HiSST

# INTERNATIONAL CONFERENCE ON HIGH-SPEED VEHICLE SCIENCE & TECHNOLOGY

# Conference Guide

November 25—29, 2018
Moscow, Russia

CEAS

ЦАГИ

1918–2018 TsAGI 100

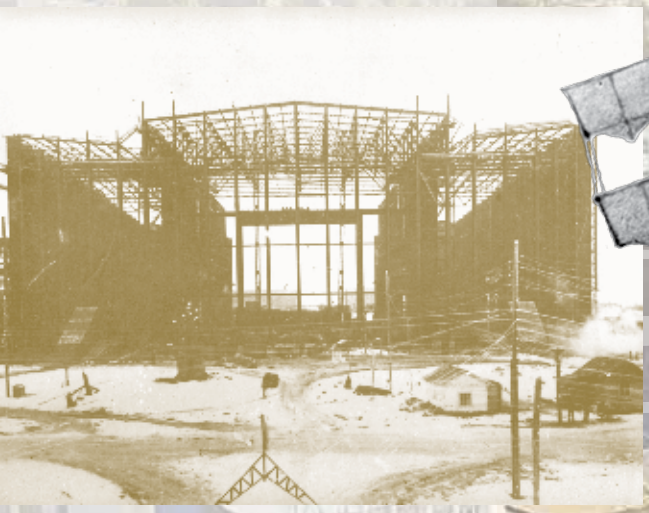
HiSST International Conference on High-Speed Vehicle Science and Technology

ЦАГИ

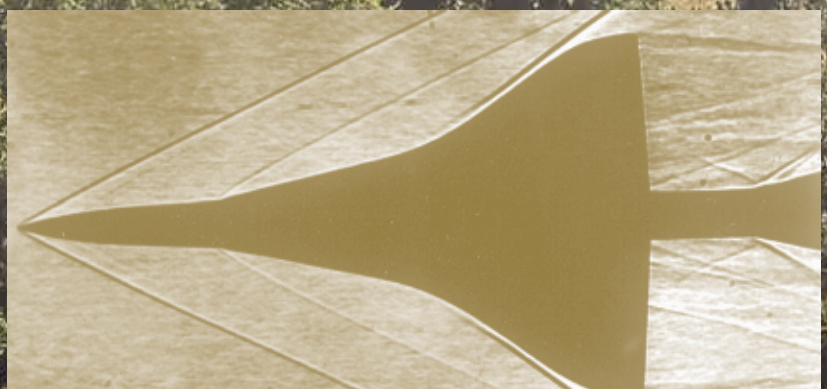
1918–2018

TsAGI 100

Founded in 1918 by initiative of Prof. N. E. Zhukovsky, 100 years of technology excellence



Leading aerospace research and development center of Russia

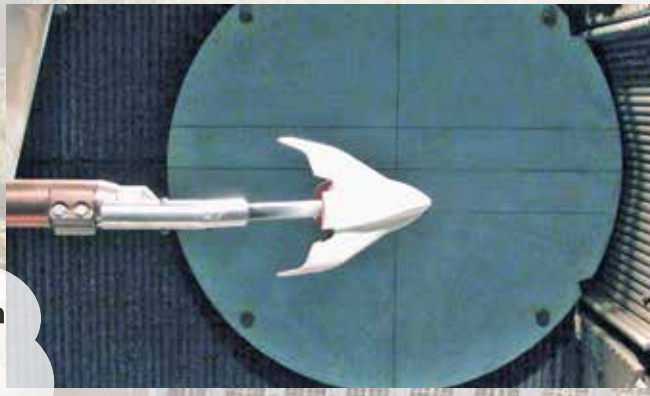


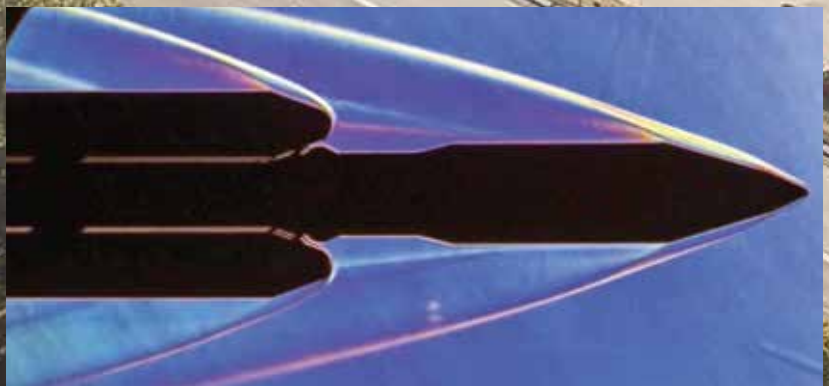
# Central Aerohydrodynamic Institute named after professor N. E. Zhukovsky

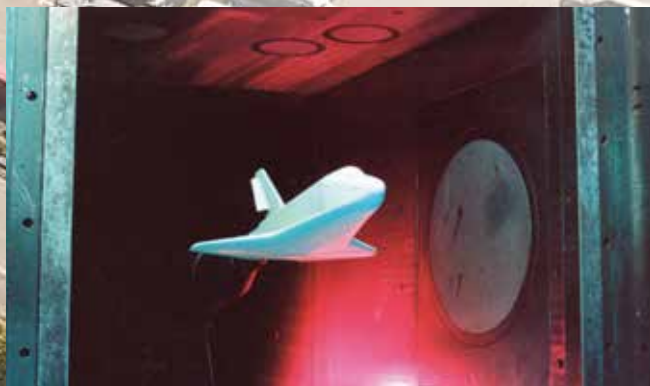
Over 100 unique testing facilities in a single location

More than 4.500 employees

TsAGI cooperates with more than 50 leading world aeronautical companies and research centers. 600 international contracts have been performed for 25 years







# HiSST International Conference on High-Speed Vehicle Science and Technology

**Kirill Sypalo**
General Director,
Professor

*Central Aerohydrodynamic Institute
n. a. prof. N. E. Zhukovsky (TsAGI), Russia*

**Sergey Chernyshev**
Chief Scientific Officer,
Professor

*Central Aerohydrodynamic Institute
n. a. prof. N. E. Zhukovsky (TsAGI), Russia*

Dear HiSST participants, our colleagues and guests,

It's a great honor for us to welcome you on the 1st International Conference on High-Speed Vehicle Science and Technologies (HiSST). This HiSST Conference is a great opportunity to discuss the latest results and achievements. The theme of this conference (supersonic and hypersonic systems and technologies) is a cutting edge in the aeronautical science, so, in our opinion, progress in this field is possible only in close collaboration and permanent discussions among researchers. Our conference is truly international, as it brings together experts in the field of high-speed aircraft from around the world, and this is the basis of the conference determined by the international Technical Committee. It's great that there are several extensive international projects in this field nowadays. We hope that this conference will be a forum to reveal new themes for possible collaboration in the future.

TsAGI was chosen to be a host of the 1st HiSST Conference not only for long and interesting history of hypersonic sciences and researches and for its significant role in creating many supersonic and hypersonic vehicles. 1st of December 2018 is a centennial anniversary of TsAGI, it was founded by the famous researcher and a pioneer of aviation Professor Nikolay Zhukovsky who became the first Director. We think the fact that the founding and holding of the 1st HiSST conference takes place as part of the celebration of the 100th anniversary of TsAGI is not accidental. This fact has a deep meaning: the birth and successful development of a new phenomenon — HiSST is possible only if it has such deep and strong roots as the 100-year history of TsAGI. During these 100 years we were on a leading role in field of aeronautical research, so this Conference is a great possibility for the participants to get some academic exchange. We hope that this experience will be a good promotion for organizing next HiSST Conferences all around the world.

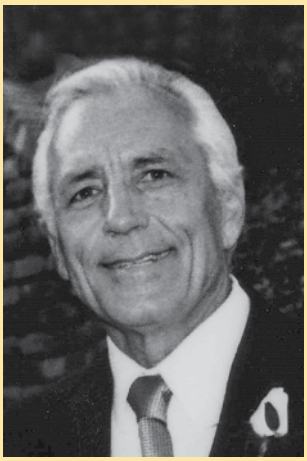
We hope that you will enjoy not only the Conference itself but also Moscow at the end of the autumn. Please, don't lose the possibility to visit beautiful galleries, theaters, museums, parks. In spite of the weather, you will definitely get some warm unforgettable memories that could promote you to visit Russia again.

Have a good time at the HiSST Conference and around!

# Welcome

**Adam Siebenhaar**
Chairman HiSST
Technical Committee

*Mach 7H, USA*



Dear conference participants and colleagues,

As the chairman of the 1st International Conference on High-Speed Vehicle Science and Technologies (HiSST), I welcome you to our 2018 event at the beautiful Metropol Hotel in Moscow. Our host here in Russia is TsAGI represented by Chief Scientific Officer, Prof. Sergey Chernyshev. Our primary reason to hold this conference here in Moscow in 2018 is to join our colleagues from TsAGI in their 100-year anniversary celebrations. We thank TsAGI for inviting us and we send our congratulations.

We aim to increase global visibility of competences, events and publications on high-speed vehicle science and technology and support the sharing of research and development results in the above-mentioned fields among subject matter experts by elaborating links with the different national entities on governmental, industrial and research level of the representing countries.

We encourage scientists to publish the outcome of their research in significant peer-reviewed Aeronautical and Space Journals. We promote dedicated international HiSST conferences to ensure this exchange on a multi-national level.

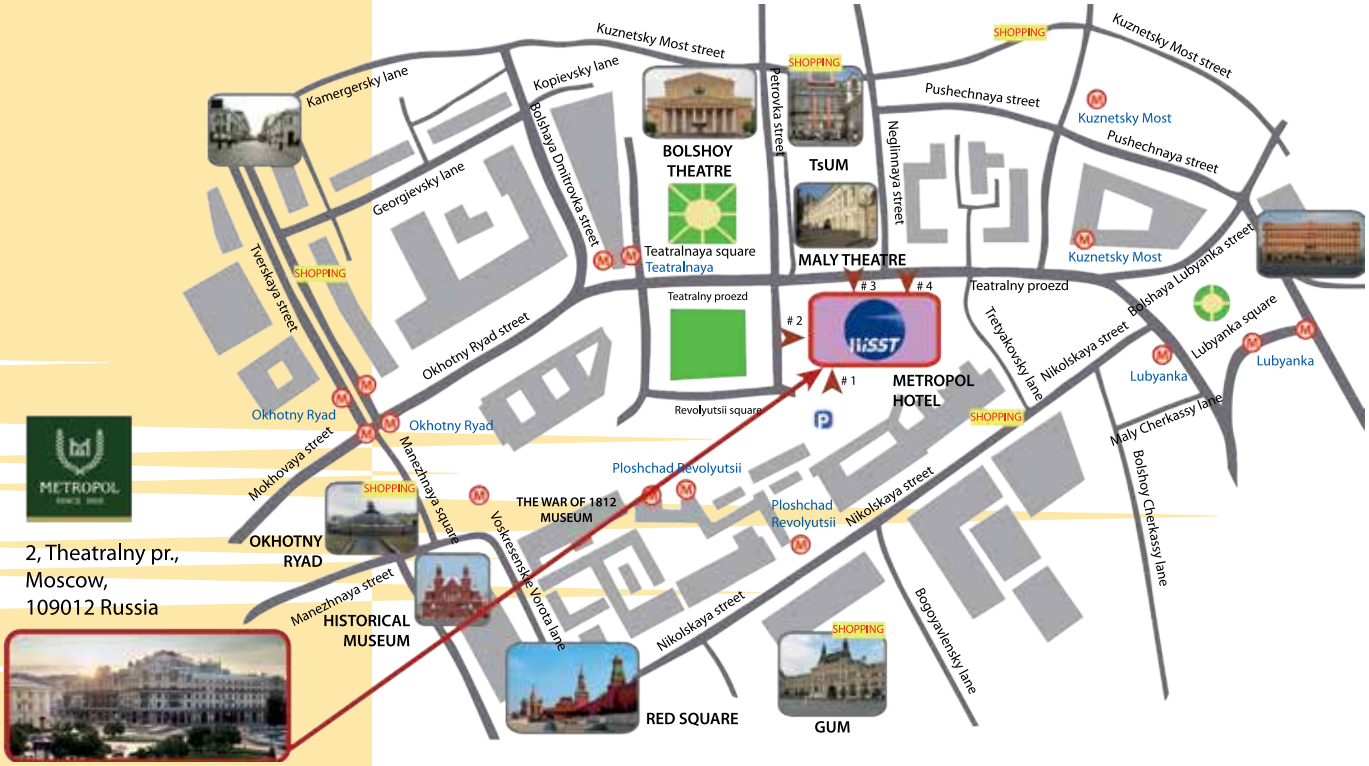
The International HiSST Conference typically takes place every 18 months and is supported by a multinational HiSST Conference Committee which will orchestrate and hold this conference around the globe at regular intervals. To realize the intent of the above statements, we are operating in partnership with an Aeronautical and Aerospace Society. The selected Aeronautical and Aerospace Society and HiSST partner is the Council of European Aerospace Societies (CEAS) represented at this conference by its chairman, Christophe Hermans.

We have assembled a stellar program giving conference attendees valuable insight into the current state of spaceplane and hypersonic programs some of which benefit from existing and evolving international collaborations. Our program opens with keynote welcome speeches from (please fill in names, titles, and affiliation). During the next four days we have organized a total of six plenary sessions addressing relevant topics and a total of (please fill in number of paper manuscripts submitted) technical papers. We dedicated all of Tuesday afternoon for visits to nearby technical points of interest like TsAGI or CIAM. I encourage all conference attendees to take advantage of this opportunity to meet and interact with many of the world's premier experts in the field of high speed vehicles during the formal sessions and the various social events including the Gala Dinner on Wednesday evening. Thank you all very much for your dedication and participation. Without you this event would not be possible. Again, let me welcome you to the 1st HiSST Conference in Moscow, Russia.

Best wishes and blue skies!

## Conference Venue

Hotel Metropol Moscow, a 5-star venue with unique architecture and rich history, comfortable accommodation for participants. The main sightseeing attractions are within walking distance. Nearby points of interest: Bolshoi Theatre, Red Square, St. Basil's Cathedral, Kremlin, Gostiny Dvor, etc.



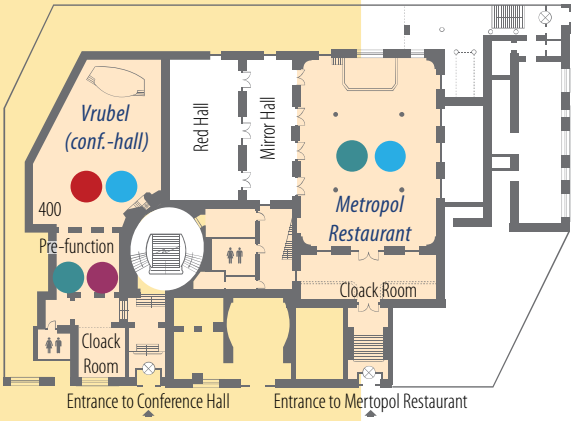

2, Theatralny pr.,
Moscow,
109012 Russia



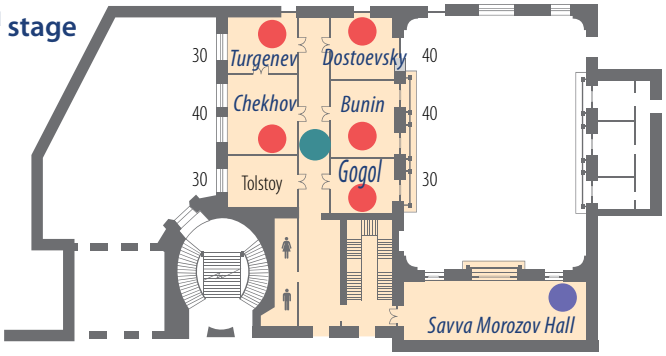
## Halls Scheme

- Plenary & Science Session
- Science Session
- Coffee break
- Lunch
- Presentation loading
- Welcome
- Reception

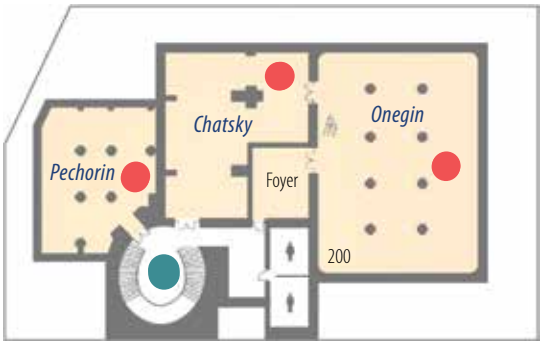
### 1st stage




### 2nd stage




### 0 stage



## International Technical Committee

The HiSST Technical Committee currently has representatives from 12 nations around the globe. These are:

- **Australia** Prof. *Dr. Vincent Wheatley* (Univ. of Queensland)
- **Brazil** Prof. *Dr. Marco Sala Minucci* (IEAv)
- **China** Dr. *Lihong Chen* (Chinese Academy of Sciences)
- **Europe** Prof. *Dr. Johan Steelant* (European Space Agency)
- **France** Dr. *François Falempin* (MBDA)
- **Germany** Prof. *Dr. Klaus Hanneman* (DLR)
- **Italy** Dr. *Gennaro Russo* (Trans-Tech)
- **Japan** Prof. *Dr. Masataka Maita* (JAXA)
- **Russia** Prof. *Dr. Sergey Chernyshev* (TsAGI)
- **South-Korea** Prof. *Dr. Yung-Hwan Byun* (Konkuk University)
- **United Kingdom** Prof. *Dr. Matthew McGilvray* (Univ. of Oxford)
- **United States** Dr. *Adam Siebenhaar* (Mach 7H)

## Topics Abbreviation

| Topic *(full name)* | Code |
|---|---|
| Guidance & Control Systems | G&C |
| High-Speed Aerodynamics and Aerothermodynamics | A&A |
| Hypersonic Fundamentals and History | HFH |
| Materials and Structures | M&S |
| Missions and Vehicles | M&V |

| Topic *(full name)* | Code |
|---|---|
| Operation and Environment | O&S |
| Propulsion Systems and Components | PSC |
| Test & Evaluation | T&E |
| Thermal, Energy and Management Systems | TEM |

## Two-digit Country Codes

| Country | Code |
|---|---|
| Australia | AU |
| Austria | AT |
| Belgium | BE |
| Brazil | BR |
| Canada | CA |
| China | CN |
| Czechia | CZ |
| France | FR |
| Germany | DE |
| Ghana | GH |
| Hungary | HU |
| India | IN |
| Italy | IT |
| Japan | JP |

| Country | Code |
|---|---|
| Korea (South) | KR |
| Kyrgyzstan | KG |
| Netherlands | NL |
| Pakistan | PK |
| Poland | PL |
| Romania | RO |
| Russia | RU |
| Saudi Arabia | SA |
| Singapore | SG |
| South African Republic | ZA |
| Spain | ES |
| United Kingdom | GB |
| USA | US |

## Sunday, November 25

| | |
|---|---|
| 15:00 | **Registration** (*Gogol hall*) |
| 18:00 | ***Welcome Drinks*** *(Bryusov & Savva Morozov halls)* |

## Monday, November 26

| | |
|---|---|
| 08:30 | **Speaker's Briefing** (*Vrubel foyer*) |
| 09:00 | **Welcome** (*Vrubel hall*): **Welcome Address, Host Speech, HiSST Partner Speech** |
| 09:30 | **Global Review** (*Vrubel hall*): **Russia, Australia, Brazil, China** |
| 11:30 | *Coffee Break* |
| 12:00 | **Global Review** (*Vrubel hall*): **Europe, Japan, Korea** |
| 13:30 | *Lunch* |
| 14:30 | **Plenary 1** (*Vrubel hall*) |
| 15:30 | *Coffee Break* |

| *Hall* | *Onegin* | *Chatsky* | *Pechorin* | *Chekhov* | *Bunin* | *Gogol* | *Dostoevsky* | *Turgenev* |
|---|---|---|---|---|---|---|---|---|
| 16:00 | **PSC-1** | **A&A-1** | **PSC-2** | **A&A-2** | **T&E-1** | **O&S-1** | **M&S-1** | **M&V-1** |
| 16:30 | | | | | | | | |
| 17:00 | | | | | | | | |
| 17:30 | | | | | | | | |
| 18:00 | ***Reception*** *(Vrubel hall)* | | | | | | | |

## Tuesday, November 27

| | |
|---|---|
| 08:30 | **Speaker's Briefing** (*Vrubel foyer*) |
| 09:00 | **Plenary 2** (*Vrubel hall*) |

| *Hall* | *Vrubel* | *Onegin* | *Pechorin* | *Chekhov* | *Bunin* | *Gogol* | *Dostoevsky* | *Turgenev* |
|---|---|---|---|---|---|---|---|---|
| 10:00 | **A&A-3** | **PSC-3** | **PSC-4** | **A&A-4** | **T&E-2** | **G&C-1** | **HFH-1** | **TEM-1** |
| 10:30 | | | | | | | | |
| 11:00 | | | | | | | | |
| 11:30 | *Coffee Break* | | | | | | | |
| 12:00 | **A&A-3** | **PSC-3** | **PSC-4** | **A&A-4** | **T&E-2** | **G&C-1** | **HFH-1** | **TEM-1** |
| 12:30 | | | | | | | | |
| 13:00 | | | | | | | | |
| 13:30 | *Lunch* | | | | | | | |
| 14:30 | | | | | | | | |
| … | **Technical tours** | | | | | | | |
| 18:00 | | | | | | | | |
| 18:30 | | | | | | | | |
| 19:00 | ***HiSST TC Dinner*** *(Chekhov hall)* | | | | | | | |

## Wednesday, November 28

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 08:30 | **Speaker's Briefing** (*Vrubel foyer*) | | | | | | | |
| 09:00 | **Plenary 3** (*Vrubel hall*) | | | | | | | |
| *Hall* | *Vrubel* | *Onegin* | *Pechorin* | *Chekhov* | *Bunin* | *Gogol* | *Dostoevsky* | *Turgenev* |
| 10:00 | **A&A-5** | **PSC-5** | **PSC-6** | **A&A-6** | **T&E-4** | **G&C-2** | **T&E-3** | **M&V-2** |
| 10:30 | | | | | | | | |
| 11:00 | | | | | | | | |
| 11:30 | *Coffee Break* | | | | | | | |
| 12:00 | **A&A-5** | **PSC-5** | **PSC-6** | **A&A-6** | **T&E-4** | **G&C-2** | **T&E-3** | **M&V-2** |
| 12:30 | | | | | | | | |
| 13:00 | | | | | | | | |
| 13:30 | *Lunch* | | | | | | | |
| 14:30 | **Plenary 4** (*Vrubel hall*) | | | | | | | |
| 15:30 | *Coffee Break* | | | | | | | |
| *Hall* | *Vrubel* | *Onegin* | *Pechorin* | *Chekhov* | *Bunin* | *Gogol* | *Dostoevsky* | |
| 16:00 | **A&A-7** | **PSC-7** | **PSC-8** | **A&A-8** | **T&E-6** | **HFH-2** | **T&E-5** | |
| 16:30 | | | | | | | | |
| 17:00 | | | | | | | | |
| 17:30 | | | | | | | | |
| 19:30 | ***HiSST Gala Dinner*** *(State Museum of A. S. Pushkin, 12/2, Prechistenko St.)* | | | | | | | |

## Thursday, November 29 (am)

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|---|---|---|---|---|---|---|---|
| 08:30 | **Speaker's Briefing** (*Vrubel foyer*) | | | | | | |
| 09:00 | **Plenary 5** (*Vrubel hall*) | | | | | | |
| *Hall* | *Vrubel* | *Onegin* | *Pechorin* | *Bunin* | *Gogol* | *Dostoevsky* | *Turgenev* |
| 10:00 | **HFH-3** | **PSC-9** | **T&E-7** | **M&V-3** | **G&C-3** | **M&S-2** | **TEM-2** |
| 10:30 | | | | | | | |
| 11:00 | | | | | | | |
| 11:30 | *Coffee Break* | | | | | | |
| 12:00 | **HFH-3** | **PSC-9** | **T&E-7** | **M&V-3** | **G&C-3** | **M&S-2** | **TEM-2** |
| 12:30 | | | | | | | |
| 13:00 | | | | | | | |
| 13:30 | *Lunch* | | | | | | |
| 14:30 | **Plenary 6** (*Vrubel hall*) | | | | | | |
| 15:30 | *Coffee Break* | | | | | | |
| *Hall* | *Vrubel* | *Onegin* | *Pechorin* | *Turgenev* | | | |
| 16:00 | **A&A-9** | **PSC-10** | **T&E-8** | **O&S-2** | | | |
| 16:30 | | | | | | | |
| 17:00 | | | | | | | |
| 17:30 | | | | | | | |
| 18:00 | ***TsAGI Anniversary Ceremonial Reception*** *(Metropol Hall)* ***for invited guests only*** | | | | | | |

## Monday, November 26

| | | | |
|---|---|---|---|
| 08:30 | **Speaker's Briefing** (*Vrubel foyer*) | | |
| | **Welcome** (*Vrubel hall*) | | |
| 09:00 | **Welcome Address.** *Adam Siebenhaar* (Mach 7H, USA)<br>**Host Speech.** *Sergey Chernyshev* (TsAGI, Russia)<br>**HiSST Partner Speech.** *Christophe Hermans* (CEAS) | | |
| | **Global Review** *(Vrubel hall)* — **Chair:** *Adam Siebenhaar* (Mach 7H, USA) | | |
| 09:30 | **Russia.** *Sergey Drozdov* (TsAGI, Russia) | 10:30 | **China.** *Lihong Chen* (CAS, China) |
| 10:00 | **Australia.** *Adrian Pudsey* (RMIT, Australia) | | |
| 11:30 | *Coffee Break* | | |
| | **Global Review** *(Vrubel hall)* — **Chair:** *Adam Siebenhaar* (Mach 7H, USA) | | |
| 12:00 | **Europe.** *Johan Steelant* (ESA-ESTEC, Netherlands) | 12:30 | **Japan.** *Hideyuki Tanno* (JAXA, Japan) |
| | | 13:00 | **Korea.** *Yunghwan Byun* (Konkuk University, Korea) |
| 13:30 | *Lunch* | | |
| 14:30 | **Plenary 1** *(Vrubel hall)* — **Session Chair:** *Klaus Hannemann* (DLR, Germany) | | |
| | **Hypersonic Flow Over a Cone in the Detached Shock Range.** *Hans Hornung* (California Institute of Technology, USA) | | |
| 15:30 | *Coffee Break* | | |

| Hall | *Onegin* | *Chatsky* | *Pechorin* | *Chekhov* |
|---|---|---|---|---|
| Topic | **PSC-1** | **A&A-1** | **PSC-2** | **A&A-2** |
| Chair | *N. Kukshinov* (CIAM, RU); *V. Zhukov* (DLR, DE) | *M. Marini* (CIRA, IT); *A. Schettino* (CIRA, Italy) | *P. Gerlinger* (Stuttgart Unv., DE); *I. Shirkovsky* (TsAGI, RU) | *V. Golubkin* (TsAGI, RU); *A. Gubanov* (TsAGI, RU) |
| 16:00 | **hisst-2018_11101019** **Design, Numerical Analysis and Experimental Studies of Model High-Speed Propane Combustion Chamber.** *V. Vlasenko, V. Sabelnikov, M. Ivankin, S. Molev, A. Nikolayev, V. Talyzin, A. Chevagin* (TsAGI, RU) | **hisst-2018_1620897** **High and Low Speed Analysis of a Re-usable Unmanned Re-entry Vehicle.** *T. Bykerk, D. Verstraete* (Sydney Unv., AU), *G. Pezzella* (CIRA, IT), *A. Viviani* (Campania Unv., IT) | **hisst-2018_39701105** **Coupled Fluid / Solid Numerical Investigation of the Heat Load on a Lobed Scramjet Strut Injector.** *P. Gerlinger, Y. H. Simsont* (Stuttgart Unv., DE) | **hisst-2018_2670918** **Numerical Simulation of Transpiration Cooling Experiments in Supersonic Flow using OpenFOAM.** *D. Prokein, J. von Wolfersdorf* (ITLR, DE), *C. Dittert, H. Böhrk* (DLR, DE) |
| 16:30 | **hisst-2018_40101115** **HEXAFLY-INT Facility Module Testing in High-Entalpy Flow.** *N. Kukshinov, V. Aleksandrov, A. Prokhorov, A. Rudinskiy* (CIAM, RU) | **hisst-2018_2940957** **Aerodynamic and Aerothermodynamic Database of the HEXAFLY-INT Hyper-sonic Glider.** *A. Schettino, G. Pezzella, M. Marini, S. Di Benedetto* (CIRA, IT), *V. F. Villace, J. Steelant* (ESTEC-ESA, NL), *A. Gubanov, N. Voevodenko* (TsAGI, RU) | **hisst-2018_40601123** **The Effect of Combustion on the Dynamic Characteristics of the Supersonic Wake Flow.** *Qing Li, Jianhan Liang* (NUDT, CN) | **hisst-2018_16501075** **Experimental Investigation of the Boundary Layer State Hysteresis and its Influence on the Starting of the Streamline-Traced Intake.** *V. Golubkin, S. Aleshin, A. Gubanov, I. Nazhimov, V. Talyzin, Yu. Shvalev, V. Yakovleva* (TsAGI, RU) |

