CISB | CENTRO DE PESQUISA E INOVAÇÃO SUECO-BRASILEIRO

Cooperation Brazil-Sweden In Aeronautics and Defence


PROGRESSO

INTRODUCTION

Aeronautics is a highly strategic area of technology both for Brazil and Sweden. Brazil is one of the four most prominent producers of civil aircraft in the world. Sweden, on the other hand, is a very successful producer of military aircraft as well as a supplier of assemblies for civil aircraft.

Additionally, aeronautics is an industry, which heavily relies on advanced technologies with strong spillover effects extended not only to its core technologies but also to a whole cloud of technology surrounding it, extending far beyond the aeronautical area, e.g., automotive industry, ICT and many others.

The full impact of aeronautical R&D explained by Eliasson (2010)[1] aeronautical R&D represents a very important component in national innovation systems. To take it into a more real perspective, Eliasson uses a “spillover multiplier” to quantify the spillover effect in the Gripen project to at least 2.6, meaning that for every Swedish Crown investment in its development, 2.6 dollars came back to the society.

Given the extensive industrial collaboration between Brazil and Sweden currently initiated in this field, it is also critical to have strong collaboration in key academic research areas together with industry. The ambitions throughout Brazil and Sweden are to acquire capabilities to develop an effective national innovation system together. By fostering research and innovation relations, there is a unique long term opportunity to develop these capabilities through collaboration.

[1] Gunnar Eliasson, Public Procurement as Industrial Policy; SAAB, Stockholm, May 24.2010

FOSTERING THE COOPERATION

The Swedish-Brazilian Research and Innovation Center (CISB) is a private non-profit association that acts as facilitator to promote the dialogue of these very different cultures that can only gain from each other`s values and expertise. CISB main goal is to function as an international hub, offering a fruitful environment to stimulate collaboration. It aims at identifying, fostering and supporting development initiatives for projects that involve advanced technologies, which are able to deliver solutions for a wide range of sectors, thus positively impacting society as a whole.

CISB has launched calls to select proposals for financial support to international missions. These enables researchers to meet potential partners abroad to visit their research groups and allows for discussions and design of joint research projects between Brazil and Sweden within the Aeronautical and Defence sectors. The aim is to integrate industrial and academic partners from both countries in order to create an R,D&I agenda to strengthen relations between the institutions, promote and contribute to the creation of networks that ensure long-term collaboration while promoting innovation in the area of Aeronautics and Defence in Brazil.

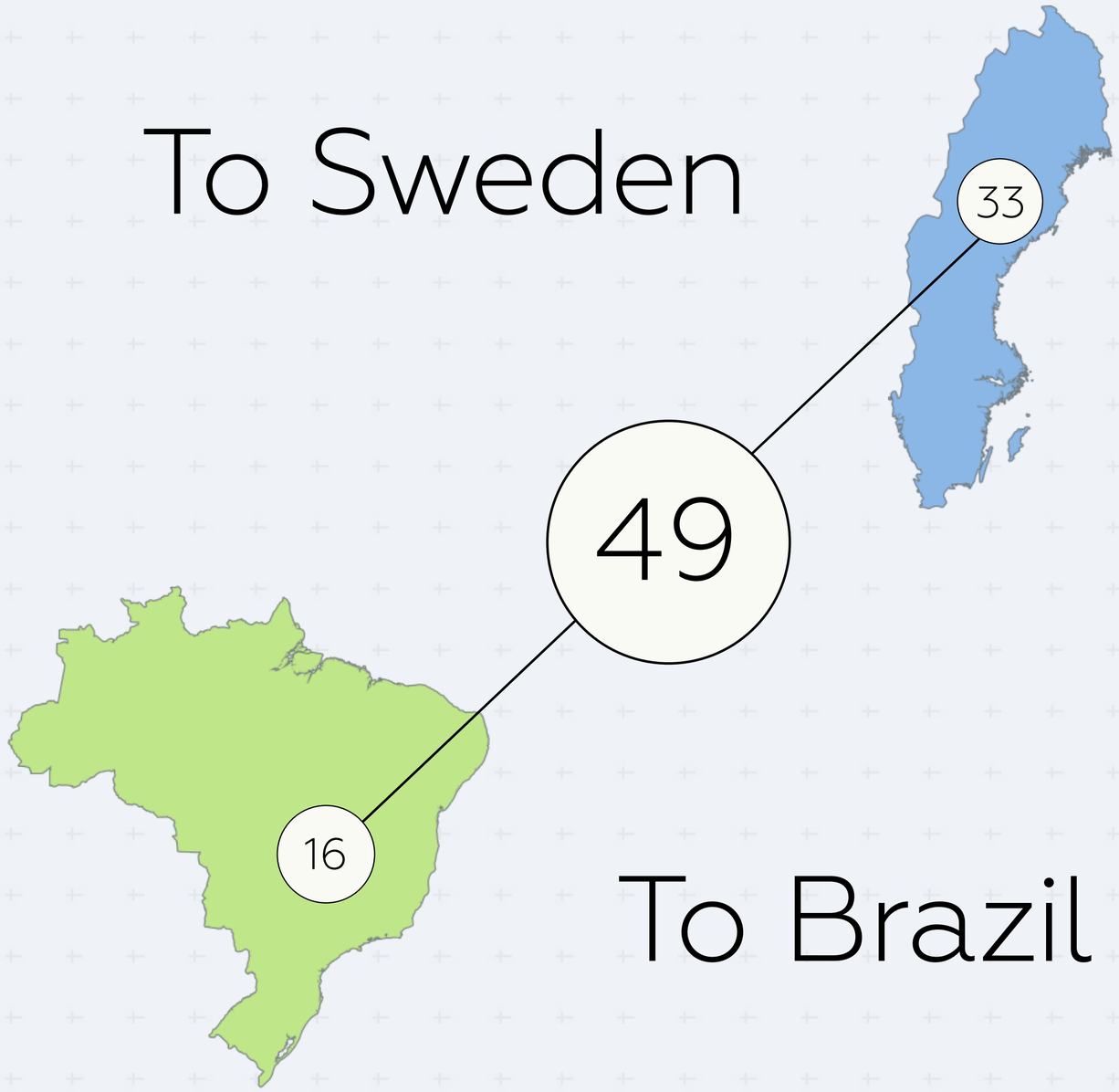
The CISB initiative of launching calls started during the 1st Brazilian Swedish Workshop in Aeronautics and Defence, as the great interaction among participants pointed out the need to encourage and provide the continuity of the discussions of such ideas. The calls represent an innovative format of support since CISB is financing international missions based on the concept of seed money that enable researchers from Brazilian institutions to go to Sweden and researchers from Swedish institutions to come to Brazil.

