ISABE 2017 CONFERENCE
ECONOMY, EFFICIENCY AND ENVIRONMENT
3 - 8 SEPTEMBER 2017
MANCHESTER, UK

(the city where The Honourable Charles Rolls met Sir Henry Royce)
ISABE 2017: Platinum Sponsors

- Rolls-Royce
- Honeywell

ISABE 2017: Gold Sponsors

- MTU Aero Engines
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- Cranfield University
- GE

ISABE 2017: Bronze Sponsors

- Safran
Welcome

Dear Colleagues,

On behalf of the UK National Organizing Committee of ISABE 2017, it is my pleasure and privilege to welcome you all to the 23nd ISABE Conference to be held in Manchester from 03 to 08 September 2017.

At this year’s conference, we are excited to have presentations from recognized world leaders and technical experts from academia, industry, and government agencies, who will present their latest achievements in the area of air breathing propulsion research and development.

With this year’s theme “Economy, Efficiency and Environment” we will be examining ways that everyone around the world, in the core and peripheral industries in air breathing engines, can work together by sharing and exchanging knowledge, information, and resources to face the challenges that lie ahead of us with state-of-the-art technologies in this ever changing world.

ISABE 2017 is privileged to have distinguished invited speakers from around the globe representing government, academia, and industry speaking on the present and the future of the core topic of air breathing propulsion as well as other related exciting and interesting topics. In addition, there will be a Special Panel Session on Friday featuring outstanding experts from Europe, America, and Asia, highlighting many experiences in global collaboration on technology developments.

We are very excited about hosting this 23nd ISABE conference as we have planned an exciting program for you with technical, social, and networking focus in mind. The ISABE 2017 conference will experience presentations of nearly 250 papers by 300 authors from 24 countries where the authors will share with you their exciting latest research and findings.

We hope you can make time during this busy 5 day conference to enjoy the unique, rich, and colourful cultural experience that Manchester and its surrounding area have to offer. Once again, a warm welcome to all of you and we hope you take home many happy memories from ISABE 2017 and the United Kingdom.

Professor Pericles Pilidis
Chairman for the UK National Organizing Committee
We’re working on technology today that will fly his kids around the world.

For 100 years we have inspired generations to take the best that exists and make it better.

Today, as the No.1 engine company for new widebody aircraft, our customers have come to expect the world-leading technology, performance and support that our global teams provide around the clock. But intelligent innovators never stand still - at the forefront of the aerospace industry, we have a responsibility to anticipate the solutions that our customers will need many decades from now.

In just a few years, he will see that this future started life long before he did with our Advance and UltraFan® engine families - demonstrating our long-term commitment to keep our customers at the top of their game and to continue inspiring for many generations to come.
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Possibilities of Flight. Made Easy.

A leader in the Aerospace industry for over 100 years, Honeywell develops thousands of innovative products to deliver increasingly safe, efficient, productive and comfortable experiences worldwide.
Steering Committee &
UK National Organizing Committee

Steering Committee

Founding President: Dr. James E. Bubb - ENCON International, Inc.
President: Prof. Richard ‘Ric’ J Parker - Rolls-Royce
Vice President: Prof. Pericles Pilidis - Cranfield University, UK
Founding Secretary: The late Dr. S.N.B. Murthy
Administrative Secretary: Prof. Rainer Walther
Treasurer: Dr. Glen Snedden - DPSS-CSIR, South Africa

UK National Organizing Committee

National Representative: Prof. Riti Singh - Cranfield University
Chairman: Prof. Pericles Pilidis - Cranfield University
Executive Secretary: Dr. Suresh Sampath - Cranfield University
Business Manager: Mr. Alvise Pellegrini - Cranfield University

Committee Members

Abhinav Premnath - WilliamHackett Ltd (ISABE Websites)
Alejandro Block - Cranfield University
Anthony Cassidy - Manchester Convention Bureau
Caroline Day - Rolls-Royce
Chana Goldberg - Cranfield University
Dodeye Igbong - Cranfield University
Eleanor Collins - Cranfield University
Emmanuel Osigwe - Cranfield University
Firas AbdulSattar - Manchester University
Francesco Mastropierro - Cranfield University
Gemma Haynes - Cranfield University
Hasani Azamer Aguirre - Cranfield University
Ibrahim Eryilmaz - Cranfield University
Jesús Ortiz Carretero - Cranfield University
Kingsley Ibrahim - Cranfield University
Lucas Pawsey - Cranfield University
Mosab Alrashed - Cranfield University
Parash Agrawal - Cranfield University
Rory Stieger - Rolls-Royce
Sarah Llyod - Cranfield University
Simon Gallimore - Rolls-Royce
Xiaoxiao Sun - Cranfield University
Yize Liu - Cranfield University
Welcome to a new era in commercial aviation: Geared Turbofan™ engines are quieter, cleaner and more efficient. The secret? MTU Aero Engines’ unique high-speed low-pressure turbine. With innovative technologies, plus the highest-quality development, series production and aftermarket services, we are a strong partner to the aviation industry.

www.mtu.de
## Program Overview:

### ISABE 2017 Week at a Glance

#### Sunday, 3 September 2017

<table>
<thead>
<tr>
<th>Time</th>
<th>Event</th>
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<tr>
<td>15.00</td>
<td>Registration</td>
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<tr>
<td>18.30</td>
<td>ISABE Welcome Drink</td>
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#### Monday, 4 September 2017

<table>
<thead>
<tr>
<th>Time</th>
<th>Event</th>
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<tbody>
<tr>
<td>09.30</td>
<td>Welcome</td>
</tr>
<tr>
<td>10.00</td>
<td>Keynote Paul Stein</td>
</tr>
<tr>
<td>11.00</td>
<td>Keynote J. F. Brouckaert</td>
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<tr>
<td>12.00</td>
<td>Keynote Alan Epstein</td>
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<tr>
<td>12.45</td>
<td>Keynote D. K. Venkatesh</td>
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<tr>
<td>13.45</td>
<td>Keynote Gary Smith</td>
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<tr>
<td>14.45</td>
<td>Keynote Eric Ducharme</td>
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<tr>
<td>15.15</td>
<td>Keynote Zeyong Yin</td>
</tr>
<tr>
<td>19.30</td>
<td>Rolls-Royce Dinner</td>
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#### Tuesday, 5 September 2017

<table>
<thead>
<tr>
<th>Time</th>
<th>Event</th>
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<tbody>
<tr>
<td>08.00</td>
<td>Keynote Simon Weeks</td>
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<tr>
<td>09.00</td>
<td>Keynote Inaki Ulizar</td>
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<tr>
<td>10.00</td>
<td>Keynote Gary Smith</td>
</tr>
<tr>
<td>10.30</td>
<td>Keynote Eric Ducharme</td>
</tr>
<tr>
<td>13.00</td>
<td>Keynote Zeyong Yin</td>
</tr>
<tr>
<td>13.45</td>
<td>Keynote Frank Grauer</td>
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<tr>
<td>14.45</td>
<td>Technical Sessions</td>
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<tr>
<td>15.45</td>
<td>ISABE Board and Invited</td>
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<tr>
<td></td>
<td>Speakers Dinner at the</td>
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<td>Midland Hotel (by invitation)</td>
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#### Wednesday, 6 September 2017

<table>
<thead>
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<tr>
<td>08.00</td>
<td>Keynote Jim Kroeger</td>
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<tr>
<td>09.00</td>
<td>Keynote Charles Champion</td>
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<tr>
<td>10.00</td>
<td>Keynote Eric Ducharme</td>
</tr>
<tr>
<td>10.30</td>
<td>Keynote Janet L. Kavandi</td>
</tr>
<tr>
<td>13.00</td>
<td>Keynote Susan Ying</td>
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<tr>
<td>13.45</td>
<td>Keynote Frank Grauer</td>
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<tr>
<td>14.45</td>
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<tr>
<td>15.45</td>
<td>Conference Visits</td>
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#### Thursday, 7 September 2017

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<th>Time</th>
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<tr>
<td>08.00</td>
<td>Keynote Iain Gray</td>
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<tr>
<td>09.00</td>
<td>Keynote Claus Bauer</td>
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<tr>
<td>10.00</td>
<td>Keynote Janet L. Kavandi</td>
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<tr>
<td>10.30</td>
<td>Keynote Susan Ying</td>
</tr>
<tr>
<td>12.30</td>
<td>Keynote Frank Grauer</td>
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<tr>
<td>13.15</td>
<td>Technical Sessions</td>
</tr>
<tr>
<td>14.15</td>
<td>ISABE Banquet Exchange Hall</td>
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#### Friday, 8 September 2017

