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THIRD GERMAN-RUSSIAN WEEK OF THE YOUNG RESEARCHER

"AVIATION AND SPACE"

Novosibirsk, September 23–27, 2013

НГТУ

RUSSIAN UNION OF YOUNG SCIENTISTS

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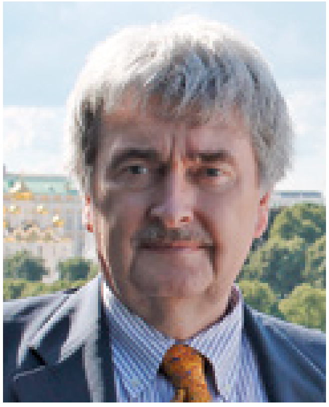
Welcome to the Third "Week of the Young Researcher"!



Dr. Gregor Berghorn

Dr. Jörn Achterberg

Two years ago on the occasion of the "German-Russian Year of Science" the idea was born to invite young researchers from both Russia and Germany to come together and to discuss current topics of mutual interest. After the great success of the first week in Kazan it was decided to turn it into an annual event. Last year we met in Yekaterinburg and this year we welcome you in Novosibirsk. Our main goal this week is to foster collaboration among young scientists and researchers who not so long from now will be setting the course of scientific cooperation between Russia and Germany.

Research organizations and institutions of higher education of both our countries will this week introduce their funding programmes and showcase the platforms that they can offer, to Russian and German PhD students and PostDocs who wish to initiate collaborative projects or broader research networks.

We have chosen Novosibirsk as the venue for this week with good reason, for it is one of most important scientific centres in Russia. Being the "Capital of Siberia" Novosibirsk is the core of a regional research and innovation cluster. Akademgorodok is host to the Presidium of the Siberian Branch of the Russian Academy of Sciences and is an internationally renowned research facility far beyond its borders. Also numerous universities and institutes have long been involved in aerospace engineering in strong cooperation with German institutions.

We would like to express our gratitude to Novosibirsk State Technical University (NSTU) and the Institute of Theoretical and Applied Mechanics (ITAM) for its academic hospitality, to the Presidium of the Siberian Branch of the Russian Academy of Sciences and the Consulate General of Germany in Novosibirsk for its support, as well as to the Council of the Russian Union of Young Scientists (RoSMU). And of course we thank all of you, the participants, for their involvement in this conference.

СПАСИБО ВАМ!

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ПРОФ. ГЕННАДИЙ РАСТОРГУЕВ
Первый проректор
Новосибирского государственного
технического университета

Уважаемые гости, уважаемые участники Недели молодого ученого!

Приветствую вас в стенах Новосибирского государственного технического университета – крупнейшего научно-образовательного центра Сибири.

Созданный в 1950 году как Новосибирский электротехнический институт, сейчас наш университет является многопрофильным политехническим университетом. По данным последнего исследования (сентябрь 2013 года) рейтингового агентства «Эксперт РА», НГТУ входит в первую двадцатку вузов России по таким показателям, как условия для получения качественного образования, уровень востребованности выпускников работодателями и уровень научно-исследовательской активности.

Лидирующие позиции нашего университета подтверждаются такими фактами, как победы в конкурсах вузов на получение грантов российского правительства и Министерства образования и науки РФ на следующие проекты:

- развитие инновационно-образовательной программы НГТУ «Высокие технологии» (2007–2008 годы);
- программа «Развитие объектов инновационной инфраструктуры и подготовка кадров в сфере инновационного предпринимательства в Новосибирском государственном техническом университете» (2011–2012 годы);
- проект создания программы повышения квалификации и учебно-методического комплекса в области производства изделий из наноструктурированной керамики в рамках конкурса Фонда инфраструктурных и образовательных программ ОАО «Роснано» (2012 год);
- проект НГТУ и ФГУП ПО «Север» «Исследование, разработка и организация промышленного производства механотронных систем для энергосберегающих технологий двойного назначения»;
- президентская программа повышения квалификации инженерных кадров по приоритетным направлениям модернизации и технологического развития экономики России;
- программа стратегического развития университета «Инженерные и научные кадры для инновационной экономики» (2012–2016 годы).

Одним из приоритетов стратегического развития НГТУ является интернационализация научного и образовательного процесса. Одним из активнейших и надежнейших направлений на пути интернационализации является сотрудничество с германскими университетами и научными центрами. Хочу отметить, что это сотрудничество зародилось более 40 лет назад. Сейчас это сотрудничество включает в себя целый спектр направлений: и разработка совместных образовательных программ, и организация обменных стажировок, совместных обменных летних школ по направлению нанотехнологий и новых материалов, и совместные исследования, семинары, публикации. Немаловажным для воспитания молодого поколения мы считаем совместный проект по уходу за могилами военнопленных силами наших и германских студентов, который уже в третий раз состоялся в этом году. В этом же году знаковыми событиями нашего сотрудничества с Германией считаю:

- состоявшийся в мае совместный семинар по проблемам развития двусторонней мобильности, в котором принимали участие представители германских университетов – партнеров НГТУ;

- успешно прошедшую на прошлой неделе панельную дискуссию экспертов из Германии и НГТУ на тему «Влияние энергетики на изменение и защиту климата в Сибирском регионе», которая проходила в рамках международной выставки «ЭЛКОМ».

Наш университет не раз принимал у себя крупные мероприятия, организуемые Германской службой академических обменов, ее московским офисом. Это и визит представительной делегации Конференции ректоров университетов Германии, совмещенный с семинаром стажеров DAAD, проживающих от Урала до Дальнего Востока (1995 год), и крупная выставка – презентация германских университетов (2000 год), и др.

Сегодня мы открываем III Российско-германскую неделю молодых исследователей в области авиации и космоса. Для нас это и большая честь, и большие надежды. Наш факультет летательных аппаратов, который готовит инженеров, конструкторов, технологов для авиационно-промышленного комплекса Новосибирска и всей России, ставит перед собой перспективную цель интернационализации исследований и образовательного процесса. Один из важных шагов на этом пути мы (а я сам, моя профессиональная жизнь связаны с этим факультетом) видим во вступлении в профессиональную сеть PEGASUS (Partnership of European Group of Aeronautics and Space Universities). Надеюсь, что профессиональные контакты, которые завяжутся на этой конференции, дальнейшее взаимодействие между нашими молодыми учеными будут способствовать реализации данной цели.

Желаю всем участникам плодотворной работы на конференции и самых положительных впечатлений от Сибири, Новосибирска и нашего университета.

Sehr geehrte Gäste,
Sehr geehrte Teilnehmer der Woche des jungen Wissenschaftlers,

ich begrüße Sie recht herzlich an der Staatlichen Technischen Universität Novosibirsk, dem größten Wissenschafts- und Bildungszentrum Sibiriens.

Im Jahre 1950 als Institut für Elektrotechnik Novosibirsk gegründet, ist unsere Universität heute eine polytechnische Universität. Den Ergebnissen einer Studie der Ranking-Agentur „Expert RA“ vom September 2013 zufolge befindet sich unsere Universität unter den besten 20 Hochschulen Russlands: Kriterien dafür sind die guten Rahmenbedingungen an unserer Hochschule, die die hohe Qualität der Ausbildung und das hohe Niveau unserer Forschungstätigkeit sichern, weshalb unsere Akademiker auf dem Arbeitsmarkt sehr gefragt sind.

Die führende Rolle unserer Universität wird auch dadurch gestützt, dass wir sehr erfolgreich an den Förderprogrammen der Föderalen Regierung und des Ministeriums für Bildung und Wissenschaft der Russischen Föderation teilnehmen. So konnten wir Fördermittel in folgenden Ausschreibungen einwerben:

1. Entwicklung des Innovations- und Bildungsprogramms „Spitzentechnologien“ an der NSTU (2007-2008)
2. Programm zur „Entwicklung der innovativen Infrastruktur und Kaderausbildung im Bereich ‘Innovatives Unternehmertum‘ an der NSTU“ (2011-2012)
3. Fort- und Weiterbildungsprogramm mit Lehrwerkentwicklung für die Herstellung nanokeramischer Produkte im Rahmen einer Ausschreibung des Fonds für Infrastruktur- und Bildungsprogramme „Rosnano“ (2012)
4. Projekt der NSTU und der Betriebsgesellschaft „Sewer“ zur „Erforschung, Entwicklung und Organisierung der industriellen Herstellung von Mechatron-Systemen für energieeinsparende Technologien“
5. Präsidentenprogramm zur Fortbildung für Ingenieure in prioritären Bereichen der Modernisierung und technologischer Entwicklung der Wirtschaft Russlands
6. Programm zur strategischen Entwicklung der Universität „Ingenieure und Wissenschaftler für die innovative Wirtschaft“ (2012-2016)

Eine der Prioritäten der strategischen Entwicklung der Universität ist die Internationalisierung von Forschung und Bildung. Unsere Zusammenarbeit mit deutschen Universitäten und Forschungseinrichtungen ist ein wichtiger und sicherer Weg zur Internationalisierung. Ich möchte betonen, dass die Zusammenarbeit bereits vor 40 Jahren begonnen hat. Heute kooperieren wir mit unseren deutschen Partnern bei der Erstellung von gemeinsamen Ausbildungsprogrammen, beim wissenschaftlichen Austausch, in Sommerschulen zum Thema Nanotechnologien und neuen Materialien. Zudem gibt es gemeinsame Forschungsprojekte, Seminare und Veröffentlichungen. Ein wichtiges Element zur Erziehung der jungen Generation ist auch unser gemeinsames Projekt für russische und deutsche Studierende zur Pflege von Kriegsgräberstätten, das in diesem Jahr bereits zum dritten Mal stattgefunden hat. Andere bedeutende Punkte unserer Zusammenarbeit sind:

- Ein gemeinsames Seminar im Mai 2013 zu Fragen der akademischen Mobilität, woran Vertreter unserer Partneruniversitäten aus Deutschland teilgenommen haben;
- Eine sehr erfolgreiche Podiumsdiskussion, die letzte Woche mit deutschen Experten zum Thema „Einfluss der Energiewirtschaft auf die Klimaveränderung und den Klimaschutz in Sibirien“ im Rahmen der internationalen Ausstellung „ELKOM“ stattfand.

An unserer Universität haben mehrere große Veranstaltungen stattgefunden, die von der DAAD-Außenstelle Moskau organisiert wurden. Höhepunkte waren sicherlich der Besuch einer hochrangigen Delegation der Hochschulrektorenkonferenz verbunden mit einem Seminar für DAAD-Lektoren aus ganz Russland (1995) sowie eine große Ausstellung zur Präsentation deutscher Hochschulen (2000).

Heute eröffnen wir die dritte „Deutsch-Russische Woche des Jungen Wissenschaftlers“ zum Thema „Luft- und Raumfahrt“. Eine große Ehre für uns, womit wir allerdings auch große Hoffnungen verbinden. Unsere Fakultät für Luftfahrzeuge, die Ingenieure, Konstrukteure, Verfahrenstechniker für die Luftfahrtindustrie von Novosibirsk und ganz Russland ausbildet, stellt sich der wichtigen Aufgabe der Internationalisierung von Forschung und Bildung. Ein großer Schritt in diese Richtung ist für uns (und auch für mich persönlich, denn mein Berufsleben ist mit dieser Fakultät verbunden) der Beitritt zum PEGASUS-Netzwerk (Partnership of European Group of Aeronautics and Space Universities). Ich hoffe, dass neue Kontakte, die im Laufe dieser Konferenz entstehen, die Zusammenarbeit zwischen unseren Nachwuchswissenschaftlern stärken und damit auch zum Erreichen dieses Zieles, d.h. der Internationalisierung unserer Hochschule, führen werden.

Ich wünsche allen Teilnehmern erfolgreiche Arbeit und sehr gute Eindrücke von Sibirien, Novosibirsk und unserer Universität.

Дамы и господа, уважаемые коллеги, дорогие друзья!

AKADEMIEMITGLIED ALEKSANDR ASEEV

Vorsitzender der Sibirischen Abteilung der Russischen Akademie der Wissenschaften

АКАДЕМИК АЛЕКСАНДР АСЕЕВ

Председатель Сибирского отделения Российской академии наук, Новосибирск

Для меня большая честь и огромная радость приветствовать вас на сибирской земле от имени Сибирского отделения Российской академии наук!

СО РАН является крупнейшим региональным объединением научно-исследовательских, опытно-конструкторских, производственных организаций РАН, а также подразделений, обеспечивающих функционирование инфраструктуры научных центров, расположенных на территории Сибири в семи областях, двух краях и четырех республиках (общая площадь территории около 10 млн кв. км). Завтра конференция будет проходить в Академгородке, где расположен Новосибирский научный центр СО РАН и где вы сможете познакомиться ближе с достижениями Сибирского отделения.

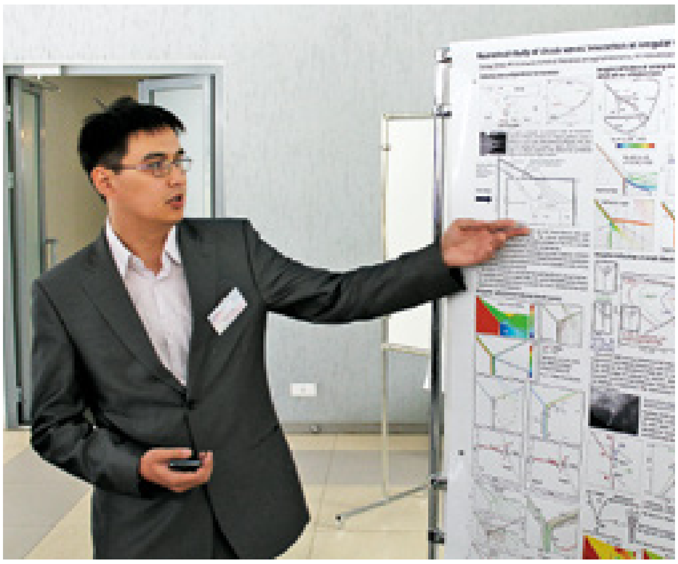
Новосибирск впервые принимает у себя Российско-германскую неделю молодого ученого, на сей раз посвященную теме «Авиация и космос». Выбор и темы, и места проведения недели показателен. Тема конференции – «Авиация и космос», – безусловно, является знаковой для всего СО РАН и для Новосибирского научного центра в частности. Вклад Сибирского отделения Российской академии наук в авиационную и космическую программу и Советского Союза, и затем России очень велик. Исследования для космоса начались благодаря личной инициативе С.П. Королёва. Сейчас институты и организации СО РАН выполняют научно-исследовательские и технологические разработки в интересах крупнейших авиационных и космических организаций России: Федерального космического агентства, Ракетно-космической корпорации «Энергия», ОАО «Информационные спутниковые системы» им. академика М.Ф. Решетнёва, ОАО «ОКБ Сухого», ОАО «Туполев», ЦАГИ и многих других.

Институты Сибирского отделения РАН активно участвуют в развитии и внедрении инноваций и новых технологий для авиации и космоса. Приведу только два примера. Институтом теоретической и прикладной механики им. С.А. Христиановича СО РАН созданы программные системы высотной аэродинамики, которые используются в РКК «Энергия», в Европейском космическом агентстве и т. д. для аэродинамического сопровождения эксплуатации МКС, для анализа процесса разрушения в атмосфере Земли сходящего с орбиты КА, при создании новых образцов ракетно-космической техники. По заказу Роскосмоса Институтом физики полупроводников им. А.В. Ржанова СО РАН разработан эскизный проект установки для синтеза нового материала для высокоэффективных солнечных батарей в открытом космосе на борту российского сегмента Международной космической станции. Эта установка в дальнейшем позволит создать орбитальную фабрику по производству полупроводниковых многослойных композиций для изготовления новой элементной базы высокочастотной электроники, нанофотоники, средств навигации и связи. Некоторые наиболее значимые разработки представлены на действующей выставке «Сибирские ученые – космосу» в Выставочном центре СО РАН.

Мне очень приятно отметить, что в ряде важнейших проектов работа ведется совместно с нашими германскими партнерами. На протяжении уже более 20 лет проводятся совместные исследования, организуются семинары, конференции, выставки и т. д. Идет активный обмен учеными. Для справки: в год, например, более 500 российских ученых выезжают в ФРГ для работы и более 300 немецких специалистов приезжают в Новосибирск. Германия – важнейший научный партнер Сибирского отделения. Так что сотрудничество идет самое интенсивное, во многом благодаря оперативности выдачи виз и профессионализму сотрудников Генерального консульства Германии в Новосибирске, за что мы им искренне признательны.

Сегодня нашей задачей является привлечение в сферу взаимовыгодного сотрудничества как можно большего числа молодых ученых. Целью предстоящего мероприятия является налаживание взаимодействия и расширение связей между молодыми учеными двух стран. Надеюсь, что эта неделя молодого ученого сыграет важную роль в решении данной задачи.

Желаю всем плодотворной и творческой работы, установления новых связей и укрепления старых!



Meine Damen und Herren, sehr geehrte Kollegen, liebe Freunde!

Es ist für mich eine große Ehre und eine große Freude zugleich, Sie in Sibirien im Namen der Sibirischen Abteilung der Russischen Akademie der Wissenschaften willkommen zu heißen!

Die Sibirische Abteilung verbindet Forschungs-, Versuchs-, Konstruktions- und Produktionseinrichtungen der Russischen Akademie der Wissenschaften, Einrichtungen, die die Tätigkeit der wissenschaftlichen Zentren sicherstellen, und ist mit ihren Forschungszentren in 7 Gebieten, 2 Regionen und 4 Teilrepubliken (Gesamtfläche ca. 10 Mio. m²) Russlands die größte regionale Abteilung. Morgen tagt die Konferenz im Wissenschaftlerstädtchen, wo sich das wissenschaftliche RAN-Zentrum von Novosibirsk befindet, dort haben Sie die Möglichkeit, mehr über die Tätigkeit der Sibirischen Abteilung zu erfahren.

Die Deutsch-Russische Woche des Jungen Wissenschaftlers kommt zum ersten Mal nach Novosibirsk, ihr Thema ist in diesem Jahr „Luft- und Raumfahrt". Die Wahl des Themas und des Ortes war sicherlich keine zufällige. „Luft- und Raumfahrt" ist für die Sibirische Abteilung und das wissenschaftliche Zentrum Novosibirsk von besonderer Bedeutung. Die Sibirische Abteilung der Russischen Akademie der Wissenschaften hat einen wichtigen Beitrag zur Entwicklung der Luft- und Raumfahrt in der Sowjetunion und später in Russland geleistet. Die Erforschung des Weltalls begann dank der Initiative von S. P. Koroljow. Heute forschen Institute und andere Einrichtungen der Abteilung im Auftrag von großen Luft- und Raumfahrtgesellschaften Russlands: Föderale Raumfahrtagentur, Raketen- und Raumfahrtkonzern „Energija", OAO „Informationssatellitensysteme Ak. M.F. Reschetnjow", Entwicklungs- und Konstruktionsbüro Sukhoi, Entwicklungs- und Konstruktionsbüro Tupolev, Zentrales Aerohydrodynamisches Institut und andere.

Institute der Sibirischen Abteilung nehmen an der Entwicklung und Einführung innovativer Produkte und Technologien im Bereich Luft- und Raumfahrt aktiv teil. Ich möchte an dieser Stelle nur zwei Beispiele nennen. Das Khristianovich-Institut für Theoretische und Angewandte Mechanik hat Programmsysteme für Raumfahrzeuge entwickelt, die vom Raketen- und Raumfahrtkonzern „Energija" und der Europäischen Weltraumorganisation ESA für die aerodynamische Begleitung der Nutzung der ISS, für die Analyse der Zerstörung des Raumfahrzeuges durch die Atmosphäre beim Abstieg aus der Bahn, bei der Entwicklung neuer Raumfahrzeuge genutzt werden. Im Auftrag von „Roskosmos" hat das Rzhanow-Halbleiterphysikinstitut einen Vorentwurf einer Anlage zur Synthese des neuen Materials für hocheffiziente Sonnenbatterien im freien Weltraum an Bord der ISS vorbereitet, die Anlage soll der Grundstein einer Raumfabrik zur Herstellung von Mehrschichthalbleiterkompositionen für Hochfrequenzelektronik, Nanophotonik, Navigations- und Verbindungsmittel sein. Andere bedeutende Ergebnisse unserer Arbeit finden Sie in der Ausstellung „Wissenschaftler Sibiriens für die Raumfahrt" in Ausstellungsräumen der Sibirischen Abteilung.

Ich bin sehr froh darüber, dass wir in einigen wichtigen Projekten mit unseren deutschen Partnern zusammen arbeiten. Im Laufe der letzten 20 Jahren forschen wir gemeinsam, organisieren Seminare, Konferenzen und Ausstellungen. Es besteht ein reger Wissenschaftleraustausch: mehr als 500 russische Wissenschaftler haben jedes Jahr die Möglichkeit eines Forschungsaufenthaltes in Deutschland, mehr als 300 deutsche Wissenschaftler kommen jährlich nach Novosibirsk. Deutschland ist der wichtigste wissenschaftliche Partner der Sibirischen Abteilung der Akademie. Unsere Zusammenarbeit ist sehr intensiv, nicht zuletzt dank der professionellen Visaunterstützung des Generalkonsulats der BRD in Novosibirsk, dem wir unseren herzlichen Dank aussprechen möchten.

Unsere Aufgabe heute ist die Einbeziehung möglichst vieler junger Wissenschaftler in unsere Zusammenarbeit. Das Ziel der Deutsch-Russischen Woche ist Ideenaustausch und Ausbau der Beziehungen zwischen Nachwuchswissenschaftlern unserer Länder. Ich hoffe sehr, dass die Woche des Jungen Wissenschaftlers einen wichtigen Beitrag dazu leisten wird.

Ich wünsche uns allen eine erfolgreiche und kreative Arbeit, durch unsere Konferenz werden neue Kontakte geknüpft und alte Kontakte gepflegt!

KLAUS MÜLLER
Ständiger Vertreter des Generalkonsuls
Generalkonsulat der Bundesrepublik Deutschland in Novosibirsk

КЛАУС МЮЛЛЕР
Постоянный заместитель Генерального консула
Генеральное консульство Германии в Новосибирске

Sehr geehrte Damen und Herren,

ich freue mich, Sie heute bei der Eröffnung der 3. Deutsch-Russischen Woche des jungen Wissenschaftlers in Nowosibirsk im Namen des Generalkonsuls Höfer-Wissing begrüßen zu dürfen.

Ich möchte meinen Dank an die Organisatoren dieser großartigen wissenschaftlichen Tagung richten: dem Deutschen Akademischen Austauschdienst und der Deutschen Forschungsgemeinschaft unter dem Dach des DWIH, der Sibirischen Abteilung der Russischen Akademie der Wissenschaften, der Technischen Universität Nowosibirsk und dem Verband Junger Wissenschaftler in Russland.

Zum Thema dieser Veranstaltungsreihe wird immer ein aktuelles Problem unserer Zeit gewählt. 2011 diskutierten in Kasan deutsche und russische Wissenschaftler zum Thema „Mensch und Energie“. Auf der Agenda der 2. Woche in Ekaterinburg 2012 stand „Health and Society“. Dieses Jahr wurde Nowosibirsk als Standort der Diskussion über „Aviation and Space“, sprich über die Entwicklung der Verkehrsinfrastruktur, gewählt. Die an der Transsibirischen Eisenbahn liegende Stadt ist das größte Drehkreuz, das Sibirien, Fernost und Zentralasien mit den westlichen russischen Regionen verbindet, und gleichzeitig eines der größten Wissenschafts- und Bildungszentren Russlands. Ich bin sicher, dass mit der 3. deutsch-russischen Woche ein weiterer Meilenstein im Wissenstransfer unter jungen Fachkräften unserer Länder gesetzt wird.

Уважаемые дамы и господа!

Я рад возможности приветствовать вас сегодня на открытии III Российско-германской недели молодого ученого в Новосибирске от имени Генерального консула, господина Хёфер-Виссинга.

Я хотел бы выразить благодарность организаторам этой грандиозной научной конференции: Германской службе академических обменов и Немецкому научно-исследовательскому сообществу под эгидой Германского дома науки и инноваций, Сибирскому отделению РАН, Новосибирскому государственному техническому университету и Российскому союзу молодых ученых.

Темой этой серии мероприятий всегда становится актуальная проблема нашего времени. В 2011 году в Казани германские и российские ученые дискутировали на тему «Человек и энергия». На повестке дня II недели, состоявшейся в 2012 году в Екатеринбурге, стоял вопрос «Здоровье и общество». В этом году в качестве места проведения дискуссии об авиации и космосе, то есть о развитии транспортной инфраструктуры, был выбран Новосибирск. Город расположен на Транссибирской магистрали и является крупнейшим транспортным узлом, который соединяет Сибирь, Дальний Восток и Среднюю Азию с западными российскими регионами, и одновременно одним из крупнейших научно-образовательных центров России. Я уверен, что III Российско-германская неделя станет важной вехой в трансфере знаний между молодыми специалистами наших стран.

Sehr geehrter Herr Rektor Pustovoi, Sehr geehrter Herr Vorsitzender Aseev, Sehr geehrter Herr Konsul Müller, lieber Herr Shcheglov, meine sehr geehrten Damen und Herren,

PROF. PETER FUNKE
Vize-Präsident der Deutschen Forschungsgemeinschaft

ПРОФ. ПЕТЕР ФУНКЕ
Вице-президент Немецкого научно-исследовательского сообщества

ich freue mich sehr, dass Sie der gemeinsamen Initiative des Deutschen Akademischen Austauschdienstes und der Deutschen Forschungsgemeinschaft gefolgt sind, und begrüße Sie ganz herzlich zur dritten Nachwuchswoche des Deutschen Wissenschafts- und Innovationshauses!

Anlässlich des Deutsch-Russischen Wissenschaftsjahres 2011/12 wurde eine neue Idee verfolgt: Jungen Wissenschaftlern beider Länder ein Forum des Austauschs zu bieten, auf dem sie selbst aus ihren wissenschaftlichen Arbeiten berichten und Vorträgen erfahrener Wissenschaftler beiwohnen können. Wir hatten vor zwei Jahren auf der ersten Woche in Kazan die Hoffnung geäußert, dass sich die Idee verstetigen möge, einmal pro Jahr an wechselnden Standorten zu wechselnden Thematiken bilaterale Nachwuchswochen in Russland durchzuführen. Nachdem wir im letzten Jahr in Jekaterinburg zu Gast waren, haben wir uns diesmal sogar hinter den Ural hier zu Ihnen nach Novosibirsk gewagt.

Aber ein so großes Wagnis ist eine Reise nach Novosibirsk – selbst von Deutschland aus – in diesen Tagen natürlich nicht mehr! Wie zu lesen ist, verdankt Novosibirsk seine Gründung im Jahre 1893 dem Bau einer Brücke der Transsibirischen Eisenbahn über den Fluss Ob. Insofern ist es erstaunlich, dass Ihre Millionenstadt von heute noch nicht einmal existierte, als Alexander von Humboldt 1829 seine große Russlandexpedition durchführte. Für uns Deutsche erschließt sich der sprechende Name ihrer Stadt „Novosibirsk" – d.h. „Neues Sibirien" – vielleicht ja sogar ohne Kenntnisse des Russischen. Allerdings erklärt sich durch ihren programmatischen Namen und ihre Bedeutung bei der Erschließung Sibiriens ihr rasanter Aufstieg vom einige Tausend Einwohner zählenden Dorf zur drittgrößten Metropole Russlands.

Heute ist Ihr „Neues Dorf" – wie Novosibirsk ja ursprünglich hieß – zur Hauptstadt Sibiriens aufgestiegen, die weit über die Grenzen Russlands hinaus bekannt ist. So ist nicht nur dem erfahrenen Russlandkenner geläufig, dass Novosibirsk lange als geographischer Mittelpunkt des riesigen Russischen Reiches galt. Es sind eben gerade diese unvorstellbaren Weiten, die mächtigen Ströme und die langen kalten Winter Sibiriens, die das Interesse der Deutschen an Russland wecken.

Mit der Transsib entwickelte sich Novosibirsk rasch zum Verkehrsknotenpunkt als Verbindung zwischen Europa und Asien. Diese besondere Mittlerfunktion Novosibirsks wollen wir auch in diesen Tagen nutzen, um den Austausch von Ideen zu einem aktuellen Thema zwischen unseren Ländern, das heißt eben auch zwischen Ost und West, voranzutreiben. Im Mittelpunkt steht nach den beiden Jahren zuvor mit Fragen zur „Energie" und zur „Gesundheit" diesmal der Themenkomplex zur „Luft- und Raumfahrt", dem sich die Wissenschaft seit jeher im Verbund über Ländergrenzen hinweg widmet.

