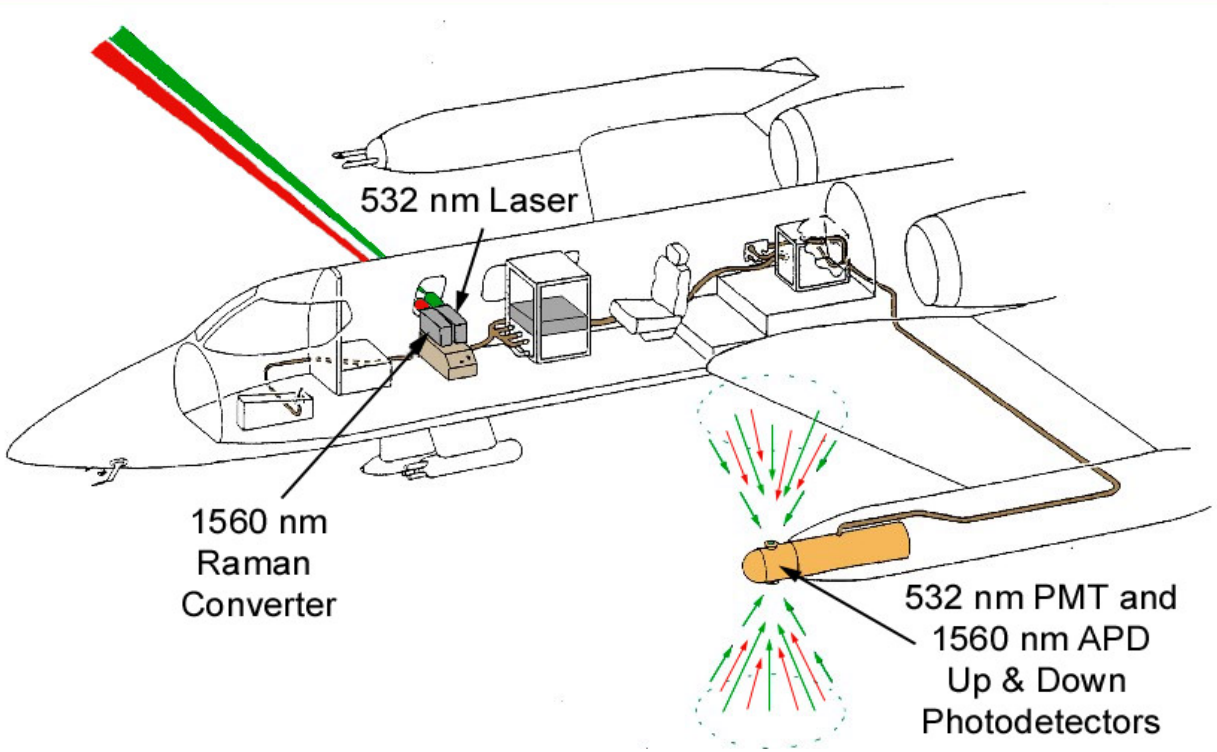
SPEC inc

New Technologies for In Situ Measurements of Microphysical and Optical Cloud Properties



Paul Lawson

ACKNOWLEDGEMENTS

SBIR Program: NASA, NSF, DOE, DoD

NSF HIAPER Aircraft Development Program

NASA Radiation Sciences Program

NSF Physical Meteorology Program

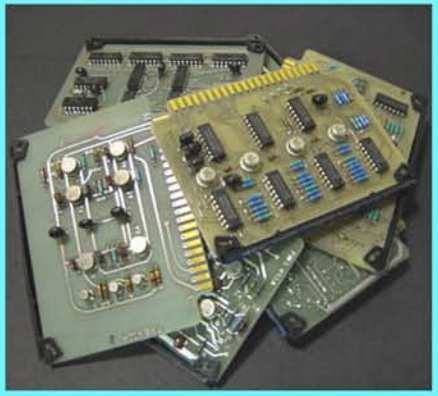
DOE AVP Program

OUTLINE

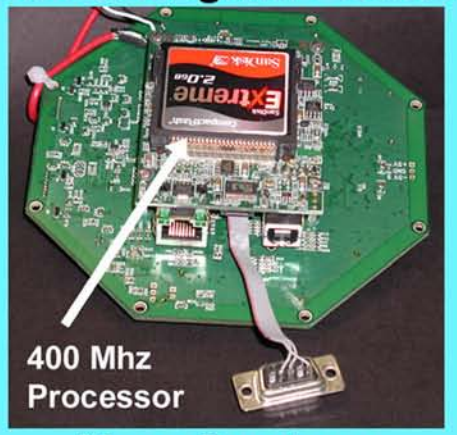
- Improvements in Existing Cloud Particle Instruments
- New Cloud Particle Instruments
- Applications on Large (Global Hawk) and Small (Aerosonde, Manta) UAS
- In situ Measurements with Very Large Sample Volumes
- E-field Module for Dropsondes
- Tethered Balloon In Situ Cloud Measurements

FSSP Electronics Upgrade (Fast FSSP)