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<thead>
<tr>
<th>Time</th>
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<tbody>
<tr>
<td>08.00</td>
<td>Keynote Fariba Alamdard</td>
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<tr>
<td>09.00</td>
<td>Keynote Jerome Bonini</td>
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<tr>
<td>10.00</td>
<td>Keynote Janet L. Kavandi</td>
</tr>
<tr>
<td>10.30</td>
<td>Keynote Susan Ying</td>
</tr>
<tr>
<td>13.00</td>
<td>Keynote Frank Grauer</td>
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<tr>
<td>13.45</td>
<td>Technical Sessions</td>
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<tr>
<td>14.45</td>
<td>ISABE Banquet Exchange Hall</td>
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<tr>
<td>15.15</td>
<td>Invitation to ISABE 2019</td>
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<tr>
<td>16.45</td>
<td>by Andrew Neely National</td>
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<tr>
<td></td>
<td>representative of Australia</td>
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</table>
Invited Speakers

Dr. Eric Ducharme
General Manager
Advanced Technology Operations
GE Aviation
Wednesday, 6 Sept’
13:45 -14:45

Prof. Iain Gray
Director of Aerospace Cranfield University
(AIRC)
Thursday, 7 Sept’
8:00 - 9:00

Prof. Zeyong Yin
Director of the Science & Technology Committee
(AECC) Aero Engine Corporation of China
Tuesday, 5 Sept’
14:45 -15:45

Dr. Janet L. Kavandi
Center Director
NASA Glenn-Research Center
Thursday, 7 Sept’
13:15 -14:15

Dr. Simon Weeks
Chief Technology Officer
Aerospace Technology Institute
(ATI)
Tuesday, 5 Sept’
8:00 - 9:00

Mr. D. K. Venkatesh
Director
(Eng. and R&D) of Design Complex
Hindustan Aeronautics Limited
Monday, 4 Sept’
13:45 -14:45

Dr. J. F. Brouckaert
Project Officer
Clean Sky
Monday, 4 Sept’
11:00 -12:00

Dr. Iñaki Ulizar
Technical Director/ Chief Technology Officer
ITP
Tuesday, 5 Sept’
9:00 -10:00

Dr. Fariba Alamdari
Vice President of Marketing and Aviation Policy
Boeing Commercial Airplanes
Friday, 8 Sept’
08:00 - 09:00

Dr. Paul Stein
Chief Technology Officer
Rolls-Royce plc
Monday, 4 Sept’
10:00 -11:00
Invited Speakers

Prof. Alan Epstein  
Vice President of Technology and Environment  
Pratt & Whitney  
Monday, 4 Sept’  
12:45 -13:45

Dr. Jerome Bonini  
Vice President of Research and Technology  
Safran Aircraft Engines  
Friday, 8 Sept’  
9:00 -10:00

Mr. Gary Smith  
Head of Engineering  
easyJet  
Tuesday, 5 Sept’  
13:45 -14:45

Mr. Jim Kroeger  
Director of Propulsion Systems Engineering  
Honeywell Aerospace  
Wednesday, 6 Sept’  
08:00 - 09:00

Dr. Charles Champion  
Président of Airbus Operations SAS & Executive Vice President Engineering  
Airbus  
Wednesday, 6 Sept’  
09:00 -10:00

Dr. Claus Bauer  
Vice President  
Engine Service  
Lufthansa Technik  
Thursday 7 Sept’  
09:00 -10:00

Dr. Susan Ying  
President  
International Council of Aeronautical Sciences (ICAS)  
Thursday, 7 Sept’  
14:15 -15:15

Dr. Frank Grauer  
Director Engineering Advanced Programs  
MTU Aero Engines AG  
Wednesday, 6 Sept’  
14:45 -15:45
Invited Panelists

Friday, 8 September, 14:30-16:00

Prof. Riti Singh  
Panel Chair  
Cranfield University

Dr. Fariba Alamdari  
VP Marketing  
Boeing Commercial Airplanes

Dr. Jerome Bonini  
VP Research and Technology  
Safran Aircraft Engines

Dr. Janet Kavandi  
Center Director  
NASA Glenn Research Center

Prof. Ric Parker  
President  
International Society of Air Breathing Engines (ISABE)

Dr. Susan Ying  
President  
International Council of Aeronautical Sciences (ICAS)
Receptions, Dinners & Banquet Information

Registration Reception
Sunday, 3 September, 15:00-18:30
An informal gathering where all participants will have an opportunity to meet and mingle before the official opening on Monday, 4 September. Attendees are welcome to drop in for the ISABE welcome drink between 18:30-22:30 after registration is complete.

Rolls-Royce Dinner
Monday, 4 September, 19:30-22:30
Victoria Warehouse, Manchester
All ISABE 2017 attendees are invited to the Rolls-Royce Dinner. The conference hosts will take this opportunity to welcome everyone to Manchester and the conference, while enjoying a buffet style meal.

ISABE Board & Invited Speakers Dinner
(by invitation)
Tuesday, 5 September, 19:00-22:30,
Midland Hotel, Manchester
The dinner is reserved for ISABE Board Members, Invited Speakers, and their Accompanying Persons.

ISABE Banquet
Thursday, 7 September, 19:00-22:30
Exchange Hall, Manchester Central

Dress Code
Business attire is recommended for the Opening Ceremony, for the ISABE Board and Invited Speakers Dinner and for the ISABE Banquet. Business casual for the rest of the conference, and casual attire for the social events.

Advanced Turboprop

By utilizing technologies proven on other GE engine platforms, we’re balancing “all - new” with “low risk + high value” for business and general aviation operators.

850 to 1,650 shaft horsepower

2,000 Thermodynamic horsepower class

16:1 overall pressure ratio

33% longer time between overhaul

20% lower mission fuel burn

Highest power to weight ratio in its class
Instructions for Speakers & Chairs

Information for Speakers
Please follow these guidelines when preparing your presentations:
• Laptops with Windows 7 and Microsoft Office 365 will be in each session room along with a projector and screen
• Please provide your presentation file(s) on a USB memory stick only
• Please use standard Microsoft PowerPoint software
• Those presenting in the Exchange Auditorium are required to hand in their presentation by 7:45 am on the day of their allocated technical session.

Information for Session Chairs
• Session chairs can pick up a folder containing author biographies and session evaluation form at the registration desk.
• Please return the evaluation form to the staff in your room after closing and summarizing your session.

Meeting Spot for Presenting Authors & Session Chairs
• All presenting authors and chairs should meet in the session room 15 minutes prior to their start time.
• This will provide an opportunity for: introductions, review meeting expectations, transfer presentation files to in-room computers, and review of biographical information.
The Venue: Manchester Central

Manchester Central
Windmill St
Petersfield
Manchester
M2 3GX
Phone: +44 (0)161 834 2700
Email: isabe2017@cranfield.ac.uk

Location Information:
Manchester Central is easily accessible from Manchester airport and train stations either by Metroshuttle bus, Metrolink tram (nearest stop: Deansgate-Castlefield), or by taxi.
Conference Venue Map

Site plan

Key

TOILETS
ORGANISERS' OFFICE
FIRST AID
ESCALATORS
LIFT
CONCIERGE
CLOAKROOM
BABY CHANGE

For more information, please contact:

T: +44 (0)161 834 2700
E: sales@manchestercentral.co.uk

We believe flight is an engine for human progress. Its magnitude both humbles and motivates us. And every day, we rise to its challenges with state-of-the-art engines, dedicated service experts, and generations of innovators working together to transform aviation.

Flight unleashes the world to go beyond.

Learn more at pw.utc.com
Visit to Manchester Museum of Science & Industry

Wednesday, 6 September, 15:45-19:30

The Museum of Science and Industry (MSI or MOSI) in Manchester is a large museum devoted to the development of science, technology and industry with emphasis on the city’s achievements in these fields.

There are extensive displays on the theme of transport (cars, aircraft, railway locomotives and rolling stock), power (water, electricity, steam and gas engines), Manchester’s sewerage and sanitation, textiles, communications and computing.

The museum is an Anchor Point of the European Route of Industrial Heritage; and is situated on the site of the world’s first railway station: Manchester Liverpool Road, which opened as part of the Liverpool and Manchester Railway in September 1830.

