

C-130 Investigators Handbook

Chapter 8. New Feasibility & Instrumentation Integration Procedures

8.1 Instrument Certification and Approval

With the recent changes to the NSF and OFAP review processes and the changing nature of the processes for approving research instrumentation payloads - specifically on the G-V, the RAF will be using some new procedures for preparing feasibility reviews and for controlling the impact of field project preparations on the facility. The two aircraft in the fleet operate under very different rules. The C-130 has been, and will continue to be, operated in the “public” category. That means that payloads can be assessed and approved for use “in-house” without consultation with the FAA - the primary criteria being compatibility with existing infrastructure and compliance with established safety concerns. Mid-project changes can be freely made at the facility’s discretion by applying the same process. While the G-V is technically a “public” aircraft, the NSF has directed the RAF to maintain the aircraft under a Standard Airworthiness Certificate. After first passing an RAF review, each payload must pass through an FAA certification process that requires very detailed documentation. This process typically takes a minimum of one month to complete, resulting in a payload that cannot undergo a “major” modification (ie external configuration change; increase in payload weight; or increase in power consumption) without going back to the FAA for approval.

The biggest impact the recent changes have had on the NSF and OFAP review processes is related to the development, delivery, and deployment of new instruments on the two aircraft. New instruments still under development are being included in requested research payloads. Field deployments have very specific deadlines and it is difficult to fully assess the airworthiness, functionality, and availability of these systems on such a time line. These new procedures will establish clear guidelines on how this issue will be handled in the feasibility review process.

The deployment schedule for each approved field project includes a very specific and limited upload interval when the entire research instrumentation payload must be installed on the aircraft. Due to various scheduling constraints only a minimal amount of pre-deployment flight testing is allotted to ready the payload for the actual deployment into the field. The new procedures will ensure that all systems included in a research payload will be ready to meet the upload and deployment schedules established for that project.

A key component of the new process will be the inclusion of annual flight test programs into the RAF schedule. These programs will be open opportunities for instrument developers to flight test their new systems without the pressure of an imminent field deployment while providing the RAF with the opportunity of evaluating and certifying each system as a routine task. The flight test programs will be

scheduled well in advance via the OFAP process and advertised within the research community.

8.1.1 New Instruments

New instruments that have never flown on any aircraft before must successfully complete a flight test sequence prior to approval for use on a field deployment. Such testing must be done to insure both the airworthiness and functionality of the instrument. PI's will be asked to denote which instruments are "required" to meet their scientific goals. "Required" sensors must complete this process at least three months prior the scheduled start of the payload integration. "Clones" of previously flown instruments will be exempted from this requirement on a case-by-case basis depending on a review of any documented differences between the two systems. Key factors that will be evaluated are: non-metallic materials; power consumption; and wiring. Sensors considered to be "optional" to the scientific goals of the experiment may delay testing until the project specific, pre-deployment flight tests ***with the clear understanding that a failure to perform satisfactorily will result in their removal from the payload prior to the field deployment.***

G-V: Participation on any flight test program on this platform requires that the instrument pass through the FAA certification process. Details on this process, including material & power/wiring constraints and design & fabrication documentation schedules can be found on the RAF web site: (www.eol.ucar.edu/raf/) under the "NSF/NCAR G-V (HIAPER)" heading. Prior certification as part of a flight test program should ensure a smooth transition to the field project certification.

C-130: For this category only, the basic requirements on materials and power/wiring constraints will be the same as the G-V. No formal FAA certification is required, but documentation on key system components must still be submitted to the RAF on the certification schedule outlined in the certification material above.

8.1.2 Instruments Previously Flown

Instruments that have successfully been flown on one of the NCAR aircraft, or any other manned research aircraft in the international fleet, will typically be exempt from the pre-upload functionality flight testing requirement. However, systems that have undergone modification since their last deployment must be re-evaluated to establish the extent of the changes. If the modifications are deemed to be significant (ie. replacement of a primary component with new technology), some form of additional flight testing may be required. Key factors that will be evaluated are: non-metallic materials; power consumption; and wiring.

