Welcome from the Organizing Committee

Dear colleagues,

On behalf of the International Committee of the European Rotorcraft Forum, it is a great pleasure for me to invite you to the 43rd ERF, which will take place in Milan. This edition is particularly significant as it is held in conjunction with the 28th Symposium of the European Chapter of the Society of Flight Test Engineers. Its key theme this year is “Shaping the future of flight testing”.

A high level of product, service and manufacturing innovation requires an equally high level of experimental and testing capabilities. You are therefore also invited to take the opportunity to attend the Symposium.

ERF has always been an extraordinary chance for all of us to exchange experiences and views on the best way forward to face the challenges of the future and deliver greater and greater advantages to the users through the evolution and application of rotorcraft technology. This year we are doing this in a city that today is central to Italian and European economy and innovation while in the past has seen the shining expression of Leonardo’s genius.

Reminding ourselves of the life and achievements of the inventor of the Aerial Screw will help us nurture the spark of innovation in the spirit of true farsighted vision of our future, inspiring us to make possible what seems not.

I therefore hope you will join us for this important Event and I look forward to meeting you in Milan in September.

Fabio NANNONI
Chair of the Organizing Committee
<table>
<thead>
<tr>
<th>Name</th>
<th>Organization</th>
<th>Address</th>
<th>Email</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mrs. B. Demaret</td>
<td>ONERA</td>
<td>Chemin de la Huniere F-91761 Palaiseau Cedex, France</td>
<td><a href="mailto:blanche.demaret@onera.fr">blanche.demaret@onera.fr</a></td>
</tr>
<tr>
<td>Mr. R. Mirgazov</td>
<td>TsAGI</td>
<td>1 Zhukovsky Street, Zhukovsky Moscow Region, 140180 Russia</td>
<td><a href="mailto:ruslan.mirgazov@tsagi.ru">ruslan.mirgazov@tsagi.ru</a></td>
</tr>
<tr>
<td>Mr. J. F. Hakkaart</td>
<td>National Aerospace Laboratory NLR</td>
<td>P.O. Box 90502 NL-1006 BM Amsterdam, The Netherlands</td>
<td><a href="mailto:joost.hakkaart@nlr.nl">joost.hakkaart@nlr.nl</a></td>
</tr>
<tr>
<td>Mr. F. Nannoni</td>
<td>Leonardo Helicopters</td>
<td>Via G. Agusta, Cascina Costa 21017 Samarate – Varese, Italy</td>
<td><a href="mailto:fabio.nannoni@leonardocompany.com">fabio.nannoni@leonardocompany.com</a></td>
</tr>
<tr>
<td>Mr. A. Irwin</td>
<td>Leonardo Helicopters</td>
<td>Lysander Road, Yeovil BA20 2YB, UK</td>
<td><a href="mailto:alan.irwin@leonardocompany.com">alan.irwin@leonardocompany.com</a></td>
</tr>
<tr>
<td>Prof. J. Narkiewicz</td>
<td>Warsaw University of Technology</td>
<td>Power and Aeronautical Engineering Warsaw, Poland</td>
<td><a href="mailto:jnark@meil.pw.edu.pl">jnark@meil.pw.edu.pl</a></td>
</tr>
<tr>
<td>Dr. P. Krämer</td>
<td>Airbus Helicopters</td>
<td>Gmbh Industriestraße 4-6 D-86607 Donauwörth, Germany</td>
<td><a href="mailto:philipp.kraemer@airbus.com">philipp.kraemer@airbus.com</a></td>
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<tr>
<td>Mr. A. Okhonko</td>
<td>JSC Russian Helicopters</td>
<td>Entrance 9, 12 Krasnopresnenskaya emb. Moscow, Russia</td>
<td><a href="mailto:a.okhonko@rus-helicopters.com">a.okhonko@rus-helicopters.com</a></td>
</tr>
<tr>
<td>Mr. T. Krysinski</td>
<td>Airbus Helicopters</td>
<td>F-13725 Marignane Cedex, France</td>
<td><a href="mailto:tomasz.krysinski@airbus.com">tomasz.krysinski@airbus.com</a></td>
</tr>
<tr>
<td>Prof. P. Masarati</td>
<td>Politecnico di Milano</td>
<td>Dept. of Aerospace Science and Technology I-20156 Milano, Italy</td>
<td><a href="mailto:pierangelo.masarati@polimi.it">pierangelo.masarati@polimi.it</a></td>
</tr>
<tr>
<td>Dr. R. Markiewicz</td>
<td>DSTL</td>
<td>Portsdown West, Fareham Hampshire, P017 6AD, UK</td>
<td><a href="mailto:rhmarkiewicz@dstl.gov.uk">rhmarkiewicz@dstl.gov.uk</a></td>
</tr>
<tr>
<td>Dr. K. Pahlke</td>
<td>DLR Program Directorate Aeronautics</td>
<td>Lilienthal Platz 7 D – 38108 Braunschweig, Germany</td>
<td><a href="mailto:klausdieter.pahlke@dlr.de">klausdieter.pahlke@dlr.de</a></td>
</tr>
</tbody>
</table>
General Information