## Monday, November 26

**Current version also available**

| Bunin | Gogol | Dostoevsky | Turgenev | 15:30 Hall |
|---|---|---|---|---|
| **T&E-1** | **O&S-1** | **M&S-1** | **M&V-1** | Topic |
| *S. Drozdov* (TsAGI, RU); *R. Ramesh* (Queensl. Unv., AU) | *M. Schultz* (DLR, DE); *A. Mirzoyan* (CIAM, RU) | *J.-F. Justin* (ONERA, FR); *A. Shardin* (TsAGI, RU) | *L. Bussler* (DLR, DE); *C. Merrem* (DLR, DE) | Chair |
| **hisst-2018_640800 Numerical and Experimental Investigation of Air Flow and Heat Transfer in a Complete Circuit of a Hypersonic Wind Tunnel.** *S. Drozdov, R. Davletkildeev, A. Rtischeva* (TsAGI, RU) | **hisst-2018_21101120 Modeling of Sonic Boom Phenomena.** *T. Kiseleva, A. Kosinov, Yu. Ermolaev, V. Volkov* (ITAM SB RAS, RU) | **hisst-2018_310812 Preliminary Design of a Hooded Fairing Accommodating Winged Payloads.** *J. Steelant, A. Jasko, J. van den Eynde, M. Appolloni* (ESA-ESTEC, NL)*; J. F. A. Martos* (ESA-ESTEC Advanced Studies Inst., BR)*; A. Kallenbach* (DLR, DE)*; A. Shardin, A. Gorskiy* (TsAGI, RU) | **hisst-2018_1130816 Assessment of VTVL and VTHL Reusable First Stages.** *L. Bussler, I. Dietlein, E. Dumont, M. Sippel, S. Stappert, J. Wilken* (DLR, DE) | 16:00 |
| **hisst-2018_41101143 Numerical Investigation of High Temperature $CO_2$-$N_2$ Flows in a Plasma Wind Tunnel Facility.** *A. Pudsey, T. Roos, M. Bricalli, H. Ogawa* (RMIT Unv., AU)*; J. Garcia-Garrido, Ch. Mundt* (Inst. for Thermodynamics, Bundeswehr Unv., DE) | **hisst-2018_810923 Numerical Simulation Assistant Design of the Near-field Sonic Boom Signature Measurement System for AVIC ARI's FL-60 Wind Tunnel.** *Qian Zhansen, Leng Yan, Liu Zhongchen* (AVIC ARI, CN) | **hisst-2018_1911571 Experimental Investigation of Thermo-barrier Coating Based on Zirconium Dioxide.** *K. Zhirikhin, A. Shardin, S. Kazhichkin, A. Nikulenko, V. Talyzin, E. Dmitriev, A. Sysoev, D. Somov , Yu. Tarasenko* (TsAGI, RU) | **hisst-2018_1280822 SPACE RIDER: Mission Analysis and Flight Mechanics of the Future European Reusable Space Transportation System.** *G. De Zaiacomo, D. Bonetti, G. Blanco Arnao, G. Medici* (Deimos Space S.L.U., ES) | 16:30 |

## Monday, November 26

| Hall | *Onegin* | *Chatsky* | *Pechorin* | *Chekhov* |
|---|---|---|---|---|
| Topic | **PSC-1** | **A&A-1** | **PSC-2** | **A&A-2** |
| 17:00 | **hisst-2018_41801146** **Modelling of Heat Transfer in Rocket Combustion Chambers using Eddy-Dissipation Combustion Model.** *V. Zhukov* (DLR, DE) | **hisst-2018_3250999** **Dynamic Effects of MHD Interaction in Hypersonic Flow under Ground-based Experiment Conditions.** *S. Bychkov, D. Baranov, V. Bityurin, A. Bocharov, V. Grushin, N. Tretyakova* (JIHT, RU), *N. Batura, N. Kolushov, E. Vasilevsky, N. Zhurkin* (TsAGI, RU) | **hisst-2018_3180980** **Experimental Study of Kerosene Combustion extinguishing and Flame Stability in Supersonic Combustor.** *Yu. Meng, Hongbin Gu, Jingheng Zhuang, ZHanbiao Gao, Huan Lian, Xinyu Chang* (IMech CAS, CN) | **hisst-2018_2930950** **Direct Numerical Simulation of Mach Wave and Supersonic Boundary Layer Interaction.** *I. Egorov* (TsAGI, RU), *Q. Din, A. Fedorov* (MIPT, RU) |
| 17:30 | **hisst-2018_34401059** **Mixing Enhancement of Wall-Injected Fuel in Supersonic Flow by Spark Discharge.** *A. Firsov, E. Dolgov, R. Rakhimov, M. Shurupov* (JIHT RAS, RU), *S. Leonov* (JIHT RAS, RU; University of Notre Dame, US) | **hisst-2018_1000934** **Experimental Study on the Design Principle of the High-pressure Capturing Wings.** *Guangli Li, Yao Xiao, Yingzhou Xu, Haoxiang Wang* (IMech CAS, CN), *Kai Cui* (Unv CAS, CN) | | **hisst-2018_2340898** **Distinctive Features of Heat Exchange and Laminar-Turbulent Transition in Hypersonic Boundary Layers on Flat Blunted Bodies.** *V. Shalaev, M. Starodubtsev* (MIPT, RU), *S. Alexandrov, A. Vaganov* (TsAGI, RU) |




## Monday, November 26

| *Bunin* | *Gogol* | *Dostoevsky* | *Turgenev* | Hall |
|---|---|---|---|---|
| **T&E-1** | **O&S-1** | **M&S-1** | **M&V-1** | Topic |
| **hisst-2018_1330906** **Capability of the X2 Expansion Tube to Generate a High Enthalpy, High Reynolds Number Test Flow.** *R. Ramesh, R. Morgan, D. Mee* (Queensland Unv., AU) | | **hisst-2018_1760854** **Structural Topology Optimisation of the HEXAFLY-INT Vertical Fin.** *D. J. Munk, G. A. Vio, D. Verstraete* (Sydney Unv., AU); *J. Steelant, V. F. Villace* (ESA-ESTEC, NL) | **hisst-2018_1870857** **Preliminary Aerodynamic Design of a Reusable Booster Flight Experiment.** *C. Merrem, V. Wartemann, Th. Eggers* (DLR, DE) | 17:00 |
| **hisst-2018_1710851** **Development of the Technique of Sonic Boom Experimental Researches.** *T. Pritulo, S. Chernyshev, A. Ivanov, A. Kiselev, V. Mosharov, D. Sboev, L. Teperin, V. Yudin* (TsAGI, RU) | **hisst-2018_24701065** **HyCost: A Life Cycle Cost Estimation Tool for Hypersonic Transportation System.** *R. Fusaro, V. Vercella, D. Ferretto, N. Viola* (Politecnico di Torino, IT); *V. F. Villace, J. Steelant* (ESA-ESTEC, NL) | **hisst-2018_28601101** **Ultra-High Temperature Ceramics: Developments for Hypersonic Applications.** *J.-F. Justin, A. Julian-Jankowiak, V. Guérineau, V. Mathivet* (ONERA, Unv. Paris-Saclay, FR) | **hisst-2018_1280821** **EXOMARS 2020 Entry Descent and Landing Mission Analysis Verification.** *G. De Zaiacomo, D. Bonetti, I. Pontijas Fuentes, G. Blanco Arnao* (Deimos Space S.L.U., ES); *F. Calantropio* (Thales Alenia Space, IT); *L. Lorenzoni* (ESA, NL) | 17:30 |




## Tuesday, November 27

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|---|---|---|---|---|
| 08:30 | **Speaker's Briefing** (*Vrubel foyer*) | | | |
| 09:00 | **Plenary 2** *(Vrubel hall)* | | | **Session Chair:** *Johan Steelant* (ESA-ESTEC, Netherlands) |
| 09:30 | **TsAGi's 100th Anniversary: History, People, Oustanding Events.** *Gennady Amiryants* (TsAGI, Russia) | | | |
| Hall | *Vrubel* | *Onegin* | *Pechorin* | *Chekhov* |
| Topic | **A&A-3** | **PSC-3** | **PSC-4** | **A&A-4** |
| Chair | *I. Egorov* (TsAGI, RU); *N. Palchekovskaya* (TsAGI, RU) | *V. Talyzin* (TsAGI, RU); *Fang Chen* (Shanghai Jiao Tong Unv., CN) | *V. Vlasenko* (TsAGI, RU); *S. Karl* (DLR, DE) | *A. Gubanov* (TsAGI, RU); *I. Amelyushkin* (TsAGI, RU) |
| 10:00 | **hisst-2018_2760930** **Study on 3D Lattice Boltzmann Method for High-Speed Viscous Flows.** *Ruofan Qiu, Yancheng You, Rongqian Chen, Chenxiang Zhu, Jianfeng Zhu* (Xiamen University, CN) | **hisst-2018_1750850** **Hysteresis Phenomenon of Shock Train in an Isolator with Incident Shocks.** *Nan Li, Juntao Chang, Kejng Xu, Wen Bao, Daren Yu* (ESEAFIS, CN) | **hisst-2018_1640846** **Post-test Analysis of the LAPCAT-II Subscale Scramjet.** *S. Karl, J. Martinez, K. Hannemann* (DLR, DE) | **hisst-2018_19601030** **Amplitude Method of Laminar-Turbulent Transition Prediction in Three-dimensional Supersonic Boundary Layer at Swept Wing.** *M. Ustinov* (TsAGI, RU) |
| 10:30 | **hisst-2018_43301174** **Effect of Reacting Flow on Flutter at Hypersonic Flight Speed.** *V. Vedeneev* (Lomonosov MSU, RU); *V. Nesterov* (MAI, RU); *A. Medvedskii, K. Sypalo* (TsAGI, RU) | **hisst-2018_42101147** **Control of Flow Parameters in the Model of the Pre-chamber Isolator for Ramjet Engine.** *D. Lapinsky, N. Guryleva, M. Ivankin, A. Tereshin* (TsAGI, RU) | **hisst-2018_3000970** **Comparison of Air-Breathing Jet Engines with Deflagration and Detonation Combustion.** *A. Kraiko, A. Egoryan* (CIAM, RU) | **hisst-2018_70810** **Estimation of Laminar-to-turbulent Transition using Empirical and Numerical Methods for Various Aerodynamic Forms.** *N. Voevodenko, A. Gubanov, D. Ivanyushkin, Yu. Shvalev* (TsAGI, RU) |
| 11:00 | **hisst-2018_2030871** **Analysis of Hypersonic Model Pitching Experiments in the TUSQ Facility.** *N. Stern, D.R. Buttsworth, R. Choudhury, B. Reimann* (S. Queensl Unv., AU) | **hisst-2018_1701070** **Investigation on the Streamline-traced Intake Starting.** *V. Talyzin, A. Fedorov, A. Gubanov, M. Ivankin* (TsAGI, RU) | **hisst-2018_2240912** **Hypersonic Hydrocarbon Fuel Vehicle with M = 6+.** *A. Kuranov, A. Korabelnikov* (HSRE, RU); *V. Abashev* (MAI, RU); *P. Tretyakov* (ITAM SB RAS, RU) | **hisst-2018_1880875** **Influence of Active Cooling on Second Mode Instabilities Investigated on Hypersonic, Conical Flows.** *V. Wartemann, P. Reiter, A. Wagner, G. Ponchio Camillo* (DLR, DE) |
| 11:30 | *Coffee Break* | | | |

## Tuesday, November 27

| Bunin | Gogol | Dostoevsky | Turgenev | Hall |
|---|---|---|---|---|
| T&E-2 | G&C-1 | HFH-1 | TEM-1 | Topic |
| *P.M. Seltner* (DLR, DE); *A. Rudinskii* (CIAM, RU) | *S. Takovitskii* (TsAGI, RU); *O. Yanova* (TsAGI, RU) | *I. Lipatov* (TsAGI, RU); *J.-Y. Andro* (ONERA, FR) | *H. Böhrk* (DLR, DE); *V.F. Villace* (ESA-ESTEC, NL) | Chair |
| **hisst-2018_31001139** **Experimental Determination of Aerodynamic Coefficients of Simple-shaped Bodies Free-flying in Hypersonic Flow.** *P.M. Seltner, S. Willems, A. Guelhan* (DLR, DE) | **hisst-2018_1130819** **Optimized Reentry Trajectories for Winged RLV Stages.** *L. Bussler* (DLR, DE) | **hisst-2018_1200959** **Asymptotic Analysis of Steady Secondary Flow in a Turbulent Boundary Layer.** *V. Zametaev, A. Gorbushin* (TsAGI, RU) | **hisst-2018_15701098** **Experimental and Numerical Achievements in High Temperature Management for Hypersonic Flight.** *H. Böhrk, T. Stäbler, Ch. Dittert, I. Sakraker, D. Prokein* (DLR, DE) | 10:00 |
| **hisst-2018_550801** **Aerodynamic Characterization of a Hooded Fairing Accommodating Winged Payloads.** *J. F. A. Martos, J. Steelant* (ESTEC-ESA, NL); *R. O. Santos, M. A. S. Minucci, I. S. Rego* (IAS, Brazil) | **hisst-2018_1580867** **Bringing Highly Efficient RLV-Return Mode "In-Air-Capturing" to Reality.** *M. Sippel, L. Bussler, S. Krause, S. Cain* (DLR, DE) | **hisst-2018_47601548** **Starting and Heating of Rectangular Hypersonic Inlet with Blunted Leading Edges.** *V. Borovoy, V. Mosharov, A. Skuratov, V. Radchenko* (TsAGI, RU) | **hisst-2018_1770921** **Thermal Management of the HEXAFLY-INT Hypersonic Glider.** *J.-Y. Andro* (ONERA, FR); *R. Scigliano* (CIRA, IT); *A. Kallenbach* (DLR, DE); *J. Steelant* (ESA-ESTEC, NL) | 10:30 |
| **hisst-2018_2270994** **Mathematical Modeling of Two-phases Flow mixing with Air in the Vortex Generator Trail.** *M. Abramov* (CIAM,RU) | **hisst-2018_1280824** **Space Rider: Entry and Taem GNC of the Future European Reusable Space Transportation System.** *G. De Zaiacomo, C. Recupero, A. Pagano, M. Kerr, P. Rosa, R. Haya-Ramos* (Deimos Space S.L.U., ES) | **hisst-2018_34501037** **Numerical Study of Wave Trains in High-speed Boundary Layer over a Cone.** *A. Novikov* (TsAGI, RU) | **hisst-2018_24701056** **Preliminary Design and Sizing of the Thermal and Energy Management Subsystem for LAPCAT MR2.** *R. Fusaro, D. Ferretto, V. Vercella, N. Viola* (Politecnico di Torino, IT); *V. F. Villace, J. Steelant* (ESA-ESTEC, NL) | 11:00 |

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11:30

## Tuesday, November 27

| Hall | *Vrubel* | *Onegin* | *Pechorin* | *Chekhov* |
|---|---|---|---|---|
| Topic | **A&A-3** | **PSC-3** | **PSC-4** | **A&A-4** |
| 12:00 | **hisst-2018_13401004** **Method for Solving the Equations Describing the Interaction of a 3-D Boundary Layer with an Outer Inviscid Supersonic Flow.** *G. Korolev* (TsAGI, RU) | **hisst-2018_39101097** **Investigation of the Features of the Flow Structure in a Multi-channel Supersonic Air Intake Device.** *D. Rakhmanin, A. Trifonov* (TsAGI, RU) | **hisst-2018_43401175** **Possible Unification of Engines for Advanced Small and Medium Supersonic Civil Aeroplanes.** *A. Mirzoyan, A. Evstigneev* (CIAM, RU) | **hisst-2018_1100813** **Micro-aerothermo-dynamic Analysis of Protuberances and Clearances on a Hypersonic Glider Using a Reduced Domain Approach.** *R. Choudhury, V. F. Villace, J. Steelant* (ESTEC-ESA, NL); *D. Buttsworth* (S. Queensl. Unv., AU) |
| 12:30 | **hisst-2018_1070895** **Generation of Three-Dimensional Disturbances in a Boundary Layer on Strong Interaction.** *G. Dudin, V. Neyland* (TsAGI, RU) | **hisst-2018_2650917** **Unsteady Simulation of the Flow in a Hypersonic Airbreathing Vehicle Air Intake during Cowl Opening using a Conservative Overlapping Mesh CFD Technique.** *M. Ferrier, P. Grenard* (ONERA, FR) | **hisst-2018_27401035** **Air-breathing Electric Propulsion for Long-term Flights in Very Low Earth Orbits.** *A. Filatyev, A. Erofeev, A. Nikiforov, O. Yanova* (TsAGI, RU); *G. Popov, S. Khartov* (MAI, RU) | **hisst-2018_960884** **Experimental Investigation of Rarefaction Effects on Aerodynamic Coefficients of Slender and Blunt Re-entry Vehicles.** *T. Schlegat, K. Hannemann* (DLR, DE) |
| 13:00 | **hisst-2018_910807** **Acoustic Diagnostics of Instability Waves in Supersonic Jet.** *V. Kopiev, M. Zaytsev, S. Chernyshev* (TsAGI, RU) | **hisst-2018_35801117** **Numerical Investi-gation of Total Pressure Pulsations in Supersonic Trapezoidal Air Intake using Eddy Resolving DES Method.** *E. Novogorodtsev* (TsAGI, RU) | **hisst-2018_41601152** **Design and Numerical Simulation of a Common Nozzle of Multi-channel TBCC Engine.** *Rongqian Chen, Yangcan Huang, Chengxiang Zhu, Ruofan Qiu, Yancheng You* (Xiamen Unv., CN) | **hisst-2018_510879** **Numerical and Experimental Analysis of Rarefaction Effects on Aerodynamic Coefficients of a Slender Re-entry Vehicle.** *K. Hannemann, C. Hepp, T. Schlegat, M. Grabe* (DLR, DE) |
| 13:30 | *Lunch* | | | |
| 14:30 … 18:00 | **Technical Tours** | | | |

## Tuesday, November 27

| *Bunin* | *Gogol* | *Dostoevsky* | *Turgenev* | Hall |
|---|---|---|---|---|
| **T&E-2** | **G&C-1** | **HFH-1** | **TEM-1** | Topic |
| **hisst-2018_540926** **Time-Domain Dynamic Response Prediction: from One Boundary Condition to Another.** *Jiaming Zhou, Longlei Dong, Guirong Yan* (Xi'an Jiaotong Unv., CN) | **hisst-2018_38001112** **Aircraft Actuating System Fault Diagnosis under Complete Uncertainty.** *E. Zybin, V. Kosyanchuk, S. Karpenko* (GosNIIAS, RU) | **hisst-2018_1300827** **Compressibility and Temperature Effects on Turbulent Spot Growth.** *J. Van den Eynde, J. Steelant* (ESA, NL) | **hisst-2018_30201125** **Computational and Experimental Research of Solid Hydrocarbons Sublimation Process in a Wide Range of Operation Parameters.** *K. Fedotova, M. Ananyan, K. Arefyev, I. Grishin, M. Ilchenko, D. Safonova, L. Yanovsky* (CIAM, RU) | 12:00 |
| **hisst-2018_2260890** **Converging-Diverging Nozzles with Constant-radius Centerbody.** *A. K. Flock, A. Gülhan* (DLR, DE) | **hisst-2018_1770922** **Design of the Actuation System of the HEXAFLY-INT Hypersonic Glider.** *J.-Y. Andro* (ONERA, FR); *F. Nebula* (CIRA, IT) *W. Rotärmel* (DLR, DE); *J. Steelant* (ESA-ESTEC, NL) | **hisst-2018_11401090** **New Kinetic Models in Non-equilibrium Aerodynamic Problems.** *E. Kustova, E. Nagnibeda* (SPbSU, RU) | **hisst-2018_40701135** **Velocity Fluctuations Effect on an Air-methane Flame Blow-off at Low Damkohler Numbers.** *K. Arefyev, A. Krikunova, V. Panov, K. Fedotova* (CIAM, RU) | 12:30 |
| **hisst-2018_640799** **Experimental Investigation of Aero-Thermodynamic Characteristics of "ExoMars" Descent Module at Hypersonic Velocities.** *S. Drozdov, V. Brazhko, R. Davletkildeev, D. Fyodorov, I. Shemetov* (TsAGI, RU) | **hisst-2018_11201006** **Optimum Trim of an Experimental Hypersonic Glider.** *V.F. Villace* (ESA, NL); *S. Takovitskii* (TsAGI, RU) | **hisst-2018_700868** **Research of Flow Control on Supersonic Inlet Diffuser.** *Jinsheng Zhang, Huacheng Yuan, Yunfei Wang, Guoping Huang* (NUA&A, CN) | **hisst-2018_9001039** **Thermal Protection of the Surface of a High-Speed Aircraft from Convective Heat Flow by Gas Blowing.** *E. Vasilevsky, I. Ezhov, P. Chuvakhov* (TsAGI, RU) | 13:00 |
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| | | | | 14:30 |
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| | | | | 18:00 |

## Wednesday, November 28

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| 08:30 | **Speaker's Briefing** (*Vrubel foyer*) | | | |
| 09:00 | **Plenary 3** *(Vrubel hall)* | **Session Chair:** *Yung-Hwan Byun* (Konkuk University, South-Korea) | | |
| 09:30 | **The experience of Construction of the Tu-144. Use the Experience in Developing a Supersonic Busness Jet (SBJ).** *Dmitry Olishevsky* (Tupolev DB, Russia) | | | |
| Hall | *Vrubel* | *Onegin* | *Pechorin* | *Chekhov* |
| Topic | **A&A-5** | **PSC-5** | **PSC-6** | **A&A-6** |
| Chair | *N. Voevodenko* (TsAGI, RU); *A. Obraz* (TsAGI, RU) | *V. Zhukov* (ISP DLR, DE); *J.-Y. Choi* (PNU, KR) | *I. Shirkovsky* (TsAGI, RU); *Pan Hongliang* (NPU, CN) | *C. Stemmer* (Muenich TU, DE); *G. Dudin* (TsAGI, RU) |
| 10:00 | **hisst-2018_31501116** **Effects of Injection on the Boundary Layer Stability over a Blunt Body.** *A. Obraz, A. Fedorov* (MIPT, RU); *N. Palchekovskaya, I. Egorov* (TsAGI, RU) | **hisst-2018_34401060** **Reduction of Power Consumption for Quasi-DC Discharge Applied for Combustion Control in Supersonic Airflow.** *A. Firsov, E. Dolgov, R. Rakhimov* (JIHT RAS, RU); *S. Leonov* (JIHT RAS, RU; Notre Dame Unv., US) | **hisst-2018_920852** **Three-dimensional Bump Design for Improving the Starting Characteristics of Hypersonic Inlets.** *Xiaogang Zheng, Yiqing Li, Yancheng You* (Xiamen Unv., CN) | **hisst-2018_870841** **Application of RANS/LES Hybrid Method in Simulation of Supersonic Base Flow.** *Fu Weijia, Ma Jingzhong, Li Jie* (AVIC Hongdu, NPU, CN) |
| 10:30 | **hisst-2018_2890979** **Mathematical Simulation, Numerical and Experimental Investigation of Nonspherical Bodies' Motion in Nonuniform Flows.** *I. Amelyushkin* (TsAGI, RU) | **hisst-2018_47001212** **Development of the Basis Naphthene Oxidation Kinetic Model for Simulation of the Practical Fuel Combustion.** *M. Abbasi* (DLR, DE), *N. A. Slavinskaya* (GRS, DE) | **hisst-2018_2400903** **Flow Visualization and Control of Unstarting Scramjet Inlet-isolator.** *Kyungrae Kang, Jong Ho Choi, Seong-kyun Im, Seung Jin Song, Hyungrok Do* (Seoul NU, KO) | **hisst-2018_1950863** **Roughness-induced Instabilities Leading to Transition in a Capsule Boundary-layer under Re-entry Conditions.** *C. Stemmer, A. Di Giovanni* (Muenich TU, DE) |
| 11:00 | **hisst-2018_1810855** **Interaction of a Solid Body with a Multiphase Supersonic Flow: Physico-Mathematical Models and Numerical Investigations.** *G. Molleson, A. Stasenko* (TsAGI, RU) | **hisst-2018_33601050** **Regimes of Turbulent Supersonic Combustion depending on Fuel Temperature.** *Jeong-Yeol Choi, Hye-Sung Kim* (PNU, KO) | **hisst-2018_43401176** **Noise Reduction using Optimal Takeoff Thrust Management for Supersonic Business Jet.** *A. Mirzoyan* (CIAM, RU) | **hisst-2018_1020853** **Application of a Reference Plane Method Calculating Flowfield behind Three-dimensional Elliptic Conical Shock Wave.** *Shi Chong-guang, Zhu Cheng-xiang, You Yan-cheng* (Xiamen Unv., CN) |
| 11:30 | *Coffee Break* | | | |

## Wednesday, November 28

| Bunin | Gogol | Dostoevsky | Turgenev | |
|---|---|---|---|---|
| T&E-4 | G&C-2 | T&E-3 | M&V-2 | Topic |
| *J. M. Schramm* (DLR, DE); *N. Kukshinov* (CIAM, RU) | *A. Fylatiev* (TsAGI, RU); *Tao Chao* (HIT, CN) | *F. Hufgard* (Stuttgart Unv., DE); *A. Volkova* (TsAGI, RU) | *S. Di Benedetto* (CIRA, IT); *M. Sippel* (DLR, DE) | Chair |
| **hisst-2018_36201052** **Investigation on Flow Characteristic of Combination of Forward-facing Jet and Spike through Wind Tunnel Tests.** *Jiang ZHANG, Xiaoyan HE, Handong MA,Yongming QIN* (CAAA, CN) | **hisst-2018_1860856** **Trajectory and Flight Mechanics Analysis of the HEXAFLY-INT Experimental Flight Vehicle.** *G. Morani, F. Nebula, S. Di Benedetto, M. P. Di Donato* (CIRA, IT); *J. Steelant* (ESA-ESTEC, NL) | **hisst-2018_720804** **Mixing Characteristics in a Hypersonic Flow around a Transpiration Cooled Flat Plate Model.** *T. Hermann, M. McGilvray, H.S. Ifti* (Oxford Unv., UK) | **hisst-2018_3101064** **Flight Testing Designs in HEXAFLY-INT for High-speed Transportation.** *J. Steelant, HXI-team* (ESA-ESTEC, NL) | 10:00 |
| **hisst-2018_40101126** **Investigation of Dynamic Characteristics of HEXAFLY-INT Facility Module in High-altitude Testing Conditions.** *N. Kukshinov, V. Aleksandrov, K. Arefyev, M. Ilchenko* (CIAM, RU) | **hisst-2018_37001100** **Optimal Climbing Trajectories of Hypersonic Aircraft based on Direct Methods of Flight Dynamics.** *A. Chekin, M. Kiselev, Ya. Moroshkin* (GosNIIAS, RU) | **hisst-2018_2330896** **Analysis of Porous Materials for Transpiration-cooled Heat Flux Sensor Development.** *F. Hufgard, S. Löhle, J. von Wolfersdorf* (Stuttgart Unv., DE); *J. Steelant* (ESA-ESTEC, NL) | **hisst-2018_42601154** **Multidisciplinary Design and Flight Test of the HEXAFLY-INT Experimental Flight Vehicle.** *S. Di Benedetto, M. P. Di Donato, A. Rispoli, G. Pezzella, R. Scigliano, F. Nebula, D. Cristillo, L. Vecchione* (CIRA, IT); *S. Cardone* (TET, IT); *J. Steelant, V. Villace* (ESA-ESTEC, NL) | 10:30 |
| **hisst-2018_2190880** **Ultra-fast Temperature Sensitive Paint Shock Tunnel Heat Flux Measurements on the Intake of the LAPCAT II Small Scale Flight Experiment Configuration.** *J. M. Schramm, S. Karl, K. Hannemann* (DLR, DE); *H. Ozawa* (TMU, JP) | **hisst-2018_1800991** **Differential Flatness-based Finite Time Sliding Mode Control of Hypersonic Vehicle.** *W. Yuxiao, Tao Chao, Songyan Wang, Ming Yang* (HIT, CN) | **hisst-2018_36801066** **Experimental Investigation on Flight Test Vehicle Aerodynamics at TsAGI T-116 Wind Tunnel: Powered and Glider Options.** *A. Gubanov, D. Gusev, V. Yakovleva* (TsAGI, RU) | **hisst-2018_940809** **Design of Gravity-assist Trajectories for Thrust Pinch in an Integrated Aircraft-propulsion System.** *Jialin Zheng, Juntao Chang, Daren Yu* (School of ESE, CN) | 11:00 |
| | | | | 11:30 |

