NTA: NEW PROJECTS FOR THE DEVELOPMENT OF UAS AND AIRBORNE RESEARCH

Instituto Nacional de Técnica Aeroespacial

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New Projects for the Development of UAS and Airborne Research

- **UAS represents a profitable option for atmospheric research and Earth observation.**
- **Advantages:**
  - **Reduced Costs of operation.**
  - **More Endurance.**
  - **Inexistency of personal risks, specially in adverse circumstances as:**
    - **High concentration of ashes**
    - **High altitude.**
    - **Icing conditions**
    - **Intense electromagnetic fields (ionizing and no ionizing radiations)**
    - **…**

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Restrictions:

- Flight in segregated air space
- Certification (There are not any civil rules)
- Low interoperability
- Communications are Critical: Security
- Need of specific infrastructures
- Need of scientific equipment adapted to UAS
- ...

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New Projects for the Development of UAS and Airborne Research

- **Spain, through INTA, is preparing the way for these new developments:**
  - **1º.- Acquisition of a group of UAS, that we can add to the UAS developed in INTA:**
    - **SIVA**
    - **Milano**
  - **2º.- Adaptation of the Aerodrome of Rozas as CIAR**
  - **3º.- Adaptation of the Center "El Arenosillo" as CEUS**

- **We pretend to join the activity of Aerial Platforms for Research with the new development with UAS.**

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- **Acquisition of aircrafts and scientific instrumentation needed for the scientific campaigns:**
  - **Endurance: + 10 h.**
  - **Payload 100kg.**
  - **Minimum Speed: < 30 m/s**
  - **Ceiling: + 25000 fts**
- **Developed according to the certification procedures with military and civil rules.**
- **Recognized as ICTS (Instalaciones Científicas Tecnológicas Singulares)**

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New Projects for the Development of UAS and Airborne Research

- CAPS (Cloud, Aerosol and Precipitation Spectrometer)
  - CIP (Cloud Imagen Probe)
  - CAS (Cloud, Aerosol and Precipitation Spectrometer)
  - LWC (Liquid water content)
- PCASP-100X (Passive Cavity Aerosol spectrometer Probe)
- FSSP-100-ER (Forward Scattering Spectrometer Probe)
- OAP-2D2-C (Optical Array Probe)
- OAP-2DGB-2 (Optical Array Probe)
- DEW POINT HIGROMETER
- 137-VIGILANT
- ANALIYZER SO2
- ANALIYZER CO
- Rosemount / PT 50
- GPS / GPS receiver
- LWC - King/CSIRO (Cloud Liquid Water Content) / CSIRO KING

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	CIP	CAS	Hotwire LWC
Technique:	Optical Array Probe with 64 elements: 62 sizing elements, end diode rejection	Forward and Back Scatter Light Sensors, dual back measurement with S and P polarization of the scattered light	Temperature-Controlled Hotwire Sensor
Measured Particle Size Range:	12.5 µm – 1.55 mm (for 25-µm resolution CIP) 7.5 – 930 µm (for 15-µm resolution CIP)	0.51 µm to 50 µm	N/A; measured LWC range is 0 - 3 g/m3
Sample Area:	Variable; depends on tip configuration and particle size	1.1 mm x 120 µm	N/A
Upper Concentration Range:	Depends on particle size, but up to 500 particles/ cm3 for a CIP with standard tips and arm width	Greater than 1,000 particles/ cm3 after corrections for coincidence that are about 25% at 800 and 30% at 1,000 particles/cm3	3 g/m3
Air Speed Range:	10 – 300 m/sec (for 25-µm resolution CIP) 10 - 180 m/sec (for 15-µm resolution CIP)	10 – 200 m/sec	10 – 200 m/sec
Number of Size Bins:	62	Selectable, 10, 20, 30, or 40	N/A
Sampling Frequency:	1D histogram data: 0.05 to 25 Hz; 2D image data: variable interval, when buffer fills	Selectable, 0.05 to 25 Hz	N/A
Laser:	658 nm, 30 mW	658 nm, ~50 mW	N/A
Calibration Verification:	Spinning glass disk with opaque dots of known size	Precision glass beads and latex spheres for sub-micron range	N/A
Non-absorbing Refractive Index:	N/A	1.3 – 1.7	N/A
Light Collection Angles	N/A	4° - 12°, 168° - 176°	N/A
Auxiliary Parameters:	Ambient Temperature, Relative Humidity, Static Pressure, Dynamic Pressure (CIP)		
Data System Interface	2D CIP data: RS-422, High Speed, 4 Mb/sec Baud Rate System data: RS-232 or RS-422, 56.6 kb/sec Baud Rate		
Software:	Particle Analysis and Display System (PADS) (Optional)		
Weight:	45 lbs./20.4 kg		
Power Requirements:	28VDC: 10A for probe system, and 45A for anti-ice heaters, optional AC voltages for anti-ice heaters		
Environmental Operating Conditions	Temperature: -40 °C to +40°C (-40 °F to +104 °F) RH: 0 – 100%, non-condensing Altitude: 0 - 50,000 ft		
Routine Maintenance:	DMT recommends conducting basic instrument performance checks and inspecting the CIP optical windows before a flight. A weekly calibration check of the CAS and CIP is also recommended.		

