

**Supplementary Materials C-RITE Workshop:  
Instrumentation and Platforms Table for C-RITE Workshop**  
(Last Updated May 2017)

The Table below shows many of the platforms and instruments considered at the C-RITE workshop. Many facilities available for the exploration of atmospheric convection and turbulence in the United States at this time are listed. This list is not complete, certainly not in terms of PI-provided instruments. It does include facilities in the NSF Lower Atmosphere Observing Facilities (LAOF) pool.. The column "Access Type" indicates whether the platform or instrument is available through LAOF, interagency collaboration / agreement, or PI collaboration. The numbers in the column "Science themes" refer to the four themes the C-RITE workshop was organized around:

1. Boundary Layer Flow and Turbulence
2. Dynamics and Thermodynamics of Convection
3. Free Troposphere Flows and Turbulence
4. Physical Processes in Convection

<b>Instrument</b>	<b>Home Institution</b>	<b>Access Type</b>	<b>Science Theme(s) addressed</b>	<b>Measurements, comments</b>
<b>Manned Aircraft</b>				
G-V (formerly HIAPER)	NCAR/EOL	LAOF	1,2,3,4	
C-130	NCAR/EOL	LAOF	1,2,3,4	
G550 "HALO"	DLR	agency collaboration	1,2,3,4	
Beech King Air	U. of Wyoming	LAOF	1,2,3,4	
Beech King Air	Weather Modification Intl.	commercial lease	2,3,4	aerosol and cloud microphysics
DC-8	NASA	agency collaboration	4	
WB-57	NASA	agency collaboration	4	HDSS dropsondes, aerosols and gases, hyperspectral

ER-2	NASA	agency collaboration	4	
P-3	NOAA	(restricted)	2,3,4	
P-3	NRL	agency collaboration	2,4	not clear whether it can carry a scanning radar
G-IV	NOAA	agency collaboration	2,4	
G-1	DOE	agency collaboration	4	
DH6 "Twin Otter"	CIRPAS	LAOF	1,2,3,4	aerosols and cloud physics
DH6 "Twin Otter"	Twin Otter International	commercial lease	1,2,4	
DH6 "Twin Otter"	NOAA	agency collaboration	1	airborne flux estimation
Cessna 206	NOAA	agency collaboration	1,4	aerosols and gases
Cessna Citation II	Weather Modification Intl.	commercial lease	2,3,4	microphysics,atmos. electrical
Lear 25	SPEC	commercial lease	2,3,4	microphysics
Lear 35A	Weather Modification Intl.	commercial lease	2,3,4	microphysics, dropsondes
Mooney	Scientific Aviation	commercial lease	1,2,4	gases and aerosols
Tethered Lift System (TLS)	CU	PI collaboration	1,2,4	
<b>Unmanned Aerial Systems</b>				
Global Hawk	NASA	agency collaboration	2,3,4	AVAPS Dropsonde
PolarShark	DOE	agency collaboration	4	
NASA ballooning program	NASA	agency collaboration	3,4	

