In-situ Aircraft Observations for Atmospheric Research

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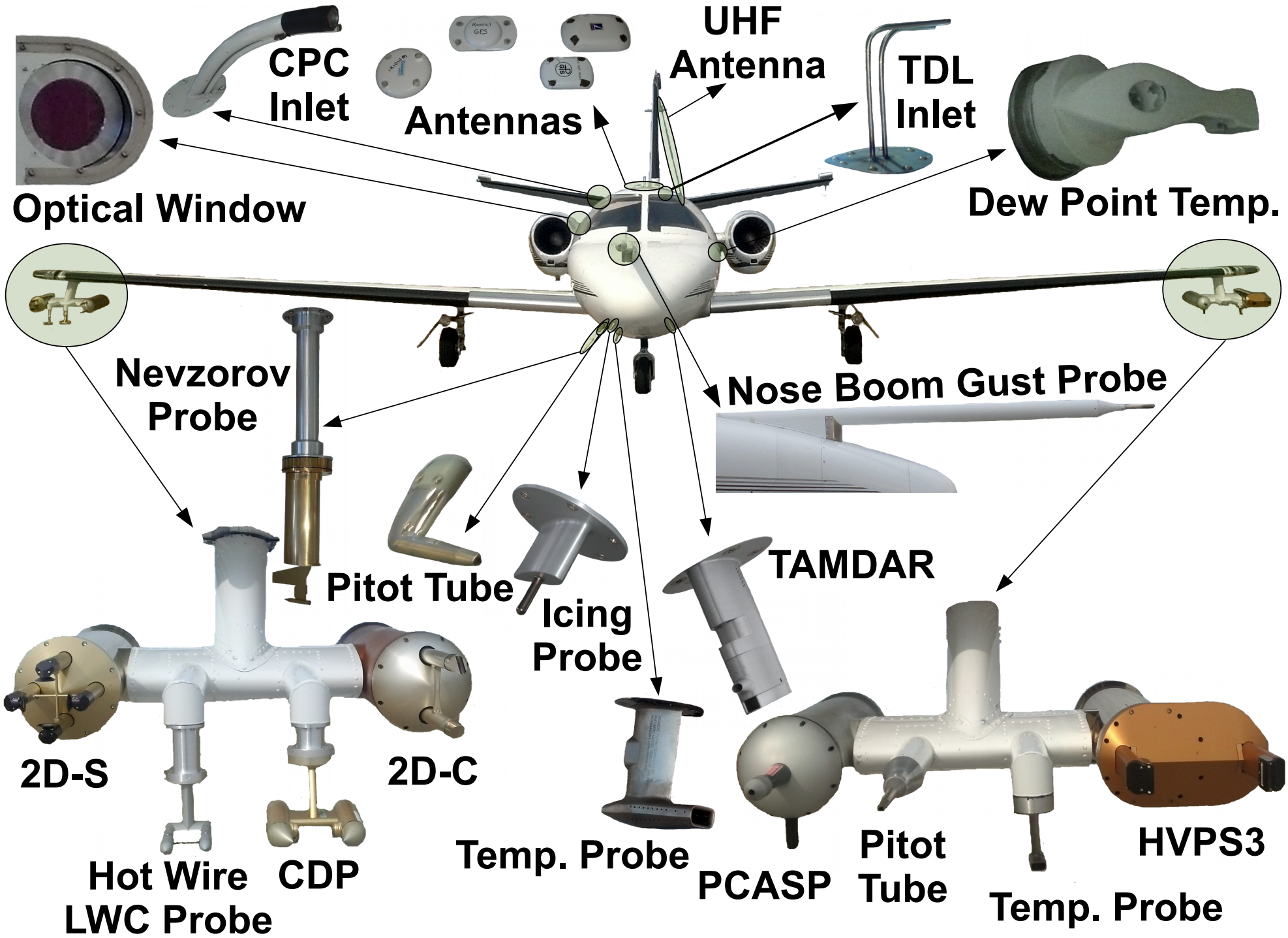
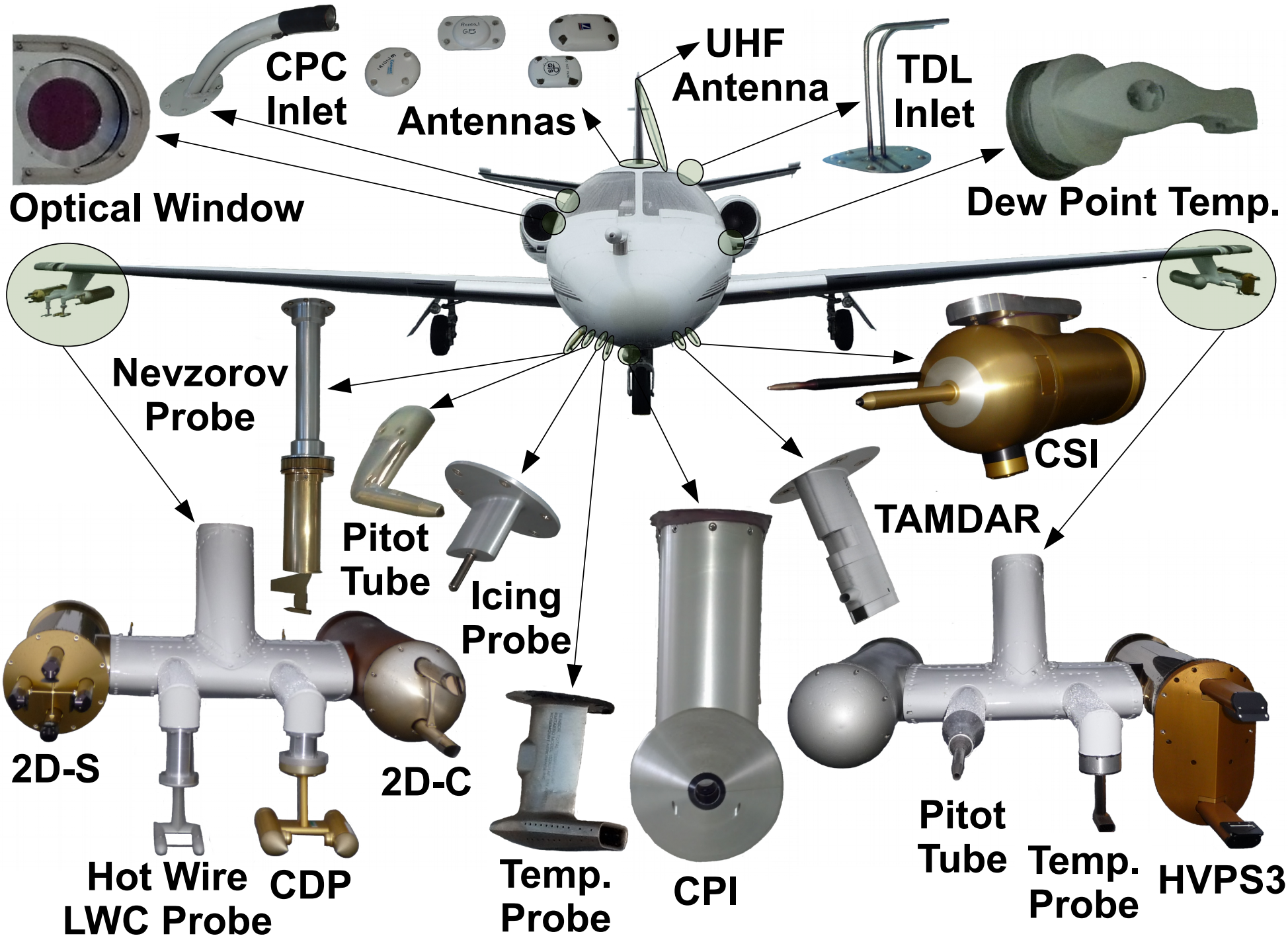
Title	Experience
Researcher	Aerosols, Precipitation, and Aerosol-clouds Interactions
Professor	Measurement Systems, Atmospheric Chemistry, Air Quality, Statistics, Numerical Methods, etc.