Cost-effective facilities to de-risk new engine technologies

NRC research facilities
- Combustion and spray testing
- Computational
- Engine aerodynamics testing
- Engine test cells
- Icing systems
- Mechanical component testing
- Research altitude testing

CONTACT
Ibrahim Yimer, Ph.D.
Director, R&D
Gas Turbines, Aerospace
+1 613 851-6009
Ibrahim.Yimer@nrc-cnrc.gc.ca
www.nrc-cnrc.gc.ca/aerospace
Monday, 4th September

Technical Session 01: Compressors
Chairs: Reid Berdanier (The Pennsylvania State University), Ulrich Wenger (Rolls-Royce)

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Baofeng Tu
Kai Zhang
Hua Liu
Jun Hu

Chunill Hah
Michael Romeo

Motoyuki Kawase
Aldo Rona

Antonio Antoran Perales
Leyre Armananzas
Andoni Puente

Carlo Cravero
Davide Marsano

Technical Session 01: Compressors (continued)
Chairs: Reid Berdanier (The Pennsylvania State University), Ulrich Wenger (Rolls-Royce)

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<tr>
<td>ISABE-2017-21397</td>
<td>ISABE-2017-21493</td>
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<tr>
<td>Numerical and Experimental Studies on Variable Geometry and Variable Camber Inlet Guide Vanes on Low Speed Axial Compressor Performance</td>
<td>Exploring a Database of Optimal Airfoils for Axial Compressor Design</td>
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</tbody>
</table>

Emandi Rajesh
Bhaskar Roy

Markus Schnoes
Eberhard Nicke

Technical Session 02: Fluid and gas dynamics
Chairs: Ruben Del Rosario (NASA), Andy Geer (Rolls-Royce)

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<tr>
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<tbody>
<tr>
<td>Investigations on the Leakage Flow Characteristics of the Brush Seal with Annular Pressure Reduction Groove</td>
<td>Computational Study on Pseudo-shock Wave in a Rectangular Duct</td>
<td>Investigation of the Boundary Layer Development at the Corner of the Special-Shaped Expansion Pipe</td>
<td>Turbulent Flow Development inside a Rotating Two-Pass Square Duct with Porous Blocks</td>
<td>Influence of Combustor Swirl on Turbulence at the Large Scale Turbine Rig (LSTR)</td>
</tr>
</tbody>
</table>

Jun Li
Yuanqiao Zhang
Xin Yan
Zhigang Li

Ruoyu Deng
Jintiu K. James
Heuy Dong Kim

Teng Fei
Jiabin Li
Lucheng Ji
Weiin Yi

Firas Abdulsattar
Dennis Cooper
Hector Iacovides
Shanying Zhang

Manuel Wilhelm
Marius Schmidt
Florian Goertz
Heinz-Peter Schiffer
Christoph Lyko

Technical Session 02: Fluid and gas dynamics (continued)
Chairs: Ruben Del Rosario (NASA), Andy Geer (Rolls-Royce)

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<tr>
<td>Comparative Studies of Ground Vortices Induced by Engine Inlets and Propellers near the Ground</td>
<td>Study of a Conceptual Design for Cooled Cooling Air in a Preswirl Cavity</td>
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Luis Gustavo Trapp
Marina Cavalli
Roberto da Motta Girardi

Zixiang Sun
John W. Chew

Xin Y an
Zhigang Li

Weilin Yi
Firas Abdulsattar
Dennis Cooper
Hector Iacovides

Shanying Zhang
Manuel Wilhelm
Marius Schmidt
Florian Goertz
Heinz-Peter Schiffer
Christoph Lyko
Monday, 4th September

Technical Session 03: New developments in gas turbine engines
Chairs: Simon Gallimore (Rolls-Royce), Jun Li (Xi’an Jiaotong University)

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<tr>
<td>15.45</td>
<td>Vladimír Korovkin</td>
<td>Gregorio Corchero</td>
<td>Mariano Di Matteo</td>
<td>Ricardo Puente</td>
<td>Sascha Kaiser, Markus Nickl</td>
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<tr>
<td></td>
<td>Alexander Evstigneev</td>
<td>Jesús U. Sainz</td>
<td>J. Steinnes, O. Berten,</td>
<td>Roque Corral García</td>
<td>Christina Salpingidou</td>
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<td></td>
<td>Vladimir Makarov</td>
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<td>P. Hendrick, J. Thibault,</td>
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<td>Zinon Vlahostergios</td>
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<td></td>
<td>Aleksey Mironov</td>
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<td>L. Seguino, B. Fulleringer,</td>
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<td>Stefan Donnerhack</td>
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<td>D. Robert, C. Corre</td>
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<td>Hermann Klingels</td>
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Technical Session 03: New developments in gas turbine engines (continued)
Chairs: Simon Gallimore (Rolls-Royce), Jun Li (Xi’an Jiaotong University)

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<th>ISABE-2017-22661</th>
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<tr>
<td>17.45</td>
<td>Scale Effects on Conventional and Intercooled Turbofan Engine Performance</td>
<td>An Approach to Multi-Disciplinary Aero Engine Conceptual Design</td>
</tr>
<tr>
<td>18.15</td>
<td>Andrew Rolt, Vishal Sethi, Florian Jacob, Joshua Sebastampillai, Carlos Xisto, Tomas Grönstedt, Lorenzo Raffaelli</td>
<td>Konstantinos G. Kyprianidis</td>
</tr>
</tbody>
</table>
# Monday, 4th September

## Technical Session 04: Hypersonic vehicle propulsion

**Chairs:** James Felder (NASA), Alessandro Cappelletti (Università degli Studi di Firenze)

### Exchange Room 3

|---------|------------------|------------------|------------------|------------------|------------------|

- **Pengcheng Dong**
- **Hailong Tang**
- **Min Chen**

<table>
<thead>
<tr>
<th>Time</th>
<th>ISABE-2017-22544</th>
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<tbody>
<tr>
<td>18.15</td>
<td>A Numerical Study Into Hypersonic Fluidic Thrust Vectoring</td>
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- **Hilbert van Pelt**
- **A. J. Neely**
- **J. Young**
- **J. H. S. De Baar**

### Exchange Room 3 (continued)

### Technical Session 04: Hypersonic vehicle propulsion (continued)

**Chairs:** James Felder (NASA), Alessandro Cappelletti (Università degli Studi di Firenze)

<table>
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<th>Time</th>
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<td>18.15</td>
<td>Experimental Investigation on Laser-Induced Plasma Ignition of Hydrocarbon Fuel in Scramjet Engine at Takeover Flight Conditions</td>
</tr>
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</table>

- **Shigeo Obata**
- **Daniel Komornik**
- **Alon Gany**

### Technical Session 05: Cooling technologies

**Chairs:** Reinhard Niehuis (Bundeswehr University Munich), Mikhail Ivanov (CIAM)

### Exchange Room 4

|---------|------------------|------------------|------------------|------------------|------------------|

- **Alastair Duncan Walker**
- **Bharat Koli**
- **Apostolos Spanelis**
- **Peter A. Beecroft**

<table>
<thead>
<tr>
<th>Time</th>
<th>ISABE-2017-21383</th>
<th>ISABE-2017-22591</th>
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<tbody>
<tr>
<td>18.15</td>
<td>Numerical Calculation of Internal Blade Cooling Using Porous ribs</td>
<td>Numerical Study of Uneven Wall Heating Effect for a One Side Rib-Roughened Channel Subject to Rotation</td>
</tr>
</tbody>
</table>

- **Qahtan Al-Aabidy**
- **H. Iacovides**

- **Zhi Wang**
- **Roque Corral García**

### Technical Session 05: Cooling technologies (continued)

**Chairs:** Reinhard Niehuis (Bundeswehr University Munich), Mikhail Ivanov (CIAM)

<table>
<thead>
<tr>
<th>Time</th>
<th>ISABE-2017-22532</th>
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<tbody>
<tr>
<td>11.15</td>
<td>Hideyuki Taguchi Motoyuki Hongoh Takayuki Kojima Toshihito Saito</td>
</tr>
<tr>
<td>11.45</td>
<td>Pengcheng Dong Hailong Tang Min Chen Shigeo Obata Daniel Komornik Alon Gany Shunhua Yang, Shunping Zhang, Jialing Le, Shuang Chen, Xiya Wang, Rufeng Kan, Zhenyu Xu, Jun Ruan, Lu Yao Hideyuki Taguchi Motoyuki Hongoh Takayuki Kojima Toshihito Saito</td>
</tr>
</tbody>
</table>
Monday, 4th September

Technical Session 06: Noise pollution
Chairs: Charles Trefny (NASA), Anestis Kalfas (Aristotle University of Thessaloniki)  
Exchange Room 5

15.15 ISABE-2017-21368
Turbine Tone Noise Reduction via Optimized Acoustic Coupling
Adolfo Serrano Gonzalez
José R. Fernández Aparicio
Paloma González
Diego Torre

15.45 ISABE-2017-22509
Effects of Fan Design Parameters and CFD Conditions on Fan Noise and Aerodynamic Performance
Shuhei Tomita
Hiroki Hano
Yuzo Inokuchi
Nobuhiko Yamasaki

