Research in Security for Aviation

Angela Vozella CIRA
Agenda

• Panoramica sul CIRA
• Attori, gruppi/associazioni
• Documenti di riferimento
• Tematiche principali
• Approcci e raccordo con gli interventi
CIRA, the Italian Aerospace Research Center
- a non-profit company located in Capua, Italy
- owned by a mixed public-private group of shareholders
- about 350 employees

CIRA’s commitments:
- perform PRORA (Italian Aerospace Research Program) to support the Italian Aerospace community with facilities and proper skills under the control of Ministry of Research
- design, manage and operate the facilities
- build up and integrate competences and expertise
- define, manage and execute R&TD projects
- prepare scientists and technicians
- keep PRORA updated

Since 1985, CIRA has successfully executed and participated to a very large number of R&TD projects supporting and cooperating with international and national aerospace industry, Research Establishment, Universities, within EC Framework programs, ESA contracts, etc.

Three large test facilities
- IWT (Icing Wind Tunnel)
- LISA (crash testing)
- Scirocco (Plasma Wind Tunnel)

Integrated capabilities for:
- Aeronautical fixed wing
- Rotary wing
- Space systems

CIRA is an active member in European groups:
- EREA (Research Establishments for Aeronautics)
- GARTEUR (Group for Aeronautic R&T)
- ACARE (Advisory Committee for Aeronautic Research)
CIRA site
Attori Europei

Expert committees and consultations:

Garteur,
ACARE WG4
EREA
EDA
EASA
- Group for Aeronautical Research and Technology in Europe (GARTEUR) is an important organisation for research collaboration in Europe in the field of aeronautics:
- MoU between Governments of 7 European nations with major research and test capabilities in aeronautics. Effective alliance with proven potential for integration of European Aeronautics R&T
- Formed in 1973 by three nations, today seven are involved in GARTEUR: France, Germany, Italy, the Netherlands, Spain, Sweden and the United Kingdom
- Focuses on collaborative research topics mainly aimed at longer-term R&T that is essential to assure sustained European Aeronautics Industry competitiveness
- defence, dual use or civil
- Experts from Academia, REs and industry.
ACARE:

Advisory Council for Aeronautics Research in Europe (ACARE) to develop and maintain a Strategic Research Agenda (SRA) that would help achieve the goals of Vision 2020

New Vision, Flightpath 2050, => new Strategic Research and Innovation Agenda was elaborated by ACARE during 2012
ASSOCIATION OF EUROPEAN RESEARCH ESTABLISHMENTS IN AERONAUTICS

Technology Development and Integration

Research

Production and Commercialisation

Transfer to Industry

Università

Spin-off

Start-up

Aziende
Security for Aviation” is:

- An increasingly rising issue and a key preoccupation for travellers (cf. recent tragic events);
- A topic in line with FlightPath 2050;
- A topic further dealt in the ACARE SRIA update and its dedicated Challenge on Aviation Safety & Security;
- A topic that fits with the PADR (Preparatory Action for defence research) in Horizon 2020 and FP9.
Dove

- Per dominio di applicazione è trattato in:

- Vehicles: DG MOVE / RTD (H2020)
- Infrastructures: DG HOME, GROW
- Information technology: DG CONNECT
- ATM: SESAR
- Crime and terrorism: DG HOME
Dove

A seconda delle attività:

• Regulation : DG MOVE, EASA, SESAR
• Research : H2020 : DG HOME, MOVE/RTD, CONNECT, (EASA, SESAR)
• It will potentially also be included, or at least be linked to, Defence research currently promoted by both EC and EDA.
Approccio alla definizione delle priorità

Top down: si parte dalle sfide ad alto livello si allocano al dominio specifico su di una scala temporale si posizionano dei risultati intermedi fino all’obiettivo finale del 2050.
Approach: Bottom Up

Bottom up: identificazione di scenari di rischio che chiedono un approccio olistico e congiunto.
Security for Aviation nelle iniziative di ricerca europea

