

WELCOME TO THE FIRST NEWSLETTER FROM THE MADELEINE PROJECT

MADELEINE stands for "Multidisciplinary ADjoint-based Enablers for Largescale INdustrial dEsign in aeronautics".

The project focuses on the development and validation of multidisciplinary design tools for optimisation.

Special attention is given to the:

- multidisciplinary optimisation
- understanding of multi-physics phenomena
- simulation of manufacturing processes
- transition to High-Performance Computing

MADELEINE gathers 15 partners from 6 European countries.

Our public newsletters will regularly keep you up-to-date on the progress made within the project. You will be given a possibility to discover how the consortium partners cooperate to achieve the project objectives. You will also know how and when we disseminate the MADELEINE results. This is in case you feel like meeting with us! We invite you to visit our website at www.madeleine-project.eu



MADELEINE in a nutshell:

GRANT AGREEMENT NUMBER: 769025	 15 PARTNERS	 6 EUROPEAN COUNTRIES	CALL: H2020-MG-2016-2017
 50 RESEARCHERS AND ENGINEERS	RESEARCH & INNOVATION ACTION	TOTAL MANPOWER:  631 PERSON-MONTHS	 TOTAL BUDGET: 5 815 181 EUROS
 36 MONTHS	TOPIC: MG-1.3-2017	PROJECT COORDINATOR: MICHAËL MEHEUT (ONERA)	PROJECT OFFICER: MIGUEL-ANGEL MARTI-VIDAL (INEA)

MADELEINE consortium:





WORD FROM THE PROJECT OFFICER

MIGUEL-ANGEL MARTI-VIDAL, INEA

First of all, I would like to congratulate the MADELEINE consortium for the selection of their proposal and the successful kick-off of the project in June 2018.

This project is included under topic MG-1.3-2017 (Maintaining industrial leadership in aeronautics) with the aiming at developing Condition-based health management (replacing scheduled inspections, decreasing maintenance costs and increasing safety and aircraft availability), novel composite aero-structures (costs reduction and productivity increase), internal and external electromagnetic environment technologies and multidisciplinary design tools (computing solutions to facilitate innovative products and services).

With 15 partners from 6 different countries and coordinated by ONERA, MADELEINE will demonstrate the benefits of using MDO (multidisciplinary adjoint-based optimisation) techniques to boost the competitiveness of the European aeronautics industry (aircraft and engine manufacturers) and reduce development time and cost. MADELEINE will make use of the adjoint-based method to achieve the efficient multidisciplinary optimisation in an industrial framework where several hundreds of parameters or constraints have to be considered during design phases. The project will improve the understanding of multi-physics phenomena while introducing simulation of manufacturing processes in multidisciplinary optimisation and looking into a transition to high-performance computing.

During the 36 months of the duration of the project, my role as Project Officer will be focused on the management of the administrative, technical and financial aspects of the Grant Agreement. I will monitor the fulfilment of your contractual obligations and check the project milestones and deliverables. After month 18 of the project, I will sit together at a Review Meeting with MADELEINE consortium to assess the progress of the work. At the end of the project, another Review Meeting will be organised. I am fully confident that MADELEINE project will achieve all its main objectives and expected outcomes.

An important aspect that I will assess during the lifetime of the project will be the communication, dissemination and exploitation activities. A good example of these activities is the official launch of the MADELEINE website(<https://www.madeleine-project.eu/>). I kindly invite the readers of this newsletter to keep an eye on this website where you can find very interesting details about this project.

My best wishes for MADELEINE consortium!

Miguel Marti – Vidal



INTERVIEW WITH MICHAËL MÉHEUT

COORDINATOR OF THE MADELEINE PROJECT, AEROSPACE ENGINEER, ONERA, FRANCE

Q1: You are the coordinator of the MADELEINE project. Can you please tell us the objectives and stakes of this initiative?

A1: The objective of MADELEINE is to increase the maturity and demonstrate the benefits of using high-fidelity adjoint-based multidisciplinary optimisation (MDO) to address the long-term industrial objectives in terms of Competitiveness (by reducing time and cost of aircraft or engine development) and environment (by finding more efficient multidisciplinary compromises and fostering the integration of greener technologies).

Q2: What factors / observations are at the origin of MADELEINE?

A2: Today in industry, during aircraft or engine design phases, most optimisation studies performed using High-Fidelity simulations are limited to single discipline (aerodynamics, acoustics, heat transfer, structural analysis). This current industrial practice is partly a legacy of the organisation structure of most companies (different departments focusing on different disciplines). The effect of single-discipline optimisation is that the design process proceeds iteratively from one-discipline to the other, with significant time-delays to the overall process, making it difficult to exploit multidisciplinary trade-offs.

Q3: What is innovative about the activities carried out in the project?