Upgraded Electronics Replaces Original Boards



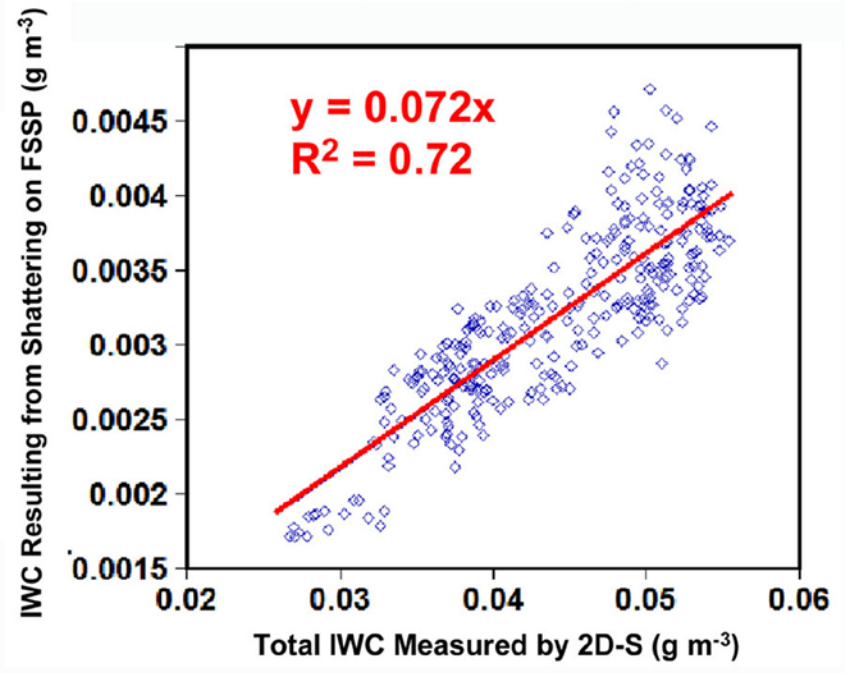
Previous Original FSSP Boards

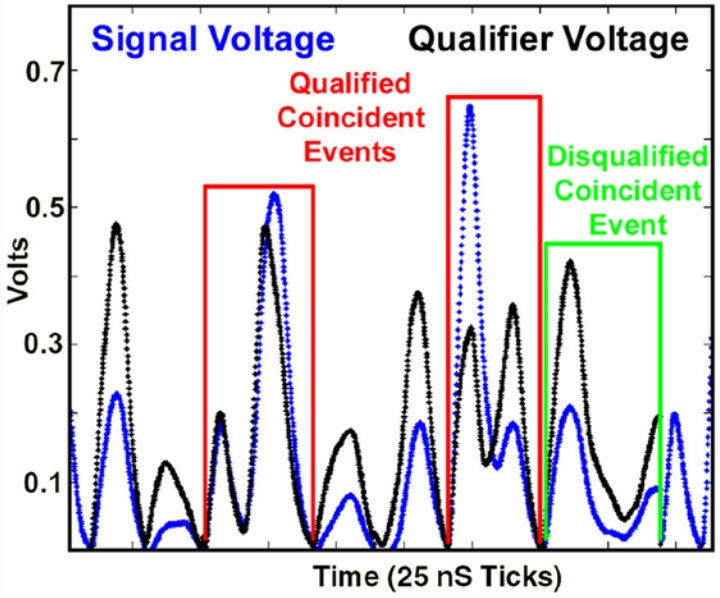


New Custom Processing Board

Features

- Board utilizes fast Linux processor and custom logic
- Improved signal processing for better data quality and accuracy
- Uses original FSSP aircraft wiring
- Real-time instrument control and monitoring via Ethernet
- Data stored within probe to robust compact flash drive