These initiatives led to the integration of a portfolio currently containing 28 research projects involving 28 institutions as described below.

A Total of 28 Projects in the Portfolio

Number of Projects per Area Related to Brazil Sweden Cooperation in Aeronautics and Defence

Total Number of International Missions



Description of Projects

LIST OF PROJECT PORTFOLIO

*CISB ID XX-YYYY-Z
Project Number in CISB's Portfolio
Year (2012,2013,...)
Area (A for Aeronautics)

CISB ID 25-2014-A

Development of 3D Printing of Metallic Parts for the Aircraft Industry

Abstract: This prospective project aims at generating data about the additive manufacturing technology known as binder-jetting and its range of applications within the aircraft industry. This technology offers several advantages over other additive manufacturing processes for metals, such as surface quality and dimensional accuracy of final parts. Under the scope of requirements usually found in the aircraft industry, a sequence of tests and analysis will be conducted under cooperation between Digital Metal AB and ITA (Instituto Tecnológico de Aeronáutica) in order to yield information about the technology. As the output of this project, it is expected that new opportunities for collaboration will be identified for both the academy and the industry.

Project Area

Materials, Airframe Design/Installation, Structural Tech and Manufacturing

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Partners

DigitalMetal AB

CISB ID 28-2014-A

New Methodologies for Conceptual Design of Aircraft – Supersonic Aerodynamics

Abstract: In summary, the “final phase” of the work done during the term of post-doctoral scholarship in the amount of 6 months can be described as:
1. The integration of OMMPCA program / Brazil with Hopsan / LiU program resulting in SANCA program.
2. Development of a SANCA interaction module with 3D CAD programs.
3. Start of SANCA program tests working with the conceptual design of a military attack aircraft. Calculate the supersonic aerodynamic drag and plots Sears–Haack diagram.
4. Start testing in order to calculate the variation of performance of aircraft by modifying the F-100 engine diameter and therefore the diameter of the aircraft fuselage section.
5. Final presentation of SANCA program for technicians and directors of Saab industry, Brazilian students and researchers participating in the Science without Borders program, fellows of CNPq/CISB during the Meeting Saab in Linköping.

Project Area

Concept Methodology/Design & Operational Integration

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Partners

Saab AB

CISB ID 29-2014-A

Project Area

Management and Integrated Product Development (E.g Lean, PMP)

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Partners

Saab AB
Combitech AB

Creating knowledge from the differences: communicating practical knowledge amongst Brazilian and Swedish professionals in Gripen-technology-transfer

Abstract: The current research project is concerned with how Swedish and Brazilian professionals can fully benefit from each other's practical or experience-based knowledge to enrich and potentiate their creation of knowledge during the Gripen-technology-transfer process. For such, the purpose of the current qualitative research is to deepen and extend the understanding of how Swedish and Brazilian professionals or engineers create knowledge from or make sense of other's practical knowledge and what accounts for differences in such practices. In this sense, the research includes but is not limited to understand Swedish and Brazilian professionals' communication and creation of practical engineering and managerial knowledge, and how each of them and both together engage and attend to their knowing-in-practice differently. The constructed understanding will inform, inspire, ground, facilitate and support the Swedish-Brazilian professionals' participations in knowledge creation, the design of the challenging Swedish-Brazilian knowing/learning from each other's practical/tacit knowledge during the Gripen-technology-transfer process, and an approach to develop intercultural-knowing-skills through a practice-based understanding of differences. Practical contributions will also include an advanced practice-based understanding of Swedish-Brazilian differences in their knowing-practices that can help harnessing such differences as generative forces in the Gripen-technology-transfer process. Theoretical Contributions mainly include the following: (a) a practice-based understanding of differences in work practice or knowing-in-practice of Swedish and Brazilian engineers and professionals, and (b) the extension and deepening of the theory of tacit knowledge creation and communication (tacit knowing or knowing theory), skills acquisition, open/collaborative/interactive innovation, and intercultural collaborative work and knowledge creation.

CISB ID 30-2015-A

EHHAA – Efficient Hydraulic Hybrid Systems for Aeronautical Applications

Abstract: This proposal aims to plan the continuity of ongoing activities linked to the calls CNPq/CISB/SAAB N ° 55/2012 and CNPq/CISB/SAAB N ° 69/2013. Two PhD candidates from Federal University of Santa Catarina – Laboratory of Hydraulic and Pneumatic Systems (LASHIP) are working on the digital hydraulic approach for aircraft hydraulic systems. The obtained results until now are very promising and further development mainly regarding to dynamic modelling and experimental evaluation are necessary to be concluding about the success of the proposed solutions.

Project Area

Aeronautical Engineering and Vehicle Systems incl. Propulsion

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Partners

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CISB ID 31-2015-A

Techniques of security and software engineering for development of aeronautics embedded systems

Abstract: The global aviation system is one of the most complex and integrated systems of information and communications technology (ICT) in the world, and it is a potential target for a large-scale cyber-attack. A diversity of cyber threat actors can interact in different contexts such as Communications, Navigation, and Surveillance (CNS), Air Traffic Management (ATM), Aircraft system design and production, Airline operation, Ground Services and Airport infrastructure. Without the appropriate cybersecurity strategies, policies, and measures defined by the actors involved and in place, the industry is at risk. Therefore, it is imperative that the industry maintain the highest levels of confidence in aviation. The scope of security in aviation is too broad and requires in depth analysis for just one research project. In this sense, this project will focus on the most relevant and urgent research topics to aircraft developer. In this project, we will address security of the aeronautics-embedded systems. The reason is that many of the aeronautics-embedded systems are also safety-critical and require special attention in terms of analysis, design, implementation, and operation.

Project Area

Communication Networks, C2/ATM and Cyber Security

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Partners

EMBRAER
Saab AB

CISB ID 33-2015-A

Simulation of Composites for applications in the aeronautical industry

Abstract: The use of structural composite materials in the design of aircraft structures is increasing as a result of the demand for cost efficient solutions. The use of composite materials can reduce the overall weight of the aircraft and it can also reduce the number of individual parts to be assembled by providing larger, more integrated parts. In this project proposal, we will investigate the possibility of simulating process variations of manufacturing of structural composites followed by geometry assurance using variation simulations. The specific composite and process and assembly simulations are to be coordinated with the industrial partner (Saab AB). As an example, the process simulation may include an infusion process by simulating the free surface resin flow. We may also investigate the curing process and how this affects the resulting structural properties. In all simulations, a focus is to acquire accurate solutions for the final non-nominal geometry.

