



May - June 2008

## ■ About INCAS



**INCAS** (National Institute for Aerospace Research) is the leading research establishment in aeronautics in Romania, with more than 50 years of experience in aerospace design, experimental aerodynamics and numerical methods for applied flow physics.

INCAS is the leading design authority for all major Romanian projects in aeronautics developed national level (e.g. IAR-93, IAR-99, IAR-705) and international developments, making usage of an important experimental platform (wind tunnels), acting in an integrated environment with partners from academia and industry.

As research establishment, INCAS mission is to offer dedicated R&D services to aerospace community: our offering ranges from basic research in flow physics, outsourcing of advanced engineering activities up to long-term R&D partnership for new concepts in aeronautics.

## ■ INCAS expertise in aeronautics

- Main design authority and system integrator
- Aerodynamic design
- Experimental wind tunnel validation
- Global performance analysis
- Structural design and analysis
- New materials and technologies in aeronautics.

## ■ INCAS at ILA Berlin 2008

### ■ EREA Stand : Hall 9 booth 9340

INCAS will be present at ILA Berlin 2008 as an associated member to **EREA** (Association of **E**uropean **R**esearch **E**stablishments in **A**eronautics). **Please attend the presentations and conferences of EREA members, from Tuesday 27 May to Friday 30 May.**

## ■ INCAS at Farnborough Air Show 2008

### ■ ROMANIA Stand : Stand H3 location B31

INCAS will participate at Farnborough Air Show 2008 together with traditional partners in aeronautical industry in Romanian.

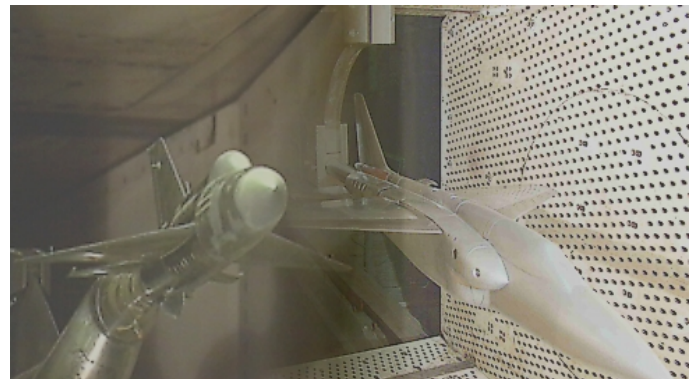
**Please visit us at Romania stand, H3/B31, where our representative will present our last technical developments within our different R&T departments.**

## ■ INCAS research infrastructure

The National Institute of Aerospace Research "ELIE CARAFOLI" is the only company in Romania with dedicated research infrastructure for basic research in applied aerodynamics and associated technologies.

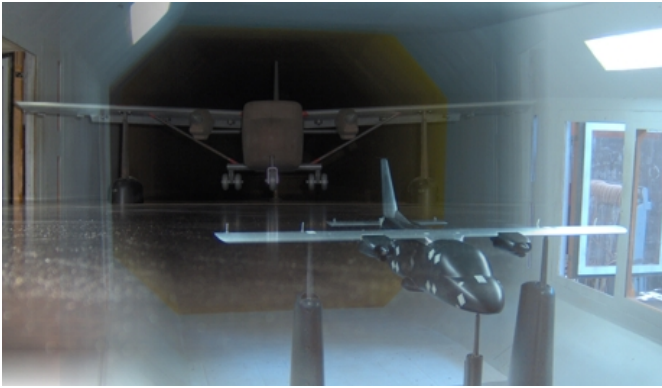
### ■ INCAS Supersonic Wind Tunnel

The supersonic wind tunnel at INCAS is a blowdown wind tunnel with a 1.2m x 1.2m test section, capable of a Mach range numbers from as low as 0.1 up to Mach 3.5, with a unity Reynolds number up to 100 millions.



This facility has an interchangeable porous transonic test section with variable porosity from 0.01% up to 9% and 780 mm schlieren windows. State of the art data acquisition system and new investigation capabilities (CTS system and PIV) are under constant development. In this facility several important Romanian aeronautical projects have been performed, from military IAR-93 combat and IAR-99 trainer, air-to-air missiles and UAV systems, to civil aviation programs IAR-705 and ROMBAC (BAC 1-11).