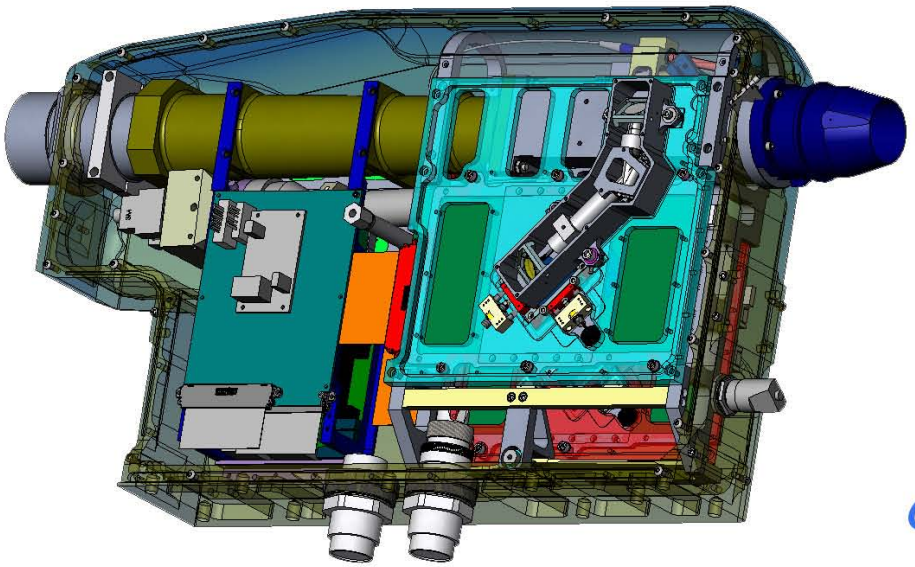


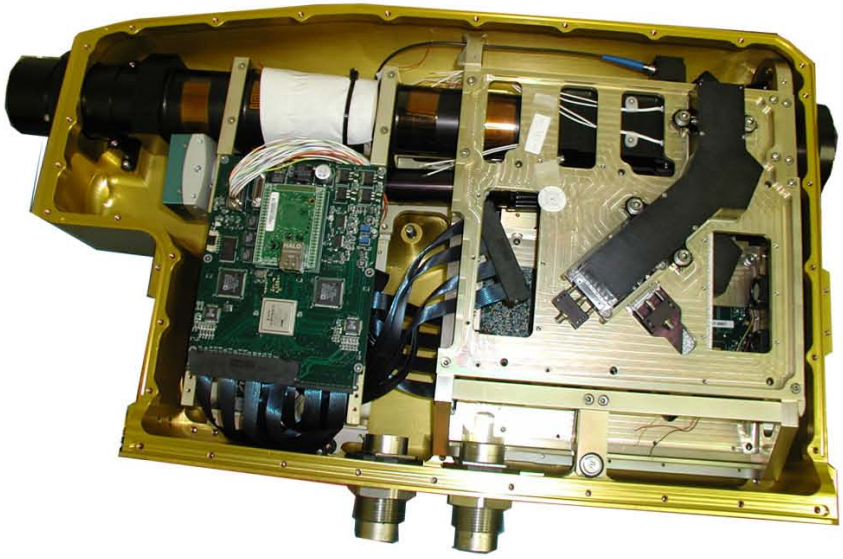


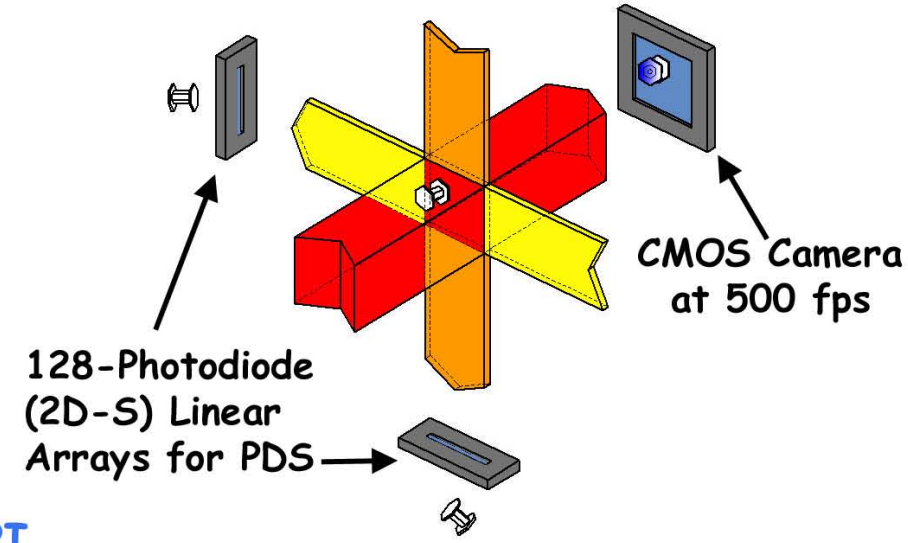
High Volume Precipitation Spectrometer (HVPS) Upgrade

- 2D-S Electro-optics: 128 Photodiodes with 150 µm Pixels
- Full Images of Particles from 150 µm to 2 cm at Airspeeds up to Mach 1

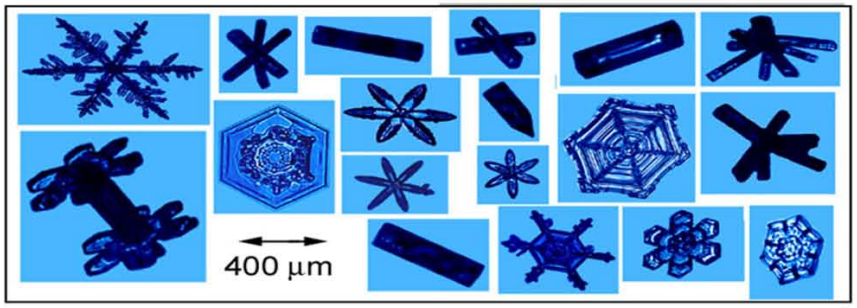
3V-CPI Combines 2D-S High-Speed (10 μm) and CPI High-Resolution (2.3 μm) Imagery



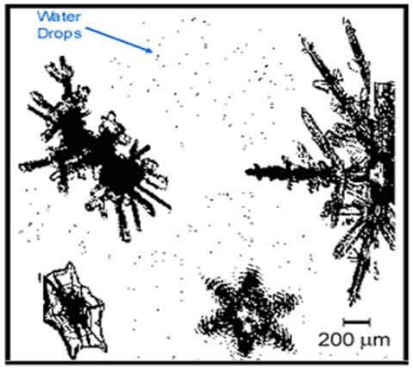


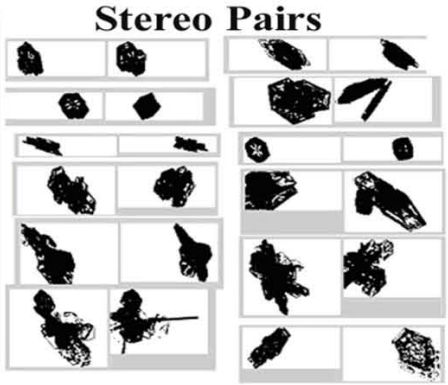


CPI Images



2D-S Images





SPECinc
Cloud Physics and Instrumentation

NASA SBIR/STTR Technologies

"Advanced Technology Cloud Particle Probe for UAS"

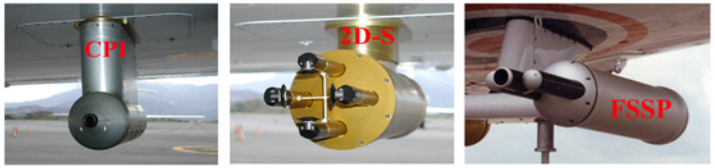
PI: Dr. R. Paul Lawson SPEC Inc. Boulder, CO

Proposal No. 08-S1.08-9098

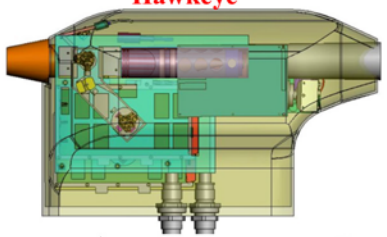
SBIR STTR

Identification and Significance of the Innovation

- Subvisible Cirrus (SVC) have a Significant Impact on Global Warming
- SVC are Observed at 55,000 to 60,000 ft and Require a Unique Research Aircraft (e.g.,WB-57F) and Dedicated (Expensive) Field Campaign
- Currently there is no Global Hawk Instrument Suitable for Studying SVC



