

# **DLR's Falcon 20-E5, D-CMET – a part of the DEEPWAVE-project**

DLR Flight Experiments  
Flight Facility Oberpfaffenhofen

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Knowledge for Tomorrow

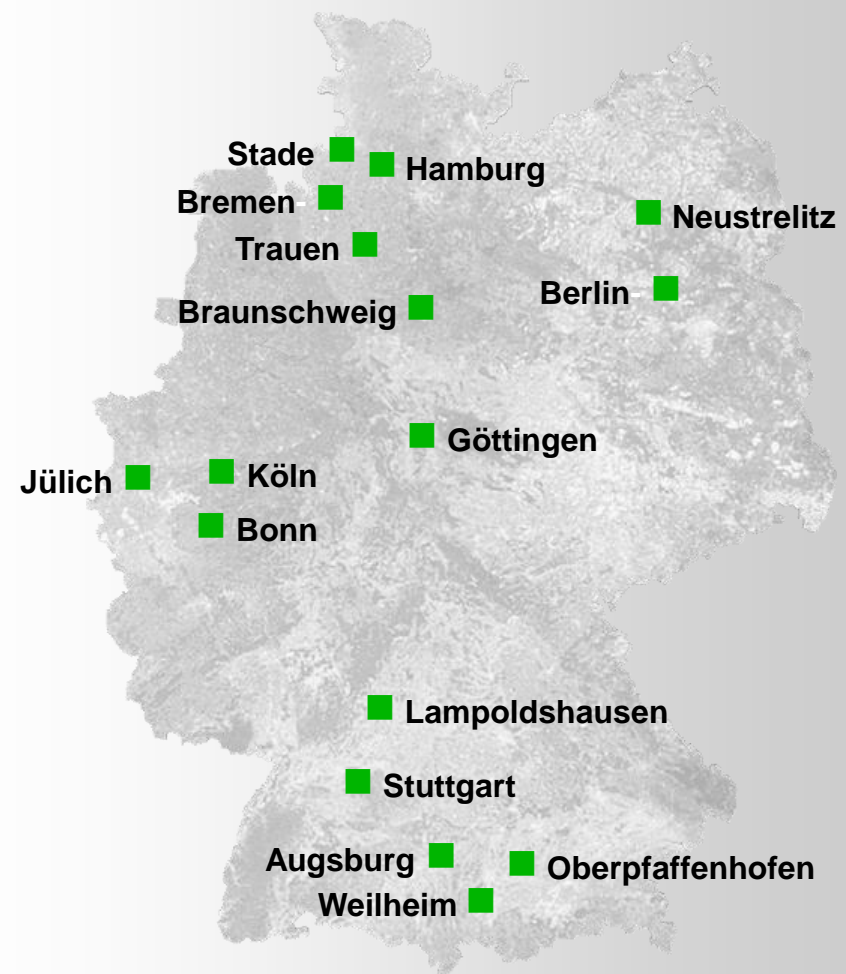


# DLR - Sites and employees

DLR is Germany's national research center for aeronautics and space. Its extensive research and development work in aeronautics, space, transportation and energy is integrated into national and international cooperative ventures.

Approx. 7400 employees working in 29 research institutes and facilities at 16 sites.

Offices in Brussels, Paris and Washington.



# Flight Facility Oberpfaffenhofen

- currently about 35 persons plus freelancers and contractors
- special use airport Oberpfaffenhofen (EDMO) (IFR CAT I), runway 1947 ft
- 2 hangars
- offices, laboratories, also for external users
- ground support equipment
- avionics and mechanical workshop
- data processing systems
- calibration equipment (pressure, humidity, temperature)
- climate chamber (-70 °C, 0 mbar)





# Flight Facility Oberpfaffenhofen



Falcon 20-E5  
D-CMET

Do228-212  
D-CFFU

Cessna C208B  
D-FDLR

G550  
D-ADLR

DLR Flight Experiments are Europe's biggest civil operator of research aircraft for atmospheric research and earth observation. Currently at Oberpfaffenhofen a fleet of four highly modified aircraft are being operated worldwide for a number of science organisations, universities, agencies and companies.



# Certification of instruments / modifications

DLR has the approval to perform in its design organisation small modifications independently and big modifications in colaboration with the German Luftfahrtbundesamt according to EASA part 21 (national). DLR's aircraft are Annex-II aircraft and therefore under national control.

Since 1968 more than 450 modifications have been done.



