**Airborne Field Project Debrief Summary**

**Field Project Name:** **ICE - T**

**Link to Feasibility Analysis:**

**Dates of Project: 1 – 31 July 2011**

**Facilities involved: C-130, Data Catalog**

**Date of Project Debrief: 25 August 2011**

**Date of Release of this report:**

**Prepared and Reviewed By**

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# PROJECT HIGHLIGHTS

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| **Summary of project**  |
| Based on the successful ICE-L project, ICE-T looked to expand the study of ice formation to the tropical regions. Specifically, the study sampled marine towering cumulus clouds, looking directly at ice nucleation as well as at the impacts of dust, pollution and biomass burning on ice nucleation processes. The project used the C-130 based from St. Croix, Virgin Islands. A total of 13 research flights were completed totaling 60.2 hours out of an allotment of 60 hours. Selected flights were flown on coordinated flight tracks with the SPEC instrumented Lear jet, also funded by NSF. Flight rf08 was a combined inter-comparison mission with several ground sites operated by the University of Puerto Rico and ferry to San Juan Puerto Rico for an educational visit to that university. The project debrief meeting was attended by the lead PI’s and most of the instrument PI’s. Their comments have been included in this summary. No NSF representatives were available. |

# OFAP Preparations/Feasibility Issues/Scheduling

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| **Examples** |
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| **Summary:**  |
| The original scope of the Facility Request was reduced by removing the dropsonde component. This was done to reduce costs and shift the request from out of the large project category. A number of the instrument PI’s were late in submitting their NSF proposals. The original feasibility review of the payload was therefore conditional and the project was budgeted at a lower level. Negotiations over the payload continued beyond the normal time line and the final NSF decision on several participants did not occur until 1 month prior to the start of the scheduled upload. This process took place with RAF/EOL participation and the delay did not adversely affect the project. The increased complexity of the payload, in addition to the presence of the SPEC Lear jet in a complimentary deployment, significantly increased the scope of DFS participation in systems interface hardware preparations and increased the number of participants in the field. Adjustments were therefore required to the original plans for the OPS center and CDS support. Final costs will be greater than the projected budget. (Details pending final audit.)Delays in finalizing key vendor contracts significantly delayed several infrastructure upgrades. This “forced” scheduling shift eliminated the planned opportunities to test fly the engine and wing wiring modifications prior to the start of the project upload and impacted the project preparations.Deployment issues were correctly assessed and no formal diplomatic clearances were required. This result was achieved by close collaboration between the PI’s and RAF OPS group in defining workable airspace for the research flights that avoided the need for such clearances. As expected, extensive preparations were required with multiple ATC regions to allow the mostly unfettered altitude and track adjustments required to work the cloud fields.  |

# Resources/Staffing

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| **Examples** |
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| **Summary of Resources/Staffing** |
| Staffing for the key activities was about right and all project milestones were achieved on time. Some difficulties did result from the simultaneous HIPPO-5 upload on the GV. Key expertise on some systems was not available on the C-130 due to this conflict. Flight hour usage was within 1 hour of the NSF allocation for testing, ferry and research.  |

# Payload Planning, Upload and Function

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| **Examples** |
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| **Summary of Payload Planning, Upload and Function** |
| The research payload layout was dictated by the total compliment of equipment and the special requirements for several of the key instruments (WCR, WCL, CVI). The upload schedule was adequate, but barely long enough due to a number of atypical systems problems. Delays from outside vendors during the engine infrastructure upgrades required multiple adjustments to pre-deployment preparations. An error in the wing re-wire conducted prior to the start of the upload was only discovered during the test flights. A key system (PLWCC) was affected and the issue was not resolved until after research flight rf01.There were some functional issues that came out during the deployment: distance and plumbing issues between CVI and multiple Users; plumbing to the shared Wyoming Heated Inlet; overheating on the ground during pre-flight; and water condensing and falling on systems during flight.  |

# Safety

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| **Examples** |
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| **Summary of Safety Issues** |
| The standard safety review procedures were used and worked well. A hurricane evacuation plan was developed, but was not triggered by local conditions. The decision not to fly a Mission Coordinator was correct despite the two lightning strikes taken by the aircraft. Those events occurred in fairly benign conditions and could not have been anticipated. The strikes did not affect the airworthiness of the aircraft and research continued as planned. |