3 Probes Combined into one Advanced Technology Solution



Technical Objectives and Work Plan

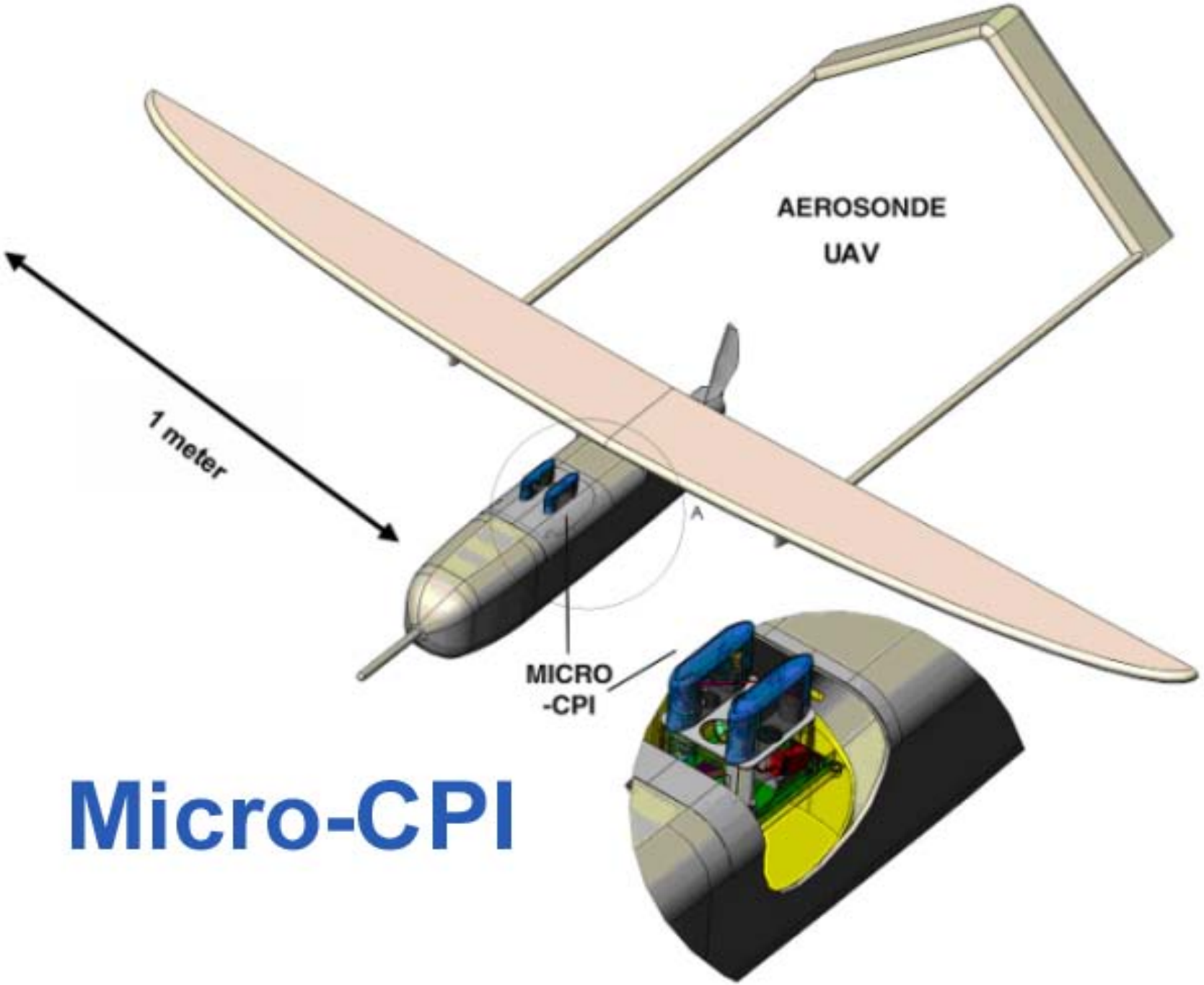
- Objectives - Phase I: Design an Instrument (the Hawkeye) that Combines and Exceeds the Capabilities of 3 Standalone Cloud Probes (CPI, 2D-S, FSSP). Phase II: Build and Test Fly Hawkeye on the Global Hawk or a Research Aircraft
- SPEC Currently Builds and Operates the CPI, 2D-S and FSSP on Research Aircraft and is in a Unique Position to Build and Test Fly the Hawkeye

TRL and NASA/Commercial Applications

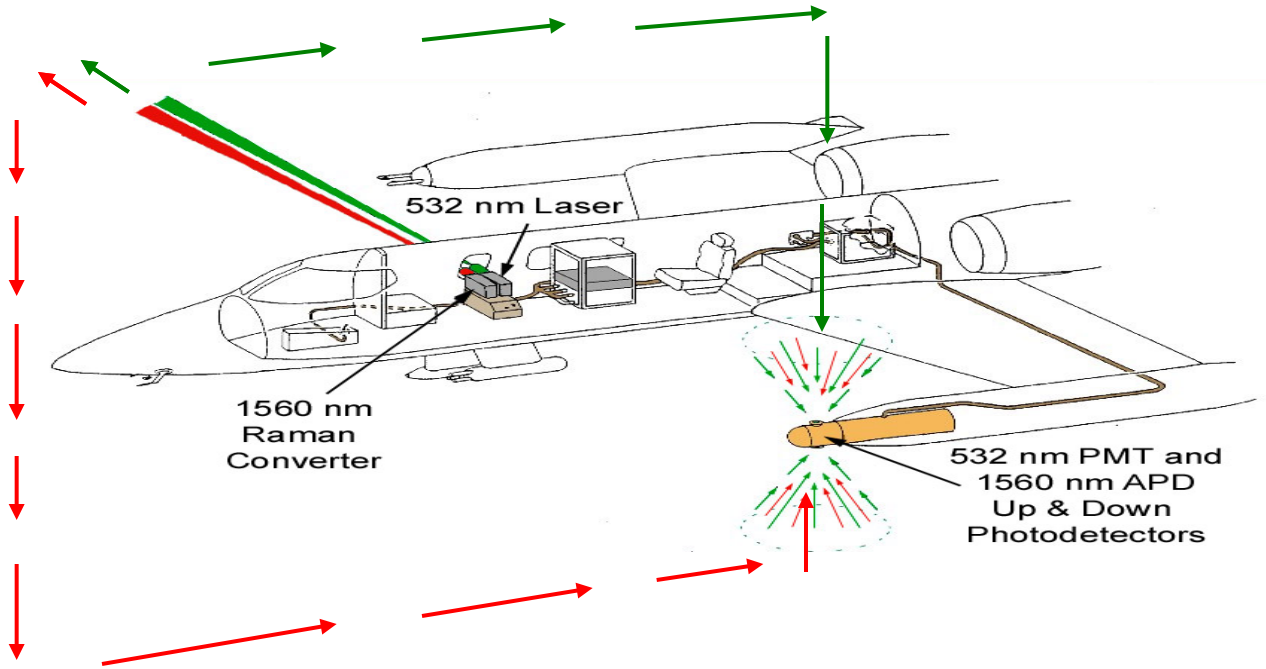
- TRL for Phase I is 3-4. TRL for Phase II is 8-9
- The NASA Radiation Sciences Program (RSP) is Planning to Investigate the Upper Troposphere/Lower Stratosphere with the Global Hawk during Upcoming Aura Validation Experiments (AVE). A Letter of Cooperation From the RSP Program Manager is Included in the SPEC Phase I Proposal.
- The Hawkeye will Replace Existing Cloud Particle Probes and be Sold for Application on Research Aircraft, Cloud Seeding and Icing Certification

