NEWSLETTER N°2

July 2018

Welcome to the second newsletter of the ACASIAS project

ACASIAS' goal is to reduce the environmental impact of aircraft by improving aerodynamics and reduction of the weight of the aircraft. ACASIAS will embed sensors and antennas into typical aircraft structures (for instance fuselage panels, winglets and tails). The aerodynamic performance is improved by the conformal and structural integration of antennas. The noise reduction of CROR engines inside the cabin is facilitated by installation of an Active Structural Acoustic Control (ASAC) system in the fuselage.

Word from the Coordinator

The first year of the ACASIAS project is over and during this period we have observed an excellent team spirit! The partners have established good cooperation between the several disciplines which are necessary to reach the ACASIAS objectives. On 6th June we have organized a workshop at the Netherlands Aerospace Centre in Amsterdam where first encouraging results of our project were presented and discussed the prospective application of the ACASIAS innovative structures and the expected impact for potential end-users.

It is also a pleasure for me to inform you that six external experts are prepared to advise us with respect to the exploitation needs and qualification aspects related to three different domains (aero-structures, antennas, and acoustics), and to ensure that our project remains in-line with the latest research developments. The experts were Airbus Defence & Space, Dassault Aviation, Lufthansa Technik, Diehl AirCabin, Aerodata and EASA.

In this second issue of our newsletter, you will be informed about the Workshop in Amsterdam, and the work progress for the smart fuselage panel with embedded Ku-band Satcom antenna array and for the smart winglet with integrated VHF communication antenna. Furthermore, the "Get together" section will inform you about the ACASIAS dedicated session at the 8th EASN-CEAS International Workshop on "Manufacturing for Growth & Innovation" in Glasgow. I wish you all a good reading!

NEWS & EVENTS

The ACASIAS Workshop has been held on 6th June 2018, at NLR premises, in Amsterdam. This event brought together Aircraft industry stakeholders, aeronautics SMEs and suppliers to present the objectives and the content of the ACASIAS project.

>> Read more

ACASIAS presentation leaflet is now downloadable :

>> Download the pdf

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ACASIAS FIRST WORKSHOP IN AMSTERDAM

The first ACASIAS Workshop has been held, at NLR's premises in Amsterdam, on 6th of June 2018. It was attended by 34 participants including external attendees from different companies (such as Airbus, Cobham, KLM and KVE composites), Industrial Advisory Board members and ACASIAS participants. The workshop objective was to present the different technologies to be developed, their future applications and impact in the aeronautics field.

Figure 1: ACASIAS Welcome speech by the coordinator Harmen Schippers

Figure 2: Networking lunch

The event proved to be a unique opportunity for the participants to obtain an overview of the recent advances in the ACASIAS project. Four presentations have been given by the work package leaders on the four ACASIAS innovative structures: fuselage panel with embedded tiles (SMART SATCOM), the lining panel with sensors and actuators for reduction of cabin noise, the winglet with integrated VHF antenna and the fibre metal laminate panel with VHF slot antenna. After the presentations, the workshop attendees had the opportunity to engage into fruitful discussions on fifteen proposed statements, such as the aircraft of the future will not contain any more protruding antennas or protruding radomes, development of new technologies and standards for aerospace communication and navigation is a long process and therefore, integrated antennas in aircraft can be used for the lifetime of the aircraft, and the ACASIAS integration technology paves the way to other applications. The networking lunch gave the opportunity to the participants to exchange more informally about the ACASIAS technologies and the future of embedded antennas in the aeronautic field.

The workshop posters are downloadable from the ACASIAS website.

Figure 3: Group picture of the Workshop participants

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FIRST RESULTS ON WINGLET WITH INTEGRATED ANTENNA

The design of the winglet with integrated antenna is conducted on a high multidisciplinary level.
The optimization of the aerodynamic shape is done by the project partner VZLU. It results in the new winglet outer surface that is now the reference surface for the work at INVENT and IMST.