Mit dieser Thematik stoßen wir aber nicht nur hier an Ihrer Technischen Universität, lieber Herr Rektor, sondern in der gesamten Region auf große Resonanz. Novosibirsk avancierte zu einem bedeutenden Industrie- und Wissenschaftszentrum, wobei die

Ingenieurwissenschaften sowie der Maschinen- und insbesondere der Flugzeugbau mit den Tschkalov-Werken eine tragende Rolle spielten. Mit der Gründung der Sibirischen Abteilung der Akademie der Wissenschaften und dem Bau des Wissenschaftlerstädtchens „Akademgorodok" wurde Novosibirsk auch zu einer der wichtigsten Bildungsstätten des Landes. Bis 1991/92 war Novosibirsk ja die einzige nichtgeschlossene Großstadt in Sibirien und stand daher auch für ausländische Studierende offen, darunter sehr viele aus der früheren DDR. Wir freuen uns auf diese Woche hier bei Ihnen, weil Novosibirsk ja auch kulturell ein attraktiver Standort geworden ist und wir unter anderem das größte Opernhaus Russlands besuchen dürfen.

„Deutschland und Russland: gemeinsam die Zukunft gestalten", – so lautete das Motto des gerade zu Ende gegangenen Deutschlandjahres in Russland. Dieses Motto spiegelt die Grundidee unserer gesamten Woche wider. Dass dem Nachwuchs dabei besondere Beachtung zukommt, liegt in der Natur der Sache. Wir werden ohne unseren Nachwuchs weder in der Wissenschaft noch in sonstigen Bereichen der Gesellschaft die Zukunft gestalten können. Darum gilt es auch und vor allem, den Nachwuchs durch Veranstaltungen wie diese zu fördern. Zudem bin ich davon überzeugt, dass diese „Woche des jungen Wissenschaftlers" in dieser „Jungen Stadt" eine ideale Plattform für einen intensiven Gedankenaustausch und eine Basis für zukünftige Kooperationen findet.

Die Förderung des wissenschaftlichen Nachwuchses ist ein Anliegen des DWIH, aber hier ist es nur eines unter anderen. Die Präsentation der deutschen Wissenschaft im Ausland, konkret in Russland, ist das vorrangige Ziel. Unter den Mitgliedern dieses Hauses befindet sich aber auch der Deutsche Akademische Austauschdienst, der DAAD, der mit dieser Universität sehr lange und sehr gute Kontakte hat. Für die deutschen Hochschulen und Universitäten organisiert er seit vielen Jahrzehnten den internationalen Austausch in vielfältiger Form. Studierende, Promovenden und Wissenschaftler, sowohl aus Deutschland, als auch aus dem Ausland, sind die traditionellen Zielgruppen. Durch individuelle Stipendien und durch die Unterstützung bilateraler Hochschulbeziehungen wird der internationale Austausch organisiert. Die Internationalisierung der deutschen Universitäten ist das strategische Ziel des DAAD. Jährlich erhalten etwa 100.000 Personen, in verschiedensten Formen und Programmen, eine Förderung vom DAAD. Im Bereich der jungen Wissenschaftler hat der DAAD in Russland mehrere Partner, mit denen zusammen er Promovenden und junge Wissenschaftler fördert. Ich nenne an dieser Stelle nur die beiden Programme „Immanuel Kant" und „Michail Lomonosov". Beide werden gemeinsam vom DAAD und dem Ministerium für Bildung und Wissenschaft finanziert. Darüber hinaus bestehen fast 180 deutsch-russische Hochschulbeziehungen, nicht wenige von ihnen sind über persönliche Kontakte zwischen zwei Wissenschaftlern entstanden. Wissenschaft öffnet Türen und insbesondere natürlich auch den jungen Leuten wie Ihnen!

Mit unseren Nachwuchswochen verfolgen wir ja zwei strategische Ziele: Zum einen werden mit der Präsentation von Spitzenforschung und der Vernetzung des Nachwuchses zentrale Punkte der bilateralen Zusammenarbeit aufgegriffen; und zum anderen wird der Austausch mit den wissenschaftlichen Zentren in den Regionen Russlands vorangetrieben - denn auch hier in Novosibirsk wird auf hohem Niveau gemeinsam mit Deutschland geforscht.

Lassen Sie mich daher hervorheben, dass es vor allem die Bedeutung Novosibirsks als Wissenschaftszentrum ist, die uns heute hier aus weiten Teilen Russlands und Deutschlands zusammenführt. Ich darf den Vertretern der Akademie ganz herzlich gratulieren! Akademiemitglied Aseev wurde vor kurzem im Amt als Vorsitzender des Präsidiums der Sibirischen Abteilung und als Vizepräsident der Russischen Akademie der Wissenschaften wiedergewählt. Mittlerweile zählt Ihre Sibirische Abteilung, die hier 1957 gegründet wurde, rund 30.000 Mitarbeiter an 80 Forschungsinstituten. Im Übrigen pflegte die Deutsche Forschungsgemeinschaft, von Beginn an enge Kontakte hierher, was auch die aktuellen Statistiken zum Wissenschaftleraustausch belegen: Deutschland rangiert nach wie vor an der ersten Stelle beim Austausch mit Wissenschaftlern Ihrer Sibirischen Abteilung!

Gestatten Sie mir hier einige weitere Ausführungen zur DFG. Die Deutsche Forschungsgemeinschaft ist heute der größte Forschungsförderer in Europa. Mit einem Jahresbudget von über zweieinhalb Milliarden Euro unterstützen wir die Entwicklung der Grundlagenforschung an Hochschulen und Forschungsinstitutionen. Im internationalen Förderhandeln der DFG spielt Russland eine führende Rolle, denn seit 2003 ist

die DFG mit einer eigenen Auslandsrepräsentanz in Moskau vertreten, die in einigen Wochen ihr 10-jähriges Jubiläum feiert. Aber bereits seit 1970 besteht ein Abkommen mit der Akademie der Wissenschaften, um den Austausch zwischen unseren Forschernationen zu befördern.

Mittlerweile arbeiten deutsch-russische Forschungsgruppen von Kaliningrad bis Vladivostok und vom Nordkaukasus bis zur Kola-Halbinsel an gemeinsamen DFG-Projekten. Gut ein Zehntel aller ausländischen Gastwissenschaftler an den DFG-Sonderforschungsbereichen in Deutschland stammt aus Russland. Damit rangiert die Russische Föderation gleich nach den USA der zweiten Stelle. Auch in der Nachwuchsförderung der DFG-Graduiertenkollegs zählt Russland mit China, Indien und Italien zu den vier größten „Entsenderländern" der Promovierenden.

Allein in den letzten Jahren finanzierte die DFG über 300 Projektanträge mit Beteiligung russischer Forscher. Beispiele dafür finden sich auch in Sibirien, insbesondere in den Natur- und Ingenieurwissenschaften, aber auch in den Pflanzenwissenschaften. Sehr erfolgreich sind hier Kooperationen aus der Chemie und der Physik wie der Optik und Quantenoptik, der Festkörper- und Oberflächenforschung sowie der Geologie und Paläontologie und der Geochemie, Mineralogie und Kristallographie. Mit Blick auf die Thematik unserer Woche finden sich zahlreiche Projekte aus der Strömungsmechanik, aus der Verfahrens-, der Produktions- und der Werkstofftechnik sowie dem Maschinenbau. Führend beteiligt an den Kooperationen sind vor allem die Institute der Akademie der Wissenschaften, wie das Khristianovich-Institut für Theoretische und Angewandte Mechanik, das Nikolaev-Institut für Anorganische Chemie, das Voevodsky-Institut für Chemische Kinetik und Verbrennung, das Budker-Institut für Kernphysik sowie das Institute Computational Technologies.

Neue Perspektiven der Zusammenarbeit ergeben sich im Zuge der aktuellen Reformen der russischen Hochschullandschaft. Ich bin sicher: Auch Ihre Technische Universität, mit 25.000 Studierenden eine der größten des Landes, wird weiterhin ein starker Kooperationspartner für Deutschland sein. Sie wissen vermutlich, dass durch die sogenannte „Exzellenzinitiative" in Deutschland zahlreiche neue Cluster und Forschungszentren an Universitäten geboren werden, die starkes Interesse an einer Zusammenarbeit mit Russland bekunden. Und viele Vertreter deutscher Hochschulen und Wissenschaftsorganisationen sind extra für diese Woche angereist.

Meine Damen und Herren, lassen Sie uns daher diese Tage in Novosibirsk nutzen, um unseren Kooperationen eine neue Qualität zu verleihen. Ich denke, wir dürfen gespannt sein, wie es gemeinsam weiter geht, eines ist jedoch sicher, dass der Standort Novosibirsk auch über das Deutschlandjahr hinaus im Fokus von DAAD und DFG bleiben wird, denn es ist uns ein besonderes Anliegen, die institutionelle Kooperation mit den hiesigen Partnern auszubauen. Ich wünsche Ihnen und uns allen eine erfolgreiche dritte Deutsch-Russische „Woche des Jungen Wissenschaftlers" und hoffe sehr, dass wir im nächsten Jahr gemeinsam die vierte Woche begehen können.

Lassen Sie mich zuvor aber noch den Organisatoren und Teilnehmern hier in Novosibirsk herzliche Glückwünsche aussprechen und persönlichen Dank sagen! Meine Damen und Herren, Sie alle tragen dazu bei, eine Veranstaltungsreihe mit Leben zu füllen.

Уважаемый господин ректор Пустовой, уважаемый господин председатель Асеев, уважаемый господин консул Мюллер, дорогой господин Щеглов, уважаемые дамы и господа!

Я очень рад, что все вы поддержали начинание Германской службы академических обменов (DAAD) и Немецкого научно-исследовательского сообщества (DFG), и я приветствую вас на открытии III недели молодого ученого, проводимой под эгидой Германского дома науки и инноваций!

Одной из ключевых инициатив Российско-Германского года образования, науки и инноваций (2011/2012) стала идея предоставления молодым ученым двух стран более широких возможностей для общения в рамках научного форума, где они смогли бы рассказать о своей работе и услышать доклады старших коллег. Два года назад, на I неделе молодого ученого в Казани, мы выразили надежду на то, что наш проект будет иметь продолжение, что раз в год мы сможем проводить такие двусторонние форумы на очень разные темы в разных городах России. Побывав в прошлом году в Екатеринбурге, в этом году мы отважились перебраться через Урал и приехать к вам в Новосибирск.

Сегодня добраться до Новосибирска, даже из Германии, совсем не так трудно, как было когда-то! В истории города записано, что его строительство началось в 1893 году с момента возведения железнодорожного моста Транссибирской магистрали через реку Обь. Удивительным кажется тот факт, что города, в котором сегодня проживает 1,5 млн человек, в 1829 году, когда Александр фон Гумбольдт совершил свое большое путешествие по России, еще не существовало. Мы, немцы, даже без знания русского языка можем расшифровать название вашего города: Новосибирск – Новая Сибирь. Само название, в котором отражено значение вашего города для освоения Сибири, объясняет столь быстрое превращение небольшого поселения в третий по величине город России.

Бывшее поселение Ново-Николаевск стало столицей Сибири, городом, известным далеко за пределами России. О том, что здесь находился географический центр огромной Российской империи, сегодня знают не только ученые и опытные путешественники. Неизмеримые просторы и расстояния, могучие реки и морозные зимы – все это и пробудило интерес немцев к России.

Со строительством Транссибирской магистрали Новосибирск быстро стал крупным транспортным узлом, соединившим Европу и Азию. Именно эту особую связующую функцию города мы и хотим использовать, поскольку наш форум представляет собой обмен идеями на актуальную тему между двумя странами, одна из которых находится на востоке, а другая – на западе. В предыдущие годы мы обсуждали такие вопросы, как энергия и здоровье, а сегодня наша тема – «Авиация и космос», она уже много лет объединяет усилия ученых многих стран.

Тематика форума актуальна не только для Новосибирского государственного технического университета, уважаемый господин ректор, но и для всего Сибирского региона. Новосибирск стал значимым промышленным и научным центром, серьезную роль в его становлении сыграли инженерные науки, а также машиностроение и особенно самолетостроение после строительства авиационного завода им. В.П. Чкалова. С момента основания здесь Сибирского отделения Российской академии наук и возникновения Академгородка Новосибирск становится одним из важнейших образовательных центров страны. До 1991–1992 годов он оставался единственным незакрытым крупным городом Сибири, и потому сюда приезжали на учебу иностранные студенты, большой процент учащихся – из ГДР. Мы очень рады, что III неделя молодого ученого проходит именно здесь, в этом интересном с точки зрения культуры городе, и мы надеемся успеть посетить самый большой оперный театр в России.

«Германия и Россия – вместе строим будущее» – таков девиз недавно завершившегося года Германии в России. Этот девиз отражает основную идею предстоящей нам недели. Будущее – в руках молодежи. Без молодежи его просто не существует, как в науке, так и в любой другой сфере общественной жизни. Именно потому необходимо поддерживать мероприятия для молодежи. Кроме того, я убежден, что неделя молодого ученого в этом молодом городе станет идеальной основой для интенсивного обмена идеями и будущих совместных проектов.

Поддержка молодежи входит в задачи деятельности Германского дома науки и инноваций и реализуется на неделе молодого ученого. Однако основной целью недели является презентация немецкой науки за рубежом, а конкретно – в России. В Германский дом науки и иннова-

ций входит такая организация, как Германская служба академических обменов (DAAD), которая уже давно и успешно сотрудничает с Техническим университетом. Для университетов и других вузов Германии DAAD уже много десятилетий подряд организует международный обмен в различных формах. Целевыми группами данной организации являются студенты, аспиранты и ученые Германии и других стран. Академический обмен осуществляется в рамках индивидуальных стипендий или поддерживаемых DAAD двусторонних межвузовских отношений. Стратегическая цель организации – интернационализация немецких университетов. Стипендии DAAD по различным программам ежегодно получают около 100 тыс. кандидатов. Что касается поддержки молодежи, у DAAD в России сегодня много партнеров, совместно с которыми организация поддерживает аспирантов и молодых ученых. Существуют совместные программы имени Иммануила Канта и Михаила Ломоносова, которые DAAD реализует вместе с Министерством образования и науки РФ. Кроме того, существует сеть вузов-партнеров; на сегодняшний день это около 180 проектов, многие из которых появились благодаря личным контактам между учеными. Наука открывает двери, особенно для молодых людей, участников нашего форума!

У недели молодого ученого есть две стратегические цели: во-первых, ключевыми вопросами двустороннего сотрудничества являются презентация исследований высочайшего уровня и установление контактов между молодыми учеными наших стран; во-вторых, активное взаимодействие с российскими региональными научными центрами. И Новосибирск как раз является одним из таких центров, который на очень высоком научном уровне сотрудничает с Германией.

В связи с этим позвольте отметить, что именно значение Новосибирска как научного центра и собрало здесь сегодня ученых России и Германии. Мне кажется, это серьезный успех Академии наук! Ее член господин Асеев недавно был переизбран на должности Председателя СО РАН и вице-президента РАН. Сибирское отделение, основанное в 1957 году, сегодня насчитывает около 30 тыс. сотрудников в 80 исследовательских институтах. Немецкое научно-исследовательское сообщество с самого начала активно сотрудничало с регионом, о чем свидетельствует сегодняшняя статистика научных обменов: контакты с учеными Сибирского регионального отделения Германия всегда поддерживала в первую очередь!

Позвольте мне сказать несколько слов о самом Немецком научно-исследовательском сообществе (DFG). Оно на сегодняшний день является крупнейшей организацией в Европе, которая поддерживает научные исследования. Годовой бюджет DFG составляет более 2,5 млрд евро и направляется на поддержку фундаментальных исследований в вузах и научных институтах. Для международной деятельности DFG Россия имеет приоритетное значение. Подтверждением тому служит основание представительства организации в Москве, которое через несколько недель отпразднует свое десятилетие. С 1970 года между DFG и РАН существует соглашение о поддержке научного обмена между нашими странами.

Сегодня немецко-российские исследовательские группы работают над проектами DFG по всей стране, от Калининграда до Владивостока, от Северного Кавказа до Кольского полуострова. Де-

сятая часть всех приглашенных DFG в Германию ученых представляет Россию. Таким образом, Россия является нашим самым важным партнером после США. Что касается обучения в аспирантских школах, то и здесь Россия, вместе с Китаем, Индией и Италией, входит в четверку лидеров по числу посылаемых страной в Германию аспирантов.

Только за последние годы DFG предоставило финансирование для 300 заявок с участием российских ученых. Некоторые заявки представляют Сибирь; чаще всего сибирские проекты относятся к сфере естественных и инженерных наук или же ботаники. Успешное сотрудничество с Сибирским регионом ведется по таким направлениям, как химия, физика, в частности оптика и квантовая оптика, изучение твердых тел и поверхностей, а также геология и палеонтология, геохимия, минералогия и кристаллография. По тематике нашей недели здесь реализуется целый ряд проектов в области гидродинамики, технологии и методов производства, конструкционных материалов, машиностроения. В них задействованы в первую очередь институты РАН: Институт теоретической и прикладной механики им. С.А. Христиановича, Институт неорганической химии им. А.В. Николаева, Институт химической кинетики и горения им. В.В. Воеводского, Институт ядерной физики им. Г.И. Будкера и Институт вычислительных технологий.

Недавняя реформа системы высшего образования в России открывает новые перспективы для нашего сотрудничества. Я уверен: Технический университет, в котором учится 25 тыс. студентов, один из крупнейших технических вузов в стране, останется сильным и интересным партнером для Германии. Вы, вероятно, знаете, что так называемая инициатива по поддержке ведущих элитарных вузов Германии дала им возможность создавать новые исследовательские кластеры и университетские научные центры, которые уже выразили свою заинтересованность в сотрудничестве с Россией. Представители многих немецких университетов и научных организаций специально приехали в Россию, чтобы принять участие в неделе молодого ученого.

Уважаемые дамы и господа, давайте используем те возможности, которые предлагает нам неделя молодого ученого в Новосибирске, чтобы вывести наше сотрудничество на качественно новый уровень. Полагаю, нам всем интересно, как будет развиваться наша совместная деятельность, но в одном я уверен: Новосибирск останется в фокусе внимания DAAD и DFG и после завершения года Германии в России, поскольку мы особенно заинтересованы в укреплении связей с партнерами в Сибири. Желаю всем нам успешной III Российско-германской недели молодого ученого и очень надеюсь, что в следующем году мы вместе откроем IV неделю.

Я хотел бы выразить особую благодарность организаторам и участникам недели в Новосибирске! Дамы и господа, я уверен в том, что эта неделя будет полезной и интересной.

Уважаемые участники, гости и организаторы мероприятия!

ALEKSANDR SHCHEGLOV
Vorsitzender des Rates der Gesamtrussischen gesellschaftlichen Einrichtung „Verband Junger Wissenschaftler in Russland" (RoSMU)

АЛЕКСАНДР ЩЕГЛОВ
Председатель Совета Общероссийской общественной организации «Российский союз молодых ученых»

Прежде всего хочу поприветствовать всех собравшихся от имени Общероссийской общественной организации «Российский союз молодых ученых», которая уже третий год подряд выступает соорганизатором Российско-германской недели молодого ученого.

В этом году для открывающегося мероприятия выбрана крайне актуальная тема – «Авиация и космос». Действительно, авиационная и космическая промышленность играет системообразующую роль в экономике государства. Ее развитие способствует совершенствованию обеспечивающих отраслей, дает ощутимый импульс развитию машиностроения, электронной промышленности и др. Кроме того, авиационная и космическая промышленность вносит значительный вклад в обеспечение национальных интересов в оборонной сфере, что также подчеркивает актуальность темы мероприятия.

Вопросам, связанным с авиацией и космосом, в России всегда придавалось особое значение. Например, в конце 2012 года Правительством Российской Федерации утверждена Государственная программа «Развитие авиационной промышленности на 2013–2025 годы», предусматривающая реализацию мероприятий, направленных на достижение глобальной конкурентоспособности российской авиационной промышленности и укрепление ее позиций на мировом рынке. Готовится реформа ракетно-космической отрасли, в рамках которой планируется создание Объединенной ракетно-космической корпорации для повышения эффективности работы предприятий отрасли.

Однако успешная реализация вышеназванных мер невозможна без развития научных и образовательных организаций, совершенствования системы подготовки научных и инженерных кадров для сферы авиации и космоса, проведения прорывных научных исследований и разработок мирового уровня в данной области. Одним из факторов эффективного решения подобных задач является расширение международного сотрудничества, направленного на обмен опытом, совместное осуществление научно-технических проектов, что будет способствовать наиболее полной реализации имеющегося потенциала всех участвующих сторон. В связи с этим открывающееся сегодня российско-германское мероприятие имеет особую значимость, так как оно внесет вклад в расширение взаимодействия между молодыми учеными двух стран и придаст дополнительный импульс сотрудничеству России и Германии в сфере авиации и космоса.

Следует отметить, что Российский союз молодых ученых принимает активное участие в процессах развития международного сотрудничества и считает это одним из важнейших элементов совершенствования и развития отечественной сферы образования, науки и технологий.

В завершение хочу поблагодарить за сотрудничество наших партнеров – Германский дом науки и инноваций в Москве, Немецкое научно-исследовательское сообщество, Германскую службу академических обменов, принимающую сторону – Новосибирский государственный технический университет, а также пожелать всем участникам Российско-германской недели молодого ученого «Авиация и космос» успешной работы.

Sehr geehrte Teilnehmer, Gäste und Veranstalter der Woche!

Zunächst möchte ich Sie alle im Namen des „Verbandes Junger Wissenschaftler in Russland“ zur Eröffnung der „Woche des jungen Wissenschaftlers“ begrüßen, die RoSMU bereits zum dritten Mal mitveranstaltet.

Die Veranstaltung in diesem Jahr ist einem hochaktuellen Thema gewidmet – „Luft- und Raumfahrt“. Diese beiden Bereiche spielen eine entscheidende Rolle für die Wirtschaft des Landes. Die Weiterentwicklung der Branche gibt neue Impulse für alle naheliegenden Bereiche, für den Maschinenbau, die Elektronik u. a. Außerdem leistet die Luft- und Raumfahrtindustrie einen wichtigen Beitrag im Verteidigungsbereich, was nochmals darauf hindeutet, dass unser Thema sehr aktuell ist.

Luft- und Raumfahrt waren für Russland immer schon von besonderer Bedeutung. Ein Bespiel dafür: 2012 hat die Regierung der Russischen Föderation das staatliche Programm „Entwicklung der Luftfahrtindustrie 2013–2025“ angenommen, das verschiedene Maßnahmen vorsieht, die zur Erhöhung der Wettbewerbsfähigkeit russischer Luftfahrtindustrie auf dem internationalen Markt führen sollen. Heute wird an der Reform der Raketen- und Raumfahrtindustrie gearbeitet, die auf die Gründung eines Vereins für Raketen und Raumfahrt zielt, womit die Effizienz der Unternehmen der Branche gesteigert werden kann.

Eine erfolgreiche Umsetzung der oben genannten Maßnahmen ist ohne Entwicklung in Forschung und Lehre, ohne Ausbildung der Nachwuchswissenschaftler und Ingenieure im Bereich Luft- und Raumfahrt auf einem ganz anderen Niveau, ohne revolutionäre Entdeckungen in der Wissenschaft der ganzen Welt nicht möglich. Einer der Faktoren für die effiziente Lösung solcher Aufgaben ist die Stärkung der internationalen Zusammenarbeit mit dem Ziel des Erfahrungsaustausches, gemeinsamer Realisierung wissenschaftlich-technischer Projekte, was zur Realisierung des Potenzials aller beteiligten Seiten führen wird. Aus diesem Grund hat die Veranstaltung, die wir heute hier eröffnen, eine besondere Bedeutung, sowohl für die Erweiterung der Zusammenarbeit zwischen unseren Nachwuchswissenschaftlern als auch für die gesamte Zusammenarbeit von Russland und Deutschland im Bereich der Luft- und Raumfahrt.

Es sei betont, dass der „Verband Junger Wissenschaftler in Russland“ aktiv an der Förderung der internationalen Zusammenarbeit teilnimmt und sie als Schlüsselelement für die Modernisierung der Bereiche Lehre, Forschung und Technologien betrachtet.

Zum Schluss möchte ich mich bei unseren Partnern – dem DWIH in Moskau, der DFG und dem DAAD – für die erfolgreiche Zusammenarbeit bedanken, ich danke der Staatlichen Technischen Universität Novosibirsk und wünsche allen Teilnehmern der „Deutsch-Russischen Woche des Jungen Wissenschaftlers“ zum Thema „Luft- und Raumfahrt“ viel Erfolg bei der Arbeit.

Дорогие друзья! Уважаемые участники и организаторы недели молодого ученого «Авиация и космос»!

JELENA ZHITENKO
Stellvertretende Ministerin für Bildung, Wissenschaft und Innovationspolitik der Region Novosibirsk

ЕЛЕНА ЖИТЕНКО
Заместитель министра образования, науки и инновационной политики Новосибирской области

В Новосибирске в рамках перекрестного Российско-Германского года образования, науки и инноваций впервые проходит международный форум молодых ученых, посвященный авиации и космосу.

Новосибирская область – исторически сложившийся научный и инновационный центр, регион, имеющий значительный потенциал для реализации международного сотрудничества в области образования, науки и технологий авиационного профиля.

Уверена, что «циркуляция знаний» в ходе этой недели, дискуссии по ключевым результатам и перспективам исследований и разработок, непосредственное знакомство молодых исследователей друг с другом будут содействовать интернационализации научного сотрудничества молодого поколения ученых наших стран.

Желаю всем участникам недели молодых исследователей «Авиация и космос» плодотворной работы, новых открытий и продуктивных решений, а также интересного знакомства с третьим по величине городом России, столицей Сибири – Новосибирском.

Liebe Freunde! Sehr geehrte Teilnehmer und Organisatoren der Woche des Jungen Wissenschaftlers „Luft- und Raumfahrt"!

Zum ersten Mal findet in Novosibirsk im Rahmen des Deutsch-Russischen Jahres der Bildung, Wissenschaft und Innovation ein internationales Forum für Nachwuchswissenschaftler zum Thema „Luft- und Raumfahrt" statt.

Novosibirsk hat sich im Laufe der Zeit zu einem bedeutenden Zentrum der Wissenschaft und Innovation entwickelt, diese Region hat großes Potenzial für internationale Zusammenarbeit im Bereich Bildung, Wissenschaft und Raum- und Luftfahrttechnologien.

Ich bin sicher, dass der Wissenstransfer während der Woche, die Diskussion zu Schlüsselfragen und Perspektiven der Forschung, neue Kontakte zwischen jungen Wissenschaftlern zur Erweiterung und Internationalisierung der wissenschaftlichen Zusammenarbeit unserer beiden Länder beitragen werden.

Ich wünsche allen Teilnehmern der Woche des Jungen Wissenschaftlers „Luft- und Raumfahrt" erfolgreiche Arbeit, neue Ideen und Lösungen und einen interessanten Aufenthalt in der drittgrößten Stadt Russlands, in der sibirischen Hauptstadt Novosibirsk.

"What will we be talking about?"

Introductory Remarks

Vice-President of the DFG, Prof. Peter Funke

Dear Distinguished Guests,
Dear Colleagues and Friends,

With the official opening this week, it is my pleasure to share with you some detailed information on what to expect. It is a little bit more difficult for me to do so than in the past, because for the last two years, I was accompanied by my colleague, Professor Huber. As Vice President of the DAAD, he would always begin and I could simply expand on his points. But today, I will have to do without him and I will represent more members of the German delegation than just the DFG, of which I am Vice President.

As a matter of fact, both of our organizations – the DAAD and the DFG – are responsible for science and the development of fundamental research. Indeed, it is this "Week of the Young Researcher" where the aims of the two funding agencies meet for the following: to support the mobility of young scientists and their research activities.

And especially abroad – here in Novosibirsk, Russia, – it all makes so much sense to combine the on-site experience of the DAAD with the research expertise of the DFG, which has funded quite a few projects at Novosibirsk research institutions over the last few years. That is why we originally had the idea to co-organize such a conference. And that is why we have always done this introduction together.

I would like to point out that the German Centre for Research and Innovation, das Deutsche Haus für Wissenschaft und Innovation, is host to many more German organizations than just the DFG and the DAAD. But what is the DWIH all about? The German Federal Foreign Office has been supporting the development of German Science and Innovation Forums since 2009 in the following cities: New York, São Paulo, New Delhi, Tokyo, and Moscow. The aim behind the Forums is to provide collective platforms for German science and research organizations represented in other countries and to unite under one roof in cooperation with German business. This joint, concerted representation of science and industry serves to strengthen the visibility of German drivers of innovation, create synergies between them and promote ties between them and similar organizations in their host countries. In turn, the foregoing bolsters Germany as a location for research and innovation.