Platforms:	Balloons, Surface, Aircraft, UAS, Rockets
Flight Engineer:	NASA, FAA, and AirDat
Software Engineer:	SourceForge ADPAA Project
Hardware Devel.:	Mini-CCN Counter
Flight Scientist:	NASA - ORACLES, OLYMPEX, IPHEX
Project Scientist:	Ophir, UTC - Instrument Testing Navy CAPE 2015, POLCAST (North Dakota), Saudi Arabia Weather Modification Project
Societies:	AGU/AMS/AAAR/AAAS/WMA

Project Scientist: Aircraft Instrument Testing

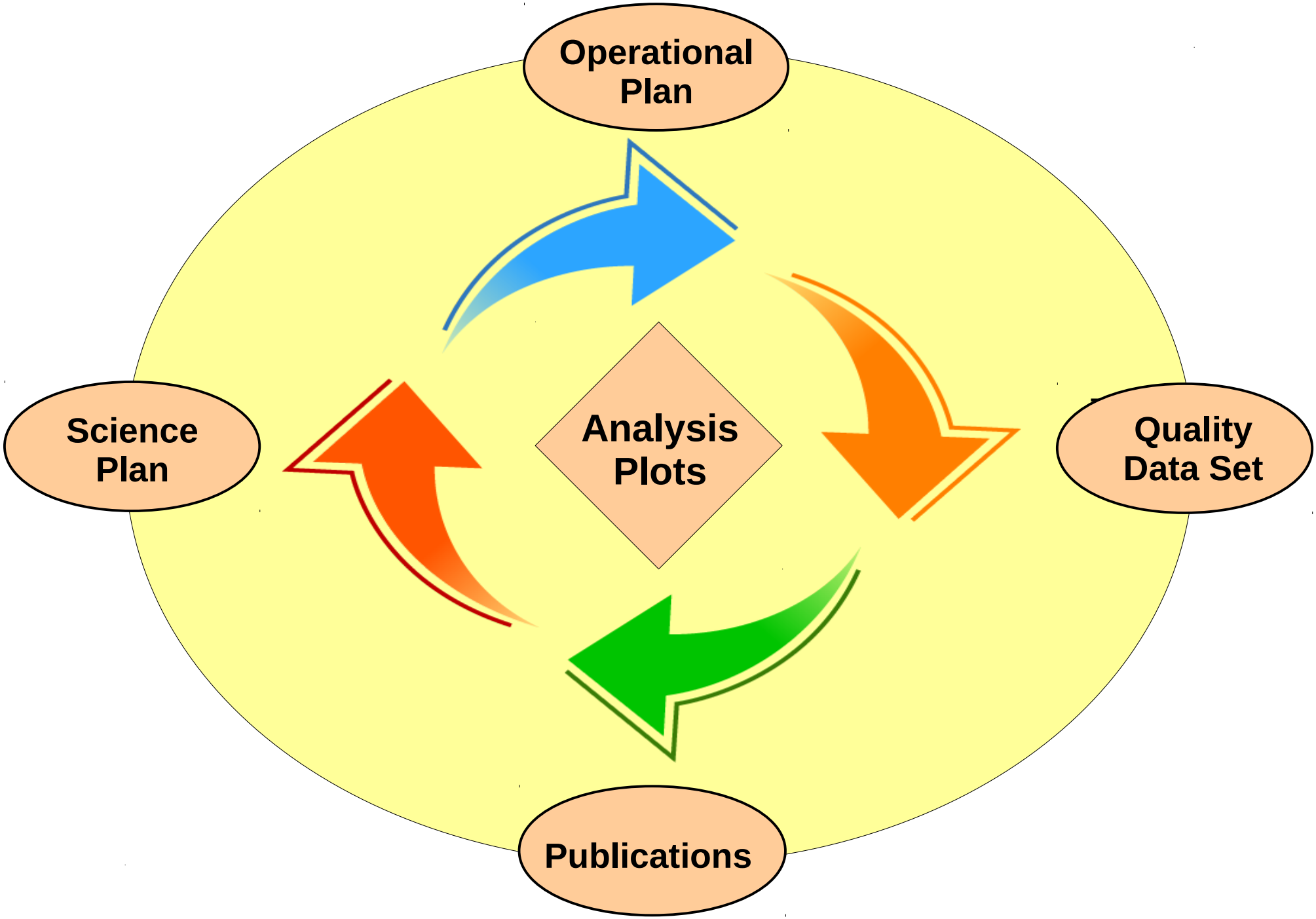


Flight Scientist on Several NASA Field Projects

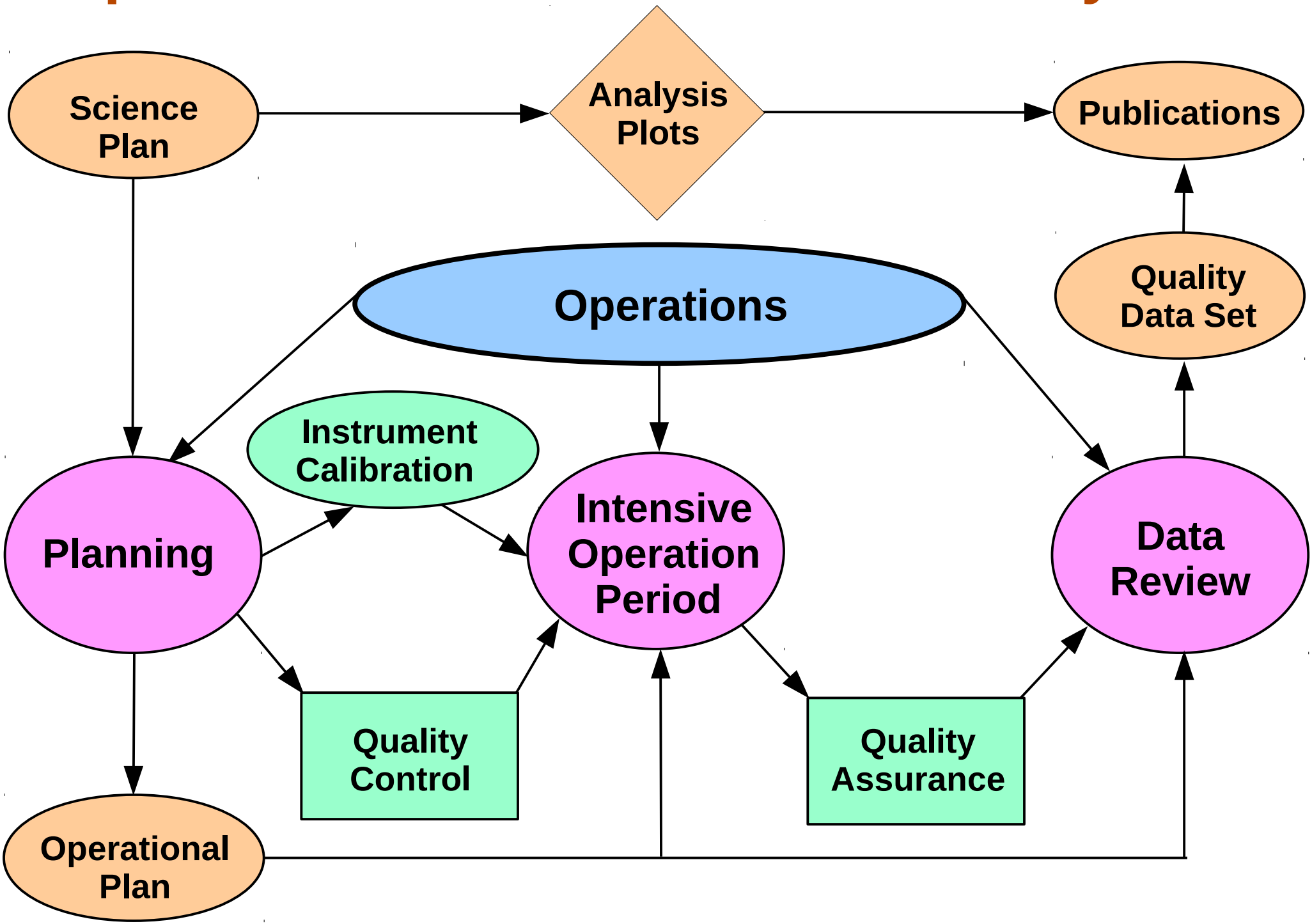


Science Plan and Proposal

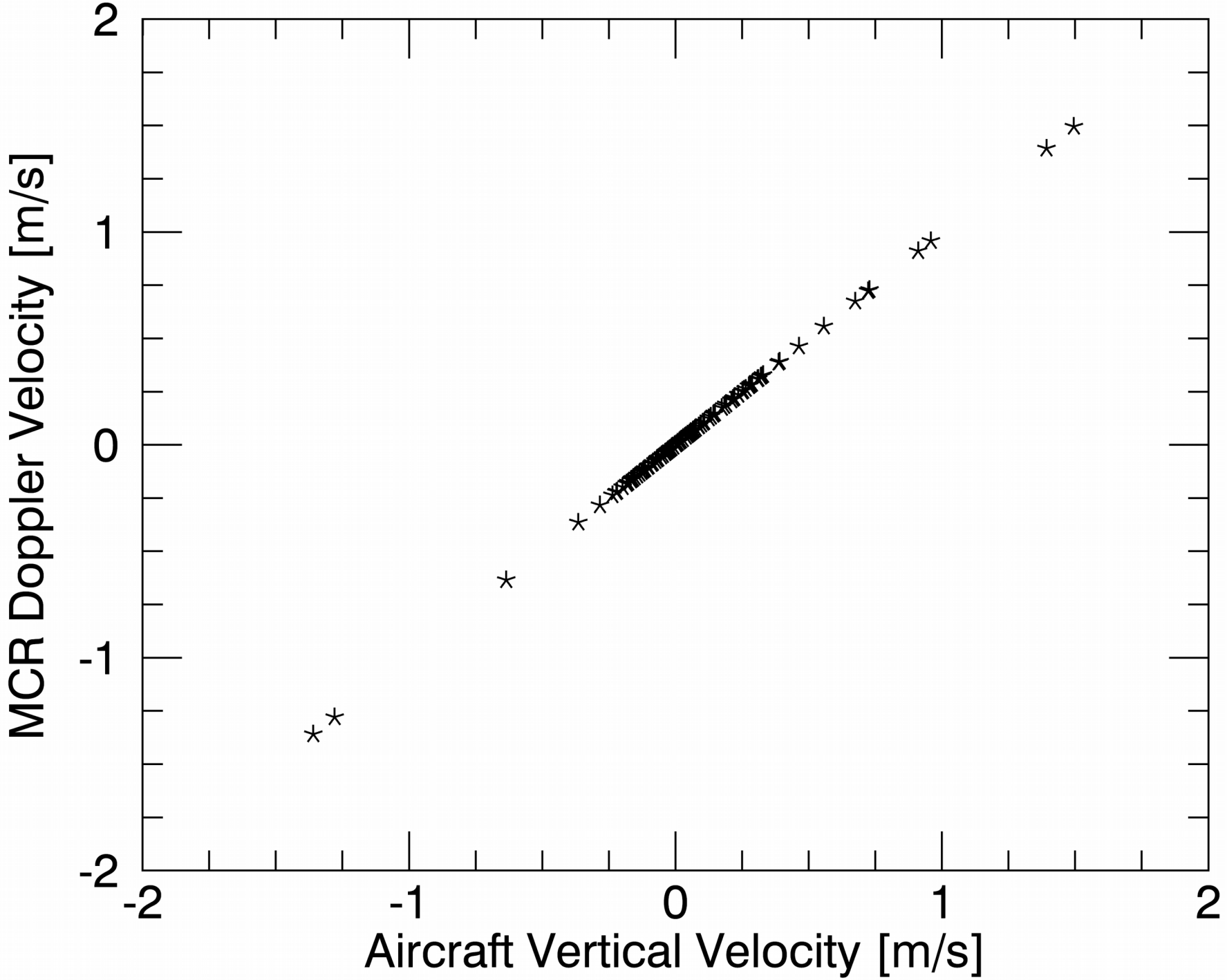
Scientific Method Applied - Repeatable



