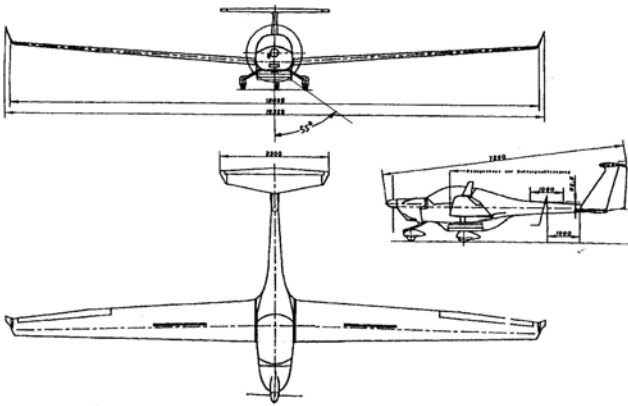


ECO-Dimona

(VH-EOS & VH-OBS)



Airborne Research Australia



Flinders University, Adelaide

Environmental Research

Aircraft specifications

Aircraft Type	HK 36 TTC ECO-Dimona	2 available: VH-EOS & VH-OBS
Manufacturer	Diamond Aircraft Austria and Canada	
Dimensions	<ul style="list-style-type: none"> • Length: 7.28m • Height: 1.80m • Wingspan: 16.33m 	
Powerplant	<ul style="list-style-type: none"> • Rotax 914S, turbocharged, 115HP, constant speed propellor • preferred fuel is Premium Unleaded petrol, but can also use AVGAS 	
Max Take-off weight	930kg	
Empty weight	636kg	
Payload	<ul style="list-style-type: none"> • 294kg total • 120kg typical scientific payload 	incl. crew, fuel, instrumentation
Certification etc.	<ul style="list-style-type: none"> • Day and Night VFR operations • No cloud flying • Restricted Category 	
Crew	1 or 2 (typically pilot/scientist + scientist)	
Cruising speed range	<ul style="list-style-type: none"> • 50 – 110kts • 92 – 203km/h • 25 – 55m/s 	
Endurance / Range	<ul style="list-style-type: none"> • 4 – 8hrs depending on power setting and flight profile • 800 – 1,500km / 400 – 700NM depending on power setting 	with standard fuel tanks
Ceiling	<ul style="list-style-type: none"> • above 6,000m / 18,000ft (with breathing oxygen for crew – cabin not pressurised) • normal ceiling without breathing oxygen: 3,000m / 10,000ft 	
Special characteristics	<ul style="list-style-type: none"> • Extended operations over water possible, but if outside of gliding distance from land (based on glide ration of 1:20) require carriage of special equipment (lifejackets, liferaft, flares, emergency locator beacon, other survival equipment). • Maximum scientific payload AND maximum endurance can only be realised when operated single seated (pilot only, no additional operator). • Operations from sealed and unsealed runways (>500m in length) • For detailed flight options, contact operator. 	
Electrical power	<ul style="list-style-type: none"> • 28VDC, 12VDC, 240VAC with total of 1kVA • for instrumentation requiring power of more than 100W on any supply, confirm with operator 	
Aircraft avionics	<ul style="list-style-type: none"> • Garmin GNS430 GPS Moving Map navigation system (including VOR/ILS with markers) • slaved HSI-system • 2 VHF communications transceivers • Stereo intercom • Transponder Mode C 	
Special features	<ul style="list-style-type: none"> • 2 underwing pods (max 55kg each) – suitable to carry 19" rack mounted instruments • room for approximately 30kg of instrumentation in luggage rack in cockpit (plus 80kg in r/h seat/footpace, if operated with one crew only) • custom-designed r/h operator's console in cockpit (no flight instruments – enhanced forward vision – foldable large data screen) • optionally no flight controls on r/h seat (more work space for operator) • fittings for scientific instruments at wingtip (light-weight only) 	

Standard Instrumentation – Aircraft Parameters

Instrument	Parameter(s)	Range	Resolution	Accuracy	Comments
Trimble TANS Vector GPS	time	UTC	1ms 1Hz	1ns	using 1s-pulse
	position/altitude(lat/lon)	global	1m 1Hz	5..20m	better with differential correction
	ground speed (3-D)	0..200m/s	0.1m/s 1Hz	0.1m/s	better with differential correction
	attitude (pitch, roll, heading)	0..60° 0..360°	0.1° 10Hz	0.1°	
Novatel 12-channel GPS	time	UTC	1ms 10Hz	1ns	using 1s-pulse
	position/altitude(lat/lon)	global	1m 10Hz	5..20m	better with differential correction
	3-D ground speed	0..200m/s	0.1m/s 10Hz	0.1m/s	better with differential correction
Rockwell-Collins AHS-85 (in r/h wingpod)	attitude (pitch, roll, heading)	0..60° 0..360°	0.1° 52Hz	0.1°	
	angular rates (pitch rate, roll rate, yaw rate)		0.1° 52Hz		
	3-D accelerations				
King KRA10 radar altimeter	height above ground or water	5-800m	0.1m 10Hz	1..5m	depending on underlying surface and aircraft attitude
Radio transmission indicator	periods of transmissions on aircraft's VHF transceivers		50Hz		

