



Marco Debiasi

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EDUCATION

UNIVERSITY OF CALIFORNIA, Irvine, California

Ph.D. in Mechanical & Aerospace Engineering, 17/6/2000, GPA: 3.96 (4.00 scale)

- Recipient of 'UCI Regents' Dissertation Fellowship' (Winter 2000).
- Dissertation: Acoustics of Dual-Stream High-Speed Jets.

This work presents the results of noise measurements in high-speed, round jets whose Mach number and velocity simulate the conditions of jet engines at take-off. The Mach number of the jet potential core ranged from 1.27 to 1.77 and the velocity ranged from 550 m/s to 1010 m/s. Most of the jets were silenced with a coflow that prevented the formation of Mach waves, a dominant contribution to supersonic jet noise. This method, called Mach Wave Elimination, relies on the shielding effect of the coflow which makes the motion of the eddies subsonic with respect to the surrounding streams, thus impeding the creation of Mach waves. Equal-thrust comparison of different experimental results shows that elimination of Mach waves is very effective in reducing noise in the direction of strongest emission. Except for localized shock-associated components, noise emission was found to be insensitive to nozzle exit pressure and to depend principally on the values of fully-expanded Mach number and velocity in the jet potential core. Jets with shorter Mach wave emitting region exhibited better noise suppression. Best results were obtained with an eccentric coflow that allows the shear layer of the upper part of the jet to grow naturally while silencing the jet in the downward direction. Coflows are capable of reducing the near-field screech peaks by up to 10 dB in imperfectly-expanded jets. Scaling the experimental results to a full-size engine shows that eccentric coflows reduce the noise perceived in the direction of peak emission by up to 11 dB. Preliminary analysis of the application of this silencing technique to engine design indicates that Mach Wave Elimination is feasible. Engines for supersonic business aircraft can apply this method and can be designed using the core of existing military turbofans.

- Graduate curriculum: mathematics (2 courses), fluid dynamics (3), computational fluid dynamics (1), turbulence (1), heat transfer (2), combustion (1), control (1), dynamics (1), instrumentation and data acquisition (1), manufacturing processes (1).

M.S. in Mechanical Engineering, 20/6/1998

- Master's Thesis: Noise Measurements in Supersonic Jets Treated with the Mach Wave Elimination Method.

UNIVERSITY OF PADUA, Padua, Italy

B.S. in Mechanical Engineering, 15/6/1995, GPA: 110 cum Laude (110 scale)

- Thesis: Metodi Pluriparametrici di Costruzione e Conteggio di Storie di Carico (Multi-Parametric Methods for the Construction and Counting of Load Histories).
- Scholarships include: UC Education Abroad Program Scholarship (1991-1992); ATA (Automobile Technical Association, Italy) Scholarship (1995).

PROFESSIONAL EXPERIENCE

CRANFIELD UNIVERSITY, United Kingdom

Research Fellow, Aeromechanical Systems Group, Centre for Defence Engineering (CDE), from 8/1/2018

- Research activities.
 - Design, supervise the manufacturing, and assemble models and experimental components for aerodynamic testing.
 - Conduct experimental measurements in aerodynamics, aeroacoustics, and flow control, analyze the data, and discuss the results.
 - Present the results of research in leading peer-reviewed journals and conferences.
 - Write proposals to attract research funds.
 - Assist the management of the wind-tunnel laboratories of the CDE.
- Teaching activities (currently attending PGCAP modules).
 - Supervise MSc/PhD students in aerodynamics, aeroacoustics, and flow control.
 - Prepare and deliver lectures to MSc/PhD students.

TEMASEK LABORATORIES, NATIONAL UNIVERSITY OF SINGAPORE, Singapore

Senior Research Scientist, Head of the Experimental AeroScience Group (EAG), from 1/1/2009 to 31/12/2017