Project Area

Materials, Airframe Design/Installation, Structural Tech and Manufacturing

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FCC – Fraunhofer Chalmers Centre

Partners

Chalmers University of Technology
Saab AB

CISB ID 34-2015-A

DARTESAT – Dynamic adaptive real-time embedded systems and accelerated test

Abstract: Considering aeronautics current trend towards the second generation of Integrated Modular Avionics (IMA2G) adoption, dynamic adaptive real-time embedded systems with mixed criticality become of fundamental importance. Devising new architecture and system avionics concepts are urgent matters, exploring recent advances on digital systems and aiming to significantly improve the balance between processing power and power consumption.
The main objective of this research project is to develop a new architecture/framework proposal applicable to distributed integrated modular avionics, focusing on processor units reconfiguration, implemented using advanced FPGAs, for example. The proposed architecture aims to implement a fault tolerant system, based on detection and diagnosing of faults, associated to the functionalities of the digital system, involving software and hardware processors, peripherals and network components. This objective is achieved through three main research lines: (i) modeling of adaptivity concepts at a high level of abstraction, the design of the main processing unit using multiprocessor System-on-Chip (MPSoC) boards, exploring FPGAs high reconfiguration capability, targeting run-time reconfiguration, which is triggered when an avionics malfunction is detected and/or prognosticated, and a design space exploration method identifying efficient and fault tolerant implementation of adaptive mixed criticality applications on a run-time reconfigurable platform; (ii) design and implementation of a monitoring system to acquire, analyze and interpret a set of signals generated by the system components, performing the functions of detection, isolation, diagnosis and prognosis of faults or failures; (iii) configure a laboratory setup to test the complete system performance, including accelerated electronic aging based on application of radiation to the prototypes.

Project Area

Concept Methodology/Design & Operational Integration

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Partners

UNICAMP – University of Campinas
Equatorial Sistemas

CISB ID 36-2015-A

ArBaWING – Artificial Bandits and Wigmen

Abstract: ArBaWING will develop technologies and methods that enable the Brazilian and Swedish industries to operate highly capable artificial bandits and wingmen in their air combat simulators.

In the short term, these hi-fidelity pilot behaviors will enable the simulators to be used in:

- Pilot training;
- Simulation based acquisition;
- Tactics development;
- Evaluation of UCAV technology that is still a number of years from being operational.

In the long term, the outcomes of this project can be used to enhance the capabilities of a number of components in a FCAS system of systems, e.g. UCAVs or a swarm of autonomous surveillance drone

Project Area

HMI and Autonomous Systems, Distributed Decision Making

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AEL Sistemas

CISB ID 37-2015-A

Project Area

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Partners

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Saab AB
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Verification of Fault-Tolerant Embedded Systems with Reconfigurable Self-Healing Hardware using a Correct-by-Construction Design Flow

Abstract: Nowadays, highly integrated embedded systems have a wide range of applications in several areas that can be considered as safety-critical, such as medical devices, aircraft flight control, automotive, etc. However, the design process is costly and time-consuming, especially because of verification and validation difficulties. In particular, avionics systems are highly sensitive to failures in software, hardware or guidance sensors and actuators. Since safety is of primary importance to the economic success of the aviation industry, designers must carefully consider efficient fault-tolerant strategies. Real-time fault diagnosis and intelligent fault-tolerant hardware systems are very important to improve the reliability of these systems. Therefore, new design methods and tools are needed to aid developers to ensure the consistency of such complex systems and exploit advanced hardware platforms. The main goal of this project is to use a correct-by-construction design flow in order to perform the design and verification of fault-tolerant embedded systems with reconfigurable self-healing hardware. As specific goals, we propose to use the ForSyDe methodology to deal with adaptive systems and develop virtual prototypes including the environment in which the avionics critical systems operates. In addition, we intend to use FPGAs with dynamic reconfiguration capabilities in order to exploit fault-tolerant techniques.

CISB ID 38-2015-A

Aero Log Lab – Logistics and Maintenance Engineering Cooperation Project

Abstract: For more than 50 years, the Instituto Tecnológico de Aeronáutica – ITA is recognized as reference in terms of Aeronautics and Airspace Engineering in Brazil. However, it is also noticed that some fundamental areas of expertise are not receiving the same level of attention if compared with the ITA's past as well as with some of ITA's competitors. Recently, It was found quite important not to miss the opportunity related to major Defense Programs that the FAB and Industry (Saab and Embraer) will have to manage and support for the next 30-50 years in terms of Logistics and Maintenance Engineering. The Saab Gripen NG Program and the Embraer KC-390 Program both have all their life-cycles ahead and lots of costs involved to supporting them. It is possible that the Brazilian Air Force alone would not be able to properly and comprehensively study the problem and, consequently, there is a huge potential for applied research in the areas of logistics engineering, maintenance engineering and systems engineering, all related to the development of these two Weapon Systems (among others) and their Logistic Support Systems. The proposal is to develop a Laboratory with Systems like the Gripen, the KC 390, and their Logistics Support described and decomposed to the component level in terms of all Reliability, Availability, Maintainability and Safety Factors (RAMS Factors) and cost performance. Everything embedded in one or more appropriate Software Tools to work as a Logistic and Maintenance development rig, platform or model. This laboratory would serve both for the development of practical and applied research on a really big problem for the Brazilian Air Force (FAB), for Embraer and for Saab, but also with potential for the development of vast academic research.

Project Area

Maintenance and Logistic Support

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Partners

ILA – Institute of Aeronautics Logistics
Saab AB
AKAER Aeronautical Engineering Company
Systecon AB

CISB ID 39-2015-A

Correct-by-Construction Design of Embedded Mixed-Criticality Multiprocessor Systems