■ **INCAS Subsonic Wind Tunnel**



INCAS subsonic wind tunnel is a traditional atmospheric pressure continuous type facility with a maximum speed of 110 m/s and usual Reynolds number up to 1.5 million. This traditional type facility is very well equipped with a

T.E.M. 6 component pyramidal type balance, state of the art data acquisition systems and laser visualization systems. It is the ideal facility for all major projects in aeronautics, from basic tests for configuration assessment (take-off and landing) to the validation of high lift low noise concepts in greening the air transport of the future.

■ **Materials and Tribology Laboratory**

The main activities are related to the creation of the advanced materials, multilayer, obtained by high technologies with application in



aeronautic industry. In the last years, the lab has developed a quick thermal shock installation, with unique capabilities for quick thermal shock testing according with functional thermal condition. The QTS2 quick thermal shock installation was designed by INCAS, with testing temperature of 1500°C, specimen heating/cooling speed – max 100°C/sec. The lab is also involved in thermomechanical and tribological characterization of two advanced materials: C-C composites mesophasic matrix with nanotubes fillers and fibre/metal type ARALL and GLARE.

■ **Systems Analysis Laboratory**



Research activities within the laboratory deal with theoretical and applied aspects in the field of

analysis, synthesis, and qualification testing and flight clearance for aircraft and helicopters hydraulic servomechanisms. The laboratory is directly involved in all Romanian aviation projects, including IAR93 and IAR99 military jets, Puma and Allouette helicopters and Romanian flight simulators projects.

Recent research areas concern analysis and synthesis of active, pseudoactive and semiactive control systems, antiwindup and antichattering control synthesis, mechatronic electrohydraulic systems, neural networks adaptive control, applied control synthesis. Smart structures and electrohydraulic servoactuators analysis, stability and synthesis - a postmodern topic and, respectively, a classical topic - cover a significant part of the laboratory scientific interest and competitiveness.

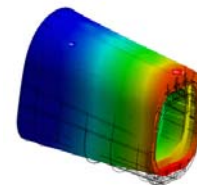
■ **Major National Projects**

■ **INCAS is leading AeroTAXI project**



AeroTAXI is a project for a 12 pax subcommuter scale twin engine aircraft (CS-23) as main vector for a next generation of air transportation system at regional scale. This project, founded by national R&D program, is a cooperation with Romanian major establishments INAv, AVIOANE Craiova and University Politehnica Bucharest and is now in the phase of delivering a specimen for fatigue test.

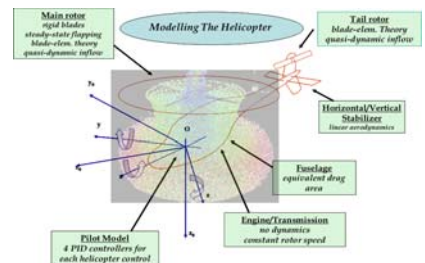
■ **Advanced techniques for structural analysis**



INCAS, as main design authority for IAR-99 Soim Romanian trainer is continuing the

development of advanced tools for structural analysis using parametric geometrical modeling. This project is a partnership INAS Craiova addressing advanced CAD/FEM and CAM techniques applicable to military products under INCAS design authority

■ **Dynamics and control for helicopters in maritime environment**



This is a multibody dynamics type modeling relative to noninertial frames with unsteady modeling for strong coupling phenomena. It deals with the simulation environment for heliship evolutions and associated control schemes for special problems of flight



## ■ Participation to the JTI “Clean Sky”



Following the process of selection of

Associate Partners to the JTI “Clean Sky”, INCAS Consortium (**INCAS**, **STRAERO**, **AVIOANE Craiova** and **ROMAERO Bucharest**) are in the negotiation phases for the following platforms:

- **SFWA** – Smart Fixed Wing Aircraft
- **GRA** – Green Regional Aircraft (in cooperation in a CIRA lead consortium)

This participation to the JTI is highly supported by Romanian authorities and is considered as a major step towards integrating R&D and industrial capabilities at EU level in aeronautics

## ■ Participation in EU projects



INCAS participation in EU projects started in FP5 with relative limited involvement. From FP6, INCAS

has increased his international visibility and currently is involved in several STREPs and one IP as follows:

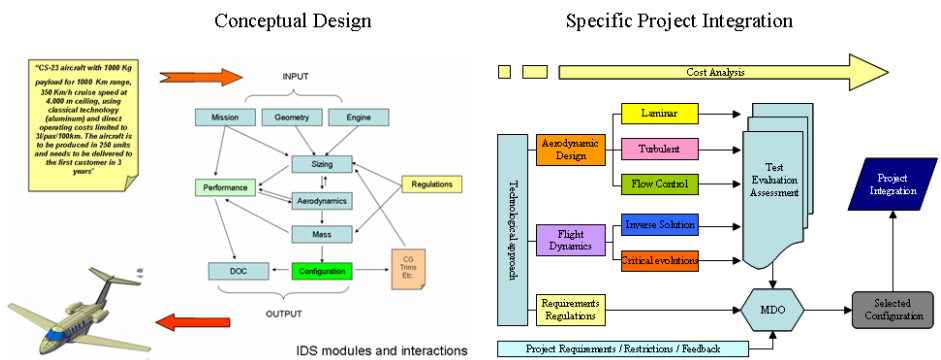
- **CESAR** - Cost Effective Small Aircraft, IP
- **UFASST** - Unsteady Effects in Shock Wave Induced Separation, STREP
- **AVERT** - Aerodynamic Validation of Emission Reducing Technologies, STREP

At the same time, INCAS is participating to several important support actions in FP7:

- **AeroPortal** (AeroSME & SCRATCH projects)
- **CEARES** (SSA - CA project in FP7)

INCAS is also participating in other activities supported by EU instruments. We are **SCRATCH** members and active participants to **AirTN** and **ERA-NET**, together with ROSA – Romanian Space Agency.

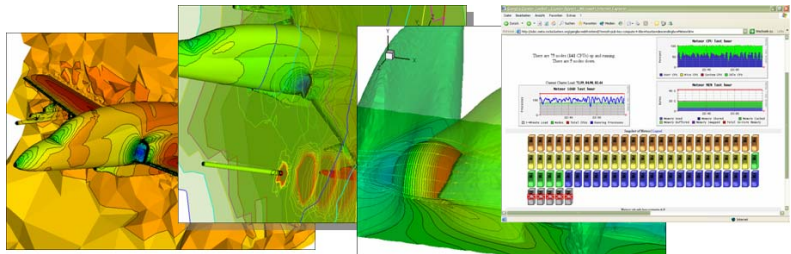
## ■ INCAS Conceptual Design Capabilities



As system integrator, INCAS has been very interested to preserve unique capabilities for conceptual design for complex aeronautical products. This activity was considered as an integration phase with traditional industrial partners and the main beneficiary for new developments. Current capabilities enable INCAS to achieve important efficiency in MDO and to address complex projects for aeronautical industry.

## ■ INCAS High Performance Computing Capabilities

INCAS has developed through the years a broad range of in-house codes for major



applications in flow physics, structural analysis and dynamics of systems. Current state of the art tools and methods have been integrated in a global virtual simulation environment, based on emerging Grid technology, taking advantage of heterogeneous delocated resources. At the same time INCAS has been active in cluster computing and extensions towards affordable HPC architectures. Current capabilities in CFD and CAA enable INCAS to perform complex simulations for most complex phenomena in aeronautics.

## ■ CNTAR – SATS in Romania

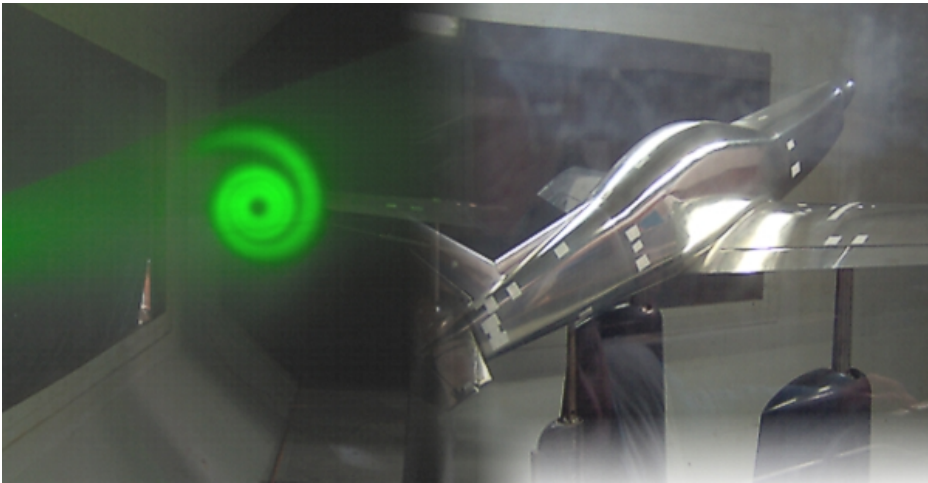


SATS in Romania

INCAS has initiated in Romania a SATS project, taking into account specific interactions in the region. This project is based on a new concept for a regional transportation system, where a new generation of CS-23 aircrafts is used on a ground infrastructure

