

Chapter 7 Feasibility & Instrumentation Integration Procedures

7.1 Instrument Certification and Approval

New instruments still under development are often 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 (see Figure 2.1 for the typical time line of field project certification, upload, test flight and deployment).

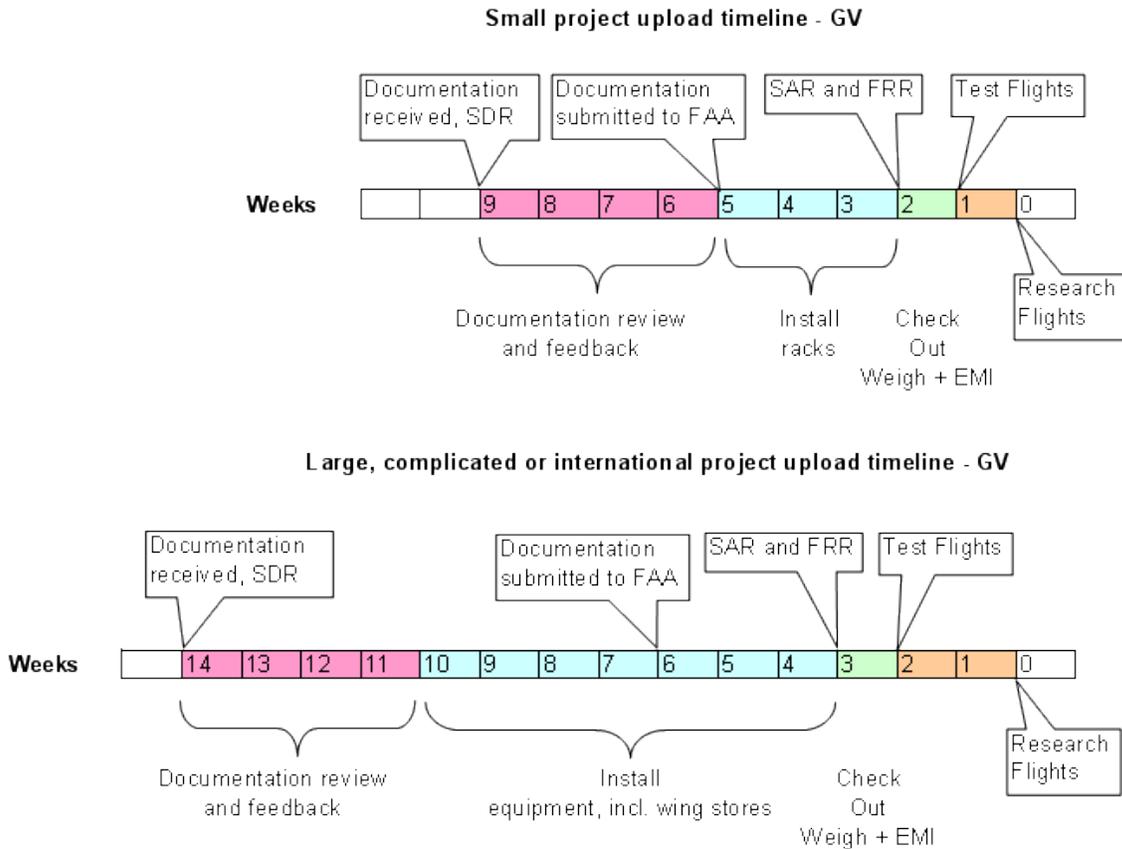


Figure 2.1: Typical time line for field project documentation, certification and review processes.

As discussed in Section 2.3, special arrangements need to be made to certify and “pre”-test these instruments prior to their inclusion in an approved research payload.

7.2 Project lifecycle reviews and payload certification

In preparation for project upload, several reviews will take place. They are: System Definition Review (SDR), System Acceptance Review (SAR) and Flight Readiness Review (FRR).

7.2.1 SDR

The SDR is to be held about a month prior to the beginning of project upload. The purpose of the SDR is to assess the status of documentation and instrument readiness for project installation with sufficient time to correct omissions and mistakes in documentations. (For equipment flown previously on the GV the documentation is needed only if the equipment has since changed). Participants in the SDR are RAF staff in consultation with the lead instrument and project PIs.

The next two milestones will take place one week before the first planned test flight. At this point the installations of equipment into the aircraft should be completed.