16.15 ISABE-2017-22515
Wall-Resolved Large Eddy Simulation for Aeroplane Aeronautical Investigation
Yuqing Lin
Rao Vadamani
Paul Tucker
Mark Savill

16.45 ISABE-2017-22538
Advanced Noise Abatement Procedures for a Supersonic Business Jet
Jeffrey J. Berton
Scott M. Jones
Jonathan A. Seidel
Dennis L. Huff

17.15 ISABE-2017-22545
Noise of Small Turbofan Engine DGEN380
Tatsuya Ishii
Kenichiro Nagai
Hideshi Ginuma
Takuya Harada

Technical Session 06: Noise pollution (continued)
Chairs: Charles Trefny (NASA), Anestis Kalfas (Aristotle University of Thessaloniki)  
Exchange Room 5

17.45 ISABE-2017-22587
Assessment of Civil Aircraft Certification and Component-Level Noise During Landing Take-off Cycle
Fakhre Ali
Dale Van Zante
Douglas Nark
Hamilton Fernandez

Technical Session 07: Integrated systems
Chairs: Vladimir Makarov (CIAM), Theo Nikolaidis (Cranfield University)  
Exchange Room 6

15.15 ISABE-2017-21390
Off-Design Performance of a Streamline-Traced External-Compression Supersonic Inlet
John W. Slater
David Grasselt
Klaus Hirschler
Stefan Kazula

15.45 ISABE-2017-21450
A Design Approach for a Coupled Actuator System for Variable Nozzles and Thrust Reverser of Aero Engines
Chana Goldberg
O. Naianda
V. Sethi
P. Pilius
R. Singh

16.15 ISABE-2017-21470
Liquid Hydrogen Fuel for a Blended Wing Body Aircraft: Case Study on the N3-X
Marie-Claire Flynn
Catherine E. Jones
Patrick J. Norman
Stuart J. Galloway

16.45 ISABE-2017-22523
Establishing Viable Fault Management Strategies for Distributed Electrical Propulsion Aircraft
Muthukrishnan Muniyandi
Andrew Dowding
Stefan Anders

17.15 ISABE-2017-22685
Vibration Testing and Validation Of Aero Engines Pipe Work

Technical Session 07: Integrated systems (continued)
Chairs: Vladimir Makarov (CIAM), Theo Nikolaidis (Cranfield University)  
Exchange Room 6

17.45 ISABE-2017-22673
Compressor Development for a Turbocharged UAV Power Unit
Colin Rodgers
Chris Robinson
ITP, the ninth biggest aircraft engine and components company in the world

ITP is currently the ninth biggest aircraft engine and components company in the world by revenue, ranking among the top one hundred companies in the aerospace industry. The company includes among its activities the design, research and development, manufacturing and casting, assembly and testing of aeronautical engines. It also offers a wide range of customised MRO solutions for engines, accessories, components and parts.

The company has 3,500 employees in centres in Spain, Mexico, United Kingdom, Malta, United States and India.

www.itp.es
Tuesday, 5th September

Technical Session 08: Compressors
Chairs: Ralf von der Bank (Rolls-Royce), Peter Schiffer (Technischen Universität Darmstadt)

<table>
<thead>
<tr>
<th>10.30</th>
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<tr>
<td>Reid A. Berdanier</td>
<td>Nicole L. Key</td>
<td>Ruiyu Li</td>
<td>Limin Gao</td>
<td>Lei Zhao</td>
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</table>

Technical Session 09: Fluid and gas dynamics
Chairs: Glen Snedden (CSIR), Chunill Hah (NASA)

<table>
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<tbody>
<tr>
<td>Numerical Simulation of Air-oil Separator with Metal Foam in Aero-engine</td>
<td>SAS-LES Simulations of the Flow and Heat Transfer Inside a Square Ribbed Duct with Artificial Forcing</td>
<td>Numerical and Experimental Study of Overexpanded Flows in Planar Supersonic Nozzles at Low Reynolds Numbers Saya Inoue</td>
<td>Experimental Study of the Pressure Loss in Aero-Engine Air/Oil Separators</td>
<td>The In-service Burn out Effect on the Transonic Leakage Flows over High Pressure Turbine Blade Tip</td>
</tr>
</tbody>
</table>

Technical Session 10: New developments in gas turbine engines
Chairs: Andrew Rolt (Cranfield University), Isaac Lopez (NASA)

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<tbody>
<tr>
<td>Comparative Assessment between Variable Area Fan Nozzle Concepts at Inner and Outer By-Pass Duct Surfaces</td>
<td>Simplified dynamic simulation of Gas Turbine SOFC Hybrid Systems</td>
<td>Sensitivity Analysis of a Triple Bypass Adaptive Cycle Engine Concept</td>
<td>The Impact of Clean Sky Technology on Future 3500 lb Single Engine Light Rotorcraft</td>
<td>Comparison Between the Optimum Performance of Mixed and Unmixed High-Bypass Turbosfans</td>
</tr>
</tbody>
</table>

Technical Session 11: Hypersonic vehicle propulsion
Chairs: Hong-Gye Sung (Korea Aerospace University), Charles Trefny (NASA)

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</table>
Tuesday, 5th September

Technical Session 12: Combustion
Chairs: Alessandro Cappelletti (Università degli Studi di Firenze), Iroizan Ubulom (UNSW Canberra)

10.30 ISABE-2017-21366
ISABE-2017-21438
ISABE-2017-21479
ISABE-2017-22634
ISABE-2017-22641

Isolator Flow Response To Scramjet-Ramjet Transition In A Scramjet Engine
Ways for Extending the Stable Operation Boundaries of Combustion Chamber Running on Different Fuel Types
Comparative Performance Study of CFD Species Models for Hydrogen Micromix Combustion
Large Eddy Simulation of a Reverse Flow RGL Combustor with Non-Adiabatic Flamelet Combustion Model
Large-eddy simulations of aero-engine combustors using the Conditional Moment Closure model

Rajarshi Das
Ha Jeong Ho
Heuy Dong Kim
Foluso Ladeinde

11.00
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Technical Session 13: Virtual development and testing
Chairs: Yiguang Li (Cranfield University), Hilbert van Pelt (UNSW Canberra)

10.30 ISABE-2017-21389
ISABE-2017-21475
ISABE-2017-22512
ISABE-2017-22543
ISABE-2017-22558

Data Re-use for Preliminary Thermo-Mechanical Design of Gas Turbine
Higher Fidelity Gas Turbine Engine Thermal Performance Modeling
Performance-Modelling of an Ultra-high Bypass Ratio Geared Turbofan
Efficient Uncertainty Quantification for an Axial Compressor, Using Adaptive Multi-fidelity Kriging
Cycle Analysis of Conventional and Advanced Airbreathing Engines Involving Real Gas and Condensed Phase Effects

Gan Lu
Feng Wang
Luca di Mare
Michael A. Moss
Gordon May

Paul Guagliardi
T. Nikolaidis
P. Pilidis
Alexios Alexiou
Nikolaos Aretakis
Ioannis Roumeliotis
Ioannis Koliou
Konstantinos Mathioudakis
Jouke Hendrik Siets de Baar
Z. Leylek
A.J. Neely

11.00
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Technical Session 14: Compressors
Chairs: Michael Bauer (MTU), Pavlos Zachos (Cranfield University)

16.15 ISABE-2017-21415
ISABE-2017-21417
17.15 ISABE-2017-21443
17.45 ISABE-2017-21478
18.15 ISABE-2017-21492

Application of shear-sensitive Liquid Crystal Coating on Flow Visualization of Compressor Cascade
Numerical Analysis of Unsteady Vaned Diffuser Flow in a Centrifugal Compressor
Investigation on the Effects of Winglet Geometry in a High Loading Compressor Rotor
The Surge Margin of an Axial Compressor: Estimations from Steady State Simulations
Investigation of Variable Inlet Guide Vanes on a Low Speed Compressor Stage with a Cantilevered Stator

Ruiyu Li
Limin Gao
Shuai Zhang
Yongzheng Li
William J. Gooding
John C. Fabian
Nicole L. Key
Cui Wei-wei
Zhou Xiao-yang
Zhao Qing-Jun
Xu Jian-zhong
Marcus Lejon
Niklas Andersson
Lars Ellbrant
Hans Mårtensson
Alok Minesh Shah
Amboor Madathil Pradeep

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Technical Session 15: Fluid and gas dynamics
Chairs: Andrew Neely (UNSW Canberra), Nobuhiko Yamasaki (Kyushu University)