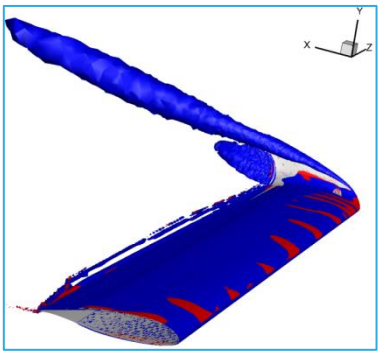

Figure 4: CFD analysis of vortex at winglet (VZLU)

INVENT looked at structural design solutions and provided material samples based on assumptions for monolithic or sandwich structures of the winglet. These samples are used for the radiofrequency transmission measurements by IMST. These tests will help to down select the right structural material, suitable for antenna operation as well. Based on the shape of the winglet both the part and tool design are started.

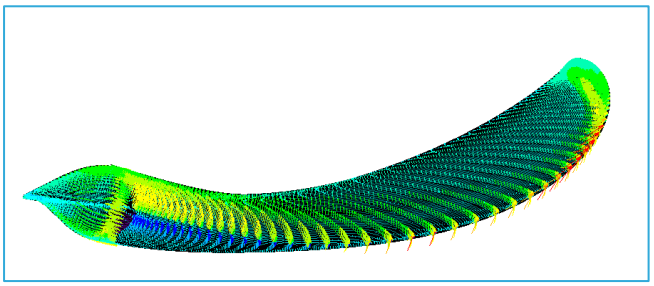

Figure 5: Load vectors of pressure distribution on winglet structural model for FEA method (INVENT)

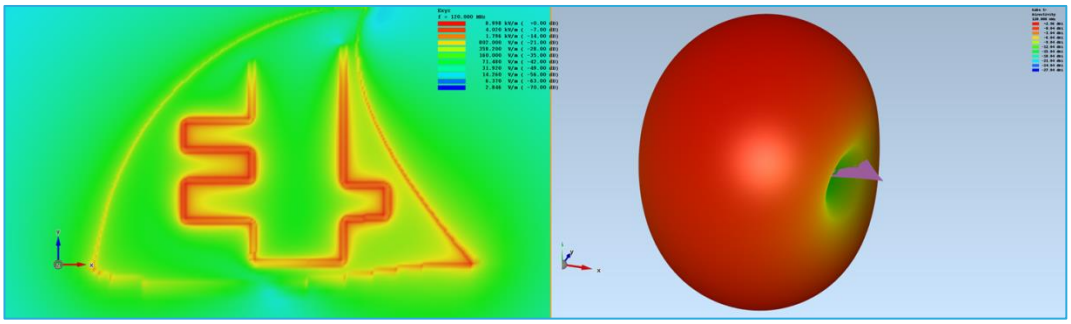

Figure 6: Fields distribution and radiation pattern (directivity) of an antenna concept f =120MHz (IMST)

The first solutions for antenna patterns are available from IMST and are based on the new winglet shape. Potential solutions are monopole with ground plane and loop antennas. The slotted antenna is investigated as well, as it seems feasible to use that concept facing a conductive lightning strike protection surface.

The project partner TRACKWISE looked at design solutions for the antenna pattern and transmission lines based on flexible PCBs.

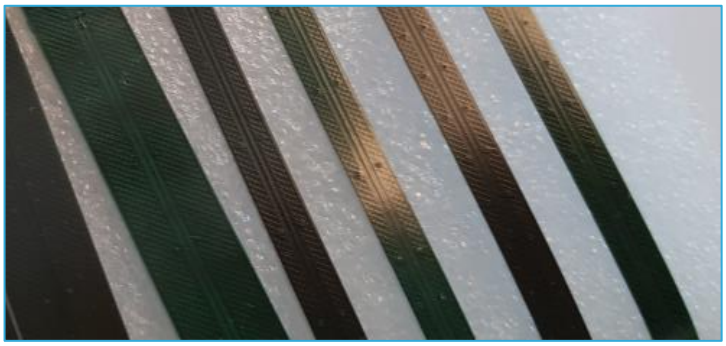

Figure 7: Flat coaxial transmission line (TRACKWISE)

Now overall design iterations have started, as well as the space allocation is to be conducted for the additional systems: position lights, lightning diverter and static discharge may influence the radiation pattern of the antenna; structural interfaces as well as integration concepts are required and can influence the antenna performance.