# Dassault Falcon 20-E5, D-CMET - modifications



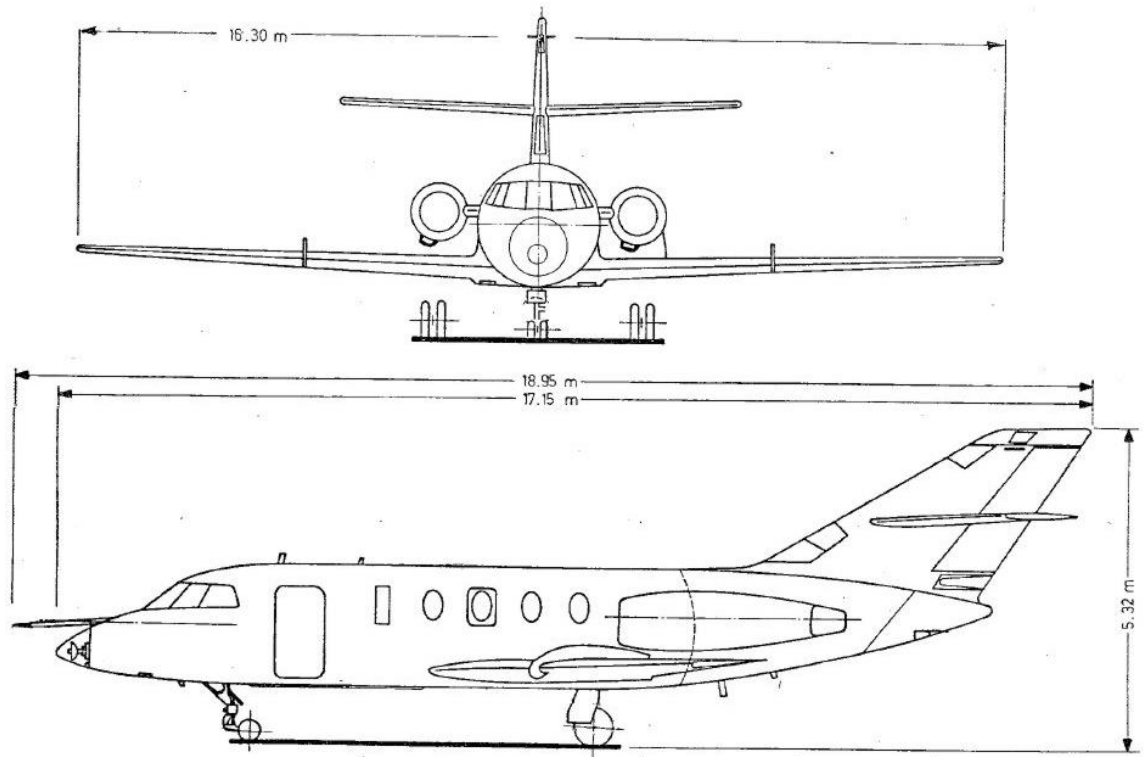
- 2 large bottom openings (515 mm)
- 4 roof openings (80 mm)
- Side opening (250x570 mm)
- Back hardpoint
- Bottom hardpoint
- Underwing hardpoint (4x) – not in use for DEEPWAVE
- Noseboom with flow angle sensor
- Basic sensor system
- Data acquisition+quicklook system
- Optional dropsonde release station





# Falcon 20-E5, D-CMET

MTOW: 13,755 t  
wingspan: 16.3 m / 53.5 ft  
length: 18,95 m / 62.2 ft  
height: 5,32 m / 17.5 ft



# Falcon 20-E5, D-CMET

## Basic instrumentation and communication

- Set of basic meteorological data and aircraft position
- VHF, UHF, HF
- Iridium and Inmarsat
- EFIS
- Turbulence weather radar
- Radio altimeter
- EGPWS
- GPS, VLF-Omega, LORAN-C
- IRS (Honeywell Laserref)
- NDB 2
- VOR/DME
- Mode-S Transponder
- RVSM-approved
- **not ADS-B equipped**





# The aircraft as platform for user-specific experimental installations



Falcon before experiment installation



Falcon after experiment installation



## **Falcon 20-E5, D-CMET – flight crew**

- max. 6 POB:
- 2 pilots
- 1 aircraft mechanic
- up to 3 instrument operators

All DLR pilots hold professional pilots' licenses and are experienced in execution of research flights. All of them have JAR licenses.

