Flying a small camera system at Airborne Research Australia

UCL-MSSL

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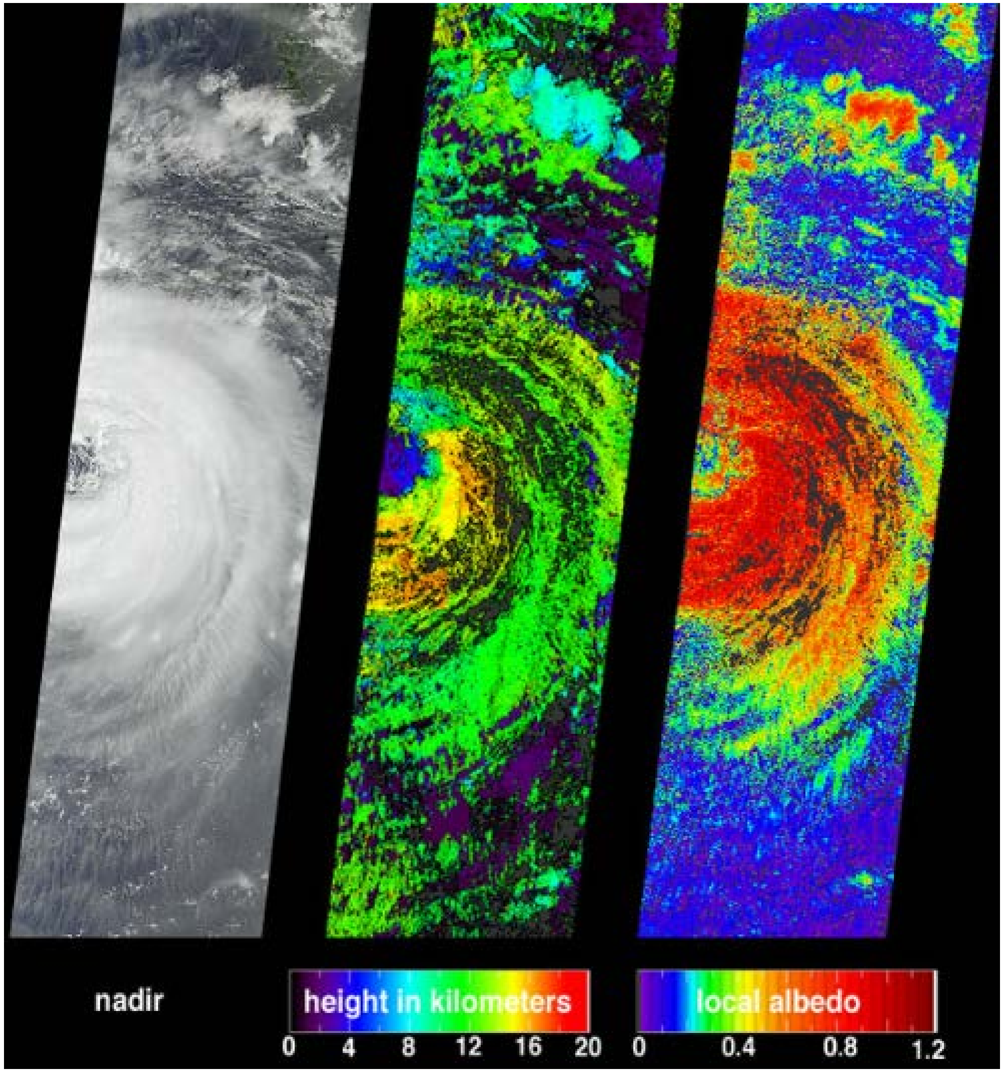
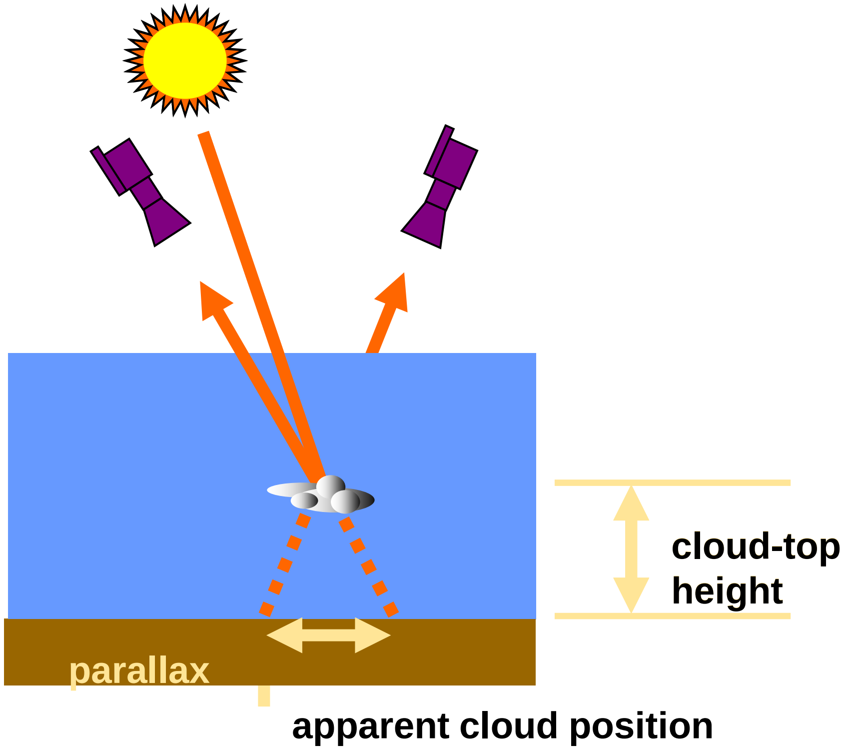
Sections of talk