Research Scientist, Aerodynamics Group, from 9/10/2006 to 31/12/2008

- Directed the EAG (http://www.temasek-labs.nus.edu.sg/program/program_aeroexperimental.php).
 - Planned and implemented the EAG research.
 - Wrote proposals to attract research funds and managed the research funds received;
 - Prepared reports and presentations for sponsors' reviews.
 - Supervised 12 research scientists, 1 associate scientist, and 2 laboratory technicians of the EAG.
 - Appraised the performance of the EAG members.
 - Reviewed, updated, and approved the SOPs and Risk Assessments of the EAG.
 - Responsible of the selection, procurement, and use of the EAG equipment comprising: 1 closed-loop subsonic wind tunnel, 2 small open-loop wind tunnels, high-pressure air delivery system, high-speed PIV, hot-wire/film anemometry, temperature/pressure-sensitive paint imaging, gauges for aerodynamic force measurements, different transducers for pressure and sound measurements, anechoic chamber, high-voltage power amplifiers, normal and high-speed cameras and their lenses.
- Research activities.
 - Advancing the design and performance of flapping-wing MAVs.
 - Morphing wings (by active airfoil shaping) for aerodynamic control of aircraft.
 - Design and use of plasma-actuators for aerodynamic flow control.
 - Improving the aerodynamics of grid-fins for transonic/supersonic aircraft control.
 - Mixing and acoustics of high-speed jets from non-conventional nozzles.
 - Control of flow separation in S-shaped inlets.
- Active roles in research activities.
 - Design or guide the design of the experiments; supervise or their set-up.
 - Perform or supervise the experimental measurements, analyze the data, and discuss the results.
 - Write articles and papers for internationally recognized journals and conferences.
- Chairman of the Temasek Laboratories Safety Committee (from 12/2007).
 - Guided the implementation of the PI Laboratory Certification scheme for the Temasek Laboratories (2011).
 - Continuously improved the safety procedures of the Temasek Laboratories and the EAG.
 - Updated the Emergency Response Plan of the Temasek Laboratories (2016).
 - Co-prepared the Safety and Health Management System of the Temasek Laboratories (2016).
 - Temasek Laboratories received the 2017 NUS Safety & Health Commitment Award.

THE OHIO STATE UNIVERSITY, Columbus, Ohio

Post Graduate Researcher, Gas Dynamics and Turbulence Laboratory (GDTL), from 6/8/2001 to 6/10/2006

- Directed the experimental activities of an interdisciplinary group exploring closed-loop flow control of cavity-flow resonance.
 - Designed and constructed a high-speed subsonic cavity-flow wind tunnel.
 - Selected and acquired the equipment of the experimental setup.
 - Performed or supervised the design and execution of experiments.
 - Designed and tested a synthetic-jet actuator for shear-layer flow control, quantified its dynamics, and contributed to the development of its dynamic compensator.
 - Assisted the development of real-time feedback controllers of the cavity flow resonance.
 - Established an extensive cavity-flow database for a variety of speeds and geometries with and without actuation.
 - Investigated the effect of acoustic modes in confined cavity flows.
 - Wrote articles and papers on flow control for internationally recognized journals and conferences.
- Design Engineer and Project Manager of the Controlled Air-Supply System for the GDTL (\$750,000 project).
 - Defined the system requirements and its overall architecture.
 - Supervised the design, manufacturing, assembly, installation, and testing of the system by Aero Systems Engineering, Speer Mechanical, and A.E. Ehrke.
- Lent support to the research in GDTL.
 - Co-authored a DURIP research proposal for use of closed-loop flow control to improve the lift of airfoils.
 - Mentored various graduate and undergraduate students working at GDTL.
 - Responsible for the safety of the GDTL laboratory.
 - Assisted to incorporate advanced diagnostics and control systems in various GDTL experimental facilities.
 - Helped to set-up flow imaging techniques (Mie and Rayleigh scattering, PIV, schlieren, fast-speed movies, still images both phase-locked and not) for studying flow physics.

UNIVERSITY OF CALIFORNIA, Irvine, California

Post Graduate Researcher, UCEI Research – Mixing Enhancement using Axial Flow, 3/7/2000 to 28/7/2001

- Investigated the mixing enhancement of liquids and gases by the flow instability in a coaxial gaseous flow.
 - Modified the UCI high-speed jet facility to incorporate a liquid injection system.
 - Obtained schlieren and stroboscopic images of the mixing of liquid and gas streams.
 - Wrote a Fortran code to obtain the particle size distribution of a spray from laser diffraction measurements.
 - Conducted a preliminary assessment of the characteristics of the liquid breakup and of the parameters required to control the mixing mechanism by the coaxial flow.

UNIVERSITY OF CALIFORNIA, Irvine, California

Research Assistant, NASA Research – Mach Wave Elimination in Supersonic Jets, 9/9/1996 to 31/3/2000

- Investigated the physics and aeroacoustics of high-speed jets and studied novel concepts for controlling jet engine noise.
 - Assisted the development of the Mach Wave Elimination method for suppressing high-speed jet noise.
 - Developed conceptual designs for quiet supersonic jet engines, analyzed their performance, and

- extrapolated their full-scale acoustic effect.
- Developed codes for the analysis of jets noise and of gas-turbine engine cycles.
- Operated a high-speed jet facility for small-scale reproduction of hot dual-stream subsonic and supersonic jets.
- Designed and constructed an anechoic chamber and a microphone supports for polar measurements of jet noise.
- Recorded and analyzed data from schlieren images, pressure transducers, and microphones.
- Established an extensive database of the acoustics of dual-stream jets in a wide range of operating conditions.
- Presented the results in internationally recognized journals and conferences.