## Wednesday, November 28

| Hall | *Vrubel* | *Onegin* | *Pechorin* | *Chekhov* |
|---|---|---|---|---|
| Topic | **A&A-5** | **PSC-5** | **PSC-6** | **A&A-6** |
| 12:00 | **hisst-2018_1300826** **Intermittency-based Transition Model with Local Empirical Correlations.** *J. Van den Eynde, J. Steelant* (ESA, NL) | **hisst-2018_2380909** **Application of Dynamic Adaptive Chemistry and in Situ Adaptive Tabulation for Computationally Efficient Modeling of Supersonic Turbulent Combustion.** *Jian An, Guoqiang He, Fei Qin, Xianggeng Wei, Duo Zhang* (NPU, CN) | **hisst-2018_2870951** **Comprehensive Effects of Secondary Heat Release on Ejection and Engine Performance in RBCC Ejector Mode.** *Pan Hongliang, Ye Jinying* (NPU, CN); *Lin Binbin* (NPU, CAFU of China, CN) | **hisst-2018_690803** **Numerical Simulation of Two Shear Layers Interaction in Double Backward-facing Steps.** *Deng Fang, Han Guilai* (IMech CAS, CN) |
| 12:30 | **hisst-2018_1440832** **Numerical Studies of Receptivity of a Supersonic Boundary Layer to Solid Particulates.** *P. Chuvakhov, A. Fedorov* (TsAGI, RU) | **hisst-2018_40401144** **Effect of Fuel Composition and Post-combustion Chamber length on Combustion Performance of Paraffin-based Hybrid Rocket Motor.** *Yi Wu, Zezhong Wang, Xilong Yu, Xin Lin, Fei Li* (IMech CAS, CN) | **hisst-2018_28701121** **Study on Ma2-7 Variable Geometry RBCC Performance Via Full Flow Path Simulations.** *Pan Hongliang, Ye Jinying, Qin Fei, Wang Yajun* (NPU, CN) | **hisst-2018_2810952** **Detailed Mathematical and Numerical Investigations of Shock Wave — Boundary Layer Interaction in Hypersonic Flows.** *S. Danaila, D. Isvoranu, C. Leveņiu, A. Bogoi* (PU Bucharest, RO) |
| 13:00 | **hisst-2018_880908** **Numerical Simulation of Mass Addition Effect on Heat Transfer of Descent Space Vehicle.** *N. Palchekovskaya, I. Egorov* (TsAGI, RU) | | **hisst-2018_1690847** **Numerical Study of Embedded Rocket on Back Pressure Resistance of an RBCC Inlet.** *Lei Shi, Haijian Lou, Da Gao, Shuaizhong Wang, Fei Qin, Guoqiang He* (NPU, CN) | **hisst-2018_13901077** **Influence of Free Stream Inhomogeneity on Heat Flux and Temperature on a Plate in a Supersonic Flow.** *G. Nikiforov, V. Lashkov, I. Mashek, R. Khoronzhuk* (SPbSU, RU) |
| 13:30 | *Lunch* | | | |
| 14:30 | **Plenary 4** *(Vrubel hall)* | | **Session Chair:** *Lihong Chen* (Chinese Academy of Sciences, China) | |
| 15:00 | **Value of Speed — Different Perspectives and Challenges.** *Volker Gollnick* (Institute of Air Transportation Systems, DLR, Germany) | | | |
| 15:30 | *Coffee Break* | | | |

## Wednesday, November 28

| *Bunin* | *Gogol* | *Dostoevsky* | *Turgenev* | Hall |
|---|---|---|---|---|
| **T&E-4** | **G&C-2** | **T&E-3** | **M&V-2** | Topic |
| **hisst-2018_38401106** **Temperature Measurements in a Carbon Dioxide Flow using Laser-induced Fluorescence.** *T. Sander, M. Kirschner, Ch. Mundt* (Bundeswehr Unv. Muenich, DE)*; A. S. Pudsey* (RMIT University, AU) | | **hisst-2018_2650953** **Scramjet Testing Methodology with Vitiated Air.** *M. Ferrier, D. Scherrer* (ONERA, FR) | **hisst-2018_1580839** **Technical Progress of Multiple-mission Reusable Launch Vehicle SpaceLiner.** *M. Sippel, S. Stappert, L. Bussler, S. Forbes-Spyratos* (DLR, DE) | 12:00 |
| **hisst-2018_38601093** **Investigation of Nonequilibrium Heat Exchange and Catalytic Properties.** *B. Zhestkov, A. Vaganov, I. Senyuev, V. Shtapov, M. Tselunov* (TsAGI, RU)*; I. Sakharov* (IMech MSU, RU) | | **hisst-2018_43001166** **Methods of the Wall Interference Reduction at Low Supersonic Velocities in the Wind Tunnel.** *A. Volkova, S. Chernyshev, A. Ivanov, E. Streltsov* (TsAGI, RU) | **hisst-2018_1900861** **Reusable Aerospace System of Horizontal Takeoff for Orbital Injection and Intercontinental Flight.** *S. Mikhalyov, V. Buzuluk* (TsAGI, RU) | 12:30 |
| **hisst-2018_2990962** **The performance of heat-resistant heterophase silicide coatings in hypersonic air-plasma flows.** *A. Astapov, I. Lifanov, V. Terentieva* (Moscow Aviation Institute, RU)*; B. Zhestkov* (TsAGI, RU) | | **hisst-2018_38901164** **Experiments of Asymmetric Exhaust Nozzle with High Temperature Gas Flow in Detonation Wave Tunnel.** *Xiaoyuan Zhang, Jinping Li, Hong Chen, Shizhong Zhang* (IMech CAS, CN), *Xuan Chen* (Science and Technology on Space Physics Laboratory, CN) | **hisst-2018_36401055** **Hyplane: Sub-orbital Easy and Common Access.** *G. Russo, R. Savino, D. Pisanti, M. Saviano, F. Perrelli* (CNS, IT) | 13:00 |
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| | | | | 15:30 |

## Wednesday, November 28

| Hall | *Vrubel* | *Onegin* | *Pechorin* | *Chekhov* |
|---|---|---|---|---|
| Topic | **A&A-7** | **PSC-7** | **PSC-8** | **A&A-8** |
| Chair | *P. Chuvakhov* (TsAGI, RU); *Y. Dobrov* (SPbSU, RU) | *I. Manuylovich* (TsAGI, RU); *Yue Huang* (Xiamen Unv., CN) | *Ke Dai* (Xiamen Unv., CN); *M Ferrier* (ONERA, FR) | *B. Reimann* (DLR, DE); *P. Polivanov* (ITAM SB RAS, RU) |
| 16:00 | **hisst-2018_1970864** **Aerodynamic Damping and Buffet Response Test of an Aeroelastic Launch Vehicle Model in Transonic Flow.** *Ji Chen* (CAAA, CN) | **hisst-2018_33801021** **Effect of Direct-reverse Successive Changes of Equivalence Ratios on Transient Combustion in a Scramjet Combustor.** *Yue Huang, Binyi Shenwu, Zhenye Luan, Fei Xing, Yancheng You* (Xiamen Unv., CN) | **hisst-2018_3010983** **Experiments on Liquid Kerosene Ignition in a Supersonic Combustor with Various Ignition Assistance Methods.** *Inyoung Yang, Kyungjae Lee, Sanghun Lee, Yangji Lee* (KARI, KO) | **hisst-2018_38101091** **Simulation of Support Module Separation in a Hypersonic Flight Experiment.** *B. Reimann* (DLR, DE) |
| 16:30 | **hisst-2018_460802** **High Credible Simulation and Validation of Turbulence Models Effects on a Low-aspect-ratio Flying-wing Model.** *Li Qing* (CAE, CN) | **hisst-2018_390987** **Numerical Investigation on A Free-jet Staged-Combustion Dual-mode Scramjet Combustor.** *Fang Chen, Di Lu* (Shanghai Jiao Tong University, CN) | **hisst-2018_15101002** **Active Flow Control of Wide-envelope Air-breathing Engine Inlet.** *Wang Jianlei, Li Tiangang, Wei Zhen, Chen Bing, Gong Chunlin, Gu Liangxian* (NPU, CN) | **hisst-2018_1480920** **Effect of Roughness of Bluntness Nose on the Laminar-turbulent Transition at High Mach Numbers.** *P. Polivanov, Yu. Gromyko, D. Bountin, A. Maslov* (ITAM SB RAS, RU) |
| 17:00 | **hisst-2018_2130878** **Nonlinear Flutter of Curved Composite Panels in High Speed Flow.** *An Xiaomin* (NPU, CN) | **hisst-2018_2160876** **Pulsation Frequency Management of Thrust Force and Gas Pressure in Nozzles.** *A. Khmelevsky, I. Manuylovich* (IMech MSU; TsAGI, RU), *V. Levin* (IMech MSU; TsAGI; IACP FEB RAS, RU); *N. Afonina, V. Gromov* (IMech MSU, RU); *V. Markov* (IMech MSU; TsAGI; V. A. Steklov Math. Inst., RU) | **hisst-2018_1780869** **Micro Cavity Control for Buzz Suppression in Supersonic Inlet.** *Ke Dai, Jian Teng, Xiao-Gang Zheng, Ian-Feng Zhu, Yan-Cheng You* (Xiamen University, CN) | **hisst-2018_41001129** **Influence of Angle of Attack on Hypersonic Wake Flow Structure of a Sharp Cone.** *Zhi Chen, Liang Zhang, Qingqing Zhang* (CAAA, CN) |
| 17:30 | **hisst-2018_13701094** **Study of Effects from Local Energy Deposition in Supersonic Gas Flow on Well-streamlined Body.** *Y. Dobrov, V. Lashkov, I. Mashek, R. Khoronzhuk* (SPbSU, RU) | | **hisst-2018_58201625** **The High-Speed Cruise Ramjet Hydrogen Demonstrator for Hypersonic Flight Velocitie.** *E. Son* (MIPT; JIHT RAS, RU); *V. Degtyar, V. Khlybov* (FRC by Makeev, RU); *A. Prokhorov, K. Arefiev, V. Alexandrov, O. Guskov* (MIPT; CIAM, RU); *S. Kalashnikov* (FRC by Makeev, RU); *R. Sidorov* (CIAM, RU); *K. Son* (MIPT, RU) | **hisst-2018_2010873** **Drag Reduction of Hypersonic Spiked Blunt Body with Sideward Jets.** *Guilai Han, Zonglin Jiang* (IMech CAS, CN) |

## Wednesday, November 28

| *Bunin* | *Gogol* | *Dostoevsky* | Hall |
|---|---|---|---|
| **T&E-6** | **HFH-2** | **T&E-5** | Topic |
| *J.A. Myrick* (Tennessee Unv., US); *A Fedorov* (TsAGI, RU) | *R. P. H. Berton* (ONERA, FR); *A. Kosinov* (ITAM RAS, RU) | *V. Lebiga* (ITAM SB RAS, RU); *Chun-lin Gong* (NPU, CN) | Chair |
| **hisst-2018_24501049** **Thin Film Heat Transfer Sensor Instrumentation Research and Development at CAAA Impulse Tunnel.** *Lin Jian, Chen Xing, Wang Dan* (CAAA, CN) | **hisst-2018_660805** **Analytic Model of a Resistive Magneto-hydrodynamic Shock.** *R. P. H. Berton* (ONERA, FR) | **hisst-2018_41701142** **The Wind Tunnel Test Method of Airframe-propulsion Integration for Rocket-based Combined Cycle Launch Vehicle.** *Chun-lin Gong, Bing Chen, Jian-lei Wang, Tian-gang Li, Liang-xian Gu, Shuo Tang* (NPU, CN) | 16:00 |
| **hisst-2018_2270994** **Fine Control of Piston Operation in FD-21 Free-piston Shock Tunnel.** *Li Chen* (SAAA, CN) | **hisst-2018_47801549** **Interaction of Oblique Shock Wave with the Bow Wave in the Presence of Underlying Plate.** *V. Borovoy, V. Mosharov, V. Radchenko, A. Skuratov* (TsAGI, RU) | **hisst-2018_41501173** **Sources and Structure of Fluctuations in High Speed Wind Tunnels.** *V. Lebiga, V. Zinovyev, A. Pak, A. Ivanov, A. Gorbushin* (ITAM SB RAS; TsAGI, RU) | 16:30 |
| **hisst-2018_1720965** **Calibration of a Plate Sensor for Total Heat Transfer into a Surface with a Spatially and Time Varying Heat Flux.** *J. A. Myrick, M. Keyhani, J. I. Frankel* (Tennessee Unv., US); *M. Bouchezt, F. Falempintt* (MBDA, FR) | **hisst-2018_12301201** **Experimental Study of Origin of Turbulence and Laminar-turbulent Transition in Inhomogeneous Supersonic Boundary Layers.** *A. Kosinov* (ITAM SB RAS, RU) | **hisst-2018_22901047** **An Energy-saving Aerodynamic Layout for Large-scale Conventional Hypersonic Wind Tunnel.** *Tiejin Wang* (IWTE, CN) | 17:00 |
| **hisst-2018_33901024** **Study of Thermal Conductivity Identification on Semi-transparent Aerogel Materials.** *Xiaona Chen* (Beijing Aerospace Technology Ints., CN) | **hisst-2018_17401155** **On Effective Implementation of Block LU-SGS Scheme on Hybrid Unstructured Grid for Hypersonic Flow.** *X. Li, X. Wang, Z. Shi, Y. Zhang* (Institute of Mechanics, CN) | **hisst-2018_2610913** **Three-dimensional Measurements on a Supersonic Jet Flame Based on Tomographic Chemiluminescence.** *Qingchun Lei, Bing Liu, Yeqing Chi, Jiawei Zheng, Yibin Xia, Wei Fan* (NPU, CN) | 17:30 |

## Thursday, November 29

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| 08:30 | **Speaker's Briefing** (*Vrubel foyer*) | | | |
| 09:00 | **Plenary 5** *(Vrubel hall)* | | **Session Chair:** *Adam Siebenhaar* (Mach 7H, United States) | |
| 09:30 | **Sonic Boom Problem: Past, Present and Future.** *Vasily Fomin, Tatiana Kiseleva, Vladislav Volkov* (ITAM SB RAS, Russia), ***Sergey Chernyshev*** (TsAGI, Russia) | | | |
| Hall | *Vrubel* | *Onegin* | *Pechorin* | *Bunin* |
| Topic | **HFH-3** | **PSC-9** | **T&E-7** | **M&V-3** |
| Chair | *A. Novikov* (TsAGI, RU); *Bing Chen* (NPU, CN) | *V. Markov* (IMech MSU, RU); *A. Firsov* (JIHT RAS, RU) | *A. Gorbushin* (TsAGI, RU); *T. Bykerk* (Sydney Unv., AU) | *A. Pavlenko* (TsAGI, RU); *G. De Zaiacomo* (Deimos Space S.L.U., ES) |
| 10:00 | **hisst-2018_32101141** **The Nonlinear Multi-Physics Coupling of Airframe-propulsion Integration for the Air-breathing Launch Vehicle.** *Bing Chen, Chun-lin Gong, Jian-jun Gou, Dan Chen, Liang-xian Gu* (NPU, CN) | **hisst-2018_9801058** **Study of Detonation Waves by Means of Mathematical Modeling.** *V. Levin, I. Manuylovich, V. Markov* (MSU, IMech MSU, RU) | **hisst-2018_46401203** **Aerodynamic Characteristics of Generic Test Models under High-Temperature Real-gas Condition in Free-PIston Shock Tunnel HIEST.** *H. Tanno, T. Komuro, K. Sato, K. Itoh* (JAXA; KSC; Kakuda Miyagi, JP) | **hisst-2018_600969** **Combined Approach to Aerodynamic Shape Optimization.** *N. Ageev, A. Pavlenko* (TsAGI; MIPT, RU) |
| 10:30 | **hisst-2018_36501072** **Parametric Investigation of the Front Section of an Aircraft for Optical Purposes.** *M. Ledyankin, A. Batrakov, S. Mikhaylov* (KAI, RU) | **hisst-2018_33401015** **Stabilization and Control of Detonation in Supersonic Gas Flow in Plane Channel.** *T. Zhuravskaya* (IMech MSU; TsAGI, RU); *V. Levin* (IMech MSU; TsAGI; ACPI FEB RAS, RU) | **hisst-2018_43801200** **Current Status of the DLR Reusability Flight Experiment — ReFEx.** *P. Rickmers, W. Bauer, M. Sippel, S. Stappert* (DLR, DE) | **hisst-2018_15901025** **A Multi-Objective Optimization for the Aerodynamic Configuration of a Re-entry Vehicle based on MOEA/D.** *Yi Li, Su Cao, Shuo Tang* (NPU, CN) |
| 11:00 | **hisst-2018_18401076** **Interaction of Free and Bow Shock Waves with Local Gas Inhomogeneities.** *O. Sutyrin, V. Levin* (MSU; IMech MSU; TsAGI, RU); *P. Georgievskiy* (MSU, IMech MSU, RU) | **hisst-2018_13801027** **Two Motion of Freedom Piston Pump Developed for Hypersonic Aircrafts.** *Lingfeng Wang, Chengjian Pan, Wenqing Shao* (BATI, CN); *Jian Ruan, Sheng Li, Liang Chang* (Zhejiang TU, CN) | **hisst-2018_36601057** **Experimental Study of the Influence of Small Angles of Attack and Bluntness of a Cone on Stabilization of Hypersonic Boundary Layer Using a Passive Porous Coating.** *S. Morozov, S. Lukashevich, A. Shiplyuk* (ITAM SB RAS, RU) | |
| 11:30 | *Coffee Break* | | | |

## Thursday, November 29

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| | | | 08:30 |
| | | | 09:00 |
| | | | 09:30 |
| *Gogol* | *Dostoevsky* | *Turgenev* | Hall |
| **G&C-3** | **M&S-2** | **TEM-2** | Topic |
| *O. Yanova* (TsAGI, RU); *A. Golikov* (TsAGI, RU) | *G. Dugast,* (MBDA-INSA Centre Val de Loire, FR); *K. Zhirikhin* (TsAGI, RU) | *V. Villace* (ESA-ESTEC, Netherlands); *Jian-Jun Gou* (NPU, CN) | Chair |
| **hisst-2018_26601040** **New Generation of Adaptive Guidance Systems for Aerospace Transport Systems.** *O. Yanova, A. Filatyev, S. Petrokovsky* (TsAGI, RU) | **hisst-2018_1090835** **Sparse Locally Linear Embedding for Modal Identification.** *Wei Guan, L. L. Dong* (Xi'an Jiaotong Unv., CN) | **hisst-2018_1430831** **Statistical Simulation of the Hypersonic Aircraft Pressurized Compartment and Surface Cooling System Thermal State.** *S. Gusev, V. Nikolaev* (SibNIA, RU) | 10:00 |
| **hisst-2018_33301012** **Integrated Optimization of Aerospace Vehicles based on the Maximum Principle.** *A. Golikov, A. Filatyev, B. Akobyan* (TsAGI, RU) | **hisst-2018_2630981** **High performance algorithm development for material with different moduli in tension and compression.** *Zhang yupeng, Quan dongliang* (Beijing aerospace technology inst., CN); *Du zongliang, Guo xu* (Dalian Unv. of technology, CN) | **hisst-2018_2280892** **Numerical Assessment of a Transpiration Cooled Wedge with adapted Permeability.** *Ch. Dittert, H. Böhrk* (DLR, DE); *S. Löhle* (Stuttgart Unv., DE) | 10:30 |
| **hisst-2018_37001103** **Health Monitoring of Aircraft Components and Assemblies through Non-destructive Methods.** *A. Chekin, I. Roberov, D. Figurovsky, V. Grama, D. Matveev, M. Kiselev* (GosNIIAS, RU) | **hisst-2018_2090907** **Structural Design of High-speed Vehicle with Topology Optimization.** *Tong Gao, Lei Tang, Zhiguang Zhao, Longlong Song, Xueying Qiu, Dihuan Wu* (NPU, CN); *Guanghui Shi, Qianying Zhou, Dongliang Quan* (BATI, CN) | **hisst-2018_560883** **Large Eddy Simulation of Combustion in Full-scale Kerosene Fueled RBCC Engine.** *Bing Liu, Guoqiang He, Fei Qin, Duo Zhang, Xianggeng Wei* (NPU, CN) | 11:00 |
| | | | 11:30 |

## Thursday, November 29

| Hall | *Vrubel* | *Onegin* | *Pechorin* | *Bunin* |
|---|---|---|---|---|
| Topic | **HFH-3** | **PSC-9** | **T&E-7** | **M&V-3** |
| 12:00 | **hisst-2018_3280998** **A Simple Extending Strategy for TENO Scheme: Scalar Equation and Euler Equations.** *Fan Zhang, Chunguang Xu* (Sun Yat-sen Unv., CN); *Jun Liu* (Dalian TU, CN) | **hisst-2018_26001011** **On Shock Train Interaction with Combustion Oscillations in a Cavity Flame Holder During Accelerating Experiments.** *Huan Lian, Hongbin Gu, Lianjie Yue, Xinyu Chang* (IMech, CN) | **hisst-2018_1620842** **Performance and Stability Analysis of a Hypersonic Vehicle for a Low Speed Flight Test Program.** *T. Bykerk, D. Verstraete* (Sydney Unv., AU); *S. Wolf, V. Villace, J. Steelant* (ESA-ESTEC, NL) | **hisst-2018_40801128** **Research Methods for Electric Actuator Characteristics of High-speed Unmanned Aerial Vehicle in Aeroservoelasticity Tasks.** *S. Parafes, I. Turkin* (MAI, RU) |
| 12:30 | **hisst-2018_1170817** **Dynamical Detonation Stabilization of Supersonic Combustible Mixtures in Expanding Channels.** *Xiaodong Cai, Jianhan Liang, Zhiyong Lin* (NUDT, CN); *R. Deiterding* (Southampton Unv., UK) | **hisst-2018_2510935** **Effect of Suction on a Sort of Supersonic Inlet.** *Ming Gao, Huacheng Yuan, Tao Yin, Rongwei Guo* (NUAA, CN) | **hisst-2018_29801111** **Investigation of the Influence of the Perforated Walls of the T-128 Wind Tunnel on the Aerodynamic Characteristics of the Reentry Vehicle at Transonic Speed.** *A. Gorbushin, S. Glazkov, A. Semenov, A. Lidovskiy, A. Podpaskov, G. Troshkov* (TsAGI , RU) | **hisst-2018_1280823** **Mars Sample Return: Entry Descent And Landing Analyses For Architecture Assessment Study.** *G. De Zaiacomo, I. Pontijas Fuentes, S. Centuori, P. Hermosín* (Deimos Space S.L.U., ES); *H. Johnson* (MDA Corp., CA) |
| 13:00 | **hisst-2018_1400830** **Asymptotic Theory of the Viscous Transonic Gas Flow.** *A. Bogdanov* (IMech MSU, RU) | | | |
| 13:30 | *Lunch* | | | |
| 14:30 | **Plenary 6** *(Vrubel hall)* | | **Session Chair:** *Adam Siebenhaar* (Mach 7H, USA) | |
| 15:00 | **Flows with Combustion and Detonation. Physical and Computational Experiment.** *Vladimir Levin* (Institute of Mechanics of MSU, Russia) | | | |
| 15:30 | *Coffee Break* | | | |

## Thursday, November 29

| *Gogol* | *Dostoevsky* | *Turgenev* | | Hall |
|---|---|---|---|---|
| **G&C-3** | **M&S-2** | **TEM-2** | | Topic |
| **hisst-2018_1600874** **A Multiobjective Hypersonic Reentry Trajectory Optimization Model.** *L. Hongqing, Zhanxia Zhu, Y. Jianping* (NPU, CN) | **hisst-2018_990964** **Determination of Thermophysical Properties for Short Fibers Reinforced Phenolic Composite and Its Thermal Behaviour under Kerosene/Air Flame.** *G. Dugast, K. Chetehouna, N. Gascoin, M. Bouchez, J.L. Marceau* (MBDA-INSA Centre Val de Loire, FR) | | | 12:00 |
| **hisst-2018_1460891** **Damage Detection and Localisation of CMCs by Means of Electrical Health Monitoring.** *T. Staebler, H. Böhrk, H. Voggenreiter* (DLR, DE) | **hisst-2018_590798** **Experimental and Numerical Investigation on Startup of Leading-Edge-shaped Heat Pipes.** *Chen Siyuan, Ai Bangcheng, Han Haitao, Hu Longfei, Chu Min, Chen Liang* (CAAA, CN) | **hisst-2018_370870** **The TPS Design of a Reusable Launch Vehicle based on Active Cooling.** *Jian-Jun Gou, Jia-Xin Hu, Chun-Lin Gong, Bing Chen, Liang-Xian Gu* (NPU, CN) | | 12:30 |
| | **hisst-2018_2990961** **Heterophase materials in $ZrSi_2$-$ZrB_2$-$MoSi_2$ system: synthesis, kinetics and mechanisms of high-temperature oxidation.** *A. Astapov, I. Lifanov, M. Prokofiev, L. Rabinskiy* (MAI, RU); *E. Levashov, Yu. Pogozhev, A. Potanin* (MISIS, RU) | **hisst-2018_1670845** **Numerical Study on a Multi-Sample Transpiration-Cooled Channel Flow.** *A. Trübsbach, Ch. Kromer, M. Selzer* (DLR, DE); *A. Schwab* (Stuttgart Unv., DE) | | 13:00 |
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## Thursday, November 29

| Hall | *Vrubel* | *Onegin* | *Pechorin* | *Turgenev* |
|---|---|---|---|---|
| Topic | **A&A-9** | **PSC-10** | **T&E-8** | **O&S-2** |
| Chair | *Cui Kai* (IMech CAS, CN); *Ch. Mundt* (Bundeswehr Muenich Unv., DE) | *P.R. Ess* (DLR, DE), D. Lapinsky (TsAGI, RU) | *A. Volkova* (TsAGI, RU); *Shizhong Zhang* (IMech CAS, CN) | *R. Fusaro* (Politecnico di Torino, IT); *Qian Zhansen* (AVIC ARI, CN) |
| 16:00 | **hisst-2018_2830937** **Effects of the Lift-to-drag Ratio on Climbing Characteristics of Reusable Launch Vehicles.** *Cui Kai, Xu Yingzhou, Li Guangli, Xiao Yao, Wang Haoxiang* (IMech CAS, CN) | **hisst-2018_1701068** **Experimental Investigation of the Hydrogen Combustion Chamber and its Complement with 2.5D CFD Data.** *V. Talyzin, V. Vlasenko, O. Voloschenko, M. Ivankin, A. Nikolaev* (TsAGI, RU) | **hisst-2018_43101169** **Novel Transient Calorimetric Heat Flux Sensor in Hypersonic Ground Experiment.** *Shizhong Zhang, Jinping Li, Hong Chen, Xiaoyuan Zhang, Hongru Yu* (IMech CAS, CN) | **hisst-2018_10801022** **Dynamic Airspace Sectorization to Enable Flight Centric Operations.** *M. Schultz, A. Temme, I. Gerdes* (DLR, DE) |
| 16:30 | **hisst-2018_38501137** **Computation of Hypersonic Flows on Compression Corner using modified k-ω model.** *A. A. Pasha, Kh. A. Juhany* (King Abdulaziz Unv., SA) | **hisst-2018_39501104** **Simulation of Pressure Gain Combustion in a Wave Rotor.** *P. R. Ess* (DLR, DE) | **hisst-2018_1990866** **The Preliminary Application of MHD Power Generation in Arc Heated Test.** *Ou Dongbin, Chen Lianzhong, Gao He, Zhu Anwen, Liu Lei, Peng Yan, Liu Baolin* (CAAA, CN) | **hisst-2018_24701082** **Towards Future LH2 Productive Scenarios.** *R. Fusaro, V. Vercella, D. Ferretto, N. Viola* (Politecnico di Torino, IT); *V.F. Villace, J. Steelant* (ESA-ESTEC, NL) |
| 17:00 | **hisst-2018_2460966** **Reentry Blackout Simulation Using CFD Combined with Radio Transmission Calculation.** *Hu Ning* (PKU, CN) | **hisst-2018_2430905** **Design and Aerodynamic Performance Analysis of a Axisymmetric Variable Geometry Inlet.** *Yunfei Wang, Huacheng Yuan, Jinsheng Zhang, Zhenggui Zhou* (NUAA, CN) | **hisst-2018_40901130** **Development and Performance Validation of Konkuk University Ludwieg Tube (KULT).** *Sungmo Yang, Yung Hwan Byun, Soo Hyung Park* (Konkuk Unv., KR) | **hisst-2018_1660844** **Integration and Evaluation of the Impact of Space Vehicle Operations in the European ATM.** *T. Luchkova, S. Kaltenhäuser, N. Klay, M. Schultz* (DLR, DE); *R. B. R. Ang* (NTU, SG) |
| 17:30 | | | | **hisst-2018_2070872** **The supersonic penetrators for delivering of any kind payload.** *A. Bagrov, V. Leonov, V. Sysoev, S. Lemeshevsky* (Lavochkin Assossiation, RU) |

## Guidance & Control Systems

### hisst-2018_1130819

**Optimized Reentry Trajectories for Winged RLV Stages**

*L. Bussler*
German Aerospace Center (DLR) Institute of Space Systems, Germany

**Speaker:** *Leonid Bussler*
Space Launcher Systems Analysis (SART) — DLR Institute of Space Systems, Bremen;
Since 2015: Scientific staff in SART department at DLR Institute of Space Systems, Bremen;
2012 — 2015: Controller Spacecraft Operations, SES.

