S O U T H W E S T   R E S E A R C H   I N S T I T U T E

# Integrated Remote-Sensing Imaging System Using Skywisp®

*A new generation of light-weight airborne remote-sensing platforms with very high spatial resolution and unsurpassed operational flexibility is poised to emerge from fusing recent technology advancements in propulsion, miniature flight control, and light-weight airframe technologies, combined with ongoing developments in miniature imaging sensors.*

Since 2002, SwRI has been developing Skywisp®, an autonomous stratospheric glider capable of reaching altitudes in excess of 100,000 feet. Skywisp is designed to remain for extended times
over the mission area at stratospheric altitudes and glide to a pre-programmed location following its mission.

The system provides line-of-sight coverage over large areas. Furthermore, its scalable airframe can be tailored to fly at different altitudes carrying a variety of mission payloads adapted to applications ranging from homeland security to climate change and deforestation. Its low cost and autonomous operation make Skywisp attractive for applications that require quick deployment and complex surveillance pathways at different altitudes.

The small payload of only 2.5 pounds imposes challenges in terms of optics, sensors, sensor control, calibration, power and space. Heavier payloads are possible by scaling up the airframe but this imposes Federal Aviation Administration coordination and operational limitations. SwRI geolocation engineers and remote sensing experts work together to meet client needs by:

- Identifying the critical elements of the earth features and human activities to be monitored

- Determining the frequency and duration of the flight

- Selecting the required sensor type (i.e., multi-arrays, single-lens solution modular, multi-camera concept)

- Processing algorithms appropriate for each specific application

In the case of agricultural, forest, or climate change applications multispectral or hyperspectral data acquisition may be required. A 1.1-lb. ADC Lite camera system with 512 MB memory storage manufactured by Tetracam, Inc. with a 2–5 second interval between sequential images could be mounted

on a Skywisp platform. The output consists of red, green, and near infrared bands for extraction of commonly used vegetation indexes (NDVI, IPVI and SAVI). Other options include a miniature 2-lb. three-dimensional spectrometer capable of collecting data in 90 spectral bands between 490 nm to 925 nm, at 3.9 nm/pixel resolution (i.e., Bodkin Design VNIR 90) and a hyperspectral imaging system SOC700-SW capable of collecting 128 bands between 1000 nm and 1700 nm, at 6.25 nm spectral resolution.
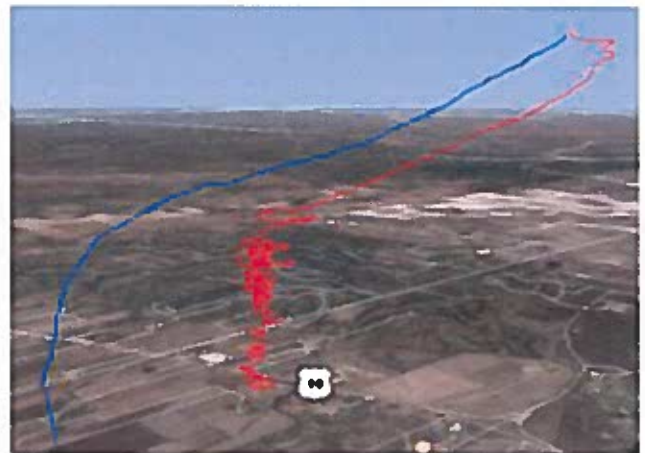
For applications requiring thermal data (i.e., 8 µm–14 µm) such as detection of oil and gas pipeline leaks, Skywisp could carry a FLIR TAU 640 uncooled thermal camera, which is a camera with outstanding sensitivity and image quality. In this case, after radiometric and geometric corrections, mosaicing, and feature extraction, the integrity of the pipeline system could be monitored as often as needed.

*Photo source: tetracam.com.* The ruggedized ADC Lite camera has a 3.2 Mpixel CMOS sensor (2048 x 1536 pixels) 4.5" x 3" x 3.38". It weighs 0.44 lb. (with lens)

## Technology Highlights

- **Local area monitoring:** This system is transportable; can be operated locally under minimal legal restrictions

- **Anytime operation (weather permitting):** Can be used day and night

- **Maximum ground spatial resolution:** Approximately 2 feet

- Can be used from **100,000 feet. to conventional low-altitude UAV**

A typical flight-path of Skywisp. Blue-Ascent, Red-Descent

- **Covertly gliding, penetrating far into hostile areas:** Can travel thousands of miles

- **Ascent/Drift Mode:** Does not require FAA coordination (<6 lbs. free balloon)

- **Quick deployment with minimal cost:** Does not require advanced planning; can be done as often as needed

- **Autonomous operation:** Long-term monitoring without human intervention based on predefined waypoints; real-time feedback allows its use as an early-warning device

- **Customized payloads and associated remote-sensing algorithms:** Land use and land cover analyses, terrain and feature extraction analysis

Overall, Skywisp provides a cost-effective aerial investigation and assessment solution for government, military and industrial customers.

For more information, contact James Moryl, Director, Surveillance and  Geolocation Department, Defense and Intelligence Solutions Division; or Marius Necsoiu, Ph.D., P.M.P., Certified Mapping Scientist—Remote Sensing, Geosciences and Engineering Division..

## **Division Publications**

Surveillance and Geolocation
Defense and Intelligence Solutions
Geosciences and Engineering
SwRI Technical Divisions • SwRI Home

April 15, 2014