Venue

MILAN

With a population of about 1.3 million, Milan is the capital of Lombardy and is located in the Po Valley, close to the Alps and with Lake Como, Lake Maggiore and Lake Lugano to the North. Milan is the Italian economic and finance center, with the headquarters of the Stock Exchange and of many of the most important Italian industrial and financial institutions.

It is also the capital city of Italian fashion and design, hosting many of the main Italian fashion houses and international design fairs, including Milan Fashion Week and “Salone del Mobile” (Milan Furniture Fair).

Several world famous cultural institutions are located in Milan an none more famous than Teatro alla Scala, the temple of lyric opera, as well as prose theatres such as the ‘Piccolo Teatro” founded by Giorgio Strehler.

The city offers to visitors the possibility to admire a wide range of monuments, museums and buildings reflecting two thousands years of history and culture, from Roman vestiges to contemporary architectural masterpieces.

POLITECNICO DI MILANO - BOVISA CAMPUS

Founded in 1863, Politecnico di Milano is the largest school of Architecture, Design and Engineering in Italy, with 3 main campuses located in Milan, and 5 campuses based around the Lombardy region, one of the most industrialized areas of Europe.

Politecnico di Milano is one of the leading universities in the world, ranked 24th on a global scale, 7th in Europe, and 1st in Italy among technical universities, according to QS World University Ranking - Engineering & Technology 2017. Thanks to a strong internationalization policy, several study programs are taught entirely in English, attracting an ever-increasing number of talented international students from more than 100 countries. In 2015/2016 21% of the students enrolled in Master of Science Programs were international.
Strategic research is carried out mainly in the fields of energy, transport, planning, management, design, mathematics and natural and applied sciences, ICT, built environment, cultural heritage, with more than 250 laboratories.

The scientific community of Politecnico di Milano is made of more than 1,300 professors and research fellows, with 38,200 students (2013 update).

The Dipartimento di Scienze e Tecnologie Aerospaziali (Department of Aerospace Science and Technology, DAER- PoliMi) was established within Politecnico di Milano as an autonomous institute in the 1950s. The personnel of DAER- PoliMi is currently comprised of 43 faculty, 27 technical and administration staff, 70 research assistants and Ph.D. students. The main activity within the Department is scientific research.

Directions to Bovisa Campus

As you are likely to land in Malpensa, Linate or Orio al Serio airport, you can plan how to reach Milan following these suggestions. Unfortunately there will be no Meet and Greet, but we’re sure that if you keep these instructions ready at hand it won’t be hard to reach us.

If you land at Linate Airport:
Air Bus to Centrale Railway Station: www.atm-mi.it
Bus no. 73 to Piazza San Babila: www.atm-mi.it

If you land at Malpensa Airport:
Malpensa Express Train to Cadorna Railway Station: www.malpensaexpress.it
Malpensa Shuttle to Centrale Railway Station: www.malpensashuttle.it

If you land at Orio al Serio Airport:
Terravision Bus to Centrale Railway Station: www.terravision.eu/milan_bergamo.html
Orio shuttle to Centrale Railway Station: www.orioshuttle.com
Bovisa Campus
From the city center, get to one of the following subway stations: Porta Venezia (Red line), Repubblica (Yellow line) or Garibaldi (Green line), take the suburban railway called “Passante ferroviario” and get off at Bovisa station.
Alternatively after reaching the Cadorna subway stop (Green or Red lines), from the subway station go to railway station above, board any train leaving from the station (except Malpensa Express) and get off at Bovisa station.
Exit Bovisa railway station, turn right to reach the Engineering Campus (Via La Masa 34).