**Synopsis:**

### hisst-2018_1580867

**Bringing Highly Efficient RLV-Return Mode "In-Air-Capturing" to Reality**

*M. Sippel, L. Bussler, S. Krause, S. Cain*
German Aerospace Center (DLR), Germany

**Speaker:** *Dr. Martin Sippel*
Head of DLR (German Aerospace Centre)'s Space Launcher Systems Analysis (SART) in the Institute for Space Systems (Bremen).

**Synopsis:** The SpaceLiner ultra-high-speed rocket-propelled passenger transport is in Phase A conceptual design. The critical separation of the passenger cabin and rescue capsule and its subsystems are one topic of the paper. The separation process is critically investigated taking into account multi-body dynamics and advanced CFD-simulations. Potential intercontinental flight routes, considering range-safety and sonic boom constraints as well as good reachability from major business centers, are evaluated.

### hisst-2018_1280824

**Space Rider: Entry and Taem GNC of the Future European Reusable Space Transportation System**

*G. De Zaiacomo, C. Recupero, A. Pagano, M. Kerr, P. Rosa, R. Haya-Ramos*
Deimos Space S.L.U., Spain

**Speaker:** *Gabriele De Zaiacomo*
Senior Engineer in the Atmospheric Flight Competence Centre at the Flight Systems B.U. at DEIMOS Space, with 11 years' experience in Mission Analysis and GNC for atmospheric flight, including flight mechanics, re-entry systems, and entry guidance.

**Synopsis:** This paper focuses on the Entry, Descent and Landing (EDL) Mission Analysis verification activities of the ESA/Roscosmos ExoMars 2020 mission, presenting the activities performed by DEIMOS Space in the programme Phase C to support the EDL Critical Design Review (CDR) in strict collaboration with Thales Alenia Space.

### hisst-2018_38001112

**Aircraft Actuating System Fault Diagnosis under Complete Uncertainty**

*E. Zybin, V. Kosyanchuk, S. Karpenko*
GosNIIAS, Russia

**Speaker:** *Eugene Zybin*

**Synopsis:**

### hisst-2018_1770922

**Design of the Actuation System of the HEXAFLY-INT Hypersonic Glider**

*J.-Y. Andro [1], F. Nebula [2], W. Rotärmel [3]; J. Steelant [4]*
[1] ONERA, France; [2] CIRA, Italia;
[3] German Aerospace Center (DLR), Germany;
[4] ESA-ESTEC, Netherlands

**Speaker:** *Jean-Yves Andro*
Master of Engineering in Aeronautics & Astronautics, PhD in AerodynamicsSenior Research Engineer at

ONERA: Hypersonic Vehicles Design, Aerothermodynamics, Thermal Management, Engineering.

**Synopsis:** This paper presents the thermal management of the HEXAFLY-INT hypersonic glider. It describes first the choice of materials for the different components of the vehicles and the selected external Thermal Protection System. Then, it deals with the design of the internal Thermal Control System of the equipment: internal thermal protection against radiation, insulation washers at the fixation point, heat storage device based on Phase Changing Material.

### hisst-2018_11201006

**Optimum Trim of an Experimental Hypersonic Glider**

*V.F. Villace*
ESA, Netherlands;
*S. Takovitskii*
Central Aerohydrodynamic Institute (TsAGI), Russia

**Speaker:** *Victor Fernandez Villace*

**Synopsis:**

### hisst-2018_1630843

**Development of High Speed Flying Vehicle on-Board Integrated Navigation, Control and Guidance System**

*M. Krasilshchikov*
Moscow Aviation Institute, Russia
*K. Sypalo*
Central Aerohydrodynamic Institute (TsAGI), Russia

**Speaker:** *Mikhail Krasilshchikov*

**Synopsis:**

### hisst-2018_1860856

**Trajectory and Flight Mechanics Analysis of the HEXAFLY-INT Experimental Flight Vehicle**

*G. Morani, F. Nebula, S. Di Benedetto, M. P. Di Donato*
CIRA, Italy
*J. Steelant*
ESA-ESTEC, Netherlands

**Speaker:** *Francesco Nebula*
Senior Researcher at CIRA (Italian Aerospace Research Centre) with experience on algorithms for autonomous flight, particularly on the navigation. His education includes a Master degree in Aeronautical Engineering and a PhD in Information Engineering.

**Synopsis:** In the HEXAFLY-INT project, the Experimental Flight Test Vehicle (EFTV) will perform a suborbital trajectory with an apogee at 90 km. After the release at 55 km, it will perform a pull-out manoeuver bringing it to a leveled flight, while the experimental phase will start at Mach 7. The mission objectives and constraints are considered as inputs in the trajectory generation process. The paper describes this process and the dispersion analysis as well, taking into account the available uncertainties.

### hisst-2018_37001100

**Optimal Climbing Trajectories of Hypersonic Aircraft based on Direct Methods of Flight Dynamics**

*A. Chekin, M. Kiselev, Ya. Moroshkin*
GosNIIAS, Russia

**Speaker:** *Andrey Chekin*

**Synopsis:**

### hisst-2018_1800991

**Differential Flatness-Based Finite Time Sliding Mode Control of Hypersonic Vehicle**

*W. Yuxiao, Tao Chao, Songyan Wang, Ming Yang*
Harbin Institute of Technology, China

**Speaker:** *Yuxiao Wang*
Harbin Institute of Technology, Control and Simulation Center Reporter, email: chaotao2000@163.com.

**Synopsis:** Differential flatness method is applied to the linearization of the longitudinal model of HV. A finite time convergent controller is designed for the nominal linearized model. Then an integral sliding mode controller is added to deal with the uncertainty of the system. In addition, a discrete linear tracking differentiator (TD) is used to extract high order differential signal of the system, which can avoid the high order differential signal polluted in the numerical calculation.

### hisst-2018_33301012

**Integrated Optimization of Aerospace Vehicles Based on the Maximum Principle**

*A. Golikov, A. Filatyev, B. Akobyan*
Central Aerohydrodynamic Institute (TsAGI), Russia

**Speaker:** *Alexander Golikov*
Education: 1989.
Master of Science: Moscow Institute of Physics and Technology (MIPT).
1989 — Present: Central Aerohydrodynamic Institute (TsAGI), Senior Research Scientist, Flihgt Dynamics & Control Division.

**Synopsis:** The technique of integrated optimization of aerospace vehicle parameters and trajectories by the united criterion of target efficiency is described. The technique uses a decomposition of a multidisciplinary problem into single-disciplinary subtasks of flight dynamics and control, aerodynamics, propulsion and structures based on the Pontryagin maximum principle. The qualitatively new optimal solutions in comparison with traditional ones are revealed due to the proposed approach.

### hisst-2018_37001103

**Health Monitoring of Aircraft Components and Assemblies through Non-destructive Methods**

*A. Chekin, I. Roberov, D. Figurovsky, V. Grama, D. Matveev, M. Kiselev*
GosNIIAS, Russia

**Speaker:** *Andrey Chekin*

**Synopsis:**

### hisst-2018_1600874

**A Multiobjective Hypersonic Reentry Trajectory Optimization Model**

*L. Hongqing, Zhanxia Zhu, Y. Jianping*
Northwestern Polytechnical University, China

**Speaker:** *Hongqing Liu*

**Synopsis:**

### hisst-2018_1460891

**Damage Detection and Localisation of CMCs by Means of Electrical Health Monitoring**

*T. Staebler, H. Böhrk, H. Voggenreiter*
German Aerospace Center (DLR), Germany

**Speaker:** *Tina Staebler*
After graduating as aerospace engineer in 2014 Tina Stäbler started her Ph.D. at the German Aerospace Center (DLR) in Stuttgart. She is now project leader of IRAS, where an integrated research platform for affordable satellites is developed.

**Synopsis:** In this work electrical resistance measurements are used to detect damages in a TPS. It will be shown, that this method reacts even to small damages where less than 0.02 % of the monitored surface is damaged and defects can be localised.

## High-Speed Aerodynamics and Aerothermodynamics

**hisst-2018_3101062**

**ADVANCE: A Space Vehicle Analysis and Design Tool**

*J. Steelant, J. Van den Eynde*
European Space Agency — ESTEC, Netherlands
*Ph. Reynier*
Ingénierie et Systèmes Avancés, France

**Speaker:** *Johan Steelant*

Johan Steelant graduated in 1989 (University of Ghent) as mechanical Engineer, in 1990 from the University of Brussels as aerospace engineer. He got his PhD on turbulence and transition modelling at the University of Ghent. Presently working at EUROPEAN SPACE AGENCY — ESTEC.

**Synopsis:**

**hisst-2018_1620897**

**High and Low Speed Analysis of a Re-usable Unmanned Re-entry Vehicle**

*T. Bykerk, D. Verstraete*
The University of Sydney, Australia
*G. Pezzella*
CIRA, Italy
*A. Viviani*
University of Campania, Italy

**Speaker:** *Tamas Bykerk*

PhD student at the University of Sydney, researching the low speed handling qualities of hypersonic vehicles. My specialisation is in experimental aerodynamics and CFD.

**Synopsis:** Re-usable, unmanned re-entry vehicles are an efficient way to experimentally validate next generation re-entry technologies. During the descent phase, free-stream velocities ranging from hypersonic to low subsonic are encountered, which requires a careful choice of aeroshape. Results from the V-one aircraft, developed by CIRA, are presented. These include aerodynamics, static stability and control authority at both low and high speed. Low speed studies are supported by a wind tunnel tests.

**hisst-2018_2940957**

**Aerodynamic and Aerothermodynamic Database of the HEXAFLY-INT Hypersonic Glider**

*A. Schettino, G. Pezzella, M. Marini, S. Di Benedetto*
CIRA, Italy
*V.F. Villace, J. Steelant*
ESTEC-ESA, Netherlands
*A. Gubanov, N. Voevodenko*
Central Aerohydrodynamic Institute (TsAGI), Russia

**Speaker:** *Antonio Schettino*

He works since 1990 in the field of Computational Fuid Dynamics, being envolved in CFD codes development and applications mainly in the fields of Aerothermodynamics and liquid propulsion. He is currently head of Aerothermodynamics Unit at CIRA.

**Synopsis:** The paper is devoted to the aerodynamic and aerothermodynamic characterization of the HEXAFLY-INT hypersonic glider, developed in the frame of an international project co-funded by EU and ESA. The project is aimed to design, manufacture and test in flight an innovative gliding hypersonic vehicle, characterized by high aerodynamic efficiency and equipped with several breakthrough technologies. The aero-database is built by means of several CFD simulations and a dedicated experimental test campaign.

**hisst-2018_3250999**

**Dynamic Effects of MHD Interaction in Hypersonic Flow Under Ground-Based Experiment Conditions**

*S. Bychkov, D. Baranov, V. Bityurin, A. Bocharov, V. Grushin, N. Tretyakova*
Joint Institute for High Temperatures (JIHT), Russia
*N. Batura, N. Kolushov, E. Vasilevsky, N. Zhurkin*
Central Aerohydrodynamic Institute (TsAGI), Russia

**Speaker:** *Sergey Bychkov*

**Synopsis:** The main purpose of the experiment-calculated studies is to determine the scale of the dynamic effect caused by changes in gas-dynamic forces on the surface of an aircraft as a result of the magneto

hydrodynamic interaction of a high-velocity flow with a strong magnetic field. The practical prospect of the research is related to the use of electric and magnetic fields to develop new methods for controlling the flow of a flying body by a gas-plasma stream.

### hisst-2018_2670918

**Numerical Simulation of Transpiration Cooling Experiments in Supersonic Flow using OpenFOAM**

*D. Prokein, J. von Wolfersdorf*
ITLR, Germany
*C. Dittert, H. Böhrk*
German Aerospace Center (DLR), Germany

**Speaker:** *Daniel Prokein*
Researcher at the Institute of Aerospace Thermodynamics (ITLR) in Stuttgart, Germany and working on his Ph.D. thesis on the topic of "Numerical and experimental investigations on transpiration cooling applied to CMC materials" (to be completed in 2019).

**Synopsis:** In the given study, we present a fully coupled OpenFOAM solver that is capable of simulating transpiration cooling processes for complex porous structures exposed to hot supersonic main flows. The solver is applied to testcases with a flat and a double wedge porous CMC sample and compared to experimental data for validation purposes. The numerical results are in good overall agreement with the measurements while capturing the influences of blowing ratio as well as variations of the external flow field.

### hisst-2018_16501075

**Experimental Investigation of the Boundary Layer State Hysteresis and its Influence on the Starting of the Streamline-traced Intake**

*V. Golubkin, S. Aleshin, A. Gubanov, I. Nazhimov, V. Talyzin, Yu. Shvalev, V. Yakovleva*
Central Aerohydrodynamic Institute (TsAGI), Russia

**Speaker:** *Valeriy Golubkin*
Professor, doctor of technical sciences; leading researcher of the Central Aerohydrodynamic Institute n.a. prof N.E. Zhukovsky. Basic results in unsteady aerodynamics under the impact of weak shock waves; general properties of viscous.

**Synopsis:** The results of thermal testing of high-speed aircraft model with the streamline-traced dorsal intake and internal power engine duct in the super/hypersonic TsAGI T-116 wind tunnel are presented. Boundary layer state on the compression intake surface was found to depend on a flight regime and particular type of turbulence stimulators. In addition to mass flow rate hysteresis found earlier, the boundary layer state hysteresis was discovered to accompany forward and reversed angle-of-attack change for definit.

### hisst-2018_2930950

**Direct Numerical Simulation of Mach Wave and Supersonic Boundary Layer Interaction**

*I. Egorov*
Central Aerohydrodynamic Institute (TsAGI), Russia
*Q. Din, A. Fedorov*
Moscow Institute of Physics and Technology, Russia

**Speaker:** *Ivan Egorov*

**Synopsis:**

### hisst-2018_2340898

**Distinctive Features of Heat Exchange and Laminar-turbulent Transition in Hypersonic Boundary Layers on Flat Blunted Bodies**

*V. Shalaev, M. Starodubtsev*
Moscow Institute of Physics and Technology, Russia
*S. Alexandrov, A. Vaganov*
Central Aerohydrodynamic Institute (TsAGI), Russia

**Speaker:** *Vladimir Shalaev*

**Synopsis:**

### hisst-2018_2760930

**Study on 3D Lattice Boltzmann Method for High-speed Viscous Flows**

*Ruofan Qiu, Yancheng You, Rongqian Chen, Chenxiang Zhu, Jianfeng Zhu*
Xiamen University, China

**Speaker:** *Ruofan Qiu*
Postdoctor of School of Aerospace Engineering, Xiamen University. Compelted PHD from Tongji Univer-

sity. Research work focus on advance CFD method, comressible lattice Boltzmann method, mechanics of complex supersonic flows, etc.

**Synopsis:** The lattice Boltzmann method, which is based on microscopic models and mesoscopic kinetic equations for particle distribution functions, has become a prominent tool in CFD. The 3D lattice Boltzmann method in the framework of coupled double-distribution-function approach for high-speed viscous flows, in which specific-heat ratio and Prandtl number can be adjustable, is developed and studied in this paper.

### hisst-2018_43301174

**Effect of Reacting Flow on Flutter at Hypersonic Flight Speed**

*V. Vedeneev*
Lomonosov Moscow State University, Russia
*V. Nesterov*
Moscow Aviation Institute, Russia
*A. Medvedskii, K. Sypalo*
Central Aerohydrodynamic Institute (TsAGI), Russia

**Speaker:** *Vasily Vedeneev*
Vasily Vedeneev is an associate professor at the Faculty of Mechanics and Mathematics, and a head of lab in the Institute of Mechanics of Lomonosov Moscow State University. His research fields are aeroelasticity, hydroelasticity, and hydrodynamic stability.

**Synopsis:** In the flutter analysis of supersonic flight vehicles, the air is usually considered as perfect gas, and linearised aerodynamic theory is used. At hypersonic speeds, two effects become significant: aerodynamic nonlinearity and chemical reactions in the flow. While the first effect was excessively studied in literature, the effect of reactions with respect to flutter was not studied previously. In this paper we analyze the changes in the flutter theory produced by chemical reactions.

### hisst-2018_2030871

**Analysis of Hypersonic Model Pitching Experiments in the TUSQ Facility**

*N. Stern, D.R. Buttsworth, R. Choudhury, B. Reimann*
School of Mechanical and Electrical Engineering, University of Southern, Queensland, Australia

**Speaker:** *Nathan Stern*
Nathan Stern is a PhD student from the University of Southern Queensland, Australia. His thesis topic is the development of small-scale robots, used to demonstrate hypersonic control in the Mach 6 Ludweig tube facility.

**Synopsis:** Experiments have been performed in the TUSQ hypersonic facility on the control of hypersonic models using 3D printed test models fitted with on-board actuation and data-sampling electronics. Analysis of experiments on a pivoted body with an actuated elevator is proceeding through the use of analytical and computational simulations. Our aim is to attempt to emulate the control system using CFD packages such as Eilmer 4 and the DLR TAU-Code.

### hisst-2018_13401004

**Method for Solving the Equations Describing the Interaction of a 3-D Boundary Layer with an Outer Inviscid Supersonic Flow**

*G. Korolev*
Central Aerohydrodynamic Institute (TsAGI), Russia

**Speaker:** *Georgii Korolev*
Born: November 10, 1952 E-mail: glk777@mail.ru, phones: +7903-133-55-001999 DSc. 1988 First Zhukovsky Prize Winner in hydrodynamics, USSR.

**Synopsis:** Advanced computational method is developed for solving the three-dimensional time-independent equations describing the interaction of a laminar boundary layer with an outer inviscid flow. By applying the method, the problem of the three-dimensional viscous supersonic gas flow over a roughness element (ahump and a cavity) is solved for the first time within the framework of the classical triple-deck theory. The asymptotic height of the roughness element corresponding to the non-separated flow is determined.

### hisst-2018_1070895

**Generation of Three-dimensional Disturbances in a Boundary Layer on Strong Interaction**

*G. Dudin, V. Neyland*
Central Aerohydrodynamic Institute (TsAGI), Russia

**Speaker:** *Georgiy Dudin*
Prof. TsAGi, Chief research officer. Investigate and apply the asymptotic and numerical methods to solve the fundamental problems of modern aerodynamics and three-dimensional boundary layer on strong interaction.

**Synopsis:** Laminar boundary layer flow over an infinite-span, finite-length flat plate is investigated in the regime of strong interaction with a hypersonic gas flow. Under the assumption that an additional condition dependent on the transverse coordinate can be imposed on the trailing edge of the plate the flow functions are expanded in power series in the vicinity of the leading edge. It is shown that these expansions include an indefinite function dependent on the transverse coordinate.

### hisst-2018_910807

**Acoustic Diagnostics of Instability Waves in Supersonic Jet**

*V. Kopiev, M. Zaytsev, S. Chernyshev*
Central Aerohydrodynamic Institute (TsAGI), Russia

**Speaker:** *Victor Kopiev*

**Synopsis:**

### hisst-2018_19601030

**Amplitude Method of Laminar-turbulent Transition Prediction in Three-dimensional Supersonic Boundary Layer at Swept Wing**

*M.V. Ustinov*
Central Aerohydrodynamic Institute (TsAGI), Russia

**Speaker:** *Maksim Ustinov*
Maksim V. Ustinov was born 26 September 1961. He graduates from Moscow Physical Technical Institute in 1984. Ph. in Phusics and Mathematics in 1988. Now works in TsAGI as a deputy chief of Department. Topics of interest: laminar-turbulent transition.

**Synopsis:** Amplitude method describing influence of surface roughness and free-stream turbulence level on laminar-turbulent transition caused by cross-flow instability is developed and tested. It is based on computation of amplitudes of steady and non-steady cross-flow instability modes in the boundary layer. Method developed was verified using available experimental data obtained in low-speed wind tunnels and applied for transition prediction in the swept-wing boundary layer for supersonic speed.

### hisst-2018_70810

**Estimation of Laminar-to-turbulent Transition using Empirical and Numerical Methods for Various Aerodynamic Forms**

*N. Voevodenko, A. Gubanov, D. Ivanyushkin, Yu. Shvalev*
Central Aerohydrodynamic Institute (TsAGI), Russia

**Speaker:** *Nina Voevodenko*
Ph.D. graduated from MIPT Faculty of Aerodynamics and Flight Dynamics. She is Head of Sector of TsAGI's Aerodynamic Dep. Author of more than 60 publications. Research Topics: Highspeed Aerodynamics, CFD, theoretical and analytical methods.

**Synopsis:** This paper presents the results of methodological studies aimed to determine the position of the laminar-to-turbulent transition using empirical criteria and CFD methods. The criteria of Simeonides and Berry have been studied, and results are compared with experimental data and CFD results, RANS solution with transition turbulence model. Studies were carried out for flat plate, and cones at Mach $M = 2…10$ and Reynolds $Re = (3…45)\cdot10^6$. Methods are applied also on HEXAFLY-INT glider model.

### hisst-2018_1880875

**Influence of Active Cooling on Second Mode Instabilities Investigated on Hypersonic, Conical Flows**

*V. Wartemann, P. Reiter, A. Wagner, G. Ponchio Camillo*
German Aerospace Center (DLR), Germany

**Speaker:** *Viola Wartemann*
Dr. Viola Wartemann is working as researcher at the German Aerospace Center (DLR) since over 10 years. Besides her studies on hypersonic boundary layer transition and re-entry aerodynamics, she is involved in several international European Research Project.

**Synopsis:** In the paper the influence of active cooling on second mode instabilities is investigated on hypersonic, conical flows.

### hisst-2018_1100813

**Micro-Aerothermodynamic Analysis of Protuberances and Clearances on a Hypersonic Glider using a Reduced Domain Approach**

*R. Choudhury, V.F. Villace, J. Steelant*
European Space Agency — ESTEC, Netherlands
*D. Buttsworth*
University of Southern Queensland, Australia

**Speaker:** *Rishabh Choudhury*
International research fellow at ESA ESTEC, on secondment from the University of Southern Queensland, Australia, where I'm a research fellow on experimental hypersonics. I completed my PhD from the University of New South Wales, Australia.

**Synopsis:** An aerothermodynamic analysis was carried out for the HEXAFLY-INT hypersonic glider incorporating geometrical elements such as wing-aileron gap, aileron hinge cavities, and communication antennas. These features exhibited localised changes to the flow-field affecting local heat-transfer distribution and control surface efficiency as compared to the existing "clean" aerodynamic (AEDB) model. The methodology presented in this paper is based on a reduced flow field domain to minimise computational costs.

### hisst-2018_510879

**Numerical and Experimental Analysis of Rarefaction Effects on Aerodynamic Coefficients of a Slender Re-entry Vehicle**

*K. Hannemann, C. Hepp, T. Schlegat, M. Grabe*
German Aerospace Center (DLR), Germany

**Speaker:** *Klaus Hannemann*

**Synopsis:**

### hisst-2018_960884

**Experimental Investigation of Rarefaction Effects on Aerodynamic Coefficients of Slender and Blunt Re-entry Vehicles**

*T. Schlegat, K. Hannemann*
German Aerospace Center (DLR), Germany

**Speaker:** *Thomas Schlegat*
2003 Study of Aerospace Engineering, University of Stuttgart2008 Occupational Trainee at the Centre of Hypersonics, University of Queensland, Brisbane2009 PhD student at the Spacecraft Department of the DLR, Göttingen2016 Missile Analyst, IABG, Ottobrun.

**Synopsis:** The experimentally investigated effects of rarefaction on the aerodynamic coefficients of a slender high lift/drag configuration are compared with those of a classical blunt-shaped lifting body at angles of attack between 0 and 34° and Knudsen numbers between $7e^{-4}$ and $9e^{-3}$. The ground based testing is conducted in the 2nd test section of the DLR Hypersonic Vacuum Wind Tunnels Göttingen and yielded about 900 experimentally obtained data sets of lift, drag and pitching moment coefficients and lift/drag ratio.

### hisst-2018_31501116

**Effects of Injection on the Boundary Layer Stability over a Blunt Body**

*A. Obraz, A. Fedorov*
Moscow Institute of Physics and Technology, Russia
*N. Palchekovskaya, I. Egorov*
Central Aerohydrodynamic Institute (TsAGI), Russia

**Speaker:** *Anton Obraz*
2009: Bachelor degree at MIPT

2011: Master of Science at MIPT
2011—present: Researcher at TsAGI
2011—present: Researcher at MIPT.

**Synopsis:** The effect of wall normal gas injection on the boundary layer stability is simulated numerically for the hypersonic flow over the blunted body. The boundary layer stability is analyzed with the linear stability theory and e-N method. For all cases considered, the critical N-factors at the experimentally observed loci of the transition onset are small. The correlation is observed between the computed critical stability points and experimental transition onset loci at various intensities of the injection.

### hisst-2018_2890979

**Mathematical Simulation, Numerical and Experimental Investigation of Nonspherical Bodies' Motion in Nonuniform Flows**

*I. Amelyushkin*
Central Aerohydrodynamic Institute (TsAGI), Russia

**Speaker:** *Ivan Amelyushkin*
PhD in Physics and Mathematics; TsAGI Senior Researcher; Lector in MIPT and MSU.

**Synopsis:** The complexity of mathematical modeling of nonstationary dynamics of multiple bodies in inhomogeneous flows and the significant stochastic nature of their trajectories in gradient media under experimental investigation lead to construction of original approaches in mathematical and numerical simulation of the dynamics of chaotic clouds of bodies of complex shapes. Results of shape influence on trajectories' stochastic and spreading of nonspherical bodies in gradient flows are obtained and presented in terms.

### hisst-2018_1810855

**Interaction of a Solid Body with a Multiphase Supersonic Flow: Physico-mathematical Models and Numerical Investigations**

*G. Molleson, A. Stasenko*
Central Aerohydrodynamic Institute (TsAGI), Russia

**Speaker:** *Galina Molleson*

**Synopsis:**

### hisst-2018_1300826

**Intermittency-based Transition Model with Local Empirical Correlations**

*J. Van den Eynde, J. Steelant*
European Space Agency, Netherlands

**Speaker:** *Jeroen Van den Eynde*
Jeroen Van den Eynde is an Aerothermodynamics Engineer in the Flight Vehicles & Aerothermodynamics Engineering section at the European Space Agency. His research interests include hypersonics and transition to turbulence.

**Synopsis:** A two-equation correlation-based transition model is presented to predict the onset and development of the laminar-turbulent transition process for boundary layers. It uses one equation for the intermittency transport, and another for the transport of a transition onset criterion. It uses some elements from the Langtry-Menter intermittency-based transition model, but introduces a physics-based rationale for the intermittency production and destruction.