Operational Plan - Obtain Necessary Data



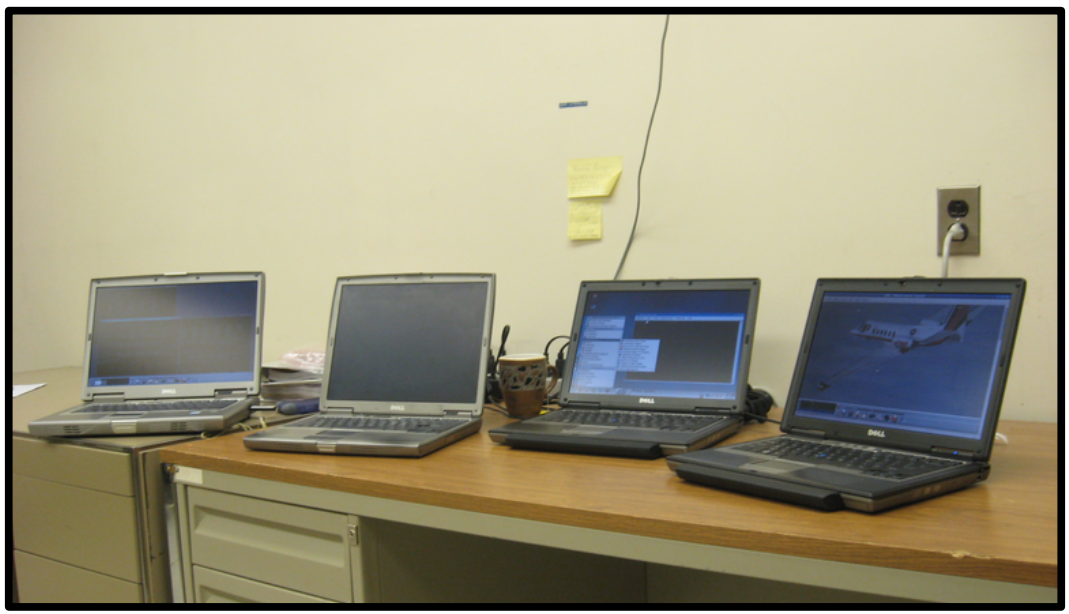
Simulated (Synthetic) Analysis Plot



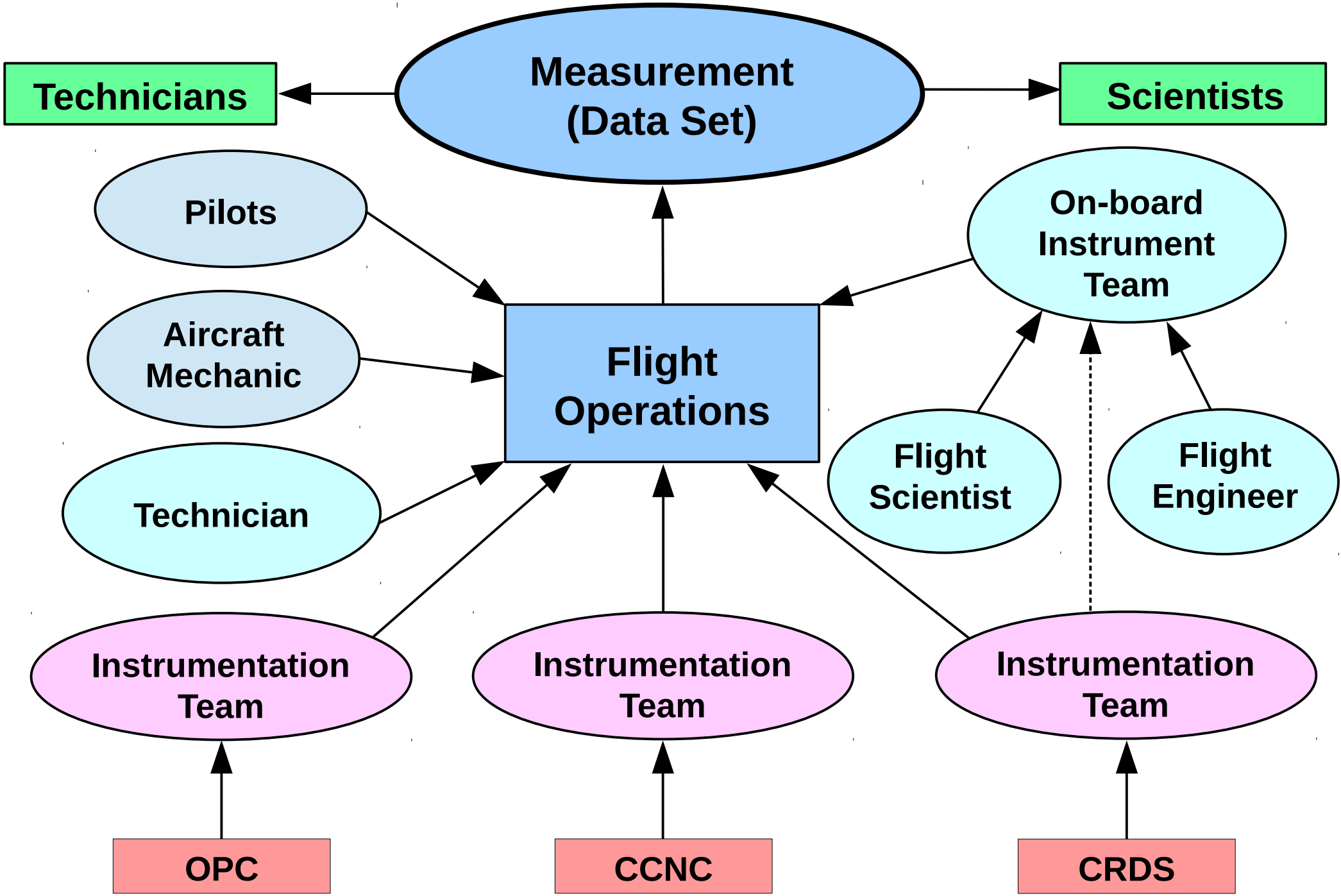
Operations:
Data Set Creation

Quality Control - The process of conducting tests to check that measurements are being made correctly and accurately.

