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Collaboration between Industry and University: the experience from Alenia Aeronautica and Politecnico di Torino

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A E R O N A U T I C A

Una Società Finmeccanica



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Finmeccanica: structure and results 2004

FINMECCANICA



Alenia Aeronautica: structure and results 2004



Alenia Aeronautica: the products

Present in both military and civil business

Combat Aircraft

Trainers (Aermacchi)

Military Airlifters

Mission Systems

Aerostructures and **Commercial Aircraft**



Overhaul and Modification (Aeronavali)

































Alenia Aeronautica operates in a fully integrated way through the design, manufacturing and in service support of military and civil aircraft and participates to the most important international civil and military programmes.

Our Mission

Design, build, and support efficiently products at all the levels of the Supply Chain



System Integration: Skill to conceive the air vehicle configuration and to design the whole Aircraft System: from the architectural design, to the system component specification, up to the aircraft production line and the client product support (Prime and Co-Prime positions)

Aerostructure supplier: Skill to design and produce major aircraft structural components. These competences together with the system integration skills, allow the company, to propose itself, in international contexts, for a "small prime and risk sharing partner" position instead of the "simple supplier" role.

Sites & Resources

Aircraft final assembly System integration Ground and flight test Turin/Caselle

Turin/SIA

Machining Large sheet metal fabrication Large panel assembly Nola

Metal bonding large structure sub-assemblies Structural laboratories Pomigliano

> Sheet metal Casoria

Headquarters

Flight Testing Decimomannu Trainer aircraft Varese/Aermacchi

Overhaul and maintenance Venezia/Aeronavali

Capodichino/Aeronavali

Brindisi/Aeronavali

Carbon fiber and composite material technologies Assembly Foggia

Alenia Aeronautica

Subsidiaries and partecipated companies

The company structure



The company structure (cont)



Central role of Research and Education

The value of Alenia Aeronautica is the knowledege, the experience, the capabilities of the resources that work there. It is fundamental to capitalize these knowledge and maintain the Technology Leadership through investments in Research & Development and through the education and collaboration with Universities and Centres of Excellence

Reciprocal roles and competences must be respected but it is necessary a tight link because on one side the industrial activities must have a scientific better structured basis, and on the other side the scientific competences must have more references to the real industrial needs

Constraints : regarding research, activities funded by the Italian Government have constraints on the so called "objective areas" which limits geographically the possible collaborations



PoliTo and Aeronautic and Space Industry in Torino

The Research activities: dimensions and type

R&D: Alenia Aeronautica invests an average of 18% of revenues

R&T : Alenia Aeronautica invests about 1,7% of revenues in Technologic Research (about 20 M€)

- More than 50 research projects (R&T), also in leader roles, partially funded (50% from government and 50% on its own)
- Civil, military and dual research: respect to the total volume of research activities : 90% is related to civil and dual research









The Research activities: main collaborations



The Research activities with PoliTo

There is an agreement between PoliTo and the Company called "Accordo quadro" a kind of framework agreement for different kind of collaborations

At present the two most important links between the Company and PoliTo are set up with the following two departments:

- Aeronautics & Space Engineering Department
- Material Science and Chemical Engineering Department

The Research activities with PoliTo - DIASP

Aeronautics & Space Engineering Department

- Collaboration on Advanced Flight Control Systems during the last 5 years
- In particular for UAV (the platform is inhabitated and this implies innovative approaches in FCS design)
- The main topic concerns Fault Tolerant FCS:
 - analytical redundancy
 - advanced Failure Detection and Isolation
 - reconfigurable Control Laws

The Research activities with PoliTo – DIASP (2)

Analytical redundancy

Analytical redundancy

Virtual sensors (Model based approach)



Advanced Failure Detection and Isolation

Innovative Voting / Monitoring algorithms

The Research activities with PoliTo – DIASP (3)

Reconfigurable Control Laws

- New Control Laws architectures
- FCS able to fly even in presence of multiple failures



The Research activities with PoliTo – DIASP (4)

Collaboration Topics

- Configuration studies
- Mathematical models refinement
- Virtual sensors design
- Design of Fault tolerant control architectures
- Innovative Control laws design methods
- Innovative Autopilot design methods