Global Hawk UAS

Contacts: PI - plawson@specinc.com (www.specinc.com)
RSP Program Manager - Hal.Maring@nasa.gov

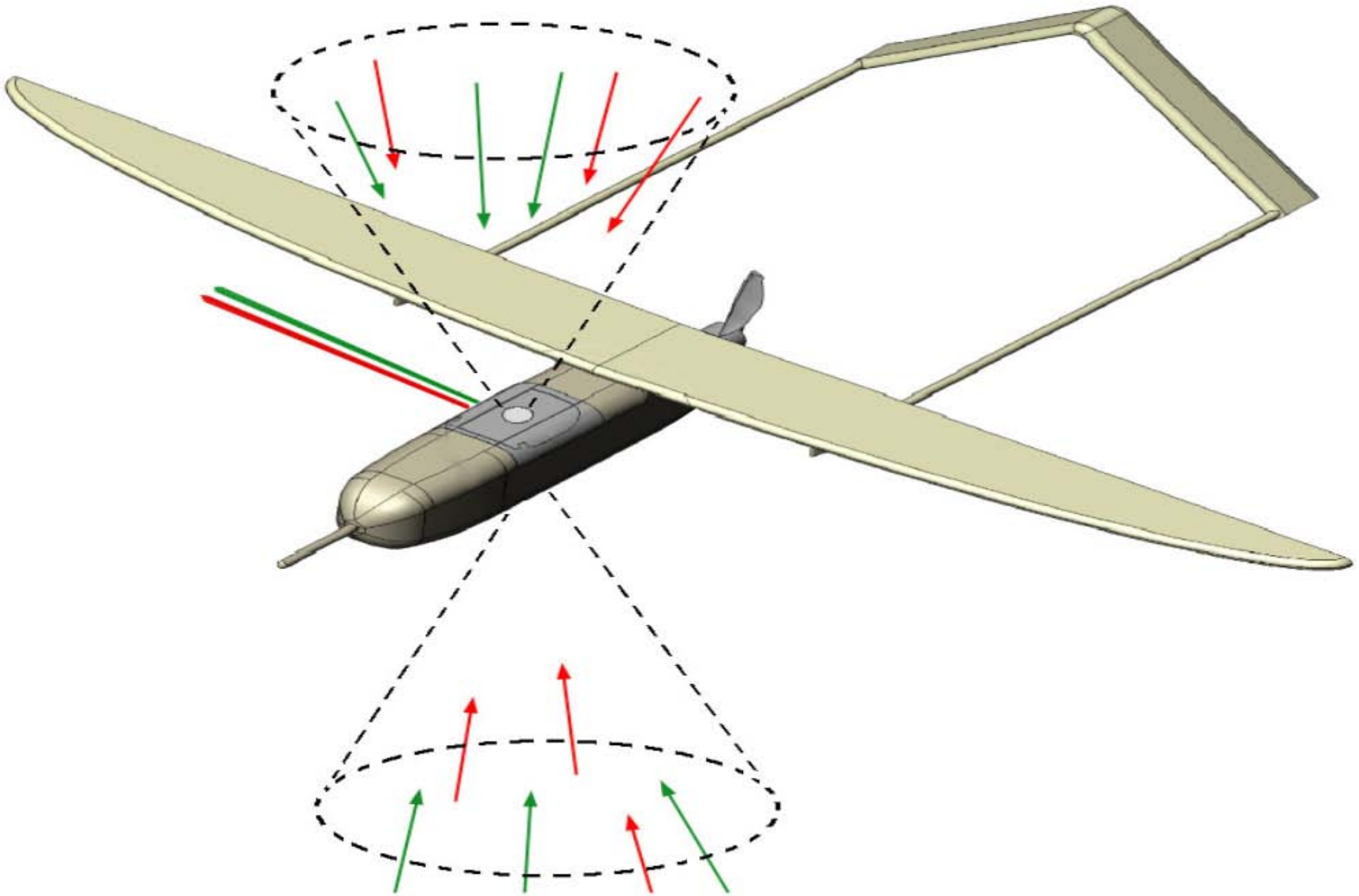


Micro-CPI

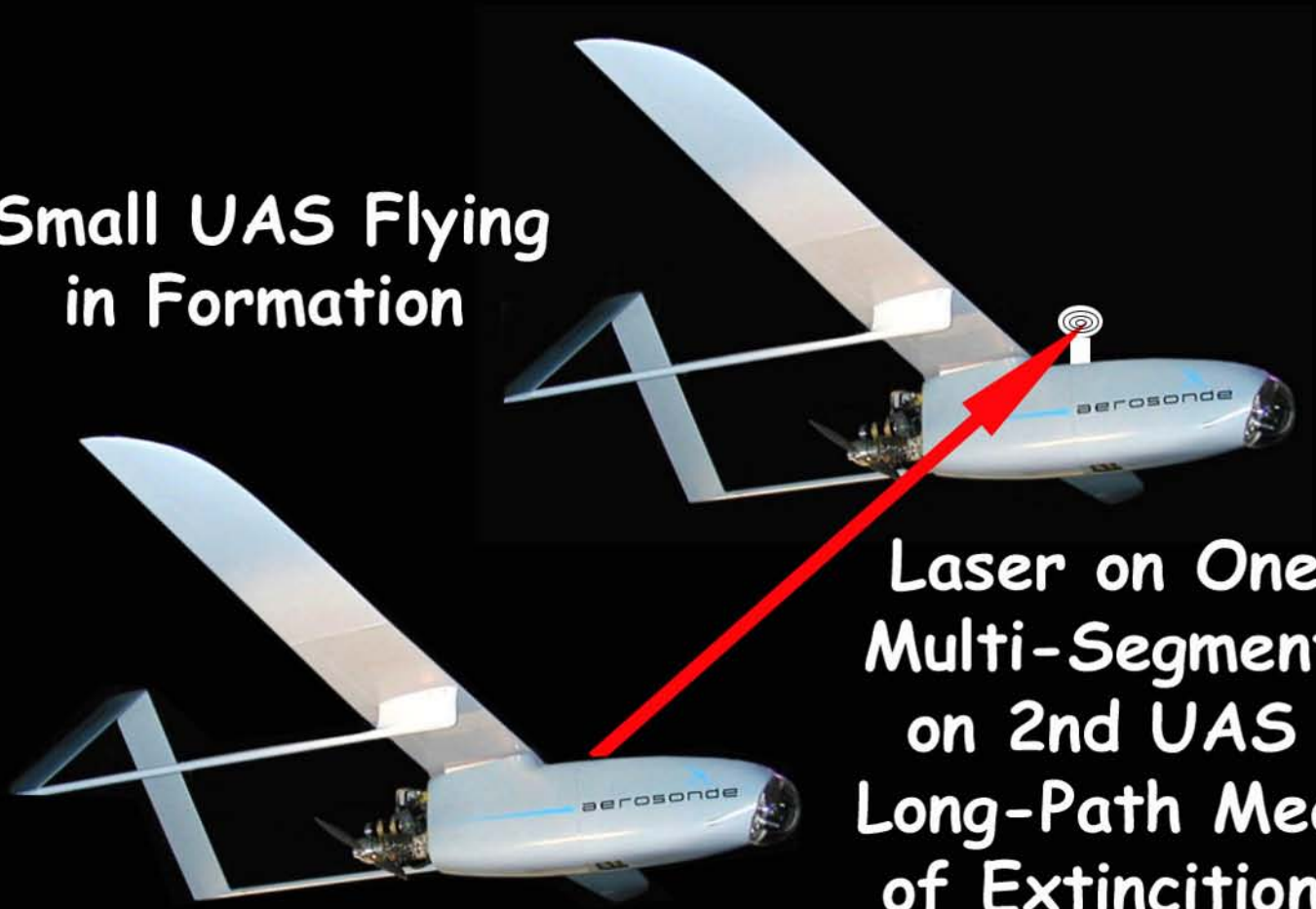


Dual-Wavelength In Situ Cloud Lidar Measures Extinction, LWC and Effective Drop Radius in Volumes Ranging from 25 m to 1 km from the Aircraft (i.,e, Sample Volumes of 10^6 to 10^9 m^3

