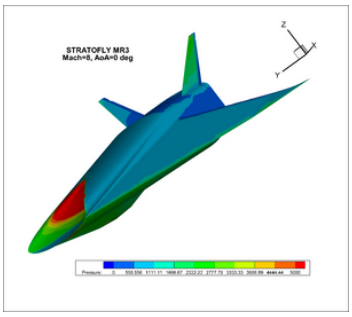
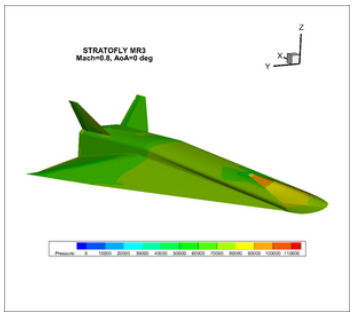
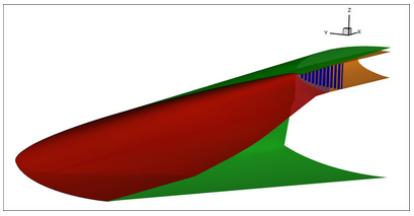
Educational Series & Academy

AEROTHERMODYNAMIC AND PROPULSIVE INVESTIGATIONS TO SUPPORT POLLUTANT AND GREENHOUSE GASES EMISSIONS ESTIMATION OF FUTURE HIGH-SPEED VEHICLES

The design of a hypersonic civil aircraft flying at stratospheric altitudes is one of the most challenging tasks in modern aerospace due to the high integration needed among the different disciplines. Aerodynamics, propulsion, structures, materials, avionics, onboard subsystems are strictly linked, exchanging each other design requirements and parameters in such a way to fulfil system and mission requirements. The course discloses many of the lessons learned from the activities performed in the framework of the H2020 STRATOFLY project.







COURSE STRUCTURE

Part 1 (2h - M. Marini and P. Roncioni)
Aerodynamic and aerothermodynamic challenges for designing a hypersonic civil transport. Aerodynamic modelling and complete database development from subsonic to hypersonic (Mach 8) speed regimes. The exploitation of aerodynamic databases in mission analysis and trajectory calculation.

Part 2 (1h - G. Saccone)
0D kinetic hydrogen/air combustion modelling and discussion on methodology to evaluate chemical pollutants and GHG emissions released by an Air-Turbo Rocket engine able to operate up to Mach 4.

Part 3 (2h - L. Cutrone)
Modelling of a Dual Mode Ramjet able to accelerate a hypersonic vehicle from Mach 4 to Mach 8. Details on modelling techniques for air-intake, isolator, and combustor. Discussion on engine performance and emissions database.

Learning objectives:

- Aerodynamic and aerothermodynamic for the design of a hypersonic civil transport
- Combustion modelling and chemical pollutants
- Modelling of Ramjet

Target audience: doctoral students, non-academic professionals, and undergraduate students.

Dates and time: 18 MAY 2022, 9:00-13:00 CEST

REGISTRATION AND CONTACTS

Course Code: 20220518

This course is part of the 2022 institutional activity for AIDAA members. The registration requires the purchase of one of the packages described here https://www.aidaa.it/package-list/, and the completion of the e form.

Course platform: Webex, a link will be sent via email as the registration is complete.
At the end of each course, **attendance certificates** will be sent to participants via email.

For further info, please, contact **academy@aidaa.it**

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SPEAKERS

Marco Marini got the Laurea in Aeronautical Engineering and PhD in Theoretical and Applied Mechanics at the Univ. of Rome "La Sapienza", respectively, in 1990 and 1994. He was employed at CIRA at the Aerothermodynamics Lab. (1994-2009), was Head of Applications and Experimentation in Aerospace Propulsion and Reacting Flows unit (2009-2010) and was Head of Combustion Unit in Propulsion Division (2011-2014). From 2015 to 2020, he was part of Space Integration Technology, and since November 2021, he has been the Head of Access to Space and High-Speed Vehicles unit. He had the technical coordination and the project engineering/project management of several national and international projects in aerothermodynamics and propulsion. He is the author or co-author of about 150 publications and reviewer of several international journals.

Pietro Roncioni got his Degree in Aeronautical Engineering in 1994 and his PhD in Thermo-mechanical Engineering Systems in 2000, both at the University of Naples "Federico II". He has been employed at CIRA since 2001, working in the former Aerothermodynamics and Propulsion laboratories and recently aggregated to the Mechanics of Fluids Unit and working in the fields of Aerodynamics, Aerothermodynamics, Propulsion, and Propulsion Combustion as an expert of numerical simulations and database development. In addition, he has been involved in several research projects, both national as USV and HYPROB and international as VEGA, VEGA-C, FLPP-IXV, LAPCAT-II and STRATOFLY. In addition, he is the author or co-author of several scientific publications among conference papers and archive journals.

Guido Saccone achieved his degree in Chemical Engineering in 2004 and a PhD in Materials and Structural Engineering in 2008, both at the University of Naples "Federico II". After a post-doc research fellowship at CIRA (2009-2011) on the topic of UHTC based thermo-structures, in 2012, he was employed by CIRA in the Combustion Unit of Propulsion Division, working mainly on chemical kinetic modelling of combustion and turbulence-chemistry interactions for methane/oxygen LRE and hydrogen/air scramjets. From 2015 up to 2020, he was in force of the Propulsion Unit, and since November 2020, he has been working at the Propulsion and Exploration Technologies Unit. He was involved in numerous national and European research projects, providing technical contributions in chemistry and materials engineering. He is the author or co-author of several publications, among conferences, journal papers and edited chapters and books. Moreover, he is a member of the American Chemical Society and the Italian Section of the Combustion Institute. Finally, he belongs to the scientific committee of the International Conferences on Combustion Science and Processes (CSP) and the Editorial Board of the International Journal of Mechanical Engineering and Applications (IJMEA).

Luigi Cutrone is a senior researcher at the CIRA Aerothermodynamics unit. He has been involved in several international research projects funded by the European Union (LAPCAT, LAPCAT II, PHYS4ENTRY, EXAFLY-INT, STRATOFLY), involving European universities and research centers (ESA, ONERA, DLR, FOI, Von Kàrman Institute for Fluid Dynamics, University of Southampton, Free University of Brussels, Università di Roma "La Sapienza", Politecnico di Torino) as well as industrial partners (SNECMA, MBDA, EADS, AVIO). He also participated to the program CAST, funded by the Italian Space Agency, in which CIRA cooperated with several leading Italian universities and research centers (CNR-IMIP, UniROMA, Politecnico di Torino, Università di Napoli "Federico II", Università degli Studi di Bari). Previous work experiences include senior researcher in the Propulsion Unit of CIRA, Liquid Combustion Laboratory, from 2010 to 2015; researcher in the Design Methodology Unit, Aerothermodynamics Laboratory of CIRA from 2005 to 2010; research assistant at the Politecnico di Bari from 2004 to 2005.