16.15 ISABE-2017-21350
ISABE-2017-21419
16.45 ISABE-2017-21422
17.15 ISABE-2017-21465
17.45 ISABE-2017-21472

An Efficient Design Method for Applying Vortex Generators in Turbomachinery
Application of Extreme Value Statistics to Reduce Test and Computational Requirements for Quantifying Maximum Engine Inlet Total Pressure Distortion
Experimental Investigation of Infrared Signal Characteristics in a Micro Turbotjet Engine
An Evaluation of Depth-Averaged Models of Laminar Falling Wavy Liquid Films
Non-intrusive Frequency Measurements of Bluff-body Vortex Shedding at High Reynolds Numbers

Jiabin Li
Lucheng Ji
Yanming Liu
Weilin Yi
David S. Kidman
James D. Brownlow
Brian A. Binkley
Craig C. Morris
Summi Kim
Seongman Choi
Rho Shin Myung
Woncheol Kim
Bruce Kakimpa
Herve Morvan
Stephen Hibberd
Judith Richter C. Steinhausen
B. Weigand
M. Beutling
T. Dreier
C. Schulz

16.45
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## Tuesday, 5th September

### Technical Session 16: Diagnostics

**Chairs:** Cleverson Bringhenti (Instituto Tecnológico de Aeronáutica), Toshio Nagashima (University of Tokyo)

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<tbody>
<tr>
<td></td>
<td>Simone Togni, Theoktis Nikolaidis, Suresh Sampath</td>
<td>Gbanaibolou Jombo, Suresh Sampath, Iain Gray</td>
<td>Sangsig Yun, N. Ramachandran, M. Charbonneau, R. B. Walker, H. Ding, D. Coulas, S. J. Mihailov</td>
<td>Emmanuel Osigwe, Yi-Guang Li, Suresh Sampath, Gbanaibolou Jombo, Dieni Indarti</td>
<td>Chao Yang, Xiangxing Kong</td>
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</table>

### Technical Session 17: Heat Transfer

**Chairs:** Yeshayahu Levy (Technion – Israel Institute of Technology), D. R. Reddy (NASA)

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<tbody>
<tr>
<td>16.15</td>
<td>Experimental Investigation on Onset of Instability of Supercritical Kerosene Flowing in Mini-tubes</td>
<td>Experimental Investigation on Heat Transfer of Kerosene Flowing in Tiny Horizontal Rectangular Tubes at Supercritical Pressure under Gravity</td>
<td>Comparison of RANS and LES on Gas Turbine Combustor Liner Temperature using Conjugate Heat Transfer (CHT) Methodology</td>
<td>Computational Modelling of the Flow and Heat Transfer in Dimpled Channels</td>
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Tuesday, 5th September

Technical Session 18: Combustion
Chairs: Yolanda Hicks (NASA), Sean Yun (National Research Council Canada)

<table>
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Alessandro Cappelletti
Francesco Martelli
Seongpil Joo
Jisu Yoon
Seongheon Kim
Sudarshan Kumar
Youngbin Yoon
Hu Bin
Wang Zhong-hao
Deng Ai-ming
Zhao Qing-jun
Xu Jian-zhong
Alexander Vasilyev
R. Medvedev
O. Chelebyan
O. Zubkova
V. Lyashenko
V. Zakharov
Jie Li
Xiaoxiao Sun
Yize Liu
Vishal Sethi

Technical Session 19: Materials, structures and structural failure
Chairs: Anders Sjunnesson (GKN Aerospace), Panos Laskaridis (Cranfield University)

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<tr>
<th>16.15</th>
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<tbody>
<tr>
<td>Experimental Characterization of Carbon Fiber Brush Seal Leakage Performance as a Function of the Bristle Pack Geometrical Parameters under Dry Conditions</td>
<td>Modelling Approach for Calculation of Leading Edge Deterioration of Fan Blades due to Erosion during the Engine Pre-Design Process</td>
<td>Challenges and Opportunities of Thermomechanical FEM Simulations of High Fidelity Aero-Engine Models by Implicit Time-Integration</td>
<td>Assessment of Propeller Blade Erosion</td>
</tr>
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</table>

Bilal Outirba
B. Patrick Hendrick
C. Kevin Nicolas
Nelli Schmidt
Frank Grauer
Jan Gregor Pfitzner
Stephan Staudacher
Konrad Vogeler
Markus Kober
Arnold Kühhorn
Akin Keskin
Kai Singh
Adel Ghenaiet
We design and develop technologies for tomorrow’s aero engines.

We focus on subsystems and components made of metals and composites with advanced manufacturing processes for new functionality, higher performance, better affordability and lower weight.

The results are of global value; our products can be found on more than 90% of all new commercial aircraft.

GKN Aerospace Engine Systems
With operations at 13 sites on three continents.

NASA’s Glenn Research Center is shaping the world of tomorrow by developing technologies that will enable further exploration of the solar system and revolutionize air travel. Our researchers are dedicated to transforming aeronautics through the development of cutting-edge concepts and systems, which will dramatically improve efficiency, reduce noise and emissions, and maintain safety in crowded skies.

As the commercial aviation sector approaches an inevitable paradigm shift, our team is developing groundbreaking technologies in power, air-breathing propulsion, communications, and materials for extreme environments. We also house some of the world’s most advanced test facilities aimed at developing and verifying research in aircraft and engine icing and innovative ways of using electricity for propulsion, supersonics, and aeroacoustics.

At NASA, we believe we are at the right place, at the right time, with the right technology and, over the next 50 years, we want to lead the aviation industry into a renaissance unlike any other. We look forward to discussing our near-, mid-, and far-term solutions to current aviation challenges with you this week at the 23rd ISABE Conference.

Janet L. Kavandi, Ph.D.
Center Director
NASA John H. Glenn Research Center
## Technical Session 20: Compressors

### Exchange Auditorium

<table>
<thead>
<tr>
<th>Time</th>
<th>Paper Title</th>
<th>Authors</th>
<th>Session Chair(s)</th>
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</thead>
<tbody>
<tr>
<td>10:30</td>
<td>Preliminary Aerodynamic Design of a Fan Stage for an Ultra High Bypass Ratio Engine</td>
<td>Daniel Giesecke, Jens Friedrichs, Udo Stark</td>
<td>Peter Schiffer, Alan Newby</td>
</tr>
<tr>
<td>11:00</td>
<td>An Improved Streamline Curvature-based Design Approach for Transonic Axial-Flow Compressor Blading</td>
<td>Hasani Azamar Aguirre, Vassilios Pachidis, Ioannis Templalexis</td>
<td>Peter Schiffer, Alan Newby</td>
</tr>
<tr>
<td>11:30</td>
<td>Development of a Streamline Curvature Axial-Flow Compressor Performance Simulator Graphical-user Interface for Design and Research</td>
<td>Hasani Azamar Aguirre, Vassilios Pachidis, Ioannis Templalexis</td>
<td>Peter Schiffer, Alan Newby</td>
</tr>
<tr>
<td>12:00</td>
<td>A Reduced Frontal Area Turbojet (RFAT) Engine Architecture with Diagonal Flow Turbomachinery</td>
<td>Radeshen Moodley, Lei Fu</td>
<td>Peter Schiffer, Alan Newby</td>
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<tr>
<td>12:30</td>
<td>Numerical Investigation on Oscillation of Tip Leakage Flow in Transonic Axial Compressor Rotor</td>
<td>Peter Schiffer, Alan Newby</td>
<td>Peter Schiffer, Alan Newby</td>
</tr>
</tbody>
</table>

## Technical Session 21: Fluid and gas dynamics

### Exchange Room 1

<table>
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<th>Time</th>
<th>Paper Title</th>
<th>Authors</th>
<th>Session Chair(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>10:30</td>
<td>Rainbow Schlieren Visualization of Shock trains in Rectangular Ducts</td>
<td>Taishi Takeshita, H. Takano, D. Ono, S. Nakao, Y. Miyazato</td>
<td>Nicole Key, Rob Mitchell</td>
</tr>
<tr>
<td>11:00</td>
<td>A One-way Fluid-thermal-structure Coupling Analysis Method for Finger Seal</td>
<td>Qiang Wang, H.H. Ji, Y.P. Hu</td>
<td>Nicole Key, Rob Mitchell</td>
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<tr>
<td>11:30</td>
<td>Optimization of an Axial Turbine Used in Small Gas Turbine Engine Based on 3D Simulations</td>
<td>Luiz Gustave F. Amaral, Jesuino Takachi Tomita, Cleerson Brighenti, Osman F. Reis da Silva</td>
<td>Nicole Key, Rob Mitchell</td>
</tr>
<tr>
<td>12:00</td>
<td>Aerodynamic Investigation of S-Duct Intake for High Power Turboprop Installed on a Channel Wing</td>
<td>Caglar Atalayer, J. Friedrichs, D. Wulff</td>
<td>Nicole Key, Rob Mitchell</td>
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<tr>
<td>12:30</td>
<td>Using Fluidic Curtains to Reduce Turbine Leakage</td>
<td>James MacCalman, Simon Hogg, Grant Ingram, Richard Williams, Stacie Tibos</td>
<td>Nicole Key, Rob Mitchell</td>
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</table>