### hisst-2018_1440832

**Numerical Studies of Receptivity of a Supersonic Boundary Layer to Solid Particulates**

*P. Chuvakhov, A. Fedorov*
Central Aerohydrodynamic Institute (TsAGI), Russia

**Speaker:** *Pavel Chuvakhov*
2007, Bachelor of science, Moscow Institute of Physics and Technology (MIPT) 2009, Master of science, MIPT 2013, Ph.D., Central Aerohydrodynamic Institute (TsAGI) 2009—present, researcher of TsAGI and MIPT; lecturer assistant of MIPT.

**Synopsis:** Atmospheric particulates may be a major source of boundary layer instabilities leading to laminar-turbulent transition on aerodynamically smooth bodies flying at supersonic speeds. The paper introduces a numerical model to simulate the particulate effect on receptivity and stability. Comparison with theory is given.

### hisst-2018_880908

**Numerical Simulation of Mass Addition Effect on Heat Transfer of Descent Space Vehicle**

*N. Palchekovskaya, I. Egorov*
Central Aerohydrodynamic Institute (TsAGI), Russia

**Speaker:** *Natalia Palchekovskaya*
PhD Research field: — Theoretical hydrodynamics — Computational Fluid Dynamics — Numerical Simulation of Separated, Vortex Flows.

**Synopsis:** Numerical study of mass addition influence on heat transfer of two models of descent space vehicle at hypersonic flow regimes is carried out. Numerical simulation is fulfilled using Navier-Stokes equations in axisymmetric statement. Various mass flow rates are considered in order to investigate effect of gas injection on values of heat flux. Comparison of the results with experimental results and numerical results of other authors is made.

### hisst-2018_870841

**Application of RANS/LES Hybrid Method in Simulation of Supersonic Base Flow**

*Fu Weijia, Ma Jingzhong, Li Jie*
AVIC Jiangxi Hongdu Aviation Industry Group, Northwestern Polytechnical University, China

**Speaker:** *Fu Weijia*
Education: Graduate from Northwestern Polytechnical University with a doctor's degree in Fluid Dynamics in 2016. Research Interests: Computational Fluid Dynamics; Aircraft Design and Engineering.

**Synopsis:** Two methods DDES, ZDES based on k-ω SST shear stress transport model with compressibility correction are applied in numerical simulation of supersonic base flow, respectively. Third-order MUSCL-Roe and fifth-order WENO-Roe spatial scheme are used to investigate the numerical dissipation effects.

### hisst-2018_1950863

**Roughness-induced Instabilities Leading to Transition in a Capsule Boundary-layer under Re-Entry Conditions**

*C. Stemmer, A. Di Giovanni*
Technical University of Munich, Germany

**Speaker:** *Christian Stemmer*
Since 2005 Technical University of Munich, Germany. Adjunct Teaching Professor and head of high-speed aerodynamics group2003-2005 Research Scientist at TU Dresden, Germany2001-2003 CTR, Stanford University, USA 2001 Ph.D. at IAG, Stuttgart, Germany.

**Synopsis:** We investigate roughness-induced transition scenarios for the capsule boundary layer in re-entry type scenarios with Direct Numerical Simulations (DNS).The effect of chemical equilibrium as well as chemical and/or thermal non-equilibrium on the disturbance development in the wake of the distributed roughness patch is investigated. DNS calculations are undertaken to show the non-linear evolution of the roughness wake andits interaction with unsteady disturbances.

### hisst-2018_1020853

**Application of a Reference Plane Method Calculating Flowfield behind Three-dimensional Elliptic Conical Shock Wave**

*Shi Chong-guang, Zhu Cheng-xiang, You Yan-cheng*
Xiamen University, China

**Speaker:** *Shi Chong-guang*
Received his BE degree and BS degree in Xiamen University, China in 2016. He is currently working toward the DS degree in Xiamen University. His research interests include aerodynamic theory, shock wave and boundary layer interaction.

**Synopsis:** In order to solve the three-dimensional flow field behind the elliptic conical shock wave, a reference plane method is applied at the cylindrical coordinate system. The main idea is to transform the

Cartesian coordinate system into the cylindrical coordinate system. Then the three-dimensional formulas can be easily applied to calculate the projection flow field at the reference plane. After that, the actual three-dimensional flow field will be acquired by the utility of geometry conversion.

### hisst-2018_690803

**Numerical Simulation of Two Shear Layers Interaction in Double Backward-facing Steps**

*Deng Fang, Han Guilai*
Institute of Mechanics, Chinese Academy of Sciences, China

**Speaker:** *Deng Fang*

**Synopsis:**

### hisst-2018_2810952

**Detailed Mathematical and Numerical Investigations of Shock Wave-boundary Layer Interaction in Hypersonic Flows**

*Sterian Danaila, Dragoș Isvoranu, Constantin Levențiu, Alina Bogoi*
POLITEHNICA University of Bucharest, Romania

**Speaker:** *Sterian Danaila*
Professor, head of the Dep. of Aerospace Sciences, POLITEHNICA University of Bucharest. Research area: Aerodynamics, CFD, Turbulence. Visiting professor: Univ. de Poitiers (France) and NUAA (China). Published 6 text books and monographs and over 50 papers.

**Synopsis:** The paper focuses, first, on a comparison of the behavior of three WENO type numerical schemes for shock tube problem. Next, the paper refers to the unsteady laminar or turbulent shock wave/boundary layer interactions over compression ramps with a sharp leading edge. The in-house code (SUPERHYP) are presented an analysed. The last part present the Proper Orthogonal Decomposition Analysis of the numerical results.

### hisst-2018_13901077

**Influence of Free Stream Inhomogeneity on Heat Flux and Temperature on a Plate in a Supersonic Flow**

*G. Nikiforov, V. Lashkov, I. Mashek, R. Khoronzhuk*
St. Petersburg State University, Russia

**Speaker:** *Gleb Nikiforov*
Fourth-year student of Saint Petersburg State University. Participant of international conference "The Eighth Polyakhov's Reading" and XXV international seminar on jet, separated and non-stationary flows.

**Synopsis:** Influence of density inhomogeneity of supersonic flow on heat flux and temperature on a plate has been studied experimentally. The inhomogeneity of the supersonic free stream was obtained by injection of a thin helium jet into the main air stream. Such approach allows to model impact of an infinitely long heated stream of gas, with lower density than gas of the main flow, on body aerodynamics. Reorganization of the gas flow around the body leads to the considerable change of power loading and a heat flux.

### hisst-2018_1970864

**Aerodynamic Damping and Buffet Response Test of an Aeroelastic Launch Vehicle Model in Transonic Flow**

*Ji Chen*
China Academy of Aerospace Aerodynamics, China

**Speaker:** *Ji Chen*
Dr. Chen JI is a senior research engineer in China Academy of Aerospace Aerodynamics. He was a visiting fellow in University of London from 2015 to 2016. His research field is experimental study of aeroelasticity.

**Synopsis:** The aerodynamic damping and buffet response of a launch vehicle were tested at the $M_a = 0.8…1.2$ and AoA = 0°, 8°. The aerodynamic undamping was found at the 2nd free-free bending mode at $M_a = 0.9$, AoA = 8°. At different Mach numbers, the variation of the PSD peak value of the free-free bending response can be up to 14.4 times. Although the second-order aerodynamic damping was zero at $M_a = 0.9$, AoA = 8°, it had a limited effect on the

second-order dynamic bending response amplitude in this test condition.

**hisst-2018_460802**

**High Credible Simulation and Validation of Turbulence Models Effects on a Low-aspect-ratio Flying-wing Model**

*Li Qing*
Chinese Aeronautical Establishment, China

**Speaker:** *Li Qing*

Qing Li was born in Xi'An city of China on Dec. 18th,1983. She gruduated from RWTH Aachen university in Germany and was honored with a Master degree in major of mechnical engineering in 2010. She has worded in Chinese Aeronautical Establishment until now.

**Synopsis:** Taking an advanced low-aspect-ratio aircraft flying-wing as the research model,many numerical simulation are conducted for aerodynamic characeristics at different attack angles in supersonic flow condition by using high credible CFD software AVICFD-X. The numerical results of aerodynamical coefficients are in a good accordance with wind tunnel test datas. This accordance validates the computational accuracy of AVICFD-X.The compuatiton accuracy and efficiency by different turbulent models are estimated.

**hisst-2018_2130878**

**Nonlinear Flutter of Curved Composite Panels in High Speed Flow**

*An Xiaomin*
Northwestern Polytechnical University, China

**Speaker:** *An Xiaomin*

Education PhD, School of Astronautics, Northwestern Polytechnical University, Dec. 2009 Research Interests 1. Aeroelasticity 2. Fluid-Structure Interaction 3. Unsteady aerodynamics

**Synopsis:** Nonlinear aeroelastic behaviors of two cylindrical composite panels are studied in a transonic flow of $M_a = 0.96$. The cylindrical shell structure is modeled by an assemblage of flat triangular elements and the large displacement is described by a parameterization of the orthogonal matrix. Euler equation is solved by an upwind flux splitting scheme and a dual-time technology to obtain nonlinear aerodynamic loads. Based on a loosely coupling procedure, nonlinear aeroelastic responses of the two cylindrical …

**hisst-2018_13701094**

**Study of Effects from Local Energy Deposition in Supersonic Gas Flow on Well-streamlined Body**

*Y. Dobrov, V. Lashkov, I. Mashek, R. Khoronzhuk*
St. Petersburg State University, Russia

**Speaker:** *Yuriy Dobrov*

**Synopsis:**

**hisst-2018_38101091**

**Simulation of Support Module Separation in a Hypersonic Flight Experiment**

*B. Reimann*
German Aerospace Center (DLR), Germany

**Speaker:** *Bodo Reimann*

Since 2005 research scientist in the Institute of Aerodynamics and Flow Technology at German Aerospace Center DLR in BraunschweigDoctor of mechanical engineering from University of Duisburg-Essen Master in physics from University of Göttingen.

**Synopsis:** In the presented work the separation between the HEXAFLY-INT high speed glider and the support module is studied numerically. The numerical simulation of the separation process has been carried out by a strong coupling of a Computational Fluid Dynamics (CFD) with a Rigid Body Dynamics (RBD) solver.

**hisst-2018_1480920**

**Effect of Roughness of Bluntness Nose on the Laminar-turbulent Transition at High Mach Numbers**

*P. Polivanov, Yu. Gromyko, D. Bountin, A. Maslov*
Institute of Theoretical & Applied Mechanics SB RAS, Russia

**Speaker:** *Pavel Polivanov*

Ph.D. (Title: Experimental Study of Unsteady Effects in Shock Wave / Turbulent Boundary Layer) — Institute

of Theoretical & Applied Mechanics, 2011. B.S., M.S. (Engineering Aerodynamics) — Novosibirsk State Technical University, 2004, 2006).

**Synopsis:** The paper presents data of the effect of the distributed and single roughness of the blunted nose of the cone on the position of the laminar-turbulent transition and the development of perturbations in the boundary layer at high Mach numbers.

### hisst-2018_41001129

**Influence of Angle of Attack on Hypersonic Wake Flow Structure of a Sharp Cone**

*Zhi Chen, Liang Zhang, Qingqing Zhang*
China Academy of Aerospace Aerodynamics, China

**Speaker:** *Zhi Chen*
Chen Zhi received PhD in Fluid Mechanics from Beijing University of Aeronautics and Astronautics in 2011. At present, he is working at China Academy of Aerospace Aerodynamics as a senior engineer and the main research area is aerothermaldynamics.

**Synopsis:** The hypersonic wake flow structure of a sharp cone with different angle of attack was investigated numerically. A sharp cone with the same half angle of attack as the Reentry-F experiment vehicle was used for simulation with the same inflow condition except the angle of attack. The flow fields with 0°, 1°, 2°, 5°, 10° and 15° angle of attack were obtained, and the wave and vortex structure are analyzed.

### hisst-2018_2010873

**Drag Reduction of Hypersonic Spiked Blunt Body with Sideward Jets**

*Guilai Han, Zonglin Jiang*
Institute of Mechanics, Chinese Academy of Sciences, China

**Speaker:** *Guilai Han*

**Synopsis:**

### hisst-2018_2830937

**Effects of the Lift-to-drag Ratio on Climbing Characteristics of Reusable Launch Vehicles**

*Cui Kai, Xu Yingzhou, Li Guangli, Xiao Yao, Wang Haoxiang*
Institute of Mechanics, Chinese Academy of Sciences, China

**Speaker:** *Cui Kai*

**Synopsis:**

### hisst-2018_38501137

**Computation of Hypersonic Flows on Compression Corner using Modified k-ω Model**

*Amjad A. Pasha, Khalid A. Juhany*
King Abdulaziz University, Saudi Arabia

**Speaker:** *Khalid A. Juhany*

**Synopsis:**

### hisst-2018_2460966

**Reentry Blackout Simulation using CFD Combined with Radio Transmission Calculation**

*Hu Ning*
PKU, China

**Speaker:** *Hu Ning*
Dr. Hu comes from China Academy of Aerospace Aerodynamics.

**Synopsis:** Multi-component flow field and radio blackout effects during the RAM C-II reentry flight are investigated using chemical non-equilibrium Navier-Stokes equation and two electromagnetic-wave propagation methods, the WKB and Finite Difference Time Domain (FDTD) methods, for L-, S-, C- and X-bands. FDTD method gives good predictions to radio attenuation and hence to blackout altitude while the WKB prediction of the onset of blackout is earlier than FDTD and flight test results.

## Hypersonic Fundamentals and History

**hisst-2018_1200959**

**Asymptotic Analysis of Steady Secondary Flow in a Turbulent Boundary Layer**

*V. Zametaev, A. Gorbushin*
Central Aerohydrodynamic Institute (TsAGI), Russia

**Speaker:** *Vladimir Zametaev*
PhD, specialist in asymptotic analysis of separated flows past bodies.Current sphere of interests is the theory of turbulent boundary and shear layers.

**Synopsis:** Turbulent boundary layer of a viscous incompressible fluid past a flat plate is studied. To analyze the problem, the method of multiple scales was applied, which allowed to find and investigate the steady secondary flow inside the turbulent boundary layer. At that, self-induced entrainment of fluid from the external flow is the main flow in this case, which ensures the supply of kinetic energy from the maximum speed zone to the turbulence generation zone near the streamlined wall.

**hisst-2018_47601548**

**Starting and Heating of Rectangular Hypersonic Inlet with Blunted Leading Edges**

*V. Borovoy, V. Mosharov, A. Skuratov, V. Radchenko*
Central Aerohydrodynamic Institute (TsAGI), Russia

**Speaker:** *Volf Borovoy*

**Synopsis:**

**hisst-2018_34501037**

**Numerical Study of Wave Trains in High-speed Boundary Layer over a Cone**

*A. Novikov*
Central Aerohydrodynamic Institute (TsAGI), Russia

**Speaker:** *Andrey Novikov*
Andrey Novikov (13 July 1980)
PhD at MIPT, 2007
Affiliation: 1) TsAGI, Department of Hypersonic Aerodynamics and Fundamental Research, head of subdeparment; 2) MIPT, part-time associate professor.

**Synopsis:** DNS of 3D wave trains in a boundary layer over 7-deg half-angle sharp cone at the freestream M = 5.95 are carried out. The Navier–Stokes equations are integrated using the in-house HSFlow solver. Unsteady disturbances are imposed via a local actuator, they form 3D wave trains that grow downstream and ultimately exhibit nonlinear breakdown. The results are compared with the experiments at ITAM SB RAS and good agreement is shown. Such simulations help to investigate laminar-turbulent transition mechanisms.

**hisst-2018_1300827**

**Compressibility and Temperature Effects on Turbulent Spot Growth**

*J. Van den Eynde, J. Steelant*
European Space Agency, Netherlands

**Speaker:** *Jeroen Van den Eynde*
Jeroen Van den Eynde is an Aerothermodynamics Engineer in the Flight Vehicles & Aerothermodynamics Engineering section at the European Space Agency. His research interests include hypersonics and transition to turbulence.

**Synopsis:** A two-equation correlation-based transition model is presented to predict the onset and development of the laminar-turbulent transition process for boundary layers. It uses one equation for the intermittency transport, and another for the transport of a transition onset criterion. It uses some elements from the Langtry-Menter intermittency-based transition model, but introduces a physics-based rationale for the intermittency production and destruction.

**hisst-2018_11401090**

**New Kinetic Models in Non-equilibrium Aerodynamic Problems**

*E. Kustova, E. Nagnibeda*
St. Petersburg State University, Russia

**Speaker:** *Elena Kustova*

**Synopsis:**

### hisst-2018_35101153

**Mathematical Modeling and Computational Simulation of Supersonic Twophase Gas-particle Flows over Bodies: Possibilities and Limitations**

*Yu. Tsirkunov, D. Romanyuk, A. Verevkin*
Baltic State Technical University, Russia

**Speaker:** *Yury Tsirkunov*

**Synopsis:**

### hisst-2018_660805

**Analytic Model of a Resistive Magnetohydrodynamic Shock**

*Roland P.H. Berton*
ONERA, France

**Speaker:** *Roland Berton*
Roland Berton graduated from the "Ecole Centrale des Arts et Manufactures" in 1978 and received a PhD in Astrophysics in 1982. Since 1987 he has been working as a research engineer at ONERA on the modelling of physical systems related to atmospheric flight.

**Synopsis:** The present work is an extension of a former model of hypersonic MHD shock with finite conductivity, when the Hall effect is included. Jump conditions at a plane oblique shock are first derived. Then a shock fitting procedure is worked out by coupling these MHD jumps with thermodynamic correlations and an electric conductivity model. We put into evidence the reduction and saturation of the MHD interaction by the Hall effect as the magnetic field increases, and the crucial role played by the ion slip factor.

### hisst-2018_47801549

**Interaction of Oblique Shock Wave with the Bow Wave in the Presence of Underlying Plate**

*V. Borovoy, V. Mosharov, V. Radchenko, A. Skuratov*
Central Aerohydrodynamic Institute (TsAGI), Russia

**Speaker:** *Vladimir Radchenko*
Senior Scientist of TsAGI. His main research interests are concentrated on Pressure and Temperature Sensitive Paints methods development and their application in aerodynamic experiments.

**Synopsis:** An experimental study of the interaction of shock waves near a cylinder perpendicular to a blunted plate was carried out. The experiments were made in the Ludwig wind tunnel at Mach number 5 and different Reynolds numbers. The heat fluxes to the model surface, measured using Temperature Sensitive Paint (TSP), were analyzed. The influence of the plate blunting radius and the distance of cylindrical obstacle from plate leading edge on the gas flow are studied.

### hisst-2018_12301201

**Experimental Study of Origin of Turbulence and Laminar-turbulent Transition in Inhomogeneous Supersonic Boundary Layers**

*A. Kosinov*
Institute of Theoretical and Applied Mechanics SB RAS, Russia

**Speaker:** *Alexander Kosinov*

**Synopsis:**

### hisst-2018_17401155

**On Effective Implementation of Block LU-SGS Scheme on Hybrid Unstructured Grid for Hypersonic Flow**

*X. Li, X. Wang, Z. Shi, Y. Zhang*
Institude of Mechanics, Chinese Academy of Science, China

**Speaker:** *Xudong Li*

**Synopsis:**

### hisst-2018_32101141

**The Nonlinear Multi-physics Coupling of Airframe-propulsion Integration for the Air-breathing Launch Vehicle**

*Bing Chen, Chun-lin Gong, Jian-jun Gou, Dan Chen, Liang-xian Gu*
Northwestern Polytechnical University, China

**Speaker:** *Bing Chen*

**Synopsis:**

hisst-2018_36501072

**Parametric Investigation of the Front Section of an Aircraft for Optical Purposes**

*M. Ledyankin, A. Batrakov, S. Mikhaylov*
KNRTU-KAI n.a. A.N. Tupolev, Russia

**Speaker:** *Maxim Ledyankin*

**Synopsis:**

hisst-2018_18401076

**Interaction of Free and Bow Shock Waves with Local Gas Inhomogeneities**

*O. Sutyrin, V. Levin*
Institute of Mechanics of MSU; Central Aerohydrodynamic Institute (TsAGI), Russia
*P.Yu. Georgievskiy*
Institute of Mechanics Lomonosov Moscow State University, Institute of Mechanics of MSU, Russia

**Speaker:** *Oleg Sutyrin*
Institute of Mechanics of Lomonosov Moscow State University, Senior Researcher.

**Synopsis:** Interaction of free shocks waves and bow shocks ahead of blunt bodies with elliptical gas bubbles is studied numerically using two-dimensional axisymmetrical Euler's equations. Two distinct flow types — internal and external shock refraction patterns — are observed depending on flow parameters for both light and heavy bubble cases. For each case, shock focusing and cumulation process features and their effect on local force loads on the body are shown to depend on shock Mach number, bubb.

hisst-2018_3280998

**A Simple Extending Strategy for TENO Scheme: Scalar Equation and Euler Equations**

*Fan Zhang, Chunguang Xu*
Sun Yat-sen University, China
*Jun Liu*
Dalian University of Technology, China

**Speaker:** *Fan Zhang*
Graduated in Dalian University of Technology, and attained his Ph.D. in Computational Mechanics. Currently, he is working at Sun Yat-sen University, P.R.China, developing high-order shock-capturing schemes.

**Synopsis:** A simple extending strategy is presented to improve the efficiency and accuracy of the state-of-the-arthigh order TENO schemes. The presented method applies the smoothness measurement of TENO todetect the position of discontinuity and then uses a polynomial selection procedure to directly applyspatial reconstruction of high-order accuracy, without crossing any discontinuity. Especially, neighboring grid points contained in smooth stencils is also applied in spatial reconstruction.

hisst-2018_1170817

**Dynamical Detonation Stabilization of Supersonic Combustible Mixtures in Expanding Channels**

*Xiaodong Cai, Jianhan Liang, Zhiyong Lin*
National University of Defense Technology, China
*Ralf Deiterding*
University of Southampton, United Kingdom

**Speaker:** *Xiaodong Cai*

**Synopsis:**

hisst-2018_1400830

**Asymptotic Theory of the Viscous Transonic Gas Flow**

*A. Bogdanov*
Lomonosov Moscow State University, Russia

**Speaker:** *Andrey Bogdanov*

**Synopsis:**

## Materials and Structures

### hisst-2018_310812

**Preliminary Design of a Hooded Fairing Accommodating Winged Payloads**

*J. Steelant, A. Jasko, J. van den Eynde, M. Appolloni*
ESA-ESTEC, Netherlands
*J.F. A. Martos*
ESA-ESTEC, Institute for Advanced Studies, Division of Aerothermodynamics and Hypersonics, Brazil
*A. Kallenbach*
German Aerospace Center (DLR), Germany
*A. Shardin, A. Gorskiy*
Central Aerohydrodynamic Institute (TsAGI), Russia

**Speaker:** *Johan Steelant*
Johan Steelant graduated in 1989 (University of Ghent) as mechanical Engineer, in 1990 from the University of Brussels as aerospace engineer. He got his PhD on turbulence and transition modelling at the University of Ghent. Presently working at ESA-ESTEC.

**Synopsis:** To accommodate the protruding wing tips and control surfaces under the fairing of a sounding rocket, a hooded fairing is proposed. This particular fairing configuration opens up the possibility to accommodate larger dimensions of flight test vehicles otherwise limited by the finite wing span.

### hisst-2018_1911571

**Experimental Investigation of Thermo-barrier Coating Based on Zirconium Dioxide**

*K. Zhirikhin, A. Shardin, S. Kazhichkin, A. Nikulenko, V. Talyzin, E. Dmitriev, A. Sysoev, D. Somov, Yu. Tarasenko*
Central Aerohydrodynamic Institute (TsAGI), Russia

**Speaker:** *Kirill Zhirikhin*
Date of birth: 25.05.1984.
Education: 2001—2007 studied at Moscow Aviation Institute (specialist).
Work: 2007—present at Central Aerohydrodynamic Institute (TsAGI).

**Synopsis:** One of the main problems in design and manufacture of a high-speed civil vehicles, an aerodynamicmodels or an experimental facility equipment, subjected to withstand a high-temperature loads, is acombination of optimal choice of construction materials and methods of their protection against thedestructive influence of high temperatures. The thermo-barrier coating is selected in terms of its structuralcompatibility with used materials, required protective and mechanical characteristics.

### hisst-2018_1760854

**Structural Topology Optimisation of the HEXAFLY-INT Vertical Fin**

*D.J. Munk, G.A. Vio, D. Verstraete*
The University of Sydney, Australia
*J. Steelant, V.F. Villace*
ESA-ESTEC, Netherlands

**Speaker:** *David Munk*
David Munk is a doctoral candidate at the University of Sydney working on topology optimisation for aerospace applications.

**Synopsis:** The highly complex, transient, multi-physics environment of hypersonic aircraft has not yet seen the application of topology optimisation. Therefore, in this study, the internal structure of the vertical fins for the High-speed Experimental Fly vehicles — International (HEXAFLY-INT) ESA led project, developing an experimental hypersonic transport aircraft, is designed using a novel discrete topology optimisation algorithm.

### hisst-2018_28601101

**Ultra-high Temperature Ceramics: Developments for Hypersonic Applications**

*J.-F. Justin, A. Julian-Jankowiak, V. Guérineau, V. Mathivet*
ONERA / DMAS, Université Paris-Saclay, France

**Speaker:** *Jean-François Justin*
Research engineer graduated from the "Conservatoire National des Arts et Métiers". At ONERA within the Materials and Structures Department. Ceramic and CMC for functional applications (combustion chambers, stealth materials, propulsion components …).

**Synopsis:** Ultra-high Temperature Ceramics are good candidates to fulfil the harsh requirements of hypersonic applications. At Onera, UHTC monolithic and composite materials have been investigated as well as several processing methods. This paper presents the work carried out on these materials. Several aspects are mentioned: manufacturing, mechanical properties, microstructure, oxidation resistance, assessment of several prototypes in realistic environment (arc-jet tests, uncooled injectors in ramjet combustor)…

### hisst-2018_1090835

**Sparse Locally Linear Embedding for Modal Identification**

*Wei Guan, L. L. Dong*
Xi'an Jiaotong University, China

**Speaker:** *Wei Guan*
Wei Guan received his M.S. degree (2016) in Computer science and technology from Huaqiao University. Now he is a PhD Candidate in School of Aerospace, Xi'an Jiaotong University. His interests include Machine learning and Structural dynamics of aircraft.

**Synopsis:** In order to address false modal parameters identification caused by the uncertainty of the selection of adjacent points in manifold learning, a novel modal identification method for structural dynamics using sparse Locally Linear Embedding (LLE) method is proposed.

### hisst-2018_540926

**Time-domain Dynamic Response Prediction: from One Boundary Condition to Another**

*Jiaming Zhou, Longlei Dong, Guirong Yan*
Xi'an Jiaotong University, China

**Speaker:** *Jiaming Zhou*
JM Zhou is currently pursuing the Ph.D. degree in Aeronautical and Astronautical Science and Technology at Xi'an Jiaotong University, China. His research interests include comprehensive mechanical environment simulation & prediction, and machine learning.

**Synopsis:** In this paper, a new approach is proposed by using Recurrent Neural Networks (RNNs) combined the Gated Recurrent Unit (GRU) to predict the dynamic responses of the same structure under different boundary conditions in the time domain. The method is validated on different structures: a three-degree-of-freedom system and a thin plate. The predicted results illustrate that this method has good learning and data prediction ability for stationary and non-stationary time sequences with 20 % noise.

### hisst-2018_2090907

**Structural Design of High-speed Vehicle with Topology Optimization**

*Tong Gao, Lei Tang, Zhiguang Zhao, Longlong Song, Xueying Qiu, Dihuan Wu*
Northwestern Polytechnical University, China
*Guanghui Shi, Qianying Zhou, Dongliang Quan*
Beijing Aerospace Technology Institute, China

**Speaker:** *Tong Gao*

**Synopsis:**

### hisst-2018_990964

**Determination of Thermophysical Properties for Short Fibers Reinforced Phenolic Composite and its Thermal Behaviour under Kerosene/Air Flame**

*G. Dugast, K. Chetehouna, N. Gascoin, M. Bouchez, J. L. Marceau*
MBDA — INSA Centre Val de Loire, France

**Speaker:** *Guillaume Dugast*
PhD candidate at INSA Centre Val de LoireResearch Engineer at MBDA.

**Synopsis:** Silicone-based composites material found a large use in the aerospace industry to protect wall structures from severe heating. To determine experimentally the thermo-physical properties and the kinetic triplet from ambient temperature to 1000°C, dedicated experimental apparatus are used. Finally, the measured data has been implemented in a finite element 1D approach, showing the efficiency of the generic silicone-based composite as a thermal barrier.