Project Area

Software Intensive Systems

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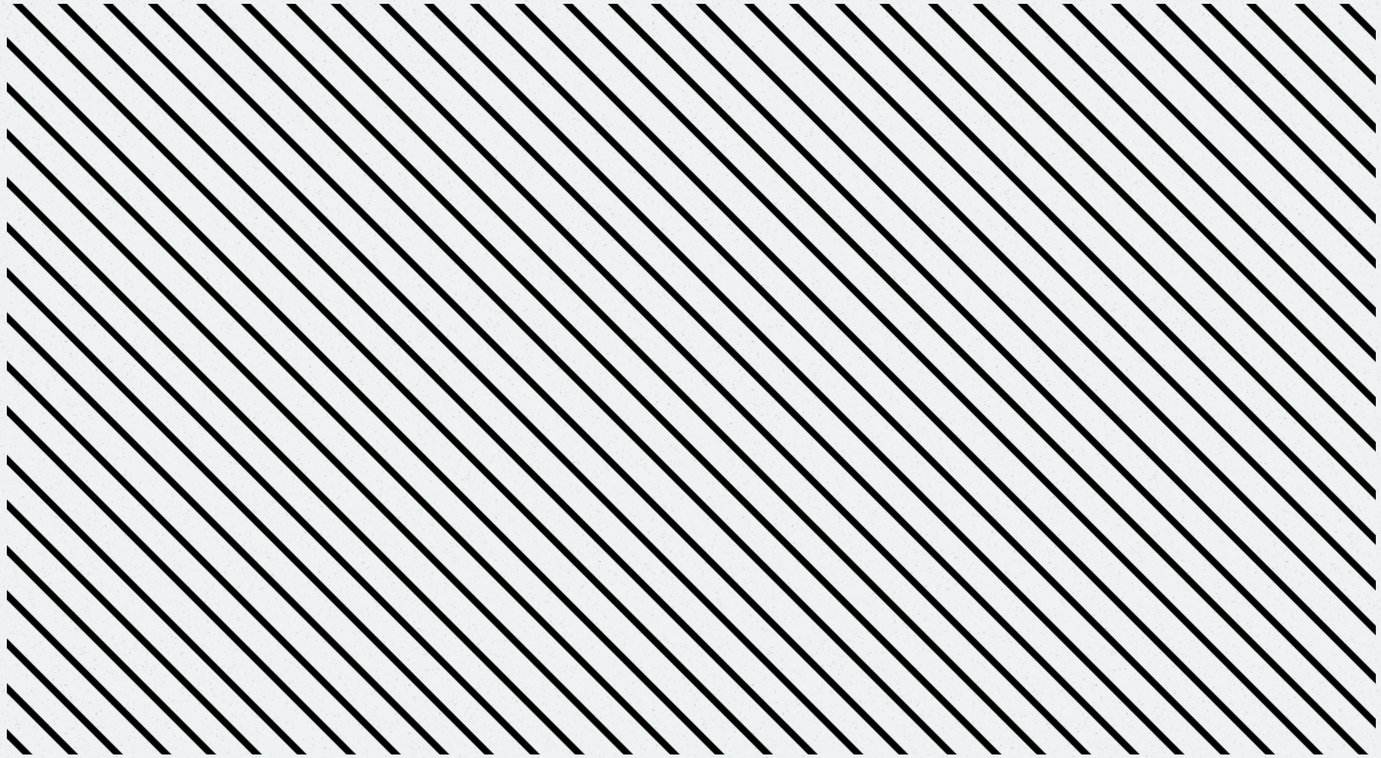
Partners

Saab AB



CISB ID 40-2015-A

Design and Commissioning of a Snake Robot for Aeronautical Manufacturing Operations

Abstract: An experimental 10 degree-of-freedom snake robot has been designed and built at ITA for operating in confined aeronautical spaces such as wings. A number of functions have been already implemented: trajectory planning, FOD, side stick control and off-fine programming. The aim of this project is to design and build a second generation of such a robot that will have 7 degrees of freedom, more robust motors and links to attend other aeronautical manufacturing operations, namely sealing aero parts and installing aero fasteners.

Project Area

Materials, Airframe Design/Installation, Structural Tech and Manufacturing

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Partners

INTELECTRON
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CISB ID 42-2015-A

Hybrid nanostructured composites for enhanced mechanical properties

Project Area

Materials, Airframe Design/Installation, Structural Tech and Manufacturing

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Abstract: The use of nanostructures, such as nanoparticles, to improve different properties of polymeric materials has been an important research subject in recent years. Nanoparticles such as nanoclays, carbon nanotubes or nanosilicas have shown to improve mechanical, thermal and many other physical properties not only in polymeric materials, but in fiber reinforced composites as well. Even though fiber reinforced polymer nanocomposites are materials with great mechanical properties for most applications, they still have some drawbacks, such as not so high impact strength, risk of delamination, among others. Different strategies have been used for improving the impact strength of laminated composites, such as blending with rubber particles or decreasing interfacial adhesion for improved fiber pullout mechanism. Another possibility is using nanoparticles, which in certain situations can improve the toughness of the matrix, as well as other mechanical properties, such as elastic modulus or mechanical strength. However there are still some challenges to overcome, such as the need to improve the dispersion and control the orientation of the nanoparticles in the nanoscale. One possibility is to prepare hybrid composites containing multiple nanoparticles, with structures and shapes that, when combined, can promote synergistic effects not available when using a single nanoparticle type. This strategy can be further improved by applying external fields, such as electrical or magnetic, to make the particles align in one, two or even three desired directions, in combination to 3D fiber reinforced composites. Very recent preliminary studies from my group on epoxy nanocomposites have shown that the combination of different nanoparticles shows improved properties over single nanoparticle counterparts. Therefore these studies can be further developed by including the effects of the addition of multiple nanoparticles to 1-, 2- or 3-dimensional fiber reinforced composites, in order to improve properties such as mechanical strength and toughness. Focusing on these ideas, this project proposes to study the effect of mixed nanoparticles on the mechanical properties of fiber reinforced laminated composites.

CISB ID 43-2015-A

Supersonic Aerodynamics for Aircraft Conceptual Design – Development of Computational Tools

Abstract: This project aims to add a high fidelity tool, that calculates supersonic aerodynamic coefficients, on SANCA program that was developed earlier by Prof. Alvaro Abdalla (EESC-USP) in your Post-Doctoral work at the Linköping University / Sweden. The
tool should establish current and new methodologies that predict aerodynamic coefficients at supersonic conditions. For new methodologies wind tunnel and CFD data will be referenced to validate the method. The tool will be developed by coordinated activates among Linköping University (LiU), School of Engineering of São Carlos (EESC-USP), Technological Institute of Aeronautics (ITA), SAAB and EMBRAER.

Project Area

Concept Methodology/Design & Operational Integration

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Partners

USP – EESC – University of São Paulo
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EMBRAER

CISB ID 44-2015-A

System safety and reliability in the conceptual design phase

Abstract: System safety and reliability have huge impact on design and operation of complex products, such as for example as an aircraft. To better understand how these issues should be addressed in the early stages of development would help optimize both the performance of the system, but also the life cycle cost including operations and maintenance costs. Despite the fact that a lot of research is being conducted within the system safety and reliability domains many challenges still exist. Much focus is on techniques and methodologies applied in different areas (like e.g. nuclear, aviation, hydroelectric power plants, new technologies etc.) but there is little work done on how these methods should be applied in early design stages, or how reliability data could be applied in order to optimize the system from an operations and maintenance perspective, e.g. optimal design for maintainability. Reliability, maintainability and safety are factors that impact the economy and usability during the entire lifecycle. The design phase is the stage at which the characteristics of future systems and products are determined; therefore it is important that designers should take safety, reliability and maintainability into account during the early design work. These are topics addressed in the proposed project. Furthermore, a general objective is to promote long-term collaboration between the partners and specifically to formulate a joint innovative application for further research.

