SOFIA

Safe Aut**O**matic **F**light Back and Land**I**ng of **A**ircraft

Overall Presentation

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Sixth Framework Programme

SOFIA Overall Data

Budget: 4,997,984 €
Duration: 36 months
Start date: 1st September, 2006
Web Site: www.sofia.isdefe.es
SOFIA Consortium:

Isdefe
DFS Deutsche Flugsicherung
GALILEO AVIONICA
THALES AVIONICS
AleniaSIA
RHEINMETALL DEFENCE ELECTRONICS
Diamond AIRCRAFT
IL
SKYSOFT PORTUGAL

SOFIA's Operational Concept

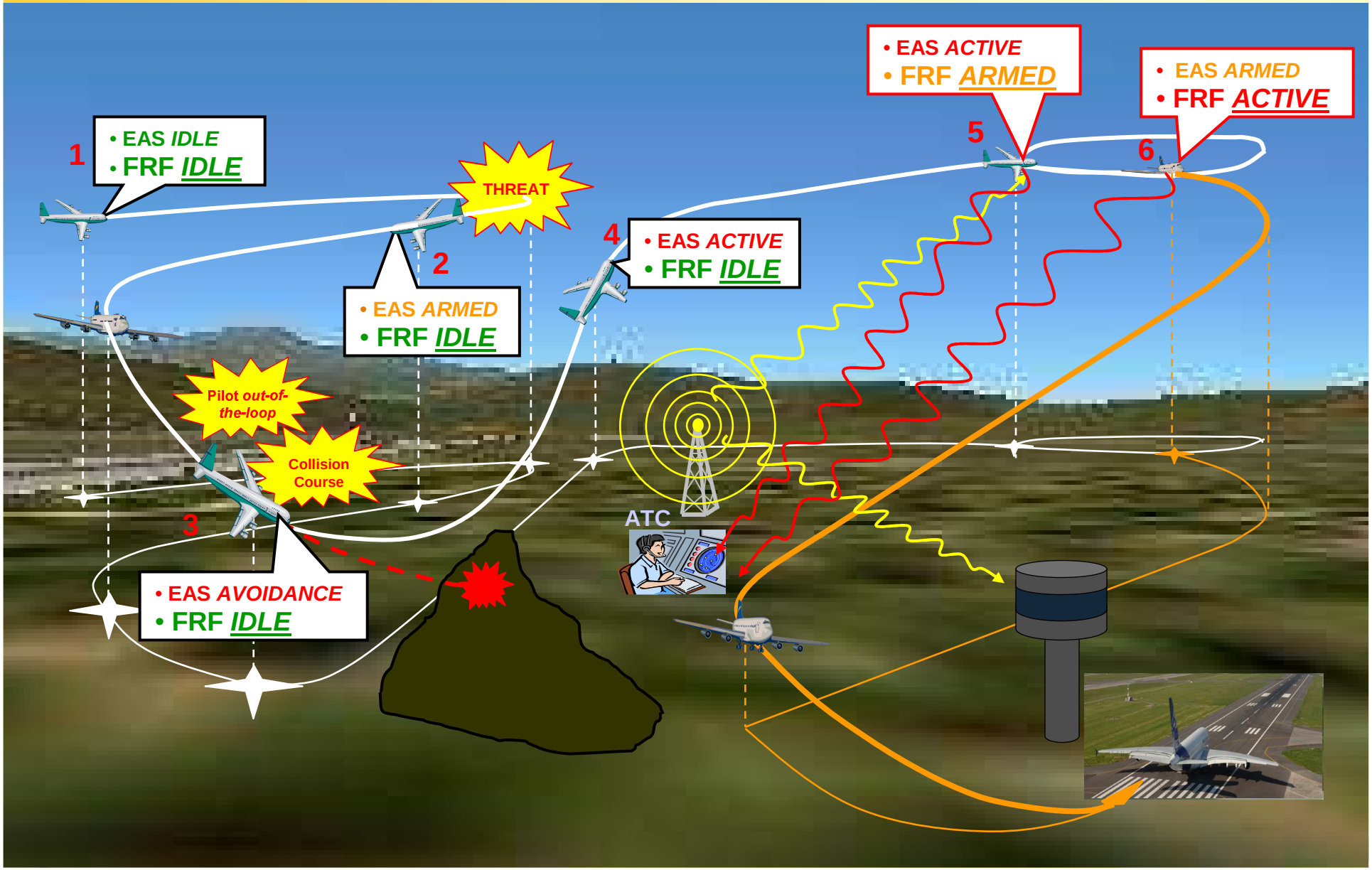
Background

- SOFIA is a response to the challenge of developing concepts and techniques enabling the safe and automatic return to ground of an airplane in the **event of hostile actions**.

- SOFIA is proposed as a continuation of a part of the SAFEE project. SAFEE focused in the development and validation of a concept that detects and evaluates on-board threats using the Threats Assessment and Management System (TARMS) and enables the Emergency Avoidance System (EAS) to autonomously flight the aircraft to a secure point. SOFIA develops the system (FRF) that, from that secure point, takes control of the airplane and safely returns it to ground.

- Both projects are mainly related to the Research Domain 3.d "aircraft security" of the FP6-2005-AERO-1, Research Area 3 "Improving safety and security".