Driftsonde	EOL/NCAR	PI collaboration	2,4	
<b>Airborne Remote Sensing Instruments</b>				
Hiaper Cloud Radar (HCR)	NCAR/EOL	LAOF	1,2,3,4	W-band, scanning, pod-mounted on G-V
Wyoming Cloud Radar (WCR)	U. of Wyoming	LAOF	1,2,3,4	W-band, up/down profiling, use on UWKA, C-130
Ka-band Profiling radar (KPR)	U. of Wyoming	PI collaboration	2,4	up/down profiling, fits in a PMS cannister
Wyoming Cloud Lidar (WCL)	U. of Wyoming	LAOF	1,2,3,4	up/down profiling, use on UWKA, C-130
Multi-function Airborne Raman Lidar (MARLi)	U. of Wyoming	PI collaboration	1,2,3,4	downward profiles of T, Q, aerosol, and clouds
Compact Raman Lidar (CRL)	U. of Wyoming	PI collaboration	1,2,3,4	downward profiles of T, Q, aerosol, and clouds
Hurricane Imaging Radiometer (HIRAD)	NASA	interagency agreement	2,3,4	
Tail Doppler Radar (TDR)	NOAA P3s, G-IV	interagency agreement	2,3,4	3D wind fields in precip
Stepped Frequency Wave Radiometer	NOAA P3s, G-IV	interagency agreement		Surface wind speed over ocean (>10 m/s)
AROTAL (airborne Raman lidar)	NASA	PI collaboration	2,3,4	
APR-2 (airborne precipitation radar)	NASA/JPL	agency collaboration	2,4	
MAS (MODIS Airborne Simulator)	King/NASA	agency collaboration	2,4	
MASTER (MODIS/ASTER airborne simulator)	Hook/JPL/NASA	agency collaboration	2,4	
HSRL (High Spectral Resolution Lidar)	Hostetler/NASA Langley	agency collaboration	2,3,4	
UV DIAL	Hair/NASA Langley	agency collaboration	2,3,4	
Troposphere Wind Lidar Technology Experiment (TWiLiTE)	NASA Goddard	agency collaboration	2,3,4	

Microwave Temperature Profiler (MTP)	NCAR/EOL	LAOF	1,2,3,4	NCAR G-V; Temperature profile
High Spectral Resolution Lidar (HSRL)	NCAR/EOL	LAOF	1,2,3,4	NCAR G-V; up/down calibrated aerosol backscatter cross-section and depolarization ratio; cloud & aerosol optical depth, and extinction cross-section
HIAPER Airborne Radiation Package (HARP)	NCAR/EOL	LAOF	1,2,3,4	NCAR G-V
<b>Deployed from Aircraft</b>				
Airborne Vertical Atmospheric Profiling System (AVAPS) (dropsonde)	NCAR/EOL	LAOF	2,3,4	PTH & Wind profiles, flight altitude to surface. Can operate on the NCAR G-V & C-130, and the NOAA P-3 & G-IV
XDR-928 dropsonde	Yankee Environmental	commercial	2,3,4	
<b>Airborne in-situ</b>				
Vertical Cavity Surface Emitting Laser Hygrometer (VCSEL)	NCAR/EOL	LAOF	1,2,3,4	NCAR G-V; Water vapor concentration
Chemical Ionization Mass Spectrometer (CIMS)	NCAR/EOL	LAOF	1,2,3,4	NCAR G-V
Fast ozone instrument	NCAR/EOL	LAOF	1,2,3,4	NCAR G-V
GPS Multistatic and Occultation Instrument (GISMOS)	NCAR/EOL	LAOF	1,2,3,4	NCAR G-V
Quantum Cascade Laser Spectrometer (QCLS)	NCAR/EOL	LAOF	1,2,3,4	NCAR G-V
Small ice detector (SID)	NCAR/EOL	LAOF	1,2,3,4	NCAR G-V, C-130
3-View Particle Imager (3V-CPI)	NCAR/EOL	LAOF	1,2,3,4	NCAR G-V
Trace Organic Gas Analyzer (TOGA)	NCAR/EOL	LAOF	1,2,3,4	NCAR G-V
Time-of-Flight Aerosol Mass Spectrometer (TF-AMS)	NCAR/EOL	LAOF	1,2,3,4	NCAR G-V