Project Area

Concept Methodology/Design & Operational Integration

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Partners

LTU – Luleå University of Technology
Saab AB

CISB ID 45-2015-A

LaFloDeS – Laminar flow design and surface quality requirements

Abstract: As a large part of the drag of an aircraft (40%) is related to skin friction, decreasing that will have significant effects towards reduction of fuel consumptions, pollution and direct operational costs. One of the viable solutions to achieve lower friction drag is to increase the portion of lifting surfaces and nacelles with laminar flow. This is a relevant issue for the transport aircraft as well as for long-endurance unmanned vehicles. Manufacturing of wings and nacelles with NLF design requires more stringent control of machined and joint tolerances, i.e. surface irregularities such as steps, gaps, surface waviness and surface finish. The present lack of knowledge on acceptable tolerances for NLF finishing standards results in tolerance specifications being over-prescribed at the design stage. This may introduce difficulties during manufacturing, incur additional more expensive machining/manufacturing tools and certainly adds unwanted overheads, for example maintaining the designer specified surface quality during the life-time operation of the surface. Due to increase restriction on fuel consumption, capability of design and manufacturing of NLF wings can strengthen position of an aircraft industry. The project will contribute to improved understanding of requirements for surface irregularity for aircraft with natural laminar flow (NLF). The project will deliver upstream research that will improve the technology base for future innovative concepts and breakthrough technologies that will lead to possibilities for implementation of natural laminar flow technology in the next generation of civil aircrafts. The problem is approached through combined numerical and theoretical efforts. A wide range of numerical tools with different degree of complexity will be used to investigate different flow cases. This includes Direct Numerical Simulations (DNS), Linearized Navier–Stokes computations, global stability analysis.

Project Area

Aeronautical Engineering and Vehicle Systems incl. Propulsion

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Partners

Saab AB

CISB ID 47-2015-A

Project Area

Concept Methodology/Design & Operational Integration

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Leader's Institutions

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Partners

USP – EESC – University of São Paulo
UFSC – Federal University of Santa Catarina
EMBRAER

FADEMO – Future Combat Aircraft Design Study and Demonstration

Abstract: The objective of this project is the development of a scaled fighter that will serve to test different technologies for future combat aircraft design. This project will serve to bring different groups together to contribute with different subprojects. It will provide an opportunity to further develop subscale prototyping and flight test capability. The activities will be focused in preparation and instrumentation of an existing demonstrator (Generic Future Fighter, GFF at LiU) for a subscale flight test mission including the evaluation os a different sort of technologies and aeronautical design concepts. The result shall lead to the definition of a larger project that would continue to the end of 2016, the GFF2, considering additionally: (i) aeroelastic and dynamic scaling; (ii) prototype with variable (relaxed) static margin; (iii) SAS implementation to fly in a relaxed stability configuration; (iv) model identification on the basis of flight test data.

CISB ID 48-2015-A

Project Area

Materials, Airframe Design/Installation, Structural Tech and Manufacturing

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Partners

IPT – LEL – Technological Research Institute
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Composite material 3D woven fabric for reinforcement of mechanical joints and other stress concentrations

Abstract: The objective of the project is to investigate the use of epoxy reinforced with a 3D woven carbon fabric for doublers in (a) mechanical joints and (b) stress concentrators such as openings, lugs etc. The design of these types of structural components is driven by strength. On the other hand, typically, the design of aeronautical structures is driven by stiffness requirements (buckling, natural frequencies, etc.). The main idea of this project is to make the stiffness and strength requirements compatible by locally using 3D fabrics that are not prone to delamination. Better design of these components avoids overdesigning leading to reduction of weight and cost.

CISB ID 51-2015-A

Robustness Analysis in the Frequency Domain of Mechatronic Systems using Efficient Algorithms

Abstract: the classical tool to solve the robustness analysis problem of uncertain electrical or mechanical systems is the Monte Carlo method. It is rather simple to implement and it can deal with linear or nonlinear models, in the time or frequency domain. Usually, this method is used as a comparison to any new robustness analysis methodology. The Monte Carlo method, however, requires thousands of simulations in order to compute, for instance, the worst-case response of a system. Other approaches such as the Unscented Transform, Collocation Methods, Polynomial Chaos and Genetic Algorithms have been proposed to accelerate the assessment of the system robustness. However, most of them are inefficient when the system model contains several uncertain parameters, since their computational complexity is exponential relative to the number of parameters. the participants of the project expect to propose, implement and test an efficient methodology (i.e.: polynomial computational complexity) for the robustness analysis of systems that can be modelled by lumped electrical and mechanical elements. One journal article and one conference are expected as a result of this project.

Project Area

Overall design and systems integration

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LiU – Linköping University

Partners

EMBRAER

CISB ID 52-2015-A

Frequency Response Analysis of the Robotic Platform of SIVOR Project

Abstract: The project aims to make an analysis of the frequency response of the robotic platform of SIVOR project (SImulador de Voo com plataforma Robótica de movimento or Flight Simulator with Robotic Motion Platform), using identification of dynamic robot models, with collaboration of Division of Automatic Control from Department of Electrical Engineering of Linköping University. The SIVOR project uses an industrial robot with linear unit to simulate the movements of a commercial aircraft and, thus, requires a detailed knowledge of the kinematics and dynamics of robot and its end-effector in order to be a reference to other simulators or similar designs.

Project Area

Software Intensive Systems

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Partners

EMBRAER

CISB ID 53-2015-A

Statistical Sensor Fusion for Application in Aeronautics and Defence

Abstract: The present text proposes a mission for discussing about sensor fusion for aeronautics and defence applications and elaborating a long-term collaboration project in this subject. The institutions involved in this proposal are the Aeronautics Institute of Technology (ITA), Linköping University (LiU), Embraer, and Saab. The mission will be a visit of two professors from ITA to the Automatic Control Division of LiU. The mission aims at discussing and structuring a collaborative research project on sensor fusion for aeronautics and defence applications, involving the ITA, LiU, Embraer, and Saab and aA graduate course on sensor fusion for aeronautics and defence applications, to be offered at ITA with the collaboration of professors/researchers from LiU.

