experience new ideas, services and products, all while reconnecting with the MRO community!

- 800+ solution providers on the exhibition floor
- Fleet and MRO Forecast
- State of the Airlines featuring Southwest Airlines and more!
- We're Hiring! Strategies for Building the Workforce Pipeline
- Aviation Week's Top 5 Supply Chain Hurdles And How to Overcome Them
- New Tech in MRO: Driving Down Costs and Accelerating Change
- Global Cargo Conversion Boom: No Signs of Slowing Down
- How Geopolitical Chaos is Shaping MRO

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- JEC World, 3-5/5/2022, Paris, France

PARIS-NORD VILLEPINTE
May 3-5, 2022

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JEC WORLD
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**JEC WORLD 2022 FROM
MAY 3 TO 5, 2022**

The world's leading composites event will now take place from May 3rd to 5th, 2022, at the same venue Paris Nord Villepinte, as well as online via the JEC World Connect digital platform.

READ THE STATEMENT

- MRO Europe, London, 18-20/20/2022



Conference: October 18-20, 2022
Exhibition: October 19-20, 2022
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SAVE THE DATE
MRO Europe returns to London in 2022!
Conference: October 18-20
Exhibition: October 19-20
ExCeL London, UK

6. Papers – Presentations in Scientific Conferences

Paper 1

Evaluation of NDT techniques for the detection of kissing bond defects in composite joints, Tat Hean Gan , Jamil Kanfoud, Srinath Ramagiri (BIC), Angelos Christopoulos, George Kanterakis, Konstantinos Kitsianos (GMI), Pratik Shukla (CU), Georgios Liaptsis, Jonathan Laidler (TWI) ,



Abstract:

Bonded joints are being increasingly used in various industries such as Aerospace, Defence, and Automobile industries etc. More and more aircraft structural elements are manufactured out of composite materials thanks to the excellent rigidity to weight ratio. Bonded joints are extensively used to join aircraft parts because they offer compactness and defect free joints compared to the other joint types. In these joints, any small defect in the bonded area can lead to a catastrophic failure. There are many types of defects in bonded joints of composite parts such as porosity, internal voids, and no-bond regions etc. Researchers have devised various methods to detect the defects except one and that is kissing bond defects. Kissing bond defects are well known and are undetectable using any classical NDT method. As they are practically a zero-volume dis-bond defect, the joint is intact but with zero shear strength, leave no signature for usual NDT methods that identify discontinuities (cracks, porosities and gaps). The only way to reliably detect a kissing bond is by destructive mechanical testing showing the limited shear resistance. For the safe use of bonded joints in aerospace or defence industries, it is critical to developing an NDT technology for reliably detecting kissing bonds. In this regard, we have developed a protocol to fabricate bonded joints with kissing bonds. The created bonded joints with kissing bonds have been subjected to mechanical testing to confirm the creation of kissing bond defects. Extensive research has been carried out on developing advanced NDT techniques to detect the kissing bonds. Some of the techniques we have explored and tested are Ultrasonic Guided Waves, Laser Shock, High frequency C-scan and Computed Tomography.

Keywords: *Kissing bond, Laser shock, guided waves, zero volume defects.*

Paper 2

This manuscript is under preparation based on reviews and will be communicated soon

Detection of kissing bond defects in composite joints using guided wave NDT and laser shock,
Tat Hean Gan , Jamil Kanfoud, Srinath Ramagiri , Angelos Christopoulos, George Kanterakis,
Konstantinos Kitsianos, Pratik Shukla, Georgios Liaptsis, Jonathan Laidler



Abstract: A kissing bond is a defect where two surfaces are partially bonded or de-bonded, but still, touch or are in very close proximity. A kissing bond is also considered as a zero-volume dis-bond offering reduced shear strength. Although the reasons behind these defects are not clearly known, poor adhesion, environmental degradation, or impact damage are considered to be some common causes. A defect of this kind cannot be observed / detected macroscopically, and because of their intimate contact, its detection using non-destructive techniques (NDTs) is more limited than that of conventional defects. It is important to devise a technique to detect these defects because, use of adhesives and adhesive joints is gaining importance in industries such as automobile, aerospace, defense, etc. The presence of these defects in bonded joints leads to catastrophic failure due to the nature of the defects. Destructive tests however detect these defects accurately but are not applicable on in-service assets. In this regard, we in this work have used guided wave NDT and laser shock techniques to detect kissing bond defects in bonded joints. For this purpose, bonded joints are created with and without kissing bond defects. Mechanical tests are used to confirm the creation of bonded joints with kissing bonds. Thus, a protocol is created to create bonded joints with kissing bonds. Later, the bonded joints are tested using guided waves NDT, laser shock tests. Time signals of the bonded joints samples are analyzed to detect kissing bond defect.