# Location/OPS-Data Center/Ground Support

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| **Examples** |
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| **Summary of Location/OPS-Data Center/Ground Support**  |
| St Croix was recommended by the RAF as a preferable flight operations base over the international airport in Puerto Rico. Support at the local FBO and the hotel were excellent and both facilities were able to contend with the increased number of participants. Flight operations were greatly facilitated by the low levels of air traffic at the St Croix airport and ramp security offered fewer restrictions. CDS supplied the key support hardware and staffed the OPS center. The Catalog products and archive proved very useful. EOL shipping was uneventful and quick, but the University of Wyoming ran into significant delays in getting a key radar component transported to and from the island for servicing. |

# Field Operations

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| **Examples** |
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| **Summary of Field Operations** |
| Despite the occurrence of two lightning strikes to the C-130, there were no significant maintenance issues and no flights were cancelled for maintenance reasons. One mission was cancelled due to a failure of the on board network.Significant preliminary work by the Flight Operations Group with the four ATC regions targeted by the science proved to be a great benefit. Only minimal limitations were placed on the real time adjustments to the flight tracks needed to make the required cloud penetrations. Real time guidance to cloud targets via CHAT worked well. |

# Facility Instrumentation

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| **Examples** |
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| **Summary of Facility Instrumentation** |
| Facility instrumentation generally worked well for the majority of the research flights. Some system failures did occur on selected flights but with a limited loss of data. Flight-by-flight status reports covering both the primary EOL and User systems are available on the ICE-T project catalog. The Wyoming cloud radar and down looking lidar (WCR & WCL-d) did experience major component failures and those systems were unavailable for flights rf02 – rf07. The upward looking lidar (WCL-u) worked well through out the project. Several User aerosol systems suffered from sample plumbing issues. The impact on the science is expected to be minor. System PI inexperience with aircraft sampling was the root cause. The HOLODEC-2 cloud particle instrument was flown on an experimental basis and its function was uneven though out the project due to water ingestion into the optics. Extensive data post processing is required and the value of the data from this instrument is uncertain at this time. |

# Science Overview: Success Criteria and Post-Project Tasks

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| **Examples** |
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| **Summary of Science Overview** |
| The PI’s have indicated that the resulting data set will be suitable to address most of the stated science objectives. Joint missions with the SPEC Lear jet are expected to provide addition information. The project catalog will serve as the primary data archive and will include all of the support data from the real time field catalog, the EOL C-130 in situ data and separate data submissions from the various User groups as well as from the CARI chemistry group, the University of Wyoming remote sensing group. The standard data delivery schedules will apply. |

# Summary of debriefing meeting

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| **Debrief meeting summary** |
| Summarize those comments from the Debrief meeting from (a) Users external to EOL, (b) EOL staff external to RAF, and (c) RAF staff, if these comments are not already covered above.  |
| **Response to comments** |
| The forward digital video camera was installed in a new location on the right side wing pod for this project. The basic infrastructure was the same as the camera mounted on the GV. In this application, there were numerous times when the optical window iced over and took to long to clear without active heating. The image was not adequate to keep the cabin PI’s abreast of the cloud penetration sequence on some flights.The Colorado State CFDC Ice Nuclei Counter had numerous difficulties during the project which limited the data collection from that system. Some of their difficulties were attributed to the overall difficulties in working in a tropical environment while some were attributed to their rack layout – which had been affected by the constraints on the overall payload design.During flight operations it became apparent that additional AEROS displays would have been beneficial in keeping the on board student observers more involved in the missions. More attention should have been paid to this issue during the initial payload planning cycle.  |

# 11 Project Closure: Lessons Learned

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| **Project Closure Summary** |
| Working with outside vendors or regulatory agencies on key infrastructure developments leaves the project schedule susceptible to delays beyond our ability to adjust. Despite careful advanced planning, such actions affected the project. More contingency time needs to be built into the Facility Planning process.Since all of the instrumentation PI’s had flown before, it was assumed that they understood the basics of the inlet technology being used and could provide the necessary interface to the inlet systems defined in the original payload design. The aerosol sampling difficulties experienced during the deployment makes it clear that RAF expertise needs to be employed at the design phase of each payload, regardless of the PI involved, with all inlet and plumbing arrangements being reviewed by the RAF science team.The new ADS system seems to be more susceptible to startup problems. Bad DSM connections or channel shifts can only be identified by a careful pre-flight review. An adjustment needs to be made to the technicians preflight routines to allow these systems checks with enough time to take action and not delay a planned departure.A variety of apparently new ADS, instrument, software and network problems occurred during the project. It was later determined via consultation with off site personnel that some or all of the issues had been encountered and corrected on previous projects. A Troubleshooting Handbook will now be developed to document this “tribal” knowledge and make it available in the field to aid field crews.   |
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# Project Closure: Customer Feedback