Project Area

Sensors - Systems and Functions

PoC Brazil

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Leader's Institutions

ITA - Aeronautics Institute of Technology
LiU – Linköping University

Partners

Saab
EMBRAER

CISB ID 54-2015-A

Data-driven fault diagnosis via causality detection methods

Abstract: The project aims to improve and develop data-driven causality detection techniques for the diagnosis of complex industrial systems, composed of coupled subsystems. among the data-driven techniques for diagnosis, the analysis via multivariate statistical methods such as the principal components method has been noted for its success in applications to detect failures in equipment and in industrial plants [1]-[2]. In the context of principal component analysis, the contribution plots allow one to group the variables that contributed to the failure. This procedure generates a group of candidates, but not the cause of the failure. In addition, the method can include in the group, variables that are correlated with failure, although they have not contributed to it [3]. Alternatives based on a classification approach have found success in many applications, such as [4], but they are often limited to the availability of labeled data used for training as in supervised learning. In a labeled dataset, the fault status and its origin is known a priori and used to train the diagnosis algorithm. Availability of labeled data is often difficult in industrial applications, particularly for the faulty cases, which are scarce.

Project Area

Software Intensive Systems

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Leader's Institutions

UFES – Federal University of Espirito Santo
LiU – Linköping University

Partners

Saab
Petrobras

CISB ID 62-2015-A

HUMAER – Design and commission a human factors laboratory for aeronautics

Abstract: The current aviation system is considered to be a safe industry as safety records have been constantly improving over the last decades. With the increase of the worldwide fleet and consequential increase in annual departures, it is necessary to further increase the levels of safety, otherwise the absolute number of accidents (and consequently the number of fatalities) might increase. Based upon this scenario, it is a must to find out new ways for improving aviation safety standards. According to a research carried out by the Flight Safety Foundation (1998), approximately 80% of the aeronautical accidents have human factors as the source cause. This figure turns the studies about human factors aspects in the design, operation and maintenance of aircrafts into a strategic matter for reducing the aviation accident rates. Thereby the design and commission of a human factors laboratory of aeronautics (HumAer) at ITA aims at supporting the industrial and academic community to fulfill the demand identified above and providing and ideal environment to identify and model the human behavior in simulated operations. The results acquired will be translated into well elaborated requirements for the design of aeronautical products and processes which might raise the safety standards, following the global tendency.

Project Area

HMI and Autonomous Systems, Distributed Decision Making

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Leader's Institutions

ITA – Aeronautics Institute of Technology
LiU – Linköping University

Partners

Saab

CISB ID 64-2015-A

Robust navigation and mapping without GNSS

Project Area

HMI and Autonomous Systems, Distributed Decision Making

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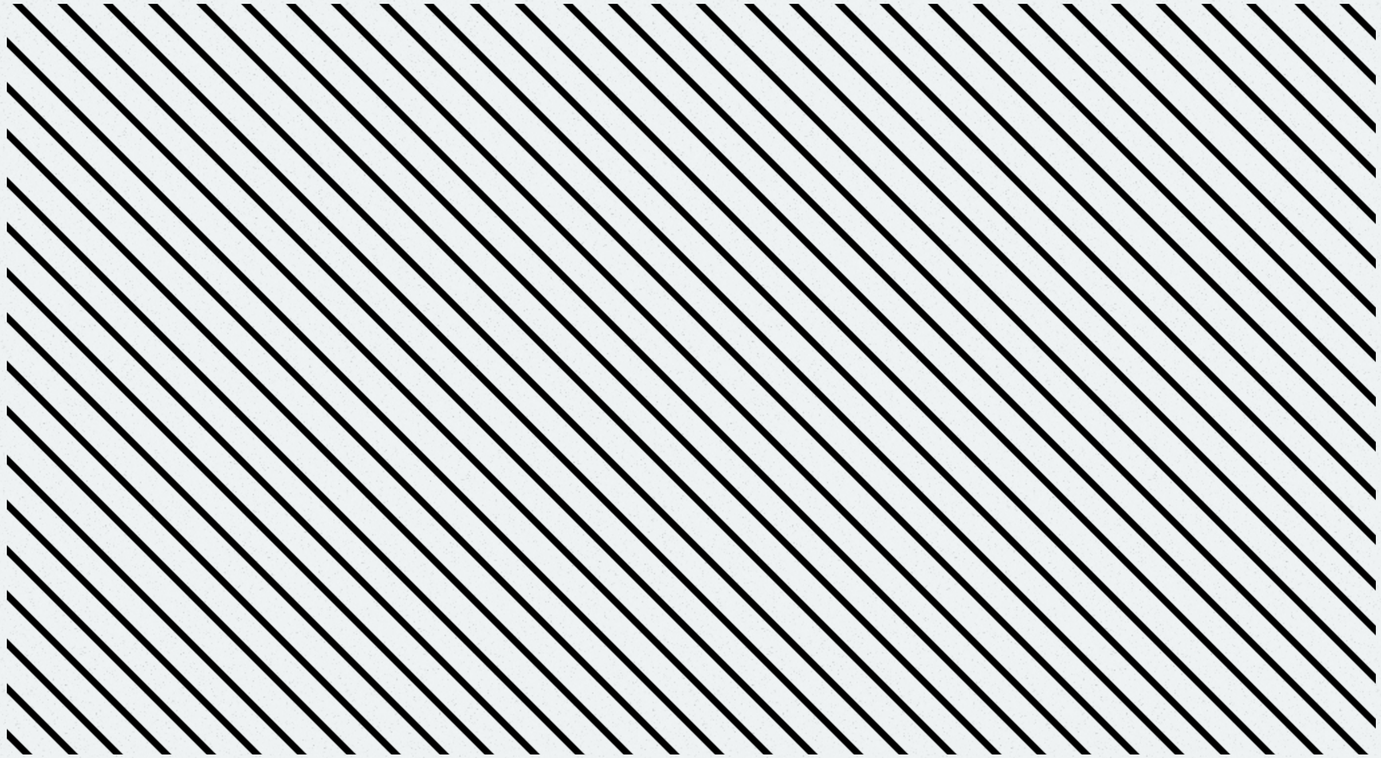
Leader's Institutions

ITA – Aeronautics Institute of Technology
LiU – Linkoping University

Partners

Saab
IEAv – Advanced Studies Institute
Embraer
National Institute of Space Research (INPE)



CISB ID 65-2015-A

IFRAM (Open Rotor)