Micro In Situ Cloud Lidar

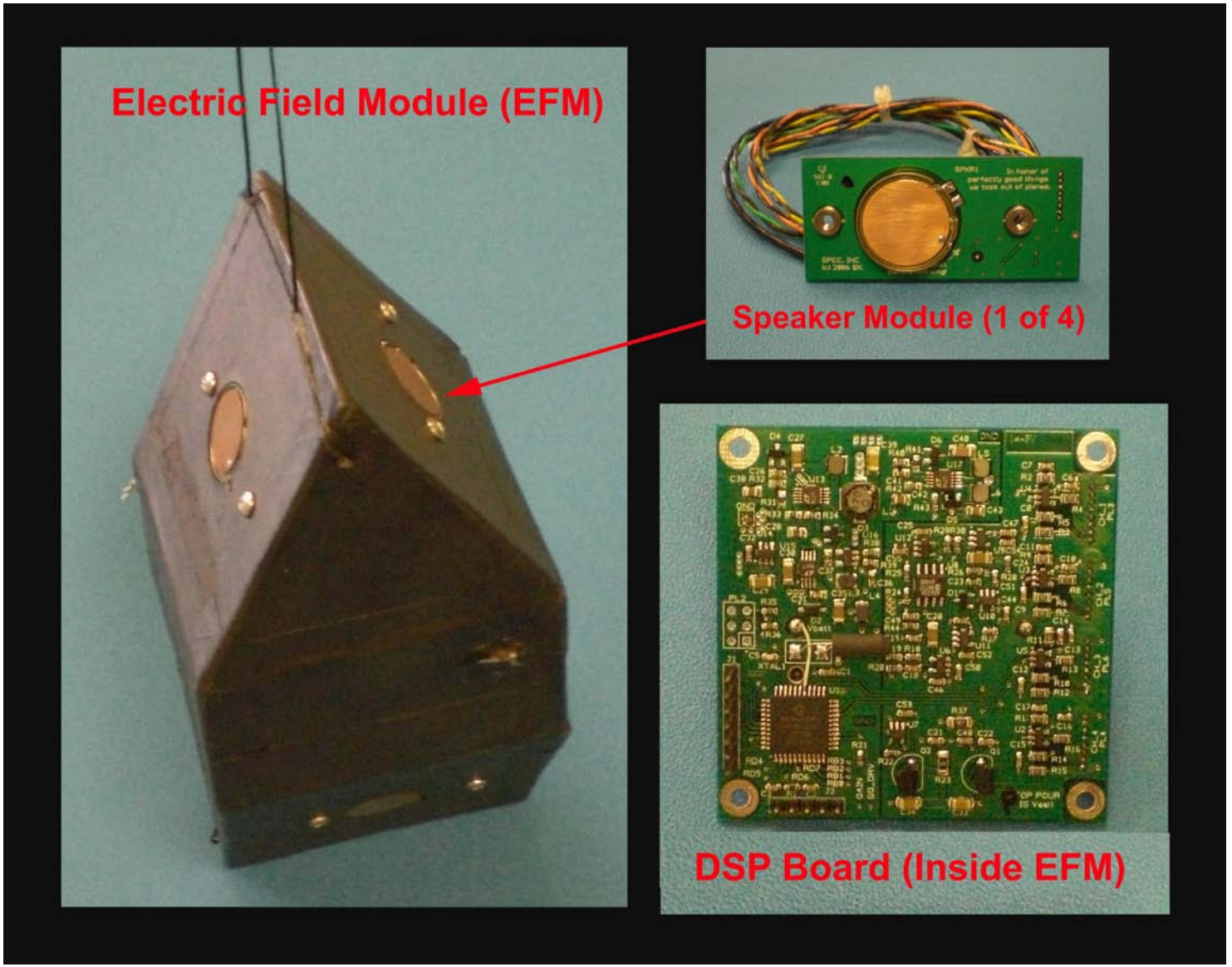


2 Small UAS Flying in Formation

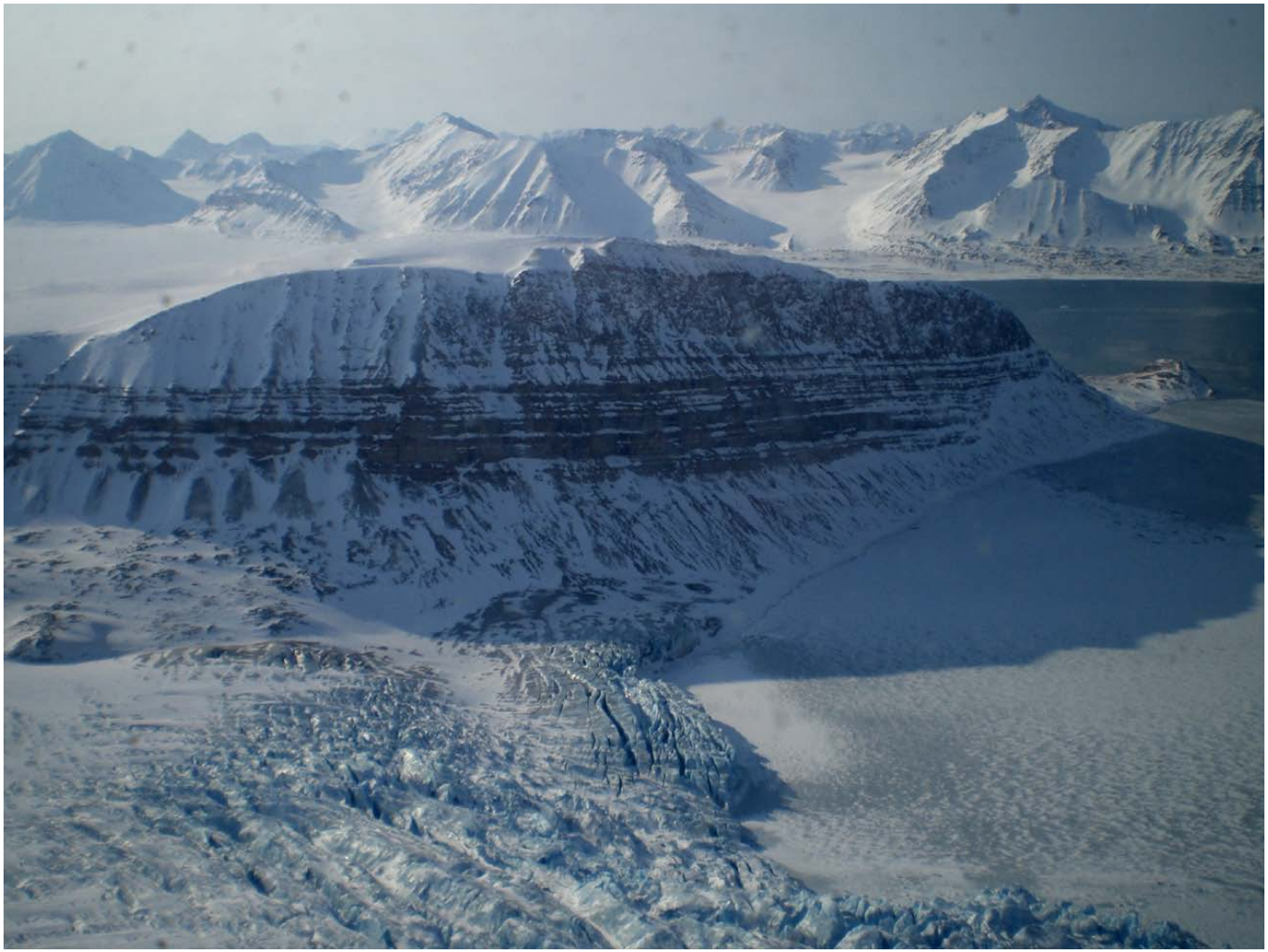


Laser on One UAS and Multi-Segment Detector on 2nd UAS Provides Long-Path Measurement