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| **Project Closure Feedback (Follow-up after formal project debrief).** |
| Summarize the comments from the EOL follow-up questionnaire (typically done months after the project debrief).  |
| **Feedback Review** |
| Input Pending  |

**TEMPLATE**

**Airborne Field Project Debrief Summary**

**Field Project Name:**

**Link to Feasibility Analysis:**

**Dates of Project:**

**Facilities involved:**

**Date of Project Debrief:**

**Date of Release of this report:**

**Prepared and Reviewed By**

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| **EOL Director’s office and Administrators** | **Signoff and date** |
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# 1 PROJECT HIGHLIGHTS

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| **Summary of project**  |
| [**Replace this text with a brief overview)**This should include a *brief* description of the scientific goals of the project, the facilities involved, the number of hours flown, etc., followed by a brief reference to the most important points discussed below.  |

# OFAP Preparations/Feasibility Issues/Scheduling

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| **Examples** |
| 1. Were project clearances issues (diplomatic and ATC) properly addressed?
2. Drop Sonde issues (e.g. were the constraints about dropping over land appropriate and realistic?)
3. Were the requirements for Lidar safety and FAA/Foreign clearance adequately discussed?
4. Budget: Was the project under/over budget? What items were not addressed properly in the budget and why?
5. Inter-facility communication. Was the support provided by RAF, CARI, FPS, DFS and CDS clearly spelled out? Did this support happen as planned?
6. Did the scheduling of the award decisions by NSF factor into the project outcome?
7. Was “mission creep” properly identified and handled?
8. Did the users provide adequate information in the request for a proper feasibility analysis?
9. Was the planned testing period proposed for the project adequate and appropriate?
10. Was the review by the RAF safety committee and the additional safety information provided by UCAR Safety and Site Services adequate? Was the RAF safety risk assessment adequate?
11. Were the project completion risk factors properly identified in the feasibility analysis?
12. Were the issues covered during the preparations for OFAP adequate?
 |
| **Summary:**  |
| Replace this text with summary of issues for OFAP preparation/Feasibility Issues/Scheduling.  |

# Resources/Staffing

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| **Examples** |
| 1. Were the allocated flight hours used appropriately to achieve project goals? Were we under or over in our flight hour budget?
2. Were the Expendables (e.g. dropsondes) adequate and were we under or over?
3. Was there adequate staff available for each of the phases of the project: (a) Upload, (b) deployment, (c) tear down, (d) Calibration, quality control and data processing?
4. Did users (requesting PIs) have adequate staff in the field to cover their needs? Was this identified in the feasibility analysis as a potential concern?
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| **Summary of Resources/Staffing** |
| Replace this text with a summary of issues for Resources/Staffing  |

# Payload Planning, Upload and Function

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| **Examples** |
| 1. Did the layout of the cabin, inlet, signal and power configuration work properly? Were data displayed adequately on the aircraft and on the ground as appropriate?
2. Was the schedule realistic? Did users and instrument PIs follow an appropriate schedule for preparing for the project?
3. Was the infrastructure (racks, inlets, pods, etc) ready for the deployment?
4. User Issues: Were user needs and readiness for the deployment an issue? If so, what could EOL have done to improve communications with the users (or NSF if appropriate).
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| **Summary of Payload Planning, Upload and Function** |
| Replace this text with a summary of issues for Resources/Staffing |