These reasons are why I am very happy to see in Novosibirsk this week representatives not only from DAAD and DFG, but also from the Alexander von Humboldt-Foundation, from the Helmholtz Association of German Research Centres and from the Freie Universität Berlin who will support us the whole week. A special welcome to our partner organization, the Russian Foundation for Basic Research (RFBR), and Irina Zhurbina, who will present their funding programmes to us. But even more grateful we are to all the researchers who have come a very long way to Siberia. Without your involvement this week, such coordination would not have been possible. So a great many thanks to all the Germans from Aachen, Berlin, Bonn, Darmstadt, Dresden, Hamburg, Heidelberg, München, Stuttgart – and finally – if I may add…from Münster, because this is where I am from!

But some of our Russian colleagues surely had a longer and more tiring journey travelling here; in fact, some of you live as far away from Novosibirsk as we Germans do. So it is a great pleasure to welcome you from various parts of the vast territory of the Russian Federation: from Belgorod, Moscow, Samara, Tomsk, Ufa, Zhukovsky, and last, but not least, from Novosibirsk and Akademgorodok. And indeed, without the help of our friends from Novosibirsk, Evgenij Tsoi from the Technical University, and Uwe Gaisbauer from ITAM in Akademgorodok, we could not celebrate the opening of this week here today in this fashion.

Obviously, we should also acknowledge the active role of ROSMU, the Russian Union of Young Scientists, and their Chairman, Aleksandr Shcheglov. And, of course, without the strong input of Artyom Fillipov, Chairman of the Association of young scientists at ITAM, it would have been very difficult to match young researchers from Germany and Russia at an eye level. Finally, to bring all these young and promising talents together with other renowned senior scientists – such as Wolfgang Schröder, Klaus Janschek, Martin Oberlack and Rainer Walther – makes this week so much more interesting for all of us.

The DAAD has operated its own representation in Russia for 20 years now, the DFG for 10 years, and the DWIH for 5 years now. But why, exactly, Russia? We believe that there is considerable research potential to be realized in many areas of science and the humanities. We, as the DFG, have always placed special focus on countries that allow scientific cooperation to be carried out on an equal footing. Within our agreements and bilateral programmes with the Russian Academy of Sciences, the Russian Foundation for Basic Research - RFFI, and the Russian Foundation for Humanities - RGNF, innumerable conferences, symposia, visits and research projects have been implemented in all areas of research, often leading to sustainable integrated networks. Our liaison office in Moscow, as one of only seven DFG offices worldwide, underlines the fact that Russia plays a key role as one of our most important strategic partners. But I will stop here at this point because my colleagues will go into detail later this week to present how the DAAD and the DFG both foster bilateral collaboration and facilitate cooperation especially among young researchers.

In short, we have heard now why the DAAD, the DFG and the DWIH are in Russia. Also, we have heard why we are in Novosibirsk today. And finally, we have already heard the motivation behind our focus on the support of young researchers this week. But, we have we not heard about the actual topic of this conference? Why did we choose "Aviation and Space" as a major topic? Let my briefly explain why. There are two good reasons for it.

First since the topic is interdisciplinary, it allows us to invite many different researchers from many different disciplines to set up international networks. We believe that this diversity will be a source for finding new ideas. Identifying and exploiting synergies between various aspects and scientific approaches will surely be the key to tackling global challenges such as aviation and transportation. And this already brings me to the second point: The topic itself is a global issue and is ideal for international cooperation. After all, research in engineering as well as in aerospace has long been a priority topic of mutual interest for German and Russian political and scientific platforms, partnerships and government agreements.

Well, I have talked a lot today and I do not want to repeat myself here. I promise you will not have to listen to me again this week! Also, I have already said quite a few words in German and in English – and there are so many great minds among us who haven't even said a single word in either language yet. So it is high time that I finish to allow the young scientists and the engineers speak!

"What will we be talking about?"

Introductory Remarks

DR.-ING. MICHAEL LENTZE

Deutsche Forschungsgemeinschaft,
Group of Engineering Sciences

Dear Readers and Young Scientists,

The Vice-President, Peter Funke, has already extended the warmest regards of the Executive Board of the Deutsche Forschungsgemeinschaft to you. Now it is a great pleasure and an honour for me to welcome you, on behalf of the Division of Engineering Sciences within the DFG, to this week here in Novosibirsk. Indeed, I am myself an engineer by training, but I am responsible now rather for the administration of science than the actual research, which is carried out by the scientists we have invited today.

Two years ago, when I first heard about the new idea to establish German-Russian Weeks for young scientists, I immediately thought about our solid bilateral collaboration in nearly all fields of engineering sciences. Our DFG project group "Efficient Energy Conversion, Storage and Utilisation" could already substantially contribute to the first week in Kazan. German and Russian scientists, active in fluid dynamics and microsystems engineering, presented their research under the topic of "Man and Energy".

This year, with the focus on "Aviation and Space", our division is even more central to the topic than in the years before. A couple of months ago, I introduced the idea to organize such a week in Novosibirsk to various DFG review boards. All over the engineering boards it met with a wide response. As a result, today, I am very happy to welcome so many very experienced German engineers and their Russian partners. Most of these elected scientific representatives from Germany, like Wolfgang Schröder, Klaus Janschek and Martin Oberlack, have for a long time worked with Russia and have shown a special interest in Novosibirsk.

The DFG, as a funding agency, has supported quite a few projects here in Siberia over the past decades. Major bilateral projects, with respect to "Aviation and Space", will be presented to you during this week. Among the highlights of our co-operation, surely, is the Research Training Group (RTG 1095) on "Aero-thermodynamic Design of a Scramjet Propulsion System", between the University of Stuttgart and the Institute of Theoretical and Applied Mechanics (ITAM). But there are many more projects that provide proof to the fact that Novosibirsk and its Akademgorodok are the right choice for the location of this Week.

The creation and preservation of transport infrastructure play a decisive role in the world welfare development. Many aspects of our everyday life would be impossible without world goods and production exchange. Also modern mobility is indispensable in many spheres. The research of new concepts for ecologically effective flights and the development of future long-term transfer systems in space are the most important challenges of the 21st century in order to correspond to urgent and current environmental problems. It is necessary to significantly reduce natural resources consumption for longevity increase. Big successes in aerodynamics development, in relation to the above mentioned, are as important as new concepts in the sphere of aviation electronics, air transport technology, and shipping logistics. Russian and German scientists are among the leading international researchers in these spheres. Moreover, within the framework of the joint research projects, scientists can use the long-term experience of their project colleagues. The cooperation embraces research spheres from flow modeling to concrete experiments in the aerodynamic tunnel. Also, both countries are bound by long-term research traditions and in the modern cosmonautics sphere. Within the framework of many joint projects, researches are conducted in such spheres as, for example, scramjet development

for future space transport infrastructure. Fruitful cooperation has existed for a long time not only between university institutes but also between the German Aerospace Center (DLR) and the Central Aero hydrodynamic Institute in Russia.

The German-Russian Week of the Young Researcher will encourage the further development of joint research interests and embody them in the current research concepts. The aim of this must be the providing of international and interdisciplinary cooperation at a high scientific level. In the course of this event, future joint directions of scientific researches, as well as such topics as supersonic technologies, jet engines concepts, reduction of aerodynamic impedance, digital program guidance and modeling, aviation electronics, and jets or aeronautic concepts designing, will be discussed. In my opinion, close cooperation is needed to find solutions to high-priority targeted social problems, where none have been found, so far. In this regard, I wish you, and all of us, great successes during the German-Russian Week of the Young Researcher!

CONTRIBUTIONS OF SENIOR GERMAN AND RUSSIAN RESEARCHERS

SENIOR SCIENTISTS

Prof. Dr.-Ing. Wolfgang Schröder
Chair of Fluid Mechanics
Institute of Aerodynamics Aachen
RWTH Aachen

Professor Schröder graduated from RWTH Aachen University. He worked as a research assistant at the Institute of Aerodynamics, where he is the current chair. From 2010 to 2012, he was the Dean of the Faculty of Mechanical Engineering at Aachen University. Before he got his first professorship in 1995, he worked on European projects for Messerschmitt-Boelkow-Blohm and for the Deutsche Aerospace AG. Earlier this year (in 2013), the Braunschweig Scientific Society awarded him the Carl Friedrich Gauss Award. Wolfgang Schröder has long been affiliated with the DFG. In the late 1980s, he received a scholarship for from Caltech, the California Institute of Technology. Since then, he has been a spokesperson and participating scientist of for numerous collaborative research centers and research units funded by the DFG. As a current member of the review board "404-03 Fluid Mechanics," he is an elected scientific advisor with the DFG and other organizations. Additionally, he is a member of the American Institute of Aeronautics and Astronautics (AIAA) and the Deutsche Gesellschaft für Luft- und Raumfahrt (DGLR).

SIMULATION OF COOLED SCRAMJET FLOWS

Supersonic slot cooling for a scramjet is numerically investigated. This cooling technology is a promising approach to mitigate the intense aerodynamic surface heating and to achieve long flight durations. Since shock waves occur in the combustion chamber of a scramjet, detailed studies are performed using LES. These studies examine shock-cooling film interactions in fully turbulent flow at a freestream Mach number of $Ma_\infty=2.44$. The cooling film interactions are characterized by analyzing the instantaneous flow field, mean flow field, and turbulence statistics. Additionally, the simulations are extensively validated by experimental data. Effects of the injection slot Mach number, slot density ratio, and shock impingement locations on cooling effectiveness are investigated. In addition, the impact of adverse and favorable pressure gradients on the turbulent flow field and the cooling effectiveness is studied since such gradients occur in the nozzle and combustion chamber of a scramjet. Furthermore, the difference of laminar and turbulent slot cooling is analyzed.

You held the opening lecture of this week. In order to introduce the general topic to our readers: What are scramjets all about? And which role can they play in "Aviation and Space"?

A scramjet is a supersonic combustion ramjet. That is, the combustion occurs in supersonic flow. Compared to rocket engines, where the oxidizer and the fuel are part of the payload of the rocket, ramjets and likewise scramjets use ambient air as oxidizer such that only the fuel has to be carried on board. Hence, scramjets are only of interest in the atmosphere where the air still has enough density. Such an engine can be used for a supersonic space vehicle that carries a rocket into a low earth orbit. From this orbit, the rocket flies into space to boldly go where nobody has gone before. Another nice feature of a scramjet is the fact that it does not contain any rotating parts which also means that it is lighter than other typical turbojet engines.

Your university, RWTH Aachen has a long list of Russian collaboration partners in Moscow, St. Petersburg and Novosibirsk. What are the highlights of the longstanding collaboration with Novosibirsk?

The highlights go back to the beginning of this century when Novosibirsk was also involved in the Collaborative Research Center (SFB 253) funded by the Deutsche Forschungsgemeinschaft. The focus of this research was on super-and hypersonic flows. Some of the experiments concerning the flow over the two-stage space vehicle ELAC could only be performed in the wind tunnels in Novosibirsk. This collaboration with Prof. Kharitonov´s group was definitely a scientific success.

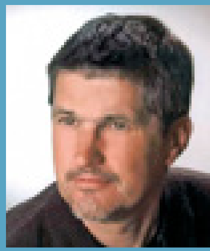
You have been involved in many international projects funded by the DFG. Also, you are an elected scientific advisor of the DFG review board "Fluid Mechanics". In which area do you see the most potential for co-operation with Russia?

The answer is certainly twofold since the bilateral character of the relationship has to be considered. From the German point of view, the Russian facilities of supersonic and hypersonic flow conditions are extremely attractive. That is, experiments can be conducted in a Mach number range and a measurement time that cannot be realized in German tunnels. From the Russian point of view, it makes sense to think about the possibilities that exist in Germany in the field of parallel computing. To use such hardware efficiently, Russian scientists should really come to Germany to really work in the area of high performance computing.

MODEL-BASED SYSTEMS DESIGN FOR SAFETY CRITICAL SYSTEMS

Aerospace systems are traditionally complex. They are built from heterogeneous technologies and they are highly susceptible to failures. This talk discusses modern model-based design aspects for ensuring high dependability of such systems. An introductory assessment clarifies relevant terms of reference such as "systems" (in particular mechatronic systems), "models", "design" and "dependability" with a special focus on safety aspects. The further considerations give answers to the following questions: "What models have to be used?" and "How to work with models (methods)?" in the context of building safe systems that are robust against threats. Current research results of our TU Dresden Automation Engineering Lab demonstrate the successful applicability of model-based system error-propagation analysis to control systems for robotic vehicles.

SENIOR SCIENTISTS



Prof. Dr. techn. Klaus Janschek

Chair of Automation Engineering
Faculty of Electrical and Computer Engineering
Technische Universität Dresden

Professor Janschek graduated from the Technical University of Graz in Austria and then worked as an R&D Engineer in the industry with such firms as Carl Schenck and Daimler-Benz Aerospace. Since 1995, he has been both Full Professor of Automation Engineering and Managing Director of the Institute of Automation at Dresden University of Technology, where he was the Dean of the Faculty of Electrical and Computer Engineering until 2012. Among other temporary positions, he was Visiting Professor in the Department of Aeronautics at Stanford University in 2005.
Klaus Janschek has been an elected scientific advisor with the DFG for many years and is the current spokesperson for the review board "407 Systems Engineering." Also, he was an assigned member of the Research-Rating Group "Electrical Engineering" for the German Council of Science and Humanities (Wissenschaftsrat). Finally, he is a member of the American Institute of Aeronautics and Astronautics (AIAA), the International Federation of Automatic Control (IFAC) and the Deutsche Gesellschaft für Luft- und Raumfahrt (DGLR).

You are an Austrian scientist from a German university who presented a co-operation with partners from Ufa here in Novosibirsk. How international do you have to be these days in engineering?

Internationality in engineering is closely linked with three issues: English as a working language, global markets and boundless communication. Let me briefly explain my experiences.
After having done my studies in Austria mainly in German language, I started my professional career 30 years ago in the German mechanical engineering industries (servo-hydraulic test systems) working for international customers from Japan, China, France etc. It was rather new for me doing to do some project work in English. After a few years, I moved into the German aerospace industries where practically all projects are traditionally done in closely linked international cooperations in order to share the high development costs. There, English was already THE working language at that time. Today, we are faced with global markets that not only force all industries not only to be international for selling products but also require them to be producers, and even compel them to perform research and development in geographically distributed enterprises. Aside from fluent English as a mandatory skill for everyday working tasks, the engineers of today also need also intercultural skills to survive and succeed in such an environment. The boundless communication technologies also turned science into a global intellectual market. Today, there is no excuse accepted for not being aware of the global state of the art when selling anything new or assumed to be new research results. The instantaneously updated global knowledge data bases make it more and more challenging today for creating real novel inventions. But today, we recognize another beneficial communication aspect that has turned out as a driver for scientific innovation: the boundless personal contacts between researchers. Global political advances and modern communication technologies have made it possible for the first time ever whereby scientists independent of nationality, race, political opinion and geographical location are able to exchange their ideas and become involved in discussions all over the globe at any time. Academic exchange programs, such as the German-Russian Week for Young Researchers, are supporting and promoting these issues perfectly: they exchange scientific ideas and initiate personal contacts between young and senior scientists across borders with all the potentials of sustainability thanks to modern communication technologies.

You are the speaker of the DFG review board „Systems Engineering". What are your responsibilities in this position? Do you see many proposals for Russian participation?

A few years ago, the DFG reorganized the review process for the preparation of funding decisions, as installed topically organized review boards to provide quality assurance for this process, and gave advice to the other statutory bodies of the DFG on strategic issues. The members of the review boards are elected every four years from the academic community in Germany. One of the 48 review boards is the review board, "Systems Engineering," which combines system oriented topics such as automation and control, robotics mechatronics, measurements systems, microsystems, traffic and transports systems, human-machine systems and ergonomics. The board members are accompanying the review process of funding proposals by checking the adequacy and completeness of reviews and they are proposing funding decisions based on these review results. Practically all of the DFG funding proposals are for individual research grants. Coordinated programs within the topical subjects of a review board are passing the respective board. This also gives the board members a good overview on the science landscape and it allows a solid assessment of the relevance in the case of priority decisions due to funding limitations. Another task of increasing importance is advisory support for the DFG statutory bodies in terms of identification of new research topics and assessment of the DFG funding portfolio. What about proposals with Russian participation? Well, frankly speaking, there is a lot of space that could be filled. In reviewing my experience from the last six years (since I am participating in the review board, "Systems Engineering"), I can remember personally only of two or three proposals with direct German-Russian project links. Some reason for this could be missing knowledge on adequate bilateral funding programs in both countries. One of the aims of the German-Russian Week for Young Researchers is reducing this deficit in knowledge and getting in personal touch with representatives of the German and Russian research funding agencies.

You have chaired a panel of young scientists here this week. What was your impression of their presentations?

One of the privileged pleasures working in academia is the ongoing contact with young, talented people in general and the promotion of their international collaboration across borders under extremely easy constraints. Just sending young researchers to workshops, conferences, or sending them on a research leave offers an attractive return on a limited (monetary) investment. These positive experiences have all been confirmed when attending the presentations of my young colleagues here at the Novosibirsk German-Russian week. I have met open minded young academics, presenting and defending their research results self-confidently in a foreign but nevertheless common language (English). They obviously own all the prerequisites for initiating and hopefully ensuring sustainable research and personal contacts with each other, thus being a very promising seed for closer German-Russian scientific collaborations.

SENIOR SCIENTISTS

Dr. Aleksandr Shiplyuk

Institute of Theoretical and Applied Mechanics

Siberian Branch of the Russian Academy of Sciences, Novosibirsk

LAMINAR-TURBULENT TRANSITION CONTROL OF HYPERSONIC BOUNDARY LAYERS BY PASSIVE POROUS COATINGS

Laminar-turbulent transition causes significant increase in heat transfer and viscous drag that leads to severe restrictions on the performance of high-speed vehicles. This motivates development of hypersonic laminar flow control (LFC) concepts to delay the transition onset. Under hard environmental conditions of hypersonic flight (high temperatures and large heat fluxes to aerodynamic surfaces), passive LFC methods are of primary interest. For the wedge-like and conical configuration of hypersonic vehicles with aerodynamically smooth surface, dominant instabilities are the 2nd mode disturbances. These are self-acoustic oscillations of these boundary layers.

Fedorov et al. proposed a new concept of controlling the hypersonic laminar boundary layers with passive porous coatings or ultrasonic-absorbing coatings (UAC). According to this concept, the hypersonic boundary layer behaves as an acoustic waveguide wherein non-stable 2nd model disturbances propagate. Fedorov et al. suggested that the absorption of acoustic energy by UAC, which is a thin passive porous layer with fine microstructure, can stabilize the 2nd mode of the boundary layer disturbance. Analysis of stability showed that the UAC is able to reduce essentially the degree of the 2nd mode amplification and to increase several times the laminar part length.

This concept was tested at the California Institute of Technology (Caltech) in the wind tunnel GALCIT T5 at Mach numbers $M = 5 - 6$ on a sharp cone. The porous coating for absorbing the boundary layer disturbances presented a plate with equidistant cylindrical blind holes. Experiments substantiated the theoretical concept by demonstrating that the UAC could effectively delay the transition. It was also demonstrated that the holes could influence the boundary layer by acting as the distributed surface roughness, resulting in an earlier transition.

Further experimental studies of 2nd mode disturbance development on UAC made in ITAM SB RAS confirmed this LFC concept. It has been shown that porous coatings of random and regular microstructures can massively suppress the 2nd mode and significantly (more than twice) increase the laminar run in high-speed boundary-layer flows on sharp cones at a zero angle of attack.

Application of the surfaces with chaotic porous microstructure for passive control of laminar flows in hypersonic aircrafts seems promising because of the low price of these surfaces. Experimental investigations for developing natural disturbances and artificial wave packets on the surface with the chaotic porous microstructure are performed in ITAM SB RAS at Mach number $M = 6$ under heat-insulated wall conditions. The material consists of thin stainless-steel wires, disposed chaotically and sintered to each other. It is has been demonstrated that the surface with the chaotic porous microstructure stabilizes high-frequency 2nd mode disturbances and destabilizes relatively low-frequency 1st-mode disturbances.

Future hypersonic vehicle will have a small bluntness on the nose tips and leading edges. The laminar-turbulent transitions of the hypersonic boundary layer are studied experimentally on the cone with the porous coating and different degrees of bluntness of the nose part. This is to determine the effect of the ultrasonic-absorbing coating on the transition position at zero angle of attack. It has been discovered that the bluntness of the nose part increases effects the length of the laminar flow. Moreover, the UAC remains its efficiency at different bluntness levels of the cone nose part and increases (from 1.3 – 1.85) the length of the laminar flow in each experiment.

Theoretical and numerical simulations have indicated that UAC stabilization effect essentially depends on the UAC thickness. It was expected that optimal coatings would be several times thinner than what had been previously assumed. To validate these findings, the UAC thickness effect was investigated on a sharp cone in the Mach=6 wind tunnel. The coatings comprised several layers of a stainless still wire mesh. Their microstructure mimicked textile materials frequently used for thermal protection. It was shown that the coatings stabilized the 2nd mode and its higher harmonics in accord with the UAC laminarization concept. Furthermore, it was found that an optimal coating was approximately five times thinner than UAC tested in previous experiments. This optimum corresponded to the UAC thickness ratio that is and was consistent with the theory. These findings allowed the assumption that an optimal UAC thickness ratio can could be established for sufficiently wide ranges of basic parameters.

Experimental investigation about 2nd mode disturbances in hypersonic boundary layer on a cone with a different length of UAC was carried out at $M = 5.8$. For the first time, it has been shown that the UAC length has a strong influence of 2nd mode amplitude and frequency and that the UAC could both stabilize and destabilize 2nd mode disturbances. Lengths range of UAC with maximum efficiency of passive porous coating was found.

Novel method of high-speed LFC by UAC was verified in wind tunnel conditions. The main parameters of UAC were investigated and established for sufficiently wide ranges of basic parameters. This may facilitate manufacturing and integration of UAC into actual thermal protection systems.

Your institute, ITAM, has a very strong and long bilateral collaboration with Germany. Who are your German partners and what area do you cooperate in?

Over the last - about - 25 years, ITAM has been being in a very intensive bilateral collaboration with many German research organizations: MTU, Munich; IAG, Stuttgart University; BTU, Berlin; RWTH, Aachen; DLR, Göttingen; European Space Operation Centre, Darmstadt; Technische Universität Kaiserslautern; Institute of Plasma Physics, KFA, Jülich; HPCC-SPACE GmbH, Salzgitter; etc. We co-operate in the field of aerospace sciences: aerodynamics of future high-speed vehicles; gasdynamics of future propulsion system for advanced reusable space transportation system and high-speed flights; instabilities and laminar-turbulent transition problem; high performance computing for high-altitude aerothermodynamics of space vehicles, and others fields. One of a very successful collaborations between Germany and ITAM was the Ludwig-Prandtl-Ring. It is the Highest Award of German Aerospace Society, and it was awarded in 2008 to Prof. Yu. Kachanov (ITAM) for his outstanding contribution in the field of aerospace engineering. Prof. Yu. Kachanov is the first and the only Russian (Soviet) recipient of this Ring.

We have spent a day at your institute in Akademgorodok. What was your personal impression of this week? And what was the response to it in Akademgorodok?

I believe this event passed at a very high organizational level; it aroused keen interest of many young scientists. For them, it was a really useful and inspiring experience. Many web-portals reported the week. Local TV presented some reports, too. All of the reports have indicated the high importance of the event and a live public interest to it.

Dr. Shiplyuk is Deputy Director of the Institute of Theoretical and Applied Mechanics (the Siberian Branch of the Russian Academy of Sciences, SB RAS). Since 2007, he has been the ITAM's Head of the Laboratory of Hypersonic Technologies. He graduated from the Novosibirsk Electro-Technical Institute's (now Novosibirsk State Technical University) Department of Aircraft Design in 1990 and now currently works at the Institute of Theoretical and Applied Mechanics (SB RAS), where he obtained his PhD degrees in 1998 and his Habilitation in 2005. Aleksandr Shiplyuk has been a corresponding member of the RAS since 2011 and a member of the Presidium of the Siberian Branch (RAS) since 2013.
While working as a visiting researcher at DLR Göttingen in 1996 and 1999, he focused his research on the analysis of hypersonic boundary layer stability and pulsation measurements. In 2003, he participated in experiments in a Mach 6 wind tunnel at NASA Langley Research Center. Also, he has been associated with the editorial board of the Journal of Thermophysics and Aeromechanics.

You are a considerably young corresponding member of the Russian Academy of Sciences. What are your recommendations to young researchers who plan a scientific career in Russia?

Within recent years, the situation in the Russian science has been changing dramatically; the Government and the President pay much attention and invest heavily in the development in this area. It means that young scientists are now well-situated. But, to take all advantages of this situation, it is necessary to understand that it is only for those scientists who can succeed in science and who can readily absorb the research process. Enthusiasm for research is a source of persistence and inexhaustible patience, when you turn the problems and results of your activity not only in your working hours, but also in every free minute, even during housekeeping or in wakeful nights. In these very moments, you may get unexpected solutions, breakthroughs, discoveries, new researching turns. Any of these possibilities is the best way to provide you with a successful scientific carrier in Russia.

SENIOR SCIENTISTS

Dr.-Ing. Uwe Gaisbauer
Institute of Aerodynamics and Gas Dynamics
University of Stuttgart

AERO-THERMODYNAMIC DESIGN OF A SCRAMJET PROPULSION SYSTEM RESEARCH TRAINING GROUP – GRK 1095/2

U. Gaisbauer, B. Weigand (Institut für Aerodynamik und Gasdynamik, University of Stuttgart, Stuttgart) / The presentation of "Aviation and Space" was given by a young researcher during the third German Russian week in Novosibirsk. It gave an overview about the work successfully completed involving more than 20 projects over the last 8 years with respect to the Research Training Group GRK 1095. The speaker of the Research Training Group GRK 1095 is Professor Weigand.

The motivation stems directly from the tasks given in modern space flight and hypersonic projects. In our days, a big demand exists to increase the efficiency of the classical rocket powered carrier systems by improving the engines themselves.

The typical space transportation systems actually used are characterized by very high overall take-off weights combined with a relatively small pay-load mass. Typically, it is about 1% compared to a liquid oxygen mass fraction of about 20 – 30%. Possible future design concepts are systems which combine the advantages of air breathing engines during the atmospheric part of the trajectory with the well-established rocket technology such as a reusable two-stage-to-orbit space transportation systems or a scramjet-rocket system itself. For such types of carriers, as well as for the hypersonic flight itself, the use of an air breathing propulsion system is the main problem to be solved concerning the design and the overall vehicle conception. Only the use of a combined propulsion system with a scramjet-powered stage meets all the aerodynamic and gas dynamic requirements. Furthermore, it offers a real alternative towards the classical rocket propulsion systems.

In this context, in Germany the Research Training Group GRK 1095 was established from 2009 and ending in 2014. Its main scientific intention has been to design a scramjet demonstrator engine using necessarily different experimental and numerical procedures and tools, provided by the involved scientists. Thus, several problems in different scientific areas appear such as aero- and gas dynamics problems in the inlet flow at the external and at the internal pre-compression along with the unsteady effects of the shock boundary layer interaction in the inlet.

The supersonic combustion itself represents one of the main problems to be solved. In effect, it entails with a lot of questions in the field of aero-thermodynamics. Therefore, the combustion represents also the "core" of the whole project: all other subprojects are established around this topic at hand. Moreover, because of the flight in the hypersonic regime, research is included concerning the highly thermal stressed components of the vehicle materials.

Within the GRK 1095, three German universities as well as the DLR Cologne are involved in this process. As a result, scientists of the Universität Stuttgart, the RWTH Aachen University, the Technische Universität München and the DLR Cologne worked together. In the last (almost) 9 years of successful work, more than 50 PhD-theses could be defended together with a large amount of scientific publications. Besides the scientific work, the educational program as well as the willingness of each ship holder to stay aboard the ship contributed to the great success of the project.

To underline or at least to complement the results of the Research Training Group, a project with financing from Stuttgart University was conducted in two separate project phases. Here, wind tunnel tests at realistic flight conditions using a working scramjet demonstrator engine were successfully performed, both to demonstrate the usability of the so-called lobed strut injection concept and to investigate a possible thrust. Consequently, a complete demonstrator engine with inlet, combustion chamber with injector and nozzle was designed and built at Stuttgart University. This model was investigated under different flow conditions in two hypersonic wind tunnels in the Khristianovich Institute of Theoretical and Applied Mechanics, ITAM, RAS SB, in Novosibirsk, Russia. For flight conditions at M=8 and flight altitude of H=30km, pure supersonic combustion could be achieved successfully. It followed that the usability of the lobed strut injection concept could clearly be demonstrated. Furthermore, it was also possible to determine positive thrust under all tested conditions.

In conclusion, the concept developed in the Research Training Group as well as in the associated projects, combined with the overall design and setup, could all be verified in wind tunnel tests. These serve as a real successfully working concept and again demonstrate the efficiency of the "model" Research Training Group.

You are one of the key figures involved in the DFG Research Training Group between Stuttgart and Novosibirsk. What are the scientific results and what are the prospects of this collaboration?

