IRPIS

Traffic Control Systems

THE SIMULATOR ENVIRONMENT FOR IFR AND RPAS INTEGRATION

The increased dependency on unmanned and remotely piloted air platforms is making our skies increasingly crowded. It is imperative, therefore, that appropriate Instrument Flight Rules (IFR), technologies and standards are implemented in order to manage and ensure the safe integration of these systems. IRPIS (IFR/RPAS Integration Simulator) is a Simulation Environment that aims to replicate aspects of real Remotely Piloted Aircraft Systems (RPAS) operations under Air Traffic Management (ATM) conditions, while providing realistic, interactive operating conditions.

Among the most important challenges faced by IRPIS is the ability to demonstrate the validity and limits of:

- The ad-hoc operational procedures to operate RPAS in non-segregated airspace
- The airworthiness rules that used to 'certify' an RPAS for experimental scope
- The technologies and systems when compared to the requirements and capabilities of existing and future ATM systems (e.g. SESAR project)

TYPICAL SCENARIOS

Typical issues include:

- Assessing the feasibility of introducing an RPAS platform into a non-segregated airspace in any traffic density environment
- Use of satellite communication to cope with the Beyond Radio Line of Sight (BRLOS) situation
- Defining test emergency procedures
- Development of Detect and Avoid (DAA) technology.

Considering the extreme practical difficulties and very high setup costs for tests and trials in the real environment, a simulation approach offers a number of obvious benefits.

IRPIS

THE SOLUTION

IRPIS is a Simulation Environment that aims to replicate aspects of real RPAS operations while providing realistic, interactive operating conditions.

Based on SimLabs technology, IRPIS is intended as a tool for Experimentation and Test, Evaluation and Training for the RPAS insertion in a IFR space, including CONOPS studies, mission preparation and rehearsal, brief and debrief sessions, basic, intermediate and advanced training.

The environment is agnostic and can be used for number of different domains where the use of IRF/ RPAS insertion will be required, such as Blue Border Surveillance and Security scenarios.

In the IRPIS implementation for Blue Border Surveillance and Security, the most relevant components are:

- ATC Simulator (which have an interface with the real equipment)
- MDA Simulator (which have an interface with the real equipment)
- RPAS Simulator (which may have both an interface with the real equipment (RPS) or be 100% simulated)
- Communication Simulator (inc. satellite segment).

The SimLabs represents the core of the system, among the IRPIS different subsystems listed above by a wide area network, for setting up an 'on-demand', scalable, distributed, operational environment. The subsystems are implemented as federates exchanging data via HLA (High Level Architecture protocol).

SIMLABS

The Simulation Network (SimLabs) is a scalable and reconfigurable on-demand operating network among simulation laboratories, which establishes a synthetic environment that allows 'constructive' simulation systems.

It allows human operators of virtual systems, together with real operators, to interact and simultaneously interoperate in a virtual environment.

The simulation test bed is based on a distributed simulation approach where, instead of implementing a single simulator, able to represent all the characteristics of the overall system, a number of network-based simulators is used. Each simulator is able to participate, in real-time, to the evolution of a specific shared operational scenario.

SimLabs can be also seen as a technological asset through which various expertise, skills and tools (available across several Labs) can be shared.

The network has been connected with several institutions including the Rome NATO Centre of Excellence of M&S, the Italian Navy facilities in Taranto and the Italian Army.

Any connected laboratory can make their best simulators available, together with people and related expertise without any increased cost and with no duplication of equipment. In addition, each institution is able to maintain all the IPR on the specific piece of software and/or the simulated or real component.

SimLabs is used to provide a proof-of-concept tool, an environment where design and experiment Concepts of Operation, to train and verify the ability of operators, to exercise operational procedures, to interact with Command & Control systems. It is also used as an easily reconfigurable demonstration tool. SimLabs has already been successfully implemented in the Defence and Commercial markets, for national and international projects.