Forum Registration

To apply for registration please go to www.ERF2017.org/registration/

Registration Fees

<table>
<thead>
<tr>
<th>ERF (including SFTE-EC Symposium) Registration Fees</th>
<th>Early Registration Before July 7, 2017</th>
<th>Late Registration After July 7, 2017</th>
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<tr>
<td>Non Member</td>
<td>840 €</td>
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<td>Member (CEAS)</td>
<td>800 €</td>
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<tr>
<td>Speaker/Chairman</td>
<td>740 €</td>
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<td>PhD Student</td>
<td>600 €</td>
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<td>BSc/MSc Student</td>
<td>300 €</td>
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<td>Social Program for Accompanying Person</td>
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ERF (including SFTE-EC Symposium) registration fee for non-members/members/speakers/chairmen/PhD students includes:
ERF attendance, ERF documentation, SFTE EC attendance, SFTE EC documentation, coffee breaks, lunches, 1 welcome cocktail ticket, 1 gala dinner ticket

CEAS Member:
Council of European Aerospace Societies (includes: 3AF, AAAR, AIAE, AIDAA, DGLR, FTF, HAES, NVVL, PSAA, RAeS, SWFV, TsAGI, CzAEs).

ERF (including SFTE-EC Symposium) registration fee for BSc/MSc students includes:
ERF attendance, ERF documentation, SFTE EC attendance, SFTE EC documentation, coffee breaks, lunches.
Please send a copy of your Student ID-Card (ERF2017@leonardocompany.com).

<table>
<thead>
<tr>
<th>SFTE-EC Symposium (including partial ERF) Registration Fees</th>
<th>Early Registration Before July 7, 2017</th>
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<tr>
<td>Non Member</td>
<td>530 €</td>
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<tr>
<td>Member (CEAS)</td>
<td>475 €</td>
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<td>Speaker/Chairman</td>
<td>440 €</td>
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<td>PhD Student</td>
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<td>BSc/MSc Student</td>
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<td>Social Program for Accompanying Person</td>
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SFTE-EC Symposium (including partial ERF) registration fee for non-members/members/speakers/chairmen/PhD students includes:
SFTE EC attendance, SFTE EC documentation, partial ERF attendance (from September 13), ERF documentation, coffee breaks, lunches, 1 gala dinner ticket

SFTE Member:
Society of Flight Test Engineers
Please send a copy of your Student ID-Card (ERF2017@leonardocompany.com)

SFTE-EC Symposium (including partial ERF) registration fee for BSc/MSc students includes:
SFTE EC attendance, SFTE EC documentation, partial ERF attendance (from September 13), ERF documentation, coffee breaks, lunches.
Please send a copy of your Student ID-Card (ERF2017@leonardocompany.com).
Insurance

Participants are advised to take out their own travel insurance and to extend any private policies for personal possessions they may bring with them. The Forum does not cover participants against cancellations of bookings or loss/theft of belongings.

Language

Conference language is English. Presentations and discussions are therefore in English. There will be no simultaneous translation during the session.

Security - Passport and visa

In Italy everyone must have a valid identity card or passport. It is the responsibility of each delegate to obtain all the necessary documents, including visa if necessary.

Hotel Accommodation

Please use the link below to find hotel rooms for the best price.
www.ERF2017.org/accommodation/
We recommend to make your reservations as soon as possible.

Social Programme

Welcome cocktail
BLUE NOTE MILANO
Blue Note Milano is a jazz club and restaurant located at Via Borsieri 37 in the Isola district of Milan, Italy. Opened on March 19, 2003, Blue Note Milano is part of the Blue Note network alongside the historical Blue Note Jazz Club in Greenwich Village New York City and the Blue Note Clubs in Tokyo and Nagoya, Japan.

Gala Dinner
MUSEO DELLA SCIENZA E DELLA TECNOLOGIA LEONARDO DA VINCI
The National Museum of Science and Technology “Leonardo da Vinci” is the pre-eminent museum of its kind in Italy and houses the largest collection of mechanical models realized on the basis of Leonardo da Vinci’s drawings.
Next to research and conservation, education is one of the main functions of the Museum and one
of the fundamental purposes of the National Museum of Science and Technology Leonardo da Vinci Foundation. Interactive laboratories and exhibitions promote discovery and exploration, helping visitors use their own knowledge and skills to interpret objects and phenomena and to independently shape their own learning process. The Museum offers a path of discovery, experience, emotions and understanding accessible for all.