The main scientific results of the Research Training Group according to the title: Aero-Thermodynamic Design of a Scramjet Propulsion System, have been the development of design-tools and skills to solve several partly coupled problems within different scientific areas. For example, aero- and gas dynamics problems at the inlet flow and at the external; and internal pre-compression and unsteady effects of the shock boundary layer interaction in the inlet. But that is not all: this also includes the part of the supersonic combustion itself representing one of the main key-problems to be solved with a lot of questions in the field of aero-thermodynamics. Moreover, because of the flight in the hypersonic regime due to consequently highly thermal stressed components of the vehicle materials, partly new calculation methods in material science have been developed. Additionally, probabilistic methods were established to estimate the behavior of a complete engine.

The main aim is to continue the very challenging work in this field because there are still a lot of questions to solve. Also, the close and very fruitful cooperation with ITAM will continue.

With regard to the structure and the aim of Research Training Groups: How did you yourself and how did the young scientists benefit from this special funding programme?

Well, for the young scientists it was, according to their comments, very interesting. Their main benefit is combining three elements to become a PhD. First, the scientific work varies: it involves an interacting structure with a lot of contact and discussion with their colleagues within the Research Training Group but also with international colleagues. Second, it entails the educational program and mainly the self-organized summer schools and meetings. These events have given them the possibility to come into contact with the international community and have been obviously very exciting and interesting for the young scientists. Third, the most impressive element was their stay abroad for six months for many of our PhD students.

My personal benefit is, for sure, the possibility to initiate such a successful project from bottom up and mainly to do all these very successful wind tunnel tests of a scramjet engine under real flight conditions.

You come quite often to Russia and stay for longer periods to carry out your research in Novosibirsk. What is the main difference between German and Russian young scientists?

The last question is very interesting. Indeed, I worked a lot with young Russian scientists and I also gave lectures in Russia, but first of all I must say that young scientists are very similar in our two countries as far as their motivation and the great interest in scientific work is are concerned. One very visible difference is their age; in Russia, PhD students are much younger and in some cases, depending on the university, very well educated - mainly in fundamental topics. But overall, I can say that the great interest in science, the motivation and passion for their work brings especially young people very close together and lets them appear very similar irrespective of their nationality and cultural background. This is a great thing, I must say.

Dr.-Ing. Uwe Gaisbauer studied aerospace engineering at Stuttgart University and finished his diploma thesis in the field of propulsion at Rolls-Royce (aero engines) in 1997. From 1997 to 2004, he worked as a research scientist at the University of Stuttgart's Institute of Aerodynamics and Gasdynamics (IAG), where he received his doctor's degree in 2004. His work concentrated on the shock boundary layer interaction in supersonic flow. Since 2006, he has been the head of the Gasdynamic Laboratory at the IAG. Additionally, he initiated different scientific projects. One such example was the Research Training Group GRK 1095: "Aero-Thermodynamic Design of a Scramjet Propulsion System for Future Space Transportation Systems." This particular project was supported by the DFG. A second very successful DFG-project, GA 1332/1-1, entitled "Scramjet Testing under Real Flight Conditions" was performed in cooperation with the Institute of Theoretical and Applied Mechanics (SB RAS) in Novosibirsk.

Since 2006, Uwe Gaisbauer has been working as a guest scientist at the Khristianovich Institute of Theoretical and Applied Mechanics, also known as ITAM (same location), while also serving as a guest lecturer at Novosibirsk State University of Architecture and Civil Engineering (SIBSTRIN) and at Novosibirsk Technical State University (NTSU).

Prof. Dr.-Ing. habil. Martin Oberlack
Department of Mechanical Engineering
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DERIVING TURBULENT SCALING LAWS FROM FIRST PRINCIPLES – A CHANGE IN PARADIGM AND FIRST IMPORTANCE FOR TURBULENCE PREDICTION

Text-book knowledge proclaims that Lie symmetries such as Galilean transformation is at the heart of fluid dynamics. These important properties also carry over to the statistical description of turbulence, i.e. to the Reynolds stress transport equations and their generalization, the multi-point correlation equations (MPCE). Interesting enough, the MPCE admit a much larger set of symmetries, in fact infinite dimensional, subsequently named statistical symmetries.

Most important, theses new symmetries have important consequences for our understanding of turbulent scaling laws. The symmetries form the essential foundation to construct exact solutions to the infinite set of MPCE, which in turn are identified as classical and new turbulent scaling laws. Examples on various classical and new shear flow scaling laws including higher order moments will be presented. Even new scaling has been forecasted from these symmetries and in turn validated by DNS. Turbulence modellers have implicitly recognized at least one of the statistical symmetries as this is the basis for the usual log-law which has been employed for calibrating essentially all engineering turbulence models. An obvious conclusion is to generally make turbulence models consistent with the new statistical symmetries.

Martin Oberlack is Professor of Mechanical Engineering at Darmstadt University and holds the Chair for Fluid Dynamics. He obtained his diploma in 1988; his Ph.D. degrees in 1994; and his Habilitation in 2000. All were received from the RWTH Aachen. In addition to his academic credentials, he co-founded the Center of Smart Interfaces and the Graduate School of Excellence Computational Engineering at Darmstadt University. Prof. Oberlack pioneered the use of Lie symmetry methods for the study of turbulence physics and statistics, combustion and modelling concepts.
For his Habilitation thesis in 2000, in which he laid the foundation for the symmetry based turbulence theory, he was awarded both the Friedrich-Wilhelm Award of RWTH Aachen and the Academy Award of the North Rhine-Westphalia Academy of Sciences. Moreover, he received the Hermann-Reissner-Award of the Dept. of Aero- and Astronautics of the University of Stuttgart for his Contributions in Turbulence Research. Recently, he was awarded the Athene Best Teaching Award of the Department of Mechanical Engineering as well as the E-Teaching-Award of TU Darmstadt for his innovative development of electronic media in teaching.
Professor Oberlack is a member of the American Physical Society, the German Committee for Mechanics, the International Association of Applied Mathematics and Mechanics, the European Mechanics Society and the European Research Community on Flow, Turbulence and Combustion.

You hold many individual grants from ehe DFG and you participate in big Clusters of Excellence (EXC) and Graduate Schools (GSC). Which role does Russia compared to other countries play in research for you and for your university?
I do not have a complete overview concerning the entire University TU Darmstadt, but in the various fields related to fluid mechanics I have the feeling that Russia is under-represented among the different countries. This is rather different in my case and is essentially due to the particular field of my scientific research interest: theoretical fluid dynamics. In this particular field of speciality, applied mathematics and methods from theoretical physics stand in the foreground. Here Russian scientists have a very long tradition and a very deep knowledge which nicely coincides with my experience.

You have a long co-operation with the Institute of Computing Technologies of the Siberian Branch of the Russian Academy of Sciences. What is your scientific interest in this bilateral collaboration?
It is particularly in the area of Lie symmetry groups, which has undergone a remarkable development since the 60th under the guidance of Prof. Lev Vasil'evich Ovsyannikov at the M. A. Lavrent'ev Institute of Hydrodynamics in Novosibirsk. These groups constitute the axio-matic basis of all fields of physics. Ovsyannikov may be named the modern founder of Lie symmetry theory in Russia and his school brought up many famous scientists in the field. Today, there are still experts in this particular field who are working in Novosibirsk and this long-standing experience nicely coincides with my knowledge on Lie symmetries applied to statistical turbulence theory, which is one of the main topics of my own research.

You have brought a young scientist from your chair to Novosibirsk. Was it a valuable experience for you and your PostDoc?
Honestly saying, in the beginning I was a bit sceptical because the topic of the workshop was rather generic. At the very end, however, I completely changed my mind and the same is true for my PostDoc, Dr. Marta Waclawczyk. We both very much considered the visit to Novosibirsk and the workshop a very valuable experience indeed. This is particularly true both from a scientific point of view as a well as the experience we made in the city Novosibirsk. Note that it was my first visit to Russia.

EARLY GERMAN-RUSSIAN SCRAMJET TECHNOLOGY DEVELOPMENT (1993–95)

The presentation starts with an historical overview on Scramjet Engine Technology development performed so far on an international level. In a the next step, the Scramjet Engine Technology development activities performed during a former joint German-Russian program (1993-95) are highlighted. In doing so, special emphasis is given to the typical collaborative conditions and cooperative working atmosphere prevailing at the Russian partner TsAGI at Zhukovsky, beginning in the 1990s. The collaboration can be characterized by a high degree of competence and expertise of the Russian partners supplemented by a large talent for pragmatic and feasible solutions. The team members were highly motivated and fully reliable. The big success of the joint project was mainly enabled by the high-level of mutual confidence and big team spirit among the collaboration partners.

The most challenging Scramjet Engine Technologies are presented, focusing on the engine components inlet, combustor and nozzle as well as on the interactions among these components. In order to investigate the combustion and gas dynamic processes in Scramjet combustors at Mach 5 to 7 flight speed, a geometrically variable combustor was designed, manufactured and tested. A comprehensive connected-pipe test program was performed elucidating a number of major questions in supersonic hydrogen combustion.
In addition, a complete subscale Scramjet engine model consisting of a fixed geometry inlet, a geometrically variable combustor and a nozzle module was designed, manufactured and tested. The model was free-jet tested in the flight Mach number 5 to 8 envelope. In these tests, emphasis was placed on the investigation of combustion-induced gas dynamic / thermodynamic interactions between the engine modules. In addition, thrust measurements were performed by use of a six components thrust balance. The presentation closes with an overview on the current status of international Scramjet Technology developments aiming for future applications to power re-usable Space Transportation Systems and Civil Air Transportation Systems.

You gave a very interesting lecture on the history of scramjet models. What do you reckon: Will they ever fly – let us say – from Novosibirsk to Sydney within four hours ?

Today's emphasis on civil air transportation is given to an improvement of economy and environmental compatibility. The current progress by use of advanced engine concepts and airframe designs is very respectable. In addition, as a future target, considerable increase in passenger comfort could become desirable. A remarkable reduction in flight time by airplanes cruising at hypersonic flight Mach numbers powered by combined propulsion systems integrating Ram- and Scramjet Engines could substantially enhance passenger comfort – and realize a week-end trip to Sydney for our grandchildren.
In addition, re-usable space transportation systems, propelled by air breathing Ram- and Scramjet Engines as long as possible during its ascent to orbit, would substantially increase not only the system's payload factor but also the economy and environmental compatibility of future space transportation.

You have a long experience in industry and university research. Could scramjets be an ideal example of science-to-business cooperation between Germany and Russia?

Thanks to a continuous and generous sponsorship of Scramjet Engine Technology development in Germany during the past two decades, the fundamental and scientific basics in aerodynamics, flow and structure mechanics, combustion, materials, cooling etc. are well prepared and widely present. On the Russian side, a number of well-equipped test facilities for testing of Scramjet components and even engine models exist. Even for the next logical steps of Scramjet Engine Technology demonstration, including flight testing of engine models, a number of excellent suitable flight test carriers in combination with adequate testing grounds is available. Last, but not least: Innovative and precise German engineering would outstandingly mate with Russian boldness and large talent for pragmatic and feasible solutions.

Prof. Dr.-Ing. Rainer Walther

Coordination Technology Networks
MTU Aero Engines AG
München

Professor Rainer Walther has been working with MTU Aero Engines Munich since 1985 in manifold design tasks (aero engine combustor, turbine and compressor design). During the German Hypersonic Technology Program (1988-95), he was the project manager of the "Joint German-Russian Scramjet Research & Development Program," which was performed in close partnership with TsAGI, Zhukovsky. His project management and coordination duties also extended into various civil and military engine programs. Now, he currently organizes and coordinates advanced engine technology development activities within the Centers of Competence of MTU collaborating with German universities and research institutions.
Furthermore, professor Walther gives lectures on "Combustion Processes in Aeronautics and Astronautics" at the University of Stuttgart, where he studied Aeronautics & Astronautics and obtained his Doctoral Degree in 1985. Professor Walther has the special position of Honorary Professor at the University of Stuttgart, Division Chair for "Propulsion Technology." Finally, he is a member of the Board of the DGLR as well as the Administrative Secretary of the International Society of Air Breathing Engines (ISABE).

Your first visits to Russia date back to the 1980s, when you regularly came to TsAGI in Zhukovsky. Now we are in Novosibirsk in the year 2013… Have you noticed any changes in the world of science in Russia since then?

The world of science in Russia has made big progress with respect to international cooperation skills: all of the young Russian scientists speak fluent English and are familiar with modern communication, presentation and project management techniques. They demonstrate an excellent education and are open-minded and highly interested in international exchange and collaboration. However, there is one thing which didn't change during the last decades: it is the timeless beauty of the Russian female scientists.

SENIOR SCIENTISTS

Prof. Dr. Vadim Lebiga

International Centre for Aerophysical Research

Institute of Theoretical and Applied Mechanics SB RAS, Novosibirsk

Vadim Lebiga is Executive Director of the International Center of Aerophysical Research at the Institute of Theoretical and Applied Mechanics (ITAM) of the Russian Academy of Sciences, Siberian Branch, since 2006. He holds a professorship at Novosibirsk State Technical University.

Professor Lebiga studied Engineering in Aerodynamics at Leningrad Mechanics Institute which is now the Baltic State Technical University "Voenmech". In 1978 he obtained his PhD degree and his Habilitation in 1993 at Leningrad Polytechnic Institute. In 1969 he joined ITAM first as researcher, then as head of laboratory. For his research activity in the field of unsteady flow effects in wind tunnel he got Zhukovsky Award in 2012.

Professor Lebiga is a member of the Scientific Council of ITAM (SB RAS) and a member of the degree awarding Academic Council.

SIMULATION OF FLOW ABOUT AIRCRAFTS IN TRANSONIC WIND TUNNELS

Some problems arising from the design of modern high-performance aircraft that require the use of modern theoretical, computational and experimental methods are considered in this paper. Regarding the latter, the main aerodynamic characteristics of aircrafts are determined in wind tunnels, where the flow about elements and aircraft as a whole are simulated. The most important criteria of this simulation are the Mach M and Reynolds Re numbers. Real flight conditions of these parameters at transonic flow speeds can be achieved in a few modern wind tunnels, namely: transonic wind tunnel T-128 TsAGI in Russia; cryogenic wind tunnels ETW in Germany; and NTF in the United States. However, the adequacy of modeling in these facilities is complicated by the presence of fluctuations, which are absent at real flight in a relatively quiet atmosphere. In this connection, the reliable information about the structure of fluctuations caused by design features of wind tunnels is desirable.

A set of experiments has been conducted in the pilot facility at ETW (Cologne, Germany). The joint research program was funded by the European Union. As a result, detailed data on the characteristics of the disturbances at cryogenic conditions were obtained using the hot-wire methods developed at ITAM SB RAS. Intensity and spectral composition of turbulent, acoustic, entropy fluctuations and their sources were determined in wind tunnels used for testing models of modern aircraft. The data obtained allow estimation for the quality of the flow in wind tunnels, identify sources of flow disturbances and provide measures to reduce them.

You are a professor at the chair of Fluid Dynamics at Novosibirsk State Technical University. Did you advise your students to attend the lectures? And was the week interesting for them?

As for me, it is not easy to judge how interesting the presentations were for the students. But the fact that auditoriums for plenary and section sessions were always overcrowded confirms the great interest of students during the week.

As the director of the International Center for Aerophysical Research of ITAM how do you rate Germans among other partners?

Germany is our main foreign partner, and most of our joint works at our institute are performed with universities and research organizations in Stuttgart, Cologne, Göttingen, Aachen etc. either according to contracts or projects or according to some joint programs of the Russian Federation and Germany. I believe that new features of fruitful cooperation could be implemented within the framework of joint research programs supported by the Presidium of Siberian Branch of RAS involving Siberian universities, on the one hand, and German foundations on the other hand.

What did you think of the topic and the format of the week? Was your Technical University a good choice as our main location?

My opinion is that the topic of the conference fits a very important area of cooperation and is of great interest to young people. Aerospace is an attractive area for students because there is a chance to prove themselves in the implementation of joint projects, such as small UAVs, microsatellites, etc. In this regard, the Technical University is preferable as the main location for the week because to realize such projects, knowledge in engineering and designing is necessary.

FUTURE SHORT AND MEDIUM RANGE AIRCRAFT CONFIGURATIONS

Jörg Fuchte gave a brief introduction of the DLR (Deutsches Zentrum für Luft- und Raumfahrt, German Aerospace Center) and the Helmholtz Association. The Helmholtz As-sociation manages research activities for a large number of research institutions, one of which is the DLR. The DLR is the German agency for space activities, space research and aviation research. It has research centers in various parts of Germany.

In his speech Mr. Fuchte showed future technologies for short and medium range aircraft in the class of surrent A320 and B737. He focused on the challenges arising from many re-searchers working together in order to arrive at integrated so-lutions. The complexity of the subject increasingly requires more sophisticated cooperation schemes in order to multiply capabilities of different research institutions. The DLR is working on better interaction be-tween its disciplinary institutions in order to provide the critical answers of future challenges such as tightening resources and increasing demand.

The DLR has a world-wide network of cooperative partners. In which fields do you collaborate with Russian institutions?

The DLR has a long cooperation in the field of space flight. In fact, many German astronauts/cosmonauts were trained in Moscow and flew to the international space station using Russian space ships. Cooperation in the field of aviation is less established but growing. The DLR has ongoing research cooperation with TsAGI (Central Aerohydrodynamic Institute) in the field of fuselage structural design.

You have visited Russia the first time, but twice within the last two months, first Moscow and then Novosibirsk. What is your impression of the country, the people and the scientists?

My visits to Russia were both enjoyable and insightful. Enjoyable because I received generous hospitality and was able to interact with many Russian scientists and people. Insightful because Russia is different than Germany in many respects. Visiting Siberia demonstrated the vastness of Russia. I was surprised by the scope and quality of research done in Russia. I say surprised because you rarely see it at international conferences or in international journals.

Was it worth coming all the way from Germany to Siberia? And what is even more: will you come back to Russia for scientific reasons?

It was definitely worth the trip! The week in Novosibirsk showed me that, despite its rather remote geographic location, Novosibirsk is also a center for competitive research, as many of the Young Scientists demonstrated. I am looking forward to my next visit to Russia, while I cannot say if it will be of private or professional nature. Concerning aeronautics research, the biyearly International Conference on Aeronautical Sciences (ICAS) takes place this year in St. Petersburg (7-12 September). The conference is the most important event of the international science community.

Dipl.-Ing. Jörg Fuchte

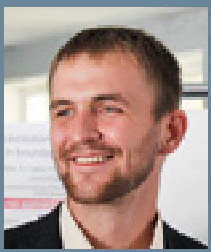
Institute for Air Transportation Systems / Integrated Aircraft Design
German Aerospace Center, Hamburg

Jörg Fuchte works for the German Aerospace Center (DLR) in Hamburg as a member of the aircraft design team. In his role, he interacts with most aircraft design related institutes of the DLR and focuses on future concepts for short and medium range aircraft.

Jörg Fuchte studied aeronautical engineering at the Technical University of Berlin, graduating in 2007. He did an internship at Airbus Central Entity in Toulouse, where he took part in an A380 engineering project in the area of structure ground & flight test. In 2009, he joined the DLR as a development engineer in flight physics. Mr. Fuchte is an active participant in the DLR graduate program, a training program for young professionals inside the DLR. Also, he is a board member of the Royal Aeronautical Society (Hamburg Branch).

CONTRIBUTIONS OF YOUNG GERMAN AND RUSSIAN RESEARCHERS

JUNIOR SCIENTISTS



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EXPERIMENTAL RESEARCH OF THERMAL STABILITY OF HEAT-RESISTANT MATERIALS

The aim of the investigation is focused on the experimental research of thermal stability of heat-resistant alloy and composite material samples exposed to prolonged high temperature flow (Mach number M = 2.2 stagnation temperature T0 up to 2400 K), and on the determination of heating features during durability tests of the combustion chamber model. The investigation was performed on the ITAM SB RAS stand of supersonic combustion.

Conducted experiments show that the most common heat-resistant materials can withstand limited time in high-temperature supersonic flow without active cooling.

On the basis of these completed tests, C/SiC material was considered the most suitable to create a channel that simulates a combustion chamber of high-speed aircraft. This channel was tested by number of prolonged (up to 110 seconds) injections of high-temperature supersonic jet (Mach number M = 2.2 stagnation temperature T0 up to 2200 K).

Conclusion: Most common heat-resistant materials can withstand limited time in high-temperature flow in the absence of active cooling. Both nonstationarity of gas dynamic structure in the flow path and the inhomogeneity of distribution of heat flux in the wall (in the longitudinal and transverse directions) should be considered to create effective active cooling protection.

JUNIOR SCIENTISTS

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CFD APPLICATION FOR ENGINE AERODYNAMIC DESIGN

The propulsion system is an essential part of modern aircraft. Power plant and airplane interference significantly provide the appropriate aircraft flight parameters. For efficient and safe propulsion system creation, it is necessary to use modern methods of investigation. Computational fluid dynamics (CFD) is one of the novel engine aerodynamic design methods. Its advantages are evident: simulation could be performed in a wide range of regimes and Reynolds numbers with a large quantity of model versions; and it could receive a full 3D flow pattern with all parameters under consideration. But the accuracy of CFD results should be confirmed by comparison with experimental data. Therefore, for receiving qualitative results, it is necessary to couple experimental and CFD investigation. Experimental investigation approaches traditionally developed in TsAGI are now applied extensively with the CFD methods for wind tunnel test technology improvement. CFD is used for a number of tasks such as:

- Wind tunnel experimental campaign preparation. CFD is used to decrease both the wind tunnel runs and aerodynamic models number.

- Experimental data extrapolation. The CFD method validated by available experimental data could be used to calculate aerodynamic model features at regimes beyond wind tunnel envelop.
- Experiment self-descriptiveness and validity enhancement. CFD allows thorough experimental data collection and robust problem solving while investigating physical features.
- Obtain experimental data corrections. By comparing CFD results for wind tunnel model and full-scale free-stream aircraft, it is possible to calculate tunnel test data corrections.
- Wind tunnel design and upgrade. Wind tunnel flow pattern investigation could be used for improving test section flow quality.

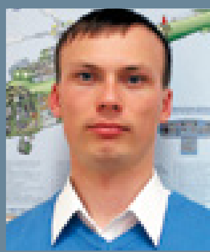
The modern TsAGI conception of fundamental and practical activities consists in integrating the wind tunnel experiments and CFD investigations.

For aerodynamic calculation, "in house" code called Electronic Wind Tunnel (EWT) is used. This solver mainly operates with structured mesh because this mesh receives higher quality results than when it is unstructured. Now in our solver, non-linear model of viscous gas is prevalent. For its description, Reynolds-averaged Navier-Stokes equation system is used. This equation system is solved with either an explicit or implicit TVD scheme. But for special tasks, it is possible to use explicit and implicit scheme simultaneously. A large variety of boundary conditions and models of turbulence allows simulating both flow around aircraft at real flight conditions and flow around objects in wind tunnel conditions. The boundary condition "active disk" allows simulating complex propulsion performance.

Experimental and CFD investigation are used in TsAGI for solving several practical tasks, such as:

- Designing new sting for wind tunnels such as T-128(TsAGI, Russia) and ETW(Cologne, Germany).
- Improving wind tunnel test technology.
- Investigating thrust reverser and safe regime definition.
- Protecting the engine against outer particles from getting inside.

SIMULATION FLOW AROUND HELICOPTER LAYOUT ELEMENTS



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JUNIOR SCIENTISTS

Helicopter drag is relatively high in comparison to airplanes, partly due to the contributions of the fuselage. In general, helicopters are not streamlined enough, and their fuselages have large areas of flow stagnation as well as rear-facing surfaces with suction. In addition, the presences of added components to the fuselage, such as external fuel tanks, mission equipment, landing gear, etc., contribute further to the drag. In this work, experiments are combined with CFD's aim to analyze the aerodynamics of realistic fuselage configurations. For this purpose, a development model was used for the ANSAT aircraft. This model featured characteristics of real designs with engine fairings, bubble windows, engine covers, and rear-facing surfaces. The model was selected to include as many features as possible and is was constructed in a modular way to allow for the addition of hubs, external fuel tanks, landing gear, etc.

The model was tested at the subsonic wind tunnel of KNRTU-KAI for a range of Reynolds numbers, pitch, and yaw configurations. The force balance measurements were complemented by PIV investigations for those cases where the experimental force measurements showed substantial unsteadiness. A substantial database of experiments has so far been compiled and is exploited for the validation of CFD.

For CFD investigations, a HMB solver developed at the Liverpool University was used. All computational grids were constructed with an ANSYS ICEM CFD tool and were structured multi-block hexa-grids with an O-grid type near the surfaces. Results of the numerical simulation of isolated fuselage show a good agreement with the experimental data by drag and lift forces. Both methods – CFD and PIV – reveal a separated flow region near the rear part of fuselage.

Contribution to the total fuselage drag by each component of the helicopter layout was estimated based on the CFD simulation of different layout configurations and isolated elements. It was shown that both the fuselage and landing gear contributed to most of the drag. Furthermore, the total drag of the helicopter layout contains interference drag, which was caused by the influence of layout components.

At this moment, investigation of rotor-fuselage interaction is carried out. In the future, simulation flow around a helicopter that takes into account both main and tail rotors is planned.

This work is supported by the "Leading Scientist" grant of the Russian Federation, under order 220 of the Russian Ministry of Education.

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THE APPLICATION EXPERIENCE OF SUPERPLASTICITY AND CREEPAGE EFFECTS FOR AIRCRAFT COMPONENTS PRODUCTION MADE OF SHEET METAL AND PLATES

The application of new resource-saving technologies with controlled parameters of the process is one of the main directions in aircraft production nowadays. The occurrence of non-traditional methods of metal forming - with low rate deformation at high temperature, using creepage effect and stress relaxation - has aroused the interest of aircraft designers (aircraft resource and durability increasing) and manufacturers (build time and cost decreasing). As it turns out, such metal forming methods have become realized in the industry, but sometimes without sufficient scientific and technical elaboration.

Modern construction materials behavior used in aircraft production (e.g., Al alloys, Al-Li alloys, Ti alloys, and high-tensile stainless steels) at creepage conditions is interesting for two main points: (1) to solve technological problems of metal forming with some special forming conditions, even superplasticity; (2) to estimate the construction workability (strength, durability, etc).

Physical and mechanical properties of construction materials are defined by many factors, which are material condition, temperature, rate of forming, and mode of deformation. Sometimes, one can observe not only numerical but also qualitative changes of behavior. Some alloys can appear anisotropically due to differences of mechanical properties in mutually perpendicular directions at creepage conditions with a slow rate of forming; with traditional elasto-plastic forming, however, they behave as an isotropic material. In addition, materials during superplastic forming have a short-term stage of hardening.

DESIGN AND OPTIMIZATION OF UNCONVENTIONAL AIRCRAFT CONFIGURATIONS IN A DISTRIBUTED DESIGN ENVIRONMENT

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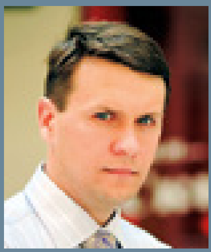
The current visions on the future of the air transportation systems pose ambitious challenges for the design of the next generation's air vehicles. Therefore, unconventional aircraft configurations are currently investigated by the research and the industry communities. However, the assessment of game-changing technologies cannot rely on conventional pre-design methodologies, which are primarily based on statistical data, to account for the potential benefits. Thus, in order to minimize the risks associated with the development of novel aircraft, and to correctly assess their behaviors, physics-based simulations have to be included in the early stages of the design process. Furthermore, when no prior knowledge of the design space is available, Multidisciplinary Design Analysis and Optimization (MDAO) techniques are necessary to capture, and to understand, the interdisciplinary interactions and dependencies.

The recent advancements in computational performance and simulation capabilities provide access to sophisticated, and at the same time, efficient analysis modules, in all the aeronautical disciplines. Nevertheless, these codes are often not included in the aircraft pre-design activities. Moreover, the state-of-the-art MDAO frameworks are often based on automated, monolithic design codes that are not managed easily. Nor are these codes adapted to cope with novel concepts or with new analysis modules as they become available. The challenge is even higher if different parties develop analysis modules, yet plan their integration within the same design process.

In order to cope with the aforementioned challenges, the German Aerospace Center (DLR) is developing a distributed design environment to foster the collaboration among the disciplinary specialists into a collaborative Overall Aircraft Design process (OAD). The design environment is built on the central data model CPACS (Common Parametric Aircraft Configuration Schema), an arbitrary number of analysis modules, and on the open source design engineering framework RCE (Remote Component Environment). CPACS is a data format based on XML technologies, and used for the interdisciplinary exchange of product and process data between the heterogeneous analysis codes. CPACS contains data, such as the geometry of the aircraft model, but also all the parameters needed to initialize and to drive the disciplinary analysis modules (for instance, the aerodynamic and the structural solvers).
The framework RCE enables the integration of the analysis modules in a design workflow, with a decentralized computing architecture, in which the analysis competences are hosted and run on dedicated servers. In turn, these are distributed among the disciplinary tools' developers. Thus, the disciplinary codes remain on the partners' computers, and only input and output data are made accessible to the integrator designer and exchanged during the process, whereas the source codes are controlled by the tools' developers and the disciplinary experts.

