

ISABE and the next generation of aircraft propulsion

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In Memoriam: Professor Riti Singh (1941 -2026)



Riti Singh (1941-2026) was an emeritus professor of Cranfield University, UK

ISABE: He was a long term board member of ISABE and a strong, caring figure in the community.

Academic Leadership: Cranfield Emeritus Professor, department head, and mentor to hundreds of postgraduates over 35 years.

Industrial & Research Impact: Led Rolls-Royce UTC, held two EPSRC Platform grants, and won a NASA distributed propulsion grant.

Specializations: Focused on sustainable civil aerospace, climate-conscious power cycles, combustion, and engine management.

Global Collaborations: Consulted in 20+ countries and established the HAL-Cranfield Highflyers Programme in India.

Industry Career: Held senior engineering roles at Rolls-Royce, Stal Laval, and Kongsberg prior to academia.

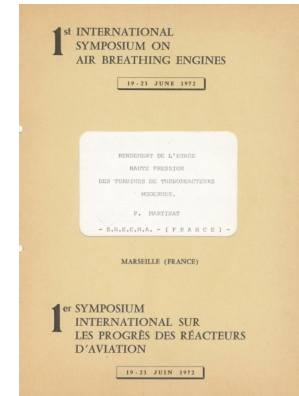
We will cherish his memory, his humor, his humility and his academic wit in our memories...

A bit of history of ISABE

- During the 7th ICAS conference in Rome in 1970 there was no international forum to discuss airbreathing propulsion. A decision was taken to organise a dedicated symposium
- As more nations joined, it was decided to let the symposium go around the world and try to have a good balance between the level of technology in the different countries
- The year 1972 was chosen for the ISABE creation and the IMFM of Marseille as the first conference location under the auspices of ICAS



Institut de Mécanique des Fluides
de Marseille (IMFM), June 1972



ISABE- Over 50 Years of Propulsion Science

- **Established in 1972:** Founded to foster global collaboration in air-breathing engine technology across academia, industry, and government research institutes.
- **Biennial Global Forum:** Held every two years in premier aerospace hubs worldwide (e.g., Tokyo, Gothenburg, Canberra, Toulouse).
- **Independent & Neutral Platform:** Serves as the premier international society solely dedicated to air-breathing propulsion systems.
- **Key Mission:** Accelerating propulsion innovation, gas turbine efficiency, education, environmental compliance, and international technical exchanges.



ISABE Conferences over the last 54 years

Edition	Year	Conference Dates	Venue / Location
1st	1972	June 19–23	Marseille, France
2nd	1974	March 24–29	Sheffield, United Kingdom
3rd	1976	March 21–26	Munich, Germany
4th	1979	April 1–6	Orlando, Florida, USA
5th	1981	February 16–21	Bangalore, India
6th	1983	June 6–10	Paris, France
7th	1985	September 2–6	Beijing, China
8th	1987	June 14–19	Cincinnati, Ohio, USA
9th	1989	September 3–8	Athens, Greece
10th	1991	September 1–6	Nottingham, United Kingdom
11th	1993	September 19–24	Tokyo, Japan
12th	1995	September 10–15	Melbourne, Australia
13th	1997	September 7–12	Chattanooga, Tennessee, USA
14th	1999	September 5–10	Florence, Italy

Edition	Year	Conference Dates	Venue / Location
15th	2001	September 3–7	Bangalore, India
16th	2003	August 31 – September 5	Cleveland, Ohio, USA
17th	2005	September 4–9	Munich, Germany
18th	2007	September 2–7	Beijing, China
19th	2009	September 7–11	Montreal, Canada
20th	2011	September 12–16	Göteborg, Sweden
21st	2013	September 9–13	Busan, South Korea
22nd	2015	October 25–30	Phoenix, Arizona, USA
23rd	2017	September 3–8	Manchester, United Kingdom
24th	2019	September 22–27	Canberra, Australia
25th	2022	September 25–29	Ottawa, Canada (Dell. 2021)
26th	2024	September 22–26	Toulouse, France
27th	2026	September 20–25	Mumbai, India
28th	2027	September 20–24	Querétaro, Mexico