ACASIAS

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FIRST RESULTS ON SMART SATCOM FUSELAGE PANEL

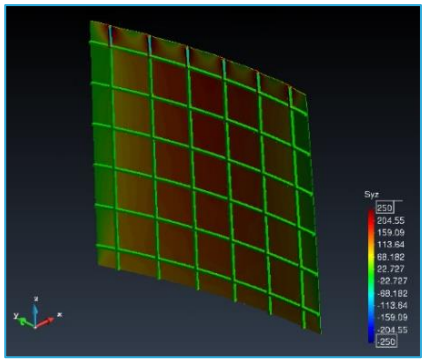

Figure 8: Fuselage panel modelling

In ACASIAS WP2 (Smart SATCOM fuselage panel) a fuselage panel with an integrated conformal Ku-band distributed antenna array will be developed. This development will address several performance aspects such as structural performance, thermal performance and RF performance. Structural performance will be assessed by manufacturing a representative fuselage panel which will be tested full size in the NLR fuselage panel test rig. Solutions for cooling of the RF electronics will be investigated by definition, manufacturing and test of breadboards. The RF aspects will be evaluated by performing measurements on breadboards and on the antennas mounted in the full size panel.

The preliminary structural design of the fuselage panel is based on an ortho-grid stiffened panel with square elements and a glass fibre skin. The Ku-band antenna tiles that will be developed are based on the antenna tiles developed in the EU FP7 SANDRA project. The antenna array will consist of both real RF tiles and dummy tiles. The dummy tiles are developed to investigate appropriate cooling solutions for the RF electronics. The dummy tiles will have the same thermal behaviour as the RF tiles.

The preliminary design phase was successfully closed in November last year and the detailed design is now underway. The structural detailed design addresses the definition of coupons and structural elements for the mechanical tests. The materials for these test objects are being ordered and a test plan is being draft to perform tests on these test samples. In addition, structural computational analysis has being carried out to support the detailed structural design. Electromagnetic simulations have been carried out for the design of the RF breadboards. The RF breadboards and the breadboards with cooling solutions will be manufactured shortly.

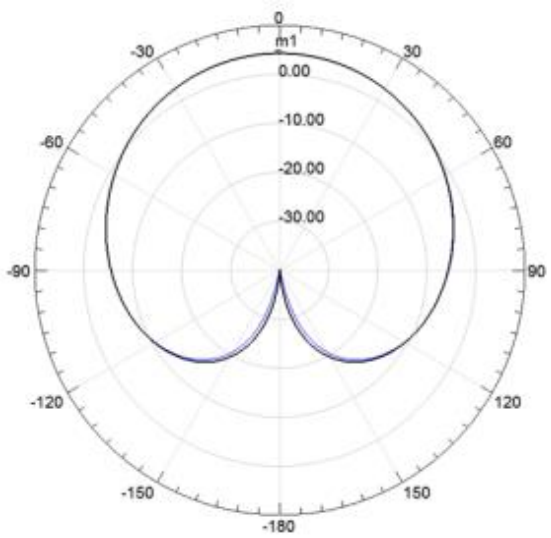

Figure 9: Electromagnetic simulations

The detailed design will be finished by the end of this year (2018). In the remaining months the coupons, structural elements and breadboards will manufactured and tested. The results of these structural, thermal and electromagnetic tests will be used to fine-tune the detailed design of the fuselage panel and the antenna tiles with cooling provisions.

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GET-TOGETHER

8TH EASN-CEAS INTERNATIONAL WORKSHOP 4TH-7TH SEPTEMBER 2018

The 8th EASN-CEAS International Workshop on "Manufacturing for Growth & Innovation" will be the first joined event gathering EASN and CEAS. The 7th international gathering of the EASN Association has been attended by more than 300 participants from various disciplines who presented their high quality recent achievements and new upstream research ideas.