### hisst-2018_590798

**Experimental and Numerical Investigation on Startup of Leading-edge-shaped Heat Pipes**

*Chen Siyuan, Ai Bangcheng, Han Haitao, Hu Longfei, Chu Min, Chen Liang*
China Academy of Aerospace Aerodynamics, China

**Speaker:** *Chen Siyuan*
Chen Siyuan is serving as a senior engineer in China Academy of Aerospace Aerodynamics. He is engaged in hypersonic vehicle aerodynamic and thermal protection. He completed his master degree at Beihang University in 2008.

**Synopsis:** Experimental researches on the heat pipe startup character are conducted. The ground tests prove the start-up property and good isothermal performance of the wedge-shaped high-temperature heat pipe. It is revealed that the charging amount of the alkali metal is one of the key factors affecting the startup characteristics of wedge-shaped heat pipes. The start-up performance prediction method of wedge-shaped heat pipes is established, and the feasibility is verified by comparison with the experimental results.

## Missions and Vehicles

### hisst-2018_1130816

**Assessment of VTVL and VTHL Reusable First Stages**

*L. Bussler, I. Dietlein, E. Dumont, M. Sippel, S. Stappert, J. Wilken*
German Aerospace Center (DLR) Institute of Space Systems, Germany

**Speaker:** *Leonid Bussler*
Leonid Bussler — Space Launcher Systems Analysis (SART) — DLR Institute of Space Systems, Bremen.
Since 2015: Scientific staff in SART department at DLR Institute of Space Systems, Bremen.
2012 — 2015: Controller Spacecraft Operations, SES.

**Synopsis:** Two-stage vertical take-off vertical landing (VTVL) and vertical take-off horizontal landing (VTHL) partially reusable launcher configurations are systematically analyzed. The investigated configurations consider a reusable first stage that either performs a landing at the launch site (return to launch site RTLS) or a landing downrange of the launch site (downrange landing DRL). The considered propellant combinations include LOX/LH2, LOX/LCH4 and LOX/RP-1.

### hisst-2018_1280822

**SPACE RIDER: Mission Analysis and Flight Mechanics of the Future European Reusable Space Transportation System**

*G. De Zaiacomo, D. Bonetti, G. Blanco Arnao, G. Medici*
Deimos Space S.L.U., Spain

**Speaker:** *Gabriele Zaiacomo*
Senior Engineer in the Atmospheric Flight Competence Centre at the Flight Systems B.U. at DEIMOS Space, with 11 years' experience in Mission Analysis and GNC for atmospheric flight, including flight mechanics, re-entry systems, and entry guidance.

**Synopsis:** This paper presents the Space Rider Mission Analysis activities carried out during the phase A/B1 of the Space Rider program in support to the system design, including assessment of the orbital scenarios, definition of re-entry opportunities, computation of the End-to-End reference trajectories, sizing trajectories for subsystems specifications, characterization of the Entry Corridor, feasible domain and trimline design, flying qualities, trajectory performance assessment, and visibility and safety analyses.

hisst-2018_1870857

**Preliminary Aerodynamic Design of a Reusable Booster Flight Experiment**

*C. Merrem, V. Wartemann, Th. Eggers*
German Aerospace Center (DLR), Institute of Aerodynamics and Flow Technology, Germany

**Speaker:** *Clemens Merrem*
Master of Science in Aerospace Engineering at Technical University Brunswicksince 2015: Scientist at DLR, Institute of Aerodynamics and Flow Technology, Department Spacecraft, Workfield: CFD simulations and aerodynamic configuration design.

**Synopsis:** The Reusable Flight Experiment (ReFEx) is an experimental which simulates the reentry of a winged reusable booster stage. The topic covered is the aerodynamic design via CFD simulations. The goal is to create an aerodynamically stable and controllable configuration along the entire reentry trajectory. It is scheduled to fly late 2021.

hisst-2018_1280821

**EXOMARS 2020 Entry Descent and Landing Mission Analysis Verification**

*G. De Zaiacomo, D. Bonetti, I. Pontijas Fuentes, G. Blanco Arnao*
Deimos Space S.L.U., Spain
*F. Calantropio*
Thales Alenia Space, Italy
*L. Lorenzoni*
European Space Agency, Netherlands

**Speaker:** *Gabriele Zaiacomo*
Senior Engineer in the Atmospheric Flight Competence Centre at the Flight Systems B.U. at DEIMOS Space, with 11 years' experience in Mission Analysis and GNC for atmospheric flight, including flight mechanics, re-entry systems, and entry guidance.

**Synopsis:** This paper focuses on the Entry, Descent and Landing (EDL) Mission Analysis verification activities of the ESA/Roscosmos ExoMars 2020 mission, presenting the activities performed by DEIMOS Space in the programme Phase C to support the EDL Critical Design Review (CDR) in strict collaboration with Thales Alenia Space.

hisst-2018_3101064

**Flight Testing Designs in HEXAFLY-INT for High-speed Transportation**

*J. Steelant, HXI-team*
ESA-ESTEC, Netherlands

**Speaker:** *Johan Steelant*
Johan Steelant graduated in 1989 (University of Ghent) as mechanical Engineer, in 1990 from the University of Brussels as aerospace engineer. He got his PhD on turbulence and transition modelling at the University of Ghent. Presently working at ESA-ESTEC.

**Synopsis:** The overall aim of the European Community (EC) co-funded HEXAFLY-INT international project with partners from Europe, Russian Federation and Australia is to design, manufacture and flight test a high-speed vehicle. The present paper described the status of the project.

hisst-2018_42601154

**Multidisciplinary Design and Flight Test of the HEXAFLY-INT Experimental Flight Vehicle**

*S.Di Benedetto, M.P. Di Donato, A. Rispoli, G. Pezzella, R. Scigliano, F. Nebula, D. Cristillo, L. Vecchione*
CIRA, Italy
*S. Cardone*
TET, Italy
*J. Steelant, V. Villace*
ESA-ESTEC, Netherlands

**Speaker:** *Sara Benedetto*

**Synopsis:** The main technical challenges of the FP7 HEXAFLY-INT project are specifically related with the design of the vehicle gliding configuration and the complexity of integrating breakthrough technologies with standard aeronautical technologies, e.g. high temperature protection system and airframe cold structures. This paper will provide a comprehensive and detailed description of the multidisciplinary activities performed by CIRA and TET to design the EFTV and its experimental flight trajectory.

### hisst-2018_940809

**Design of Gravity-assist Trajectories for Thrust Pinch in an Integrated Aircraft-propulsion System**

*Jialin Zheng, Juntao Chang, Daren Yu*
School of Energy Science and Engineering, China

**Speaker:** *Jialin Zheng*
Citizenship: Chinese Education: Ph.D candidate Research Interests: System analysis and control design of supersonic/hypersonic propulsion system.

**Synopsis:** An alternative proposal is put forward to solve the transition thrust pinch issue in a turbine-based combined cycle engine via trajectory optimization.

### hisst-2018_1580839

**Technical Progress of Multiple-mission Reusable Launch Vehicle SpaceLiner**

*M. Sippel, S. Stappert, L. Bussler, S. Forbes-Spyratos*
German Aerospace Center (DLR), Germany

**Speaker:** *Martin Sippel*
Dr. Martin Sippel Head of DLR (German Aerospace Centre)'s Space Launcher Systems Analysis (SART) in the Institute for Space Systems (Bremen).

**Synopsis:** The SpaceLiner ultra-high-speed rocket-propelled passenger transport is in Phase A conceptual design. The critical separation of the passenger cabin and rescue capsule and its subsystems are one topic of the paper. The separation process is critically investigated taking into account multi-body dynamics and advanced CFD-simulations. Potential intercontinental flight routes, considering range-safety and sonic boom constraints as well as good reachability from major business centers, are evaluated.

### hisst-2018_1900861

**Reusable Aerospace System of Horizontal Takeoff for Orbital Injection and Intercontinental Flight**

*S. Mikhalyov, V. Buzuluk*
Central Aerohydrodynamic Institute (TsAGI), Russia

**Speaker:** *Semyon Mikhalyov*
Semyon graduated from Moscow Institute of Physics and Technology, department Aeromechanics and Flying Engineering. He started his work at Central Aerohydrodynamic institute 6 years ago, being engaged in aircraft conceptual design and optimization.

**Synopsis:**

### hisst-2018_36401055

**Hyplane: Sub-orbital Easy and Common Access**

*G. Russo, R. Savino, D. Pisanti, M. Saviano, F. Perrelli*
Center for Near Space, TRANS-TECH srl, Italy

**Speaker:** *Gennaro Russo*

**Synopsis:**

### hisst-2018_600969

**Combined Approach to Aerodynamic Shape Optimization**

*N. Ageev, A. Pavlenko*
Central Aerohydrodynamic Institute (TsAGI), Moscow Institute of Physics and Technology, Russia

**Speaker:** *Nikita Ageev*
Born in 1990, Rostov-on-Don, Russia. Graduated Moscow Institute of Physics and Technology with bachelor (2011) and master (2013) degree with honors. Work in TsAGI since October 2009.

**Synopsis:** At the present time two main approaches to aerodynamic shape optimization may be distinguished. The first approach requires only direct calculations. The second one expects the availability of tools for the evaluation of the constraint and objective function gradients. The first approach is robust and has opportunities for the topological optimization. The second one allows to operate with large number of design variables. To achieve high aerodynamic efficiency, it is proposed to combine these approaches.

### hisst-2018_15901025

**A Multi-Objective Optimization for the Aerodynamic Configuration of a Re-entry Vehicle based on MOEA/D**

*Yi Li, Su Cao, Shuo Tang*
Northwestern Polytechnical University, China

**Speaker:** *Yi Li*
Mr. Yi Li is an assistant Professor at Northwestern Polytechnical University (NPU), China. He received the Master Degree in 2009 from NPU and the PhD in 2015 from Technical University Braunschweig.

**Synopsis:** The aerodynamic optimization of a waverider derived re-entry vehicle is presented. The waverider has the advantage of high lift-to-drag ratio. A Multi-objective Evolutionary Algorithm Based on Decomposition is applied for the multi-objective optimization. A suboptimal aerodynamic configuration is obtained which meets the requirements of lift-to-drag ratio, volume and stability.

### hisst-2018_39801107

**Multi-disciplinary Design and Optimisation of a Minimum Scale Hypersonic Flight Demonstrator**

*R. Wuilbercq, J. Y. Andro, L. Serre, A. Tremolet*
ONERA, France

**Speaker:** *H. Taguchi*
Japan Aerospace Exploration Agency (JAXA), Japan

**Synopsis:** Romain Wuilbercq

**Synopsis:**

### hisst-2018_40801128

**Research Methods for Electric Actuator Characteristics of High-speed Unmanned Aerial Vehicle in Aeroservoelasticity Tasks**

*S. Parafes, I. Turkin*
Moscow Aviation Institute, Russia

**Speaker:** *Sergey Parafes*

**Synopsis:**

### hisst-2018_1280823

**Mars Sample Return: Entry Descent and Landing Analyses for Architecture Assessment Study**

*G. De Zaiacomo, I. Pontijas Fuentes, S. Centuori, P. Hermosín*
Deimos Space S.L.U., Spain
*H. Johnson*
MDA Corporations, Canada

**Speaker:** *Gabriele Zaiacomo*
Senior Engineer in the Atmospheric Flight Competence Centre at the Flight Systems B.U. at DEIMOS Space, with 11 years' experience in Mission Analysis and GNC for atmospheric flight, including flight mechanics, re-entry systems, and entry guidance.

**Synopsis:** The paper presents the Earth return Entry Descent and Landing analysis carried out to support the Mars Sample Return Architecture Assessment Study, lead by DEIMOS Space under ESA contract. The EDL mission analysis, based on a robust methodology for the design of the EDL phase in case of high energy entry scenarios, included Entry Corridor analysis for different Earth return scenarios and preliminary EDL mission performance assessment.

### hisst-2018_34301048

**On the Concept of Cleaning Near-Earth Space from Space Debris using the Re-entry Vehicles with Aerodynamic Braking Systems**

*A. Medvedskiy, O. Alifanov, V. Kul'kov, V. Terentyev, S. Firsyuk*
Moscow Aviation Institute, Russia
*V. Finchenko*
S&P Association n. a. S. A. Lavochkin, Russia

**Speaker:** *Alexandr Medvedskiy*

## Operation and Environment

### hisst-2018_21101120

**Modeling of Sonic Boom Phenomena**

*T. Kiseleva, A. Kosinov, Yu. Ermolaev, V. Volkov*
Khristianovich Institute of Theoretical and Applied Mechanics, SB RAS, Russia

**Speaker:** *Tatiana Kiseleva*

**Synopsis:**

### hisst-2018_810923

**Numerical Simulation Assistant Design of the Near-field Sonic Boom Signature Measurement System for AVIC ARI's FL-60 Wind Tunnel**

*Qian Zhansen, Leng Yan, Liu Zhongchen*
AVIC Aerodynamics Research Institute, China

**Speaker:** *Qian Zhansen*
Dr. Qian Zhansen jointed AVIC Aerodynamics Research Institute (ARI) in 2011. His main research includes aerodynamic design and optimization, high-order and high resolution CFD numerical schemes, and turbulence/transition models for high speed flows.

**Synopsis:** In the present paper, we present the design of the near-field sonic boon signature measurement system for AVIC ARI's FL-60 wind tunnel. Most of the design works are by virtue of CFD numerical analysis, and the hybrid mesh with a combination of tetrahedral and hexahedral grid is utilized with mesh adaptive strategy to improve the grid resolution. A rail pressure measurement equipment is used in the present work to instead of the traditional pressure probe to improve the measurement.

### hisst-2018_43401176

**Noise Reduction using Optimal Takeoff Thrust Management for Supersonic Business Jet**

*A. Mirzoyan*
Central Institute of Aviation Motors (CIAM), Russia

**Speaker:** *Artur Mirzoyan*

**Synopsis:**

### hisst-2018_24701065

**HyCost: A Life Cycle Cost Estimation Tool for Hypersonic Transportation System**

*R. Fusaro, V. Vercella, D. Ferretto, N.Viola*
*Politecnico di Torino, Italy*
V. F. Villace, J. Steelant
ESA-ESTEC, Netherlands

**Speaker:** *Roberta Fusaro*
Dr. Roberta Fusaro is Assistant Professor at Politecnico di Torino. Her main research activities are related to Systems and Subsystems conceptual design with special focus on high-speed transportation systems.

**Synopsis:** This paper aims at presenting an innovative tool developed by Politecnico di Torino to support the designer in cost estimation during conceptual and preliminary design phases, allowing the evaluation of Research, Development, Test and Evaluation Costs (RDTE costs), Production (Prod costs) as well as Direct and Indirect Operating Costs (DOC and IOC).

### hisst-2018_10801022

**Dynamic Airspace Sectorization to Enable Flight Centric Operations**

*M. Schultz, A. Temme, I. Gerdes*
German Aerospace Center (DLR), Germany

**Speaker:** *Michael Schultz*
Dr. Michael Schultz is the Head of Air Transportation Department at German Aerospace Center (DLR e.V.).

**Synopsis:** To efficiently provide air navigation services for today's and future airspace users, we introduce a dynamic airspace secorisation. Our approach approach covers operational, economic and ecological constraints under both nominal and dynamic air traffic flow conditions. We consequently changed the outdated paradigm 'flow follows structure' to an innovative approach of 'structure follows flow'. In this way, we will contribute to a future flight-centric air traffic management.

hisst-2018_24701082

**Towards Future LH2 Productive Scenarios**

*R. Fusaro, V. Vercella, D. Ferretto, N.Viola*
Politecnico di Torino, Italy
*V.F. Villace, J.Steelant*
ESA-ESTEC, Netherlands

**Speaker:** *Roberta Fusaro*

Dr. Roberta Fusaro is Assistant Professor at Politecnico di Torino. Her main research activities are related to Systems and Subsystems conceptual design with special focus on high-speed transportation systems.

**Synopsis:** Considering that the expenses related to fuel can reach up to the 90% of the overall Direct Operating Costs, this represents one of the most relevant cost items of the overall Life Cycle Cost. For this reason, this paper suggests a methodology to assess the impact of the LH2 price on DOC for a hypersonic point-to-point mission.

hisst-2018_1660844

**Integration and Evaluation of the Impact of Space Vehicle Operations in the European ATM**

*T. Luchkova, S. Kaltenhäuser, N. Klay, M. Schultz*
German Aerospace Center (DLR), Germany
*R.B.R. Ang*
Nanyang Technological University, Singapore

**Speaker:** *Tanja Luchkova*

Holds a degree in Air Traffic Engineering and Transport and have been with DLR since 2007. The main work generally focuses on ATM operational development studies including improvement and validation of new operational requirements, methods and procedures.

**Synopsis:** Space flight activities are becoming an eminent part of flight operations in the world today. Launch and re-entry operations are expected to grow beyond state use and research purposes into a commercial space transportation business. That creates an evident need to integrate space vehicle operations into the existing air traffic management system in a safe and efficient way.

## Propulsion Systems and Components

### hisst-2018_11101019

**Design, Numerical Analysis and Experimental Studies of Model High-speed Propane Combustion Chamber**

*V. Vlasenko, V. Sabelnikov, M. Ivankin, S. Molev, A. Nikolayev, V. Talyzin, A. Chevagin*
Central Aerohydrodynamic Institute (TsAGI), Russia

**Speaker:** *Vladimir Vlasenko*

**Synopsis:**

### hisst-2018_40101115

**HEXAFLY-INT Facility Module Testing in High-Entalpy Flow**

*N. Kukshinov, V. Aleksandrov, A. Prokhorov, A. Rudinskiy*
Central Institute of Aviation Motors (CIAM), Russia

**Speaker:** *Nikolay Kukshinov*

**Synopsis:**

### hisst-2018_41801146

**Modelling of Heat Transfer in Rocket Combustion Chambers using Eddy-dissipation Combustion Model**

*V. Zhukov*
Institute of Space Propulsion, German Aerospace Center (DLR), Germany

**Speaker:** *Victor Zhukov*
Ph. D., Chemical Physics and Physics of Combustion and Explosion, Moscow Inst. of Physics and Technology, 2005. In 2006–2007 Researcher at National University of Ireland, Galway. Since 2007 Research Associate at German Aerospace Center (DLR-Lampoldshausen).

**Synopsis:** In the work an extension of the eddy-dissipation model (EDM) is developed in order to simulate turbulent combustion of hydrogen in undiluted oxygen in rocket combustion chambers. The modification of the EDM model allows eliminating of main demerits of the original EDM model. This is achieved by introducing additional parameters, which limit the reaction rate and depend on the local stoichiometry and temperature. The model is validated against experimental data from three different rocket combustors.

### hisst-2018_34401059

**Mixing Enhancement of Wall-injected Fuel in Supersonic Flow by Spark Discharge**

*A. Firsov, E. Dolgov, R. Rakhimov, M. Shurupov*
Joint Institute for High Temperatures of the Russian Academy of Sciences (JIHT RAS), Russia
*S. Leonov*
Joint Institute for High Temperatures of the Russian Academy of Sciences (JIHT RAS), Russia; University of Notre Dame, USA

**Speaker:** *Aleksandr Firsov*

**Synopsis:**

### hisst-2018_39701105

**Coupled Fluid/Solid Numerical Investigation of the Heat Load on a Lobed, Scramjet Strut Injector**

*P. Gerlinger, Y.-H. Simsont*
University of Stuttgart, Insitute of Combustion Technology of Aerospace Engineering, Germany

**Speaker:** *Peter Gerlinger*
Apl. Prof. Dr.-Ing. Peter Gerlinger PhD from University of Stuttgart, Head of Computer Simulation Group.

**Synopsis:** The thermal load on a lobed scramjet (supersonic combustion ramjet) strut injector is investigated numerically for Mach 8 flight conditions. For this purpose, coupled 3D RANS (Reynolds Averaged Navier–Stokes) simulations of the supersonic external flow field around the strut injector and the subsonic strut internal hydrogen flow are performed.

### hisst-2018_40601123

**The Effect of Combustion on the Dynamic Characteristics of the Supersonic Wake Flow**

*Qing Li, Jianhan Liang*
National University of Defense Technology, China

**Speaker:** *Qing Li*

**Synopsis:**

### hisst-2018_3180980

**Experimental Study of Kerosene Combustion Extinguishing and Flame Stability in Supersonic Combustor**

*Yu Meng, Hongbin Gu, Jingheng Zhuang, Zhanbiao Gao, Huan Lian, Xinyu Chang*
University of Chinese Academy of Sciences, Institute of Mechanics, China

**Speaker:** *Yu Meng*
Doctor student of University of Chinese Academy of Sciences.

**Synopsis:** In this paper, the experiments of guided hydrogen kerosene under different equivalence ratio conditions under Mach 2.5 conditions were carried out. It was found a stable flame and flameout mechanism for supersonic combustion in this experiment. Shock — flame balance each other.

### hisst-2018_700868

**Research of Flow Control on Supersonic Inlet Diffuser**

*Jinsheng Zhang, Huacheng Yuan, Yunfei Wang, Guoping Huang*
Nanjing University of Aeronautics and Astronautics, China

**Speaker:** *Jinsheng Zhang*
PhD student College of Energy and Power Engineering, Nanjing University of Aeronautics and Astronautics, Nanjing People' Republic of China, E-mail: 1021965168@qq.com

**Synopsis:** Design of a two-dimension variable inlet operating from Mach 0 to 4 was developed in this paper to meet the specific request. Numerical simulation was carried out to investigate the aerodynamic performance and variable geometric rules of the inlet. In addition, passive control methods were used to improve the performance. The result indicated that the initial inlet basically met the design request over a wide speed range expect Ma3 and Ma3.5. Using geometric modification and suction case could improve inlet.

### hisst-2018_1750850

**Hysteresis Phenomenon of Shock Train in an Isolator with Incident Shocks**

*Nan Li, Juntao Chang, Kejng Xu, Wen Bao, Daren Yu*
School of Energy Science and Engineering, Academy of Fundamental and Interdisciplinary Sciences, China

**Speaker:** *Nan Li*
Citizenship: Chinese Education: Ph.D candidate Research Interests: Supersonic/hypersonic inlet; shock wave-boundary layer interactions; shock train; boundary layer separation

**Synopsis:** The behaviours of the shock train, associated with the separation flow within it, depend on not only the incoming flow conditions but also the characteristics of the boundary layer heavily. The hysteresis characteristic of a shock train in an isolator has been investigated in a direct-connect wind tunnel. The results indicate that with a same pressure ratio, the STLE could be either downstream or upstream of the SWBLI region. The hysteresis behaviour of the shock train was also confirmed.

### hisst-2018_42101147

**Control of Flow Parameters in the Model of the Prechamber Isolator for Ramjet Engine**

*D. Lapinsky, N. Guryleva, M. Ivankin, A. Tereshin*
Central Aerohydrodynamic Institute (TsAGI), Russia

**Speaker:** *Dmitry Lapinsky*
Working as scientist in Propulsion System Aerodynamics department of Central Aerohydrodynamic Institute after graduation from Moscow Institute of Physics and Technology in 2009.

**Synopsis:** Results of experimental studies of flow in sectioned duct of precombustion diffuser models divided into compartments by longitudinal partitions are presented. It is shown, that the presence of a gas-dynamic connection between the channels reduces the flow irregularity, equalizes the flow parameters at the end of the channel, reduces the longitudinal dimensions of the flow deceleration area.

### hisst-2018_1701070

**Investigation on the Streamline-Traced Intake Starting**

*V. Talyzin, A. Fedorov, A. Gubanov, M. Ivankin*
Central Aerohydrodynamic Institute (TsAGI), Russia

**Speaker:** *Vadim Talyzin*
Vadim Talyzin is working in position of research associate in the propulsion department of the Central Aerohydrodynamic Institute n.a. prof. N.E. Zhukovsky (TsAGI) since he has graduated from Moscow State Technical University.

**Synopsis:** Investigation of starting process of the stream-traced intake is presented. It's shown that starting of the intake could significantly correlate with boundary layer state at the compression surface. Results of the experimental investigation of the internal characteristics with different boundary layer tripping devices and vortex generators (and without them) are presented.

### hisst-2018_39101097

**Investigation of the Features of the Flow Structure in a Multi-channel Supersonic Air Intake Device**

*D. Rakhmanin, A. Trifonov*
Central Aerohydrodynamic Institute (TsAGI), Russia

**Speaker:** *Dmitry Rakhmanin*
D.Rakhmanin@gmail.com. Education: MIPT (Applied physics and mathematics), graduated in 2012. Work experience: junior scientist in TsAGI since 2012 — till present.

**Synopsis:** Experimental studies of a four-channel air intake device were carried out at Mach number M = 1.8 and angle of attack alpha = 0. It is shown experimentally both non-synchronous throttling of the channels and the difference between the highest and lowest values of the total pressure recovery coefficient in the channels of the air intake device in the area of the angular point of throttle characteristic can reach a significant value.

### hisst-2018_2650917

**Unsteady Simulation of the Flow in a Hypersonic Airbreathing Vehicle Air Intake during Cowl Opening using a Conservative Overlapping Mesh CFD Technique.**

*M. Ferrier, P. Grenard*
ONERA, France

**Speaker:** *Marc Ferrier*
Marc Ferrier received his Ph. D. Degree in Fluid Dynamics in 2008 from University of Orléans for his work on boundary layer transition in supersonic flow. He is now a research engineer at ONERA, wh ere he mainly works on scramjets simulations.

**Synopsis:** An original moving mesh CFD technic has been used to compute the flow around a hypersonic vehicle forebody and into its air intake during the engine cowl opening. This technic computes the intersection between a static background and a moving overlapping mesh at each time step. This ensures a continuity relationship between both meshes and the conservative property of the method. Results of Euler simulations show transient flow during cowl opening. When completely open, the air intake is started.

### hisst-2018_35801117

**Numerical Investigation of Total Pressure Pulsations in Supersonic Trapezoidal Air Intake using Eddy Resolving DES Method**

*E. Novogorodtsev*
Central Aerohydrodynamic Institute (TsAGI), Russia

**Speaker:** *Egor Novogorodtsev*
Air inlets computational researcher.

**Synopsis:** As a result of flow compression in shock waves, wall friction, eddy formations and other phenomena, the flow in the inlet duct of the supersonic

air intake becomes nonstationary and dynamic distortion appears. Numerical simulation of unsteady flow was performed using isolated trapezoidal intake configuration equipped with a boundary layer control system on the compression ramp surface.

### hisst-2018_1640846

**Post-test Analysis of the LAPCAT-II Subscale Scramjet**

*S. Karl, J. Martinez, K. Hannemann*
Germany Aerospace Center (DLR), Germany

**Speaker:** *Sebastian Karl*
Since 2001: Research Scientist at the Institute of Aerodynamics and Flow Technology of DLR. Development of numerical simulation tools for reacting high-enthaply flows, plasma flows and combustion.

**Synopsis:** A Mach 8 subscale scramjet vehicle was designed within the EU-FP7 project Lapcat II. Its purpose was to demonstrate the capability to produce adequate thrust for hypersonic level flight. A test campaign at the HEG shock Tunnel of DLR confirmed precedent CFD predictions of total thrust. Yet, significant differences between CFD analyses and detailed measurements of the pressure distribution inside the combustor could not be resolved. This paper focuses on a further analysis of these discrepancies.

### hisst-2018_3000970

**Comparison of Air-breathing Jet Engines with Deflagration and Detonation Combustion**

*A. Kraiko, A. Egoryan*
Central Institute of Aviation Motors (CIAM), Russia

**Speaker:** *Alexander Kraiko*
Author: Doctor of Physical and Mathematical Sciences, Professor A. Kraiko graduated from the Moscow Institute of Physics and Technology (MIPT) in 1959. Head of the Department 704 of the CIAM n.a. P.I. Baranov.

**Synopsis:** In connection with the allegations of a possible significant increase in thrust characteristics when replacing air-breathing jet engines with deflagration combustion to engines with combustion in detonation waves (PDE and RDE), a comparison of ramjet engines of different schemes with deflagration and detonation combustion was performed.

### hisst-2018_2240912

**Hypersonic Hydrocarbon Fuel Vehicle with M = 6+**

*A. Kuranov, A. Korabelnikov*
Hypersonic Systems Research Enterprise, Russia
*V. Abashev*
Moscow Aviation Institute (MAI), Russia
*P. Tretyakov*
Institute of Theoretical and Applied Mechanics SB RAS, Russia

**Speaker:** *Alexander Kuranov*
Director General / Chief Designer of the Hypersonic Systems Research Enterprise JSC, Leninetz holding company, Professor and Doctor of Engineering.