City of Milan: Vertical Flight Heritage Site Awards
We are very pleased to announce that during the Gala Dinner, the City of Milano will receive an important recognition from AHS International: The Vertical Flight Heritage Site Awards. The Vertical Flight Heritage Sites program is intended to recognize and help preserve locations associated with the most noteworthy and significant contributions made in both theory and practice of vertical flight aircraft technology.
In 2016 the committee selected Milan as a site to be recognized for its historic significance. Leonardo da Vinci’s Studio in Milan was the site of the first known VTOL design (c. 1487). Although the exact location is not known, Leonardo di Ser Piero da Vinci – while working for Ludovico Maria Sforza, Duke of Milan – designed the Helix Aerial Screw, a flying machine intended to be capable of vertical take-off and landing using a hand-cranked rotating wing. The Helix is generally considered to be the first known engineering design for a manned helicopter.

Technical Visit
Vergiate Site: Leonardo Helicopters Final Assembly Line and Flight Line
Vergiate, located in Lombardy close to Lake Maggiore, is a fundamental site for the Italian aviation history since 1937, when SIAI (Società Idrovolanti Alta Italia) started the production of fixed-wing aircraft. In 1969 Agusta acquired control of SIAI and of the Vergiate facilities, transferring part of its helicopter assembly activities. From 1997, when Agusta re-organised its business, and fixed-wing activities were transferred to Aermacchi, the Vergiate plant has been exclusively dedicated to helicopter assembly. Today Vergiate plays a critical role in AgustaWestland’s manufacturing operations, being home to final assembly lines for our main helicopter models. Aircrafts exit the assembly line for the near flight line, where they undergo preparations for delivers, occurring each week, and the customer acceptance.”
# Programme at a Glance (Preliminary)

For further detail check on www.ERF2017.org

## DAY 1 - TUESDAY 12th SEPTEMBER

<table>
<thead>
<tr>
<th>Time</th>
<th>Session</th>
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<tbody>
<tr>
<td>09:00</td>
<td>Opening Ceremony</td>
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<tr>
<td>11:30</td>
<td>PLENARY SESSION - HEMS</td>
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<tr>
<td>12:30</td>
<td>Networking Lunch</td>
</tr>
<tr>
<td>13:30</td>
<td>Aerodynamics, Flight Mechanics, Simulation and Training, Aircraft Design, Dynamics</td>
</tr>
<tr>
<td>16:00</td>
<td>Aerodynamics, Flight Mechanics, Simulation and Training, Aircraft Design, Dynamics</td>
</tr>
<tr>
<td>20:00</td>
<td>Welcome Reception - Blue Note</td>
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## DAY 2 - WEDNESDAY 13th SEPTEMBER

<table>
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<tr>
<th>Time</th>
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<tbody>
<tr>
<td>09:00</td>
<td>Aerodynamics, Flight Mechanics, Operational Aspects, Aircraft Systems, Test and Evaluation</td>
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<tr>
<td>11:00</td>
<td>AHS Best Paper - Plenary</td>
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<tr>
<td>11:30</td>
<td>KEYNOTE ADDRESS - POLIMI Industria 4.0 - Prof. Taisch</td>
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<tr>
<td>12:30</td>
<td>Networking Lunch</td>
</tr>
<tr>
<td>13:30</td>
<td>Aerodynamics, Flight Mechanics, Dynamics, Aircraft Systems, Test and Evaluation</td>
</tr>
<tr>
<td>16:00</td>
<td>Aerodynamics, Flight Mechanics, Acoustics, Engine and Propulsion, History of Rotorcraft</td>
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<tr>
<td>20:00</td>
<td>Gala Dinner- Museo della Scienza e della Tecnologia L. Da Vinci</td>
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## DAY 3 - THURSDAY 14th SEPTEMBER

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<th>Time</th>
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<tbody>
<tr>
<td>09:00</td>
<td>Airworthiness, Flight Mechanics, Dynamics, Structures and Materials, Crew Station and Human Factors</td>
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<td>11:00</td>
<td>KEYNOTE ADDRESS - EASA</td>
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<td>11:30</td>
<td>KEYNOTE ADDRESS - UAV</td>
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<td>12:30</td>
<td>Networking Lunch</td>
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<tr>
<td>13:30</td>
<td>Aerodynamics, Avionic and Sensors, Acoustics, Structures and Materials, Test and Evaluation + Manufacturing</td>
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<tr>
<td>18:00</td>
<td>END of CONFERENCE</td>
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## DAY 4 - FRIDAY 15th SEPTEMBER