The event will give the opportunity to scientists and researchers from all over the world to present their recent findings in a series of thematic sessions, organized by internationally recognized scientists. In this frame,**the ACASIAS project will organize a session dedicated to its results presentation.**

The ACASIAS program will include:

1. The ACASIAS overview (NLR);
2. Smart fuselage panel with structurally integrated Ku-band satcom antenna array (NLR);
3. Lining panel with integrated sensors and actuators for reduction of cabin noise (DLR);
4. Multiscale procedures for structural design of smart fuselage panels (CIMNE);
5. Aerodynamic and structural design of winglet with integrated VHF antenna (VZLU);
6. Application of flexible substrates in ACASIAS innovations (TRACKWISE).

Furthermore, NLR as coordinator will contribute to round table discussions.

Source: https://easnconference.eu/i/

ICSV25, HIROSHIMA 8TH–12TH JULY 2018

The 25th International Congress on Sound and Vibration (ICSV25) is a leading event in the area of acoustics and vibration and provides an important opportunity for scientists and engineers to share their latest research results and exchange ideas on theories, technologies and applications in these fields. The congress will feature a broad range of high-level technical papers from across the world: distinguished plenary lecturers will present recent developments in important topics of sound and vibration and include discussions about future trends.

Source: https://www.iiav.org/icsv25/

ICAST 2018 30TH SEPTEMBER–4TH OCTOBER 2018

The 29th International Conference on Adaptive Structures and Technologies (ICAST2018) will be held on in Seoul, Republic of Korea. ICAST2018 aims at promoting research, development, and applications of adaptive structures and technologies through the exchange of scientific results and insights from leading international scholars and specialists. The conference provides a forum for discussion of recent advances in the highly multidisciplinary field of smart materials and structures. In addition, this conference encourages the transfer of the advanced scientific results to various engineering applications. ICAST is a single session conference with limited attendance.

Source: http://icast2018.com/

SPIE SMART STRUCTURES & NONDESTRUCTIVE EVALUATION 3RD–7TH MARCH 2019

SPIE Smart Structures and Nondestructive Evaluation showcases the latest research in advanced materials, electroactive polymers (EAP), bioinspiration and biomimetics for robotics design, along with energy harvesting, sensor networks, nondestructive evaluation (NDE) and structural health monitoring (SHM) for automotive, aerospace, civil infrastructure, smart factories, and Industry 4.0.

Source: http://spie.org/conferences-and-exhibitions/smart-structures/nde?SSO=1

ACASIAS CONFERENCE IN JUNE 2019

A Conference will be organized by ACASIAS project, focused on 'Technologies for Multifunctional Structures' in Barcelona in June 2019. CIMNE, together with NLR and DLR, will organize the event, where the scientific advances produced in ACASIAS will be presented and discussed among the experts in this area.

Advances from other institutions (apart from the ACASIAS partners) will be also integrated in the conference.

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INTERVIEW

ACASIAS newsletters offer you the possibility of getting to know some of the project partners a little better… Thus, the Interviews section will let you discover the day-to-day life of the people involved in achieving the ACASIAS goals.

In this edition of the ACASIAS Newsletter n°2, Dr. Marta Martínez-Vázquez was interviewed, she is working at IMST, within the Antennas and EM Modelling department. She is also the vice-chair of the European Association of Antennas and Propagation (EurAAP), and a former member of the Administrative Committee of the IEEE Antennas & Propagation Society.

The tags leading the interview are: **Antenna tiles in fuselage – Smart Winglet –Innovation and future trends – gender equity**.

DR. MARTA MARTINEZ-VAZQUEZ
SENIOR ENGINEER AND PROJECT MANAGER
IMST GMBH– GERMANY

Q1 : As the project manager at IMST, you are involved in the antenna tiles development and testing (in WP2) and the design of miniaturized VHF antenna to be integrated in the smart winglet (in WP4). Could you please remind us the objectives and challenges of these activities?

The overall goal and chalenge of the ACASIAS project is the development and demonstration of integrated aero-structures which will allow reducing the weight of the antenna systems and help achieve better aerodynamic performance as well as decreased manufacturing and operational cost. The replacement of protruding antennas and radomes with integrated solutions will reduce the aerodynamic drag and aircraft weight, with positive effect on fuel consumption, reduction of CO_2 and NO_x emissions, and of the direct operating costs.