cryogenic frostpoint hygrometer (CFH)	Vömel - NCAR/EOL	PI collaboration	2,3,4	
2-channel NO/NO <sub>y</sub>	ACOM/NCAR	LAOF	4	
4-channel NO <sub>x</sub> & O <sub>3</sub>	ACOM/NCAR	LAOF	4	
Fast O <sub>3</sub>	ACOM/NCAR	LAOF	4	
Picarro WS-CRDS CO <sub>2</sub> & CH <sub>4</sub>	ACOM/NCAR	LAOF	4	
aerosol integrated light scattering (TSI 3563)	Clarke/U Hawaii	PI collaboration	4	
ATHOS (tropospheric hydrogen oxides)	Brune/Penn State	PI collaboration	4	
APMIR (polarimetric microwave imager)	Coffey / NRL	PI collaboration	4	
TD-LIF (airborne nitrates)	Cohen/UC Berkeley	PI collaboration	4	
Cloud absorption radiometer	Gatebe/ USRA	PI collaboration	1,2,4	
open path laser hygrometer	EOL/NCAR	PI collaboration	1,2,4	
DMA-TDMA (Aerosol mobility analyzer)?	Clarke/ U. Hawaii	PI collaboration	4	
Scanning mobility particle sizer	ACOM/NCAR	PI collaboration	4	
MEDUSA (flask sampling system)	EOL/NCAR	PI collaboration	4	
NCAR O <sub>2</sub> /N <sub>2</sub> ratio	EOL/NCAR	PI collaboration	4	
PAN gas chromatograph	ACOM/NCAR	PI collaboration	4	
size-resolved aerosol volatility	Clarke/ U. Hawaii	PI collaboration	4	
various instruments for VOCs, PANs, NO <sub>x</sub> , HO <sub>x</sub> , RO <sub>2</sub> , etc.	ACOM/NCAR	PI collaboration		<a href="https://www2.acom.ucar.edu/observations/additional-situ-measurement-instrumentation-and-resources">https://www2.acom.ucar.edu/observations/additional-situ-measurement-instrumentation-and-resources</a>
Aero-Laser CO	NCAR/ACOM	LAOF	3,4	
CAPS (cloud aerosol and precipitation spectrometer)	DMT		4	

CIP (Cloud imaging probe)	DMT		4	
PIP (Precipitation imaging probe)	DMT		4	
LW-100 (hot wire cloud water probe)	DMT		1,2,4	
SP2 (soot particle photometer)	DMT		1,2,4	
2D-S (2D stereo precip imaging probe)	SPEC		2,4	
HVPS-3 (high volume precipitation spectrometer)	SPEC		1,2,4	
FCDP (fast cloud droplet probe)	SPEC		2,4	
CPI (cloud particle imager)	SPEC		2,4	
3V-CPI (CPI + 2D-S)	SPEC		2,4	
Hawkeye (CPI+2D-S+FCDP)	SPEC		2,4	
time-of-flight aerosol mass spectrometer	Aerodyne		4	
<b>Ground-based Remote Sensors</b>				
S-Polka dual wavelength dual polarization radar	NCAR/EOL	LAOF	1,2,3,4	Reflectivity, Doppler velocity, dual-polarization, low-level moisture, liquid water content in clouds
Water Vapor DIAL	NCAR/EOL		1,2,3,4	
NPOL S-band dual-pol radar	NASA Wallops	agency collaboration		
Integrated Sounding System (ISS)	NCAR/EOL	LAOF	1,2,3	Wind profilers, radiosonde soundings, sodar, RASS, ceilometer, and surface met in fixed site and mobile configurations
MIPS (Mobile Integrated Profiling System)	UAH	University support	1,2,3	
CSU-CHILL (S/X-band, transportable)	Colorado State U.	University support	2,3,4	
SEA-POL (C-band, deployable on ships)	Colorado State U.	University support	2,3,4	