The described distributed environment is in operational use in all the DLR aeronautical branches and adopted by external research and academic institutions in international collaborative researches. An application of the system is presented here for the preliminary design of the Blended Wing Body (BWB). The Blended Wing Body (BWB) aircraft is an unconventional performance driven concept, which offers a potential and efficient solution to the increasing growth of the global air transportation system. The BWB is a highly integrated concept, with strong disciplinary couplings, whose performance can only be assessed by an integrated overall design process. The described distributed MDAO system it has been applied for the design of a BWB with the typical transportation mission of a long-range conventional aircraft. The assessment results show the reduction of 20% in terms of necessary fuel per passenger seat-kilometer.

JUNIOR SCIENTISTS



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CRITERION TO SELECT OPTIMUM DIRECTIONAL CONTROL SENSITIVITY FOR MODERN TRANSPORT AIRCRAFT

Presented are the results of theoretical and experimental research concerning the effect of directional control sensitivity on transport aircraft handling qualities (HQ).

Directional control has not been studied as well as longitudinal or lateral control. This is due to the fact that the rudder is not considered the major controller in flight. It is used very rarely during "far-from-the-ground"

flight, and only to support zero sideslip in coordinated turn. But this very controller has to be used before landing if there is a severe side wind or large lateral offset and altitude deficit. Large bank angles are not permissible at low altitudes, and the gust landing is possible to perform only with the help of the rudder.

Inadequacy in directional control is caused eventually by the lack of reliable criteria and requirements for directional handling qualities. Aircraft control sensitivity affects aircraft handling qualities and flight safety considerably. Nevertheless, there has not been a method to select these characteristics and current standards impose unspecified limitations on some of them. While developing aircraft, the selection of characteristics typically involves an empirical approach. However, this does not guarantee optimum characteristics, which further complicates the process of aircraft development.

The work was conducted to collect the extensive experimental database on the effect of control sensitivity on directional handling qualities of large transport aircraft, and to develop the criteria for selecting these characteristics.

The main results of the work are as follows:

- HQ criteria are developed to select angular (yaw) control sensitivity as a function of directional dynamics and pedal feel system characteristics.
- HQ criterion is developed to select optimum values of parameter L_b determining lateral/directional dynamics and control sensitivity to lateral aircraft displacement.

JUNIOR SCIENTISTS

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SEARCH FOR THE HIGGS BOSON WITH ATLAS

The aim of my PhD project is to contribute to the search for the Higgs Boson.

In my talk, I introduce the Standard Model of elementary particle physics at a basic level and discuss the very important role of the Higgs Boson in this theory. Second, I present CERN, the new particle accelerator LHC, and the ATLAS detector, which played an important role in discovering a new particle in 2012. This particle is likely to be the Higgs Boson predicted in 1964.

Thereafter, I present the current state of research and finally discuss how my thesis can help with testing if this new particle is indeed the Higgs Boson.

MODELING OF NONLINEAR UNSTEADY AERODYNAMICS OF AIRCRAFT AT HIGH ANGLES OF ATTACK USING RECURRENT NEURAL NETWORKS

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According to the Commercial Aviation Safety Team, a government/industry partnership formed to address aviation accidents, loss-of-control is the main cause of fatal accidents. Greater attention has turned to the study of aircraft dynamics and pilot training recently in the prevention of and recovery from upsets, including stall and spin. Consequently, there is a growing need for models that describe unsteady aerodynamics in flow separation conditions suitable for studying aircraft dynamics, upset recovery, and use for flight simulators.

CFD has progressed significantly in recent years and shows very good results. However, solving simultaneous equations of fluid dynamics and aircraft motion is very resource-consuming and cannot be used in aircraft dynamics applications since a great number of parametrical investigations is required for aircraft dynamics analysis and control design. Moreover, flight simulators require a real-time modeling.

Mathematical models of unsteady aerodynamics covering the full flight envelope can be identified using the experimental data. To obtain the data, several wind-tunnel tests were used. Each experiment corresponded to one-type motion in the restricted region of flight parameters: for example, forced oscillations with small amplitudes for investigation of aerodynamic damping derivatives; forced oscillations with large amplitudes; and free controllable motion for investigation of dynamic phenomena of nonlinear aerodynamic characteristics, etc.

It was shown that the traditional approach for unsteady aerodynamics simulation based on the damping derivatives failed to describe nonlinear phenomena observed in the large-amplitude test. At the present paper, a neural network approach was used to obtain the models of pitching moment coefficient of a delta wing, a model of passenger airliner Transonic Cruiser (TCR) with canard and generic passenger aircraft.

Neural networks had advantages over conventional techniques. It was shown that any continuous function could be approximated to any desired accuracy by a network of one hidden layer of nonlinear units and one layer of linear output unit. In addition, no simplifying assumptions were required to identify the model. For dynamic system simulation, the recurrent neural networks were usually utilized.

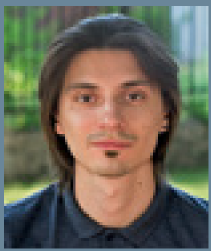
Recurrent neural network NNARX (nonlinear autoregressive network with exogenous inputs) was used in the paper. The neural network (NN) output was an aerodynamic coefficient Ca, the inputs of the neural network were angle of attack α and pitch rate q. To simulate output value of $Ca(t)$ at the time instant t the neural network used both the current kinematic parameters $x(t) = (\alpha(t),q(t))$ and the preliminary history of motion, namely, the previous kinematic parameters $x(t-\Delta tk)$ and neural network simulation results $Ca(t-\Delta tc)$

$Ca(t) = NN(x(t), x(t-\Delta tk), Ca(t-\Delta tc))$.

The experimental data of small- and large-amplitude pitch oscillation tests were utilized to train the neural network. About half of the data were used to train (training set); the rest were used to test the generalization ability of the neural network (testing set).

The neural networks revealed good precision for the delta wing, TCR, and generic passenger aircraft for training and testing sets. The neural network was shown to simulate, with acceptable precision, the aerodynamic coefficient hysteresis that was obtained using the wind-tunnel dynamic experiment of forced pitch oscillations with large amplitudes, and also dependences of the aerodynamic derivatives on oscillation frequency.

JUNIOR SCIENTISTS



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NUMERICAL SIMULATION OF NON-EQUILIBRIUM FLOW OVER A PLATE IN AERODYNAMIC TUNNEL

The development of prospective airspace vehicles required conduction of various complex numerical and experimental investigations closer to real flight conditions. During atmospheric flight, a hypersonic or re-entry vehicle at a high velocity and temperature causes some phenomena to occur in gas. These phenomena include excitation and thermal non-equilibrium of molecular degrees of freedom, dissociation, and ionization. Real gas properties have a significant effect on the mean flow around aircraft and in turn evolution of its instability.

The present work deals with the influence of internal degrees of freedom on the mean flow and development of disturbances in the hypersonic shock layer over a flat plate. This problem was simulated numerically on ANSYS Fluent package and on the high enthalpy aerodynamic wind tunnel IT-302 ITAM SB RAS. The investigation was conducted to examine the of flow over a plate L=0.2м (Re_1~7×10^5) at angles of attack $\alpha=0 \div 10.2°$ in hypersonic ($M_\infty>6$) flow consisting of air, carbon dioxide, and a mixture of carbon dioxide and air, all of which were at a high stagnation temperature (under 3000 K). The investigation showed that amplitude of pressure fluctuation on the plate surface for CO_2 was essentially greater than it was for both air and a mixture of air and CO_2.

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NUMERICAL SIMULATION

Aerodynamic hysteresis of single-element airfoils is a well-known phenomenon that has been studied experimentally in detail, especially for relatively low Reynolds numbers (Re < 500 000). Hysteresis describes a history dependence of lift and drag for changing angles of attack in a certain angular range, with differences for increasing and decreasing angles. High lift configurations with extended flap also show hysteresis effects. They are significantly influenced by the nature of the flow around the flap and the flow separation behavior.

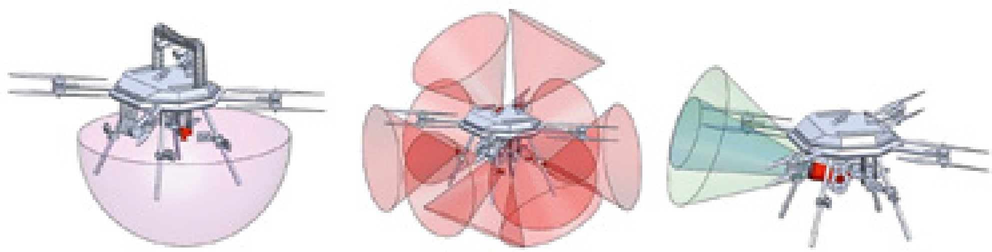
However, only a few numerical studies are available in literature on hysteresis effects in general and for high lift configurations in particular. This study is dedicated to the numerical simulation of the two-element low Reynolds number airfoil NASA GA(W)-2, in high-lift configuration with a 30° inclined slotted flap. The simulation was conducted with the flow solver PowerFLOW, which is based on the Lattice-Boltzmann method. This method originates from the gas dynamic Boltzmann equation with the BGK collision model and incorporates a VLES turbulence modeling approach to simulate unsteady turbulent flows. In this study, the high-lift configuration was simulated at $Re = 2.2 \cdot 10^6$ in two and three dimensions. This simulation was for both static positions at discrete angles of attack and dynamically changing angles of attack between $\alpha = 0°$ and 20° with the goal to capture the highly dynamic time dependent hysteresis effect. Several modifications and parameters were investigated, such as resolution of the mesh, laminar boundary layer regions, different roughness heights on the flap surface, and a reduced Reynolds number. The correct representation of the flow's type on the flap revealed the following: it was found to be decisive for the accurate simulation of the performance of the airfoil including the hysteresis, for which the separation on the flap is essential.

The analysis of the results indicates the necessity to simulate this configuration in 3D in order to include the correct behavior of the flow separation and reattachment on the flap and, hence, reproduce the hysteresis effect. The delayed separation of the flow on the upper side of the flap compared to available experimental results is still present in the 3D simulations and is expected to be the main reason for the difference in the shape of the hysteresis loop between simulation and experiment.

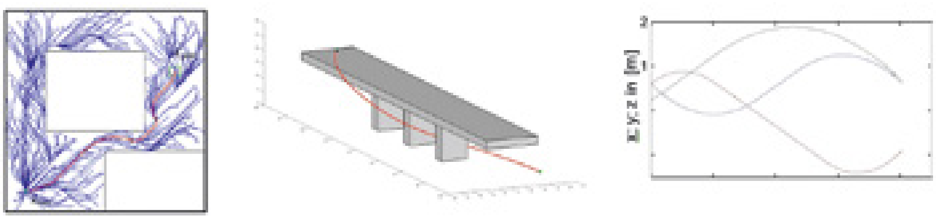
ADAPTIVE FEDERATIVE 3D EXPLORATION WITH MULTI ROBOT SYSTEMS

The concept behind project ADFEX (adaptive federative 3D exploration with multi-robot systems) is three-dimensional urban exploration with a fleet of unmanned semi-autonomous aerial vehicles (UAV). Our interdisciplinary group consists of four postdoctoral and nine novel researchers from five different institutes of the Technische Universität Dresden. We use three octocopters with various types of sensors. Our development and test scenarios are matched with some key requirements of local partners in the industry. The three-dimensional model of the explored area with high accuracy is finished in post-processing.

Michael Klix: Project ADFEX, Navigation. Each vehicle is equipped with a GPS-sensor (GPS), an inertial measurement unit (IMU), some ultrasonic rangers (US), and a navigation camera (NavCam). As the system should be "easy-to-use," no detailed information about the map is available before. That's why we do sensor fusion (GPS, IMU, US) and simultaneous localization and mapping (SLAM) with increased accuracy of the estimated position by visual odometry using NavCam.



Martin Pfanne: Project ADFEX, Motion planning. To allow the UAVs to achieve their goal of autonomously exploring their objective, a motion planning system is required, which generates and executes trajectories for each vehicle. Using sample-based algorithms, the motion planner guides the UAVs through the environment, while avoiding obstacles. Simultaneously, optimality constrains and the exploration quality are considered to improve the calculated paths. During execution, model predictive control is used to follow the precomputed trajectories.



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DEVELOPMENT OF PRO-COMPOSITE FUSELAGE STRUCTURES FOR PERSPECTIVE AIRLINERS

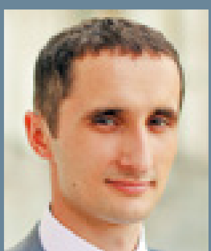
Novel fuselage structures have to be developed in order to design a weight efficient composite fuselage. Years of experience in development and design of composite airframes have shown that it is almost impossible to obtain significant weight benefits for load-bearing composite structures when they are conventional semi-monocoque structures akin to those widely used in state-of-the-art metallic aircraft structures. Due to the orthotropic nature of composites, innovative pro-composite fuselage designs have to be generated in order to utilize the full potential of this light, strong, stiff material.

Investigations carried out by DLR and TsAGI in the FP7 ALaSCA project have shown the substantial weigh-saving potential of lattice and lattice-derived pro-composite fuselage structures in comparison to that of traditional metal fuselage. The principal benefits of these developed composite airframes are:

- Unidirectional lattice ribs are loaded only in tension-compression parallel to the direction of fibers, which allows for lightweight design and reduces cracking in the resin due to orthogonal layers.
- Crossings of lattice ribs have a high level of fiber volume fraction that reduces the level of strain concentrations in the resin in these zones.
- An alternate design without rib crossings but with ribs on either side of the skin eliminates the mechanical and production issues associated with the rib crossings.
- Non-rectangular composite skin bays show higher buckling loads in comparison to the rectangular skin bays' loads of the conventional semi-monocoque design.
- A lattice design provides load path redundancy in the primary structure of lattice ribs, which is excellent for damage tolerance. Furthermore, these monolithic ribs can be protected by special elements to improve impact resistance and provide safe and long-term operation for the lattice composite fuselage structure.

Lattice and lattice-derived composite fuselage structures can lead to significant weight and in-use cost savings for future aircraft structures.

JUNIOR SCIENTISTS



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THE CONCEPT OF THE AUTOMATED SYSTEM OF FORECASTING AND PREVENTION OF FLIGHT ACCIDENTS

Despite achievements in flight safety, flight accidents continue. According to the ICAO, increased flights have been accompanied by increased accidents in recent years.

Current methods for safety management are mainly aimed at prophylactic work with aviation events occurred (reactive strategy) and the identification of dangerous trends in pilot skills along with the technical condition of the aircraft (proactive strategy). Predictive methods for safety management are not practically developed.

The purpose of the research was to develop a method for forecasting and preventing flight accidents, enabling the prediction of flight accidents prior to flights identification of their potential causes. This would further enable development of preventive measures. With implementation of this method by airlines, the expected effect is a reduction in flight accidents in global aviation.

The method includes modeling of possible scenarios of flight accidents and their probability estimation using the hazard trees. A Hazard tree is a logical scheme reflecting the possible flight accidents scenarios. Hazard trees are necessary to describe and identify the most typical and shortest flight accidents scenarios that represent the greatest threat to flight safety.

Hazard trees of 10 flight accident types were developed including runway excursion, loss of control, controlled flight into terrain, midair collision, and others. Each tree was described as a forecasting probabilistic model. Here are some facts about hazard trees: they are based on the analysis of more than 10,000 aviation accidents and incidents; they include more than 600 hazards; they describe more than 200 of the most typical and shortest scenarios of flight accidents; and they predict up to 80% of possible flight accidents.

Initial data for the forecasting model was grounded on information concerning the expected conditions of the aircraft's operations. By extension, they were the following: (a) estimations of hazards probabilities and (b) probabilities concerning the realization of a hazard tree's causal links. After the introduction of the initial data in the hazard trees, we obtained predictive estimates of the probability of flight accident types. In case of exceeding a warning level of accident probability, we identified the most important hazards, recognizing potential causes of flight accidents. Some appropriate methods and algorithms were developed: (1) both "a" and "b" above; (2) assessment of a warning level of accident probability; and (3) identification of the most important hazards of hazard trees.

The development concept of forecasting and prevention of flight accidents received positive feedback from some leading organizations in the field of flight safety as well as from some airlines. It was also implemented in the software of the automated system of forecasting and prevention of flight accidents in Volga-Dnepr Airlines. System possibilities are the following: to estimate the risk of each flight; to identify potential causes of flight accidents; to form measures to prevent flight accidents; and to reduce the vulnerability of the air transport system.

In continuation of the research, several suggestions have been made. They include the need to develop: methods to assess the harm from flight accidents; methods to assess the effectiveness of measures aimed at the prevention of flight accidents; flight accident models (hazard trees), taking into account new threats to the flight safety. Finally, there is a need to develop and apply new scientific methods of data analysis.

EXCITATION AND EVOLUTION OF GÖRTLER INSTABILITY MODES IN BOUNDARY-LAYER FLOWS

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The laminar-turbulent transition is one of the most important basic problems of modern fluid mechanics. Görtler instability is a part of this general problem; nevertheless, it has its own great fundamental and applied significance. It may occur in boundary layers over concave walls in a wide range of free-stream speeds and Mach numbers and lead to amplification of streamwise vortices, which are able to induce the laminar-turbulent transition, the enhancement of heat and mass fluxes and to other changes important for aerodynamics. Despite more than 70 years of its intensive experimental, theoretical, and numerical investigation, a lot of principal questions connected with this problem still remain open. Due to this, the disturbance growth rates obtained experimentally did not agree with those calculated by the linear-stability theory in the whole range of spanwise wavenumbers and Görtler numbers studied. Also the problem of receptivity of boundary layers to various external disturbances weren't studied experimentally at all. Moreover, practically all preview investigations were devoted to the stationary Görtler instability, despite an unsteady one is able to appear in a lot of practical cases (for example on the blades of turbo machines). This situation occurred due to a lot of technical difficulties in experiments. The observed lack of valid investigations of early stages of Görtler instability does not allow developing of reliable methods for the laminar-turbulent transition prediction in flows over curved surfaces. This paper includes important, new, experimental and theoretical results obtained by developing and using a new (for studying the problem of Görtler instability) unsteady experimental approach. It provides extremely high accuracy and, simultaneously, gives the possibility to use the flow disturbances of very low amplitudes (tenths and hundredths of a percent of the mean flow velocity). This provided for the first time the possibility of obtaining reliable experimental results on the Görtler linear instability [1] and Görtler distributed and localized receptivity [2, 3]. It can also be used for studying a broad range of other problems associated with the phenomenon of the steady (in quasi-steady approach) and unsteady Görtler instability.

In these series of works, an accurate correspondence between the experimental and theoretical linear-stability characteristics was obtained for the first time for steady Görtler vortices, which corresponded to the most dangerous first discrete-spectrum Görtler modes. Similarly, a very good agreement was obtained for unsteady Görtler vortices. The amplification rates of unsteady Görtler vortices decrease, in general, with frequency, but at low frequencies this reduction is very weak and the disturbance behavior corresponds to a quasi-steady one. (In practice, it gives a possibility to use low-frequency disturbances to study properties of steady Görtler instability.) Phase velocities of unsteady Görtler vortices turned out to be close to 0.60–0.65 and depend only marginally on the base-flow and disturbance parameters. A paradoxical result was obtained that the growth of the Görtler number is able to stabilize the flow with respect to unsteady Görtler vortices. The Görtler instability can be present for a given frequency at Görtler number (Gö) of several units but absent (for all spanwise scales) at Gö of several tens and even hundreds.

Due to application of the developed experimental procedure, we have evaluated for the first time the coefficients of boundary-layer receptivity to surface non-uniformities at excitation of unsteady and steady first Görtler mode. Independence of these coefficients from amplitude and shape of the examined nonuniformities was substantiated. It was found that the amplitudes of the receptivity coefficients at the excitation of Görtler vortices are normally much smaller than those at the excitation of other modes of hydrodynamic instability (Tollmien-Schlichting waves and cross-flow instability modes). It was found that the amplitude of flow receptivity coefficients increases with frequency, and at high frequencies, this amplitude can be several times higher than the flow receptivity to stationary surface non-uniformities. Variation of the spanwise scale of surface vibrations affects very weakly the receptivity at zero frequency; however, at high frequencies the efficiency of excitation of Görtler vortices depends substantially on the spanwise scale. It was found that the frequency dependences of the efficiency of the mechanisms of linear instability and receptivity are oppositely directed, compete with each other, and are able to compensate partially each other. In practical situations, this circumstance can promote the development of boundary-layer Görtler vortices in a broad range of frequencies.

The mechanism of distributed excitation of unsteady Görtler vortices in a boundary layer on a concave wall under the influence of streamwise (3D) freestream vortices was studied experimentally for the first time. It was found that this receptivity mechanism is rather efficient and is able to change significantly the growth rates of the Görtler vortices (in comparison with the linear-instability growth rates). In particular, the presence of streamwise freestream vortices can convert attenuating Görtler vortices into the amplified ones. For the first time the corresponding coefficients of the distributed vortex receptivity were estimated experimentally. It was found, that the distributed receptivity mechanism excites most efficiently those Görtler vortices which have spanwise wavelengths corresponding to the most linearly unstable modes. The receptivity amplitudes are found to decay with the streamwise coordinate.

The obtained fundamental results can be used for the design of new modern engineering methods of prediction of the laminar-turbulent transition location.

MATHEMATICAL MODEL OF RADIATION HEAT TRANSFER IN RETICULATED VITREOUS CARBON

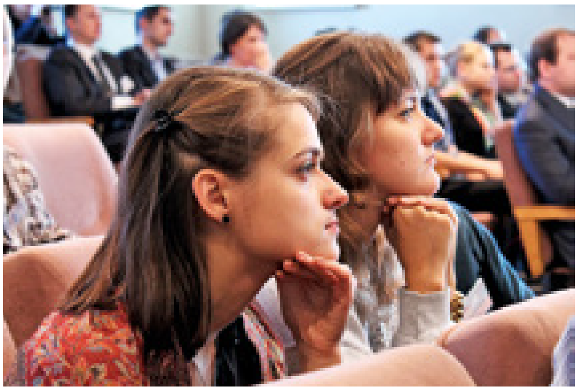
Reticulated vitreous carbon (RVC) is a highly-porous composite material with a strong scattering coefficient. In respect to aerospace manufacture it can be used as thermal protective material because of its weight characteristics and high-temperature strength. During space flight, especially during re-entry, the radiative heat transfer plays an essential role. That's why there is the necessity to create a methodology for the estimation of values integrated by the radiative spectrum in these types of materials more clearly.

The usual methods used are diffusion and transport-diffusion approximations, radiative thermal conductivity approximation, or their combination, for the estimation of radiation components of thermal conductivity. However, if the material fragments are anisotropic and their sizes are comparable to the wavelength, such as the fragments of RVC, or the material layer is optically thin in the spectral range, then the radiations for these wavelengths can be far different from isotropic radiation. So it is necessary to describe the radiation by means of kinetic theory. There are various methods for the numerical solution to these problems. But it is very simple to solve the problem if we introduce the "dummy" time so that we can determine the stationary solution during stabilization of the non-stationary solution, which was received with the help of the discrete ordinates method (DOM). However, the use of stable implicit finite difference approximations in the equations with an integral operator leads to the linear systems with high dimension. It is difficult enough to make the explicit and comparatively low-cost DOM variants stable. That problem is easily solvable in the frame of a three-step method.

Practical use shows the simplicity and efficiency of this method. The method convergence practically does not depend on the choice of an initial condition, as well as the structure of the stationary solution, which is an attractor condition, depending only on problem parameters. However, in similar calculations the continuous control of stationary equation discrepancy in the knots of finite-difference grids should also be provided.

As the example of the practical use of the developed method, we considered the radiation transfer with wavelength $\lambda = 2.4$ µm in RVC ETTI-CF-ERG with the following parameters: thickness d = 26 mm, temperature of boundaries T_{min} = 800 °C, T_{max} = 1200 °C. As the full thermal conductivity contained radiation component, the energy equation in the problem of radiation-conductive heat transfer for flat layer with known dependences of C(T) and λ(T) had the divergence form closed under temperature and its stationary solution determined the necessary temperature profile in the material layer.

A three-step iterative numerical method based on splitting the problem operator by "physical processes" was developed. This method has a great stability factor in comparison to the traditional two-step method. The method is quick enough, easy to understand and doesn't lead to any restrictions in optical thickness of a layer or scattering character.



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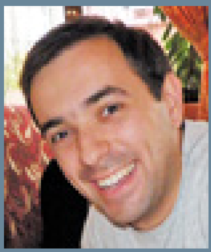

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SIMULATION OF WORKING PROCESSES IN GAS-DISCHARGE CHAMBER OF HIGH-FREQUENCY ION ENGINE

Several trends in modern and prospective spacecraft development include the following: increase of payload and available electric power; enlargement of the time of active existence; and expansion of the range of spacecraft mass (because of time enlargement of active existence). To solve thruster problems, it is necessary to create a new generation of engines, with higher specific impulse, greater efficiency, and longer operation time.

The solution to these tasks is available using electric thrusters. Of the different types of thrusters available, one of the more promising ones is the Radiofrequency Ionization Thruster (RIT). Since early 1960s, research has been conducted on this type of engine at the University of Giessen. Led by professor H. Loeb along with input from the industry, the flight models for the Eureka and Artemis platform were created. Also created was a whole family of RIT engines ranging from 4 cm to 35 cm. In 2011 our Department and research Institute, RIAME, was jointly organized with the laboratory of RIT Mai under the leadership of H.W. Loeb.

The RIT promised numerous advantages, but also held a significant disadvantage: the energy consumption it contained for ionization was far greater than that of other ion thrusters used in Space.

Thus, to create a new more efficient RIT, it must solve the problem of cost-reduction on ionization. This can be attained in several ways. For example, a change in the number and location of inductor turns, or in the form of the chamber. Yet another way is to combine both options.

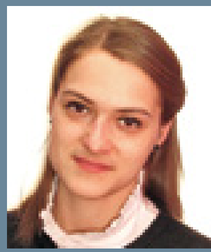
Aside from this, there were conducted experimental works changing the number of turns and their location. This research continues. We also produced chambers of different shape and tested them..

Such experimental research a substantial amount of time and money. To facilitate the work of the experimenter, find out what makes sense to be investigated, and determine what fails to constitute "promising" in terms of good results, we decided to develop an engineering calculation model. This streamlined the assessment of the impact of changes on integral characteristics of the engine. Similar works were also carried out in other research groups; they naturally had some inherent assumptions and complexity.

First, we separately calculated the magnetic field in implementing Ansys complex, followed by the code of our development, which calculated the parameters of the plasma. Next, we estimated the effect of the plasma on the initial magnetic field (and so on) before thermal electron temperature could not vary by more than 5000 K. Upon this event, the calculation was finished.

In the future, we will continue to work on the program - it is not finished yet. And we will continue a series of experiments. In conclusion, we can say that the first results obtained came with the help of an engineering model, which qualitatively coincided with the experiments. From experimental studies to the completed stage of the research materials of the chamber, work on the engine continues; and we have orders from the aerospace industry for a prototype of such thrusters.

HYDRONIC CHEMICAL CURRENT SOURCE AS A CONTROLLED HYDROGEN GENERATOR FOR POWER PLANTS BASED ON OXYGEN-HYDROGEN FUEL CELLS



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A critical need of aerospace equipment in sources of autonomous power supply exists today. And among them, great attention is given to direct conversion systems of different types of energy into electrical energy. Chemical current sources (CCSs) are especially interesting. They have a higher coefficient of efficiency (close to 100%) than in traditional machine schemes, and CCSs don't have any toxic exhausts. An oxygen-hydrogen fuel cell (O_2/H_2 FC) is the most energy efficient one among hydrogen based autonomous (independent) power plants. O_2/H_2 FC is a power plant (PP) which converts the chemical energy by means of an oxygen-hydrogen reaction directly into electrical power. High density of energy output (119.0 MJ/kg or 33.1 kWh/kg) and thermodynamic efficiency of the oxygen-hydrogen reaction are increasingly attracting the attention of developers in various fields. But in spite of its advantages it has the problem of hydrogen storage.

There are 3 types of gas storage in existence:

1. The gas tank storage approach (when hydrogen in a gaseous form is stored at high pressures)
2. The cryogenic method (to store hydrogen in a liquid state)
3. And the so-called "combined hydrogen storage" (hydrogen is tightly bound in water molecules). It is the safest today known solution, since pure hydrogen enters the system only as needed and is consumed at once in the O_2/H_2 FC. This storage system resolves the problem of low temperatures (required by cryogenic systems), accuracy of manufacturing, and high reliability, since water is not explosive in case of leakage.

