

Airborne DWL: hurricane and boundary layer studies

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and

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Boulder, Colorado

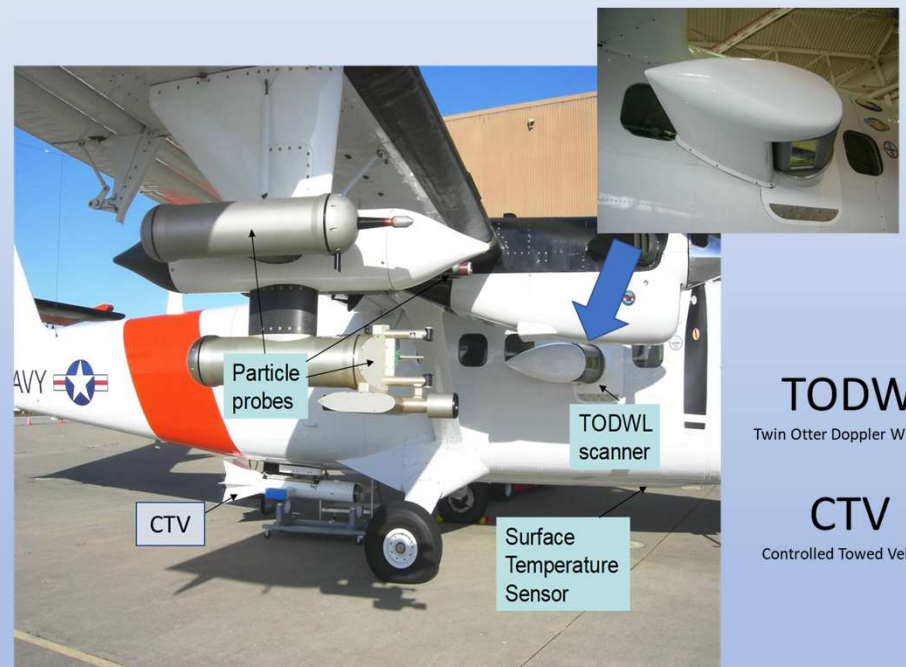
7-9 February, 2018

US Agency Airborne DWLs currently being used in atmospheric research

- Coherent DWLs funded to perform atmospheric research through SWA
 - TODWL (ONR and USArmy)
 - 2 um MAG 1A WindTracer flown on Twin Otter
 - P3DWL (NOAA/AOML)
 - 1.6um WTX flown on NOAA P3
 - DAWN (NASA)
 - 2 um flown on DC-8 and UC-12B
 - HALO-TX (ONR)
 - 1.6um HALO adapted for airborne use on NPS Twin Otter

TODWL activities

- Phase II C-17 wing tip vortex study funded by USArmy
 - Collaboration with K. Allen and D. Ligon (USArmy)
 - Phase III planned for summer 2018
- Boundary layer roll study off Monterey coast funded by ONR
- Collaboration with Naval Postgraduate School (H. Jonnsson) and University of Washington (R. Foster)
- In planning:
 - Forest fire management using airborne DWL observations with numerical models (UMd and others)
 - Airborne mapping of gas leak emission rates (NDA)



TODWL

Twin Otter Doppler Wind Lidar

CTV

Controlled Towed Vehicle

P3DWL science activities

- Collaboration with J. Zhang (University of Miami) & Lisa Bucci and R. Atlas (NOAA/AOML)
- Airborne DWL hurricane research transitioning into operations
- P3DWL flown in 2016 and 2017
 - Paper in final stages for submission to journal
- P3DWL to be flown in 2018 with onboard wind profile processing and downlinking of profiles (LOS, u,v,SNR,GOF,FWHM) to operations center



1.6 μm coherent WTX (ARL/LMCT)
10 cm bi-axis scanner (NASA)
P3 and other parts (NRL)
Analyses software (SWA/CIRPAS)



DAWN instrument and science activities

- Collaboration with NASA/LaRC, CPEX Science Team and Co-I Z. Pu (University of Utah)
- NASA is funding several activities related to DAWN as an airborne DWL
 - PolarWinds I and II data processing and archive at NASA/LaRC ASDC
 - CPEX data processing and archiving at NASA/LaRC ASDC
 - Preparation for DAWN's use in ADM Cal/Val 2018/19
 - Development of three advanced signal processing tools specifically designed for DAWN
 - Adaptive Sample Integration
 - Supervised Signal Search Algorithm
 - Multiple LOS Integration Algorithm (similar to MFAS)
- Planning for field missions including EUREC4A and EVS-3.
- Expected use in testing WINDSP sampling strategies