The Research activities with PoliTo - DISMIC

Material Science and Chemical Engineering Department

- Collaboration mainly on metallic and hybrid materials (following the philosophy of the Italian Technology Districts, collaboration on polymeric materials are mainly performed with IMAST in Campania region)
- In particular
 - Characterization of metallic and hybrid materials (metal matrix composites, glare)
 - Superplastic forming-diffusion bonding (spf-db)
 - New joining methods for metallic parts (bonding, friction stir welding, laser welding)





LASER BEAM WELDING

Materiali ibridi



SPFDB



FRICTION STIR WELDING

Education in collaboration with PoliTo

2 Facts:

- in Piemonte region the company is mainly oriented to system integration activities
- products require more and more avionic specialists

Need for avionic engineers (mix between the traditional electronic & aeronautics knowledge)



Agreement with PoliTo and set up of a

• New orientation : System & Avionic Engineering within the 3 year degree in Aeronautics and Space Engineering

with direct involvement of teachers coming from the Company

Education in collaboration with PoliTo (cont 1)

First level degree in Aerospace Engineering – System orientation (3 years) Alenia personnel hold the following degree courses:

- System Engineering Foundation
- System Engineering Complements
- Company Procedures for Systems Integration
- Product development Methodologies
- Guidance & Control Systems
- Simulation & Data transmission network

Great effort coming from the Company:

- the above courses represent around the 30% of the specializing disciplines of the degree course
- involvement of about 20 people as teachers and collaborators for the lessons, the exercises and the lecturers activities

Education in collaboration with PoliTo (cont 2)

Benefits:

- Invest in advance in preparing the potential future technicians and managers of the Company and/or of the national major supplier / partners
- Cost and time saving on training activities when employed

Education in collaboration with PoliTo (cont 3)

 Support to the development of a new course in Graphic & Virtual Design degree (3 years) of the Architecture Faculty (within PoliTo)

Alenia personnel hold the

Computer Science Laboratory II

The program includes:



- 3 D modelling with rendering techniques (Tool: 3D Studio Viz).
- General information on Digital Mock-Up and Product Data Management tools together with exchange formats
- Participation to yearly conferences like Virtuality and visit to Multi Media Park near Torino

This collaboration is based on our well established skill in Synthetic Environment, Simulation Technology and Virtual Design





Education in collaboration with PoliTo (cont 4)

Hosting of workshops, stages, thesis: around 50 students per year from PoliTo

Stages

- Since a couple of years, in Italy students need to spend a short period in a company doing some work before gaining the degree
- Normally the period ranges from 2 to 6 months
- Important aspects:
 - the kind of work they perform in the company
 - the company experience in itself (capability to work in teamwork, how to address unforeseen events, flexibility etc)

Education in collaboration with PoliTo (cont 5)

 Moreover Alenia Aeronautica built a new PoliTo site near the company for 1.600 students,

2 buildings with well equipped classrooms, Rapid Prototyping laboratories and offices



BUILDING B: Opening day 07/11/2001

BUILDING A: Opening day 20/10/2000

 In these builings the following degree courses are kept: Aeronautics Engineer, Management Engineer, Graphic and Virtual Design (Architecture)

Other initiatives

Another initiative started in 2003 – it is called briefly known as North-South Project

There is an agreement between PoliTo –DIASP and Federico II University - DIA for exchange students that need to perform industrial stages

Alenia Aeronautica represents the "industrial terrain" for this kind of exchange: hosting in the Torino and Caselle sites students coming from Federico II and in Pomigliano site students coming from PoliTo

Other initiatives (cont 1)

Alenia Aeronautica and PoliTo side by side in the education of people coming from Alenia suppliers / partners outside Italy

Alenia Aeronautica is developing several agreements with emerging countries in Aeronautical Industry (example C-27J programme):

- Alenia participated companies in other countries
- New suppliers from emerging countries

There is the need for the "right competence" depending to the kind of agreement

High Level Training Course in Aeronautics Engineering

for students coming from local Universities and for young designers already employed in local Industries

Other initiatives (cont 2)

Participants will come in Torino and Pomigliano to

- Follow courses on different topics : teachers are both PoliTo Professors and Alenia technicians and managers
- Make esperience in the company through training on the job

At the end the participants will work in Alenia subsidiaries in the origin country or Alenia supplier companies with improved competence on Aeronautics, with knowldege of our products and processes

Benefits on both sides:

- the foreign Country has the opportunity to receive new work packages related to the Engineering course and to be involved in future high level technology programme
- Alenia can rely on partners with the right competence for the business

Summary of collaborations ALA - PoliTo