In WP2, ACASIAS focuses on the structural integration of tiles into the fuselage of the aircraft, to implement a conformal Ku-band active antenna array. The novel fuselage structure will weight much less than the existing systems, and will not produce additional aerodynamic drag. The challenge is also to develop an efficient thermal management concept, to dissipate the heat produced by the active components of the array.

WP4 deals with the integration of VHF antennas on the airplane's winglets. The replacement of conventional antennas with integrated ones in will also in this case decrease the overall drag and thus, also reduce the maintenance costs. The aim of this work package is to develop a winglet with integrated antenna based on the integration of a flexible PCB into a special foam, covered by a hybrid skin. The challenge is to develop an integrated manufacturing process for hybrid skins which is cost efficient and suitable for industrial production.

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Q2 : What is innovative about these research activities?

In WP2, we will test innovative solutions for integrating Ku-antennas into the frame of the aircraft. This includes developping and testing thermal solutions for the cooling of the electronics required for the active antenna arrays. The breadboards will allow defining and testing new manufacturing procedures for the satcom antennas.

In WP4, the innovative aspect lies in the design of the VHF antenna on a flexible PCB integrated into RF transparent foam and composite skin by heat press. Also, the effect of the lightning diverters and other components such as the winglet's lights has to be considered and minimised. The antenna structure will be optimised considering available winglet shape and volume, and the deformations due to aerodynamic loading on structure.

Contributing to future trends in Industry

The results obtained in the ACASIAS project can be extrapolated to other industrial fiels of application:

- Innovative manufacturing technologies and cooling systems are of capital importance for the design and deployment of active array antenna systems.
- The results obtained for the aeronautical SatCom system in Ku-band can be used for the upcoming 5G communications systems.
- The know-how obtained in the development of the integrated VHF antenna can help in the design of other products involving flexible substrate materials.

Q3 : What are the strenghts of IMST in the ACASIAS consortium?

IMST ia a SME with a large experience in R&D projects, both industrial and public funded. In our more than 25 years of history, we have designed a large number of communications systems, in different frequency bands and for a large range of applications (SatCom, radar, automitive, mobile communications…).

IMST contribute to ACASIAS by supporting the RF and active antenna technology design. We also bring our experience in relationship with substrate integrated cooling technologies for active antennas. Within the project, we will develop dedicated tiles for RF and thermal testing. Also, IMST is in charge of the design of the integrated VHF antenna for smart winglets.

Q4 : How does the work performed correlate to general trends in industry? As an industrial partner involved in numerous research program, how do you plan to bridge the gap from the lab to the market?

The results obtained in the ACASIAS project are important for us, as they can be extrapolated to other industrial fields of application. IMST can test innovative manufacturing technologies and cooling systems, that are of capital importance for the design and deployment of active array antenna systems. Also, the results obtained for the aeronautical SatCom system in Ku-band can be used also for the upcoming 5G communications systems, by scaling the frequency and adjusting the performance requirements. The know-how obtained in the development of the integrated VHF antenna can help us in the design of other products involving flexible substrate materials.

Q5: Research and development are generally perceived as a mainly male domain. As a female researcher participating in ACASIAS, can you tell us how gender aspects are considered in European research & innovation collaborative projects? What would be your recommendations to make science and technology more women-friendly and to increase women's visibility in this field?

In the antenna department of IMST, 20% of the staff are women, which is much higher than the average. But this make no difference in the work. Antenna and RF design are gender-independent, and we all contribute in different ways, independently of our gender. Of course, it is nice to have an working environment with a relatively high number of other women. Also, IMST is a family-friendly company, in which it is possible to concile work and family, and this is important for both male and female employees. Personaly, I have been fortunate enough not to have had any bias against me for being a woman. On the contrary, by being in the minority it has been sometimes easier to stand out of the crowd of men!
It is true that the number of women in our field is too low, but the problem cannot be solved at our level. It starts already at school, with a bias against girls and science and a lack of role models. More effort should be made in this direction, not waiting until they reach the university or join the work force. It is then too late, and the numbers of women engineers are therefore too low.
On my side, I try to get involved though different actions within the IEEE and the European Association on Antennas and Propagation, and participating in mentoring programs for young female researchers.
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