Quality Assurance - The process of reviewing a data set to eliminate measurements that are invalid due to known problems.

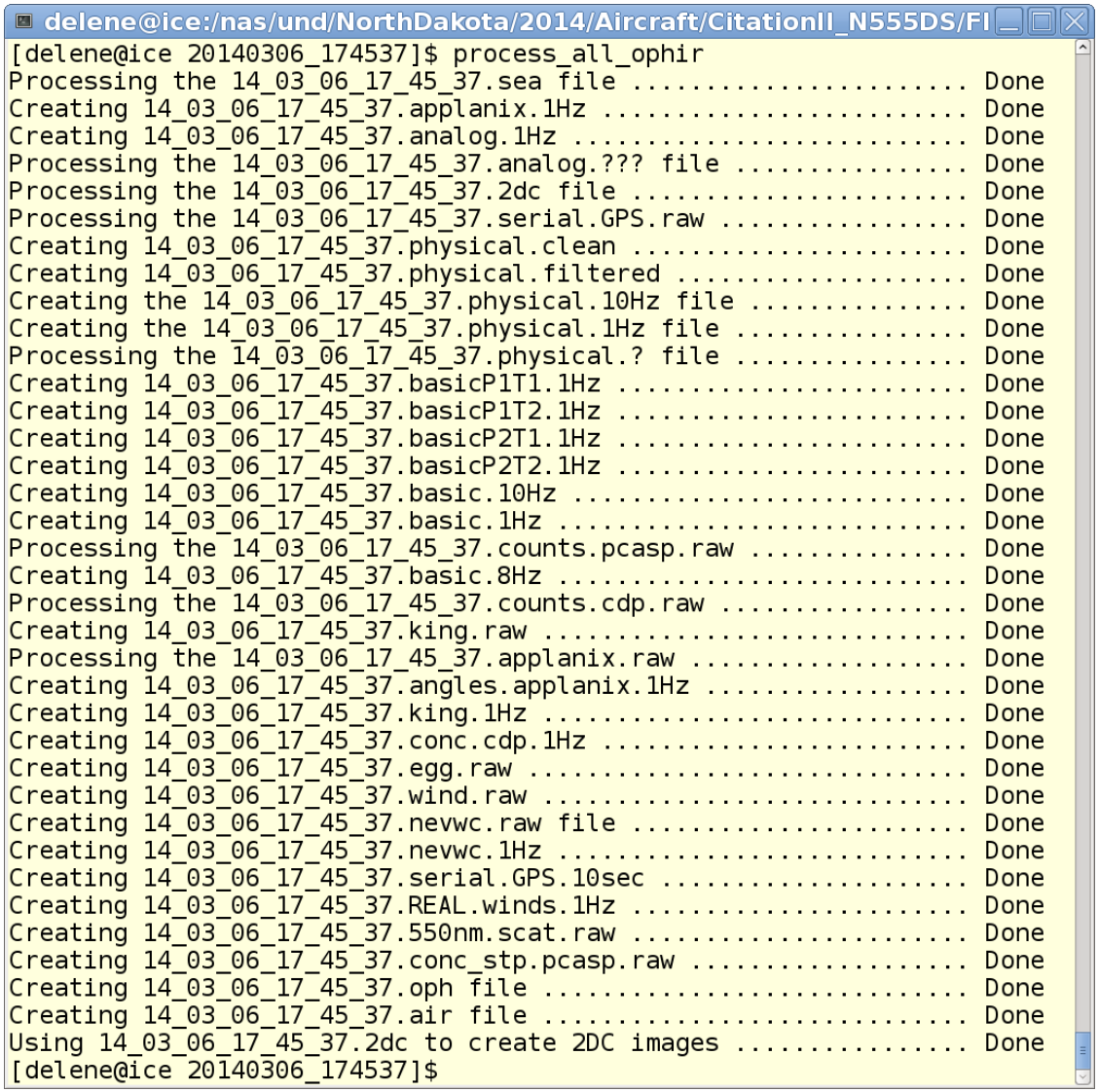


Aircraft Intensive Operation Period (IOP)



Automated Data Processing (ADPAA)

- Data Quality Control
  - Calibration Checks
- Missing Values Code
- Data Processing Levels
  - Raw Recorded Data
  - Units Conversion
  - Single Instrument Files
  - Combined Instrument File
- Quality Assurance
  - Scientific Data Review
  - Scripts Search