7.2.2 SAR

The purpose of the SAR is to assess the state of measurements from each instrument as installed on the aircraft. Instrument PIs will be asked to comment on measurements, data logging, communication with other systems, etc. and essentially provide an overview of the measurement quality at the time of the SAR. Participants in the SAR include RAF staff, instrument PIs, and the lead experiment PI.

7.2.3 FRR

The FRR will determine the airworthiness of the payload and will also be held one week prior to the first flight. The lead RAF aeronautical engineer (Mark Lord) will go through instrument installation one-by-one, and ask the RAF group heads (maintenance, technicians and pilots) if all required information (structural, materials, electrical, etc.) have been provided by the instrument PI. Instrument PIs do not participate in the FRR.

These reviews are not "pass-fail" exams but rather they are a formalized way of assessing the project preparedness status at several critical stages in the lead up to the project launch. We stress that the installations should essentially be done prior to the SAR and the FRR, and that the week between these reviews and the first test flight should only be used for minor instrument tune-ups, calibrations, etc.

Results of all reviews will be summarized and distributed to the project participants via E-mail.

7.2.4 EMI Test and safety briefing

In addition, three activities need to take place before the first test flight: the airplane must be weighed; electromagnetic interference (EMI) test conducted and all persons flying on the aircraft must attend a safety briefing. Attending an RAF safety briefing for an earlier project does not count: safety briefings are mandatory before each project.

7.3 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. 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.

Instruments that have not flown before and need to participate in a flight test sequence can satisfy that requirement by requesting a test flight sequence either as a part of the request process for a field deployment, or as a separate request for instrument flight testing (see Section 7.6, below). We recommend that proposers discuss instrument testing needs with RAF management and engineering and their NSF project officer when planning future field programs with new instrumentation.

For the purpose of approval for flight some particularly important factors are: non-metallic materials; power consumption; and wiring.

7.3.1 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 and wiring constraints, as well as design and fabrication documentation requirements can be found in Chapter 6.

7.3.2 C-130

For this category only, the basic requirements on materials and power/wiring constraints are 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. However, it is highly recommended that newly designed instruments to be flown on the C-130 comply with the full set of requirements for the GV. This will ensure their future compatibility with the GV.

7.4 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 (i.e. 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.

7.4.1 G-V

Participation on any field program on this platform requires that the instrument pass through the FAA certification process. Details on this process, including material, power and wiring constraints, as well as design and fabrication documentation requirements can be found Chapter 6 above. 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.

7.4.2 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, power and 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. Drawings and documentation should be available for submittal to the RAF Aeronautical Engineering upon request. Project specific payload flight testing will be conducted just prior to deployment to the field site.

7.5 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 (<http://www.eol.ucar.edu/deployment/request-info/forms/request-forms-for-nsf-lower-atmospheric-observing-facilities>). 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 RAF will communicate with the PIs and the NSF to determine a course of action that may include:

- Delaying the research project until the flight and performance testing or the required instrument is completed,
- Investigating the possibility of involving an equivalent instrument with existing performance history,
- Investigating whether or not the instrument is justified as "required" for the field project.

If an EOL supplied New Instrument is included in a Facility Request as "required" or "essential" and has not completed the functionality flight testing by the time of the OFAP meeting discussing the request, the request will be deemed "Unfeasible". In the event that any User supplied New Instrument on the required list cannot meet the GV certification and safety 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 without impact on the overall project feasibility.

7.6 Flight Test Opportunities

A key component of ensuring that new instrumentation is ready for research deployments without compromising the compressed project deployment timelines will be the inclusion of annual flight test programs into the RAF schedule. Scheduled 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 (based on the example of the IDEAS programs). 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 the RAF Facility Manager.

Chapter 8 Insurance – Liability Coverage, Bodily Injury, Property Damage

Aircraft operations conducted by UCAR/NCAR personnel are insured – to the extent of the policy coverage – for legal liability arising from third-party claims.

This coverage extends to instrumentation installed on the aircraft as part of NSF-approved flight operations. UCAR also is insured for legal liability involving operation of motor vehicles and general liability hazards.

All UCAR/NCAR staff members are covered by the UCAR Travel Accident Policy as stated in the UCAR Benefits Manual.

Non-UCAR staff should check with their home institution for workers compensation coverage, medical and life insurance coverage, for possible insurance exceptions related to flying in a public aircraft operation.