PASSIVATION OF MISUSED AIRCRAFT TO PROTECT PASSENGERS, AIRPORTS AND INFRASTRUCTURE

Dirk-Roger Schmitt*, Helmut.Többen*, Hans Philippens**
***AT-One/DLR, Germany**
****42 Solutions, The Netherlands**

Keywords: *aircraft security, misused aircraft, autonomous aircraft, UAS*

Abstract

Misused aircraft may be a threat to passengers, airports and other sensitive infrastructure. Within the project PATIN (Protection of Air Transportation and Infrastructure) the concept to passivate a misused aircraft has been investigated. A passivation system was designed, and the misuse case was simulated in an Air Traffic Control environment using cockpit simulators and an air traffic simulator.

1 Introduction

The European Commission project Protection of Air Transport and Infrastructure (PATIN) provided a 15 months preparatory action to ensure a comprehensive integrated system to improve the security of EU citizens by protecting against terrorism in the whole air transportation system, including airport, aircraft, critical infrastructure on the ground and the information system. The project assessed aspects of crisis management, interoperability and optimisation of security networks.

The project's primary aim was to deliver tangible results in the field of air transportation security. PATIN analysed all potentially relevant threats and technologies and from these derived a set of viable future operational concepts. PATIN also defined and executed a conference and joint exercises where the entire stakeholder community, users and security organisations could assess the operational concepts and the improved security provided. PATIN adapts a layered protection mechanism which forms a system-of-systems interconnected through networks. A top level information network will provide situation awareness for the whole European air transportation. Local networks will detect anomalies at airports followed by reactive and proactive measures against co-ordinated terrorist attacks. Major deliverables were the basis for developing the roadmaps required to establish a platform for the future European Security Research Programme.

To provide the required integration across Europe in this security field, a pan European consortium from nine countries including end users, SMEs (Small and Medium Enterprises) and research establishments was formed. PATIN also addressed the issues of human factors, security implications of measures implemented, regulations as well as social and ethical values.

2 The Passivation Concept

2.1 Problem

Misused aircraft may be a threat to passengers, airports and other sensitive infrastructure. So all over the world different approaches to deal with that threat have been investigated. Those include escorting the aircraft by fighters, force it to land, or, finally destroy it in case a catastrophic event has to be prevented. This paper describes a new approach to passivate the aircraft and let it land automatically at an alternate airport by technologies also used for unmanned aerial systems (UAS) [1].

2.2 Experimental Setup

The passivation concept is shown in Fig. 1. It makes use of the proposed ERRIDS (European Regional Renegade Information Dissemination System), which was developed as a prototype by EUROCONTROL. ERRIDS is an information dissemination system to be used by organisations involved in response to acts of unlawful interference or suspected acts on board an aircraft. The information that will be made available on a need-to-know basis will concern the flight, the route, the passengers and crew, the cargo, the alert state, threat assessment by states, the progress of the response by states and the handover information between states.

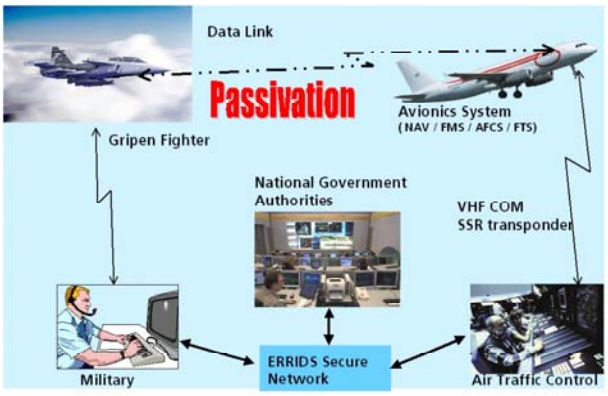

Figure 1: Integrated passivation concept by using the ERRIDS-System

The concept proposes, that the aircraft has to be equipped with an avionics system which could be passivated, in case of a renegade. I.e., no more inputs from the cockpit are accepted, and the system will fly the aircraft to an alternate intervention airport and land it safely. Passivation is monitored by a military "air policing" interceptor aircraft. Decision will be taken by the national authorities who are connected through ERRIDS with air traffic control and the military operations centre.

The aircraft is equipped with an on-board system which is similar to those used to fly Unmanned Aerial Systems (UAS), see Fig. 2.

