

# PROJECT facts

DEPARTMENT OF ENERGY  
NATIONAL ENERGY TECHNOLOGY LABORATORY

## REMOTELY PILOTED AIRSHIP FOR ATMOSPHERIC TRACER SAMPLING PROGRAM (RPATS)

### PRIMARY PROJECT PARTNER

Tracer ES&T  
San Marcos, CA

### OIL RESEARCH PROGRAM Effective Environmental Protection

### MAIN SITE

San Joaquin Valley  
Bakersfield, CA

### TOTAL ESTIMATED COST

\$0.2 million

### COST SHARING

DOE - \$0.2 million

### Background/Problem

The Clear Air Coalition, comprising California businesses, industries, agriculture and government agencies, is working to bring California air quality into EPA compliance. The Coalition's research, covering a wide area of California, concentrates on sampling and modeling air quality in California's Central Valley. Coalition research projects, funded for nearly \$45 million to improve the understanding of air pollution in the region, have improved conditions somewhat: Between 1988 and 1998, the number of days the southern portions of the Central Valley exceeded federal ozone standards fell by 47 percent, and the number of days that particulates exceeded standards fell by 90 percent.

One of the problems confronting the researchers was the collection of air quality data during adverse weather conditions, such as the Tulle Fog, a low, dense, stagnant and very moist layer of air that blankets the Central Valley during the winter months. Inert gaseous tracer materials sensed by aircraft-mounted instruments have been used for nearly 30 years by Tracer ES&T to study air pollution sources and distribution, but normal aircraft collection of these emissions is impossible at low-altitude and in fog. Deployment of a dense network of moored balloons with adsorption tube samplers attached to tether lines would have been costly and lacked the flexibility to adapt to changing weather conditions. A method of remotely collecting data at low levels during the Tulle Fog conditions was needed so aircraft pilots would not be at risk in the adverse weather. Pilot and eventual incorporation of all permit applications were estimated to be \$3.1 million.

### Project Description/Accomplishments

Tracer ES&T, with assistance and funding from the Department of Energy (DOE) and the Western States Petroleum Associates, analyzed the needs and provided a solution – a remotely piloted blimp with advance air monitoring instruments capable of sampling and measuring vertical plume measurements in dense fog conditions at elevations less than 1,000 feet and transmitting the data to ground-based computers. The Remotely Piloted Airship for Atmospheric Tracer Sampling (RPATS) combines a commercially available radio-controlled airship, a Global Positioning System (GPS) and real-time data analysis that measures plume concentrations as a function of downwind distance, horizontal location and height above ground.

RPATS is a 30 by 7.5-foot helium-filled blimp capable of lifting a payload of up to 10 pounds. The airship, guided by radio control from the ground, is capable of cruising for over an hour at speeds of 15 to 20 mph or for shorter periods up to 30 mph. The seven-pound payload with its battery-powered gas-sampling equipment is mounted in a gondola on the under side. The system is highly portable. The deflated airship is transported by truck and can be inflated and ready to fly in less than one hour by a ground crew of three. The navigation and computer instrumentation for sampling is in a second truck. Tracer ES&T has two certified pilots trained to locate an emissions plume, fly the airship cross-wind through the plume at various altitudes and distances downwind, collect data and transmit it back to the ground. (The California Air Resources Board also maintains six fixed-wing aircraft and monitoring and meteorological instruments at 185 stations throughout the state to provide data to improve air quality.)

The maiden voyage of the airship was made on December 5, 2000 in connection with a planned release from a steam generator at Belridge oil field in the San Joaquin Valley near Bakersfield. Aera Energy injected a tracer into the steam prior to release to allow analysis of where and how the steam plume is distributed in the atmosphere. The oil field selected offers easy access for the airship and ground-based controls, and is representative of the types of locations that can be monitored using the airship sampling technology. The winter sampling phase extended from December 5, 2000 to the end of January 2001.



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## Project Benefits/Impacts

Development of the RPATS Clean Airship is an excellent example of cooperative efforts by private industry and federal and state government agencies to improve air quality. The airship was designed and tested in California's Central Valley to demonstrate the effectiveness of remotely collecting and sampling air quality data at low altitude in foggy and overcast weather conditions. The design met rigid specifications for global positioning navigation, maximum sampling capabilities, computer relays, and minimum weight instrumentation to be carried in the small platform beneath the 30-foot blimp. Initial sampling flights in December 2000 have successfully provided data on air currents and air quality in the Bakersfield, CA area.

Because of its uniquely designed capabilities, RPATS will enable the acquisition of real-time in-flight data below 2,000 feet in low-visibility weather, critical air quality data otherwise unavailable because of safety considerations. The airship also offers economy of operation compared to the cost of such alternative systems as networks of sensor-bearing anchored balloons or, in certain respects, fixed-wing aircraft, which obviously fly higher, faster and cover broader areas than RPATS. The California Air Resources Board estimates that standard aircraft surveys, which deliver only minimal onsite processed data, run about four to six hours flight time per day at a cost of \$15,000 to \$20,000. For full air quality data reduction and reporting from low altitudes in foggy or overcast weather, Tracer ES&T Inc. is confident they can run four to five RPATS flights daily at a cost of about \$6,000 to \$8,000. For its designed task, RPATS is an efficient, safe and economical aircraft that fills a vital gap in atmospheric data gathering for air quality surveys.

## CONTACT POINTS

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