ATC SIMULATOR

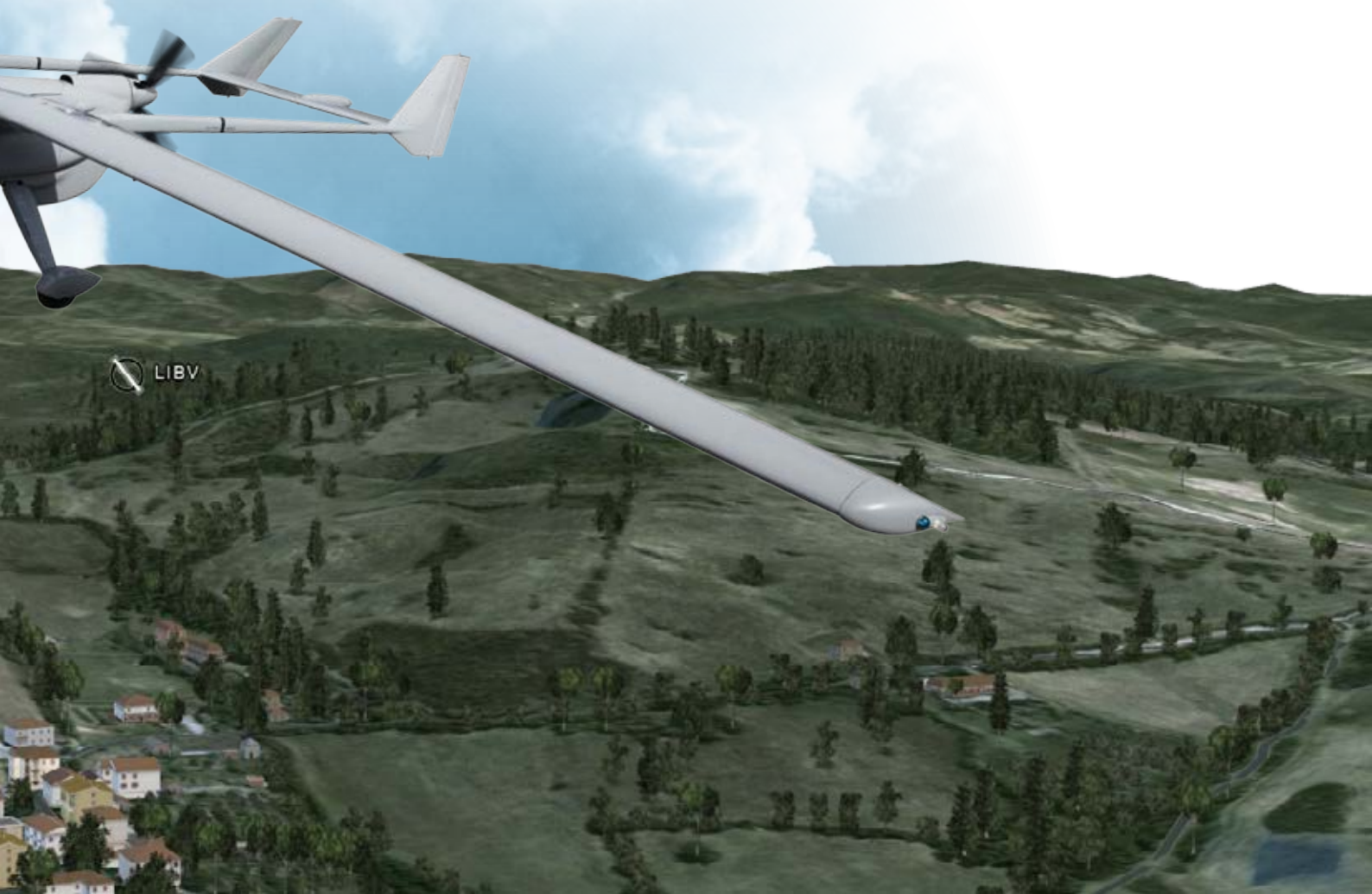
The ATC Simulator is an essential part of the IRPIS infrastructure and represents one of the subsystems. It provides a support functions for the ATC environment, including workload evaluation, flow control, optimum airspace configuration, new control procedure for RPAS.

The primary function of the ATC Simulator within the RPAS simulation infrastructure is the realistic simulation of an ATC environment, where a predefined group of aircraft is automatically flown by the System alongside aircraft controlled by Pseudo-Pilots.

Remotely Piloted Aircraft can then be placed into the scenario, controlled by RPS according to the ATC rules and Controllers instructions.

It is a flexible and powerful system having the capability of running a wide range of ATC Simulation Scenarios for advanced training of Controllers in order to investigate ways in which RPAS may be able to use a technical capability or procedural means to comply with ATC instructions, allowing current and new concepts to be conceived and tested in the simulation.

During the simulation exercise, the air traffic controller shall have an indication that the aircraft in question is an RPA by dedicated track over symbol.



IRPIS

MDA SIMULATOR

The Maritime Domain Awareness (MDA) Simulator is the second main subsystem of IRPIS. This simulator represents the specialisation of this specific application for the Blue Border Surveillance.

The system provides simulations of:

- Distributed sensors
  - Radar, EO sensors, transponders (AIS) and radio equipment (voice, communication intelligence-COMINT), airborne sensors (UAV, Airplane, helicopter), buoys sensors
- Satellite surveillance providing images relevant to the whole extended EEZ including the continental shelf
- Protection systems for coastal infrastructures (e.g. ports, oil terminals) and offshore platforms
- Local C4I centres performing data collection and processing, sensor management, compilation and broadcasting of Common Operational Picture (COP)
- Regional C4I centers that receive and merge data from local C4I, protection systems as well as other legacy systems and satellite imagery, compile the high level COP and manage operations.

RPAS SIMULATOR

The RPAS simulator is composed of a synthetic environment and several objects, including a number of RPAS models, represented in a 2D/3D scenario.

SYNTHETIC ENVIRONMENT ANIMATOR

The Synthetic Environment Animator is a Simulation Environment Suite designed to create, run and manage complex tactical scenario with a high level of realism.

It is also meant to provide the user with the maximum level of flexibility in the creation of elaborated scenario and mission planning. Scenarios with thousands of entities can be generated very fast and their run-time evolution can be monitored and easily modified by the user. It is here used to implement the RPAS operational environment that is placed into the ATC Simulation.

COMMUNICATIONS SIMULATOR

Communications are simulated by the SVC Communication Simulator and Evaluator, that is a simulation environment dedicated to communications network analysis and validation.

The applications fields of SVC are based on the evaluation of new architectures and solution to Acquisition Support and Training with the possibility to model and simulate new communication techniques and technologies to be verified, before their introduction ‘in-the-field’, using simulated complex scenarios.

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SECURITY & INFORMATION SYSTEMS

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