RAXPOL (X-band polarimetric)	Oklahoma U.	PI collaboration	2,3,4	
OU-PRIME (C-band polarimetric)	Oklahoma U.	PI collaboration	2,3,4	
PX-1000 polarimetric X-band radar	Oklahoma U.	PI collaboration	2,3,4	
Doppler-on-Wheels (mobile X-band polarimetric; 3)	CSWR	LAOF	2,3,4	two dual-pol DOWs, one rapid-scan DOW
NOXP (mobile X-band polarimetric)	NOAA NSSL	agency collaboration	2,3,4	
SMART-R (2 mobile C-band radars, 1 is polarimetric)	OU	contract	2,3,4	
TTU Ka-band (2 mobile)	Texas Tech U	PI collaboration	2,3,4	two Ka-band mobile radars, narrow beamwidth with pulse compression
TTU DOE-X (transportable)	Texas Tech U	PI collaboration	2,3,4	containerized; high power, narrow beamwidth with pulse compression
MWR-05XP (mobile X-band phased array)	FAA	collaboration	2,3,4	formerly CIRPAS equipment
MAX (Mobile Alabama X-band)	UAH	University support	2,3,4	
ARMOR 5 cm dual-pol C-band	UAH/NASA	collaboration with UAH	2,3,4	
KASPR (35-GHz, polarimetric)	Stony Brook U.	University support	2,3,4	transportable (seatainer) scanning polarimetric Ka-band
CFMCW (94-GHz, profiling)	Stony Brook U.	University support	2,3,4	portable W-band radar profilign
LPAR (X-band, phased array)	Stony Brook U.	University support	2,3,4	mobile (on truck), dual-pol
XR-Doppler Lidar (Halo)	Stony Brook U.	University support	1,2,3,	Long range (12 km), high power Doppler lidar
Ka/W-Scanning ARM Cloud Radar	DOE/ARM	Mobile Facility Request	2,3,4	3 systems at fixed sites, 1 in mobile facility
Ka/X-Scanning ARM Cloud Radar	DOE/ARM	Mobile Facility Request	2,3,4	1 system at fixed site, 1 in mobile facility
C-SAPR2	DOE/ARM	Mobile Facility Request	2,3,4	Transportable C-band dual-pol system
KAZR (Profiling)	DOE/ARM	Mobile Facility Request	2,3,4	Profiling 35-GHz radar (6 systems)

SR-Doppler Lidar (Halo)	DOE/ARM	Mobile Facility Request	1,2,3	Short-range (3 km) Doppler lidar, 8 systems
Compact Microwave Radiometer Network	Reisling / CSU	PI collaboration	1,2,3,4	
Lidar Atmospheric Sensing Experiment (DIAL lidar)	Ferrare / NASA	PI collaboration	1	
microwave sounding systems	DeTect, Inc.	commercial	1	
Doppler wind lidars (profiling and scanning)	NRG/LEOSPHERE	commercial	1	
High Resolution Doppler Lidar (HRDL)	NOAA CSD	agency collaboration		
Doppler wind lidars (Windcube 200S)	NOAA CSD	agency collaboration		
FTUVS (Fourier-transform UV sounding system)	JPL/NASA	agency collaboration	1.2	permanently installed at Table Mountain, CA site
profiling Ka-band mm cloud radar	NOAA ESRL	agency collaboration	1,2,4	
W-band mm cloud radar	NOAA ESRL	agency collaboration	1,2	
X-band dual-pol scanning radar	NOAA ETL	agency collaboration	1,2,3,4	
3-wavelength microwave radiometer	NOAA ETL	agency collaboration	1,2,3,4	
REAL eye-safe 1.5 micrometer lidar	Mayor/Cal State Chico	PI collaboration	1,2	
S-band precipitation profiler	NOAA/ETL	agency collaboration	2,4	
multi-frequency microwave profiling radiometer	Radiometrics, Inc	commercial	2,4	
S-band FMCW boundary layer profiler	UMass	PI collaboration	2,4	
X-Pol mobile polarimetric Doppler radar	UMass	PI collaboration		