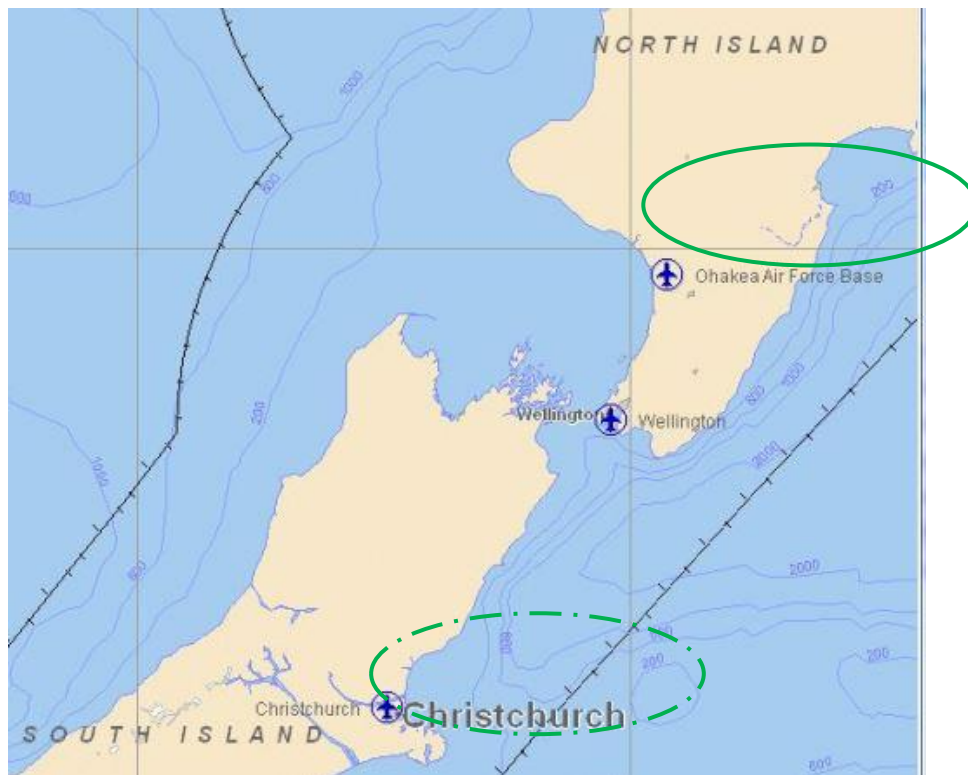
## **Falcon 20-E5, D-CMET – team**

- Approx. 15-20 persons:
- 2 pilots, 1 aircraft mechanic (DLR-FX)
- 1 person operations, 2 of sensor & data team (DLR-FX)
- 9 + x instrument operators, scientists, technicians from DLR-IPA



# Airport(s) of operation

- Main base for D-CMET: Ohakea Air Force Base (NZOH) – **tbc!**
- Fuel stops, eventually customs clearance: Christchurch (NZCH) – **currently Christchurch as main base of operation being discussed, critical issue is hangar (lidar)**





# Airport(s) of operation - team

## Ohakea:

2 pilots, 1 aircraft mechanic, 2 sensor and data team

1 of operations (partly) ?

X technicians / scientists / forecaster

## Christchurch:

Scientific project leader: Dr. Andreas Dörnbrack

operations (partly) ?

X scientists / forecaster



# DEEPWAVE –June/July 2014 – Falcon contribution

## planned schedule:

- 10 - 13 June: latest time window for aircraft installation, ground and flight test (EDMO)
- 17 – 22 June: transfer flight Oberpfaffenhofen (EDMO) – Ohakea  
(including extra measurement flight on the way)
- 23 June: preparation for measurement flights at NZ
- 24 June – 12 July: measurement flights for DEEPWAVE**
- 13 July: preparation of transfer back to EDMO
- 14 – 19 July: transfer Ohakea – EDMO  
(including extra measurement flight on the way)
- 21 - 23 July: de-installation of instruments at EDMO



## Falcon measurement flights:

- available flight hours: ~60 hours block time
- Max. duration of a flight: 3:30 – 4 hrs
- Ohakea -> Christchurch: approx. 00:45 hrs
- sometimes 2 flights per day/night (depending on requirement to fuel at Christchurch / location and setup of measurement flight)
- Flights possible during day and night