DROPLET MEASUREMENT TECHNOLOGIES

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The activities realized on our aircrafts can be classified as:

- Atmospheric Research.
- Remote Sensing.
- Testing new equipments.

Applications for UAS:

- Cloud particle research
- Climate studies
- Aircraft icing
- Storm and hurricane research
- Weather modification
- Cloud chambers
- Agricultural and industrial spray characterization
- Control of natural zones (vegetation, fire control, pollution, etc.)
- Environmental Control (Air Quality, contaminants distribution, prevention of atmospherics intrusions, volcanic emissions etc.)
- Verification of events (concentrations of birds, fishes, etc.)

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- **Adaptation of ROZAS Aerodrome as CIAR (Centro de Investigación Aerotransportada de Rozas):**
  - Adaptation of UAS Flights
  - Scientific laboratories for development of useful payloads for UAS
  - EMC (Electromagnetic Compatibility) allowing the flight on the safety certified conditions.
- **Approximated size:**
  - 4x3km

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Flights with UAS

- Certification flights
- Instrumentation integration in UAS.
- Flights as a Aerial Platform for Research

In CIAR we are doing the following activities:

- Flights for the development of SIVA
- Flights for the development of Atlante (CASSIDIAN)
- Flights for the development of ALO
- Flights for development and verification for Fly-tech, in collaboration with Civil Aviation.
- Flights for the development of helicopter UAV TEKPLUS

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New Projects for the Development of UAS and Airborne Research

- In Arenosillo Center flights with the UAS developed in INTA were done, but with catapult.
- CEUS project pretends to include some infrastructures and the capacity of take off/landing for the UAS:
  - Runway
  - Platform
  - Hangars
  - Control Tower
  - Control Center on Land for UAS
  - Fuel tanks…

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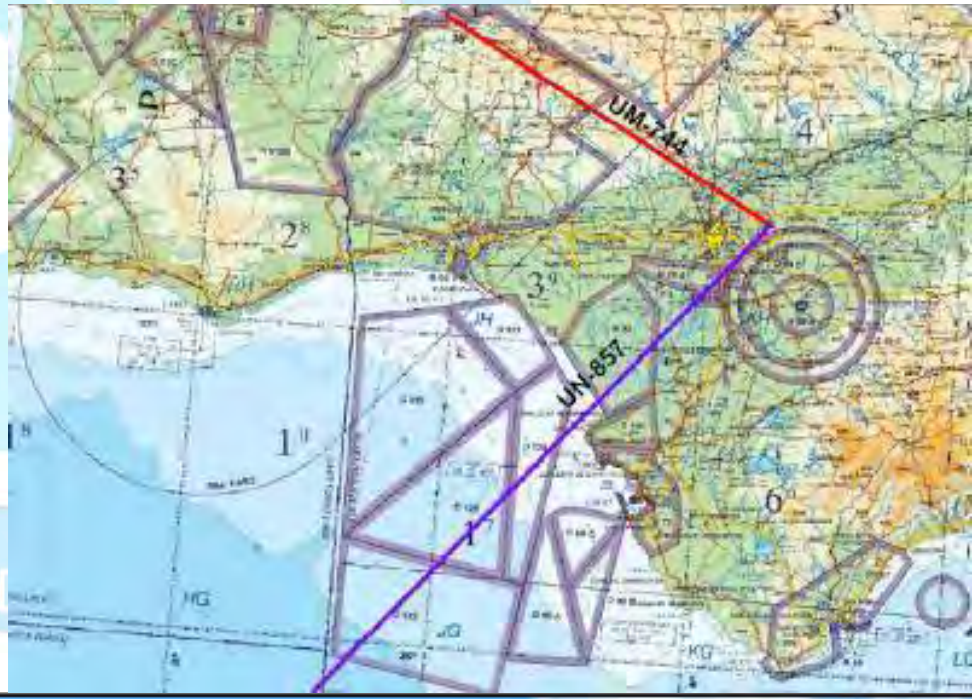
- This center has a huge area over the sea, were testing flight are available.
- Flights with prototypes/ new developments of UAS, to verify safety and reliability.
- Certification Flight.
- Approximated size:
  - 100x50 NM



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New Projects for the Development of UAS and Airborne Research

- This project will open the ways for the use of UAS for civil applications in Spain.
- Combine:
  - Safety and flexibility
  - Technological development and scientific knowledge
- New possibilities for researchers
- Collaborate with de development of certification rules for UAS

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Thank you

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