## Technical Session 22: New developments in gas turbine engines

### Exchange Room 2

<table>
<thead>
<tr>
<th>Time</th>
<th>Paper Title</th>
<th>Authors</th>
<th>Session Chair(s)</th>
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</thead>
<tbody>
<tr>
<td>10:30</td>
<td>Optimisation of an Aircraft Fluid Heat Management Using Exergy Analysis Method</td>
<td>Alexandre Neophytou, Jean-Michel Rogero, Anthony Roux</td>
<td>Aspi Wadia, Areti Malkogianni</td>
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<tr>
<td>11:00</td>
<td>Challenges of Preliminary Aircraft Engine Design with Variable Cycle Technology</td>
<td>Christian Hennig, Frank Grauer</td>
<td>Aspi Wadia, Areti Malkogianni</td>
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<tr>
<td>12:00</td>
<td>The Rolls-Royce Advance3 Project – Proving our Future Core</td>
<td>Andy Geer</td>
<td>Aspi Wadia, Areti Malkogianni</td>
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<tr>
<td>12:30</td>
<td>Clean Sky Research and Demonstration Programmes for Next Generation Aircraft Engines</td>
<td>Jean-François Brouckaert, François Miraille, Kevin Phuah, Peter Taferner</td>
<td>Aspi Wadia, Areti Malkogianni</td>
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## Technical Session 23: Hypersonic vehicle propulsion

### Exchange Room 3

<table>
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<th>Time</th>
<th>Paper Title</th>
<th>Authors</th>
<th>Session Chair(s)</th>
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<tbody>
<tr>
<td>10:30</td>
<td>Experimental Investigation on Fuel Distribution with Far-Field Injection in a Scramjet Combustor with Dual Cavity</td>
<td>Yu Pan, Xi-Peng Li, Wei-Dong Liu, Lei-Chao Yang, Bin An, Jia-Jian Zhu</td>
<td>Dries Verstraete, John Slater</td>
</tr>
<tr>
<td>11:00</td>
<td>Analysis of Steady State Characteristics of Scramjet Engines</td>
<td>Zifei Ji, Bing Wang, Huqiang Zhang, Zhuming Rao</td>
<td>Dries Verstraete, John Slater</td>
</tr>
<tr>
<td>11:30</td>
<td>Research on Quantitative Evaluation Method of Scramjet and Integration</td>
<td>Huanrong Zhang, Yuchun Chen, Yuanhu Cai, Junjie Zhao</td>
<td>Dries Verstraete, John Slater</td>
</tr>
<tr>
<td>12:00</td>
<td>Sea Level Static Tests of Gas Generator Cycle Air Turbo Ramjet Engine for Supersonic UAV</td>
<td>Kazuyuki Higashino, D. Nakata, R. Minato, R. Imai, N. Tanatsugu, Y. Yoshima, H. Mukae</td>
<td>Dries Verstraete, John Slater</td>
</tr>
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</table>
### Technical Session 24: Combustion

**Chairs:** Seongman Choi (Chonbuk National University), Ibrahim Yimer (National Research Council Canada)

**Exchange Room 4**

<table>
<thead>
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<th>Time</th>
<th>Paper 1</th>
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- **Combustion Instability Characteristics in a Dump Combustor using Different Hydrocarbon Fuels**
- **Development of Front Module for GTE Combustor with Low NOx Emission**
- **Gas Turbine Combustor Modeling with and without Nozzle Guided Vanes --- Phase II**
- **Gas turbine combustion using Low Swirl Injection – Defining a new swirl number**
- **Evaluation of the Lean Blowout Limit of Alternative Fuels in a Gas Turbine Combustor**

**Authors**

- Donghyun Hwang
- Yoonho Song
- Kyubok Ahn
- A. Vasiliev
- Oganes Chelebyan
- V. Zakharov
- V. Lyashenko
- Lei-Yong Jiang
- Yinghua Han
- Prakash Patnaik
- Joseph Kalyan Raj I.
- Yeshayahu Levy
- Lukai Zheng
- Ihab Ahmed
- Emamede Ubogu
- Yang Zhang
- Bhupendra Khandelwal

### Technical Session 25: Materials, structures and structural failure

**Chairs:** Ann Bolcavage (Rolls-Royce), Dae Sung Lee (Korea Aerospace Research Institute)

**Exchange Room 5**

<table>
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<tr>
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- **Analysis of an Acoustic Casing Structure for Tip Clearance Control under Various Temperature and Pressure Conditions**
- **Fretting Wear Modeling of Misaligned Spline Couplings in Aero-engine Accessory**
- **Kinetics and Mechanisms of Chemical Reactions at the Unidirectional Continuous SiC Fibre/Ti-17 Composite Interfaces**
- **Thermo Mechanical Fatigue Life of Turbine Rotor for Small Gas Turbine Engine : A Reliability Approach**
- **Predictive Model of Forces for Aeronautic Materials Fir Tree Broaching**

**Authors**

- Tobias Schmidt
- Sina Eisenmann
- Velislav Velikov
- Volker Gümmer
- Andreas Hupfer
- Wen Li
- Kening Xu
- Xuebing Zhang
- Yong Huang
- Tong Zhang
- Yingwei Fan
- Xiaorong Zhou
- S. Esakki Muthu
- P. Udayanan
- Gorka Ortiz-de-Zarate
- Daniel Soler
- Mikael Cuesta
- Aitor Madariaga
- Alhara Garay
- Pedro Arrazola Arriola

### Technical Session 26: Turbines

**Chairs:** Jun Li (Xi’an Jiaotong University), Paloma González (ITP)

**Exchange Room 6**

<table>
<thead>
<tr>
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</table>

- **Numerical Simulation of ITD Flows in the Presence of HP Blade and LP Vane**
- **Modelling and Performance Analysis of Vanless Counter Rotating Turbine in Gas Turbine Engines**
- **Efficiency Losses Resulting from Base Pressure Deficit and Energy Separation over the Speed Range**
- **The Difference of Down-stream Mixing Loss due to the Trailing Edge Configuration**
- **On and Off-design Performance of a Model Rotating Turbine with Non-Axisymmetric Endwall Contouring and a Comparison to Cascade Data**

**Authors**

- Jie Gao
- Weiliang Fu
- Xuezheng Liu
- Guoqiang Yue
- Qun Zheng, Xudong Zhao
- Linyuan Jia
- Yuchun Chen
- Yuan Gao
- Junjie Zhao
- Jonathan Paul Gestelow
- A. Rona
- Joo Furukawa
- Masaaki Hamabe
- Kenichi Funasaki
- Glen Snedden
- Dwayne Dunn
- Grant Ingram
Thursday, 7th September

Technical Session 27: Advanced Aero Engine Research and Assessments 1
Chairs: Nateri Madavan [NASA], Devaiah Nalianda [Cranfield University]

Vision 20 – Rolls-Royce’s Long Term Civil Aircraft Propulsion System Concept and Technology Strategy
John Whurr
Peter Beecroft
Andrew Roll
Joshua Sebastiampillai
Florian Jacob
Vishal Sethi
Carlos Kiste

Technical Session 28: Fluid and gas dynamics
Chairs: Paloma González [ITP], Theo Nikolaidis [Cranfield University]

Experimental Results of Shock Trains in the Thermal Ablation C-SiC Composite Isolator
Xue-bin Cao
Yan-jin Man
Shou-mei Zhu

Technical Session 29: New developments in gas turbine engines
Chairs: Anestis Kalfas [Aristotle University of Thessaloniki], Alan Newby [Rolls-Royce]

ENOVAL - Low Pressure System Technologies for Ultra High Bypass Ratio Engines
Joerg Sieber
Edgar Merkl
Artem Karpenko
Sergiy Riznyk
I. Kravchenko

Technical Session 30: Combustion
Chairs: Ibrahim Yimer [National Research Council Canada], Askin Isikveren [Safran]

Fuel Vaporization in Small Jet Engine’s Vaporizers
Supersonic Combustion Behaviors for Mixtures of Methane and Ethylene in a Scramjet Model Combustor
Yeshayahu Levy
Vladimir Erenburg
Igor Gaissinski
Valery Sherbaum
Pervez Canteenwalla
Wajid Ali Chishty
Malcolm Imray
Yolanda R. Hicks
Kathleen M. Ticina
Robert C. Anderson
Ryosuke Kinoshita
Toshiki Nomura
Shinji Nakaya
Mitsuhiro Tsue
Technical Session 31: **Turbines**