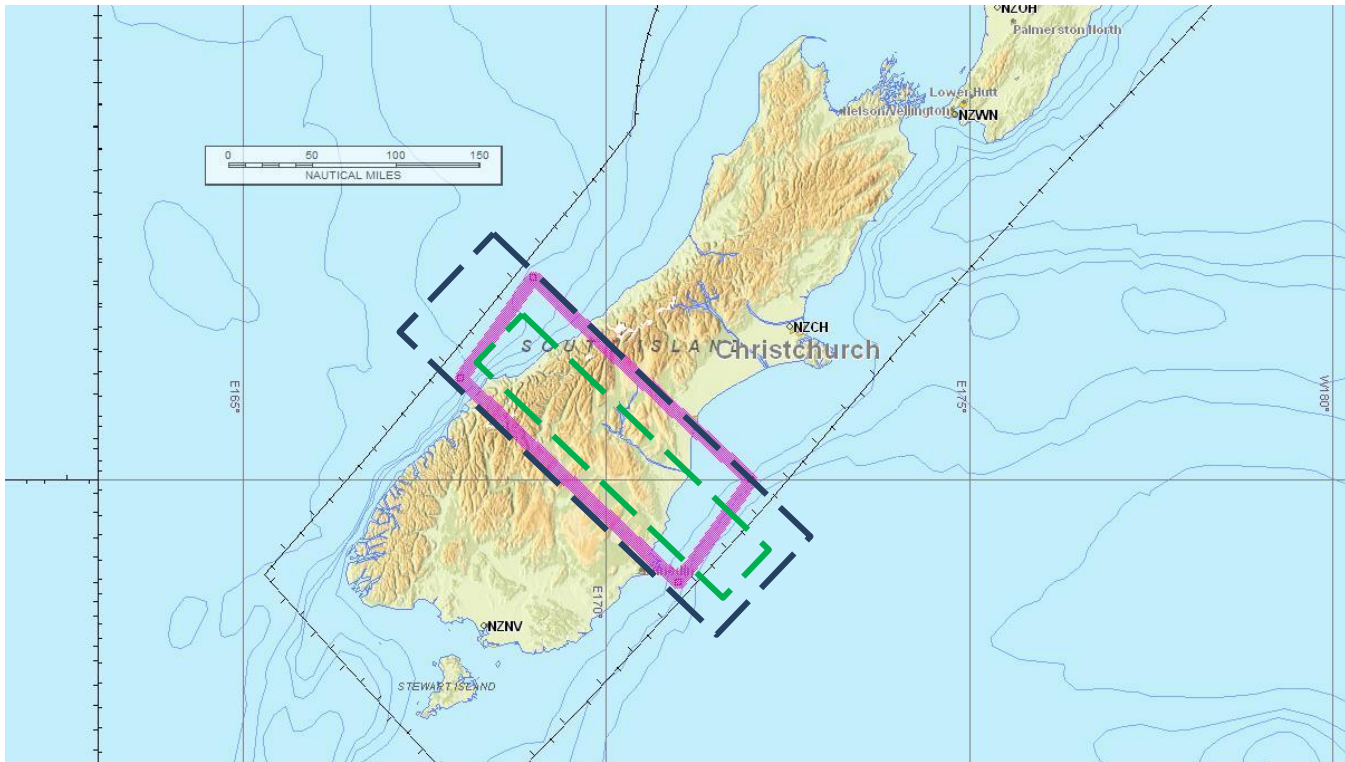




## Falcon measurement flights:

rectangular or triangle pattern, variable size, some examples plotted in the map below

FL270 – FL350



## Falcon 20-E5, required infrastructure at main base of operation (Ohakea?)

- Hangar
- Offices with telephone/fax and internet access for 15-20 persons, preferably one small office for data processing (noisy old file system)
- Storage room for boxes and equipment
- Accomodation for 15-20 persons
- Place for 1(-2) 20-feet sea-containers
- Access to offices/hangar/aircraft 24/7
- Fuel: Jet A1
- NOTAMS, weather briefing, FPL submittance
- Payment mode for hangar, offices, communication, fuel, landing fees, etc?



## **Falcon 20-E5, infrastructure at Christchurch (only fuel stops?)**

- Office space with telephone/fax and internet access for 1-3 persons
- Accommodation for 1-3 persons
- Fuel: Jet A1
- NOTAMS, weather briefing, FPL submittance
- Payment mode for offices, communication, fuel, landing fees, etc?





## Falcon 20-E5, power supply

D-CMET doesn't need a GPU for aircraft starting. However, the scientists need power on the aircraft when working in the cabin on ground, mainly in the hangar, eventually outside before/after a flight.

For outside use we may bring our own diesel/Jet A1 powered 28VDC GPU (sea freight container) – to Ohakea or rent locally, if available (important for Christchurch).