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<tbody>
<tr>
<td>09:00</td>
<td>TECHNICAL VISIT</td>
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<tr>
<td>12:00</td>
<td>at VERGIATE Final Assembly Line and Flight Line</td>
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## Programme (Preliminary) – For further detail check on www.ERF2017.org

<table>
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<tr>
<th>Time</th>
<th>Session</th>
<th>Location</th>
<th>Speaker(s)</th>
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<tbody>
<tr>
<td>9:00</td>
<td>Opening Ceremony</td>
<td>Welcome Reception</td>
<td>F. Mannoni</td>
</tr>
<tr>
<td>11:00</td>
<td>Coffee Break</td>
<td></td>
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<tr>
<td>11:30</td>
<td>Plenary Session</td>
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<tr>
<td>12:30</td>
<td>Networking Lunch</td>
<td></td>
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<tr>
<td>13:30</td>
<td><strong>AERODYNAMICS</strong></td>
<td>508</td>
<td>Molter Christian, Wu Mei-Li-Wen, Lu Linghai, Kim Seong-Kwan, Arnold Juergen</td>
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<tr>
<td>14:00</td>
<td><strong>CFD analysis during the design of Fuel Equipment</strong></td>
<td>715</td>
<td>Ripollés Frederic, Riccardi Fabio, Scala Stefano, Smith Marilyn, Quaranta Giuseppe</td>
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<tr>
<td>14:30</td>
<td><strong>Measurements on a Yawed Model Rotor Blade Pitching in Reverse Flow</strong></td>
<td>599</td>
<td>Smith Luke, Avanzini Guile, Kelly Michael, Han Dong, Reggiu Daniele</td>
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<td>15:00</td>
<td><strong>Flowfield Measurements of Reverse Flow on a High Advance Ratio Rotor</strong></td>
<td>625</td>
<td>Lind Andrew, Cardillo Fekeil, Barakos George, Weiland Peter, Ward Elizabeth</td>
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<tr>
<td>16:00</td>
<td><strong>A novel hybrid method for helicopter cost effective aeroelastic simulations</strong></td>
<td>677</td>
<td>Riziotis Vasilis, Bhatu Jakob, Sridharan Ananth, Cabot Philippe, Fairol Roland</td>
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<tr>
<td>16:30</td>
<td><strong>Numerical simulation of the laminar-to-turbulent transition for helicopter rotor flows with 3D-Real-time transition model</strong></td>
<td>516</td>
<td>Richez Francois, Cortigiani Nicola, Fabbroni Daude, Dibble Robert, Tamir Aykut</td>
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<tr>
<td>17:00</td>
<td><strong>Towards High-Order Methods for Rotorcraft Applications</strong></td>
<td>579</td>
<td>Barakos George, Trainelli Lorenzo, Staburatti Claudio, Govindarajan Bharath, Nitsche Fred</td>
</tr>
<tr>
<td>17:30</td>
<td><strong>Aerelastic Simulation of the Tail Shake Phenomenon</strong></td>
<td>573</td>
<td>Schäferlein Ulrich, Bergamasco Marco, Owen Iwan, Hashim Farahani, Sankar Lakshmi</td>
</tr>
<tr>
<td>18:00</td>
<td>Welcome Reception</td>
<td>Networking Lunch</td>
<td></td>
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</table>
## GENERAL INFORMATION AND PROGRAMME

### 13.30 - 14.00

**AERODYNAMICS**

- **FORCES ON OBSTACLES IN ROTOR WAKE - A GARTEUR ACTION GROUP**

**AERODYNAMICS**

- **Simulation of Helicopter Aerodynamics in the Vicinity of an Obstacle using a Free Wake Panel Method**

**AERODYNAMICS**

- **Differential GPS landing system: an instant-on tactical and precision approach capability**

**AERODYNAMICS**

- **First results of LiDAR aided helicopter approaches during NATO DVE-Mitigation trials**

**AERODYNAMICS**

- **Experiments on numerical investigations of the aerodynamic interactions between a stationary helicopter and surrounding obstacles**