• SRIA
• GARTEUR SECURITY
• ACARE WG4
• PADR
<table>
<thead>
<tr>
<th>Cluster of Challenges Description</th>
<th>Enable</th>
<th>Capability Description</th>
<th>Short-Capability Description</th>
<th>R&amp;A Needs Description</th>
<th>Domain Category</th>
<th>2020</th>
<th>2015</th>
</tr>
</thead>
<tbody>
<tr>
<td>Creating the foundation</td>
<td>Understanding customer expectation and their role in transportation mobility</td>
<td>To know Customer profile</td>
<td>Wa</td>
<td>Identify the customer profiles and properties (e.g., demographic and psychographic aspects, access and preferences of travel, economic background, technology acceptance and use, security acceptance and awareness)</td>
<td>Knowledge</td>
<td>The future (2020) customer profile and expectations are known by means of a finished study assessing safety and volume of customer expectations for very different groups of travel for individuals of different culture, age, familiarity with technical gadgets, purpose of travel and ethical issues are clearly understood for a lifetime of about 10 years. New studies to be finished by 2015 and updated every 5 years.</td>
<td>The future (2014) customer profile and expectations are known by means of a finished study assessing safety and volume of customer expectations for very different groups of travel for individuals of different culture, age, familiarity with technical gadgets, purpose of travel and ethical issues are clearly understood for a lifetime of about 10 years (update).</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Investigate changes in customer needs and ensure the current role of customer profiles by means of a finished study assessing safety and volume of customer expectations for very different groups of travel for individuals of different culture, age, familiarity with technical gadgets, purpose of travel and ethical issues are clearly understood for a lifetime of about 10 years. New studies to be finished by 2015 and updated every 5 years.</td>
<td>Knowledge</td>
<td>The future (2020) customer profile and expectations are known by means of a finished study assessing safety and volume of customer expectations for very different groups of travel for individuals of different culture, age, familiarity with technical gadgets, purpose of travel and ethical issues are clearly understood for a lifetime of about 10 years. New studies to be finished by 2015 and updated every 5 years.</td>
<td>The future (2014) customer profile and expectations are known by means of a finished study assessing safety and volume of customer expectations for very different groups of travel for individuals of different culture, age, familiarity with technical gadgets, purpose of travel and ethical issues are clearly understood for a lifetime of about 10 years (update).</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Determine new needs in light of the A2060 goal and ensure diversification to regional markets with diverse requirements</td>
<td>Knowledge</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Identify new needs in light of the A2060 goal and ensure diversification to regional markets with diverse requirements</td>
<td>Knowledge</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Define which infrastructure is needed to satisfy customer needs</td>
<td>Infrastructure</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Define methodology to predict mobility and expectations</td>
<td>Concepts</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>To know Customer expectation</td>
<td>Wa</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Identify Customer expectation towards an integrated door-to-door journey involving air transport as well as customer role in planning and execution of travel are clearly understood in all its complexity and form a solid basis for the development of the transportation systems and services</td>
<td>Knowledge</td>
<td>Customer expectation towards an integrated door-to-door journey involving air transport as well as customer role in planning and execution of travel are clearly understood in all its complexity and form a solid basis for the development of the transportation systems and services</td>
<td>Customer expectation towards an integrated door-to-door journey involving air transport as well as customer role in planning and execution of travel are clearly understood in all its complexity and form a solid basis for the development of the transportation systems and services</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Identify customer expectations and requirements towards the multi modal door-to-door travel experience, the ground phase at the airport, security measures, the critical processes at the airport (e.g., baggage, security) and new services</td>
<td>Knowledge</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Identify customer expectation in light of the A2060 goals</td>
<td>Knowledge</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Develop concepts to translate and predict customer expectations into operational requirements</td>
<td>Concepts</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Develop the infrastructure needed to satisfy customer expectation in light of the A2060 goal</td>
<td>Infrastructure</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Develop the infrastructure needed to satisfy customer expectation in light of the A2060 goal</td>
<td>Infrastructure</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Develop methodology to capture feedback from 100% of customers. This needs to be</td>
<td>Technology</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Define role of a customer in the transportation process</td>
<td>Technology</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Define of customer (passenger, cargo) role in the transportation process from planning to conclusion</td>
<td>Knowledge</td>
<td>Airports and Airlines offer specific services tailored to cultural and demographical needs (reference situation for the future)</td>
<td>Improvement measurement of Airports and Airlines specific services tailored to cultural and demographical needs (reference situation for the future)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Define of customer (passenger, cargo) role in the transportation process from planning to conclusion</td>
<td>Knowledge</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Develop seamless flow within existing infrastructure needed to accommodate with uncertainties 1 unit</td>
<td>Infrastructure</td>
<td>Passenger satisfaction survey done for the total direct (non-revenue)</td>
<td>Passenger satisfaction survey done for the total direct (non-revenue)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Develop seamless flow within existing infrastructure needed to accommodate with uncertainties 1 unit</td>
<td>Infrastructure</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Security for Aviation in SRIA

1. Pre-flight security to prevent any dangerous devices, articles or substances from being introduced inside an aircraft;

1. In-flight security to neutralize threats which could infiltrate the vehicle, its equipment or its software;

1. Post-flight security that addresses incidents reporting and analysis;

1. Air navigation and traffic control security that concerns communications, electronic systems and infrastructures that monitor and control the safe passage through airspace.
The work proposed by GARTEUR addresses all domains except post-flight security. Four research themes are defined:

- Cybersecurity that addresses in-flight and air navigation and traffic control security,
- Chemical, Biological and Explosive (CBE) detection that addresses pre-flight security,
- Dazzling that addresses in-flight security,
- Malevolent use of RPAS (MALURPAS) that does not fit into the four domains but is needed to anticipate new threats in an evolving airspace.