of Extincition and Drop Size Distribution

Solid-state Module for Measurement of Electric Field Strength from Dropsondes



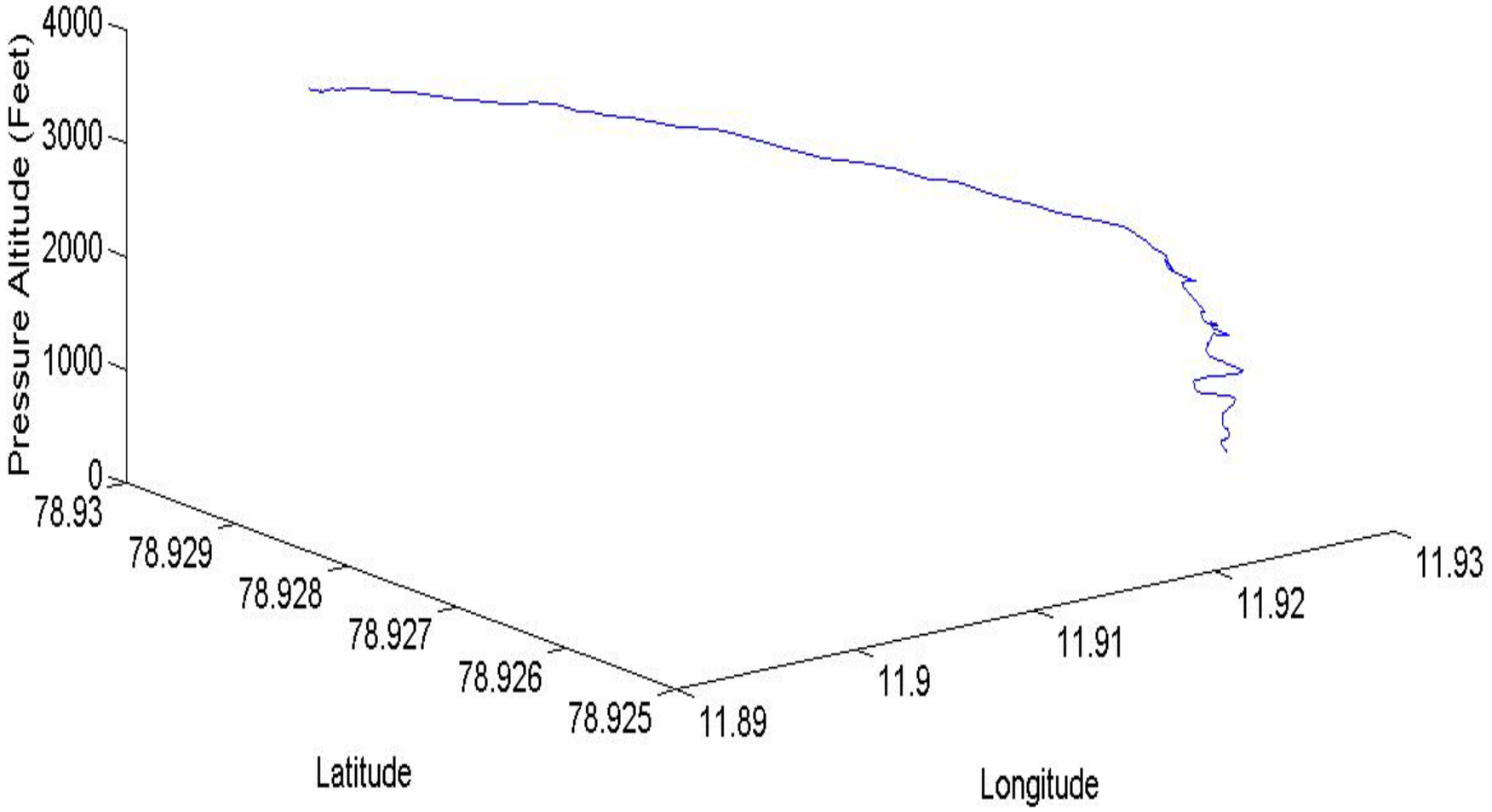
Tethered Balloon Ascents from Ny-Ålesund During Thorpex

