

DOE Research Aircraft Facility

What it takes to carry out
a field campaign.

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Purpose

- To improve planning for future field campaigns by having more investigators be aware of what needs to be done to conduct a field campaign with the Gulfstream I.



Stages of a Field Campaign

- Pre-campaign activities
- Deployment to field site
- Conduct of the campaign
- Post-campaign activities



Pre-Field Campaign Activities

- Submit Request for Aircraft Support
 - form is available as WORD97 or pdf at http://www.pnl.gov/atmos_sciences/as_g1_2.html
 - gives pertinent information for designing and planning the field campaign
 - geographic area
 - instruments
 - time frame
 - logistical support
 - flight patterns
 - meteorology
 - 6 month lead preferred; earlier is better
 - completion is an iterative process



Select Airport

- Criteria for selecting an airport as base of Gulfstream I (G-1) operations
 - distance from area of operations
 - runway length >5,000 ft
 - jet fuel and ground support equipment
 - ground electrical power access
 - office/lab space and hangar availability



Instrumentation on the G-1

- Specified by mix of investigators, driven by scientific questions to be answered
- Request for Aircraft Support form gives
 - **weight** - affects total payload including fuel
 - **power** - total limited to 4 KVA AC
 - **inlet** - where to locate, special needs
 - **rack/floor space** - where to locate
 - **calibration** - need for lab space, supplies
 - **data acquisition** - A/D I/O channels



Contracting for Services

- **Aircraft support:** fuel, GPU, hangar, parking, flight planning, shore power
- **Staff support:** office/lab space, telephone/Internet, airport access, air conditioning, office furniture, living quarters, vehicles
- FBO at airport is main point of contact



FAA Coordination

- Contact with local FAA Air Traffic Control managers early to describe goals of project and required access to air space
- Follow up with detailed flight plans for ATC review and comment
- Meet with ATC personnel one month prior to deployment to review flight plans, local obstruction maps, and restricted flight areas



Aircraft Preparation

- Instrument installation
 - installation at PNNL preferred
 - coordinated with collaborators
 - sequence determined by location and other factors
 - interface to data acquisition system
 - pre-deployment calibration
 - calculate aircraft weight / balance
- Preventive maintenance up-to-date



Test Flight

- After successful ground operation of all instruments and aircraft systems
- At least one week prior to scheduled deployment
- Allows time for required adjustments to instruments and systems
- In-flight and post-flight analysis of data to confirm proper operation



Deployment to the Field

- **Shipping:** ~1 week prior to deployment
 - equipment needed at base of operations
 - spare parts for aircraft and instruments
 - computers, calibration gases, supplies
- **Advance team:** ~3 days prior to deployment
 - take possession of shipped items
 - check on status of contracted services
 - organize office and lab space
 - configure computers and networking



Deployment to the Field

- Aircraft departure from PNNL
 - equipment loaded day before
 - all inlets/openings sealed for pressurized flight
 - calculate weight / balance
 - flight plans filed to destination
 - early morning departure for field study location
 - less than 10 hour transit time to any location in lower 48 states



Deployment to the Field

- Final aircraft configuration
 - unload equipment & supplies
 - install remaining instruments
 - test instrument and data systems
 - configure data system and display
 - calculate weight / balance
- Test flight to check all systems
 - prior to routine research flights or inter-aircraft comparisons



Daily Flight Operations

- Pre-flight activities
 - science team - flight day / time / pattern decision, often afternoon before flight
 - pilots - FAA flight plan, aircraft systems, navigation computer way-points
 - instrument collaborators - pre-flight checks & calibrations; GPS systems
 - flight crew - on board 15 minutes prior to scheduled departure