- **Science Background**
- **Reasons for employing an a/c test**
- **Design issues**
- **Installation issues**
- **Flight Issues**
- **Lessons learnt**

MISR cloud-top heights and albedos



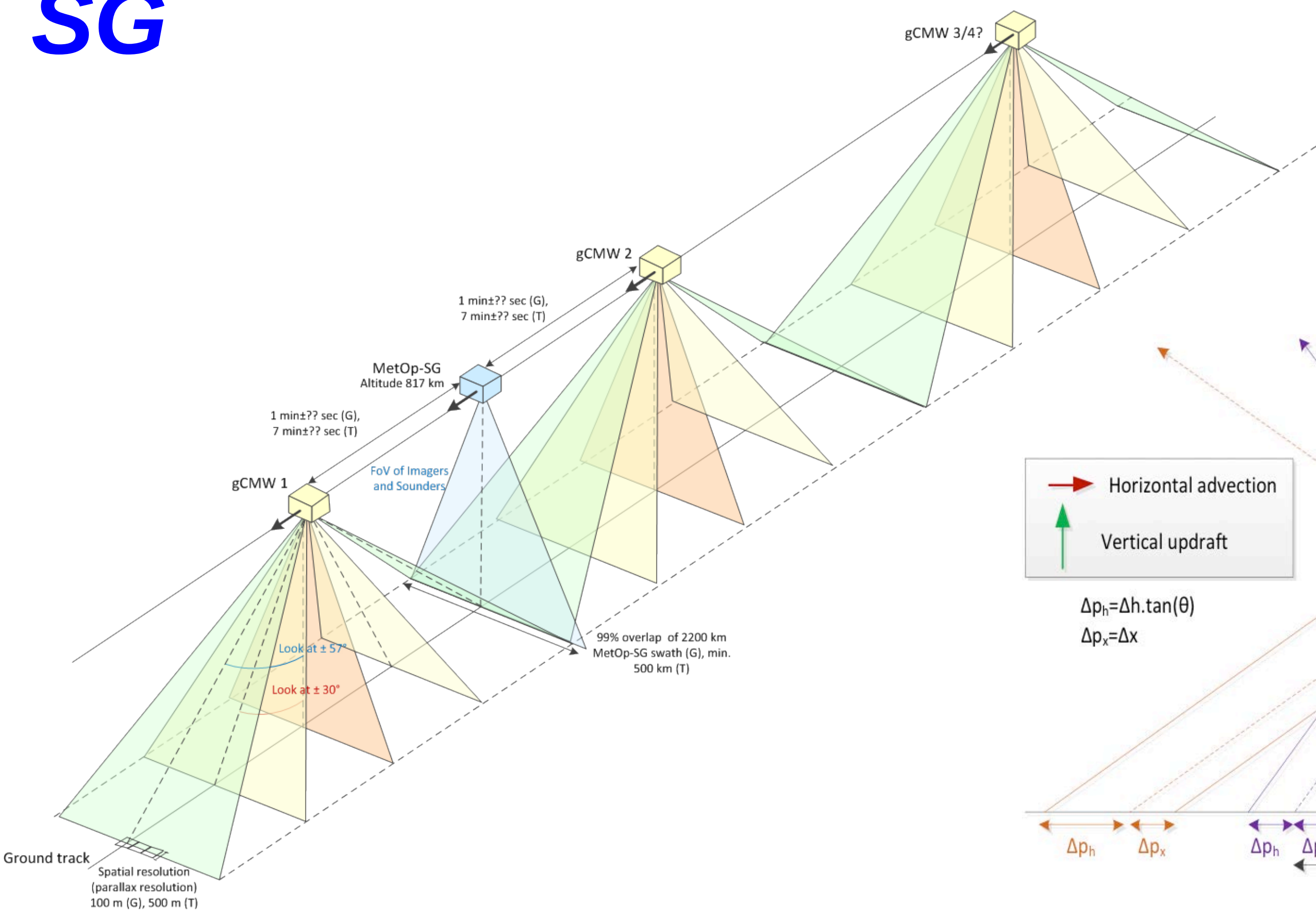
Typhoon Sinlaku, 5 September 2002

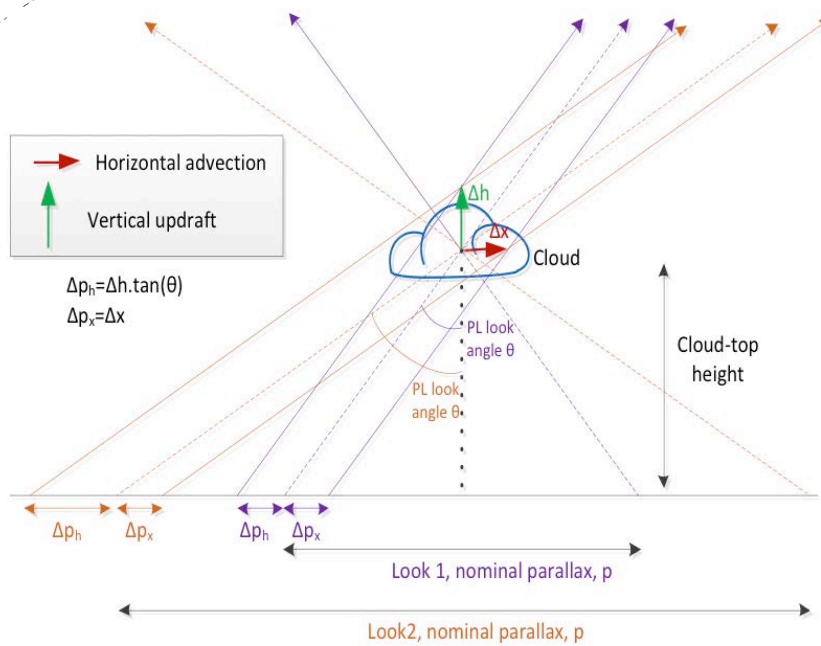


Height attributes

- derived from purely geometric approach
- completely automated, globally
- independent of radiometric calibration, atmospheric temperature profiles, and cloud emissivity
- instantaneous height accuracies of 500 m - 1 km, validated against ground-based radar/lidar

