SkyEye Project Update for TFRSAC

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ICARUS Group Presentation

- **Technical University of Catalonia**
  - 15 schools, 40 departments, 30,000 students, 2,500 researchers

- **Escola Politècnica Superior de Castelldefels**
  - 4 degrees: telecomunicacions and aeronautics, 3,000 students, 15 research groups, inside the Parc Mediterrani de la Tecnologia
ICARUS Group Presentation

- ICARUS: Intelligent Communications and Avionics for Robust Unmanned aerial Systems
  - 11 researchers (4 Ph.D.), multidisciplinary group

- Computer Science
  - Web services
  - Embedded systems
  - SIG
  - Formal methods

- Telecomunicaciones
  - Wireless communications: WiFi, WiMax, RC, Satellite
  - Hardware design

- Aeronautics
  - Aeronavigation procedures
  - ATM
Our UAS Strategy

- Flexible UAS operation will be possible by:
  - Link flight-plan with payload: global mission concept
  - Having a flexible mission/payload control
  - Mission reconfiguration can be achieved in short time

- Methodology:
  - Exploit information technology concepts and methods
  - Pragmatic view: structure applications rather than using Artificial Intelligence
Sky-Eye development platform
Automation key for productivity

- Define Exploration Perimeter
- Define Optimal Nº of Scans
- Define Scans Parameters
- Perform Scan
- Correlate Hot-Spots
- Retrieve Perimeter
- Compute Perimeter
- Retrieve Initial Hot-Spots
- Store Track Samples
- Download Thermal/Visual/Fuse Images
- Ground Perimeter Review
- Ground Individual Hot-Spots Review
- Update Perimeter

Mission Stage
- Task Selection
- Pattern Select
- 0
- 1
- 2
- 3
- Join
- Scan Area
- Navigation
- Scan Point
- Hold
- Miss Loop

Exploration Proc:
- Start Exp.
- Flash Exp.

Exp Parameters:
- Speed
- Heading
- Lat Error
- Altitude
- Hot Spot List
- Lat/Lon Type
- Lat/Lon
- Lat/Lon Type
- Lat/Lon

Dem
- Sym
- Lon
- Alt
- Heading
- G Bys

Battery
- CPU
- Comm

UPC
- Polytechnic University of Catalonia
Automation key for productivity
Review of activity

- UAV Platform integration
- Automated support for operations
- IPM: on-board flexible computation
- Small failures
UAV Platform integration

- Improved platform integration (weight & vibrations):
UAV Platform integration

- Fully autonomous platform under integration:
Automated support for operations

- Automation of scanning / perimeter analysis:
Automated support for operations

- Parameter-based flight plan definition.
- Dynamic update capabilities.

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  <entrySide>Left</entrySide>
  <exitSide>Left</exitSide>
  <offset>5</offset>
  <PItype>Standard</PItype>
  <PIcourse>45</PIcourse>
  <area>
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    <point>41.9002422 2.2004379</point>
    <point>41.8329421 2.5259285</point>
    <!-- More points may follow -->
  </area>
</leg>
```
Automated support for operations

- Turn design.
Automated support for operations

- Simulation results.
Technical objectives:

- Employ UAS based missions to verify real-time operability of small surveillance platforms via the use of on-board multicore processor technology (IPM).
- Demonstrate IPM integration feasibility on highly integrated and physically constrained systems.
- Demonstrate the UAS flight-plan / mission management interaction with the IPM architecture to exploit sensor data on-board the UAS.
- Permit high-level of surveillance dynamics and flexibility according to the actual stream of data being sensed.
IPM: on-board flexible computation

Strategy:
- Configure multiple levels of surveillance automation and operation phases by exploiting IPM computational reconfiguration and Power/CPU tradeoffs.
- Generate real-time operational commands through UAS mission subsystems and reconfigure IPM according to the mission phase requirements.
Mission:

- In collaboration with CSIC science requirements, design a jellyfish detection, identification and classification system.

- Invasive jellyfish species are appearing in one of the biggest river deltas in Spain. Expected to greatly affect the existing ecosystem.

- Monitor distribution of the population and dynamic evolution along the season. Identify and catalog the specific jellyfish types.

- Two phase surveillance procedure:
  
  1. Medium altitude / high speed overfly of the area for detection of population presence. Real-time analysis based the IPM box.
  2. Low altitude / low speed overfly to achieve identification and classification of species.

- Both phases are executed in the same flight. Second phase is executed based on data processed in the first.

- IPM box will provide location of population, identification and distribution maps through web-services directly provided from the helicopter.
IPM: on-board flexible computation
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Thanks for your attention!

Questions?