For use inside the hangar we ask for power supply, the **Falcon requires 28VDC @ 40 Amps**. As we are using 400VAC 3phase @ 50Hz in Germany it doesn't make any sense to bring our own inside ground power unit.

**What kind of high voltage current supply will be available in the hangar?**

plug to the aircraft:

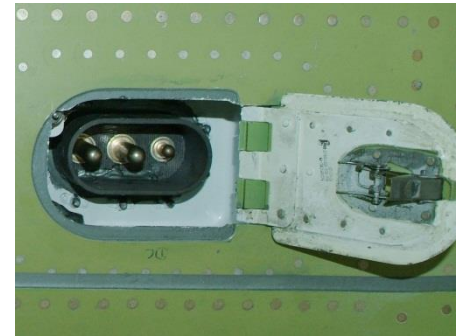
standard 28V DC Connector per MIL 7974D / ISO 461 -2 (Style 1B, page 3)

15 kVA (500A @ 28VDC continuous - 1200A for aircraft start)



## Falcon 20-E5, power supply

- ground power:
  - 28VDC 500A continuous power, 1200A for engine start
- standard 28Volt DC external power recepticle



external power recepticle

- for use of DLR's ground power: 400V@50Hz 3Phase  
32Amp



32 Amps 3phase 400 V plug



32 Amps 3phase 400 V receptible



# DEEPWAVE – June/July 2014 – questions

- customs clearance at Christchurch?
- ground support for D-CMET at Christchurch? (GPU, handling etc.)
- hangar for D-CMET at Christchurch (may be available during daytime, NOT at night, according to current knowledge)
- handling / payment for fees and fuel at Christchurch and Ohakea
- transfer route via Lucknow or Muscat? (no influence on arrival at NZ)
- DLR-team at Christchurch – persons, travel dates