Geometric Cloud Motion Winds from a satellite convoy : a proposal for MetOp-SG

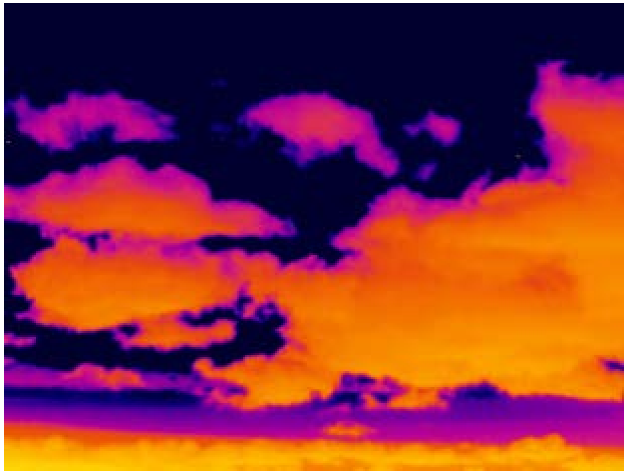




Courtesy of Ad Stoffelen, KNMI; Karl Atkinson, Astrium Ltd., Amanda Regan, ESA-ESTEC

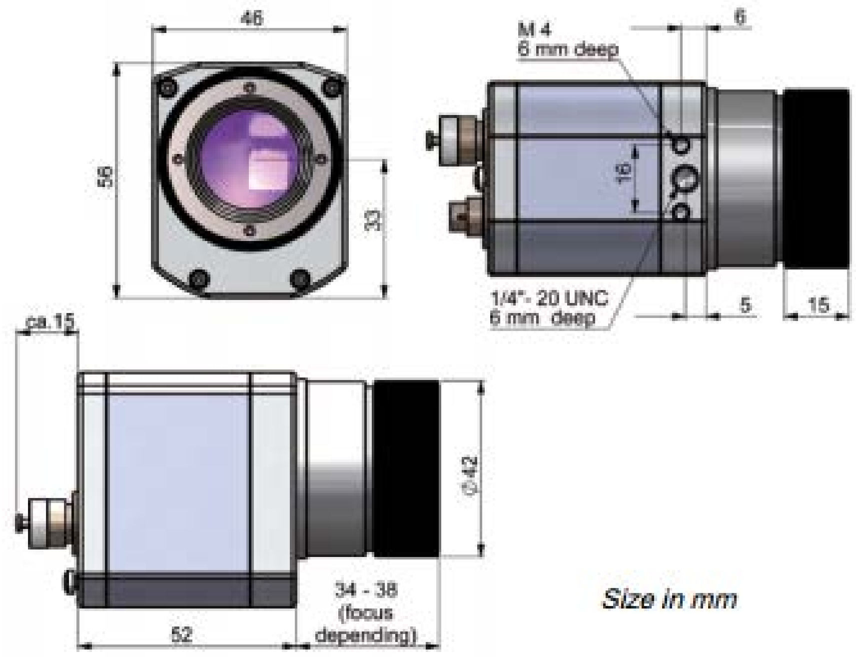
Reasons for employing an a/c test to prove MISRlite technologies

- **Room temperature IR sensors - ULIS**
  - **Summing signal across rows**
- **Determining that useful images of certain clouds types can be achieved**
  - **Algorithm lock onto cloud structure**
- **Cannot be achieved 'looking up'**