Europe: 11 Americas: 7(8) Asia/Pac: 9



Core Themes of ISABE 2024



Net-Zero 2050 Pathways

- Fleet renewal
- Next generation aircraft technology
- Sustainable Aviation Fuel
- Improved operations
- Carbon offsetting



Architectures & Technologies

- Open Fan
- Ultra-high bypass ratio ducted turbofans
- Advanced cycles
- Water Enhanced Turbine
- H2 combustion



Hybridization & Digitalization

- Auto & micro-hybridization
- Parallel hybrid architecture
- High voltage challenges
- Advanced thermal management
- Digital twin

Key Presenters & Industry Keynotes



Airframers CTOs messages

Airbus & Boeing

Both airframers detailed their decarbonization strategy. Airbus emphasized hydrogen flight demonstrator progress and airframe-engine integration requirements. Boeing presented their technology advancement towards net zero carbon



Key Presenters & Industry Keynotes



Leading university and institutes University of Michigan, DLR

Executive keynotes highlighting how leading universities and institutes contribute to advancing science and technology in the field of materials, aerodynamic science and new energies



Key Presenters & Industry Keynotes



Global CTOs Panel

GE Aerospace, Safran, Airbus, Pratt & Whitney, Rolls-Royce

The CTOs presented advancement related to CFM RISE open rotor, RR UltraFan and PW GTF programs



Executive Symposia & Panels

Executive Panel Topics

- **Decarbonization Roadmap Panel:** CTOs discussed realistic timelines for 100% SAF drop-in certification vs. direct hydrogen combustion entry-into-service
- **Sustainable Fuels & Supply Chain:** Regulatory challenges, synthetic e-fuel synthesis economics, and non-CO2 contrail mitigation strategies
- **Young Engineers & Diversity Forum:** Mentorship, skill development, and attracting next-gen aerospace engineering talent



Key Technical Research Topics



Advanced Aerodynamics

High-efficiency axial compressors, low-noise fan design, boundary layer ingestion and unsteady aerodynamics in high-pressure turbines



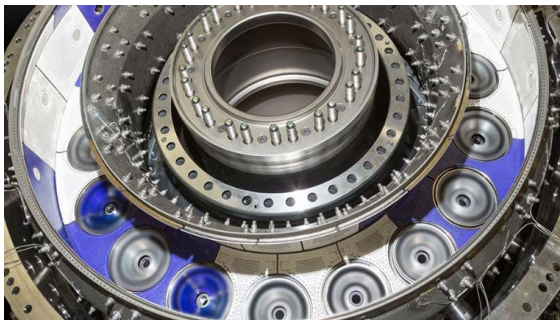
Low-Emission Combustors

Lean-premixed combustion chambers engineered for 100% synthetic SAF and direct injection of cryogenic liquid hydrogen



Hybrid-Electric & AI

Megawatt electric motor integration, high-voltage thermal management and AI-driven digital twin fault diagnostics



Core Decarbonization Pillars



Fleet Modernization: Replacing current fleets with next-gen aircraft provides immediate 20–30% CO₂ savings.