Project Area

Aeronautical Engineering and Vehicle Systems incl. Propulsion

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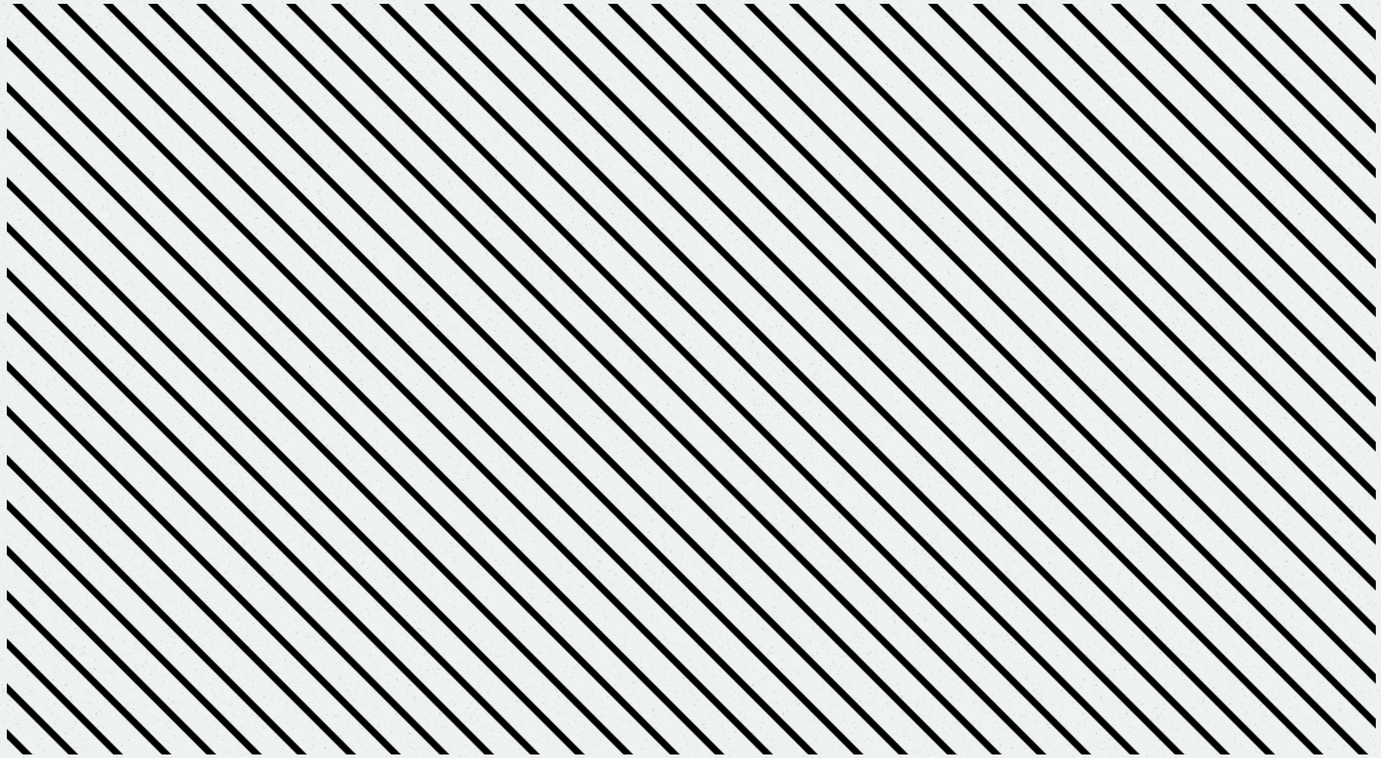
Leader's Institutions

Chalmers University of Technology

Partners

ITA – Aeronautics Institute of Technology
Embraer



CISB ID 66-2015-A

Project Area

Aeronautical Engineering and Vehicle Systems incl. Propulsion

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Leader's Institutions

UFSC – Federal University of Santa Catarina
KTH – Royal Institute of Technology

Partners

LiU – Linköping University
EMBRAER
USP – EESC – University of São Paulo

Modeling and prediction of sound reducing treatments (liners) and development of techniques for jet noise reduction

Abstract: Large efforts are being directed towards improving the noisy environment in the vicinity of airports. The main objective of the project is to contribute to more quiet aircraft jet engines and thereby to a better environment around airports. This will be done by further developing methods for modeling and prediction of sound reducing treatments, so called liners and development of techniques for jet noise reduction. The project aims at initiating long term cooperation between the research groups in sound and vibration at UFSC and KTH. The two research groups who are already active in this field of research will collaborate on the joint research project. Synergy effects are expected by combining the experience and competence of the two research groups. This cooperation will be started by an exchange program for senior researchers, postdocs, PhD students and Master students. The senior researcher will also participate in teaching courses during their visits at the partner location. Apart from the fact that noise is an important environmental issue in itself, development in these areas is also driven by other environmental consideration such as CO2 emission reduction, leading to the need for downsizing and optimization of the noise control designs.

CISB ID 67-2015-A

Project Area

Materials, Airframe Design/Installation, Structural Tech and Manufacturing

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Leader's Institutions

ITA – Aeronautics Institute of Technology
KTH - Royal Institute of Technology

Partners

AKAER Aeronautical Engineering Company
Saab

Prediction of post-cure Residual Stresses and Distortions in the Fabrication of Composite Structures

Abstract: Distortions and residual stresses are inherently present in advanced composite structures that undergo curing cycles at elevated temperature. These are undesirable effects of the fabrication processes since distortions deviate the structure from the nominal geometry, what can compromise aerodynamic performance or make impossible assemblage of structural components. Residual stresses are the driving mechanisms to induced distortions but, additionally, they may significantly and adversely reduce the strength of composite structures. In this project a model intended to predict the levels of distortions and residual stresses shall be developed and embedded in an in-house FE code. The model shall take into account thermal, chemical and frozen-in strains that develop during curing cycles. The adequacy of the model shall be checked to determine whether it can successfully be applied in modern fabrications processes such as AFP and ATL.

CISB ID 68-2015-A

MARTES – Models of Computation (MoC) supporting Adaptivity in Real Time Embedded Systems

Abstract: Modern FPGAs are capable to delivery significant computational power, including hardware and software multiprocessors, memories, and hardware multipliers, which can be combined to implement complex system design solutions, especially if it demands reconfigurability. More important, this reconfigurability may be fast enough to be used online, which makes FPGA-based systems a very interesting component for future avionics systems. Therefore, the main objective of this research project is to develop a new framework proposal applicable to real time embedded critical systems, focusing on reconfiguration, implemented using advanced FPGAs. This could be achieved by modeling of adaptivity concepts at a high level of abstraction. This research project proposal is part of the Dynamic Adaptive Real-Time Embedded Systems and Accelerated Test – DARTESAT project which was extensively discussed in Sweden with KTH, Saab and LiU. DARTESAT was approved and supported by the Call of Innovation Projects CISB 01/2014. It was also presented in the 1st and 2nd Brazilian Swedish Workshop in Aeronautics and Defence.