Optris Camera

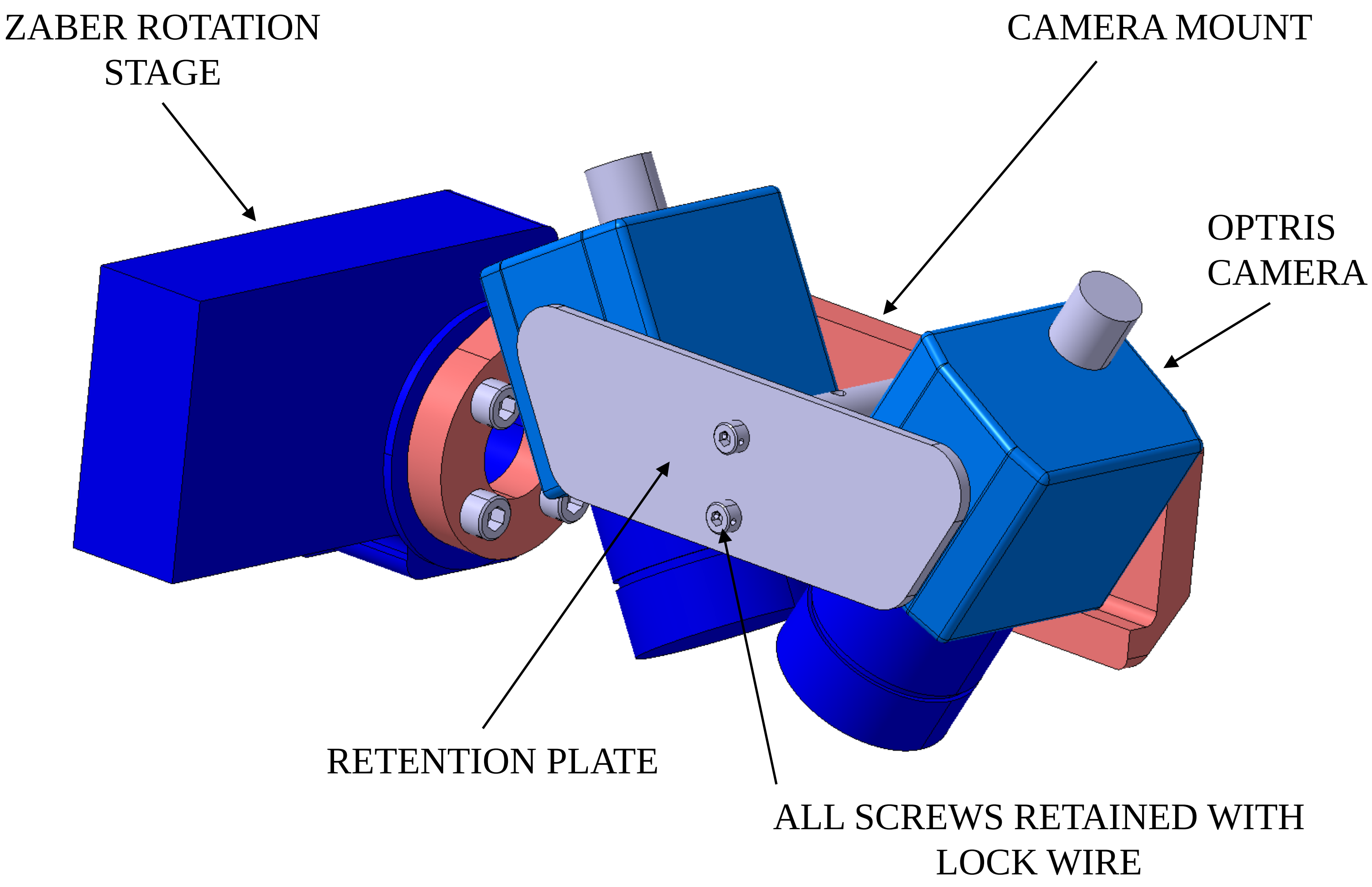
- **Uncooled amorphous silicon bolometer array**
- **382 x 288, 25µm pixels**
- **Spectral range: 7.5 to 13 µm**
- **Frame rate: 80 Hz**
- **Field of view: 50x50deg**