Each of the four themes encompasses three different steps: risk analysis, detection and counter-measures. Risk analysis is needed to precisely identify the potential threats, detection means and counter-measures can then be defined to mitigate the risk.
Security for Aviation in GARTEUR

1. To be assessed in piloted and remote piloted environment
2. The use of simulation tools and quality of results.
3. "Cyber security: Cyber threat protection Still a long way for RPAS to be integrated AT systems. Security aspects are relevant."
4. "CBE detection Improvement to be; fast & fully reliable."
5. "A good knowledge of threats is required. Improvement of database and simulation tools. Do not forget operators security aspects; pilots, remote pilots."
6. Assessment of performance is required.
Security for Aviation in ACARE WG4

Action area 6: Security management

System-wide Security Management Systems
Interdependencies
Security Baseline

Intervento del colonnello Valentino:
Distribuzione capillare dei sensori

Intervento del dott. Cardi di Enac:
Da certification approach a operation centric approach
Action Area 7: Security Intelligence

Forensic Analysis
Security Radar
Security Information Management and Sharing

Intervento del dott. Cardi di Enac

Identificazione dei piloti
collaborazione con la polizia di stato e con le autorità
Security for Aviation in ACARE WG4

Action Area 9: Security by design, manufacturing and performance assessment
Resilience by design
Performance verification
Interoperability

Legato allo spunto del Colonnello Valentino: dotarsi di air superiority
Security for Aviation in ACARE WG4

Action Area 8: Operational security

Operational mission management:

legato alla tematica proposta dal dott. Cardi di Enac

-> Operation centric approach
Security for Aviation in ACARE WG4

Action Area 10: Human, Organisational and Societal Factors

People Management
Security Culture

-> legato al concetto espresso dal dott. Cardi di Enac
Ruolo del pilota, censimento,

Ma anche esame della public acceptance e analisi e gestione del rischio percepito
Security for Aviation in PADR

Start Date: 07/2013
Type of work: programme under development with a launch date in 2017
Participating Countries: all
Other partners: European Commission

The European Commission will launch a Preparatory Action (PA) on defence research with a view of inserting a thematic area on defence research in the next framework programme, after Horizon 2020, in support of European defence cooperation and of the European defence industries.
Spunti in linea con la ricerca europea:

- Necessità di definire scenari critici tipici in evoluzione
- Per ciascun scenario identificare hazardous drones e specifiche mitigation actions
- Mutuare da classico safety assessment la risk analysis complessiva (safety e security harmonization)
- X identificazione: Persistenza nella sorveglianza con rete di sensori (anche passivi) e sistemi esperti
Spunti in linea con la ricerca europea:

- Contromisure guidate dalla tutela dei terzi
- Public perception and acceptance
- Utm sostituirà atm? Si integrerà in esso?
- Rapporto delle contromisure integrate con i legacy systems
- Dotarsi di air superiority
Spunti in linea con la ricerca europea:

- Necessità di capitalizzare esperienze nel dominio della safety di sistemi critici per fronteggiare droni ostili con open mind:
  - Applicare dynamic risk assessment per scenari in evoluzione
  - Definire delle mitigation action che in modo armonizzato garantiscano safety, security
  - Formare vari classi di attori: piloti, esperti, pubblico rispetto ai rischi ed alle contromisure.
Caratterizzazione degli attacchi

- **Attacco Hardware**: l’attaccante ha accesso ai componenti UAV direttamente;
- **Attacco Wireless**: l'attaccante realizza gli attacchi attraverso uno dei canali di comunicazione senza fili (GPS, ADS-B, Command and Control link);
- **Sensore Spoofing**: l’attaccante passa dati falsi attraverso i sensori a bordo del UAV.
Assicurazione di proprietà chiave

• Il sistema deve essere in grado di conservare anche sotto attacco le seguenti proprietà:

• **Confidentiality:** i dati non devono essere esposti a soggetti non autorizzati;

• **Integrity:** i dati devono mantenere la loro veridicità ed essere intenzionalmente modificati solo da soggetti autorizzati;

• **Availability:** i soggetti autorizzati hanno accesso tempestivo e ininterrotto ai dati.
Tipi di attacchi e proprietà che si possono compromettere