**MOSAiC Flux Engineer plan**

*M. Shupe, 3/2018*

This document lays out a plan for engineering support of PSD’s MOSAiC surface flux project. The flux systems for this project will be designed based on our history of flux measurements in PSD and will serve our longer-term vision of streamlined flux systems leading to products that support assessment and development of PSD and NOAA modeling capabilities. This document outlines a plan for engineering support to develop these flux systems. As background, the project has NSF funding totaling $1.6M for the period of 10/1/17–9/30/2021, which will cover CIRES salaries for scientists and some engineer time, and equipment. In addition, NSF will cover berth fees that allow two participants onboard the *Polarstern* icebreaker for the year-long deployment (~$1.4M). In support of this project, PSD committed “engineering support for enhanced Atmospheric Surface Flux stations” and “salary support for NOAA federal collaborators.” While we envision multiple engineers being involved according to their skills and availability, most discussions to date have been with Dave Costa (CIRES) and Sergio Pezoa (Federal). CIRES scientist (Shupe, Persson, Cox) will be involved in scientific support for implementing these systems, in consultation with federal scientists Fairall and Uttal as needed. In addition to personnel time, there is also the opportunity for PSD to contribute to equipment to further enhance and expand the observational systems; this could be discussed independently.

The plan below lays out specific engineering tasks by project year, with an estimate of typical engineering time required for each task (CIRES or Federal). For each year the total engineering time required is summarized, along with the amount of support that is already available at CIRES for engineering support in that year. The difference between these is requested as part of the PSD Front Office contribution to the project and the overall PSD observing effort.

**SUMMARY of PSD Front Office support needed for federal and/or CIRES engineers:**

**6 mon (FY2018), 5 mon (FY2019), 4 mon (FY2020), 2 mon (FY2021)**

**Year 1 (FY2018): INSTRUMENT DESIGN AND DEVELOPMENT.** This is the first project year where we will focus on developing and testing our basic systems. A variety of engineering skills are required to address specific engineering tasks.

*MAJOR ENGINEER TASKS*:

* Initial design of autonomous flux systems:
  + power requirements and production (1 mon)
  + communication system (1 mon)
  + operational control logic (1 mon)
  + enhanced system integration (1 mon)
  + full system design (1 mon)
* Build prototype autonomous flux system (2 mon)
* Full design of flux tower system (1 mon)

*ENGINEERING TIME REQUIRED*: 8 months total (2 months CIRES engineer already covered)

**Year 2 (FY2019): SYSTEM TESTING AND PRODUCTION.** This year is dedicated to final development, testing, and production of systems. The year will end with finalization of systems and then shipping all equipment to the field. Shipping deadline is likely mid-August 2019.

*MAJOR ENGINEER TASKS*:

* Field test of prototype autonomous systems (1 mon)
* Final design of autonomous systems (1 mon)
* Reproduction of 3 autonomous systems, calibration (2 mon)
* Final build of flux tower system, calibration (1 mon)
* Logic software development (1 mon)
* Field equipment, supply, spare preparations (1 mon)
* Pack and ship all equipment, field supplies, spares (1 mon)

*ENGINEERING TIME REQUIRED*: 8 months total (3 months CIRES engineer already covered)

**Year 3 (FY2020): DEPLOYMENT AND OPERATIONS.** This is the field year. For the full year we will have two people in the field for the whole time, one scientist and one engineer. These people will be in the field for periods of 2-4 months at a time. Crew rotations will occur via multiple different approaches, some involving ship-based travel to/from the MOSAiC location in the Central Arctic. Travel through Russia may be necessary.

*MAJOR ENGINEER TASKS*:

* MOSAiC Field Work. Routine field support and operation of flux systems (14 mon)
* Modification of systems to address operational issues (as needed)

*ENGINEERING TIME REQUIRED*: 14 months total (10 months CIRES engineer already covered)

**Year 4 (FY2021): PRODUCTS, ANALYSIS, AND SYNTHESIS.** This year of the project will entail developing and finalizing data products from the MOSAiC year, including application of various flux algorithms, quality control standards, and basic analyses. These products will then be incorporated into various modeling activities. Most of these activities will be accomplished by CIRES scientists in collaboration with Federal scientists. Modest engineering time is required to deal with field equipment returning home and post-campaign instrument calibrations.

*MAJOR ENGINEER TASKS*:

* Receive equipment, organize, store (1 mon)
* Calibrations (1 mon)

*ENGINEERING TIME REQUIRED*: 2 months total