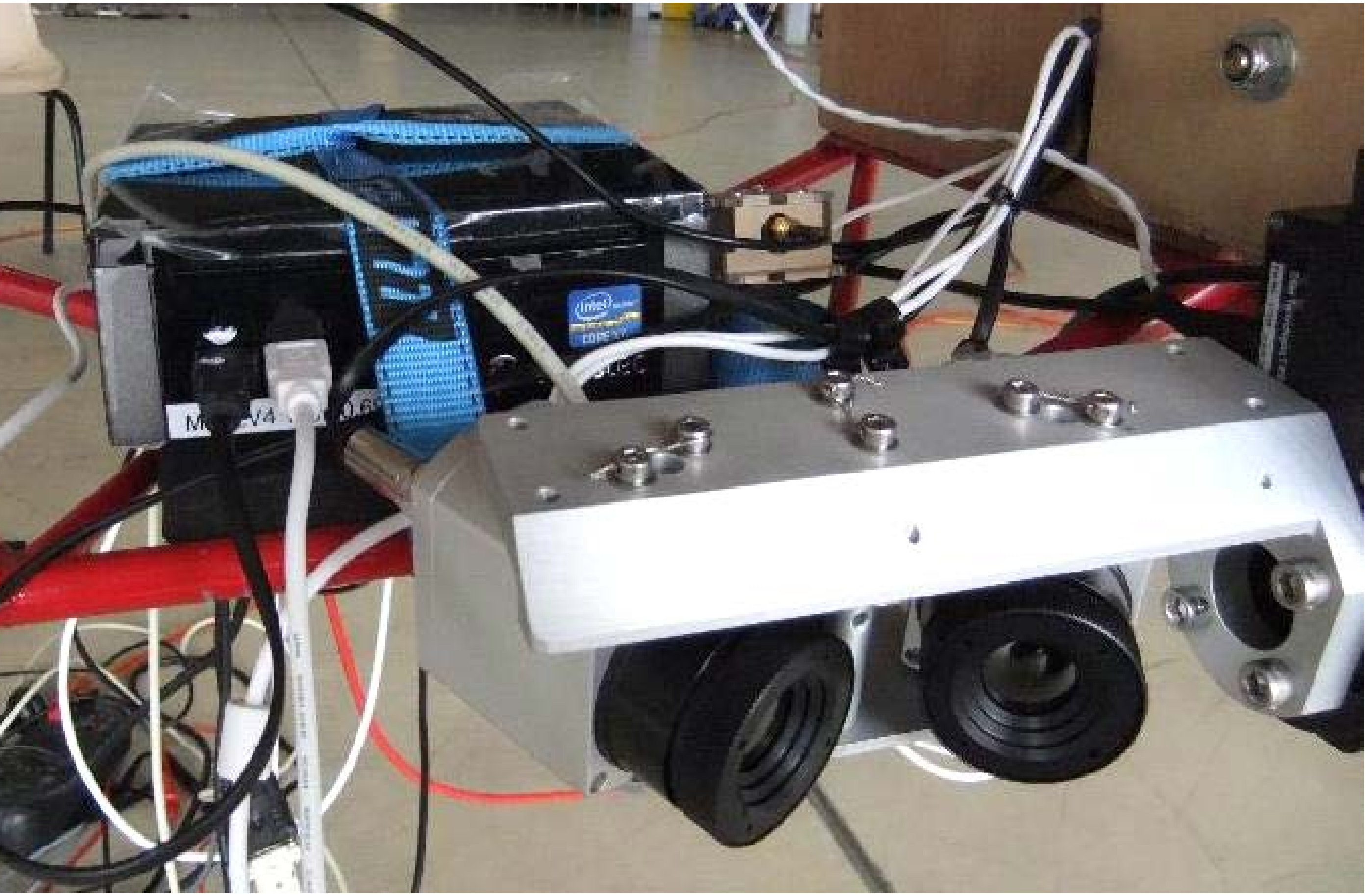
Design issues

- **Level of certification on final instrument**
- **Mass and volume available**
- **Attitude control and knowledge**
- **Real-time ground-air data links?**
- **Level of control required in-flight (simple)**
- **Need system that can installed and be reliable in the field**
- **High altitude environment**
  - **Solid-state disk drives only**