Hydrogen could be produced by combining hydrides with water and metals with water. In terms of hydrogen discharge from water, the "aluminium-

water" system is the most efficient means of generating hydrogen per component mass unit, and it trails only "lithium hydride-water" and "lithium-water" systems. The advantage of aluminium over the other systems and metals lies in the fact that it is a cheap and easily accessible material, an environmentally friendly, non-toxic agent, and the most abundant metallic element in the Earth's crust.

If we conduct the electrochemical reaction between aluminium and water in a hydronic CCS, this reaction produces not only hydrogen but also electrical power, due to a partial conversion of thermal energy generated when aluminium is dissolved in water. Such CCS is called "hydronic" because it is generated by a metal-water electrochemical system and because it produces hydrogen. Hydronic CCS consists of aluminium or an aluminium alloy which acts as the anode, and inert material which acts as the cathode, and an electrolyte between them (in most cases, alkaline and saline solutions). Since the "aluminium-water" system has a thermodynamic instability, the aluminium anode is consumed in the corrosion reaction in addition to the current-forming reaction. The results of our research show that the speed of hydrogen discharge in both types of electrolyte used in hydronic CCS has an almost linear relation to the current running in the cell and can be controlled by changing the current.

The use of hydronic CCS with O_2/H_2 FC is capable of forming a combined power plant, consisting of two current sources - hydronic CCS and O_2/H_2 FC. The calculation results of the characteristics of the battery hydronic CCSs, for a commercial 1 kW O_2/H_2 fuel cell, show that at the start of operation the developed hydronic CCS can increase the energy of the FC from 30 to 50%, depending on the electrolyte. The life cycle and output efficiency depend on the hydronic CCS construction and component combinations (the anode, the cathode materials, the type of electrolyte and additions to this electrolyte).

Conclusion:

1. Our research is the first to show that, based on hydronic CCS, it is possible to create a controlled hydrogen generator with a wide range of hydrogen discharge speed.
2. Our research paper is the first to show that the use of a combined "hydronic CCS + O_2/H_2 FC" PP is an effective and safe solution to the problem of hydrogen storage for an independent PP based on O2/H2 FC.
3. The developed combined PP is efficient for land and household usage. The use of such a PP is also promising for the aviation and space industries.

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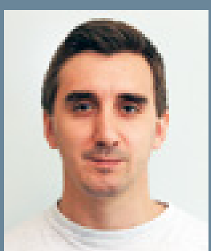

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EFFECT OF THE LOCAL WALL COOLING/HEATING ON THE HYPERSONIC BOUNDARY LAYER STABILITY AND TRANSITION

In the framework of FP7 project TransHyBeriAN, the study of the influence of local surface temperature on the laminar-turbulent transition in hypersonic boundary layer was carried out. The experimental study was performed in wind tunnel Tranzit-M (ITAM SB RAS). The experiments were conducted for the following flow conditions: $M = 6$, $Re_1 = 5\text{-}25 \cdot 10^6\ m^{-1}$ and $T_0 = 380$ K.

Initially, the space distribution and spectral characteristics of aerodynamic noise in the wind tunnel had been investigated. It was shown that the noise level in wind tunnel "Transit-M" corresponds to conventional aerodynamic facilities, and decreases with increasing of the unit Reynolds number. The results of the noise measurement, in free stream, were used for further analysis of the experimental and numerical data.

Study of the boundary layer stability and laminar-turbulent transition was performed on the model of a sharp cone, with 7° half-angle, and an element of a local heating / cooling system built-in-surface in the region of laminar flow. Heating of the element was performed by an electrical heater; cooling was carried out by circulation of liquid nitrogen. These techniques made possible to carry out experiments in a wide range of wall temperatures, from 90 K to 450 K. The development of disturbances in the boundary layer was studied by means of high-frequency measurements of pressure pulsations, and the position of the laminar-turbulent transition was detected by measuring the heat flux with an IR-camera.

It was found that the local heating / cooling of the surface has a strong effect on the stability of the boundary layer and position of the laminar-turbulent transition. The generating of local heated or cooled area, changes the temperature distribution along the wall that influences significantly the development of the second Mack mode, and also leads to changes of the flow characteristics of the downstream boundary layer. It is commonly accepted that the development of the second mode is a determining factor in the laminar-turbulent transition at hypersonic speeds. Furthermore, it is known that the frequency of the most unstable disturbances of the second mode, and growth rate, are closely coupled with the local boundary layer thickness. In this study it was shown that the dominating contribution to control of the disturbance development is introduced by control of the boundary layer thickness.

In the baseline case, without heating/cooling of the wall, the unstable disturbances responsible for transition develop in the boundary layer gradually achieving a critical amplitude and initiating turbulence in the flow. The growth rate and frequency of the most unstable waves of the second mode depend mostly on the local thickness of the boundary layer.

In the case of local cooling build-up of the boundary layer, thickness is reduced in the cooler region, thereby prolonging the favorable conditions for amplification of some high-frequency disturbances. Low temperature of the wall additionally increases their amplification ratio. However due to the small length of the cooling element these perturbations cannot grow up to a critical amplitude and initiate the transition. Downstream from the element, there is accelerated growth of the boundary layer thickness as a result of flow heating by the relatively warm wall. In this zone the amplification region for disturbances of each certain frequency is reduced, and perturbations cannot achieve critical amplitude. It leads to later turbulence and transition displacement downstream.

In the case of heating, the opposite case has occurred. Because of thickening of the boundary layer in the heater zone, the region of disturbance growth for each certain frequency is shortened, and perturbations cannot achieve critical amplitude. Downstream from the heater, the rate of boundary layer thickness growth is reduced. In the zone, where boundary layer thickness changes slowly, the favorable conditions for the growth of some disturbances of the second mode are established. It leads to early turbulence.

The direct numerical simulation was carried out to study 2D development of the second mode. The parameters calculation was consistent throughout the experiment, the results of noise measurements in the wind tunnel "Transit-M" were taken into account in data processing. All details of the disturbance development in the case of local heating / cooling and also in the baseline case were well predicted by CFD and subsequently carefully analyzed in comparison with experimental and computational results.

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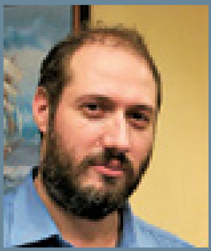

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BLACKOUT MITIGATION IN A PLASMA LAYER NEAR A HIGH-SPEED BODY IN EXB FIELDS

When a space vehicle re-enters the atmosphere at a high velocity, a layer of ionized gas is formed around it. This layer shields the radio signal transmission to and from the vehicle. The ionization, of the atmospheric gas, results from aerodynamic heating. If the vehicle velocity is very high, a complete interruption of the communication can occur. This phenomenon, the so-called radio transmission "blackout", was observed during the first re-entry phase of space flights.

A vehicle re-entering the Earth's atmosphere from an orbital flight has a velocity of about 8 km/s at an altitude of about 120 km. The atmospheric drag increases significantly at this altitude, and the vehicle kinetic energy is converted into gas internal energy, due to deceleration. The flow around the vehicle is characterized by an extremely complex structure, with a bow shock wave in front of the vehicle. The maximum heating for a typical re-entry trajectory of a "Space Shuttle" corresponds to the range of altitudes 80–60 km.

The gas temperature in the shock layer, between the bow shock wave and the vehicle surface, can reach 104 K, and the gas becomes ionized, thus forming a plasma layer in the vicinity of the vehicle surface. For a typical re-entry trajectory the plasma frequency in this layer can be significantly higher than 109 Hz. This gives rise to attenuation and "blackout" of radio communication with the vehicle. For the "Space Shuttle", it typically lasts approximately from 25 to 12 minutes prior to landing, which is the most critical period of time during the re-entry. If a problem in this phase of flight arises, the diagnostic telemetry cannot be received from the vehicle and necessary commands do not reach the vehicle because of the communication "blackout".

In recent years a number of papers devoted to modeling of the flow in crossed electric and magnetic fields (ExB layer) in application to the blackout mitigation problem has been published. Among them there is a series of papers concerned with the use of the MHD approach in the physical model. In this report a computational modeling of the method of mitigation of a radio transmission blackout during a flight at a high velocity in crossed electric and magnetic fields, is presented. This computational modeling shows that a decrease in the plasma frequency can be obtained by applying electric and magnetic fields to the ionized layer near the model surface, which leads to a decrease in the charged particle density, in some regions, near the electrodes. This computational model gives interesting and promising results, but, no doubt, it is only a step to a more complicated model that will include 3D effects and plasma parameters that vary in time and space near the model.

Some experimental results and plans for research activities using the L2K facility of DLR, Kologne, are also presented.

SOFTWARE TOOL FOR ERROR PROPAGATION ANALYSIS

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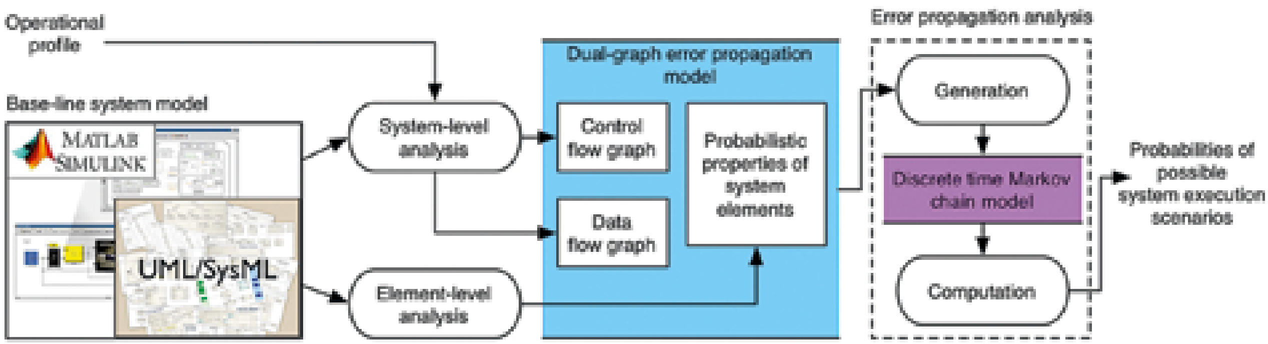
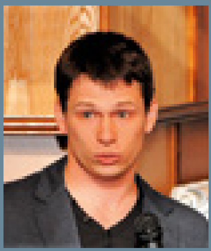
Reliability is an important non-functional property of all types of safety-critical systems, including aircrafts and space vehicles. Nowadays, industrial standards require error propagation analysis as an essential part of the reliability and safety evaluation processes. From the theoretical point of view, error propagation analysis is a probabilistic description of the spreading of data errors through the components of a system. The results of this analysis are extremely helpful in a wide range of analytical tasks associated with dependable systems development including reliability forecasting, system safety design, testing, diagnostics, and error localization.

In 2012 our colleagues from the Institute of Automation of TU Dresden introduced a novel error propagation model, based on separate control and data flow analysis of a system. The central idea is a synchronous examination of two directed graphs that describe the system behavior: a control-flow graph and a data-flow graph. The structures of these graphs can be derived systematically during system development. The knowledge about an operational profile and properties of individual system components allow the definition of additional probabilistic parameters of the model.

During an internship in TU Dresden in February and March 2013, the author developed a software tool for the described dual-graph approach to error propagation analysis. This software incorporates a probabilistic error propagation model, a specific Discrete Markov chain model, and a number of algorithms for the estimation of the likelihood of various faulty and fault-free system execution scenarios. In the forthcoming presentation, the author plans to discuss the theoretical background of error propagation analysis and the developed software tool.





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SOLVING DIFFERENT DYNAMIC PROBLEMS USING THE SAME MASS-STIFFNESS AIRCRAFT MODEL

There is a wide range of very important aircraft problems which come from the critical necessity of considering structure deformations. These problems can be dynamic and static. For example, aero elasticity, by itself, is an interaction of inertia and stiffness forces of an airplane with aerodynamic forces of the outer flow. To accurately model landing process interaction of the same stiffness and inertia forces of an airplane with non-linear reactions from landing gears, have to be investigated. There are a few more examples (such as taxing loads, on-ground loads on the stop) where the so called mass-stiffness model of an airplane, with different additions, makes it possible to solve quite complicated problems.

In this work, a finite element mass-stiffness aircraft model, with nonlinear landing gears, has been developed. The planner has built it with beams and lumped masses. This simple model represents all general inertia and stiffness characteristics of the real structure. Its accuracy had been verified with experimental data obtained from a modal test of the full scale structure of the airplane, and showed good agreement. The model was built in a widely used preprocessor MSC Patran. The solution was conducted in MSC Nastran, using a direct transient solution module. Using programming language, the mass-stiffness model can be built automatically, which significantly simplifies preparation of the model, transferring and changing its properties. This feature is very important for the research department, as it makes the model more clear and understandable. In addition, it allows conducting optimization using any numerical method.

Developed procedures and models were successfully applied to the landing simulation of one modern mid-range passenger aircraft. Symmetry and non-symmetry landing with different vertical velocities and turn angles was investigated.

In future work it is planned to apply developed models for optimization analysis of landing gears, shock absorbers parameters and airplane construction, in order to minimize dynamic loads.

SUPERSONIC COMBUSTION IN A SCRAMJET ENGINE RESEARCH TRAINING GROUP GRK 1095

Future space transport vehicles – even aircrafts – are supposed to use air-breathing propulsion systems for their flight in a wide range of hypersonic Mach numbers. The great benefit of air-breathing systems such as scramjets is the ability to draw the oxidizer from the surrounding atmosphere, which increases the maximum possible payload. Unfortunately, scramjet propulsion systems have many technical challenges to overcome. Therefore, the Research Training Group 1095, funded by the German Research Foundation (DFG), was initiated to investigate such a highly integrated propulsion system within the framework of a national research program consisting of universities in Aachen, Munich and Stuttgart as well as the German Aerospace Centre (DLR) in Cologne.

The combustion process is widely acknowledged as one of the central aspects of a SCRamjet propulsion system. Within the subproject B1, issues regarding an efficient combustion were addressed. These included fuel injection and mixing strategies, efficient heat release, and the investigation of thermal loads on the structure of the combustion chamber and injectors. Particular focus was given to on different fuel injectors and injection schemes with single and multi-staged configurations. The approach in this subproject was to acquire an experimental database by using the supersonic combustion facility at the University of Stuttgart's Institute of Aerospace Thermodynamics (ITLR). Subsequently, the acquired database was used to develop and validate a set of 1D and 3D numerical simulation tools. These tools in turn will be deployed to extrapolate the obtained data to a theoretical flight vehicle, which is has been proposed by the Research Training Group.

The project evolved over three generations of graduate students with their own particular field of research based on the work of their respective predecessor. In the first phase (Dr. T. Scheuermann), a 1D simulation tool was developed, which enabled the design of a base configuration for a generic combustion chamber. As many effects inside the combustor proved to be of a highly three-dimensional nature, the second phase (J. Vellaramkalayil) focused on results of 3D simulation tools with which more advanced injection configurations could be realized. The last phase (N. Dröske) was then dedicated to the impact of the heat release onto combustion chamber structures. All phases were accompanied by dedicated experimental campaigns.

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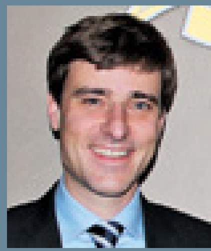

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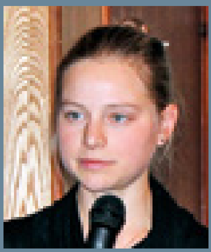

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TECHNOLOGY AND CODE FOR NUMERICAL SIMULATION OF DIFFERENT COMBUSTION TYPES IN HIGH-SPEED VISCOUS GAS TURBULENT FLOWS

The principal aim of the work is the development and realization of a computationally efficient method for numerical simulation of turbulent flows, with combustion, that occur in perspective aircraft combustors. The development of numerical methods for a combustion process in a combustor is caused by the necessity to avoid, or to reduce to minimum, the expensive experiments concerned with the designing and development of combustion chambers.

An essential problem while turbulent combustion modeling is the correct description of chemical processes in the presence of turbulent pulsations. Now, the most reliable and widespread approach for turbulence-combustion interaction (TCI) is the use of a probability density function (PDF).

An original combined method for taking into account TCI on the basis of the PDF approach has been developed. Its advantage is that it might be applied in different combustion regimes that occur in any practical problems, including limits of premixed and non-premixed diffusive combustion. The method takes into account non-equilibrium combustion effects and turbulence intermittency effects. It has been implemented into the code and is now being tested and adjusted. Some results of this testing, including a simulation of the Evans, Schexnayder, Beach experiment, are presented in this work.

On the basis of this combined method, the code has been created for simulation 3D viscid turbulent flows, on the basis of the full, non-stationary, Reynolds equation system for multi-component compressible gas with finite rate chemical reactions. The equation system is closed by a turbulence model and by a kinetic scheme of gaseous hydrogen or hydrocarbon fuel combustion in air. A numerical method of the second order approximation in all variables is used.

Original numerical technology for the fast and correct computation of non-stationary viscid gas flows has been incorporated into the code. It has been verified by comparison with the calculations based on standard non-accelerated technology. This technology gives the possibility to perform 3D calculations of real combustor geometry.

The program has undergone a thorough testing. The results are compared with experimental, theoretical and computational results presented in available literature. The most interesting results of this testing are presented, including the simulation of an experiment with the transverse jet of fuel with combustion, in supersonic crossflow. This test demonstrates the ability of a new code to simulate essentially 3D flows with turbulent combustion. The accordance of obtained results proved to be satisfactory and thus the testing stage was considered to be accomplished.

In the near future it is planned to apply the developed 3D code in a numerical simulation of an advanced combustor for studying problems of practical interest: influence of the fuel injectors' geometry and position on turbulent combustion in an advanced combustor.

NUMERICAL STUDY OF SHOCK WAVES INTERACTION AT IRREGULAR REFLECTION IN STEADY GAS FLOWS

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Steady shock wave reflections and interactions are very important in supersonic aerodynamics. Shock/shock interactions of various types can occur on supersonic and hypersonic aircraft during maneuvers and in cruise flight. Shock waves propagating from the nose of an aircraft can interact with shocks generated by other elements of the aircraft, such as wings, fins, inlet cowls, etc. Regular (two shocks) and irregular interactions (three shocks) of different types are inherent in such critical phenomena as off-design inlet flows and inlet starting.

This work is devoted to a numerical study of fundamental problems of shock interaction at irregular reflection in steady gas flows. Classical theoretical methods, such as the shock polar analysis and the three-shock theory, based on Rankine–Hugoniot jump conditions across oblique shocks, were developed by von Neumann to describe shock wave configurations for various flow parameters and to predict transitions between different types of shock wave interaction. It is assumed that all shocks have negligible curvature and thickness. These theoretical methods predict well most of the features of shock wave interaction, at least for strong shocks. However, there are situations where the von Neumann theory fails. In reflection of weak shock waves (i.e., at flow Mach numbers lower than 2.2 in air), there is a range of flow parameters where the von Neumann three-shock theory does not produce any solution, whereas numerous experiments and numerical simulations reveal a three-shock structure similar to the Mach reflection pattern. This inconsistency is usually referred to as the von Neumann paradox. One of the possible approaches to resolve the von Neumann paradox is to account for viscous effects in the vicinity of the triple point.

The numerical study is conducted with the continuum and kinetic approaches. The continuum simulations are based on a finite-difference solution of the full, two-dimensional, Navier–Stokes equations of a compressible gas. Kinetic simulations use the direct simulation Monte Carlo method (DSMC) for a numerical solution of the Boltzmann equation.

In the case of strong shock reflection (flow Mach numbers higher than 2.2 in air), the results of the computations show that flow viscosity and heat conduction strongly affect the triple point region, where the numerical solutions differ from the values prescribed by the inviscid three-shock theory. The size of this region has the order of the shock wave thickness and rises with increasing flow viscosity. The flowfields in the vicinity of the triple point, obtained at different Knudsen numbers, coincide, if plotted in coordinates normalized to the freestream mean free path.

In the case of weak shock reflection, simulations performed with substantially different approaches suggest that the flow viscosity induces the formation of a smooth three-shock transition zone, where classical Rankine–Hugoniot relations cannot be applied. The flow parameters in this zone differ from the theoretical values predicted by the inviscid three-shock solution. For the von Neumann paradox conditions, the computations predict an overall shock interaction configuration similar to Mach reflection. The existence of a viscous shock transition zone in the region of shock wave intersection allows a continuous transition from the parameters behind the Mach stem to the parameters behind the reflected shock, which is impossible in the inviscid three-shock theory. Thus we can conclude that the von Neumann paradox can be explained by a strong impact of viscosity in the region of shock/shock interaction.

JUNIOR SCIENTISTS

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VISION BASED ESTIMATION AND 3D RECONSTRUCTION FOR RENDEZVOUS NAVIGATION RELATIVE TO AN UNKNOWN AND UNCOOPERATIVE TARGET SPACECRAFT

Autonomous, in-orbit servicing of uncooperative and unknown target spacecrafts (e.g. space debris or heavily damaged spacecrafts) requires special abilities of the approaching spacecraft (chaser) during the proximity phase. A precise, relative navigation with known uncertainties between the chaser and the target spacecraft is essential. Furthermore, the estimation of the target spacecrafts 3D shape is necessary for collision-free interaction. Using adequate estimation algorithms, camera based solutions can be realized, taking advantage of the cheap, lightweight, low power camera sensor hardware. Special boundary conditions for the system design and algorithm development have to be taken into account, e.g. demanding illuminated conditions, particular spacecraft surfaces and a limited onboard calculating capacity.

The presentation will give a summary of our work on vision based estimation and 3D reconstruction for spacecraft rendezvous.

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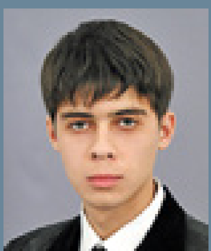

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IMPROVING OPERATIONAL CHARACTERISTICS OF GAS TURBINE ENGINES PARTS BY INTENSIFYING NITRIDING IN A GLOW DISCHARGE

It is known that one of the main reasons for low resource gas turbine engine part wear is its working surface. The improvement of the wear resistance can be achieved using various methods of hardening, aimed at changing the physical-chemical and mechanical properties of the surface layer. One of the most perspective methods of hardening is the ion nitriding in a glow discharge.

Nitriding in a glow discharge has many advantages compared with gas. These are significantly shorter duration of technological cycle, high controllability and stability of processing parameters. The duration of ion nitriding is 6-12 hours, during this time the modified layer by depth 100-500 microns is formed. For intensification of diffusion and chemical reactions, nitriding in a glow discharge with a magnetic field was proposed.

Much attention is given by the literature to ion nitriding of tool materials. However, there are practically no publications about structure and properties of tool steels after nitriding in a glow discharge with a magnetic field. Therefore, the aim of this work is to study the influence of magnetic field on structural phase composition and surface microhardness of gas turbine engine part.

THE ACOUSTO-OPTIC DISPLACEMENT TRANSDUCERS OF INFORMATION MEASURING SYSTEMS

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The development of high technology processes and their automation, including aviation and space, requires the creation of a large variety of transducers of physical quantities, with high metrological characteristics and enhanced functionality.

The number of linear displacement transducers comes to 90–95% of all types of transducers in existence. In foreign countries, production of linear displacement transducers is between 80-90% of the total number of data processors made.

Some sources of error acoustooptic displacement transducers (AODT) and ways of reducing their impact will be analyzed. The operational sources of errors of the APDT are the aging of parts and random variations of the light beam. The errors, connected with the aging of parts, are considered in and do not have significant value.

The error caused by random variations of the light beam can occur due to the drift pattern or because of changes in the fluctuation of the gradient refractive index of air.

To eliminate this error, position-sensitive systems should be used, in which, if the direction of the laser beam on the acoustooptic modulator (AOM) output position-sensitive is changed, the photodetector will show an error signal.

Instability of the frequency of ultrasonic signal. Instability of the frequency of ultrasonic signal of a high frequency generator leads to an error of calculation of displacement (linear or angular) of the object movement. Relative instability of frequency with a quartz oscillator can, by now, reach values of the order 10^{-6}.

Instability of the frequency of the laser emission. A source of coherent light is fundamental in the AODT. The single-frequency or dual-frequency lasers operating on a mixture of He-Ne (a monochromatic radiation with a wavelength of 0.6328 micrometer) are commonly used as such a source. One of the important parameters that determine the precision of the measurements is the frequency stability of the laser (i.e. stability of its wavelength). Currently achieved frequency stabilization is 10^{-10} and higher for a long time.

Instability of the spreading of the ultrasonic wave in the acousticoptic modulator mainly depends on the ambient temperature. For example, the relative instability of the spreading of the ultrasonic wave in the acousticoptic modulator (AOM) based on of TeO_2 (under normal conditions) is $\Delta V/V \approx 10^{-4}$. A reduction of this error of the AODP is achieved by the selecting of a material for the AOM, which has the lowest values of the spreading of ultrasonic wave V. The AOM crystals – TeO_2 (V = 617 m/c), KRS-6 (V = 2280 m/s), KRS-5 (V = 1920 m/s) have the most good value.

In general, if the acousto-optical transducers are correctly designed, the errors will be small. Also, it will be possible to use the AODT as part of the management of information measurement systems.

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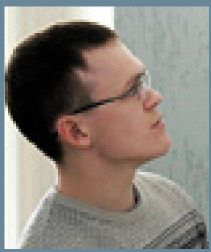

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MHD-CONTROL OF A SHOCK-WAVE STRUCTURE GENERATED BY THE FLAT PLATE

The work contains experimental results about the magnetohydrodynamic (MHD) control of a shock-wave structure near the flat plate in a hypersonic air flow, with the unidirectional magnetic field using electrical discharges for the flow ionization. It is shown that MHD-interaction over the plate can generate a new oblique shock in the interaction zone or even transform the attached oblique shock wave, in the detached bow shock, using radiofrequency (RF) and pulse discharges as the flow ionizers.

Developing of perspective hypersonic vehicles stimulates a new interest in the unconventional techniques of the flow control in the field of magneto-plasma aerodynamics (MPA). MPA proposes new possibilities to control high-speed flows, through the change of physio-chemical properties of the medium surrounding a flight vehicle.

Investigation of the MHD-interaction in the hypersonic air flow has been carried out at the MHD test rig based on a shock tube. The test rig permits to obtain flow parameters corresponding to the flight altitude of 30-50 km with Mach number M = 6, 8, 10. An electromagnet generates a magnetic field up to 2.2 T. Pictures of the flow have been obtained by high-speed CCD camera using shadow technique.

Test schematic shown in Fig. 1. MHD-interaction is provided by external electrical discharge within 120–290 µs. Flow Mach number is M = 6, 8 the static flow pressure is 12 Torr, the static temperature is 270 K, the flow rate is about 2000 m/s.

It has been shown experimentally that both the pulse and the RF discharge can be efficiently used for the flow ionization in the transverse B-field and for the generation of the nonequilibrium conductivity. This can be confirmed by the significant MHD-influence on a shock wave structure over the plate. The MHD-interaction can be used to control the shock wave structure of the flow and generate control forces and moments under hypersonic flight conditions.

In particular, a local MHD-interaction on a flat plate leads to the transformation of the attached oblique shock wave to the detached normal shock, using the electrical pulse discharge as an ionizer (Fig. 2). Without a magnetic field, the flow blows the discharge away from the model. As a result of the magnetic field increase up to B = 0.7 T, the discharge moves to the leading edge of the model, under the ponderomotive force. When B > 0.9 T the discharge region goes ahead of the model on both sides of the plane, pushes away the shock wave of the model and significantly expands the area of the MHD interaction.

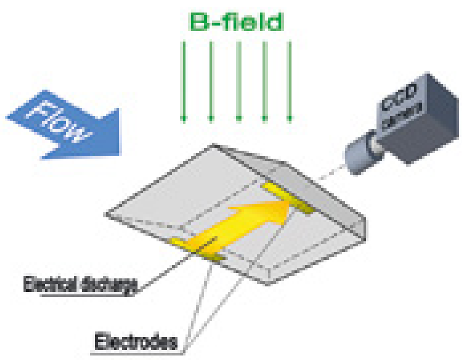


Figure 1: Test schematic.