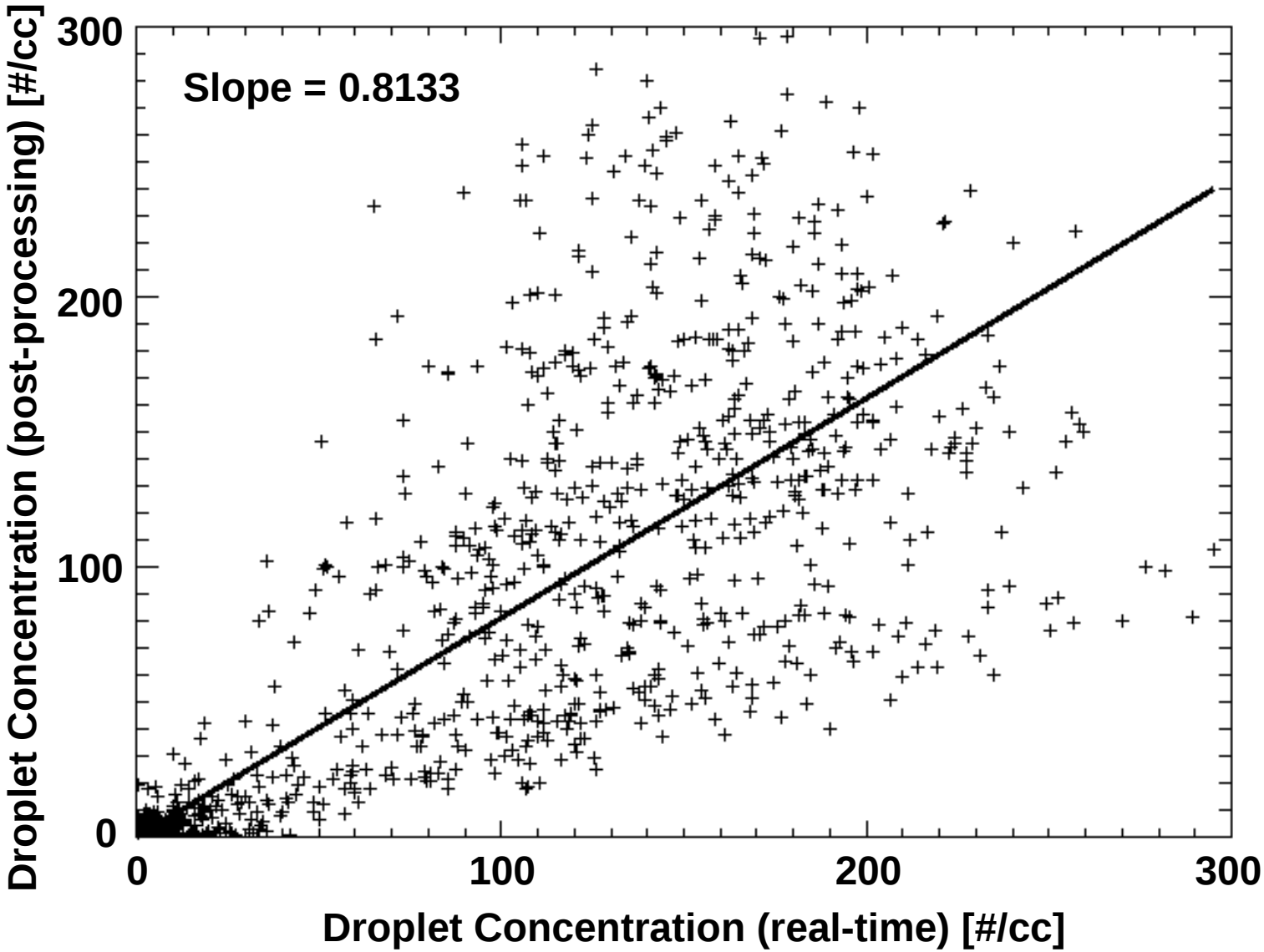


Reference Delene, D. J., 2011: Airborne data processing and analysis software package. Earth Sci Inform, 4, 29–44, doi:10.1007/s12145-010-0061-4.

Comments on Scientific Data Processing

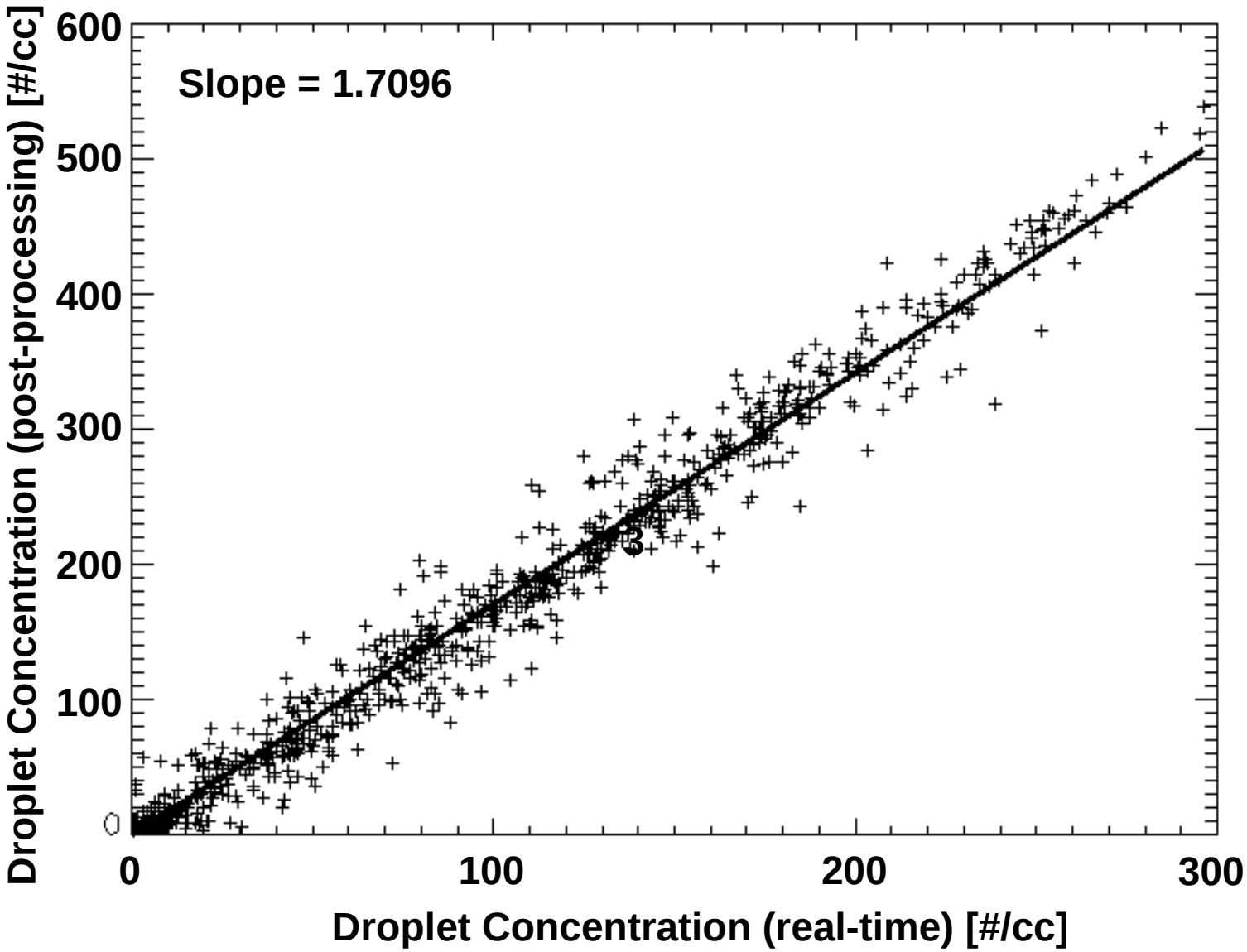
- Quick visualization of data is very important.
  - Create a preliminary version of the data using automated processing scripts.
  - Create a final data set after the project is over by applying manual edits to the “raw” data files which replace “bad” data with missing value codes.
- Archive the raw data and any editing files.
- Work with ASCII data as much as possible.
  - Compress ASCII files, if necessary.
- Use a standard data format, which includes Meta data in all data files.