UNIVERSITY OF PADUA, Padua, Italy

Researcher, FIAT Auto Research – Advances in Life Prediction of Structures, 3/7/1995 to 28/6/1996

- Developed and tested innovative concepts for characterizing and testing the structural integrity of automotive components.
 - Introduced a novel, DNA-sequence based coding method for real-time construction of random load histories consisting of cycles of specified amplitude, frequency, and mean value.
 - Implemented a digital modulator-demodulator for constructing and counting load histories.
 - Studied the surface stress close to the weld bead of plates in cross joints by using finite elements methods.
 - Studied the propagation of cracks in notched components and refined predictive models for crack failure.

AERONAUTICA MILITARE ITALIANA (ITALIAN AIR FORCE), Florence and Padua, Italy

Second Lieutenant, Arma Aeronautica – Ruolo Servizi, 3/1/1994 to 31/3/1995

- Logistic support of several SAM-based air defense groups within the 1st Aero-Brigade.
 - Directed a section providing spare parts and supplies to combat-ready units.
 - Superintended ground services.
 - Responsible for organizing and ensuring the airport security (2 days/month).

TEACHING EXPERIENCE

NATIONAL UNIVERSITY OF SINGAPORE, Singapore

Teaching Associate – Department of Mechanical Engineering, from 1/1/2008 to 31/12/2016

- Prepared and delivered lectures (class size of 40-50), and prepared and administered exams in ME4231 “Aerodynamics and Propulsion”. Responsible for the high-speed aerodynamics and propulsion parts of the module (from 2008 to 2012).
- Supervised 14 students in ME4105 "Aeronautical Engineering Specialization" (from 2008 to 2012).
- Co-supervised 2 M.S. students (NUS and ETH Zurich) and 1 Ph.D. student (Imperial College) in their thesis work.
- Supervised 22 students conducting their internship in the EAG (from 2009).

THE OHIO STATE UNIVERSITY, Columbus, Ohio

Post Graduate Researcher, from 6/8/2001 to 6/10/2006

- Given class lectures in gas dynamics and flow control.

UNIVERSITY OF CALIFORNIA, Irvine, California

Teaching Assistant, Courses: *Compressible Flow, Aircraft Performance, Thermodynamics*, 10/1997 to 6/1999

- Class sizes of 12 to 60.

PROFESSIONAL AFFILIATIONS

- American Institute of Aeronautics and Astronautics (AIAA) (from 12/2001)
 - Chair (from 6/2004 to 6/2006), Vice-Chair (from 4/2003 to 6/2004), and Secretary (from 10/2001 to 4/2003) of the AIAA Columbus Section.
 - Editor of the monthly newsletter "AIAA Columbus Section News" (from 1/2002 to 6/2004).
- American Society of Mechanical Engineers (ASME) (to 12/2006)
- American Physical Society (APS) (from 11/2005 to 12/2006)

EXPERTISE

- Direction of research activities and personnel in experimental aerodynamics laboratories.
- Management of research projects in aerodynamics/mechanical engineering.
- High- and low-speed flow measurements, flow actuation and control, aerodynamic morphing, aeroacoustics, noise characterization and reduction, jet mixing.
- Experimental techniques: flow-velocity measurements, particle image velocimetry, Mie and Rayleigh scattering, shadowgraph and schlieren imaging, aerodynamic-forces measurements, pressure and acoustic measurements, thermal measurements; design, calibration, and testing of experimental instrumentation; flow control with hardware-in-the-loop.
- Equipment: Nd:YAG lasers, optical systems, CCD, CMOS and film cameras, temperature/pressure-sensitive paint, hot-wires/films anemometers, dynamic and static pressure transducers, microphones, loudspeakers, piezoelectric actuators, thermocouples, jet atomizers; National Instruments ADC and DAC converters and acquisition systems; dSPACE DSPs and control systems.
- Design and fabrication of facilities and models for aerodynamic and aeroacoustic research, and of the jigs and fixtures for their construction.
- Manufacturing processes: cutting-tool machining, rapid prototyping, vacuum-bag forming.
- Some experience in implementing different feedforward, feedback, and adaptive control techniques.
- Good experience in using MATLAB, LabVIEW, SolidWorks, LaTeX, HTML, MS Office, MS Windows, Adobe Photoshop; limited experience in using Simulink, dSPACE, Fortran, and ANSYS.

ADDITIONAL SKILLS

- Bilingual: fluent in English and Italian.
- Organization of social and cultural events: AIAA Columbus Section Distinguished Lectures (5/2002, 3/2003, 2/2004, 4/2004, 3/2005) and Dinner and Lecture Meetings (11/2003, 10/2004, 11/2004).
- Photography (www.marcodebiasi.lx.com)
- Website development.

OTHERS

- Recipient of the AIAA 2002-2003 Communication Award in the Very Small Section Category.
- Manuscript reviewer for: *Physics of Fluids* (from 2009), *Experiments in Fluids* (from 2009), *AIAA Journal* (from 2003), and the 38th AIAA Fluid Dynamics Conference and Exhibit (2007).