G-V: Participation in any field program on this platform requires that the instrument pass through the FAA certification process. Details on this process, including material & power/wiring constraints and design & fabrication documentation schedules can be found on the RAF web site: (www.eol.ucar.edu/raf/) under the "NSF/NCAR G-V (HIAPER)" heading. Certification on another platform or by another regulatory agency on a similar platform (like the DLR "HALO" G-550) does **NOT**

transfer between platforms, but the basic documentation should be similar. The certification process, which is payload specific and not instrument or rack specific, must be completed prior to the start of sensor integration on the G-V. **Therefore, all certification documentation must be submitted to the RAF engineering staff 2 month prior to the scheduled upload. Failure to submit the required documentation by this deadline will result in the removal of this instrument from the research payload.** Instrument providers may be required to rebuild structural and electrical components or replace unsuitable materials as part of the certification process. Project specific payload flight testing will be conducted just prior to deployment to the field site.

C-130: Participation in any program on this platform only requires notification of key integration and support needs and successful completion of a structural, materials and power/wiring review by RAF staff. There are no formal documentation deadlines beyond the initial submission of the facility request, although some basic documentation will be needed for the facility records. Project specific payload flight testing will be conducted just prior to deployment to the field site.

8.2 Feasibility Review of Proposed Campaigns

The process for requesting one of the NSF/NCAR aircraft platforms in support of a scientific field project and the deadlines for filing such a request can be found on the EOL web site (www.eol.ucar.edu). Large projects with budgets exceeding \$1M require the submission of an Experimental Design Overview (*EDO*) for an advanced evaluation of the project followed up with a specific *Facility Request* for final review and allocation of resources. Projects projected to cost less than that amount only need to submit the *Facility Request*. As per standard practice, information on all User supplied equipment to be included in a specific research payload must be provided as part of the *EDO* as well as the formal request. Any special instrument integration requirements should be noted at this time. Prior to a scientific review by NSF and the OFAP panel, EOL conducts a very specific “feasibility review” to determine if the research payload is supportable and if the requested flight operations can be supported in a safe manner.

In the *EDO* and *Facility Request* feasibility review processes, field program payload requests will be evaluated on the basis of “required” versus “optional” sensors. During the interactive communications prior to the submission of a formal request for support, PI’s will be asked to denote which instruments are “required” to meet the scientific goals of their project. If a **New Instrument** (EOL or User supplied sensor) is included in the list of required instrumentation for an *EDO* and this instrument has not completed the functionality flight testing, the best response that can be provided by the review process is that the overall project is deemed to be “Provisionally Feasible”. If an EOL supplied **New Instrument** is included in a *Facility Request* and has not completed the functionality flight testing by the time of the relevant OFAP meeting, the request will be deemed to be “Unfeasible”. In the event that any User supplied **New Instrument** on the required list cannot meet the stated requirements, RAF will inform NSF that the sensor is not “airworthy” and recommend that the field

project be re-evaluated for feasibility and scientific merit with that sensor omitted from the research payload. Failure of an “optional” sensor to comply with the stated requirements would result in the removal of that system from the overall research payload.

8.3 Flight Test Opportunities

There are four flight test periods (HEFT-I & II & III & IV) currently on the RAF schedule in 2007 – 2010, one per year. These flight test opportunities are open to all NSF supported instrument developers so that they can comply with the new requirements on **New Instrument** flight testing. Space is limited and will be allocated based on system readiness and on association with an NSF funded research project. EOL plans to continue with some form of annual flight test program (ala the IDEAS programs) after 2009. Depending on community need and available intervals in the RAF deployment schedule, more than one test program may be scheduled in a particular year. The platform chosen for any specific flight test program (GV or C-130) will vary, depending upon availability. For more information on how to participate in one of these flight test program contact Dr. Jeffery Stith (stith@ucar.edu).