**Synopsis:** The main problems of the organization of the working process in the ramjet engine are: providing high combustion efficiency and minimal hydraulic losses, reliability of cooling of high-heat areas using cooling capacity of fuel and ensuring the strength of elements of motor channel. The report examines the principal ways and approaches to solving mentioned problems, their novelty and advantages are proved and compared with traditional methods.

### hisst-2018_43401175

**Possible Unification of Engines for Advanced Small and Medium Supersonic Civil Aeroplanes**

*A. Mirzoyan, A. Evstigneev*
Central Institute of Aviation Motors (CIAM), Russia

**Speaker:** *Artur Mirzoyan*

**Synopsis:**

### hisst-2018_27401035

**Air-breathing Electric Propulsion for Long-term Flights in Very Low Earth Orbits**

*A. Filatyev, A. Erofeev, A. Nikiforov, O. Yanova*
Central Aerohydrodynamic Institute (TsAGI), Russia
*G. Popov, S. Khartov*
Moscow Aviation Institute (MAI), Russia

**Speaker:** *Alexander Filatyev*
In 1973 graduated from the MIPT Dep. of Aeromechanics and Flight Engineering, in 1978 — PhD in Engineering sciences, in 2001 — Grand PhD in Engineering sciences, author of 130 papers on Flight Dynamics, Optimization, Aerospace Vehicle Ascent and Reentry.

**Synopsis:** Results of solving problems for the practical implementation of the concept of air-breathing electric propulsion (ABEP) using gases of the surrounding atmosphere as a propellant are presented. Conditions for long term existence of spacecraft (SC) with ABEP in low Earth orbits were determined. The possibility of creating a working gas density in ABEP, hundreds of times greater than the density of the environment, is shown. A laboratory model of ABEP thrust unit and optimal control synthesis are presented.

### hisst-2018_41601152

**Design and Numerical Simulation of a Common Nozzle of Multi-channel, TBCC Engine**

*Rongqian Chen, Yangcan Huang, Chengxiang Zhu, Ruofan Qiu, Yancheng You*
School of Aerospace Engineering, Xiamen University, China

**Speaker:** *Rongqian Chen*

**Synopsis:**

### hisst-2018_34401060

**Reduction of Power Consumption for Quasi-DC Discharge Applied for Combustion Control in Supersonic Airflow**

*A. Firsov, E. Dolgov, R. Rakhimov*
Joint Institute for High Temperatures of the Russian Academy of Sciences (JIHT RAS), Russia
*S. Leonov*
Joint Institute for High Temperatures of the Russian Academy of Sciences (JIHT RAS), Russia; University of Notre Dame, USA

**Speaker:** *Aleksandr Firsov*

**Synopsis:**

### hisst-2018_47001212

**Development of the Basis Naphthene Oxidation Kinetic Model for Simulation of the Practical Fuel Combustion**

*M. Abbasi*
German Aerospace Center (DLR), Germany
*N.A. Slavinskaya*
GRS, Germany

**Speaker:** *Nadezda Slavinskaya*

**Synopsis:** A reaction mechanism of cyclohexane (cyC6H12) and n-propylcyclohexane (cyC9H18) is developed to study its oxidation at both low and high temperatures, including PAH precursors routes. Improvements are due to rivaling the main reaction classes, uncertainty boundaries of the rate coefficients. The comparison low-temperature oxidation of both fuels has been performed. It is shown, that unlike cyC6H12 the ignition of n-propylcyclohexane demonstrates negative temperature coefficient (NTC) behavior.

hisst-2018_33601050

**Regimes of Turbulent Supersonic Combustion depending on Fuel Temperature**

*Jeong-Yeol Choi, Hye-Sung Kim*
Pusan National University, Korea

**Speaker:** *Jeong-Yeol Choi*
Ph.D. 1997 Seoul National University Professor of Aerospace Engineering, Pusan National University, 1998 Associate Fellow, AIAA Program Manager(former) of Space R&D, National Research Foundation of Korea Government.

**Synopsis:** A series of high-resolution numerical study is carried out to understand the effects of fuel temperature the characteristics of supersonic combustion. Constant mass flow rate condition was selected to investigate the effect of fuel temperature on the supersonic turbulent flame. The inflow pressure and Mach numbers were listed for the constant mass flow rate condition at different temperatures. As the fuel temperature increase, it is found that the regime changes to partially premixed to diffusive combustion.

hisst-2018_2380909

**Application of Dynamic Adaptive Chemistry and in Situ Adaptive Tabulation for Computationally Efficient Modeling of Supersonic Turbulent Combustion**

*Jian An, Guoqiang He, Fei Qin, Xianggeng Wei, Duo Zhang*
Northwestern Polytechnical University, China

**Speaker:** *Jian An*
PhD, Northwestern Polytechnical University, P.R. China. Propulsion Theory and Engineering of Aeronautics and Astronautics. Interest: Combustion physics, such as flame structures, heat and mass transfer and combustion modeling.

**Synopsis:** To deal with the major challenges of combustion simulation with detailed chemical kinetics, dynamic adaptive chemistry (DAC) method and In Situ Adaptive Tabulation (ISAT) method were introduced to accelerate numerical calculation in supersonic turbulent combustion flows. The successful validation demonstrates that the two proposed methods can be efficiently used in the simulation of supersonic reactive flow for detailed kinetic mechanisms.

hisst-2018_40401144

**Effect of Fuel Composition and Post-combustion Chamber Length on Combustion Performance of Paraffin-based Hybrid Rocket Motor**

*Yi Wu, Zezhong Wang, Xilong Yu, Xin Lin, Fei Li*
Institute of Mechanics, Chinese Academy of Sciences, China

**Speaker:** *Zezhong Wang*
Gener: male PhD student Research Direction: Experimental study of paraffin-based HRE (hybrid rocket engine) State Key Laboratory of High Temperature Gas Dynamics, Institute of Mechanics, CAS.

**Synopsis:** With $H_2O_2$/paraffin-based fuel as the propellant, the effects of fuel composition and post-combustion chamber length on combustion performance of hybrid rocket motor have been experimentally investigated.

hisst-2018_42801161

**SABRE Bypass Ramjet Concept Evaluation**

*C. Bauer, R. Baumann, G. Kurth, R. Schlaps, Ph. Störchle*
MBDA-Systems, Germany

**Speaker:** *Christoph Bauer*

**Synopsis:**

hisst-2018_920852

**Three-dimensional Bump Design for Improving the Starting Characteristics of Hypersonic Inlets**

*Xiaogang Zheng, Yiqing Li, Yancheng You*
Xiamen University, China

**Speaker:** *Xiaogang Zheng*
Male, Unmarried, Born in January 1994 in Zhejiang Province,China, a student of Professor Yancheng You from School of Aerospace Engineering, Xiamen University.

**Synopsis:** A three-dimensional bump was generated based on the theory of conical waverider at Mach 6, which was applied to analyse the internal and external flow field as well as the low-speed starting characteristic of hypersonic inlets. The effect of separation control was discussed in detail. And the effect of 3D bump on the lift-drag characteristic of hypersonic inlet was considered as well. The results showed that the designed 3D bumps based on the theory of conical flow can play an effective role in boundary layer.

### hisst-2018_2400903

**Flow Visualization and Control of Unstarting Scramjet Inlet-Isolator**

*Kyungrae Kang, Jong Ho Choi, Seong-kyun Im, Seung Jin Song, Hyungrok Do*
Seoul National University, South Korea

**Speaker:** *Kyungrae Kang*
Integrated Ph.D Program Mar. 2016 — present, Seoul National University / Seoul, Republic of Korea, Advisor: Professor Hyungrok Do Bachelor of Science (B. S.) Mar. 2010 — Feb. 2016, Seoul National University / Seoul, Republic of Korea.

**Synopsis:** Flow visualization using high-speed schlieren imaging of unstarting scramjet inlet-isolator was conducted. Inlet unstart was triggered by excessive nitrogen injection and the unstarting flow was temporally resolved over a rectangular scramjet engine. Boundary layer sunction was applied in the isolator wall to examine the effect on the inlet unstart. It was found that with a small portion of mass extraction, early activation can stop while late activation can delay the unstart.

### hisst-2018_2870951

**Comprehensive Effects of Secondary Heat Release on Ejection and Engine Performance in RBCC Ejector Mode**

*Pan Hongliang, Ye Jinying*
Northwestern Polytechnical University, China
*Lin Binbin*
Northwestern Polytechnical University, Civil Aviation Flight University of China, China.

**Speaker:** *Pan Hongliang*
Pan Hongliang, female, she focuses in eaching and scientific research of propulsion system in aerospace and astrunautics engineering. The main researches are related to combustion and control in rocket engine and its combined cycles.

**Synopsis:** In the paper three-dimensional CFD and ground direct-connect experiments have been undertaken to study effects of combustion organization on ejection and engine performance. A steady burning and thermal choke have been realized through pylon and cavity aided combustion organization in a range of 0.4—0.8 kg/s of rocket flow rate at flight Ma2.

### hisst-2018_28701121

**Study on Ma2-7 Variable Geometry RBCC Performance Via Full Flow Path Simulations**

*Pan Hongliang, Ye Jinying, Qin Fei, Wang Yajun*
Northwestern Polytechnical University, China

**Speaker:** *Pan Hongliang*
Pan Hongliang, female, she focuses in teaching and scientific research of propulsion system in aerospace and astrunautics engineering. The main researches are related to combustion and control in rocket engine and its combined cycles.

**Synopsis:** This paper aims to study the matching between the combustor and the inlet/exhaust of a variable geometry RBCC engine at low inflow Mach numbers, and also furthermore the paper focus on the feasibility of using a variable geometry combustor to carry out a steady secondary combustion in a pure ramjet mode instead of in a rocket aided ramjet

mode in order to improve the engine performance at low inflow Mach number stage.

**hisst-2018_1690847**

**Numerical Study of Embedded Rocket on Back Pressure Resistance of an RBCC Inlet**

*Lei Shi, Haijian Lou, Da Gao, Shuaizhong Wang, Fei Qin, Guoqiang He*
Northwestern Polytechnical University, China

**Speaker:** *Lei Shi*

Lei Shi, borned in 5 Aug. 1986, is now an associate professor in College of Astronautics in Northwestern polytechnical Univeristy. He is majored in airbreathing propulsion and combined cycle propuslion.

**Synopsis:** Sufficient back pressure resistance of inlet is one of the most important performance requirements for an RBCC engine. Two-dimensional numerical simulations were conducted based on an RBCC inlet model operating at Mach 2.5. The dynamic generation and movement of the shocks in the inlet were simulated under a certain back pressures. The influence rules of the embedded rocket operation conditions and configuration on the maximum back pressure resistance of the RBCC inlet were also numerically investigated.

**hisst-2018_33801021**

**Effect of Direct-reverse Successive Changes of Equivalence Ratios on Transient Combustion in a Scramjet Combustor**

*Yue Huang, Binyi Shenwu, Zhenye Luan, Fei Xing, Yancheng You*
Xiamen University, China

**Speaker:** *Yue Huang*

Associate Professor, School of Aerospace Engineering, Xiamen University.

**Synopsis:** The impact of successive increases and decreases of the equivalence ratios on unsteady characteristics in the transition of combustion modes of a hydrogen-fuelled dual-mode ramjet/scramjet combustor were simulated with DES and finite-rate chemistry model. The present studies were focused on the transient combustion features, the shock train structure, and movement. The numerical results confirmed the main qualitative findings of the transition of combustion modes and wall pressure oscillation.

**hisst-2018_390987**

**Numerical Investigation on a Free-jet Staged-Combustion Dual-mode Scramjet Combustor**

*Fang Chen, Di Lu*
Shanghai Jiao Tong University, China

**Speaker:** *Fang Chen*

Dr. Fang Chen is associate professor at Shanghai Jiao Tong University. His research focuses on combustion and thermal management of propulsion system in hypersonic vehicle.

**Synopsis:** A generic freejet engine has been explored to find a better way to operate in a wider range. Numerical studies with CFD ++ 2D RANS solver pave the way for the wide-range operation of dual-mode scramjet burners. The basic flow characteristic was analyzed and two major combustion structure were found. The strategies to operate at lower flight Mach number and higher Mach number were proposed.

**hisst-2018_37901081**

**Characteristics on Combustion Mode in Dual Mode Scramjet Engine**

*Hyuck-Joon Namkoung*
Hyundai Rotem Company, Korea (South)

**Speaker:** *Hyuck-Joon Namkoung*

**Synopsis:**

### hisst-2018_2160876

**Pulsation Frequency Management of Thrust Force and Gas Pressure in Nozzles**

*A. Khmelevsky, I. Manuylovich*
Institute of Mechanics, Lomonosov Moscow State University, Central Aerohydrodynamic Institute (TsAGI), Russia
*V. Levin*
Institute of Mechanics, Lomonosov Moscow State University, TsAGI, Institute for Automatics and Control Processes FEB RAS, Russia
*N. Afonina, V. Gromov*
Institute of Mechanics, Lomonosov Moscow State University, Russia
*V. Markov*
Institute of Mechanics, Lomonosov Moscow State University, Central Aerohydrodynamic Institute (TsAGI), V.A. Steklov Mathematical Institute, Russia

**Speaker:** *Aleksander Khmelevsky*
The experiments are carried out at the facility of our Institute. Calculations are also obtained on the author's complex of programs for numerical intergration of Navier-Stokes equations.

**Synopsis:** Complex results in experimental and numerical flow dynamics research and spectra signals of gas pressure pulsations in annular and linear dual slotted nozzles are presented. Experiments are performed in a pulsed aerodynamic facility using acetylene-air mixture combustion products as working gas. Viscous flow calculations are based on the Navier-Stokes equations for multicomponent reactive gaseous medium using single-temperature chemical nonequilibrium model.

### hisst-2018_3010983

**Experiments on Liquid Kerosene Ignition in a Supersonic Combustor with Various Ignition Assistance Methods**

*Inyoung Yang, Kyungjae Lee, Sanghun Lee, Yangji Lee*
Korea Aerospace Research Institute, Korea (South)

**Speaker:** *Inyoung Yang*
Ph. D at Korea Advanced Institute of Science and Technology in 2013.Since 1999, working for Korea Aerospace Research Institute.Research interests: scramjet intake, supersonic combustor, combined cycle engine.

**Synopsis:** The ignition characteristics of the liquid kerosene in a model combustor was explored with the assist of atomization, pilot gaseous hydrogen, and fuel heating. The air flow speed was Mach 2.0, air total pressure and temperature were 500 kPa (abs) and 1,100 K. The ignition and flame holding was possible with the help of the hydrogen assist atomization or the pilot hydrogen. Fuel heating up to 170—220°C was also helpful, but not enough for flame holding.

### hisst-2018_15101002

**Active Flow Control of Wide-envelope Air-breathing Engine Inlet**

*Wang Jianlei, Li Tiangang, Wei Zhen, Chen Bing, Gong Chunlin, Gu Liangxian*
Northwestern Polytechnical University, China

**Speaker:** *Wang Jianlei*

**Synopsis:**

### hisst-2018_1780869

**Micro Cavity Control for Buzz Suppression in Supersonic Inlet**

*Ke Dai, Jian Teng, Xiao-Gang Zheng, ian-Feng Zhu, Yan-Cheng You*
Xiamen University, China

**Speaker:** *Ke Dai*
Master Student, Department of Flight Vehicle, Xiamen University, People's Republic of ChinaResearch Field: Supersonic Propulsion Technology.

**Synopsis:** In this paper, buzz phenomenon of a typical supersonic inlet is analyzed using unsteady RANS simulation and proper orthogonal decomposition (POD) method. On the basis of POD results, a one-dimensional (1D) model, which approximates the original flow field, is proposed by taking into account only the first-order POD mode. It is believed that the model proposed here can serve as a good candidate for quick and onboard analysis of the complicated inlet buzz phenomenon.

hisst-2018_58201625

**The High-speed Cruise Ramjet Hydrogen Demonstrator for Hypersonic Flight Velocitie**

*E. Son*
Moscow Institute of Physics and Technology, Joint Institute for High Temperature RAS, Russia
*V. Degtyar, V. Khlybov, S. Kalashnikov*
FRC by Makeev, Russia
*A. Prokhorov, K. Arefiev, V. Alexandrov, O. Guskov*
Moscow Institute of Physics and Technology, Central Institute of Aviation Motors (CIAM), Russia
*R. Sidorov*
Central Institute of Aviation Motors (CIAM), Russia
*K. Son*
Moscow Institute of Physics and Technology, Russia

**Speaker:** *Eduard Son*

**Synopsis:**

hisst-2018_9801058

**Study of Detonation Waves by Means of Mathematical Modeling**

*V. Levin, I. Manuylovich, V. Markov*
Lomonosov Moscow State University, Institute of Mechanics MSU, Russia

**Speaker:** *Vladimir Levin*

**Synopsis:**

hisst-2018_33401015

**Stabilization and Control of Detonation in Supersonic Gas Flow in Plane Channel**

*T.A. Zhuravskaya*
Institute of Mechanics MSU, Lomonosov Moscow State University, Central Aerohydrodynamic Institute (TsAGI), Russia
*V.A. Levin*
Institute of Mechanics, Lomonosov Moscow State University, Central Aerohydrodynamic Institute (TsAGI), Institute for Automatics and Control Processes FEB RAS, Russia

**Speaker:** *Tatiana Zhuravskaya*

Using a detailed kinetic model of chemical interaction, detonation stabilization in a hydrogen-air mixture flowing at a supersonic velocity into a plane channel with constriction and possibility of control of detonation location in the flow were studied.

**Synopsis:** Using a detailed kinetic model of chemical interaction, detonation stabilization in a stoichiometrical hydrogen-air mixture flowing at a supersonic velocity into a symmetric plane channel with constriction the outflow section of which exceeds the inflow one, and possibility of control of stabilized detonation location in the flow have been studied. Several methods of control of detonation location in the flow with purpose of thrust increase have been proposed.

hisst-2018_13801027

**Two Motion of Freedom Piston Pump Developed for Hypersonic Aircrafts**

*Lingfeng Wang, Chengjian Pan, Wenqing Shao*
Beijing Aerospace Technology Institute, China
*Jian Ruan, Sheng Li, Liang Chang*
Zhejiang University of Technology, China

**Speaker:** *Lingfeng Wang*

Education: 2002.9 — 2005.4 Northwestern Polytechnical University, Xi'an China, Master degree,
Major: Engine control systems
Experience: 2005.4 — Present Beijing Aerospace Technology Institute, Beijing China, Senior engineer,
Research field: Propulsion systems.

**Synopsis:** The two motion of freedom piston pump has been invented to enhance efficiency, compactness, integration and reduce weight, noise, vibration. This article presents recent developments on piston pumps, particularly on two motion of freedom piston pumps used for hypersonic aircrafts. In this study, the structures and key techniques of this pump are presented briefly. Experimental results show that the performance characteristics of the pump achieve the anticipated aim and suitable for hypersonic aircrafts.

### hisst-2018_26001011

**On Shock Train Interaction with Combustion Oscillations in a Cavity Flame Holder During Accelerating Experiments**

*Huan Lian, Hongbin Gu, Lianjie Yue, Xinyu Chang*
Institute of Mechanics, China

**Speaker:** *Huan Lian*
Research Scientist, Institute of Mechanics, Chinese Academy of Sciences.

**Synopsis:** The combustion oscillation characteristics are investigated in a dual-mode model combustor equipped with cavity flameholders during acceleration experiments. The combustion oscillations are measured by a spark plug sensor at 200 kHz. Nonlinear analysis is performed to evaluate the deterministic and random nature of transient flame dynamics. Strong deterministic behavior is observed for the first time that positively supports further evaluation and development of predictive flame dynamics model.

### hisst-2018_2510935

**Effect of Suction on a Sort of Supersonic Inlet**

*Ming Gao, Huacheng Yuan, Tao Yin, Rongwei Guo*
Nanjing University of Aeronautics and Astronautics, China

**Speaker:** *Ming Gao*
Gao Ming, Postgraduate, from Nanjing University of Aeronautics and Astronautics, People's Republic of China; the direction of study is the Inlet and exhaust system for hypersonic vehicle.

**Synopsis:** The influence of boundary layer suction on the aerodynamic performance of a two-dimensional mixed compression variable geometry inlet was studied. The preliminary calculation results show that the main reason of the inlet's unstarting is the obstruction of throat caused by the smaller area of it. In this paper, the design of the suction scheme is carried out, and the suction is carried out in the severely separated part of the area. The ultimate goal is to design a relatively excellent suction scheme.

### hisst-2018_1701068

**Experimental Investigation of the Hydrogen Combustion Chamber and its Complement with 2.5D CFD Data**

*V. Talyzin, V. Vlasenko, O. Voloschenko, M. Ivankin, A. Nikolaev*
Central Aerohydrodynamic Institute (TsAGI), Russia

**Speaker:** *Vadim Talyzin*
Vadim Talyzin is working in position of research associate in the propulsion department of the Central Aerohydrodynamic Institute n.a. prof. N.E. Zhukovsky (TsAGI) since he has graduated from Moscow State Technical University.

**Synopsis:** Results of the experimental investigation of the hydrogen combustion chamber within the HEXAFLY-INT project are presented. Cross-sections of combustor have elliptic sections. Influence of different ways of hydrogen injection on pressure distribution along the combustor walls is studied experimentally. Experimental data are applied to validation of the new 2.5D method that had been proposed recently for approximate numerical simulation of duct flows.

### hisst-2018_39501104

**Simulation of Pressure Gain Combustion in a Wave Rotor**

*P. R. Ess*
Institute for Combustion Technology, German Aerospace Center (DLR), Germany

**Speaker:** *Peter Ess*
2007—present: Research Scientist/Engineer at DLR Institute of Combustion Technology
2003—2006: Research Associate at Imperial College
University Education in Aerospace Engineering in Stuttgart, Toronto (UTIAS) and Bristol (PhD).

**Synopsis:** The numerical study of constant volume combustion with associated pressure gain in awave rotor configuration, specified in the project TREVAP, is presented. A more sophisticated representation of the chemical reactions in the flow is employed than in the established literature for wave rotors. A first understanding of the combustion process and resulting

flow and wave patterns is obtained. The formation of pollutants was found to be significantly influenced by the high temperatures in the wave rotor.

**hisst-2018_2430905**

**Design and Aerodynamic Performance Analysis of a Axisymmetric Variable Geometry Inlet**

*Yunfei Wang, Huacheng Yuan, Jinsheng Zhang, Zhenggui Zhou*
Nanjing University of Aeronautics and Astronautics, China

**Speaker:** *Yunfei Wang*
Wang Yunfei, Ph.D student, study in College of Energy and Power Engineering, Nanjing University of Aeronautics and Astronautics,interested in combined cycle inlet and hypersonic inlet.

**Synopsis:** To satisfy the demand of combined circle engine, design and aerodynamic performance analysis of an axisymmetric variable geometry inlet was carried out. First, an axisymmetric fixed geometry inlet was designed based on a design condition and analyzed at different Mach number. Second, a variable scheme was designed to satisfy the demand of mass flow rate and ensure the inlet start under different Mach number, Finally, the annular to circle diffuser was studied to achieve better aerodynamic performance.

## Test & Evaluation

**hisst-2018_640800**

**Numerical and Experimental Investigation of Air Flow and Heat Transfer in a Complete Circuit of a Hypersonic Wind Tunnel**

*S. Drozdov, R. Davletkildeev, A. Rtischeva*
Central Aerohydrodynamic Institute (TsAGI), Russia

**Speaker:** *Sergey Drozdov*
Sphere of scientific interests: Aerotermodynamics of aircrafts and space vehicles, hydrodynamics, coherent structures, two-phase flows, transition to the turbulence.

**Synopsis:** This work presents numerical and experimental investigation of high-enthalpy real air flow structure in the complete circuit of TsAGI T-117 hypersonic wind tunnel with account for heat transfer processes in the air cooler and at wind tunnel walls.

**hisst-2018_41101143**

**Numerical Investigation of High Temperature $CO_2$-$N_2$ Flows in a Plasma Wind Tunnel Facility**

*A. Pudsey, T. Roos, M. Bricalli, H. Ogawa*
RMIT University, Australia
*J. Garcia-Garrido, Ch. Mundt*
Institute for Thermodynamics, Bundeswehr University, Germany

**Speaker:** *Adrian Pudsey*
Tim Roos is a PhD student at RMIT University in the field of Hypersonics. BSc in Aerospace engineering from Delft University of Technology. His main research focus is aerospace propulsion systems and aerodynamics.

**Synopsis:** Recent interest in missions to Mars brings about the necessity for ground based testing of the flowsexperienced during entry into the Martian atmosphere. Numerical investigations of the addition of $N_2$ into the flow of an arc-heated plasma wind tunnel with high-enthalpy $CO_2$ flows are presented. The objective of the study is to improve the numerical prediction of a plasma wind tunnel by considering the effect of adding $N_2$ to the flow as a diluent.

### hisst-2018_1330906

**Capability of the X2 Expansion Tube to Generate a High Enthalpy, High Reynolds Number Test Flow**

*R. Ramesh, R. Morgan, D. Mee*
University of Queensland, Australia

**Speaker:** *Ranjini Ramesh*
Highly motivated PhD student at University of Queensland's Centre for Hypersonics. Research project involves measuring heat transfer for Martian entry flows using a experimental technique known as infrared thermography.

**Synopsis:** This paper reports on the development of a high enthalpy, high Reynolds number turbulent flow condition for a representative Mars entry in the X2 expansion tube at the University of Queensland. A point in the trajectory of Mars Science Laboratory after transition to turbulence has been chosen for experimental investigation using the X2 expansion tube. The aim is to use the established flow condition to measure turbulent heat flux at Mars entry conditions using infrared thermography.

### hisst-2018_1710851

**Development of the Technique of Sonic Boom Experimental Researches**

*T. Pritulo, S. Chernyshev, A. Ivanov, A. Kiselev, V. Mosharov, D. Sboev, L. Teperin, V. Yudin*
Central Aerohydrodynamic Institute (TsAGI), Russia

**Speaker:** *Tatiana Pritulo*
Tatiana Mich. Pritulo graduated from the Moscow Institute of Physics and Technology (MIPT) in 1981. In 1984 she has got Ph. D. degree. T.M. Pritulo works at Central Aerodynamic Institute (TsAGI) as a senior scientific researcher since May 2001 up to date.

**Synopsis:** The possibilities of the experimental-numerical technique development of sonic boom researches at large industrial supersonic TsAGI wind tunnels are analyzed. This technique is based on the disturbed pressure measuring at aircraft model near-field in the wind tunnel test section. Then the obtained data are recalculated for the large distances by using the quasi linear theory. In order to define the pressure distribution at the model near-field it is proposed the high-informative method used the luminescent.

### hisst-2018_31001139

**Experimental Determination of Aerodynamic Coefficients of Simple-shaped Bodies Free-flying in Hypersonic Flow**

*P. M. Seltner, S. Willems, A. Guelhan*
German Aerospace Center (DLR), Germany

**Speaker:** *Patrick Seltner*
Research scientist in the field of gasdynamics at the German Aerospace Center (DLR) since 2016.

**Synopsis:** The impact of the flight attitude and the body shape on the aerodynamic behaviourof differently simple-shaped bodies in hypersonic flow fields were studied. Therefore, several series offree-flight tests were conducted in the H2K at the DLR in Cologne by the use of a non-contact stereotracking system. This measuring technique allows to determine the aerodynamic coefficients.

### hisst-2018_550801

**Aerodynamic Characterization of a Hooded Fairing Accommodating Winged Payloads**

*J.F.A. Martos, J. Steelant*
ESTEC-ESA, Netherlands
*R.O. Santos, M.A.S. Minucci, I.S. Rego*
Division of Aerothermodynamics and Hypersonics, Institute for Advanced Studies, Brazil

**Speaker:** *João Felipe de Araujo Martos*
I´m from Brazil, where I did my Ph.D. in Science and Space Technologies (2017), a Master degree in Mechanical Engineering (2014), a Bachelor´s degree in Aerospace Engineering (2013). I have expertise in emphasis aerothermodynamics numerical and experimental.

**Synopsis:** Flight tests of winged payloads narrow the teste vehicle size due to fairing size, rather than a hammerhead fairing which impacts the drag, a hooded fairing is proposed here allowing the wingspan to cross the fairing's periphery. An extensive experimental and numerical aerodynamics analysis

has been performed for the proposed hooded fairing and is presented in this work provides the necessary pressure and thermal loads for a preliminary thermos-structural design.

