

Autonomous Flying Platforms for Atmospheric and Earth Surface Observations (APAESO)

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Goals

→ to carry out at high spatial resolution Atmospheric and Earth-surface observations in the Mediterranean:

- Physical, Chemical and Radiative atmospheric properties
- Physical, chemical, and optical properties of aerosols
- Atmospheric Dynamics
- Cloud physics
- Surface Morphology
- Vegetation and Land use patterns
- Archaeological Site Reconnaissance
- Contaminant detection
- Ocean Surface properties (biology, waves, currents)

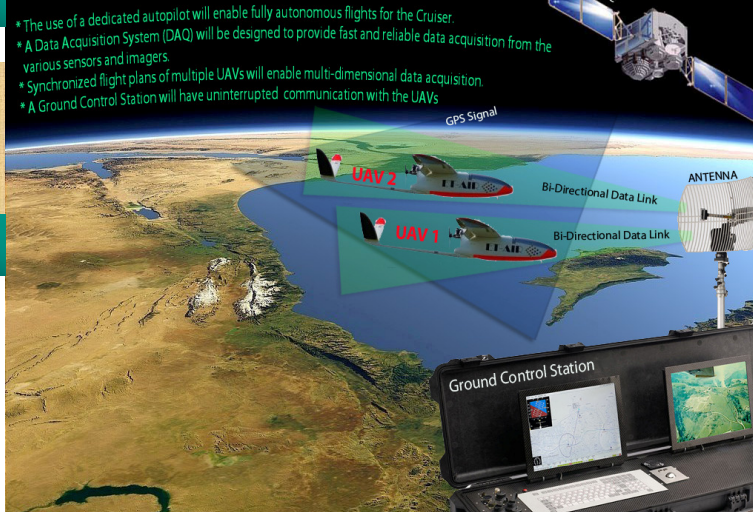
Design Characteristics

APAESO UAV: The Cruiser

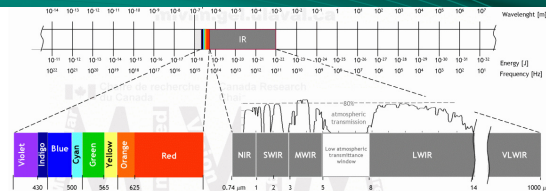
- Medium size Unmanned Aerial Vehicle (UAV)
- Wingspan: 3.8m
- Altitude: 5 km
- Maximum take-off weight: 30kg
- Payload 15kg including fuel



CONCEPT OF OPERATION



Imaging Sensors on UAS



Sauran Medieval Archaeological Complex in South Kazakhstan (From : <http://www.transoxiana.org/13/smagulov-sauran.php>)

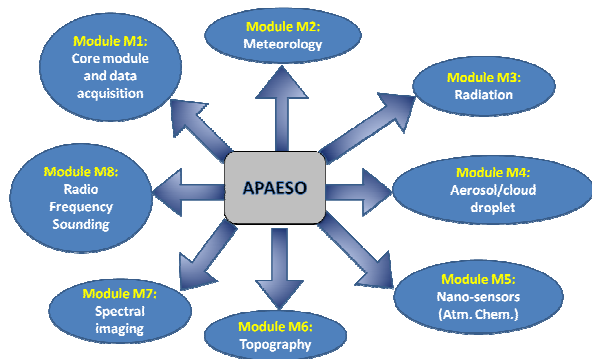
Airborne image of pine trees and juniper bushes Classification map (top) - Real color (bottom) Juniper (green) and Pine (red). (From <http://www.resonon.com/airborne.html>)

(Thermal orthomosaic obtained from the UAV over the peach orchard. The image on the top shows the water stressed trees (warmer, in red and yellow) as compared with the fully irrigated trees (blue). The bottom image shows a low-altitude image where within-crown thermal variability is observed. (Berni et al. 2009)

References

- Berni et al., IEEE Trans. Geo. Rem. Sensing, 47, 3, 722-738, 2009.
- Chiabrando et al., Proc. of SPIE Vol. 7478, 747807, 2009
- Corrigan et al., Atmos. Chem. Phys., 8, 737-747, 2008.
- Rango et al., J. App. Rem. Sensing, Vol. 3, 033542, 2009.
- Reuder et al., Met. Zeitschrift, Vol. 18, No. 2, 141-147, 2009.
- Robert et al., PNAS, V. 105, 21, 7370-7375, 2008.
- Techi et al., J. Field Robotics, 1-9, 2010.

Modularity



Sensors, Imagers and Data Acquisition System will be designed in a modular fashion in order to allow easy interchangeability between modules (M1-M8) for the different missions and applications.

Applications (Examples)

Application name	Objectives (examples)	Instruments/measurements
Meteorological measurements	Boundary Layer studies (Reuder et al., 2008)	Temperature (T), Relative Humidity (RH), Pressure (P)
Remote sensing - Earth surface observations	land and ocean surface properties, vegetation and land-use properties, archeological studies (Rango et al., 2009; Chiabrando et al., 2009)	RH, P, T, Radiometer, Hyperspectral camera, Infrared (IR) Imaging, Visual Imaging
Aerosol & Cloud measurements	Aerosol-Cloud Interactions (Roberts et al., 2008)	RH, P, T, Cloud Droplet Probe, Optical Particle Counter
Aerosol and Radiation measurements	Aerosol direct & indirect effects on climate (Corrigan et al., 2008)	RH, P, T, Optical Particle Counter, Albedometer
Aerosol sampling	Ice Nuclei, Cloud Condensation Nuclei, bio-aerosol sampling (Techi et al., 2010)	RH, P, T, Aerosol inlet, IN sampler, impactors