Camera Mount



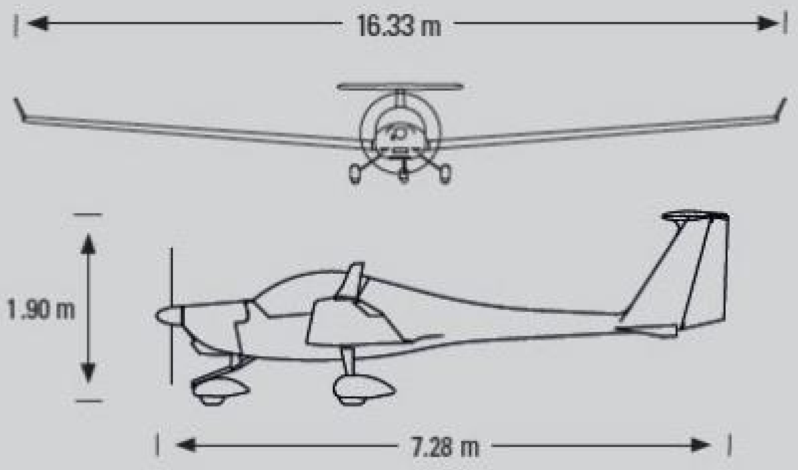
Instrument Design



- **2xOptris cameras**
- **Rotating mechanism**
- **Small form factor PC**
- **heater with relay**
- **GPS**
- **3-axis accelerometer**

Airborne Research Australia Parafield Airport, Adelaide

HK36 Super Dimona - fact sheet



Specifications applyto standard equipped aircraft, if not otherwise stated.
Specifications may change without notice.

Dimensions/ mass/ loading	TC 100	TTC 115
Length	7.28 m	7.28 m
Height	1.90 m	1.90 m
Wing span	16.33 m	16.33 m
Seats	2	2
Empty weight	560 kg	568 kg
MTOM	770 kg	770 kg
Payload	210 kg	202 kg
Fuel capacity (standard-/ long range tank)	55 lt/ 79 lt	55 lt/ 79 lt


Interface PC behind the seats
Small monitor for science instrument control.
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Position, attitude control and knowledge

- **Key challenge is to keep track of timestamping and location coordinates**
- **Used the Aircraft's Inertial Measurement Unit and a separate GPS for timestamping instrument data.**
  - **instrument's GPS Antenna outside the pod**
- **Aircraft inertial measurement unit determines attitude (pitch, roll and yaw) as well as other motion dynamic parameters (e.g. height, latitude, longitude, speed, course etc).**
  - **Attitude accuracy needs to be matched**

- Payload relatively easily secured with common fixings.
- Straps, cable ties, and non-slip nylock nuts used to fit a payload to the plywood.


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Thermal cameras look downwards from the Aircraft's Pod.


ECO-Dimona HK 36 TTC
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POD
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Flight Issues

- Problems
  - Integration of PC system to external network
  - Response of system to power reset
  - Experience of operational crew to light aircraft flight
- Not problems
  - Vibration
  - Cooling (=>defocus)
  - Wind buffeting
- Generally an easy ride

Lessons Learnt

- **Service provider has to understand all the requirements very clearly**
- **Be clear how much flight time is needed to achieve goals (and allow for weather)**
- **Need full understanding of attitude reconstruction**
- **Ground rehearsals of the a/c experiment sequence would save actual flight time and iron-out problems**