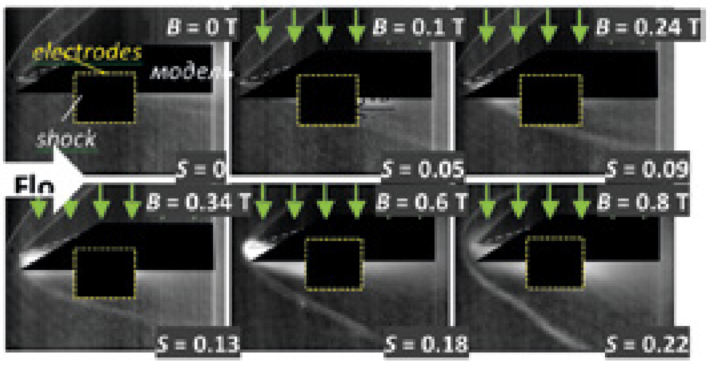
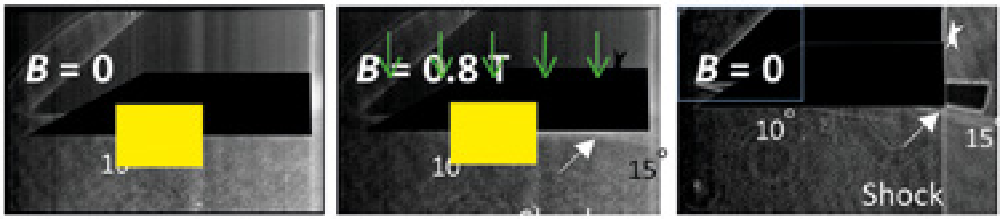


Fig. 2. MHD-transformation of the shock-wave structure near the plate at M = 6.

Use of the RF-discharge is rather interesting, because the local conductivity area is created with practically constant resistance and electrical contact between the electrodes. It has been shown that 1 MHz discharge in the magnetic field leads to the generation of a new oblique shock wave near the model surface (Fig. 3). The angle of the shock increases with the B-field respectively. When the shock wave slope angle is 15 degrees at B = 0.8 T, that corresponds to the hypersonic flow near the plate, with extended flap at 10 degrees (Fig. 3c). Such alteration, under MHD-interaction, can be interpreted as "MHD-flap". The MHD-effect permits to generate control forces and moments on the body surface under hypersonic flight conditions.

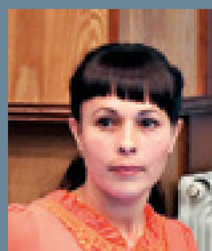
The nature of the obtained effects are planned to be studied in a future work devoted to the MHD flow control.



a. b. c.

Figure 3: MHD-flap and equivalent aerodynamic configuration.

AUTODYN AND FLUENT SOLVERS FOR CALCULATING BLAST PRESSURE WAVE PROPAGATION



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Novosibirsk

JUNIOR SCIENTISTS

This work pertains to the first stage of the project. In particular, it encompasses both the modeling of shock and propagation of detonation waves in air and the interaction with obstacles.

There is a wide range of modern CAE software, such as ANSYS AUTODYN, LS-DYNA, ANSYS CFD (CFX & Fluent), etc. Accordingly, this work also represents the authors' analysis and comparison of calculation potential of two solvers (ANSYS AUTODYN and ANSYS Fluent) for shock actions on buildings.

We computed three test cases with regard to the explosion of: (1) a single charge in the vicinity of a separately located prism; (2) a single charge in the vicinity of two prisms; and (3) 6 charges in the vicinity of several prisms.

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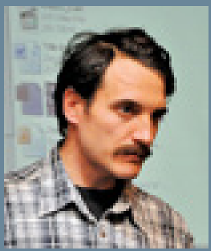

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AERODYNAMIC PERFORMANCE IMPROVEMENT OF MAV WINGS BY STREAMWISE STRUCTURING OF BOUNDARY LAYER

Nowadays, micro air vehicles (MAV) have found new military and civil applications. Miniaturization of the electronic equipment promotes the creation of progressively smaller unmanned aircraft. At the moment, many researchers pay much attention to MAVs with an overall mass below 0.5 kg and a chord-based Reynolds number between 104 and 105. In spite of certain success, the wide application of MAVs is limited by their rather modest aero-dynamic performances. Important MAV parameters, such as the critical angle of attack and lift-to-drag ratio, are mainly deteriorated by changes in the boundary-layer flow character at low Reynolds numbers. Wing surface modification is one of the major resources of separation, control and aerodynamic performance improvement. One of the most important aspects is to consider the effect of spanwise-periodic modifications to the wing surface on the laminar boundary-layer separation. In our work, it was demonstrated that the stall angle of attack of a wavy surface wing is 1.5 times higher than a classical wing, and aerodynamic performance hysteresis was not observed.

SCIENTIFIC INSTITUTIONS

NOVOSIBIRSK STATE TECHNICAL UNIVERSITY (NSTU)

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Novosibirsk State Technical University (NSTU), the former Novosibirsk Electronic Technical Institute, was founded in 1950. The university comprises 8 Technical Faculties, 3 Humanitarian Faculties, Institute of Social Rehabilitation, Institute of Further Professional Education and Training, and Institute of Distance Learning.

The Aircraft Faculty has existed in NSTU since 1959. The distinctive feature of this faculty is a close connection with manufacturing, particularly with the Chkalov Novosibirsk Aircraft Production Association (NAPO) and academic institutes of the RAS Siberian branch. The graduates of this faculty successfully work as engineers, technologists, heads of departments and enterprise services of aircraft and machine building specification.

NSTU has worked out and today executes its own conception of the net partnership, which includes training, research, summer and winter schools, in such fields as economics, material science, information technologies, and others. Within the program of the university strategic development for 2012–2016, double-degree programs with universities of Germany, Great Britain, Italy, Poland, Finland, Kazakhstan, and Mongolia are being developed.

Every year, about 300 employees, postgraduates, and students of the university go abroad for educational and scientific purposes. Germany takes a noticeable place in international contacts of the university. The most remarkable example is that, in 2012, 33% of the total number of our employees' business trips abroad accounted for the scientific centres and the universities of Germany. These international contacts lead to joint scientific projects. Most notably, these are projects with the Institute of Photonic Technology of Jena, the Institute of Material Science of Hannover, the Universities of Hamburg and Berlin, the University of Applied Sciences of Landshut, and the Chemnitz University of Technology, which has been the first German partner of our university (since 1972). NSTU has already carried out four inter-faculty student exchange summer schools with the Rhein-Main University of Applied Sciences of Wiesbaden.

In 2013, NSTU took the 20th place in the general rating of higher education institutions, the 13th place in scientific and research activities, and the 8th place among higher education institutions – with the biggest percentage of foreign students amongst higher education institutions in Russia (as reported by rating agency "Expert"). NSTU has been the winner of various federal competitions (Innovation and Education Program «High Technologies», «Development of Innovational Structure and Personnel Skills Development at NSTU», «University Strategic Development Program», and others) since 2007.

The results of NSTU scientific research are regularly displayed at international exhibitions. In 2012, the following developments received gold medals: «Technology for producing porous ceramic low-temperature annealing on the basis of the ash-and-slag waste (ASW) of power stations», «Subsystem for smart support at the operational control of hydro-power plants, «Technology dimensional processing of metals and alloys», «Integrated starter generator ISG», and «Web-complex for solving tasks in geological exploration by electromagnetic methods».

THE SIBERIAN BRANCH OF THE RUSSIAN ACADEMY OF SCIENCES

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The Siberian Branch of the Russian Academy of Sciences was established in 1957 and incorporates all organizations of the Russian Academy of Science located in Siberia.

The Siberian Branch consists of 75 research institutions working in different areas of physical, mathematical, chemical, biological, Earth and economic sciences, as well as humanities. The central location of the Siberian Branch is Novosibirsk. Research centers are established in Novosibirsk, Tomsk, Krasnoyarsk, Irkutsk, Yakutsk, Ulan-Ude, Kemerovo, Tyumen, and Omsk. Individual research institutions are located in Barnaul, Biisk, Chita, and Kyzyl.

Basic Principles for Organization of Siberian Branch of RAS are:

- Multidisciplinary approach and concentration of Institutes in Scientific Centers
- Development of priority trends of fundamental research
- Integration of science and education; involvement of staff and facilities of academic institutes in teaching at Novosibirsk State University and other Siberian universities; graduation of students for research institutes, higher schools and industry of Siberia
- Application of scientific results into industry and practice in Siberian region first

Institutes of SB RAS integrate with universities, and as a result there are 179 basic chairs, 80 research-education centers, 52 objects of joint scientific infrastructure, and 42 other education structures functioning with participation of SB RAS.

THE INSTITUTE OF THEORETICAL AND APPLIED MECHANICS (ITAM), SB RAS

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The Institute of Theoretical and Applied Mechanics was founded in 1957 by an outstanding scientist, academician Sergey Khristianovich, who was appointed as director of the Institute by the Presidium of the USSR Academy of Sciences. The main research activities are as follows: highspeed aerodynamics, combustion, kinetics and turbulence, strength of materials and constructions, and the mechanics of soils and rocks as applied to mining problems.

Since 1990 the Institute has been headed by academician V.M. Fomin.

The Institute of Theoretical and Applied Mechanics is an academic research organization, which successfully works in the field of advance problems of mechanics. The main research activities of the Institute deal with fundamental investigations in the field of aerohydrodynamics of super- and hypersonic flows: hydrodynamic stability, boundary layer, theory of fuel mixing and combustion in supersonic flows, mechanics of multiphase media with regard for physico-chemical transformations, plasma dynamics, and strength.

To promote the integration of Russian scientists into the international scientific community, the International Center of Aerophysical Research (ICAR) was created at the Institute of Theoretical and Applied Mechanics in 1991. In 1998 the Tyumen' Department joined the Institute of Theoretical and Applied Mechanics SB RAS as an independent budget division. Since May, 1997, ITAM SB RAS has been a member of Supersonic Tunnels Association, International (STAI).

NOVOSIBIRSK STATE UNIVERSITY (NSU)

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Novosibirsk State University was founded in 1959 in the center of Akademgorodok, Novosibirsk, as an essential part of the Novosibirsk Scientific Center. Higher education teaching personnel accounts for about 2,000 teachers, which include over 600 D. Sci. professors and 800 PhD assistant professors. In recent years, NSU's model of integration with research institutes has been transferred to business partnerships: joint research centers, laboratories and academic centers with the largest Russian and foreign companies established. At present, there are nearly 6,000 students at NSU. In addition to the School of Physics and Mathematics and the Higher College of Information Technologies, NSU consists of 13 departments, postgraduate and doctoral studies department, research centers modernized with the latest equipment (for example, "Living Systems", "Nanosystems and modern materials", "Earth Sciences"), and an institute for professional retraining.

The mission of NSU is to train highly educated specialists to conduct research and innovate on the global market. The university model is based on a unique, for Russia, integration of research and educational activities. Since its establishment, NSU adheres to a number of basic principles:

- university faculty members are also active researchers;
- the final stages of bachelor, master and postgraduate studying are based on the active research work in research institutes of the Siberian Branch of the Russian Academy of Sciences;
- the system of continuous education and training – from the Physical and Mathematical School and the Higher College of Informatics to the University – has been implemented. This unique system of training highly qualified personnel in Russia, created by M.A.Lavrentiev, has brought international fame to NSU and Akademgorodok.

The university offers a wide range of educational services for foreign students. It includes the choice of individual courses within educational programs of departments, participation in double diploma programs as well as joint Master's and Bachelor's programs (some of which are taught in English), practical experience in research laboratories or in businesses, and participation in summer field work and summer school.

At the present time NSU has nearly 60 joint educational programs and maintains direct relationships with 102 international universities and organizations from 23 countries.

NSU holds a solid place in the top five universities among more than 1,000 universities in Russia. Since 2009 NSU has been one of the 29 National Research Universities in Russia. In 2013 NSU was one of 15 winners of the Government grant, which promotes universities in world rankings. Novosibirsk State University is also included in the Top-500 universities in British ranking.

NOVOSIBIRSK STATE UNIVERSITY OF ARCHITECTURE AND CIVIL ENGINEERING (SIBSTRIN)

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Sibstrin is the father of the University of Novosibirsk. It was established in 1930. Within 83 years over 45,000 engineers have graduated from Sibstrin on civil and environmental engineering, architecture, and construction economics. Nowadays about 4,000 young people study at University. There are around two hundred students who are foreigners from 43 Asian, African, and Eastern European countries.

Sibstrin is among the 50 Russian universities whose graduates are the most desired by the labor market. The University provides more than 30 degree programs at the bachelor's, master's and postdoc levels, including innovative interdisciplinary programs. The school's staff and faculties consist of more than 400 professors.

We put into practice services through full-time tuition and distant education. Sibstrin University combines educational work with research in traditional schools and advanced study. These are the materials and technology of construction, computer engineering, information technology, fluid mechanics, building mechanics, and environmental science. We plan to elaborate and focus on a wide range of advanced materials including nanotechnology, computer science and engineering, ecology, and so on. Among the priority projects there are concrete composites and structures, multi-functional coatings and their modifications through nanotechnology, water treatment materials and technology, dynamics of heterogeneous dispersion systems, computing simulation of structures' aerodynamics, u-city and virtual city, safety of waterside structures, noise control and heat insulation, vibration and seismic protection, construction equipment. The University continues to put into practice a large scale of meaningful projects in different regions of Russia. We fulfill these and other projects in cooperation with some other universities and research institutes of Russia.

The University is keen to strengthen the links with industry. And we also attend to joint academic work and research with foreign institutions, e.g. from Germany, Korea, Kazakhstan, China, Poland, Spain and some others. Thus, Sibstrin University is in prospect, and we should be able to effectively work towards our goal of making more meaningful contributions to the world community.

RUSSIAN UNION OF YOUNG SCIENTISTS (RoSMU)

The Russian Union of Young Scientists (RoSMU) is an all-Russian, non-governmental organization that was registered with the Ministry of Justice of the Russian Federation on April 26, 2006. The organization was established during the Congress of Young Scientists of Russia (October 20-21, 2005), which gathered over 700 delegates, and represented more than 500 major higher education institutions, research universities and research centres from 77 territorial subjects of the Russian Federation. As of September 1, 2012 there are regional branches of RoSMU in 43 different territorial subjects of the Russian Federation.

The main goals of the organization are:

- Extending the cooperation between young scientists and specialists of the Russian Federation to contribute to new knowledge-exchange and to grow the efficiency of current scientific and innovative activities.
- Contributing to the high rate of Russia's social and economic development and to the development of Russian science and technology; to create an innovative economy and the building of a knowledge-based society.
- Contributing to the promotion of international cooperation in science and research as well as participating in international projects that effectively advance the work of young Russian scientists and specialists with a strong adherence to the best practices worldwide.

To reach these goals, RoSMU not only elaborates and implements theme-based projects and programmes, but also organizes national and international events, and performs data-processing, analytical, and expert work.

At the national and interregional levels RoSMU's most significant events include theme-based training seminars aimed at increasing the scientific, innovative and social activity of young scientists. In addition, RoSMU organizes annual interregional (district) forums for young scientists that include workshops on the most urgent issues of scientific and innovative activities, such as issues of international co-operation.

At the regional level RoSMU organizes theme-based round tables, exhibitions of innovative achievements of young scientists, discussion clubs, training sessions, etc.

In its activities, RoSMU cooperates with research organizations, educational institutions, companies, charity foundations as well as federal and regional authorities. These include the Ministry for Education and Science, the Federal Agency for Youth Affairs, the Federal Agency for the Commonwealth of Independent States, Compatriots Living Abroad and International Humanitarian Cooperation, the Council of Federation, the State Duma, etc.

RoSMU representatives are invited as experts to participate in consulting and advisory meetings of state bodies at the regional, federal and international level.

RoSMU represents Russia in the European association EURODOC that unites national organizations from 34 different countries in the European Union and from the member-states of the Council of Europe.

There is also the Regional branch of all-Russian non-governmental organization of RoSMU at Bashkortostan. This branch was founded in 2007.

The Regional branch cooperates with:

- Office of the Plenipotentiary Representative of the President of the Russian Federation in the Volga Federal District;
- Ministry of Education, Ministry of Youth and Sport, Ministry of Enterpises;
- Youth parliament of Bashkortostan;
- Ufa Scientific Center of the Russian Academy of Sciences;
- Universities of Bashkortostan.

RUSSIAN UNION OF
YOUNG SCIENTISTS

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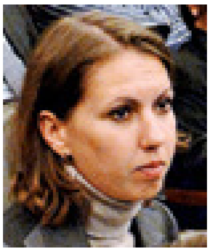
RUSSIAN FOUNDATION FOR BASIC RESEARCH (RFBR)



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The Russian Foundation for Basic Research (RFBR) provides targeted diverse support to leading groups of scientists or individual scientists. The main task of the Foundation is to select the best scientific projects on the basis of competition. Among the projects submitted, scientists take the initiative to organize and support the selected projects financially.

Scientific directions supported by RFBR are the following:

- mathematics, mechanics, and information technology;
- physics and astronomy;
- chemistry and studies of materials;
- biology and medical science;
- Earth science;
- natural-science methods in humanities sciences;
- information technology and computer systems;
- fundamental basics of engineering sciences.

The main competitions held by RFBR are the following:

- to call for an initiative in scientific projects, carried out by small (up to ten persons) groups of scientists or individual researchers;
- to call for projects organizing Russian and international scientific events on Russian territory;
- to call for publishing projects;
- to call for projects organizing expeditions (and field trips);
- to call for international projects;
- to call for projects of oriented fundamental research on interdisciplinary subjects of current interest;
- to call for projects of oriented fundamental research;
- to call for regional projects;
- to call for popular scientific articles by RFBR grant holders;
- to implement programs, such as “Electronic Scientific Library”, etc.

RFBR also pays a lot of attention to support of young researchers.

Starting from 2012 a range of competitions specifically for young scientists was developed and launched by RFBR, such as:

1. “My first grant”. Young and talented scientists who were not leaders of supported projects before can participate in this competition. A small group of scientists (up to 5 people) or individual scientists can apply for such grant.
2. Leading young research groups. RFBR accepts applications from research groups (5–10 people) with strong scientific backgrounds and achievements. Previous experience of leading supported research projects is required.
3. Organizing Russian and international scientific conferences, schools, etc. for young scientists.
4. Internships for Russian and foreign young researchers in Russia.

THE GERMAN HOUSE FOR RESEARCH AND INNOVATION (DWIH) MOSCOW

Deutsches Wissenschafts- und Innovationshaus – Moskau

Deutschland
Land der Ideen

The German Houses of Research and Innovation (DWIH) provide a platform for the German research and innovation landscape, showcasing the accomplishments of German science, research, and research-based companies and promoting collaboration with Germany and innovative German organizations. Our goal is to present German scientific and research organizations abroad under the banner of the DWIHs.

The German Houses of Research and Innovation are part of the Internationalization Strategy of the German Federal Government and the Federal Foreign Office's Research and Academic Relations Initiative. The Federal Foreign Office is implementing this project in cooperation with the Federal Ministry of Education and Research and in close collaboration with the Alliance of German Science Organizations, which includes the Alexander von Humboldt Foundation, Fraunhofer-Gesellschaft, German Academic Exchange Service (DAAD), German Council of Science and Humanities (WR), German National Academy of Sciences Leopoldina, German Rectors' Conference (HRK), German Research Foundation (DFG), Helmholtz Association, Leibniz Association, Max-Planck-Gesellschaft - as well as the Association of German Chambers of Industry and Commerce (DIHK).

The houses were created for various goals:

- Promote Germany as a research location
- Provide a forum for international dialogue and scientific exchange
- Present German innovation and transfer of technology in cooperation with German economy.

The German House for Research and Innovation in Moscow goes back to a June 2009 meeting between Germany's then Foreign Minister Frank Walter Steinmeier and his Russian counterpart Sergey Lavrov, when both agreed with expanding the institute under the leadership of the DAAD. In 2011 a joint declaration between Guido Westerwelle and Sergey Lavrov on the establishment of a German House of Research and Innovation in Moscow was signed. Currently the DWIH project in Moscow is lead jointly by the German Academic Exchange Service (DAAD) and the German Research Foundation (DFG) and comprises partners with a representation/representative in Moscow like the Helmholtz Association of German Research Centres (HGF), Alexander von Humboldt-Foundation (AvH), the Freie Universität Berlin and the German Historical Institute (DHI) Moscow. The German-Russian Chamber of Foreign Commerce (AHK) is also member of the DWIH.

In its various activities the DWIH Moscow focuses mainly on the topics of the German-Russian Modernization Partnership, i.e. climate, energy, health care, resource management, logistics and legal cooperation. Beside these, it has established an event portfolio on additional fields of German Russian scientific interest as aviation and space, energy saving technologies in constructing, bioenergy and several more. The DWIH regularly organizes and supports German-Russian events like e.g.:

- Science Lectures of outstanding German scientists
- Science Talks with high-ranked representatives of German and Russian science, science organizations, company-based research and representatives of regional administrations
- The „German-Russian Week of the Young Researcher", once a year on varying subjects in the Russian regions
- Regular meetings with rectors of leading Russian universities
- Symposia/Conferences on current scientific topics
- Information seminars in centres of scientific and innovative research in Russia
- Economy and innovation: participation in economic conferences on innovative topics
- Round table talks with scientists and journalists.

In 2013, the German House of Research and Innovation in Moscow participated in more than 40 events and organized itself several high-ranked scientific events.

Dr. Gregor Berghorn

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DFG Deutsche Forschungsgemeinschaft

Jürgen Breitkopf

German Research Foundation, Group of Research Careers

GERMAN RESEARCH FOUNDATION (DFG)

The Deutsche Forschungsgemeinschaft (German Research Foundation) is the biggest funding agency in Europe for the development of fundamental research with an annual budget of 2,5 billion Euro. Its membership consists of German research universities, non-university research institutions, scientific associations and the Academies of Science and the Humanities. The DFG has expanded its presence in other research regions around the world with its 7 liaison offices. The office Russia/CIS was opened in Moscow in 2003. Framework agreements on the co-funding of research projects and researcher mobility exist with the following partners: the Russian Academy of Sciences (RAN), the Russian Foundation for Basic Research (RFFI), the Russian Foundation for the Humanities (RGNF).

How does the DFG promote young researchers? Creative and intelligent minds are the key to successful science and research. That is why the DFG places a special focus on promoting young researchers. We are committed to helping young talents pursue cutting-edge investigations in top-level settings and help them to become independent early on in their careers.

Flexible individual funding and customised excellence programmes give young researchers the opportunity to advance in their careers and undertake projects from all branches of science and the humanities. The DFG accepts funding proposals from researchers with a doctoral degree (PhD) who live and work in Germany or plan to do so in the future. PhD students are not supported individually, but can be, indirectly through the funding of programmes and projects.

Project-based doctoral and post-doctoral qualifications. For doctoral researchers, who like working in a team and value a well-designed framework, a Research Training Group (RTG) may be the right choice. It combines an ambitious research programme with target-oriented supervision and academic freedom to form an ideal environment for a successful doctorate. Post-docs help design the research and qualification programmes of an existing RTG and explore new research topics for your future career.

Following completion of the doctorate there is the possibility to assume responsibility as an investigator in an existent DFG-funded project. This will give young researchers the opportunity to advance their qualifications and improve their career prospects by gaining experience and by building new networks.

The Temporary Position is a funding mechanism that provides young researchers with funding for a temporary post-doctoral position in conjunction with a proposal for a research grant. Researchers may select the scientific setting in Germany that they think will provide the best conditions for their project.

Excellence programmes. The Emmy Noether Programme is aimed at outstanding scientists and academics with at least two and no more than four years of post-doctoral research experience (or up to six years for licensed medical doctors). It allows young researchers to head their own independent junior research group that will work on a project for five or, in exceptional cases, six years. It offers a fast-track opportunity to qualify for a leading position in research.

For young researchers, who have all the qualifications for a professorship, the Heisenberg Programme may be the right option. This programme provides them with funding for up to five years so they can distinguish themselves further academically. There are two variations of the programme: the portable Heisenberg fellowship, which also allows one to go abroad for some time; and the Heisenberg professorship, which offers the prospect of acquiring a tenured position at a German university, provided the candidate receives a positive review.

THE GERMAN ACADEMIC EXCHANGE SERVICE (DAAD)

DAAD Deutscher Akademischer Austausch Dienst
German Academic Exchange Service

Dr. Gregor Berghorn

Head of DAAD Office
Moscow

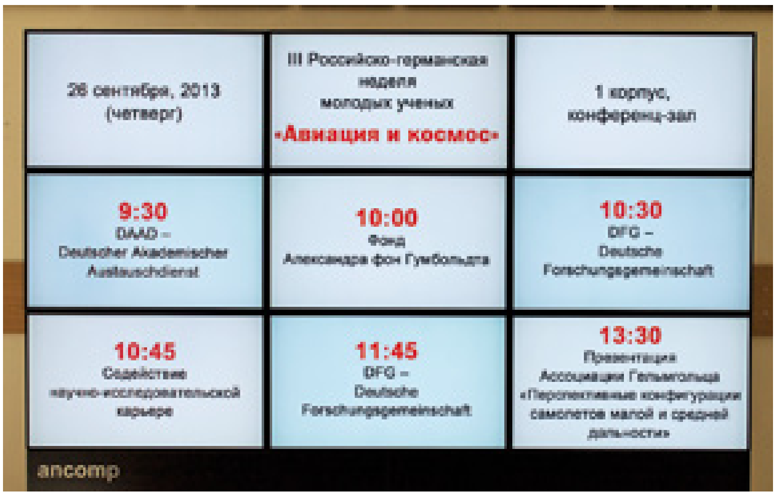
The German Academic Exchange Service (DAAD) is the largest funding organisation in the world supporting the international exchange of students and scholars. Since it was founded in 1925, more than 1.5 million scholars in Germany and abroad have received DAAD funding. It is a registered association and its members are German institutions of higher education and student bodies. Its activities go far beyond simply awarding grants and scholarships. The DAAD supports the internationalisation of German universities, promotes German studies and the German language abroad, assists developing countries in establishing effective universities and advises decision makers on matters of cultural, education and development policy.

Its budget is derived mainly from the federal funding of various ministries, primarily the German Federal Foreign Office, but also from the European Union and a number of enterprises, organisations and foreign governments. Its head office is in Bonn, but the DAAD also has an office in the German capital, Berlin, to which the famous Berlin Artists-in-Residence Programme (Berliner Künstlerprogramm) is closely affiliated. It maintains contact with and provides advice to its main partner countries on every continent via a network of regional offices and information centres.

In 2011, the DAAD funded more than 70,000 German and international scholars worldwide. The funding offers range from a year abroad for undergraduates to doctoral programmes, from internships to visiting lectureships, and from information gathering visits to assisting with the establishment of new universities abroad. Voluntary, independent selection committees decide on the funding. The selection committee members are appointed by the DAAD's Executive Committee according to certain appointment principles. The DAAD supports the international activities of German institutions of higher education through marketing services, publications, the staging of events and training courses.

The DAAD's programmes have the following five strategic goals:

- to encourage outstanding young students and academics from abroad to come to Germany for study and research visits and, if possible, to maintain contact with them as partners lifelong;
- to qualify young German researchers and professionals at the very best institutions around the world in a spirit of tolerance and openness;
- to promote the internationality and appeal of Germany's institutions of higher education;
- to support German language, literature and cultural studies at foreign universities;
- to assist developing countries in the southern hemisphere and reforming countries in the former Eastern Bloc in the establishment of effective higher education systems.



Alexander von Humboldt
Stiftung / Foundation

Prof. Dr. Andrey Morozov

Ambassador Scientist
of Humboldt Foundation
Sobolev Institute
of Mathematics
SB RAS, Novosibirsk

THE ALEXANDER VON HUMBOLDT FOUNDATION (AVH)

The Alexander von Humboldt Foundation promotes academic co-operation between excellent scientists and scholars from Germany and abroad. AvH research fellowships and research awards allow scientists to come to Germany to work on a research project they have chosen themselves together with a host and a collaborative partner. As an intermediary organization for German foreign cultural and educational policy AvH promotes international cultural dialogue and academic exchange.

What is important to us? Only one thing is important to becoming a member of the Humboldt Family: your own excellent performance. There are no quotas, neither for individual countries nor for particular academic disciplines. AvH selection committees comprise of academics from all fields of specialisation and they make independent decisions based solely on the applicant's academic record. So in this case people are supported, specific not projects. After all, even in times of increased teamwork, it is the individual's ability and dedication that are decisive for academic success.

Roots of the AvH: Alexander von Humboldt was a discoverer and cosmopolitan. He was a fighter for the freedom of research, a humanist and a patron of excellent academic talent. Shortly after his death, the Alexander von Humboldt Foundation for Nature Research and Travel was established in 1860.

Today's Alexander von Humboldt Foundation was established by the Federal Republic of Germany on 10 December 1953. With Humboldt as a model, the Foundation maintains an international network of academic co-operation and trust. It links more than 25,000 Humboldtians throughout the world together, including 49 Nobel Laureates. The Foundation is funded by the Federal Foreign Office, the Federal Ministry of Education and Research, the Federal Ministry for Economic Co-operation and Development, the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety as well as a number of national and international partners.

Become a Humboldtian: Whether you are a young post-doctoral researcher at the beginning of your academic career, an experienced established academic, or even a world authority within your discipline - our research fellowships and research awards offer you sponsorship specifically tailored to you and your career situation.