Standard Instrumentation – Atmospheric Parameters

Instrument	Parameter(s)	Range	Resolution	Accuracy	Comments
BATprobe with FUST (mounted under r/h wing)	flow angles (angles of attack and sideslip)	±30°	0.02° 50Hz	0.1°	
	indicated and true airspeed	10..80m/s	0.1m/s 50Hz	0.2m/s	
	static pressure	1100..400hPa	0.1hPa 50Hz	0.5hPa	
	air temperature	-50..+100°C	0.1° 50Hz	0.5°	
	3-D accelerations	±1.5g	0.001g 50Hz	0.01g	
	3-D wind and turbulence	0..100m/s	0.02m/s 50Hz	0.1m/s	
	turbulent fluxes	sensible heat flux latent heat flux (evaporation) – using LiCor 7500 for humidity CO ₂ flux – using LiCor 7500 for CO ₂ momentum flux			
LiCor 7500 open-path IR-gas analyser (mounted under r/h wing)	water vapour		20Hz		
	CO ₂ concentration		20Hz		
MeteoLabor TP4 dewpoint mirror (in r/h wing pod)	air temperature	-50..+100°C	0.1° 10Hz	0.5°	thermocouple
	dew point	-50..+50°C	0..1° 10Hz	0.5°	

Standard Instrumentation – Remote Sensing

Instrument	Parameter(s)	Sensor resolution	Best ground resolution	Comments
TSL5 AWI/ARA Tri-spectral line scanner	red, green, blue, near-IR, ndvi	2048 pixels 3 channels	0.7m	
FLIRTS SC60 IR-imager	IR-surface temperature	640 x 480 pixels 0.08K resolution ±2K absolute	depends on flying altitude	spectral range 7.5 to 13µm
PLMR Polarised Low-Frequency Microwave Radiometer	soil moisture in the root zone (~10cm depth) sea surface salinity	6 beams across track at 17° viewing angle (push-broom)	depends on flying altitude; 50m at 150m flying height	in combination with IR-imager
3-CCD digital video camera	progressive scan digital video	720 x 576 PAL		
Digital still camera		11.1 Mega-pixels		Canon EOS 1D-S
2 and 3-band VegMeters	irradiances (upwelling or downwelling) 630, 780, 830nm		<0.1m	viewing angle 2°
fwd-looking lipstick video camera		720 x 576 PAL		
Riegl LMS-Q140i Laser Scanner	height of underlying terrain		1m horizontal 0.02m vertical	acquisition of LMS-Q280i planned

Standard Instrumentation – Data Systems

System	Capabilities	Comments
Central system	Several PC/104-based real-time systems	

Other Instrumentation available for VH-EOS

Instrument	Parameter(s)	Range	Resolution	Accuracy	Comments
2nd BATprobe with FUST	same parameters as 1 st BATprobe				mounted under the other wing
Honeywell LaserNav INS	attitude (pitch, roll, heading)	0..60° 0..360°	0.1° 52Hz	0.1°	
	angular rates (pitch rate, roll rate, yaw rate)		0.1° 52Hz		
	3-D accelerations				
	3-D inertial position (lat/lon/alt)				
LiCor 6262 closed-path IR gas analyser	water vapour				
	CO ₂ concentration				
LiCor 6251 closed-path IR gas analyser	CO ₂ concentration				
PSI Ozone analyser	Ozone concentration	2ppb..1ppm	1ppb 4s	1..2ppb	UV absorption
MetAir NOxTOy 6-channel Luminol-detector with CrO3- and Mo-converters	NO ₂ , NO _x , NO _y , HNO ₃ , PAN, O _x	0.5..500ppb	0.1ppb 1..5s	0.5ppb	currently not operational
TSI particle counter	CNC, LPC				
Monitor Labs gas analyser	NO, NO ₂ , NO _x				chemiluminescence
Monitor Labs gas analyser	SO ₂				fluorescence
TECO 48 gas analyser	CO				gas filter correlation
MRI Nephelometer	backscatter				
Horiba gas analyser	CH ₄ , NMHC				FID selective oxidation
Eppley hemispheric radiometers	up- and downwelling solar and terrestrial radiation				PIR, PSP
Net radiometer					
Heimann KT15	IR-surface temperature	-20..100°C	0.1°	0.5°	4° viewing angle

Instrumentation for ECO-Dimona available from international partners

A wide range of additional instruments and sensor systems is available through ARA's international partners. These instruments and systems can easily be fitted to the ECO-Dimona and are available to the users of the aircraft. For some of the sensors, special conditions exist – as listed. Some of the instruments would require an operator from the collaborating institution to participate in the measurements.