HALO-TX adaptation to mobile operations

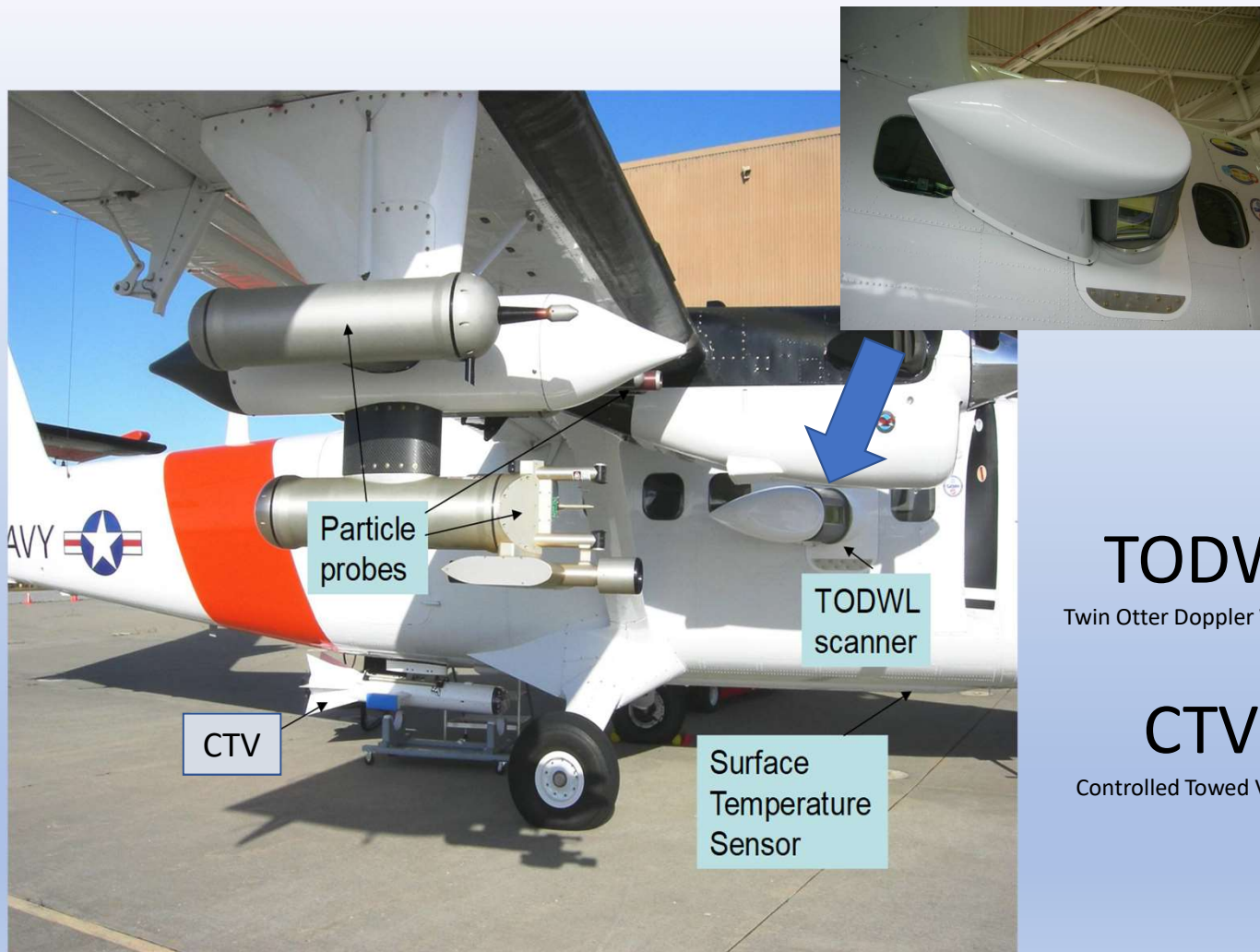
- Collaboration with S. de Wekker and M. Bossche (University of Virginia)
- ONR requested a smaller SWAP DWL for use on its Twin Otter
- Funded through a DURIP at UVa
- Dual purpose DWL:
 - Trailer hosted for wind profiles on the move using airborne operations software developed for TODWL
 - Twin Otter hosted to allow multiple “significant” instruments to fly together...TODWL still used when appropriate

Comments (1)

- These US agency airborne DWLs are not the only systems available for science investigations and technology evaluations. The Europeans have been flying a coherent DWL for many years in science campaigns and more recently, a direct detection molecular DWL. Japan and China have airborne DWL programs. Ball's airborne OAWL represents a very valuable “non-coherent” DWL that needs to be included in future research campaigns.
- The collective use of these airborne DWLs for science investigations and various support applications enhances the advocacy for a space-based mission.

Comments (2)

- Field campaigns need to be designed to specifically address the sampling issues related to an orbiting lidar's small footprint (illuminated volumes) and DWL representation in OSSEs and other modeling studies such as those ongoing with PolarWinds, CPEX and HFIP data.
- A special effort is being made with the DAWN data from CPEX and PolarWinds to develop a set of reference cases (under various weather conditions) where the sample density, patterns and measurement precision/bias mimic those for a space based DWL.
- OSSEs designed to evaluate synergisms between wind observing systems, both currently operational and proposed, should use the airborne DWL data to “calibrate” or “validate” the sampling and measurement errors used in the OSSE data assimilation.



TODWL

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P3DWL for NOAA HFIP



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DAWN Integration on DC-8:
PolarWinds 2014-2015

HALO-Trailer