Comparison of Software Processing Methods



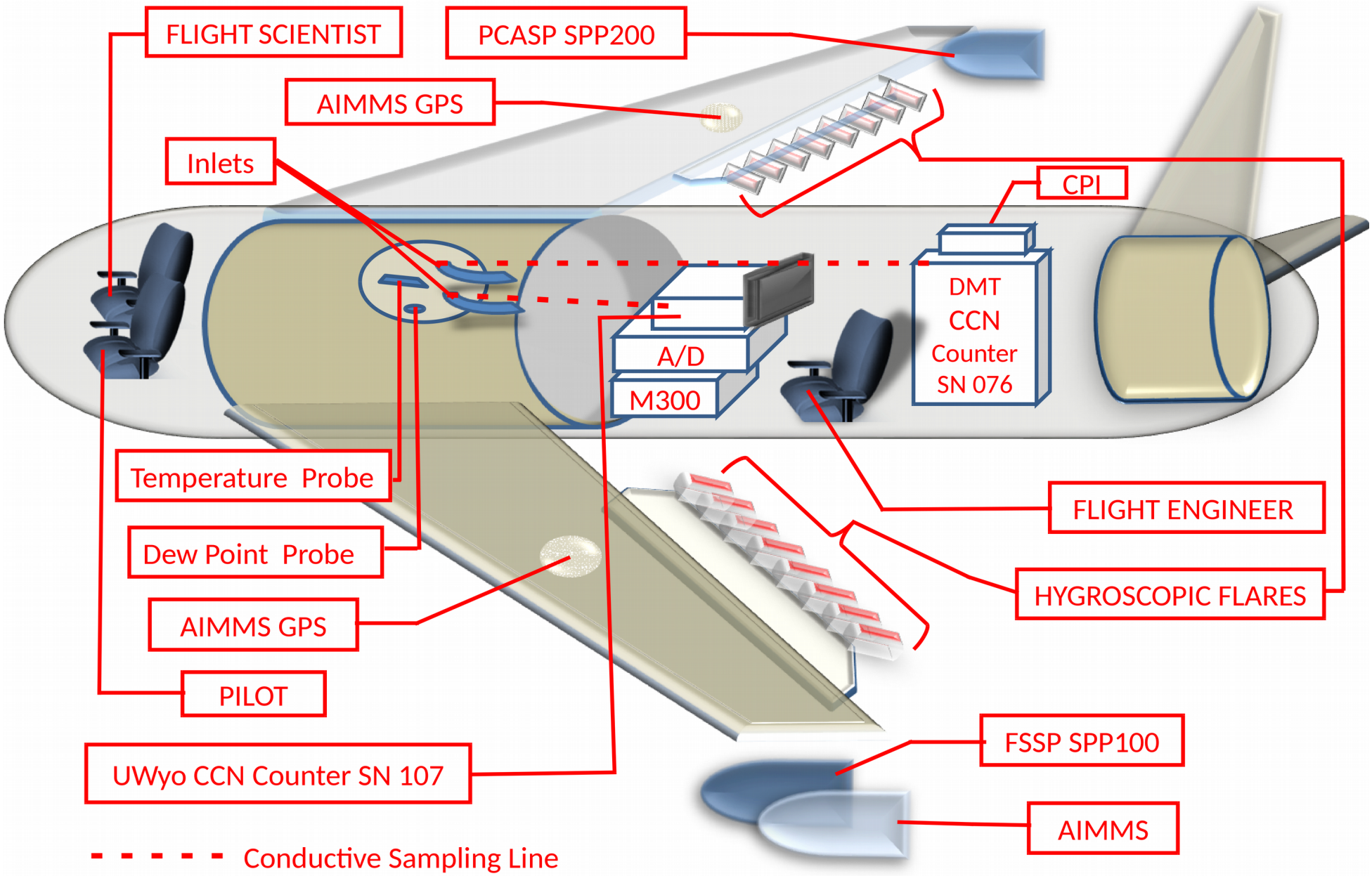
Comparison of the M300 real-time data processing method (x-axis) and Airborne Data Processing and Analysis (ADPAA) post-processing method for the Forward Scattering Spectrometer Probe. All 1 Hz average data from the second flight on January 10, 2008 are included.

Comparison of Software Processing Methods



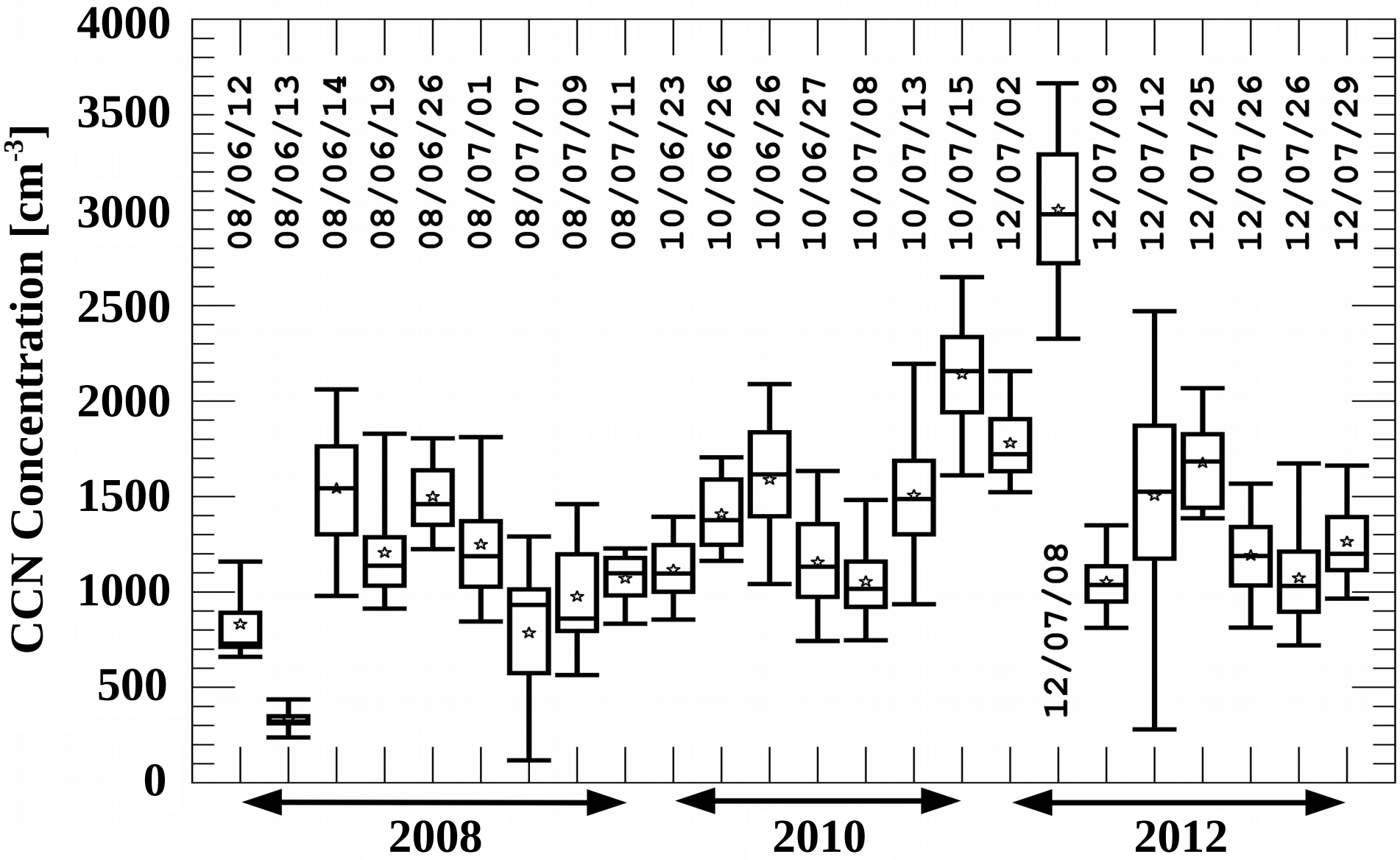
Comparison of the M300 real-time data processing method (x-axis) and post-processing method (y-axis) after fixing bead fraction problem. All 1 Hz average data from the second flight on January 10, 2008 are included. Processing includes beam fraction correction but not coincidence and dead time corrections.