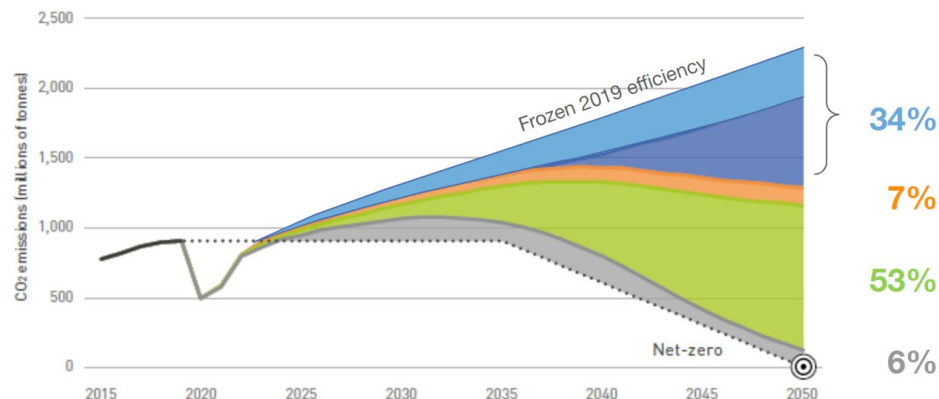
Sustainable Aviation Fuel (SAF): Cuts up to 80% lifecycle emissions; key focus on 100% SAF drop-in capability.



Hydrogen & ZEROe: Direct H₂ combustion & fuel cell systems aimed at zero-emission short/medium-haul routes.



Open Fan & Hybrid Systems: CFM RISE targeting >20% fuel gain; hybrid-electric platforms advancing to flight test.

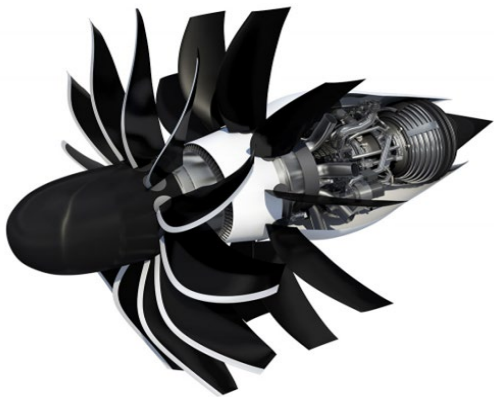


> ATAG CO₂ Roadmap based on most ambitious technology scenario & central traffic growth scenario: 3.1% CAGR 2019-2050)

Engine Architecture: Open Rotor vs. Ducted Fan

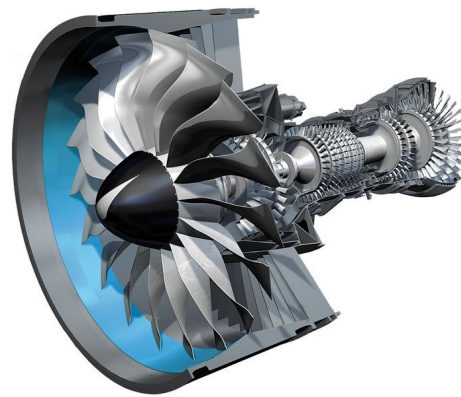
Open Rotor Architecture

- **Ultra-High Bypass Ratio:** Eliminates the traditional nacelle cowl to dramatically improve propulsive efficiency
- **Fuel Saving claim:** Delivers over 20% reduction in specific fuel consumption and CO2 emissions compared to current engines
- **Trade-offs:** Cabin acoustic and complex wing/engine integration



Ducted Geared Fan Architecture

- **Enclosed Nacelle Design:** Retains acoustic ducting to satisfy stringent airport noise regulations effortlessly
- **High-Power Gearbox:** Improves fan efficiency by enabling low speed fan while maintaining optimal turbine speed
- **Trade-offs:** Weight and nacelle drag penalties at higher fan diameters



Some statistics

341

Participants

180

Papers

14

Speakers

20

Student Volunteers

9

Stands at Exhibition
Hall

2

Social Events

>200

Participants to 9
Debate Sessions

11

Visits

We
made
Profit

40

Posts on
LinkedIn

3000€

Donated Food

9

Sponsors



ISABE 2024 Conference Gala Dinner



2 years of Certifications & Regulatory Milestones

DEC 2024

LEAP- 1A & PW1100G Approval

FAA certified updated engine variant, enabling long-range commercial operations for the Airbus A321XLR.

Source: Pratt & Whitney / Simple Flying

FEB 2025

GTF Advantage FAA Clearance

Type certification issued for GTF Advantage, delivering lower fuel burn, increased thrust, and better thermal margin.