**Chairs:** D. R. Reddy (NASA), Seongman Choi (Chonbuk National University)

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<tr>
<td>10.30</td>
<td>Investigation on Internal Flow Field Non-axisymmetric Characteristics in a Double-sided Centrifugal Compressor with Non-balanced Inlets</td>
<td>Design and Commissioning of a Rotating Turbine Rig for Cavity Flows Investigation</td>
<td>The Design and Modelling of an Inward-flow Radial (IFR) Turbine Stage</td>
<td>A Strategy to Implement Optimization Techniques in the Preliminary HPT Design Phase</td>
</tr>
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</table>

**Presenters:**
- Hanzhi Zhang
- Ce Yang
- Dazhong Lao
- Ding Tong
- Daniele Simoni
- Pietro Zunino
- Davide Lengani
- Roberto Guida
- Francis V. Smit
- SJ van der Spuy
- TW von Backstrom
- Osmar Francisco Reis da Silva
- Jesusu Takachi Tomita
- Cleverson Brighenti
- Diogo Ferraz Cavalc
- Vinicius G. Monteiro

Technical Session 32: **Intelligent engine control and health monitoring**

**Chairs:** Rainer Walther (MTU), Yury Temis (CIAM)

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**Presenters:**
- Luis Sánchez de León
- J. M. Vega
- J. L. Montañés
- J. Rodrigo
- Elias Tsoutsanis
- Yi-Guang Li
- Pericles Pilidis
- Mike Newby
- O. S. Gurevich
- A. I. Gulienko
- Shchurovskiy Yury
- O. S. Gurevich
- S. E. Krasnov
- F. D. Golberg
- Sergey Smelanin

Technical Session 33: **Diagnostics**

**Chairs:** Massimiliano Di Domenico (GE Aviation), Jouke de Baar (UNSW Canberra)

|-------|-----------------|-----------------|-----------------|-----------------|

**Presenters:**
- Nicholas Bojdo
- Antonio Filippone
- Yiguang Li
- Michael Diakostefanis
- Theoklis Nikolaidis
- Suresh Sampath
- Theodoros Triantafyllou
- Jiri Pecinka
- Adolf Jiří
- Suresh Sampath
### Technical Session 34: Advanced Aero Engine Research and Assessments 2

Chairs: Nateri Madavan (NASA), Chana Goldberg (Cranfield University)

**Exchange Auditorium**

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<tr>
<td>15.45</td>
<td>Design of a Counter Rotating Fan using a Multidisciplinary and Multifidelity Optimisation under High Level of Restrictions</td>
<td>Installation Effects for Ultra-high Bypass Engines</td>
<td>Design Optimization of Separate-Jet Exhausts for the Next Generation of Civil Aero-Engines</td>
<td>Turbo-Electric, Distributed Propulsion with Flap Blowing for the NASA N3-X Aircraft</td>
</tr>
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</table>

- Lionel Meillard
- Cristian Mihai Stanica
- Nabil Ben Nasr
- William Riera
- Anders Lundbladh
- Hans Mårtensson
- Andreas Petrusson
- Olivier Petit
- Ludovine Wettler
- Ioannis Goules
- John Otter
- Tomasz Stankowski
- David MacManus
- Nicholas Grech
- Christopher Sheaf
- Jun Wei Tan
- Panos Laskaridis
- Iain Gray
- Esteban A. Valencia

### Technical Session 35: Fluid and gas dynamics

Chairs: Francesco Martelli (Università degli Studi di Firenze), Simon Gallimore (Rolls-Royce)

**Exchange Room 1**

|-------|-----------------|-----------------|-----------------|-----------------|

- Christine Tiedemann
- Alexander Heinrich
- Dieter Peitsch
- Akinola A. Adeniyi
- Hervé P. Morvan
- Kathy A. Simmons
- David G. Cuadrado
- Jorge Saavedra
- Valeria Andreoli
- Guillermo Paniagua
- Man Zhang
- Wenjie Tao

### Technical Session 36: New developments in gas turbine engines

Chairs: Andy Geer (Rolls-Royce), Natalie Smith (SwRI)

**Exchange Room 2**

|-------|-----------------|-----------------|-----------------|-----------------|-----------------|

- Oleksiy Antoshkiv
- Thanapong Poojigkanont
- Lothar Jehring
- Heinz Peter Berg
- Mikhail Ivanov
- Rob Mitchell
- Mike Whitehead
- Xiaojie Qiu
- Jun Zang
- Linshan Jin
- Fulong Sun
- Yiyan Sheng
- Jaganmohana Rao Danda
- Tashie-Lewis Bernard
- Suresh Sampath
- Panagiotis Lashkaridis
### Technical Session 37: Combined cycle engines

**Chairs:** Pavlos Zachos (Cranfield University), Ralf von der Bank (Rolls-Royce)

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<thead>
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<tr>
<td>Khaled Zarati</td>
<td>Jinglei Xu</td>
<td>Inyoung Yang</td>
<td>Theofilos G. Efstathiadis</td>
<td>Ibrahim Sinan Akmandor</td>
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<td>Samer Maalouf</td>
<td>Wenda Hua</td>
<td>Kyung-jae Lee</td>
<td>Konstantinos I. Magkoutas</td>
<td>Melih Okur</td>
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<td>Askin Isikveren</td>
<td>Yanfeng Niu</td>
<td>Yang-ji Lee</td>
<td>Panagiotis Ntalianis</td>
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<td>Baocheng Xu</td>
<td>Chune-taek Kim</td>
<td>Anestis I. Kalfas</td>
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<td>Shuai Huang</td>
<td>Dae-sung Lee</td>
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### Technical Session 38: Combustion

**Chairs:** Sean Yun (National Research Council Canada), Yolanda Hicks (NASA)

<table>
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<tbody>
<tr>
<td>The Design and Testing of a Can-type Combustor in a Compressor Test Rig</td>
<td>Coarse and Fine Atomization Regimes in Miniature Airblast Atomizer</td>
<td>Research of Solid Propellant Burning Processes in Low Temperature Aeroengine Gas Generators</td>
<td>Gaseous Emissions Results from a Three-Cup Flametube Test of a Third-Generation Swirl-Venturi Lean Direct Injection Concept</td>
<td>A Hybrid LES-RANS Validation of Effusion Cooling Array Measurements</td>
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<tr>
<td>Bronwyn Clara Meyers</td>
<td>Igor Gaissinski</td>
<td>Leonid Yanovsky</td>
<td>Kathleen M. Tacina</td>
<td>Xiaosheng Chen</td>
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<td>M. A. Jan</td>
<td>Yeshayahu Levy</td>
<td>I.S. Averkoy</td>
<td>D.P. Podboy</td>
<td>Hao Xia</td>
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<td>S. J. van der Spuy</td>
<td>Valery Sherbaum</td>
<td>A.V. Baikov</td>
<td>F. Lee</td>
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<td>Daniel Kulikov</td>
<td>P.D. Toktalev</td>
<td>V. A. Shikhovtsev</td>
<td>B. Dam</td>
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<td>Vladimir Rovenski</td>
<td>A.F. Zhukov</td>
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</table>
### Technical Session 39: Aeromechanics, flutter, vibration & HCF

Chairs: Markus Kober (Brandenburg University of Technology Cottbus-Senftenberg), Glen Snedden (CSIR)

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<tr>
<td>15:45</td>
<td>Study on Rotor Dynamics Characteristics of Gas Turbine Rotor-Bearing-Seal System</td>
<td>Fluid-Structure Interactions for High-Cycle Fatigue Life Estimation</td>
<td>Model Update and Validation of a Mistuned High Pressure Compressor Blisk</td>
<td>Analysis of Mistuned Forced Response in an Axial High Pressure Compressor Rotor with Focus on Tyler-Sofrin Modes</td>
<td>Robust Design Method to Depress the Rotor’s Vibration for Aircraft Turbofan Engines</td>
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Huang Hai
Ma WenSheng

Iroizan Adasi Ubulom
Andrew J. Neely
Krishna K. Shankar

Bernd Beirow
Arnold Kühn
Felix Figaschewsky
Peter Hönsch
Thomas Giersch
Sven Schrape

Yongquan Liu
Fayong Wu
Deyou Wang
Jie Hong

---

### Technical Session 40: Virtual development and testing

Chairs: John Whurr (Rolls-Royce), Andrew Rolt (Cranfield University)

|-------|------------------|------------------|------------------|------------------|

David J. J. Toal
X. Zhang
A. J. Keane, Simon Stow, M. Zedda, F. Witham, J. Gregory