X-band polarimetric phased array (1D)	UMass	PI collaboration		
W-band mobile Doppler radar	UMass	PI collaboration		
94 GHz Doppler cloud radar	U Miami	PI collaboration	2,4	
5 cm dual-pol Doppler radar	U North Dakota	PI collaboration	2,4	
CLAMPS I (AERI, MWR, Doppler wind lidar)	Univ/ of Oklahoma/NOAA NSSL	PI collaboration	1, 2, 3, 4	mobile profiling system funded through NSF MRI grant
CLAMPS II (AERI, MWR, Doppler wind lidar)	NOAA NSSL	PI collaboration	1, 2, 3, 4	mobile profiling system funded by NOAA
SPARC (AERI, HALO wind lidar, HSRL, sondes)	U Wisconsin/SSEC/CIMSS	PI collaboration	1,2,3,4	mobile profiling trailer funded by UW Space Science and Engineering
Doppler Sodar	GI-UAF	PI collaboration		
Doppler wind lidars (Windcube 200S)	U Texas Dallas (Iungo)	PI collaboration		
Doppler wind lidars (Windcube 200S)	U Maryland Baltimore County (Delgado)	PI collaboration		
West Texas Mesonet	Texas Tech U	PI collaboration	1,2	104 fixed surface meteorological stations, 7 sodars
West Texas Lightning Mapping Array	Texas Tech U	PI collaboration	2,4	fixed deployment of 11 sensors centered on Lubbock, TX
<b>Surface In-situ, deployable</b>				
Integrated Surface Flux System (ISFS)	NCAR/EOL	LAOF	1	network of stations, variable tower height
Li-Cor 7500 CO <sub>2</sub> sensor	NCAR/ACD	PI collaboration	1	
CSAT sonic anemometers (4)	Univ. of Oklahoma	PI collaboration	1	
NEON Assignable Assets	NEON/Battelle	Mobile Facility Request	1	<a href="http://www.neonscience.org/opportunities/assignable-assets">http://www.neonscience.org/opportunities/assignable-assets</a>
Ameriflux Rapid Response Flux System	DOE/LBL	Mobile Facility Request	1	Ecosystem eddy flux systems for response to rapid changes (fire, disturbance) <a href="http://ameriflux.lbl.gov/resources/rapid-response-flux-systems/">http://ameriflux.lbl.gov/resources/rapid-response-flux-systems/</a>

Optical Scintillometers	GI-UAF	PI collaboration		
Integrated Sounding System (wind profiler, MW41 sounding systems, RASS, SODAR)	NCAR/EOL	LAOF	1	449 MHz Modular spaced array wind profiler, 915 MHz & 1290 MHz DBS wind profiler, SODAR, RASS, Vaisala MW41 radiosonde system, surface met station.
Ballooning and Observation Laboratory for Thunderstorms (BOLT)	Texas Tech U.	PI collaboration	1,2	Mobile laboratory with adaptable payload system, Vaisala radiosonde system, 6.5 m deployable mast
West Texas Mesonet	Texas Tech U	PI collaboration	1,2,4	104 surface meteorological stations, 7 sodars
200 m tower	Texas Tech U	PI collaboration	1,2,4	10 levels, logarithmic spacing, 50 Hz sonic anemometers, P/T/H. Elevator and trained staff for servicing.
StickNet (currently 24 sensors)	Texas Tech U	PI collaboration	1,2	Rapidly deployable conventional meteorological sensors (P/T/H/wind) on 2.5 m tripod. Network connected. Solar powered for long-term deployments.
<b>Emerging Technologies</b>				
Airborne Phased Array Radar (APAR)	NCAR	LAOF	2,4	conceptual design phase
Storm-Penetrating A-10	TBD	LAOF	2,4	paused in development
CentNet	NCAR	LAOF	1,2,4	paused, ready to build
Multimode Radar (SAR, StripSAR, ISAR, MTI)	NOAA P-3	agency collaboration		testing phase surface roughness, scatterometry, PPI w/Doppler
Full Stokes Lidar 1.57 micron	GI-UAF	PI collaboration		testing phase
X-band Dual-Pol Phased Array (2D)	UMass	PI collaboration		to be installed in late 2017/early 2018
Rapidly Deployable Lightning Mapping Array (LMA)	Texas Tech U.	PI collaboration	2,4	3 deployable platforms used to supplement fixed-base networks. Further expansion in part by removing two fixed-base stations from West Texas LMA.