Keywords: *kissing bonds, Non-destructive testing, Guided waves NDT, Laser shock*

7. Continuous Professional Development Seminar

Based on the innovations developed with the SealedWithoutAKiss project, together with the R&D results deriving from a variety of other EU projects, GMI in cooperation with the Polish Institute of Aviation (ILOT) will organize a Continuous Professional Development seminar in Warsaw, from 16-17 June 2022.



The banner features logos for Łukasiewicz Instytut Lotnictwa, Continuous Professional Development (CPD), and GMI AERO. The central text reads: "CONTINUOUS PROFESSIONAL DEVELOPMENT ON BONDED COMPOSITE REPAIRS". To the left, it says "ILOT & GMI Aero CPD Seminar on". To the right, it specifies "When: 16-17.06.2022" and "Where: Warsaw, Poland". At the bottom left, there is a "Contact & Registration [email address to insert here]" field. A circular "SAVE THE DATE" stamp is located at the bottom right.



The graphic includes logos for GMI AERO and Łukasiewicz Instytut Lotnictwa. The text reads: "SAVE THE DATE !", "CONTINUOUS PROFESSIONAL DEVELOPMENT ON BONDED COMPOSITE REPAIRS", "WHERE : WARSAW, POLAND", "WHEN : 16 & 17 JUNE 2022", and "WITH DISTINGUISHED SPEAKERS FROM MAJOR MRO, OEMS AND ACADEMY !". The background is a blue network of nodes and lines.

The CPD Seminar will be focused on the contemporary repair challenges and the latest innovations in equipment and methodologies, taking into consideration the fact that the recent venue of all - composite fuselage aircraft (A350 –B787), together with the expansion of older aircraft fleets, introduces new requirements in bonded composite repair.

Experienced industrial personnel, together with academic experts, provided an insight of recent R&I developments and critical issues in the field of bonded composite repair, ensuring that seminar participants acquire a full “process understanding”, including a demonstration workshop, to support reliable application of bonded repairs, even on Class I (safety critical) structures.

SealedWithoutAKiss Topic Manager has been also invited to participate as KeyNote Speaker in this event.

8. Internet Posts


Linkedin

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Srinath Ramagiri has successfully conducted the Laser shock tests for the SWAK project with the support of Pratik Shukla and Coventry University. The experiment involves subjecting test samples to high-energy laser pulses to generate sufficient shock waves and to simultaneously use a laser vibrometer to measure the induced vibrations in order to detect defects.

Sealed Without A Kiss (SWAK) is a #EU #horizon2020 funded project focusing on detecting kissing-bond defects in composite joints/bonds. We have joined forces with GMI Aero and TWI for this H2020 project. We along with the consortium are experimenting with various advanced NDT methods to detect kissing bond defects.


Find out more at:
<https://lnkd.in/dMx2e6Zp>
#lasersystem #defectdetection #shockwave #ndtinspection GMI AERO TWI



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Research Centre of Brunel University London
2mo • Edited • 4

Srinath Ramagiri has successfully conducted the initial tests for the Sealed Without A Kiss (SWAK) project in our Cambridge labs. SWAK is a project focussing on detecting kissing-bond defects in composite joints/bonds. We have joined forces with GMI AERO and TWI for this H2020 EU funded project. We along with the consortium are experimenting with various advanced NDT methods to detect kissing bond defects. Find out more at <https://lnkd.in/dMx2e6Zp>

#innovation #NDT #defectdetection #compositebonding #collaboration




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Research Centre of Brunel University London
1w • 4

Srinath Ramagiri will be presenting later on this morning at The @13th International Symposium on NDT in Aerospace 2021. He will discuss his research from the SWAK project 'Evaluation of NDT techniques for the detection of kissing bond defects in composite joints/bonds'

Sealed Without A Kiss (SWAK) is an EU-funded project focusing on detecting kissing-bond defects in composite joints/bonds. We are delighted to be working with GMI AERO and TWI on this #HORIZON2020 collaboration. The consortium is experimenting with various advanced NDT methods to detect kissing bond defects.