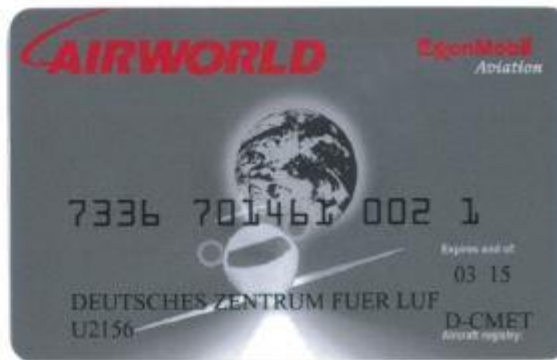




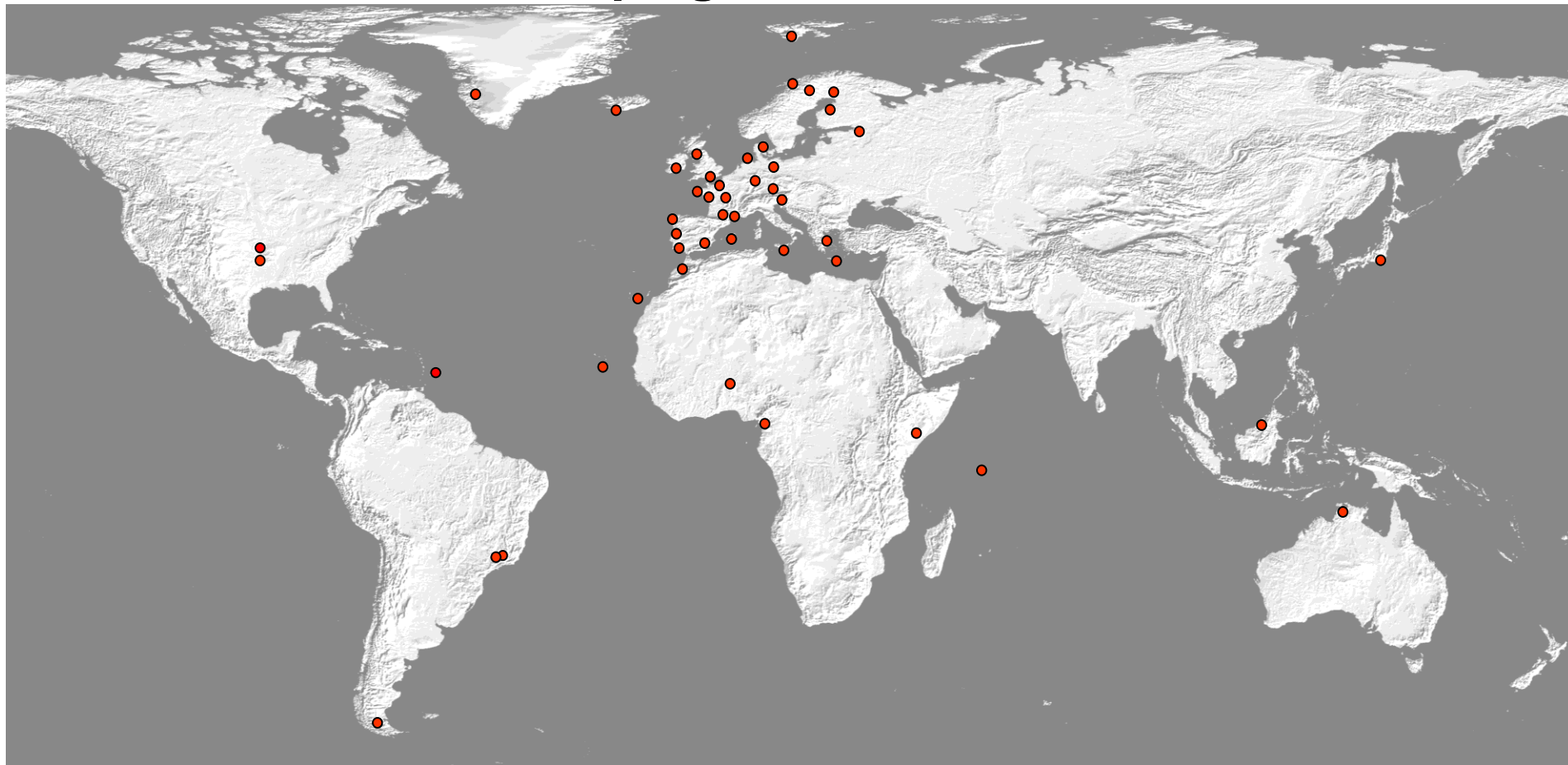
## Falcon 20-E5, fuel

required: Jet A1

DLR has fuel carnets of Airworld/Exxon Mobil, Shell, AirBP, Multiservice and company credit cards (VISA, Master)



# Selection of Falcon campaigns



ACSYS, ACSYS II, ADM I + II, AERO-CONTRAIL1-2, AEROIMPACT, AFO 2000, Airbus – Toulouse, AMMA, ANASTASIA, APE THESEO, ASTAR, A-TOAST, AWIATOR, ASUR, BASIS, CAATER, CAMEL, CIRRUS, CIRRUS 94, CLARE, CLEOPATRA, CONTRACE, CONTRAIL 1-10, CONTRAILS, DRAMAC, EFEDA, ELITE, ESCOMPTE, EUCREX, EUCREX 2, EUPLEX, EuroSOLVE, Flugzeug Immission, FRAMZY, FETCH, HIMSPEC 1+2, H2O, HRSC / MARS 96, IHOP, INCA 1 + 2, ITOP, KORRIDOR, LACE, LOFZY, Luftverkehr und Umwelt, MAP, METEOSAT, METEX, MINOS, PAZI, PAUR 96, POLECAT96+97, POLARCAT, POLINAT95+97, POLSTAR, POLSTAR 2, SALTRACE, SAMUM I + II, Schadstoffe in der Luftfahrt, SCOUT, SESAME 1-3, SHIPS, SHIVA, STAAARTE 98, STAAARTE, STAIRSS, SULFUR 1-6, SUMAS, THOMAS, THORPEX-IPY, T-PARC, TROCCINOX 1 + 2, TROPOSAT/SCAVEX, UFA-EXPORT, VAP / SCIA, Vulkanasche, 500 GHz Arctic Campaign

## Recent highlights

### 2010: Falcon flew during eruption of Eyjafjallajökull

17 flights im between 19 April - 18. May 2010



19 April:

TV teams in front of the Falcon hangar



Iceland: above the ash cloud



ILA 2010: the German Minister of Transport together with DLR pilot

### Nov/Dec 2011:

Campaign SHIVA, deployment in Miri (Borneo, Malaysia) for about 5 weeks, combined with measurements from research vessel „Sonne“, joint European-Malayan project



## **May/June 2012:**

Campaign DC-3, deployment in Salina, KS (USA), joint campaigning with NCAR and NASA

## **June/July 2013:**

Campaigns VOLCATS and SALTRACE, deployment in Sal, Cabo Verde and Barbados. Investigation of dust transport from the Sahara over the Atlantic to the Caribbean