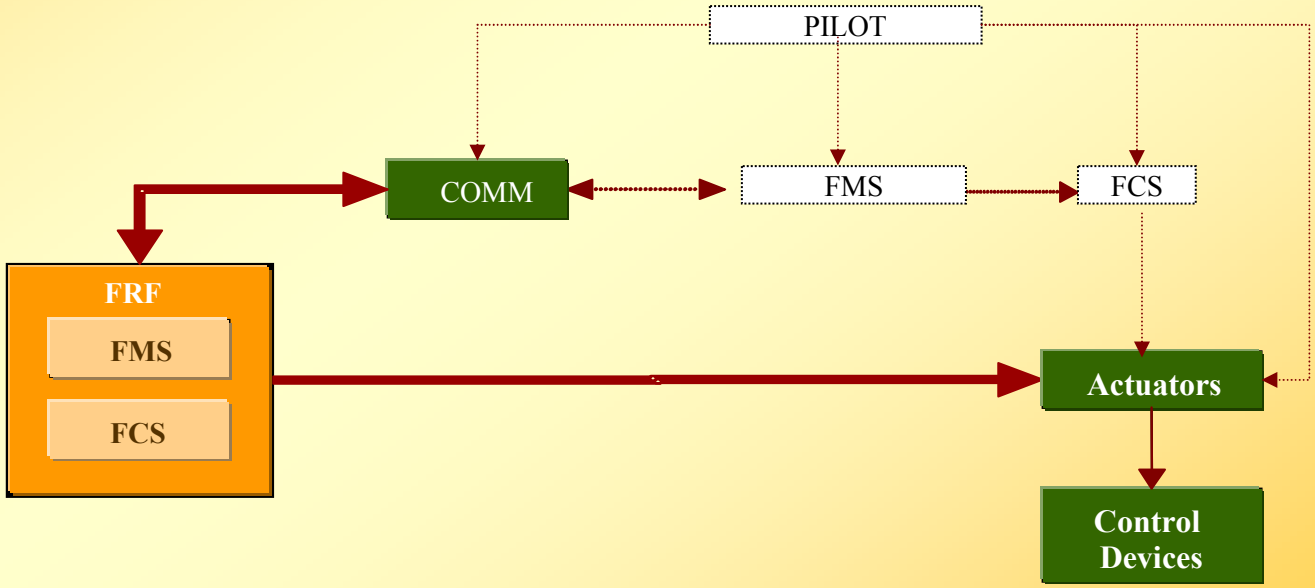
SOFIA Scope


1
• EAS IDLE
• FRF IDLE
THREAT
2
• EAS ARMED
• FRF IDLE
3
• EAS AVOIDANCE
• FRF IDLE
Pilot out-of-the-loop
Collision Course
4
• EAS ACTIVE
• FRF IDLE
ATC
5
• EAS ACTIVE
• FRF ARMED
6
• EAS ARMED
• FRF ACTIVE

SOFIA Core: the FRF (1/2)

The Flight Reconfiguration Function (FRF) is SOFIA´s core:

- Disables the control and command of the airplane from the cockpit
- Takes the control of the airplane under on-board security emergencies
- Manages to safely return the airplane to ground



SOFIA Core: the FRF (2/2)

It means to *create* and *execute* without any control from ground, a new flight plan towards a secure airport and landing the airplane at it

- The **flight plan** can be ***created***:
  1. Integrally by the **FRF** system
  2. By an **Authority on Ground** and negotiated with the FRF system
  3. In a **military airplane** and transmitted to the aircraft

- The ***execution*** of the new flight plan is **autonomously** performed **by FRF**

SOFIA Solutions

Three different solutions for the FRF are considered:

- **Solution 1: Flight Planning without negotiation**: FLPN is generated by the FRF system.
- **Solution 2: Flight Planning with negotiation:** FLPN is generated on ground and up-linked to the airplane. FRF system checks its feasibility.
- **Solution 3: Military A/C Relay:** FLPN is transmitted from a a military aircraft.

Trajectory Generation by FRF

The Trajectory is generated by FRF considering:

- Destination airport according to the threat
- Jeppessen data
- Weather, terrain, obstacles, restricted areas and PSA (Prohibited for Security Areas)
- Fuel
- Aircraft performances

FRF enables Trajectory updates due to:

- ATC messages (e.g. change in destination airfield)
- Weather
- Traffic
- Obstacles, PSA

FRF Functions

Decision Centre Function (DCF)

- Manages FRF capabilities and controls events

Health Monitoring System Interface (HMS)

- Monitors for external systems failures critical to FRF

Route Planning and Static Flight Monitoring (RPL)

- Generates a suitable flight path to a secure airfield

Guidance Management and Leg Management (GLM)

- Performs flight guidance

Route Re-planning (RRP)

- Performs re-routing due to a conflict

Dynamic Flight Monitoring (DFM)

- Monitors aircraft performances and resolves conflicts

External Communication (COM)

- Processes the information to be exchanged with the GSDS

Display Management (DSM)

- Manages displays when FRF is active

SOFIA Safety Assessment

Safety assessment made at three levels

- Aircraft level (following ARP 4761)
- FRF level (following ARP 4761)
- ATM level (following EUROCONTROL SAM)

For every level, safety assessment is composed of:

- FHA
- PSSA

Safety Validation on:

- Flight simulators
- Real flights
- ATCO participation in trials

Validation Resources

IoA Validation Resources

- **Aircraft: I-23 Manager**

- **Permissions from EASA and Polish Aviation Office to fly with FRF have been obtained**

Integration at IoA Aircraft

- **HW integrated in the I-23:**
  - FRF/AP Computer
  - Actuators with the steering cords
  - CAN Bus connecting
  - AP Panel and separated supplying system with safety switches and fuses

DAI Validation Resources

- **Flight Simulator: Testbed DA42 SIM**
- **Aircraft: DA42 Twin-Star**

Integration at DAI Aircraft

Garmin G1000

A/C DATA

3. DAI

FRF (FMS)

1. RDE

2. RDE

A/C GUIDANCE

CDI

COMM

FLIGHT PLAN

Autopilot

Bendix King KAP 140

THAK YOU VERY MUCH FOR YOUR ATTENTION

ANY QUESTION, PLEASE?