A simulation set-up of the system was developed. It comprised of the Saab Gripen simulator in Linköping, Sweden, an ERRIDS server network established at 42 Solutions, Eindhoven, The Netherlands, and the AT-One/DLR Cockpit Simulator, which was deployed to the PATIN exercise at Munich airport (Figure 3).

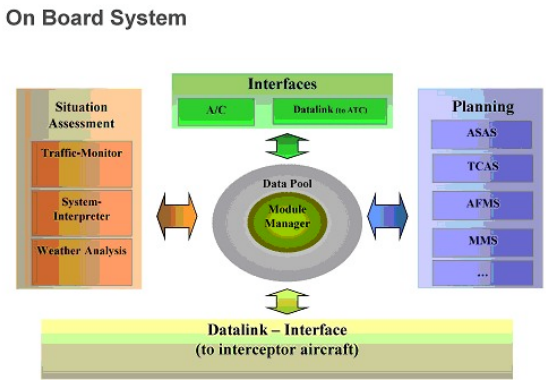

Figure 2: On board passivation system

In the set-up, the flight dynamics of the fighter aircraft was integrated. The cockpit simulator was running the AT-One/DLR based Flight Management System with a component for situation awareness, and another for flight planning and execution. It also includes the flight model of a passenger aircraft. A system to passivate the avionics and to fly the aircraft automatically to an alternate airport was implemented as well as the interface for the data link to the interceptor aircraft. The situation awareness between the two cockpits was realised by using the AT-One/DLR Traffic Simulator, a system capable to simulate real traffic in the airspace [2].

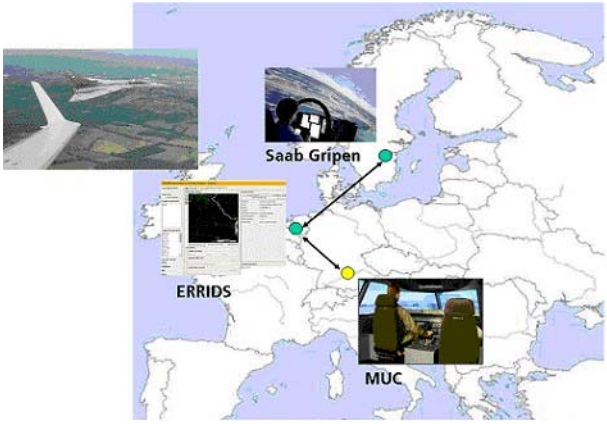

Figure 3: Geographical distribution of the simulators in Europe

2.3 Results

A renegade exercise was conducted at Munich airport end of 2007 using the interfaced systems and simulators. ERRIDS initiated the action for the renegade case, the fighter aircraft was deployed and intercepted the passenger aircraft. After command from the "national authorities" the real running avionics of the passenger aircraft was passivated and automatic modus was started. The flight management system then headed the aircraft to Munich airport under escort of the fighter aircraft which was "remotely flown" from the Saab Gripen simulator in Linköping. A successful fully automatic landing was conducted. The simulation set-up worked perfectly, i.e. also the appropriate situation awareness was available in both cockpit simulators; the passivation interface to the cockpit also showed proper function as well.

3. Summary

The experiments conducted at Munich airport show, that the technology in principle is available to passivate a misused aircraft and to safely guide it for autonomous landing at an intervention airport. However, before any implementation, political decision is required as well as acceptance in the world of aircraft crews and the public.

3. Contact Author Email Address

.

Dirk-Roger Schmitt:
Dirk-Roger.Schmitt@at-one.aero

Helmut Többen:
Helmut.Toebben@at-one.aero

Hans Philippens:
Hans.Philippens@42solutions.nl

References

[1] Lemmers A, Valens M, Beemster T, Adam V, Keck B, Klostermann E, Evaluation of ATC/ATM integration concepts for civil UAV operations. in: Unmanned Aerial Vehicle Safety Issues for Civial Operations (USICO), Report D4.1, European Project funded within the GROWTH Aeronautical Part of the 5th Framework Programme of the European Commission, Contract G4RD-CT-2002-00635, 2004.

[2] Kaltenhäuser S, Tower and airport simulation: flexibility as premise for successful research. Simulation Medelling and Theory, Vol 11, pp 187-196, 2003.

Copyright Statement