# 5 Safety

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| **Examples** |
| 1. What safety concerns/issues, if any, took place during the project? Were these identified pre-project? Were they addressed properly during the project?
2. If a mission coordinator was required for the project, did the MC provide adequate information for the flight crews and project scientist? Was the information available on the MC display adequate? Were there sufficient ground personnel (e.g. from FPS, RAF or CDS) and products available to support the mission coordinator function?
3. Was the Safety briefing for the field project adequate and well received by participants?
4. Were the RAF (and UCAR) Safety/Security policies and procedures followed for the project? Were these adequate for the safety issues relevant to the project?
5. Was the information provided by UCAR Safety and Site Services adequate (e.g. pre travel security analysis, hazardous materials, etc.). How did the project safety officer function in the field?
 |
| **Summary of Safety Issues** |
| Replace this text with a summary of Safety Issues |

#  Location/OPS-Data Center/Ground Support

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| **Examples** |
| 1. Were the services provided by the FBO adequate?
2. Was the OPS center adequate in terms of physical characteristics, staffing, display capabilities, internet service, and location?
3. Was the hotel adequate and cost effective?
4. Was the field catalog and mission coordinator display effective and adequately supported?
5. Where there shipping problems? Were they resolved adequately?
 |
| **Summary of Location/OPS-Data Center/Ground Support**  |
| Replace this text with a summary of Location/OPS-Data Center/Ground Support Issues |

# Field Operations

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| **Examples** |
| 1. What maintenance issues occurred with the aircraft? What maintenance issues occurred with RAF/EOL instrumentation? Did these affect the project outcome? Was there adequate staff available to handle problems that arose?
2. Was ATC Coordination handled well?
3. What maintenance or operational issues occurred with user (PI) instruments? Was EOL’s response in helping solve problems with user instruments appropriate and adequate?
4. What special circumstances (night flights / crew duty limits / loss of critical staff, etc.) occurred during the project and were these handled appropriately?
5. Was the flight crew able to get the aircraft in the proper location? Was the communications between the flight crew and the science coordinator/mission coordinator appropriate? Did new investigators receive enough training to perform their duties appropriately?
6. Were students provided training and an appropriate educational experience? What fraction of this training was provided by EOL staff versus PIs?
7. What special weather circumstances affected mission performance (e.g. lightning strikes, turbulence, icing, etc.) and were these adequately: (a) handled by RAF, (b) identified prior to the project.
 |
| **Summary of Field Operations** |
| Replace this text with a summary of Field Operations Issues |

# Facility Instrumentation

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| **Examples** |
| 1. Did the following instruments perform adequately? What data quality issues arose? What support issues were there for these instruments?
	1. Routine instruments provided by EOL.
	2. Mission specific instruments provided by EOL.
	3. Data systems.
	4. User instruments
2. Was the system performance review adequate? Were special support needs adequately identified?
 |
| **Summary of Facility Instrumentation** |
| Replace this text with a summary of Facility Instrumentation Issues |

# Science Overview: Success Criteria and Post-Project Tasks

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| **Examples** |
| 1. What is the assessment of the following:
	1. Preliminary assessment of completion of field project goals for the project.
	2. Identification of data quality issues that need attention.
	3. Schedule for data release, archival, etc.
	4. Need for follow on meetings and action items.
 |
| **Summary of Science Overview** |
| Replace this text with a Science Overview and summary of Post-project tasks |

#  Summary of debriefing meeting

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| **Debrief meeting summary** |
| Summarize those comments from the Debrief meeting from (a) Users external to EOL, (b) EOL staff external to RAF, and (c) RAF staff, if these comments are not already covered above.  |
| **Response to comments** |
| Replace this text with a summary of responses (if appropriate) to issues raised in the meeting (if not discussed above).  |

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# 11 Project Closure: Lessons Learned

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| **Project Closure Summary** |
| 1. Summary of pre project planning issues
2. Overview of support issues (staffing, location, etc.)
3. Summary of data quality issues (instrument trouble shooting, data review, data system or signal issues that arose, EOL instrument action items needs, Suggestions for improving EOL’s support for user instruments, etc.)
4. Lessons learned of interest to NSF (e.g. schedule issues, support issues, facility capabilities, PI needs).
 |
| **Project Closure Summary** |
| Replace this text with a summary of lessons learned.  |

# 12 Project Closure: Customer Feedback

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| **Project Closure Feedback (Follow-up after formal project debrief).** |
| Summarize the comments from the EOL follow-up questionnaire (typically done months after the project debrief).  |
| **Feedback Review** |
| Discuss the comments in the context of the post-project debrief. Are the major issues/concerns addressed? What additional items are needed? How should we follow up on items not covered?  |