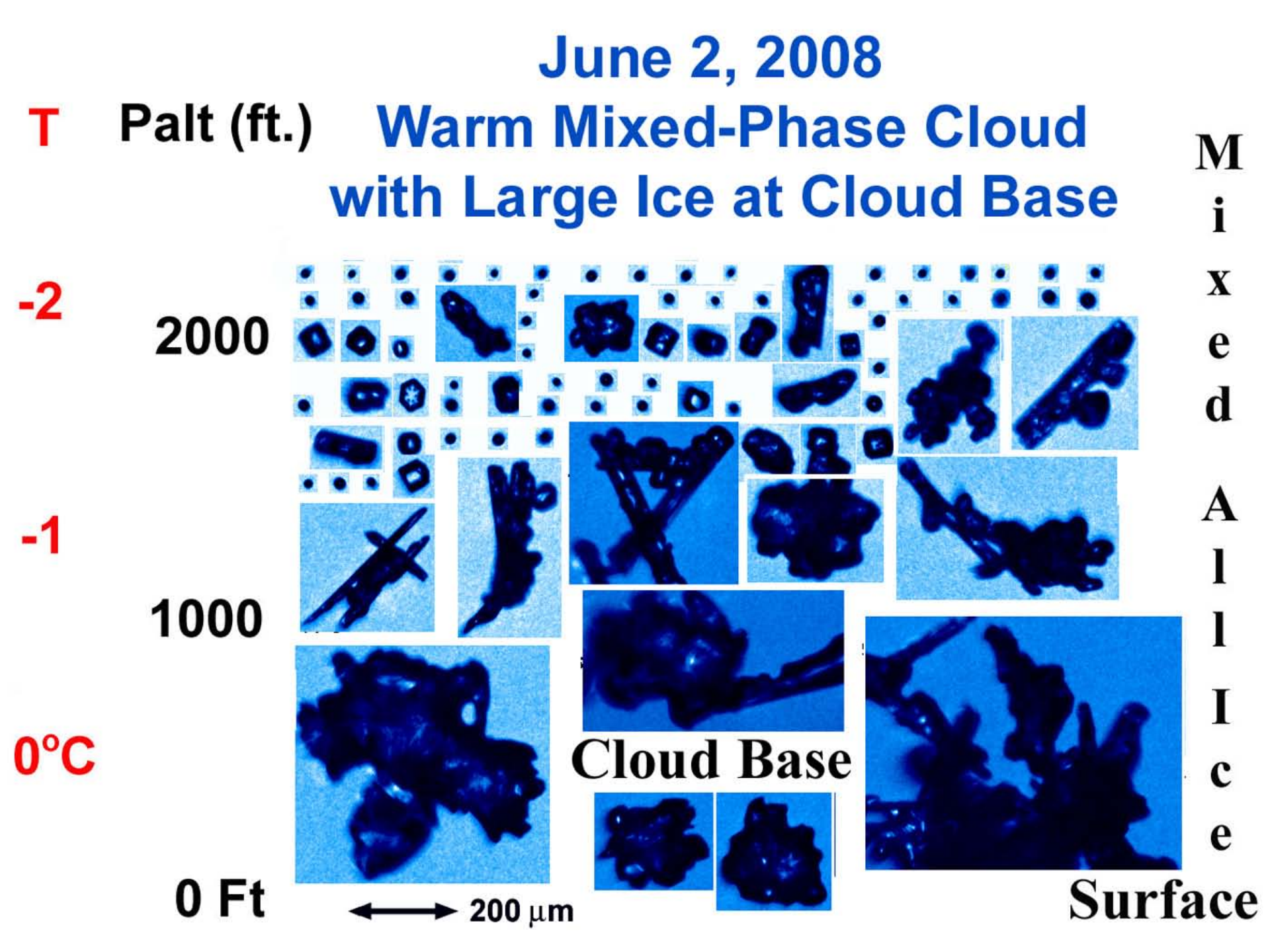



Svetlana

Moored Before Launch

Balloon 3-D Flight Track on 7 May 2008




June 2, 2008
Warm Mixed-Phase Cloud
with Large Ice at Cloud Base
T
Palt (ft.)
-2
2000
-1
1000
0°C
0 Ft
200 μm
Cloud Base
Mixed All Ice
Surface

Thank You!