A3: In this context, MADELEINE will strengthen the capabilities and use of multi-physics adjoint solvers. The goal is to maximise benefits of High-Fidelity simulations that are key enablers for future airframe and engine design but which are too computationally expensive for optimisation with many parameters if not using the adjoint method. This increased capability can impact the design process of aircraft and engine manufacturers, for complete systems, as well as the design of specific components by subcontractors, which includes SMEs.

Q4: How will the MADELEINE results be beneficial for the project partners, both academic and industrial?

A4: The results of MADELEINE will demonstrate that using coupled simulations (in terms of disciplines) to optimize the aircraft or engine components enables to reduce design time and costs while improving the overall performance of the system. This is obviously of key importance for the industrial partners of the project. MADELEINE will also be the opportunity for the other partners (SMEs, universities or research centres) to demonstrate their ability to use challenging MDO techniques to design very complex systems or configurations that could, beyond MADELEINE, be applied on other industries or on different applications.

Q5: In broader terms, how does the work align with contemporary trends in industry? How do you ensure that your results match the needs of end users?

A5: The previous answers show the multidisciplinary aspect is one of the key drivers to find better compromise between the disciplines involved in the design process and to define greener configurations with improved performance compare to the current know-how. In MADELEINE, the demonstrations are based on test-cases provided by the industrial partners in order to ensure that the results match the needs of end-users.

WORK PROGRESS SINCE JUNE 2018

The MADELEINE consortium held the project kick-off meeting on 20-21 June 2018. This physical meeting was an opportunity for the partners to remind the objectives of the project, set up a detailed planning of activities for the upcoming months and clarify expectations. It helped to reinforce the enthusiasm and understanding about the vision and goals of the work in MADELEINE. Most importantly, the discussions built a team spirit to set off to a very good start of the project!



FIGURE 1: THE MADELEINE CONSORTIUM AT THE KICK-OFF MEETING AT ONERA IN MEUDON, FRANCE, JUNE 2018.

Since June, the partners have launched the activities aiming to develop and improve key technology bricks of the adjoint-based processes that will be applied on the 5 industrial demonstrators planned in the project:

- TC1: Aero-structure aircraft wing design;
- TC2: Aero-structure-manufacturing fan blade design;
- TC3: Aero-thermal-manufacturing turbine blade design;
- TC4: Aero-acoustic isolated propeller blade design;
- TC5: Aero-acoustic air inlet and fan blade design.

Various information and data are being prepared and exchanged by the partners in order to achieve several milestones set for these demonstrators in December i.e. geometries, CFD and CSM parameterised models as well as CAD files and operating conditions.

More details will follow in the next issue!

GET TOGETHER

Feel free to inform us of any other event likely to interest the MADELEINE community. Hereunder you will find our short selection of major events to take place in the upcoming months.

AIAA SCITECH 7-11 JANUARY 2019, SAN DIEGO, CALIFORNIA, USA

The 2019 AIAA SciTech Forum will explore how our industry is being transformed by on-demand delivery of customized products and services. Learn how advances in additive manufacturing, high-speed networked computers, autonomous systems, and big data analytics, are reshaping aerospace supply chains, improving productivity, and opening the market to new entrants. Source: [AIAA SciTech 2019](#)

PARIS AIR SHOW 17-23 JUNE 2019, PARIS, FRANCE

The 53rd Paris Air Show will take place at the Le Bourget Parc des Expositions from 17 to 23 June 2019, and once again will bring together all the players in this global industry around the latest technological innovations. The first four days of the Show will be reserved for trade visitors, followed by three days open to the general public. Source: [Paris Air Show 2019](#)

AIAA AVIATION FORUM 17-21 JUNE 2019, DALLAS, USA

The AIAA Aviation and Aeronautics Forum and Exposition will combine the best aspects of technical conferences with insights from respected aviation leaders. Source: [AIAA Aviation Forum 2019](#)

EASN INTERNATIONAL CONFERENCE 2019 3-6 SEPTEMBER 2019, ATHENS, GREECE

The 9th EASN International Conference on Innovation in Aviation and Space will include a number of plenary talks by distinguished personalities of the European Aviation and Space sectors from academia, industry, research community and policy makers. It will also include thematic sessions, along with technical where evolving ideas, technologies, products, services and processes will be discussed. Research projects are invited to exploit the opportunity and disseminate their results and achievements in dedicated Sessions. The conference is co-organised by the EASN Association, the University of Patras and the National Technical University of Athens. Source: [EASN International Conference 2019](#)

EUROGEN 2019 12-14 SEPTEMBER 2019, GUIMARAES, PORTUGAL

The conference aims at bringing together specialists from Universities, Research Institutions and Industries developing or applying Evolutionary and Deterministic Methods in optimization of design and emphasizing on industrial and societal applications. The conference will include plenary invited and keynote lectures, minisymposia and contributed papers. Source: [EUROGEN 2019](#)

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