POLCAST 2008, 2010, and 2012 Field Projects



Reference Delene, D., 2016: Suitability of North Dakota for Conducting Effective Hygroscopic Seeding. Journal of Weather Modification, 48, In Press.

POLCAST Analysis Plot



Statistical distributions near cloud base of 30 s, 0.6 % ambient supersaturation Cloud Condensation Nuclei (CCN) adjusted to standard temperature and pressure. Measurements made with the University of Wyoming (Uwyo) CCN counter in North Dakota. Stars are means, horizontal line is the 50th percentile, top of the box is the 75th percentile, bottom of the box is the 25th percentile, and the top and bottom of the whiskers are the 95th and 5th percentiles, respectively.

Conclusions and Take Away Points

- POLCAST paper provides an example of the full cycle of planning, executing, analyzing and publishing in-situ aircraft observations.
- Peer reviews of papers should require not only open data sets but open source software.
- There are many tasks scientists are required to conduct to complete a successful aircraft field project, not just writing papers.
- Advanced software tools are critical to enable efficient quality control of instruments and quality assurance of data.
- In-situ aircraft observations are difficult; however, they have a large impact on advancing scientific understanding.

Questions and Discussion

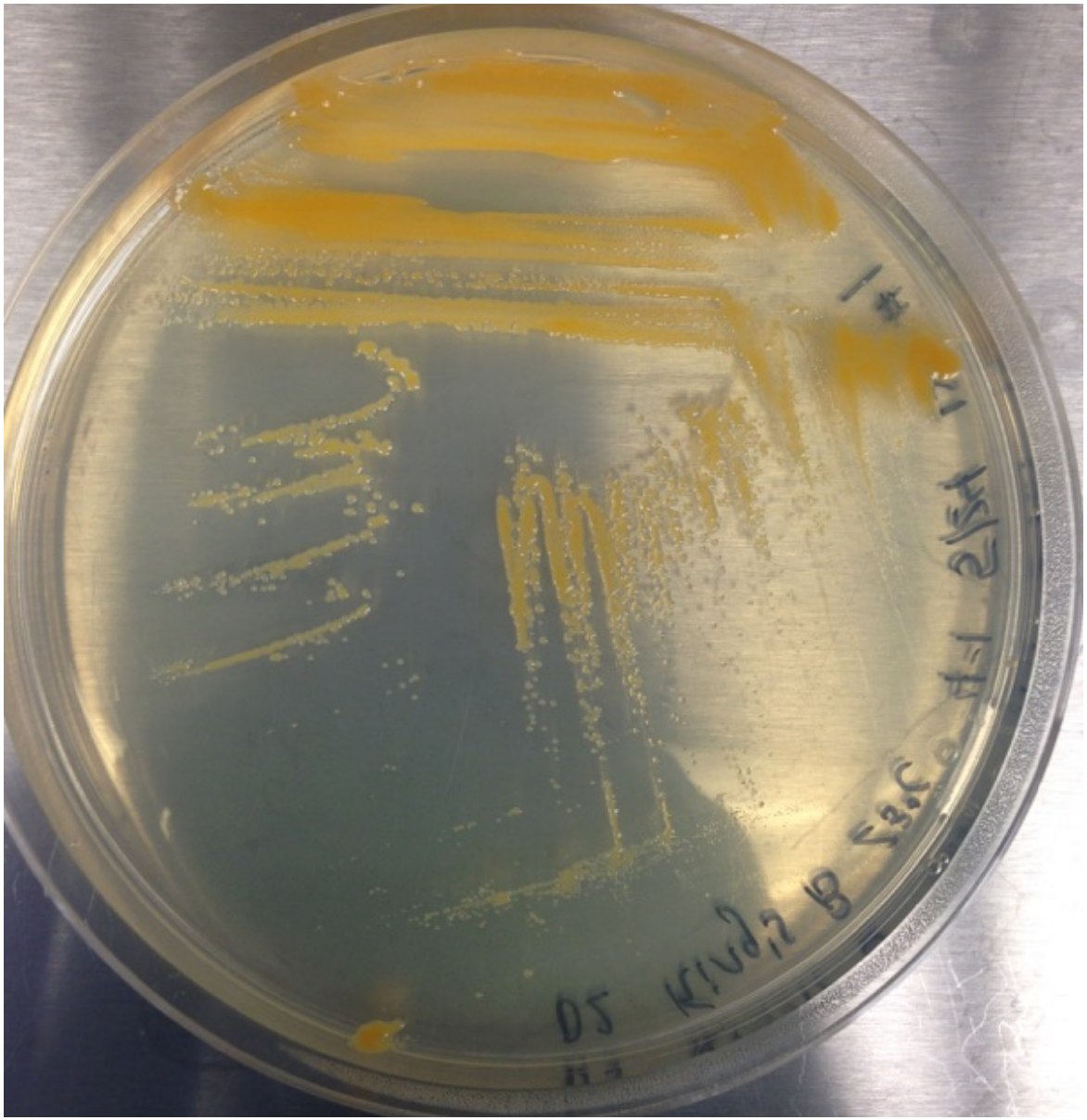


Image of bacteria growth from filter D2 sample. In cloud sample at altitude of 20,000 - 25,000 ft. collected in North Dakota on April 14, 2016.

King Air 200
Saudi Arabia
Spring 2009

King Air 200
Bamako, Mali
2008 Season