### hisst-2018_40101127

**Dynamic Characteristics of the Working Process In Vitiated Heaters of High-Enthalpy Test Rigs**

*N.V. Kukshinov, V.Yu. Aleksandrov, M.A. Ilchenko*
Central Institute of Aviation Motors (CIAM), Russia

**Speaker:** *Nikolay Kukshinov*

**Synopsis:**

### hisst-2018_39901110

**Calculated-experimental Investigation of the Flow In the Gasdynamic Throttle**

*V. Zakharov, A. Rudinskii, S. Gusev*
Central Institute of Aviation Motors (CIAM), Russia

**Speaker:** *Viacheslav Zakharov*

**Synopsis:**

### hisst-2018_2260890

**Converging-diverging Nozzles with Constant-radius Centerbody**

*A.K. Flock, A. Gülhan*
German Aerospace Center (DLR), Germany

**Speaker:** *Andreas Flock*
Mechanical engineering at Karlsruhe University and Purdue University — PhD at DLR Köln in 2016. Topic: Design and Performance analysis of three-dimensional Scramjet Intakes — Still at DLR working as Research Scientist on Super- and Hypersonics.

**Synopsis:** Several flow phenomena, such as recirculating wake flows or noise generation, occur in aerodynamic configurations with backward facing steps. In this context subsonic nozzles with constant-radius centerbodies exist, which enable fundamental research of these phenomena for M < 1. For the supersonic regime, however, the existing database and knowledge is limited. Therefore, the present work presents a design approach for a converging-diverging nozzle with constant-radius centerbody.

### hisst-2018_640799

**Experimental Investigation of Aerothermodynamic Characteristics of "ExoMars" Descent Module at Hypersonic Velocities**

*S. Drozdov, V. Brazhko, R. Davletkildeev, D. Fyodorov, I. Shemetov*
Central Aerohydrodynamic Institute (TsAGI), Russia

**Speaker:** *Sergey Drozdov*
Sphere of scientific interests: Aerotermodynamics of aircrafts and space vehicles,hydrodynamics, coherent structures, two-phase flows, transition to the turbulence.

**Synopsis:** Results of experimental investigation of stationary aerodynamic characteristics and heat flux distribution on the surface of DM-18 descent module of "ExoMars" project at hypersonic flow regimes are presented.

### hisst-2018_720804

**Mixing Characteristics in a Hypersonic Flow around a Transpiration Cooled Flat Plate Model**

*T. Hermann, M. McGilvray, H. S. Ifti*
University of Oxford, United Kingdom

**Speaker:** *Tobias Hermann*
Post doctoral research assistant at the hypersonics group of the Oxford Thermofluids Institute.

**Synopsis:** This paper presents transpiration cooling experiments conducted in the Oxford High Density Tunnel. Theflow structure and mixing phenomena between the injected coolant gas and the hypersonic free streamare investigated for a flat plate model. Surface mounted heat flux gauges, pressure sensors Schlieren imaging and pressure sensitive paint are used.

### hisst-2018_2330896

**Analysis of Porous Materials for Transpiration-Cooled Heat Flux Sensor Development**

*F. Hufgard, S. Löhle, J. von Wolfersdorf*
University of Stuttgart, Germany
*J. Steelant*
ESA (TEC-MPA), Netherlands

**Speaker:** *Fabian Hufgard*
Fabian Hufgard received a Masters degree in Aerospace Engineering at the University of Stuttgart. Currently, he works on his PdH which focuses on the developement of a heat flux sensor for high thermal loads using plenum pressure data.

**Synopsis:** In transpiration cooled environments a measurement of the plenum pressure changes can be used for heat flux determination based on Non-integer System Identification. This paper presents fundamental experiments required for the identification of susceptibilities with respect to thermophysical and fluidmechanical properties. The test setup for two different porous materials ($ZrB_2$ and C/C) and the resulting pressure impulse responses over varying coolant mass flows are presented, compared and discussed.

### hisst-2018_36801066

**Experimental Investigation on Flight Test Vehicle Aerodynamics at TsAGI T-116 Wind Tunnel: Powered and Glider Options**

*A. Gubanov, D. Gusev, V. Yakovleva*
Central Aerohydrodynamic Institute (TsAGI), Russia

**Speaker:** *Anatoly Gubanov*
Ph.D. Works for TsAGI since 1979 after graduation from the Moscow Institute of Physics and Technology MIPT, current position: Head of Department in Aerodynamics Division. Author of more than 80 scientific publications.

**Synopsis:** The results of experimental investigation on aerodynamics of the two experimental flight test vehicle EFTV options (powered and glider ones) which are under study within the international project HEXAFLY-INT are presented. The tests were performed in TsAGI supersonic and hypersonic wind tunnel T-116 at Mach numbers from 3 to 8. Particular attention is paid to aerodynamic efficiency and trim-ability of the vehicles.

### hisst-2018_2650953

**Scramjet Testing Methodology with Vitiated Air**

*M. Ferrier, D. Scherrer*
ONERA, France

**Speaker:** *Marc Ferrier*
Graduated from Ecole Centrale de ParisJoined ONERA in 1981 Deputy Director of Energetics Dept from 1997 to 2017 In charge of hypersonic propulsion research since 2017 Research topics: droplet combustion, combined cycle propulsion, scramjet design and CFD.

**Synopsis:** In many scramjet test facilities, air preheating is ensured by combustion of hydrogen or a hydrocarbon fuel. For connected pipe test, the main effect of vitiation is an increase of the specific heat which results in a too low effect of combustion on the flow. For free jet test, the reduction of gamma by the vitiation does not allow to respect both the flight conditions and the conditions at the combustor entrance. In addition, condensation of water vapor may occur in the nozzle of a free jet wind tunnel.

### hisst-2018_43001166

**Methods of the Wall Interference Reduction at Low Supersonic Velocities in the Wind Tunnel**

*A. Volkova, S. Chernyshev, A. Ivanov, E. Streltsov*
Central Aerohydrodynamic Institute (TsAGI), Russia

**Speaker:** *Anastasia Volkova*

**Synopsis:**

### hisst-2018_31201165

**Hypersonic Characterisation of Rarefied Flow Generated in the Oxford Low Density Wind Tunnel**

*N. L. Donaldson, C. F. Wilson, P. T. Ireland*
Oxford Thermofluids Institute, University of Oxford, United Kingdom

**Speaker:** *Nathan Donaldson*

**Synopsis:**

hisst-2018_40101126

**Investigation of Dynamic Characteristics of HEXAFLY-INT Facility Module in High-altitude Testing Conditions**

*N. Kukshinov, V. Aleksandrov, K. Arefyev, M. Ilchenko*
Central Institute of Aviation Motors (CIAM), Russia

**Speaker:** *Nikolay Kukshinov*

**Synopsis:**

hisst-2018_2190880

**Ultra-fast Temperature Sensitive Paint Shock Tunnel Heat Flux Measurements on the Intake of the LAPCAT II Small Scale Flight Experiment Configuration**

*J. M. Schramm, S. Karl, K. Hannemann*
German Aerospace Center (DLR), Germany
*H. Ozawa*
Tokyo Metropolitan University, Japan

**Speaker:** *Jan Martinez Schramm*

**Synopsis:** A subscale flight experiment configuration (SSFE) powered by a Mach 8 scramjet was designed within the European Commission co-funded project LAPCAT II and tested in the High Enthalpy Shock Tunnel Göttingen (HEG) of the German Aerospace Center. To address the laminar to turbulent boundary layer transition process on the intake, additional heat flux experiments are conducted by using an ultra-fast Temperature Sensitive Paint (TSP).

hisst-2018_38401106

**Temperature Measurements in a Carbon Dioxide Flow using Laser-Induced Fluorescence**

*T. Sander, M. Kirschner, Ch. Mundt*
Institute for Thermodynamics, Bundeswehr University Münich, Germany
*A.S. Pudsey*
RMIT University, Australia

**Speaker:** *Christian Mundt*

**Synopsis:** At the Institute of Thermodynamics at the Bundeswehr University Munich an arc-heated plasma wind tunnel can provide realistic entry conditions into Martian atmosphere. For the thermometry of the flow with an enthalpy of 3.1 MJ/kg and 3.8 MJ/kg a two-photon excitation process of CO molecules is used. Simulated spectra were calculated in advance with a simulation tool. The rotational temperature of CO in a high-temperature flow is evaluated by a correlation automated rotational fitting method.

hisst-2018_38601093

**Investigation of Nonequilibrium Heat Exchange and Catalytic Properties**

*B. Zhestkov, A. Vaganov, I. Senyuev, V. Shtapov, M. Tselunov*
Central Aerohydrodynamic Institute (TsAGI), Russia
*I. Sakharov*
Institute of Mechanics, Moscow State University, Russia

**Speaker:** *Boris Zhestkov*

**Synopsis:**

hisst-2018_41701142

**The Wind Tunnel Test Method of Airframe-propulsion Integration for Rocket-based Combined Cycle Launch Vehicle**

*Chun-lin Gong, Bing Chen, Jian-lei Wang, Tian-gang Li, Liang-xian Gu, Shuo Tang*
Northwestern Polytechnical University, China

**Speaker:** *Chunlin Gong*

**Synopsis:**

hisst-2018_41501173

**Sources and Structure of Fluctuations in High Speed Wind Tunnels**

*V. Lebiga, V. Zinovyev, A. Pak, A. Ivanov, A. Gorbushin*
ITAM SB RAS, Central Aerohydrodynamic Institute (TsAGI), Russia

**Speaker:** *Vadim Lebiga*

**Synopsis:**

### hisst-2018_22901047

**An Energy-saving Aerodynamic Layout for Large-scale Conventional Hypersonic Wind Tunnel**

*Tiejin Wang*
Institute of Wind Tunnel and Engineering, China

**Speaker:** *Tiejin Wang*

**Synopsis:**

### hisst-2018_2610913

**Three-dimensional Measurements on a Supersonic Jet Flame Based on Tomographic Chemiluminescence**

*Qingchun Lei, Bing Liu, Yeqing Chi, Jiawei Zheng, Yibin Xia, Wei Fan*
Northwestern Polytechnical University, China

**Speaker:** *Bing Liu*

**Synopsis:** This work describes an experimental study on a sonic $C_2H_4$/air diffusion jet flame based on the three-dimensional (3D) measurements at 15 kHz. The 3D measurements are obtained by a combination of the tomographic reconstruction of luminescence field and the fiber-based endoscopes. Key properties of the flame are extracted based on the 3D measurements. The properties include the detailed 3D flame structure and the 3D luminescence distribution. The results show the capabilities and potentials of the presented…

### hisst-2018_24501049

**Thin Film Heat Transfer Sensor Instrumentation Research and Development at CAAA Impulse Tunnel**

*Lin Jian, Chen Xing, Wang Dan*
China Academy of Aerospace Aerodynamics, China

**Speaker:** *Lin Jian*

I am currently a senior engineer in the hypersonic wind tunnel laboratory of CAAA, mainly to carry out aerodynamic, aero thermal test and associated pneumatic test technique in the hypersonic wind tunnel.

**Synopsis:** A range of thin film transfer heat sensor technology has been demonstrated enabling measurement of transfer heat either individually or in sensor arrays. Multiple methods for design, construction, calibration and testing of thin film platinum resistance temperature detectors (RTDs) are described. The technology research and development ongoing at China Academy of Aerospace Aerodynamics (CAAA) for applications to future launch vehicles, space vehicles, and ground systems is outlined.

### hisst-2018_2220894

**Study on Sapphire Fiber Optic Sensor for High Temperature**

*Jingbo Yu, Guojian Kang, Wei Wang, Bo Zhao, Zhan Huang, Xuejun Zhao*
China Academy of Aerospace Aerodynamics, China

**Speaker:** *Jingbo Yu*

Organisation: China Academy of Aerospace Aerodynamics (CAAA)
Address: Yungang west road, Fengtai District, Beijing, China
Email: yujingbo0110@126.com
Research Interests: experimental aerodynamics
Title: engineer.

### hisst-2018_1720965

**Calibration of a Plate Sensor for Total Heat Transfer into a Surface with a Spatially and Time Varying Heat Flux**

*J. A. Myrick, M. Keyhani, J. I. Frankel*
The University of Tennessee, USA
*Speaker: M. Bouchezt, F. Falempintt*
MBDA-France, France

**Speaker:** *Justin Myrick*

Justin Myrick is a Mechanical Engineering Ph. D. candidate working in the Heat Transfer Laboratory at The University of Tennessee, Knoxville. His research focus is on the estimation of surface thermal conditions using calibrated sensors.

**Synopsis:** This study presents the calibration and testing of an uncoated and $ZrO_2$ coated stainless plate senor used to measure the total surface heat transfer from a heat flux source that varies in space and time. It was demonstrated that an accurate prediction can

be obtained regardless of the spatial distribution of the surface heating, the choice of calibration test data or the measurement noise magnitude in the field test temperature.

### hisst-2018_46401203

**Aerodynamic Characteristics of Generic Test Models under High-temperature Real-gas Condition In Free-piston Shock Tunnel HIEST**

*Tanno Hideyuki, Komuro Tomoyuki, Sato Kazuo, Itoh Katsuhiro*
JAXA, Kakuda Space Center, Kakuda Miyagi, Japan

**Speaker:** *Hideyuki Tanno*
Hideyuki Tanno received his Ph. D. degrees in Mechanical Engineering from Tohoku University in 2005. He is a senior researcher in high-enthalpy shock tunnel HIEST. He is currently working on aeroheating of sample re-entry capsules includes Hayabusa.

**Synopsis:** A series of wind tunnel test campaigns conducted in the HIEST free-piston high-enthalpy shock tunnel were reported. Three-component aerodynamic characteristics (drag, lift and pitching moment) with generic test models; blunted cone, capsule and lifting body, were measured under high-temperature real-gas condition.

### hisst-2018_43801200

**Current status of the DLR Reusability Flight Experiment — ReFEx**

*P. Rickmers, W. Bauer, M. Sippel, S. Stappert*
German Aerospace Center (DLR), Germany

**Speaker:** *Peter Rickmers*
2005: Meng. Aerospace Engineering with Astronautics, Kingston University London
2005—2016: Work at the Center of Applied Space Technology and Microgravity (ZARM)
2010: PhD at the University of Bremen
2016— today: ReFEx project manager at DLR.

**Synopsis:** The Reusability Flight Experiment (ReFEx) is being developed by DLR (German Aerospace Center) to provide flight and design data on, as well as operational experience with, a winged first stage of a reusable launch vehicle (RLV). The experiment will be launched on a VSB-30 sounding rocket to altitudes and velocities similar to a first staging event and will then attempt an autonomous return flight along a trajectory comparable to a winged first stage RLV.

### hisst-2018_36601057

**Experimental Study of the Influence of Small Angles of Attack and Bluntness of a Cone on Stabilization of Hypersonic Boundary Layer using a Passive Porous Coating**

*S. Morozov, S. Lukashevich, A. Shiplyuk*
Institute of Theoretical and Applied Mechanics SB RAS, Russia

**Speaker:** *Sergey Morozov*

**Synopsis:**

### hisst-2018_1620842

**Performance and Stability Analysis of a Hypersonic Vehicle for a Low Speed Flight Test Program**

*T. Bykerk, D. Verstraete*
The University of Sydney, Australia
*S. Wolf, V. Villace, J. Steelant*
ESA-ESTEC, Netherlands

**Speaker:** *Tamas Bykerk*
PhD student at the University of Sydney, researching the low speed handling qualities of hypersonic vehicles. My specialisation is in experimental aerodynamics and CFD.

**Synopsis:** This paper evaluates the feasibility of moving onto a low speed flight test program for the HEXAFLY-INTernational waverider. A modified, scaled model of theaircraft has been built and tested in the University of Sydney 7×5 Low Speed Wind Tunnel to evaluate its static stability and performance. CFD played a supporting role in flow visualisation which was otherwise not possible to achieve through tunnel tests alone.

### hisst-2018_29801111

**Investigation of the Influence of the Perforated Walls of the T-128 Wind Tunnel on the Aerodynamic Characteristics of the Re-entry Vehicle at Transonic Speed**

*A. Gorbushin, S. Glazkov, A. Semenov, A. Lidovskiy, A. Podpaskov, G. Troshkov*
Central Aerohydrodynamic Institute (TsAGI), Russia

**Speaker:** *Anton Gorbushin*
Anton Gorbushin is working at TsAGI since 1983 after graduating from MIPT. TsAGI' post graduated course: 1987—1991. Since 1998 Gorbushin is a head of laboratory (T-128 transonic wind tunnel). Ph. D. — 2009. He is a docent at MIPT since 2011.

**Synopsis:** The paper is devoted to the study of the influence of wind tunnel perforated walls on the aerodynamic characteristics of the reentry vehicle model and wall boundary layer at transonic speed. An experimental investigations were carried out in the TsAGI transonic wind tunnel T-128. Numerical investigations were performed by solving RANS equations using EWT-TsAGI software. Satisfactory agreement was obtained between the computational and experimental data.

### hisst-2018_39201167

**Study on the Effect of the Base Area to the Suction Performance in the Supersonic Ejector**

*S. Hasegawa, K. Tani, T. Kanda*
Research Unit IV, JAXA, Chubu University, Japan

**Speaker:** *Susumu Hasegawa*

**Synopsis:**

### hisst-2018_43101169

**Novel Transient Calorimetric Heat Flux Sensor in Hypersonic Ground Experiment**

*Shizhong Zhang, Jinping Li, Hong Chen, Xiaoyuan Zhang, Hongru Yu*
Institute of Mechanics, Chinese Academy of Sciences, China

**Speaker:** *Shizhong Zhang*
Shizhong Zhang, Male, born in December 1983, working as an engineer at the Institute of Mechanics, Chinese Academy of Sciences, research direction is hypersonic aerodynamic thermal measurement technology.

**Synopsis:** This paper presents a novel transient calorimetric heat flux sensor using diamond chips to replace the commonly used copper pieces as the calorimetric sheet. The temperature on reverse side of the calorimeter is measured by a thin film thermometer, which greatly improves the output sensitivity of the calorimeter. The experimental results show that the repeatability error of the transient calorimetric heat flux sensor is within 4 % and the error of measurement accuracy is within 6 %.

### hisst-2018_1990866

**The Preliminary Application of MHD Power Generation in Arc Heated Test**

*Ou Dongbin, Chen Lianzhong, Gao He, Zhu Anwen, Liu Lei, Peng Yan, Liu Baolin*
China Academy of Aerospace Aerodynamics, China

**Speaker:** *Ou Dongbin*
The main work is ground test design and analysis. The author has got the bachelor degree at Nanjing University of Science and Technology in 2002 and got the master degree at CAAA in 2005.

**Synopsis:** The MHD power generation experimental equipment which is based on high temperature inert gas has been built by using arc heater. The equipment has generated electricity successfully. The design of experiment and the composing of equipment are introduced detailedly, while the result is analyzed also. The experiment result shows that one side is the generated electricity power is decided by gas electrical

conductivity, and the other side is $CsCO_3$ can improve the electrical conductivity of argon gas.

**hisst-2018_40901130**

**Development and Performance Validation of Konkuk University Ludwieg Tube (KULT)**

*Sungmo Yang, Yung Hwan Byun, Soo Hyung Park*
Konkuk University, Korea (South)

**Speaker:** *Sungmo Yang*
Master's Degree, Konkuk University, 2017—Present. Force/moment measurement on free-flying models in a Ludwieg Tube Researcher, Korea Advanced Institute of Science and Technology, 2014—2016. Flame holding in a scramjet model using a shock tunnel.

**Synopsis:** Ground-based test facilities are used to study different aspects of hypersonic flows. Ludwieg tube can produce hypersonic flow with high Reynolds number and the run time is longer than that of a shock tunnel. Konkuk University has developed a Ludwieg tube, named as Konkuk University Ludwieg Tube (KULT). To verify the performance of KULT, shock angle and pressure measurement were performed. The performance of KULT validated through the comparison between the experimental results and the theoretical values.

## Thermal, Energy and Management Systems

**hisst-2018_15701098**

**Experimental and Numerical Achievements in High Temperature Management for Hypersonic Flight**

*H. Böhrk, T. Stäbler, Ch. Dittert, I. Sakraker, D. Prokein*
German Aerospace Center (DLR), Germany

**Speaker:** *Hannah Böhrk*
Dr. Hannah Böhrk, Dept. Space Systems Integration, DLR, Helmholtz Young Investigator's Group "High Temperature Management for Hypersonic Flight".

**Synopsis:** High Temperature Management focuses on the development ofrequired numerical methods for thermal response for both transpirationand ablation cooling. In order to design thermal protection systems, these developed models and tools requirethe input of material data. However, temperature management alsodepends on measurement and a sensor network provides healthmonitoring of ceramic heat shields. In order to validate the resultsfrom models, sensor measurement a portable test cell for in-situX-ray.

**hisst-2018_1770921**

**Thermal Management of the HEXAFLY-INT Hypersonic Glider**

*J-Y. Andro*
ONERA, France
*R. Scigliano*
CIRA, Italy
*A. Kallenbach*
German Aerospace Center (DLR), Germany
*J. Steelant*
ESA-ESTEC, Netherlands

**Speaker:** *Jean-Yves Andro*
Master of Engineering in Aeronautics & Astronautics, PhD in AerodynamicsSenior Research Engineer at ONERA: Hypersonic vehicles design, Aerothermodynamics, Thermal Management, Engineering.

**Synopsis:** This paper presents the design of the Actuation System of the two elevons of the HEXAFLY-INT hypersonic glider. It describes successively the following items: high level functional architecture, GNC requirements, actuation lane design including servo-actuator, CMC torsion bar and elevon. It ends with the preliminary groud tests of the torsion bar.

### hisst-2018_24701056

**Preliminary Design and Sizing of the Thermal and Energy Management Subsystem for LAPCAT MR2**

*R. Fusaro, D. Ferretto, V. Vercella, N. Viola*
Politecnico di Torino, Italy
*V. F. Villace, J. Steelant*
ESA-ESTEC, Netherlands

**Speaker:** *Fusaro Roberta*
Dr. Roberta Fusaro is Assistant Professor at Politecnico di Torino. Her main research activities are related to Systems and Subsystems conceptual design with special focus on high-speed transportation systems.

**Synopsis:** This paper deals with the preliminary design and sizing of the Thermal and Energy Management Subsystem elaborated by ESA for the LAPCAT MR2 high-speed vehicle. The working principle of this subsystem is based on the exploitation of liquid hydrogen boil-off. This work aims at analyzing the various components which the TEMS consists of, suggesting proper Estimation Relationships (ERs) for mass, volume and power budgets.

### hisst-2018_3130978

**Numerical Solution of the Problem of Flow and Heat Exchange in Model Chambers of Combustion of High-speed Direct Air-reactor Engines on Hydrogen Fuel**

*M. Frantsuzov, O. Serpinsky*
Central Institute of Aviation Motors (CIAM), Russia

**Speaker:** *Maksim Frantsuzov*

**Synopsis:**

### hisst-2018_40701135

**Velocity Fluctuations Effect on an Air-Methane Flame Blow-off at Low Damkohler Numbers**

*K. Arefyev, A. Krikunova, V. Panov, K. Fedotova*
Central Institute of Aviation Motors (CIAM), Russia

**Speaker:** *Konstantin Arefyev*

**Synopsis:**

### hisst-2018_9001039

**Thermal Protection of the Surface of a High-speed Aircraft from Convective Heat Flow by Gas Blowing**

*E. Vasilevsky, I. Ezhov, P. Chuvakhov*
Central Aerohydrodynamic Institute (TsAGI), Russia

**Speaker:** *Eduard Vasilevsky*

**Synopsis:**

### hisst-2018_1430831

**Statistical Simulation of the Hypersonic Aircraft Pressurized Compartment and Surface Cooling System Thermal State**

*S. Gusev, V. Nikolaev*
S. A. Chaplygin Siberian Aeronautical Research Institute, Russia

**Speaker:** *Gusev Sergey*

**Synopsis:**

### hisst-2018_2280892

**Numerical Assessment of a Transpiration Cooled Wedge with Adapted Permeability**

*Ch. Dittert, H. Böhrk*
German Aerospace Center (DLR), Germany
*S. Löhle*
University of Stuttgart, Germany

**Speaker:** *Christian Dittert*
Since 2011 German Aerospace Center (DLR), Research Scientist Development of transpiration-cooled sharp leading edges layout, design and pre-assembly of the thermal protection system for ATV.

**Synopsis:** This paper presents that transpiration cooling can be effectively used for cooling sharp leading edgesas demonstrated during a plasma wind tunnel campaign at the Institute of Space Systems. Duringthis campaign a wedge geometry comparable to a re-entry leading edge with adaptable permeability,was successfully tested at re-entry heat flux conditions with different cooling mass flows rates.

hisst-2018_560883

**Large Eddy Simulation of Combustion in Full-scale Kerosene Fueled RBCC Engine**

*Bing Liu, Guoqiang He, Fei Qin, Duo Zhang, Xianggeng Wei*
Northwestern Polytechnical University, China

**Speaker:** *Bing Liu*
Propulsion Theory and Engineering of Aeronautic School of Astronautics Northwestern Polytechnical University Combustion Physics (flame structure, mass and heat transfer, combustion diagnosis).

**Synopsis:** In this paper, Large Eddy Simulation (LES) of combustion adopting Partially Stirred Reactor (PaSR) combustion model is performed for a full-scale kerosene fueled RBCC engine. The code is validated against experimental wall pressure, the results are satisfactory. Then, the wall pressure distribution, heat release, area-average Mach number, combustion efficiency and flame structure of the two configurations are studied.

hisst-2018_1270944

**Soft-objects based Procedure for Thermal Protection System Modelling of Reusable Launch Vehicles**

*A. Aprovitola, L. Iuspa, C. Rainone, A. Viviani*
Università della Campania "Luigi Vanvitelli", Italy

**Speaker:** *Andrea Aprovitola*
Andrea Aprovitola works as post-doctoral Research Fellow at Università della Campania "L.Vanvitelli". His current research activities are related to the aerodynamic shape optimization of both lifting, and winged re-entry vehicle using a free-CAD paradigm.

**Synopsis:** The present paper deals with a modeling procedure of a thermal protectionsystem designed for a conceptual Reusable Launch Vehicle.A novel parametric model based on a scalar field createdby a set of soft object primitives, is used to assign an almost arbitraryseamless distribution of insulating materials over the vehicle surface.Applications to different conceptual vehicle configurations of an assignedthickness map, and materials layout show the flexibility of the model.

hisst-2018_370870

**The TPS design of a Reusable Launch Vehicle based on Active Cooling**

*Jian-Jun Gou, Jia-Xin Hu, Chun-Lin Gong, Bing Chen, Liang-Xian Gu*
Northwestern Polytechnical University, China

**Speaker:** *Jian-Jun Gou*
Assistant professor of Northwestern Polytechnical University, Xi'an, China. Research interest: thermal protection / thermal management of flight vehicles.

**Synopsis:** In this paper, a TPS design method coupling active cooling is developed. A reusable launch vehicle and its typical trajectory is studied.

hisst-2018_1670845

**Numerical Study on a Multi-sample Transpiration-cooled Channel Flow**

*A. Trübsbach, Ch. Kromer, M. Selzer*
German Aerospace Center (DLR), Germany
*A. Schwab*
University of Stuttgart, Germany

**Speaker:** *Amadeus Trübsbach*

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| | | |
|---|---|---|
| **Government Offices** | Monday to Friday | 09:00 or 10:00 to 17:00 or 18:00 |
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| **Currency exchange booths** | Monday to Saturday | All day |
| **Shops** | Monday to Saturday | 08:00 to 20:00 |
| **Restaurants** | Monday to Sunday | 12:00 to 24:00 (sometimese to 02:00) |

**Russian Currency**

Russian banknotes: 10 RUB, 50 RUB, 100 RUB, 500 RUB, 1 000 RUB, 5 000 RUB.
Coins in use are kopeks : 5, 10, 50 ; and rubles: 1, 2, 5, 10.

**Credit cards**

American Express, MasterCard, Discover, and Visa are accepted in most hotels, restaurants, and shops.

**Insurance.** Participants are advised to arrange travel insurance for medical, personal belongings, etc. The Forum organisers do not cover participants against travel, cancellations of bookings or loss/theft of belongings.

**First aid**

The emergency phone numbers are :

- 01 — Fire assistance
- 02 — Police assistance
- 03 — Medical assistance
- 04 — Emergency gas service
- 112 — Any kind of emergency first aid

**Mobile Phone**

Both GSM and CDMA standards for cell phones are used in Russia.

**Time**

The time zone in Moscow is UTC+04.

**Tipping**

Common tipping rate is about 5—7 %.

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