Source: RTX / Pratt & Whitney

AUG 2025

ZeroAvia P-1 Paper Issued

FAA & ZeroAvia finalized P-1 Issue Paper for the 600kW Electric Propulsion System, setting formal certification criteria.

Source: ZeroAvia / FAA

OCT 2025

GTF Advantage EASA Validation

EASA validated FAA type certification for GTF Advantage, granting full European clearance for entry into service.

Source: RTX / Pratt & Whitney

2 years of Flight & Ground Demonstrators

SEP 2024

Safran Liquid H2 Run
Ground testing of regenerative gas turbine coupled directly to cryogenic liquid hydrogen tanks.

Source: Safran / Turbotech

JAN 2025

Boom XB-1 Supersonic Test
Supersonic test flights validated inlet aerothermodynamic performance for the Symphony engine.

Source: Boom Supersonic

APR 2025

Symphony Test Center
Selection of Colorado Air & Space Port to construct custom core testing facilities for Symphony.

Source: Boom Supersonic

JUN 2025

RTX IMW Hybrid Flight Test
Full-power operation of 1-MW hybrid-electric powertrain with high-voltage H55 batteries.

Source: RTX / P&WC

JUL 2025

CFM RISE Module Reviews
Completed preliminary design reviews for Open Fan and compact core modules under RISE.

Source: CFM International

DEC 2025

Rolls-Royce UltraFan Phase 2
Tested cold-weather ops, high-altitude ground relight, and combustor stability on UltraFan.

Source: Rolls-Royce

MAR 2026

EU Clean Aviation € 64M Award
Project UNIFIED granted € 64M to support UltraFan 30 ground tests for narrowbody aircraft.

Source: Clean Aviation JU

MAY 2026

Rolls & easyJet 100% H2 Test
Simulated full flight profile from startup to takeoff using 100% gaseous hydrogen on Pearl 15 engine.

Source: Rolls-Royce / easyJet

JUN 2026

GE Megawatt Hybrid Test
Completed testing on CT7-powered hybrid-electric powertrain under NASA EPFD project.

Source: GE Aerospace

JUL 2026

CFM RISE Aeroacoustic Targets
Passed 500 test campaigns confirming Open Fan noise profiles met strict maturity goals.

Source: CFM International

2 years of Partnerships & Strategic Alliances

JUL 2024

Safran & Boeing X-66 Alliance

Safran selected to supply high-efficiency electrical power generation systems for NASA X-66 demonstrator.

Source: Safran

JAN 2025

Clean Aviation HEROPS Launch

MTU launched HEROPS project to develop zero-emission hydrogen fuel-cell powertrains.

Source: MTU Aero Engines

JUN 2025

Airbus & MTU H2 Agreement

Potential joint partnership to accelerate fuel cell electric propulsion systems and motor testing.

Source: Airbus / MTU

OCT 2025

GE & BETA Technologies

Strategic partnership and equity investment to co-develop hybrid-electric turbogenerators.

Source: GE Aerospace

FEB 2026

Open Fan Airport Readiness MoU

Airbus, CFM, and CAAS partnered to make Singapore the world's first airport tested for Open Fan.

Source: Airbus / CFM / CAAS

To conclude

- ISABE still delivers a great forum to dive deeper into the technologies, operational and strategic opportunities and challenges of aircraft propulsion
- The 2024 conference was exceptional well received and especially having the major aircraft manufacturers and all the engine OEM engineering executives at the conference made it a very rich conversation
- The last two years since the conference had been filled with a variety of key milestones showing the delivery along the industrial technology maturity plans towards as laid out on the conference
- Some recent highlights are the parallel hybrid demonstrator of GE and PW, the preparation of the flight testing for the open fan by Airbus and CFM as well as the hydrogen combustion work of Rolls-Royce as well as the activities around new alliances and JVs for technology maturation