Jouke Hendrik S. de Baar
Z. Lelyk
A. Habib
A. J. Neely
T. Ray

Joury M. Temis
A. V. Selivanov
D. A. Yakushev

Xianxin Cai
Chunlai Wu
Sixin Qi
Jian Li

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**Thursday, 7th September**
ISABE 2019 CONFERENCE

September 2019

CANBERRA, AUSTRALIA
Friday, 8th September

Technical Session 41: Combined cycle engines
Chairs: Jesuino Takachi Tomita (Instituto Tecnológico de Aeronáutica), Aspi Wadia (GE Aviation)  
Exchange Auditorium

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Technical Session 42: Cost and business
Chairs: Toshio Nagashima (University of Tokyo), Ruben Del Rosario (NASA)  
Exchange Room 1

<table>
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Technical Session 43: New developments in gas turbine engines
Chairs: Mikhail Ivanov (CIAM), Areti Malkogianni (Cranfield University)  
Exchange Room 2

<table>
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Technical Session 44: Heat transfer
Chairs: Jianzhong Xu (Institute of Engineering Thermophysics - Chinese Academy of Sciences), Natalie Smith (SwRI)  
Exchange Room 3

<table>
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<th>Time</th>
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<tr>
<td>Infrared Signature of Serpentine Nozzle with Different Aspect Ratio</td>
<td>Experimental Set up and Characterization of Air-oil Heat Exchangers in Oil Systems for Aero Engines</td>
<td>The Numerical Simulation and Experimental Study on Aero-engine Bearing Cavity Wall Heat Transfer</td>
<td>The Influence of Descent and Taxi Profiles on the Thermal State of a Jet Engine at Shutdown</td>
<td>Heat Transfer Coefficient on Air-contact Surfaces of an Airfoil Heat Exchanger</td>
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</table>
## Technical Session 45: *Micro and small engines - VTOL & STOVL*

**Chairs:** Reid Berdanier (The Pennsylvania State University), Chris Robinson (PCA Engineers)

**Exchange Room 4**

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**Participants:**
- **Koji Okamoto**
- **Kenta Goto**
- **Susumu Teramoto**
- **Kazuo Yamaguchi**
- **Johan van der Spuy**
- **Macaera Preston Kock**
- **TW von Backstrom**
- **Andrew Gong**
- **Dries Verstraete**
- **Jennifer L. Palmer**
- **Rens MacNeill**
- **Dries Verstraete**

---

## Technical Session 46: *Aeromechanics - Engine safety*

**Chairs:** Richard Parker (Rolls-Royce), Jeffrey Berton (NASA)

**Exchange Room 5**

|--------|------------------|------------------|------------------|------------------|------------------|

**Participants:**
- **Vladimir Makarov**
- **Victor Shorstov,**
- **Sergej Andreev**
- **Vladimir Frolov**
- **Yun-fan Jiang**
- **Ya-ting Zhao**
- **Ming-ju Liao**
- **Shi-jl Wang**
- **Ibrahim Eryilmaz**
- **Vassilios Pachidis**
- **Evon Oscar Smith**
- **T. Mulholland**
- **J.H.S. de Baar**
- **A.J. Neely**
- **Lucas Paussey**
- **David John Rajendran**
- **Vassilios Pachidis**

---

## Technical Session 47: *Virtual development and testing*

**Chairs:** Alon Gany (Technion – Israel Institute of Technology), Hilbert van Pelt (UNSW Canberra)

**Exchange Room 6**

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<td></td>
<td>Application of Sub-Modeling Technique for Whole Engine Transient Dynamic Analysis</td>
<td>Bi-objective Optimization of Thermal Cycles for Turboprops</td>
<td>Modeling Boundary Layer Ingestion at the Conceptual Level</td>
<td>An Enhanced Hybrid Component Mode Synthesis Procedure for Rotor Dynamic Analysis of Turbo-fan Engines</td>
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</tbody>
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**Participants:**
- **Shoufeng Hu**
- **Xianghai Chai**
- **Adel Ghenaieb**
- **Andy Turnbull**
- **Hugo Jouan**
- **Panagiotis Giannakakis**
- **Askin T. Isikveren**
- **Shanmugam Arumugam**
Technical Session 48: Integrated testing prediction and evaluation
Chairs: Rob Mitchell (Rolls-Royce), Dale Van Zante (NASA)

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<td>A Whole Engine Optimization Based on Medial Object Transformations</td>
<td>Real Time Thrust Estimation and Display for Ski-Jump Takeoff of Fighter Aircraft</td>
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<td></td>
<td>Loran Wang</td>
<td>Aishwarya Gogoi</td>
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<td>Budharaju Balaji</td>
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<td>Andy J. Keane</td>
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<td>Felix Stanley</td>
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Technical Session 49: Cost and business
Chairs: Richard Parker (Rolls-Royce), Massimiliano Di Domenico (GE Aviation)

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<td>Flow Visualization of Jet Test Using Background Oriented Schlieren in Altitude Test Facility</td>
<td>Flow Conditioning of Subsonic and Supersonic Blowdown Wind Tunnels</td>
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<td>Jorge Saavedra</td>
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Technical Session 50: Fuels, injection and ignition
Chairs: Leonid Yanovsky (CIAM), Michael Bauer (MTU)

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<td>13.45</td>
<td>Numerical Study of Fuel Atomization and Vaporization in a Micro Turbojet Vaporizer Tube</td>
<td>Influence of the Primary Spray Characteristics on the Performance of a Double-Swirl Airblasting Atomizer</td>
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<td>Clement Delord</td>
<td>Xu Huasheng</td>
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<td>Huang Yiying</td>
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<td>Cesar Celis</td>
<td>Fan Zhencen</td>
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<td>Vishal Sethi, Pericles Pilidis</td>
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Technical Session 51 Compressors
Chairs: Ulrich Wenger (Rolls-Royce), Rainer Walther (MTU)

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<td>13.45</td>
<td>Aerodynamic Characteristic Research on Final Stage Stator of a Highly Loaded Fan</td>
<td>Using Annulus Contouring to Compensate Compressor Mismatching Effects in the Presence of Casing Treatments</td>
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<td>Peng Sun</td>
<td>André Inzenhofer</td>
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<td>Jingjun Zhong</td>
<td>Volker Gümmer</td>
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<td>Muxiao Yang</td>
<td>Bernd Becker, Patrick Grothe</td>
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<td>Ruochi Pan, Lili Li</td>
<td>Frank Heinichen</td>
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Friday, 8th September

Technical Session 52: **Manufacturing processes**  
Chair: Ann Bolcavage (Rolls-Royce), Anders Sjunnesson (GKN Aerospace)  
Exchange Room 4

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Additive Manufacturing of a Compressor Vane with Multi-hole Pressure Probes

Stefan Bindl  
Felix Kern  
Reinhard Niehuis

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Technical Session 53: **Pulsed and other detonation engines**  
Chairs: Konstantinos Kyprianidis (Mälardalen University), Dae Sung Lee (Korea Aerospace Research Institute)  
Exchange Room 5

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Performance Analysis of Continuous Rotating Detonation Aero-turbine Engine  
Operating Characteristics of Gas Turbine Driven by Pulse Detonation toward Self-sustained operation

Zifei Ji  
Bing Wang  
Huiqiang Zhang  
Zhuming Rao

Takashi Sakurai  
Hiroto Takahashi  
Yuki Hirai  
Shigehito Yomo

---

Technical Session 54: **Chemical pollution**  
Chairs: Konstantinos Kyprianidis (Mälardalen University), Kathy Tacina (NASA)  
Exchange Room 6

<table>
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A Case Study on Contrail Avoidance: Effects of Collection of Condensed Water from Engine Core Exhaust on Aircraft Performance  
Prediction of NOx for Double Annular Combustors using Stirred Reactor Approach

Fernando Lartategui Atela  
Devaiah Nalianda  
Vishal Sethi  
Pericles Pilidis  
Riti Singh

Qi Zeng  
Xiaoxiao Sun  
Yize Liu  
Vishal Sethi  
Devaiah Nalianda
Welcome to Manchester

Manchester welcomes all ISABE delegates.

We want you to really enjoy your time in Manchester. So whatever you need information on from restaurants and bars to must-see arts and culture and places to shop, check out visitmanchester.com or call into the Manchester Visitor Information Centre.
ISABE Board of Directors & National Representatives

The Board of Directors and National Representatives of the International Society of Air Breathing Engines include:

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Prof. Andrew Neely  
School of Engineering & Information Technology  
UNSW Canberra  
Australian Defense Force Academy  
Canberra ACT 2600  
a.neely@adfa.edu.au

**Austria**
Prof. Dr. Franz Heitmeir  
Institute for Thermal Turbomachinery and Machine Dynamics  
Graz University of Technology  
Inffeldgasse 25 A  
A-8010 GRAZ  
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