Project Area

Concept Methodology/Design & Operational Integration

PoC Brazil

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Leader's Institutions

UNICAMP – University of Campinas
KTH - Royal Institute of Technology

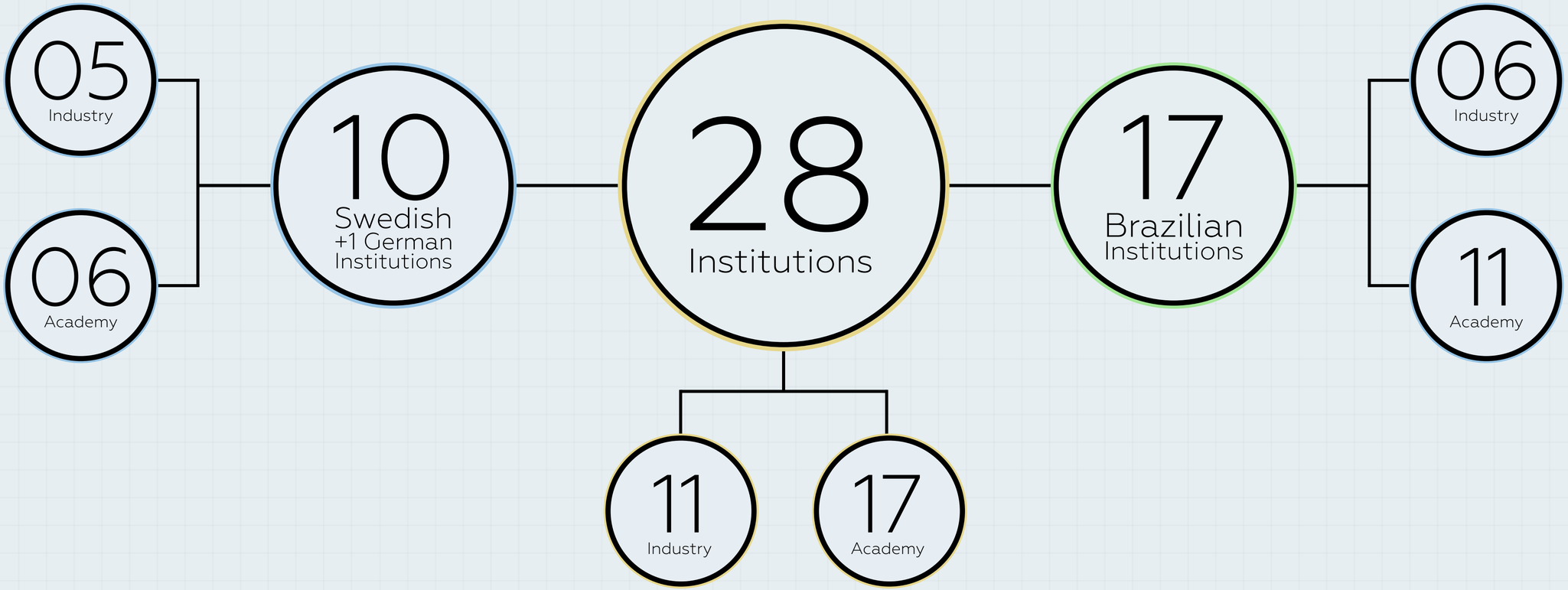
Partners

ITA - Aeronautics Institute of Technology
Saab

Institutions Involved in the Project Portfolio

Institutions	Triple Helix	Country	Projects Involved
Saab AB	Industry	Sweden	19
ITA - Aeronautics Institute of Technology	University/Institute	Brazil	15
LiU - Linköping University	University/Institute	Sweden	14
KTH - Royal Institute of Technology	University/Institute	Sweden	9
EMBRAER	Industry	Brazil	8
USP - SC - University of São Paulo	University/Institute	Brazil	6
UFSC - Federal University of Santa Catarina	University/Institute	Brazil	5
AKAER Aeronautical Engineering Company	Industry	Brazil	3
Chalmers University of Technology	University/Institute	Sweden	3
LTU - Luleå University of Technology	University/Institute	Sweden	3
Unicamp – University of Campinas	University/Institute	Brazil	2
UFABC – University Federal of ABC	University/Institute	Brazil	1
IPT - LEL - Technological Research Institute	University/Institute	Brazil	1
FCC - Fraunhofer Chalmers Centre	University/Institute	Sweden	1
Equatorial Sistemas	Industry	Brazil	1
AEL Sistemas	Industry	Brazil	1
UnB - University of Brasilia	University/Institute	Brazil	1
DFChip	Industry	Brazil	1
Ruhr-Universität Bochum	University/Institute	Germany	1
ILA - Institute of Aeronautics Logistics	University/Institute	Brazil	1
Systecon AB	Industry	Sweden	1
UFRGS - Federal University of Rio Grande do Sul	University/Institute	Brazil	1
INTELECTRON	Industry	Brazil	1
DigitalMetal AB	Industry	Sweden	1
Biteam AB	Industry	Sweden	1
Mackenzie Presbyterian University	University/Institute	Brazil	1
Combitech AB	Industry	Sweden	1
UFES – Federal University of Espirito Santo	University/Institute	Brazil	1

OVERVIEW OF INSTITUTIONS



PARTNERS INSTITUTIONS INVOLVED IN THE COOPERATION

CISB | CENTRO DE PESQUISA E INOVAÇÃO SUECO-BRASILEIRO

The Swedish-Brazilian Research and Innovation Centre (CISB), acts as an open innovation arena, that aims to attract innovative ideas and projects; create a neutral environment that fosters collaboration; connect actors from the industry, academy and government both in Sweden and in Brazil; integrate different areas of knowledge ; give life to both multidisciplinarity and interdisciplinarity in projects and spread knowledge.

More information: www.cisb.org.br

INNOVAIR STRATEGIC INNOVATION PROGRAMME AERONAUTICS

INNOVAIR is Sweden's national strategic innovation program for aeronautics. The aim is to coordinate and support stakeholders from industry, universities, institutes, associations and government agencies active in the aerospace sector. The main objective is to promote favorable conditions for a strong aerospace industry in Sweden and to strengthen the aerospace sector through increased collaboration, research and demonstrator programs.

More information: http://innovair.org/en

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