**AERODYNAMICS**

- **Simulation of unsteady aerodynamic load for rigid coaxial rotor in forward flight with vortex particle method**

**AERODYNAMICS**

- **Experimental Validation of a Fluristic Pitch Link Model**

**AERODYNAMICS**

- **Integrated performance simulation: a stress based critical-plane approach for study of rolling contact fatigue crack propagation in planet gears**

**AERODYNAMICS**

- **Experimental investigation and validation of structural properties of a new design for active twist rotor blades**

**AERODYNAMICS**

- **Design and Manufacture of Instrumented Rotor Blades for a Helicopter Test Rig**

**AERODYNAMICS**

- **Automated insertion of Z-pins into thick composite laminates**

**AERODYNAMICS**

- **FTK Rotor Blades Design, Manufacturing and Testing**

### 14.00 - 14.30

**AERODYNAMICS**

- **Modeling Pilot Pulse Control**

**AERODYNAMICS**

- **Numerical Simulation of Rotor Aerodynamics and Acoustics Using High-Accuracy Schemes on Unstructured Meshes**

**AERODYNAMICS**

- **Computational Aerodynamic Analysis of Propeller Installation Effects**

**AERODYNAMICS**

- **An emission surface approach for noise propagation from high speed sources**

**AERODYNAMICS**

- **Examination of the Influence of Empiric Parameters on the Aero-acoustic Results of the Free Wake Code FIRST**

**AERODYNAMICS**

- **Structural Test Rig Design Optimisation**

**AERODYNAMICS**

- **Analysis of the flow produced by a low-Reynolds rotor optimized for low-noise applications. Part I: Aerodynamics**

**AERODYNAMICS**

- **Solution of Schermanti Su Velocita with Utilizzo di Tessoli Elettricamente Conduttivi Accoppiati con Carbone, Kevlar ed Altri in Alternativa Alla Copper Mesh**

### 14.30 - 15.00

**AERODYNAMICS**

- **Basic aerelastic stability studies of hingeless rotor blades in hover using geometrically exact beam and finite-state inflow**

**AERODYNAMICS**

- **A stress based critical-plane approach for study of rolling contact fatigue crack propagation in planet gears**

**AERODYNAMICS**

- **A stress based critical-plane approach for study of rolling contact fatigue crack propagation in planet gears**

**AERODYNAMICS**

- **Viscoelastic shear damping mechanism for vibration reduction on a helicopter anti torque beam**

**AERODYNAMICS**

- **Design and Manufacture of Instrumented Rotor Blades for a Helicopter Test Rig**

**AERODYNAMICS**

- **Automated insertion of Z-pins into thick composite laminates**

**AERODYNAMICS**

- **FTK Rotor Blades Design, Manufacturing and Testing**

### 15.00 - 15.30

**AERODYNAMICS**

- **Computational Aeroacoustic Analysis of Helicopter Acoustical methods and experiments for studying rotorcraft fuselage Scattering**

**AERODYNAMICS**

- **Fatigue Substantiation and Damage Tolerance Evaluation of Rotorcraft Helicopter Tail**

**AERODYNAMICS**

- **Experimental investigation and validation of structural properties of a new design for active twist rotor blades**

**AERODYNAMICS**

- **Design and Manufacture of Instrumented Rotor Blades for a Helicopter Test Rig**

**AERODYNAMICS**

- **Automated insertion of Z-pins into thick composite laminates**

**AERODYNAMICS**

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- **Automated insertion of Z-pins into thick composite laminates**

**AERODYNAMICS**

- **FTK Rotor Blades Design, Manufacturing and Testing**

### 16.00 - 16.30

**AERODYNAMICS**

- **Experimental and Numerical Investigation of the Hydrodynamic Load on a Rotorcraft in Forward Flight**

**AERODYNAMICS**

- **Analysis of the Flow Produced by a Low-Reynolds Rotor Optimized for Low-Noise Applications. Part I: Aerodynamics**

**AERODYNAMICS**

- **Solution of Schermanti Su Velocita with Utilizzo di Tessoli Elettricamente Conduttivi Accoppiati con Carbone, Kevlar ed Altri in Alternativa Alla Copper Mesh**

**AERODYNAMICS**

- **Automated insertion of Z-pins into thick composite laminates**

**AERODYNAMICS**

- **FTK Rotor Blades Design, Manufacturing and Testing**

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