<https://lnkd.in/dEwpQmzt>



<https://www.linkedin.com/posts/brunel-innovation-centre-eu-horizon2020-lasersystem-activity-6844592011027214337-fCZh>

<https://www.linkedin.com/posts/brunel-innovation-centre-innovation-ndt-defectdetection-activity-6835482672811282432-1eLL>

<https://www.linkedin.com/posts/brunel-innovation-centre-srinath-ramagiri-will-be-presenting-later-activity-6851416379464155136-7iyb>


Press Releases

THE 'SWAK' PROJECT: A Q&A WITH TWI'S PAUL EVANS




THU, 03 MARCH, 2022

TWI has been working on a project alongside GMI Aero S4S and Brunel University London to investigate non-destructive sensing methods for determining the quality of adhesive bonds on composite materials used in the aerospace industry, with the aim of increasing confidence and uptake of these lightweight materials.

We spoke with TWI's senior project leader, Paul Evans to find out more...



Related articles

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SWAK - CLEAN SKY 2



Non-destructive testing (NDT) of bonded assemblies (SealedwithUTaKiss)



With the growing demand for composite materials in aircraft, joint defect NDT capabilities are vital to the industry, growth in air transport has driven the world's economy at 5.4% (2012), the most rapid of OECD countries (excluding oil & gas) in 2012 and is expected to rise to 6.5% by 2020 and is expected to rise to 7.5% by 2025. It is expected that the



Non-destructive testing of bonded assemblies

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Sealed Without A Kiss (SWAK): Non-destructive testing of bonded assemblies

Background

Adhesive joints are used to join structural elements in aircraft. Compared to the conventional structural joining techniques such as bolting, riveting and welding, adhesive joints minimize stress concentration and fatigue problems. Adhesive joints are susceptible to environmental degradation and manufacturing defects, hence it is imperative to use methods of inspection which provide information on these structural joints. In this project we focus mainly on a specific type of defect known as KISSING BOND defect.

A kissing bond is sometimes referred to as a zero-volume dis-bond between adhesive and adherend. In such defects, there is intimate solid-solid contact, and the dis-bond has no volume at the interface between adhesive and adherend. Furthermore, despite this intimate contact, there is no tensile strength across the interface. Together, these two factors make the dis-bond both very difficult to detect non-destructively, and very dangerous in that the joint strength is severely compromised. A zero-volume dis-bond can occur during joint manufacture due to poor preparation of the adherends. If adequate control of the adherend preparation is maintained, the occurrence of these types of dis-bond can be dramatically reduced. However, this type of kissing bond is difficult to produce intentionally. Hence a special method will be developed in this project out of extensive research.

Objective

The main objective of this project is to develop a manufacturing control procedure to generate Kissing Bond defects in bonded joints made out of composite materials and a non-destructive technique (NDT) to detect Kissing Bond defects in these samples. Different adherence models and NDT methods for different material bonded structures will be reviewed. Test samples are fabricated based on the review. Various NDT methods for bonded structures will be reviewed. An innovative NDT technique will be developed to detect Kissing Bonds defect.

Funding Body



Contact our research team members

Principal investigator(s)
Professor Tat-Hean Gan



Explore similar research

9. Conclusions

As detailed in SealedwithoUTaKiss (SWAK) Description of Work (DoW), **WP6** encompasses the dissemination and exploitation activities of the project as well as actions related to maximisation of its impact. Task 6.1 addresses dissemination of outputs in the specialist industrial and academic communities that can benefit from the developments in SealedwithoUTaKiss project. The exploitation potential of the NDT solutions will be examined. The task will run as soon as WP1 is completed when the specifications are established. GMI has been assigned responsibility for project dissemination, exploitation and IP management. Activities were in line with the outcome of IP management (Task 6.2) focusing on market potential and future actions required. The Innovation manager will coordinate the definition of the exploitation plans and will streamline activities with the help and agreement of the Topic Manager. Deliverable 6.4 summarizes the dissemination activities performed from M19-M36. Such activities have been partially affected by the COVID-19 pandemic but will keep on being implemented following the conclusion of the project, so as to maximize its impact towards the aeronautical community.