QUESTION 7: PURPOSE OF EXPERIMENT

The Center for Western Weather and Water Extremes (CW3E) of Scripps Institution of Oceanography at the University of California San Diego pursuant to Section 5.61 of the Federal Communications Commission's (FCC) rules, respectfully requests authority to operate the experimental license as indicated in the attached application. In support thereof, the following information is provided.

Program of Research and Objectives

The Radar Wind Profiler (RWP) will be operated by CW3E to serve two research programs: The California Atmospheric River Program (AR Program) and Forecast Informed Reservoir Operations (FIRO).

The California Atmospheric River (AR) Program was authorized by California Senate Bill SB-758 and signed by Governor Brown in 2015. The AR Program is housed in the CA Department of Water Resources and aims to develop the science of atmospheric rivers to support planning, forecasts and warning elements of flood management and water management in California. Atmospheric rivers (ARs), elongated transports of water vapor, are important for water supply in California, however, the most extreme ARs can lead to flooding. Better monitoring and prediction of ARs has the potential to enhance use of existing reservoirs as to increase water storage while maintaining flood control capabilities. Implementation of existing knowledge and research to extend that knowledge and develop tools could mitigate risks of too much or too little precipitation and could aid in adaptation to changes in climate.

This interdisciplinary project requires innovations in meteorology, hydrology, climate science, data science, oceanography, civil engineering, water resources management, fisheries management, and decision support systems. Major observational, computational, and educational capacity, including science and engineering, are core elements of the AR Program. Execution of AR Program Phase II builds on the partnerships, tools, staff, and project management built during Phase I, which included close and strong leveraging of federal facilities (e.g., weather reconnaissance aircraft, supercomputers, and Forecast Informed Reservoir Operations, FIRO, which enabled changes to the operations guidance and training of the U.S. Army Corps of Engineers, USACE). Research efforts in the AR Program focus on further improving situational awareness of ARs and the associated precipitation to enhance the resilience of California to extreme water related events.

The goal of FIRO is to develop, demonstrate, and implement tools and science that enable more effective management of reservoirs by leveraging improvements in weather and water forecasts. FIRO creates a natural linkage between research, applications, technology, reservoir operations and water control manuals to enable continuous improvement based on state-of-the-science. FIRO is a management strategy that leverages data from watershed monitoring, state-of-the-science, and meteorological and hydrologic forecasts to help water managers to selectively retain or release water from reservoirs taking into consideration current and predicted conditions.

In California, almost all of the major floods, and associated costs, are attributable to ARs. Their interaction with topography can lead to intense precipitation. ARs also produce beneficial water supply when the events are relatively short in duration and/or weak in strength. The duration and intensity of ARs, when represented by the total upslope water vapor flux, explain 75% of the variance in the amount of precipitation produced by an AR. Thus, understanding the interaction of processes across multiple scales, including micro, meso, and synoptic phenomena that can modulate the duration and strength of an AR, is necessary to support improved forecasts of extreme events. Similarly, understanding how other characteristics of ARs, such as orientation, atmospheric stability, vertical distribution of water vapor flux, and the presence of different aerosol types and amounts, explain variability in the amount of precipitation produced by an event, and developing the capability to observe these characteristics, can support improved forecasts. Further developing methods to evaluate forecasts of ARs and associated precipitation, as well as reliably quantifying the prediction uncertainty, increases forecast knowledge and facilitates the integration of information into reservoir management and decision-making processes. Research and development on ARs is a cornerstone to implementing FIRO along the U.S. West Coast given the dominance of ARs in water supply planning and flood hazard management.

The RWP creates a cross-sectional view of the air column providing information at high vertical resolution on horizontal winds up to 5 km in the atmosphere. Wind data at this spatial and temporal resolution does not currently exist in San Diego. The additional data provided by the RWP about atmospheric processes during ARs will enhance forecasting and modeling capabilities to support the AR Program and FIRO, and will enhance emergency preparedness and resource management via near real time monitoring. Data collected from these profilers will be disseminated via MADIS to the National Mesonet Program, will be sent to the Weather Service, and provided via CW3E's website.

Equipment

The RWP is comprised of the following subsystems: an antenna subsystem consisting of a vertically-looking, high-performance, low-sidelobe antenna whose main beam is retained within 25 degrees of the zenith; the antenna was designed with additional amplitude tapering to further reduce near-horizontal sidelobes significantly; a transmitter subsystem utilizes a linear (Class A-B) solid-state commercial pulsed radar transmitter, frequency controlled by fixed crystal, and capable of amplitude-shaped and phase-modulated pulses to minimize spectrum occupancy and restrict duty cycle to a maximum of 15%; a specialized low-noise receiver subsystem having matched filtering capability; a signal processing subsystem performing target parameter extraction and identification, and a data processing/communication subsystem for charting, recording, and long-line transmission of results. The antenna and transmitter subsystems were specifically designed to reduce mutual interference among co-located systems. The power levels in the instant application using 26 dBi main beam gain are 1.5 kW effective peak transmitted power, and 360 kW ERP for the phased array. This is put out for 30 microseconds followed by a receive interval of 90 microseconds. This mode continues for 30 seconds at which time another mode or direction may be used.

The center of the array will be operating straight in the air. In no event is there a horizontal

component of the emissions, as the wind profiler is not intended for land use and is only assessing the wind columns in the air. The profiler is specifically designed to operate on a non-interference basis with other RF equipment in the area.