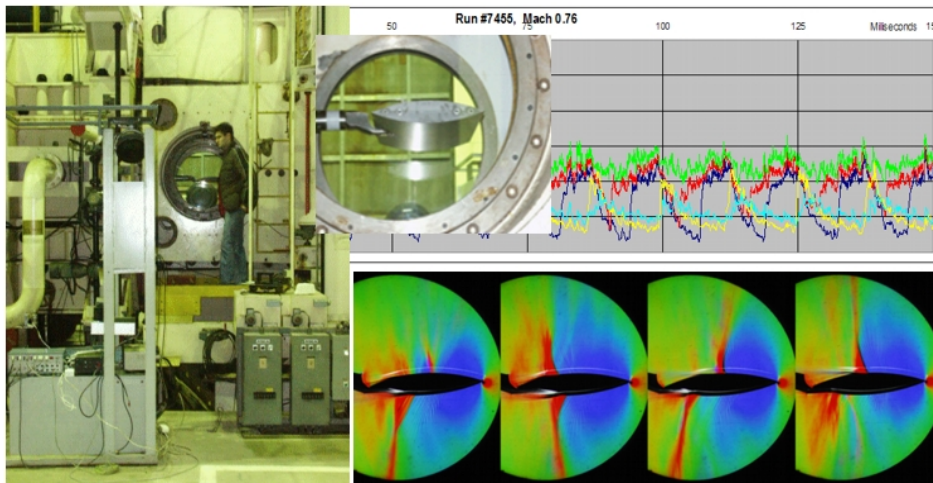
that is under used or can be organized with maximum efficiency. The AeroTAXI subcommuter scale aircraft (12 pax.) under development at INCAS is the target vector for the system. Pilot studies and exploitation tests for a door-to-door transportation system have already been performed in a national project, where partners from Romanian Aeroclub and industry have provided necessary support. The project is intended as a major initiative for a regional development plan based on existing needs for mobility in the region.

## ■ New Laser Visualization System at INCAS Subsonic Wind Tunnel



This work is aimed at enhancing visualization capabilities in INCAS Subsonic Wind Tunnel using laser and optoelectronic technology for noninvasive flowfield analysis adapted for large scale environmental facilities. The focus is on visualization techniques to be used for wind flow characterization at different altitudes both for aeronautical applications (aircraft models) and civil buildings areas (for pedestrian comfort analysis) using a light sheet generated by a Nd:YAG cw pumped and doubled laser at 532 nm wavelength. These results are important for basic flow physics phenomena analysis as well as for future quantitative measurements.

## ■ Buffet Alleviation using Synthetic Jets in INCAS Supersonic Wind Tunnel



The aim of the project is to gain a better understanding of the flow physics of SWBLI, especially for the turbulence physics, and then to use this for active control for buffeting. The target configuration is based on a classical biconvex aerofoil, at 3.5 deg. incidence, Reynolds 11 mil. at transonic speeds in the range of Mach 0.7 – 0.9. Controls used in wind tunnel experiment are custom made SJ actuators, surface mounted and operated as either single units or arrays. The key issue is to focus on large-scale flow characterization, including the investigation of spanwise coherence and the unsteady aspects of the complex fluidic interaction between the shock wave, boundary layers and the actuators. SJ actuators proved to have beneficial effect on flow separation by enhancing energy exchange in the boundary layer. However, it is necessary to understand in detail the effect of SJ for buffet alleviation before this type of control could be applied to real aircraft configurations.

## ■ INCAS News

### ■ *INCAS is EREA associate member*

Starting from year 2006 INCAS has become EREA associated member. EREA is a major contributor to European aeronautical research (higher annual budget than the budget in the Framework Programme). As part of this important association, INCAS will try to achieve higher international visibility and to extend international partnerships. INCAS participation to EREA is currently orientated towards ARG group.

### ■ *INCAS participation to ACARE*

Starting from year 2007 Romania has nominated as ACARE member an representant of INCAS. This nomination is a recognition of the role and influence INCAS has inside Romanian aerospace community and is a chance for higher visibility of existing national capabilities and stronger representation of national aeronautical interests at EU level.

### ■ *INCAS expert in PC7 - Transport*

A specialist from INCAS has been nominated as national expert in PC7 – Transport in order to represent current integration of Romanian interests in transport sector (including aeronautics) with respect to R&D policy. Harmonization of Romanian national R&D program with the major strategic objectives of EU research and innovation policy is a key element of national strategy for EU integration.

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