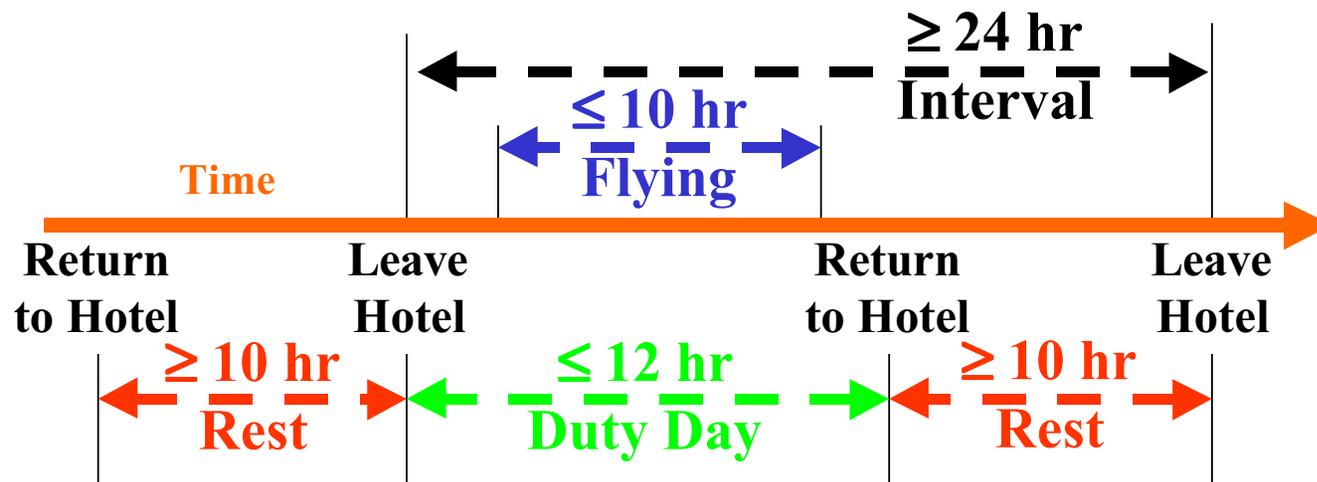
Daily Flight Operations

- Ground activities
 - **ground crew**: shore power, wheel chocks, GPU, air conditioner, base GPS
- In-flight activities
 - **pilots**: control aircraft, communicate with ATC, coordinate flight plan changes with ATC, navigate to way-points
 - **scientific crew**: operate power distribution and data acquisition systems; operate individual instruments; monitor instrument performance and output



Pilot Duty Time

- Duty time limits are vital for safe operation
 - Compensatory additional rest prior to next flight if duty time is exceeded
 - Scientific crew can benefit from similar duty time limits



Daily Flight Operations

- Post-flight activities
 - **pilots**: aircraft systems check, squawk list, preventive maintenance
 - **instrumentalists**: device shut-down, required calibrations, maintenance
 - **scientific crew**: download DAS, GPS, and other data to surface computers
 - **science team**: debrief flight, review day's data, plan next day's flights



Post-Campaign Activities

- Ship equipment back to PNNL and other destinations
- Aircraft preventive maintenance
 - calendar and hour use driven
 - squawks addressed and rectified
 - local and off-site maintenance
- Instruments
 - post-campaign calibrations, repairs



Post-Campaign Activities

- Data processing
 - convert from engineering to physical units using final calibrations
 - synchronize time on data sets
 - process base and aircraft GPS data
 - calculate derived quantities
 - create data tables for all variables
 - distribute data sets



Cost of Field Campaign

- Pre-campaign preparation -
 - labor for pilots and technical team to prepare, install, and test instruments
 - travel to check out airports, meet with FAA ATC, science planning meetings
 - expenses for offsite calibrations, shipping, expendable supplies



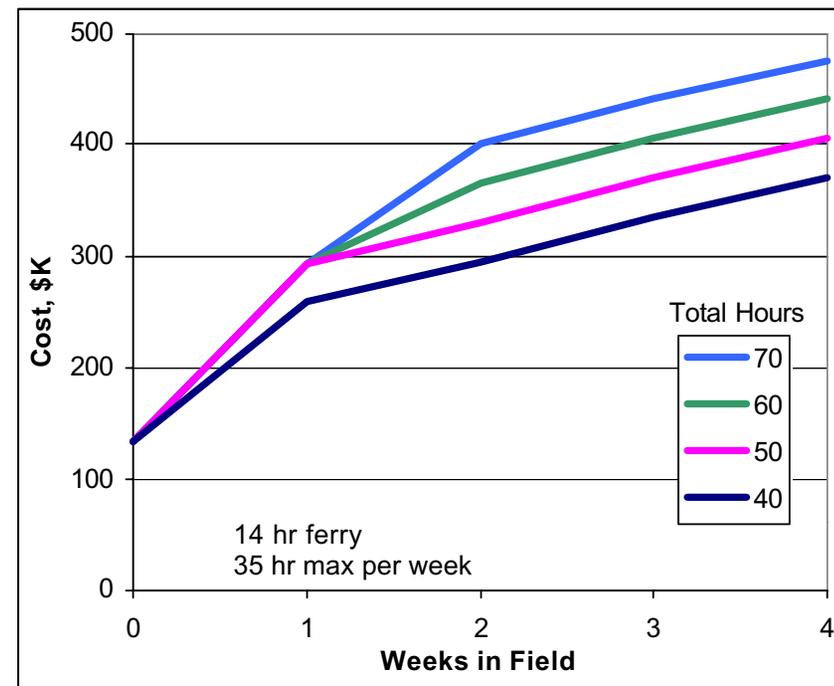
Cost of Field Campaign

- Field campaign -
 - labor & living expenses for flight and scientific crew including air fares and rental cars
 - expenses for fuel/oil, aircraft usage, office/lab space & furniture, hangar, landing fees, GPU, telephones, air conditioners, utilities
- Post-campaign -
 - labor for data processing and distribution
 - shipping of equipment and supplies
 - instrument repair and calibration
 - aircraft maintenance



Cost of Field Campaign

- Pre- & post-campaign costs set intercept
- Slope depends on
 - Aircraft / fuel cost
 - Logistics cost
 - Labor cost
 - Per diem
 - Travel/airfare



Status of the G-1

- Engines are performing at or above rated
- Left propeller overhauled by Battelle
- Corrosion within allowable tolerances
- Power distribution system moved forward; obsolete wiring removed
- New 110 VAC belly plug rated at 30 amp
- Use of air exhaust scoops and internal cowling reduced cabin heat load



Locations of Projects Using the G-1