Key Sponsorship Programmes:

- Research Fellowships for post-doctoral researchers and for experienced researchers (up to 24 months of stay in Germany).
- Awards (Sofja Kovalevskaja Award, Friedrich Wilhelm Bessel Research Award, Humboldt Research Award, Alexander von Humboldt Professorship and others)
- German Chancellor Fellowships to prospective leaders from the USA, the Russian Federation and China who have shown an outstanding potential for leadership in their careers thus far. For representatives of all professions and disciplines, giving special preference to the humanities, law, social science and economics.

HELMHOLTZ ASSOCIATION OF GERMAN RESEARCH CENTRES

The Helmholtz Association is the largest German scientific organization which strives to solve the grand challenges of society, science and industry. The Helmholtz Associatin performs top-rate research in strategic programmes in six fields: Energy, Earth and Environment, Health, Key Technologies, Structure of Matter, Aeronautics, Space and Transport. Its work follows the tradition of the great natural scientist Hermann von Helmholtz (1821-1894). The Helmholtz Association consists of 18 national centres with 36,000 employees and an annual overall budget of €3,8 billion.

The Helmholtz Association produces more than 11,500 scientific publications every year, around 400 new patent registrations, and 3,000 cooperation projects on business and industry. The Helmholtz Association shows excellent results in both basic research and application. The Helmholtz Association provides an excellent infrastructure for research with large-scale facilities, such as particle accelerators, super computers and research ships, some of which are globally unique. Every year the Helmholtz centres welcome several thousand visiting domestic and foreign scientists who come to use these scientific research opportunities.

As a strong member of the global scientific community, the Helmholtz Association works with national and international partners representing science and research as well as business and industry. This is the Helmholtz Association's key to achieving outstanding research results.

Russia is one of the key strategic partners of the Helmholtz Association. There are more than 200 cooperation projects between Helmholtz centres and Russian institutions. The Helmholtz Moscow Office was established in 2004 in order to strengthen the cooperation between Russian scientists and researchers of Helmholtz Centres, as well as initiate new partnerships. It is the first point of contact for Helmholtz researchers who wish to cooperate with Russian partners, and for Russian scientists who need special information and contacts with their potential partners in the Helmholtz research centres.

In 2008 the Helmholtz Association and the Russian Foundation for Basic Research launched a joint program called the Helmholtz-Russia Joint Research Groups (HRJRG). HRJRG is a program designed especially for young researchers from Germany and Russia. One of its aims is to improve the academic career perspectives of young Russian scientists within Russia. Meanwhile, this program allows Russian scientists to have the possibility of using the unique research large-scale infrastructure of the Helmholtz Association. Each group consists of Russian and German (Helmholtz) researchers and receives funding of up to 160,000 Euros for three years. 32 projects out of five calls have already received funding. In March 2014 the Helmholtz Association and the Russian Foundation for Basic Research will meet together to discuss future possibilities of cooperation and funding for outstanding research projects of Russian and German scientists.

The Helmholtz Association highly appreciates the outstanding work of Russian scientists and intends to extend its co-operation with Russian partners in the future.

HELMHOLTZ
ASSOCIATION

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PLENARY DISCUSSIONS

Prospects for Young Researchers: What Can Be Expected From Research Organizations?

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of Freie Universität Berlin, Moscow
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The 3rd Week of the Young Researcher on "Aviation and Space", like the two previous "Weeks", was rounded up by an open discussion for all participants on the "Prospects for young researchers: what can be expected from research organizations?" As in the "Weeks" before, Russian organizations presented their programs and therefore got direct feedback and experience, in how young researchers' applications were handled and where procedures could be improved.

Prof. Dr. Peter Funke and Dr. Jörn Achterberg (DFG), Dr. Gregor Berghorn (DWIH and DAAD), and Mrs. Nadezhda Okorokova, from the Moscow Aviation Institute, took part in the discussion panel. During the conference, dedicated to a technical topic in part very close to applied science, it had already become clear that all the problems connected with fundamental science, especially in non-technical areas, were of much less importance. The first question raised was about personal motivation. Scientific careers of young and experienced researchers are based on personal interest and the motivation to find answers to a certain question, which appeared during their studies. This leads to an early integration of young researchers into international research groups, which is demonstrated by the fact that Russians are now doing research in Germany and Germans have become involved in Russian scientific groups.

Furthermore, the financial situation in the technical disciplines seems to be, by far, better than those in the humanities or social sciences. During the discussion, it turned out that most of the young researchers were not only well integrated, but also had better financial support and professional career perspectives.

In comparison to the previous weeks, which had been dedicated to "Man and Energy" and "Health and Society", this week was on the broad topic of "Aviation and Space". Still within the conference, the focus was on the big topic of scramjets and related questions. This led not only to discussions between experts but also to lively debates, after individual presentations of research projects. The expectation from the research organizations was to keep up the funding opportunities and support for young researchers, in the format of the Week of the Young Researcher.

To sum it up, all participants came to agree that this week had provided an excellent opportunity to exchange research approaches, share scientific interests and make new contacts. Although another week of the Young Researcher is unlikely to be held on this special topic, the participants would appreciate the opportunity to meet again. However, since the first reliable contacts have been established under the patronage of DWIH, DAAD, DFG, Russian Union of Young Scientists, the hosting Novosibirsk State Technical University and the Khristianovich Institute of Theoretical and Applied Mechanics Siberian Branch of the Russian Academy of Sciences, it is now up to the young generation probably not to wait until scramjets will become everyday transportation vehicles, but meet earlier to push it towards realization.

LIST OF PARTICIPANTS

OF THE INTERNATIONAL CONFERENCE "WEEK OF THE YOUNG RESEARCHER: AVIATION AND SPACE"

Novosibirsk, September 23–27, 2013

GERMAN DELEGATION

TITLE	LAST NAME	FIRST NAME	STATUS / INSTITUTION
Dr.	ACHTERBERG	Jörn	Head of DFG Office Moscow, Deputy Head of DWIH Moscow
Dr.	BERGHORN	Gregor	Head of DAAD Office Moscow, Managing Director of DWIH Moscow
Dr.	BREITKOPF	Jürgen	Director of Programmes, Group of Research Careers, DFG Bonn
Mr.	CIAMPA	Pier	Researcher, PhD Student, Institute for Air Transportation Systems / Integrated Aircraft Design, German Aerospace Center, Hamburg
Dipl.-Ing.	DRÖSKE	Nils	PhD Student, Institute of Aerospace Thermodynamics, University of Stuttgart
Dipl.-Ing.	FUCHTE	Jörg	Scientific Assistant, Institute for Air Transportation Systems / Integrated Aircraft Design, German Aerospace Center, Hamburg
Prof. Dr.	FUNKE	Peter	Vice-President of the DFG, Director of the Institute of Ancient History and the Institute of Epigraphy, University of Münster
Dipl.-Ing.	GAISBAUER	Uwe	Institute of Aerodynamics and Gas Dynamics, University of Stuttgart
Mr.	HAGEBÖCK	Stephan	PhD Student, Institute of Physics, University Bonn
Mrs.	HOLST	Sandra	Project Coordination "Science Slam" German-Russian Forum, Berlin
Mrs.	ILINA	Julia	Project Manager, DFG Office Moscow
Prof. Dr. techn.	JANSCHEK	Klaus	Professor, Chair of Automation Engineering, Faculty of Electrical and Computer Engineering, Technische Universität Darmstadt
Mr.	KLEMM	David	PhD Student, Aerospace Engineering, University of Stuttgart

TITLE	LAST NAME	FIRST NAME	STATUS / INSTITUTION
Dipl.-Ing.	KLIX	Michael	PhD student, Institute of Automation, Technische Universität Dresden
Dr.	KRISPIN	Martin	Project Coordinator, DWIH Moscow
Dr.-Ing.	LENTZE	Michael	Director of Programmes, Ingineering Sciences, DFG Bonn
Prof.	OBERLACK	Martin	Head of the Institute, Department of Mechanical Engineering, Chair of Fluid Dynamics, Technische Universität Darmstadt
Dipl.-Ing.	PFANNE	Martin	Research Assistant, Institute of Automation, Technische Universität Dresden
Mr.	RUSAKOV	Mikhail	Staff Member, DWIH Moscow
Dr.-Ing.	SCHEUERMANN	Tobias	Team Leader "New Technologies", IHI Charging Systems International GmbH, Heidelberg
Prof. Dr.-Ing.	SCHRÖDER	Wolfgang	Head of the Institute, Chair of Fluid Mechanics, Institute of Aerodynamics Aachen, RWTH Aachen
Dipl.-Ing.	SONNENBURG	Arne	PhD student, Institute of Automation, Technische Universität Dresden
Mr.	STÜDEMANN	Tobias	Head of the Liaison Office of Freie Universität Berlin in Moscow
Mr.	VELLARAMKALAYIL	Jiby	PhD Student, Institute of Aerospace Thermodynamics, University of Stuttgart
Dr.-Ing.	WACŁAWCZYK	Marta	Scientific Researcher, Chair of Fluid Dynamics, Department of Mechanical Engineering, Darmstadt University of Technology
Prof. Dr.	WALTHER	Rainer	Coordination Technology Networks, MTU Aero Engines AG, München

RUSSIAN DELEGATION

TITLE	LAST NAME	FIRST NAME	STATUS / INSTITUTION
Mr.	ALEKSEEV	Anton	Research Fellow, Institute of Theoretical and Applied Mechanics, SB RAS, Novosibirsk
Mr.	ANISIMOV	Kirill	Junior Researcher, Central Aerohydrodynamic Institute, Zhukovsky
Prof.	ASEEV	Alexandr	Academician, Chairman of the Presidium, Siberian Branch of Russian Academy of Sciences, Novosibirsk
Mr.	BATRAKOV	Andrey	PhD Student, Kazan Technical University named after A.N. Tupolev, Kazan
Dr.	BOBIN	Konstantin	Associate Professor, Novosibirsk State Technical University, Novosibirsk
Mrs.	CHERKASHINA	Natalia	Research Fellow, Belgorod State Technical University, Belgorod
Mr.	DANILOV	Maksim	PhD Student, Novosibirsk State University of Architecture and Civil Engineering, Novosibirsk
Mr.	DESYATNIK	Pavel	Research Fellow, Central Aerohydrodynamic Institute, Zhukovsky
Prof.	FEDORUK	Mikhail	Rector, Novosibirsk State University, Novosibirsk
Mr.	FILIPPOV	Artyom	Chairman, Association of Scientific Youth, Institute of Theoretical and Applied Mechanics, SB RAS, Novosibirsk
Prof.	FOMIN	Vasily	Academician, Director, Institute of Theoretical and Applied Mechanics; Deputy Chairman of the Presidium, SB RAS, Novosibirsk
Dr.	GOTSELYUK	Tatyana	Associate Professor, Siberian Aeronautical Research Institute named after S.A. Chaplygin, Novosibirsk
Prof.	GOVERDOVSKIY	Vladimir	Vice-Rector, Novosibirsk State University of Architecture and Civil Engineering, Novosibirsk
Mr.	IGNATYEV	Dmitry	Junior Research Fellow, Central Aerohydrodynamic Institute, Zhukovsky
Dr.	KIRILLOVSKY	Stas	Institute of Theoretical and Applied Mechanics, SB RAS, Novosibirsk
Mr.	KONDAKOV	Ivan	Research Assistant, Central Aerohydrodynamic Institute, Zhukovsky

TITLE	LAST NAME	FIRST NAME	STATUS / INSTITUTION
Prof.	KOSINOV	Aleksandr	Head of Laboratory, Institute of Theoretical and Applied Mechanics, SB RAS, Novosibirsk
Dr.	KUZIKOVSKY	Stas	Research Fellow, Institute of Automation and Electrometry, SB RAS; Corporation "Soft-Lab-NSK", Novosibirsk
Prof.	LEBIGA	Vadim	Executive Director, International Centre for Aerophysical Research at the Institute of Theoretical and Applied Mechanics, SB RAS, Novosibirsk
Dr.	MAKAROV	Valery	Senior Scientist, State Centre of Flight Safety Civil Aviation, Moscow
Dr.	MISHCHENKO	Dmitry	Institute of Theoretical and Applied Mechanics, SB RAS, Novosibirsk
Prof.	MOROZOV	Andrey	Ambassador Scientist of Humboldt Foundation, Sobolev Institute of Mathematics, SB RAS, Novosibirsk
Mrs.	MORZHUKHINA	Alena	PhD-Student, Moscow Aviation Institute, Moscow
Prof.	NETESOV	Sergey	Vice-Rector for Science, Novosibirsk State University, Novosibirsk
Mr.	NIGMATZYANOV	Vladislav	Research Fellow, Moscow Aviation Institute, Moscow
Dr.	OKOROKOVA	Nadezhda	Teaching Assistant, Moscow Aviation Institute, Moscow
Prof.	PAKHOMOV	Maksim	Leading Scientist, Kutateladze Institute of Thermophysics, SB RAS, Novosibirsk
Dr.	POLIVANOV	Pavel	Institute of Theoretical and Applied Mechanics, SB RAS, Novosibirsk
Dr.	PONIAEV	Sergey	Senior Research Fellow, Ioffe Physical-Technical Institute, RAS, St. Petersburg
Prof.	PUSTOVOI	Nikolai	Rector, Novosibirsk State Technical University, Novosibirsk
Mr.	RASHIDOV	Arseny	Student, Ufa State Aviation Technical University, Ufa
Dr.	RYBIN	Andrey	PhD-Student, Moscow Power Engineering Institute, Moscow
Dr.	RYNGACH	Nikolai	Associate Professor, Novosibirsk State Technical University, Novosibirsk
Dr.	SERDYUKOVA	Yulia	Deputy Chair of the Council, Union of Scientific Youth, SB RAS, Novosibirsk

TITLE	LAST NAME	FIRST NAME	STATUS / INSTITUTION
Dr.	SHCHEGLOV	Alexander	Chairman of the Council, Russian Union of Young Scientists, Moscow
Dr.	SHIPLYUK	Alexander	Corresponding Member of RAS, Deputy Director for Science, Institute of Theoretical and Applied Mechanics, SB RAS, Novosibirsk
Mrs.	SHIRYAEVA	Anna	Research Fellow, Central Aerohydrodynamic Institute, Zhukovsky
Dr.	SHOEV	Georgy	Institute of Theoretical and Applied Mechanics, SB RAS, Novosibirsk
Dr.	TKACHENKO	Ivan	Engineer, Samara State Aerospace University, Samara
Prof.	TSOI	Evgeny	Vice-Rector for International Affairs, Novosibirsk State Technical University, Novosibirsk
Dr.	VAFIN	Ruslan	Research Fellow, Ufa State Aviation Technical University, Ufa
Mrs.	VALGER	Svetlana	PhD student, Novosibirsk State University of Architecture and Civil Engineering, Novosibirsk
Dr.	VAZHDAEV	Konstantin	Senior Lecturer, Ufa State University of Economics and Service Head of Department of International Cooperation and Exchange Programs of ROSMU Bashkortostan, Ufa
Mr.	YADRENKIN	Mikhail	Institute of Theoretical and Applied Mechanics, SB RAS, Novosibirsk
Dr.	ZAKHAROVA	Yulia	Research Fellow, Novosibirsk State University of Architecture and Civil Engineering, Novosibirsk
Mr.	ZHELOBKOV	Vladimir	Teaching Assistant, Novosibirsk State Technical University, Novosibirsk
Dr.	ZHURBINA	Irina	Head of Youth Programs Department, Russian Foundation for Basic Research, Moscow
Dr.	ZVERKOV	Ilya	Senior Lecturer, Novosibirsk State Technical University, Novosibirsk

PROGRAMME

SEPTEMBER 22, SUNDAY

13:00	Light lunch
14.00 – 18:00	Sightseeing Tour
19:00	Words of Welcome to the participants of the week by • Dr. Gregor BERGHORN, DAAD Moscow • Dr. Jörn ACHTERBERG, DFG Moscow • Dr. Aleksandr SHCHEGLOV, Chairman of the Council of the Russian Union of Young Scientists (ROSMU)

SEPTEMBER 23, MONDAY

09:30	Transfer to the University
10:00	Registration of Participants
11:00	Official Opening of the Week with welcome addresses by • Prof. Dr. Nikolai PUSTOVOI Novosibirsk State Technical University • Academician Prof. Aleksandr ASEEV Chairman of Siberian Branch of Russian Academy of Sciences (SB RAS) • Prof. Dr. Mikhail FEDORUK Rector of Novosibirsk State University • Neithart HÖFER-WISSING Consul General of the Federal Republic of Germany in Novosibirsk • Prof. Dr. Peter FUNKE Vice-President of the DFG • Dr. Aleksandr SHCHEGLOV Chairman of the Council of the Russian Union of Young Scientists (ROSMU)
12:00	Simulation of Cooled Scramjet Flows Prof. Dr.-Ing. Wolfgang SCHRÖDER Institute of Aerodynamics (AIA), RWTH Aachen University *– Discussion –*
13:00	Lunch
14:00	Introductory remarks to The Third German-Russian “Week of the Young Researcher” • Prof. Dr. Peter FUNKE Vice-President of the DFG
14:30	Presentation of Novosibirsk State Technical University (NSTU) Prof. Dr. Evgeny TSOI Vice-Rector for International Affairs, NSTU

15:00 **Model-Based Systems Design For Safety Critical Systems**
Prof. Dr. techn. Klaus JANSCHEK
Chair of Automation Engineering, Technische Universität Dresden
– Discussion –

16:00 **Coffee Break**

16:30 **Short Lectures of Young Researchers**
Chair:
- Prof. Dr.-Ing. Wolfgang SCHRÖDER
  RWTH Aachen University
- Prof. Dr. techn. Klaus JANSCHEK
  Technische Universität Dresden

MAKAROV, Valery: "The Concept of the Automated System of Forecasting and Preventing Flight Accidents"

SONNENBURG, Arne: "Vision Based Estimation And 3D Reconstruction For Rendezvous Navigation Relative To An Unknown And Uncooperative Target Spacecraft"

KLIX, Michael / PFANNE, Martin: "Adaptive Federative 3d Exploration with Multi Robot Systems"

KONDAKOV, Ivan: "Development of Pro-Composite Fuselage Structures for Perspective Airliners"

IGNATYEV, Dmitry: "Modeling of Nonlinear Unsteady Aerodynamics of Aircraft at High Angles of Attack Using Recurrent Neural Networks"

RASHIDOV, Arseny: „Software Tool for Error Propagation Analysis"

18:00 **Transfer to the Hotel**

19:30 **Evening Reception**
by DWIH and the German Consulate General

SEPTEMBER 24, TUESDAY

09:00 **Transfer to Akademgorodok**

10:00 **Presentation of Akademgorodok**
Academician Prof. Vasily FOMIN
Deputy Chairman of Siberian Branch of Russian Academy of Sciences (SB RAS)

10:30 **Presentation of Novosibirsk State University**
Prof. Dr. Sergey NETESOV
Vice-Rector for International Affairs, NSU

11:00 **Presentation of the Institute of Theoretical and Applied Mechanics (ITAM)**
Academician Prof. Vasily FOMIN
Director of ITAM

11:30 **Coffee Break**

11:45 Aero-thermodynamic Design Of A Scramjet Propulsion System – Research Training Group GRK 1095
Dr.-Ing. Uwe GAISBAUER
Institute of Aerodynamics and Gas Dynamics (IAG), University of Stuttgart

12:30 AShort Lectures of Young Researchers from Research Training Group GRK 1095
SCHEUERMANN, Tobias / DRÖSKE, Nils / VELLARAMKALAYIL, Jiby: "Supersonic Combustion in a Scramjet Engine"

13:00 Laminar-Turbulent Transition Control of Hypersonic Boundary Layers by Passive Porous Coatings
Dr. Aleksandr SHIPLYUK
Institute of Theoretical and Applied Mechanics (ITAM)

13:30 Supersonic Boundary Layer Transition: Instability Mechanisms and Control
Prof. Aleksandr KOSINOV
Institute of Theoretical and Applied Mechanics (ITAM)

14:00 Lunch

15:00 Poster Session of Young Researchers
Chair:
- Dr.-Ing. Uwe GAISBAUER
  University of Stuttgart
- Dr. Aleksandr SHIPLYUK
  Institute of Theoretical and Applied Mechanics

SHOEV, Georgy: "Numerical Study of Shock Waves Interaction at Irregular Reflection in Steady Gas Flows"

MISHCHENKO, Dmitry: "Excitation and Evolution of Goertler Instability Modes in Boundary-layer Flows"

ALEKSEEV, Anton: "Experimental Research of Thermal Stability of Heat-Resistant Materials"

YADRENKIN, Mikhail: "MHD-Control of a Shock-Wave Structure Generated by the Flat Plate"

KIRILLOVSKY, Stas: "Numerical Simulation of Nonequilibrium Flow over a Plate in Aerodynamic Tunnel"

POLIVANOV, Pavel: "Effect of the Local Wall Cooling/Heating on the Hypersonic Boundary Layer Stability and Transition"

15:45 Transfer to and Visit of ITAM
Institute of Theoretical and Applied Mechanics (ITAM)

17:30 Transfer to Hotel

18:15 Dinner

20:00 Cultural Programme
Bowling Night at "Vesyolaya keglya"

SEPTEMBER 25, WEDNESDAY

08:45	Transfer to the University
09:30	DWIH Moscow German Centre for Research and Innovation Dr. Gregor BERGHORN, Managing Director
10:00	ROSMU – Russian Union of Young Scientists Dr. Konstantin VAZHDAEV Ufa State University of Economics and Service, Head of the Department of International Cooperation and Exchange Programmes of RoSMU, Bashkortostan
10:30	Council of Young Scientists of the Russian Academy of Sciences, Siberian Branch Dr. Yulia SERDYUKOVA Institute of Economics and Industrial Engineering, Deputy Chair of the Council of Scientific Youth SB RAS
11:00	Coffee Break
11:15	RFFI – Russian Foundation for Basic Research Dr. Irina ZHURBINA Head of Youth Programs Department
12:00	Deriving Turbulent Scaling Laws From First Principles – A Change In Paradigm And Its Importance For Turbulence Prediction Prof. Dr.-Ing. Martin OBERLACK Institute of Fluid Dynamics, Darmstadt University of Technology *– Discussion –*
13:00	Lunch
14:00	Simulation of Flow about Aircrafts in Transonic Wind Tunnels Prof. Dr. Vadim LEBIGA Chair of Aerodynamics, NSTU, International Centre of Aerophysical Research, Institute of Theoretical and Applied Mechanics *– Discussion –*
15:00	Coffee Break
15:15	Short Lectures of Young Researchers Chair: • Prof. Dr.-Ing. Martin OBERLACK Darmstadt University of Technology • Prof. Dr. Vadim LEBIGA NSTU and ITAM PAKHOMOV, Maksim: "Numerical Modelling of Flow Patterns, Turbulence Modification and Heat Transfer in Droplet-laden Flow in a Separated Subsonic Flow"

ZVERKOV, Ilya: "Aerodynamic Performance Improvement of MAV Wings by Streamwise Structuring of Boundary Layer"

WACLAWCZYK, Marta: "Description and Modelling of Turbulence as a Stochastic Field"

KLEMM, David: "Numerical Simulation"

HAGEBÖCK, Stephan: "Search for the Higgs-Boson with ATLAS"

PONIAEV, Sergey: "Blackout Mitigation in a Plasma Layer Near a High-speed Body in ExB Fields"

NIGMATZYANOV, Vladislav: "Simulation of Working Processes in Gas-discharge Chamber of High-frequency Ion Engine"

DESYATNIK, Pavel: "Criterion to Select Optimum Directional Control Sensitivity for Modern Transport Aircraft"

SHIRYAEVA, Anna: "Technology and Code for Numerical Simulation of Different Combustion Types in High-speed Viscous Gas Turbulent Flows"

ANISIMOV, Kirill: "CFD Application for Engine Aerodynamic Design"

OKOROKOVA, Nadezhda: "Hydronic Chemical Current Source as a Controlled Hydrogen Generator for Power Plants Based on Oxygen-hydrogen Fuel Cells"

BATRAKOV, Andrey: "Simulation flow around helicopter layout elements"

17:30	Transfer to Hotel
18:00	Dinner
19:00	Workshop of the German-Russian Forum: "Science Slam" Sandra HOLST, Project Coordination "Science Slam", Berlin

SEPTEMBER 26, THURSDAY

08:45	Transfer to the University
09:30	DAAD – Deutscher Akademischer Austauschdienst / German Academic Exchange Service Dr. Gregor BERGHORN Head of DAAD-Office in Moscow
10:00	Alexander von Humboldt-Foundation Prof. Dr. Andrey MOROZOV Sobolev Institute of Mathematics, RAS, Novosibirsk
10:30	DFG – Deutsche Forschungsgemeinschaft / German Research Foundation "Fostering German-Russian Cooperation" Dr. Jörn ACHTERBERG, DFG-Office Russia/CIS
10:45	"Promoting Research Careers" Dr. Jürgen BREITKOPF Group of Research Careers, DFG Bonn
11:30	Coffee Break
11:45	DFG – Funding Engineering Sciences in Germany Dr. Michael LENTZE Group of Engineering Sciences, DFG Bonn

12:30 **Lunch**

13:30 **Presentation of the German Aerospace Center of the Helmholtz Association**
Future Short and Medium Range Aircraft Configurations
Dipl.-Ing. Jörg FUCHTE
Deutsches Zentrum für Luft- und Raumfahrt (DLR)
– Discussion –

14:30 **Presentation of Novosibirsk State University of Architecture and Civil Engineering (Sibstrin)**
Autodyn & Fluent Solvers for Calculating Blast Pressure Wave Propagation
Dr. Julia ZAKHAROVA
Sibstrin University
Co-Lecturers:
VALGER, Svetlana / DANILOV, Maksim
– Discussion –

15:30 **Coffee Break**

15:45 **Short Lectures of Young Researchers**
Chair:
- Dipl.-Ing. Jörg FUCHTE
  German Aerospace Center
- Dr. Julia ZAKHAROVA
  Sibstrin University

VAFIN, Ruslan: "Improving operational characteristics of gas turbine engines parts by intensifying nitriding in a glow discharge"

RYBIN, Andrey: "Solving different dynamic problems using same mass-stiffness aircraft model"

KHASANOV, Azat: "Electrochemical Dimensional Machining of Nanostructures and Coarse-graines Analogues, Corrosion and Corrosion Protection"

GOTSELYUK, Tatyana: "Computational and experimental analysis of strength of bolted composite joints in airframes"

CIAMPA, Pier: "Design and Optimization of Unconventional Aircraft Configurations in a Distributed Design Environment"

TKACHENKO, Ivan: "«AIST»: a joint project of SSAU and SRC "TsSKB-Progress"

16:30 **Transfer to Hotel**

17:00 **Dinner**

17:45 **Walk to the Theatre**

18:30 **Ballet "Swan Lake"**
Novosibirsk State Theatre of Opera and Ballet

SEPTEMBER 27, FRIDAY

08:45	**Transfer to the University**
09:30	**Early German-Russian Scramjet Technology Development (1993–1995)** Prof. Dr. Rainer WALTHER MTU Aero Engines AG, Munich
10:30	**Using Virtual Reality Methods for Space Simulators** Dr. Stas KUZIKOVSKY Institute of Automation and Electrometry, Novosibirsk, Corporation "SoftLab-NSK"
11:30	**Coffee Break**
11:45	**Short Lectures of Young Researchers (6)** Chair: • Prof. Dr. Rainer WALTHER MTU Aero Engines AG • Dr. Stas KUZIKOVSKY, Institute of Automation and Electrometry SOKOLENKO, Igor: "Development of New Radiation Protective Polymeric Composition Material of Space Type" CHERKASHINA, Natalya: "Effect of Vacuum Ultraviolet to the Thermostatic Properties of Polystyrene Composites" BOBIN, Konstantin / ZHELOBKOV, Vladimir: "The Application Experience of Superplasticity and Creepage Effects for Aircraft Components Production Made of Sheet Metal and Plates" RYNGACH, Nikolay: "Pulse Magnetic Forming" MORZHUKHINA, Alyona: "Heat and Mass Transfer in Space Flight Condition" VAZHDAEV, Konstantin: "Errors of Acoustooptic Displacement Transducers of Information Measuring Systems"
13:00	**Lunch**
14:00	**Planning International Scientific Careers – Best Practice from Freie Universität Berlin** Tobias STÜDEMANN, Head of the Liaison Office of Freie Universität Berlin, Moscow
15:00	**Panel Discussion:** "Prospects for Young Researchers: What can be expected of Research Organizations?" **Invited panelists:** • Young Russian and German Researchers, Representatives of DAAD and DFG **Chairperson:** Tobias STÜDEMANN, Head of the Liaison Office of Freie Universität Berlin, Moscow
16:00	**Closing remarks** Dr. Gregor BERGHORN, Managing Director DWIH Moscow
16:30	**Technical questions** Departure of Participants and transfer to Hotel
18:00	**Dinner**