The partners include

- Forschungszentrum Jülich, Germany (FZJ)
- Forschungszentrum Karlsruhe, Germany (FZK)
- Hochschule Anhalt, Germany
- MetAir AG, Switzerland
- NOAA, ATDD Oak Ridge/Tenn., USA
- Paul-Scherer-Institute, Switzerland (PSI)
- UMIST – University of Manchester, Institute of Science and Technology, Manchester, UK
- University of Wales, Aberystwyth, UK
- York University, Toronto, Canada

Third-Party Instrumentation – Remote Sensing

Instrument	Parameter(s)	Sensor resolution	Best ground resolution	Comments
hyper-spectral imager Specim AISA+				see http://www.specim.fi/products-aisa-aisa+.html Owned by L Bannehr, Hochschule Anhalt
Aerosol Lidar				under developmen at York University (J Whiteway)

Third-Party Instrumentation – Air Chemistry/Pollution

Instrument	Parameter(s)	Range	Resolution	Accuracy	Comments
AirMotec gas-chromatograph HC-1010 (modified by MetAir)	speciated hydrocarbons (C ₄ ...C ₁₀) see list below	10ppt...10ppb	10ppt	10ppt/50ppt or 20%	
AeroLaser AL-5003 gas analyser (modified by MetAir)	CO	2ppb..5ppm	1ppb 10Hz	1..2ppb	vacuum UV-fluorescence
Gas analyser (Junkermann, IFU-IMK)	Peroxides (H ₂ O ₂ and organic)	0.1..20ppb	50ppt 10s	0.1..0.5ppb	enzymatic fluorometry; owned by PSI
AeroLaser gas analyser	Formaldehyde (HCHO)				owned by PSI
Scintrex LOZ-3	Ozone	1ppb..1ppm	0.1ppb 10Hz	10ppb	
Fluorimeter	CH ₂ O		90s		
Manual sampling of up to 12 glass flasks					
Automatic sampling units for VOCs, biogenic VOCs, SF₆, etc.					

Third-Party Instrumentation – Aerosol / Particles / Radiation

(owned by IMU-FZK or MetAir)

Instrument	Parameter(s)	Range	Resolution	Accuracy	Comments
TSI Condensation Nuclei Counter	aerosols (>10nm)	0..10,000cm ⁻³	1cm ⁻³ /1s	1/10cm ⁻³	
TSI 3010	condensation nuclei	>0.01..3µm	1s		
MetOne 4903 Laser particle counter	aerosols (number)	>0.3µ >0.5µ 0..150cm ⁻³	2s 1cm ⁻³	1/10cm ⁻³	2 channels
15-channel aerosol spectrometer	aerosols (size distribution)	>0.3µ..20µm			
FSSP 100	aerosols (size distribution)		6s		20-40 channels
nano SMPS	submicron aerosol size distribution				
TSI 3563 Nephelometer	backscatter coefficient	450, 550, 700nm	6s		
Schmitt Actinic Spectroradiometer		290..600nm	2s		up- and downwelling
7 channel Magee Aethalometer	optical properties				see http://www.mageesci.com/

List of substances identified by MetAir/airmotec gaschromatography

short	name:	remarks
i4	isobutane	ev. coeluting with acetaldehyde
n4	n-butane	coeluting with 1-butene and probably with isobutene
tn4en	t-2-butene	tentative identification
cn4en	c-2-butene	tentative identification
i5	isopentane	
ace	acetone	coeluting with n-pentene, see below
n5	n-pentane	coeluting with 2-me-1-butene, n-pentane main component
ipe	Isopren	coeluting with trans-2-pentene, see below
cn5en	c-2-pentene	
cp	cyclopentane	coeluting with 2.3-dimethyl-butane
2mp	2-methyl-pentane	
3mp	3-methyl-pentane	coeluting with unknown, ev . secondary component
n6	n-hexane	
mcp	methylcyclopentane	coeluting with 2.4-dimethyl-pentane
bz	benzene	
cn6	cyclohexane	
2mh	2-methyl-hexane	coeluting with 2.3-dimethyl-pentane
3mh	3-methyl-hexane	
i8	isooctane	or 2.2.4-trimethyl-pentane
n7	n-heptane	
mch	methylcyclohexane	
tol	toluene	
2mn7	2-methyl-heptane	probably coeluting with 4-methyl-heptane
3mn7	3-methyl-heptane	
n8	n-octane	
ebz	ethylbenzene	
mpx	m&p-xylene	m&p-xylene coeluting
sty	styrene	
ox	o-xylene	
n9	n-nonane	
cum	cumene	or isopropyl-benzene
ap	a-pinene	
pbz	n-propylbenzene	coeluting with unknown, ev . secondary component
met	m&p-ethyltoluene	m&p-ethyltoluene coeluting
135	135-trimethylbenzene	
oet	o-ethyltoluene	partly coeluting with unknown, ev . secondary component
124	124-trimethylbenzene	ev. coeluting with unknown, ev . secondary component
n10	n-decane	
123	123-trimethylbenzene	