

A large, light blue watermark logo for NAWVC (North American Weather Consultants, Inc.) is centered in the background. The logo consists of a circle containing a stylized mountain range with a cloud above it and wavy lines at the bottom representing water. The letters 'NAWVC' are overlaid on the mountain range, and 'INC' is at the bottom.

# **Cloud Seeding Operations in the Western U.S.**

**Todd Flanagan, CCM**

**North American Weather Consultants, Inc. / Rainmaker**

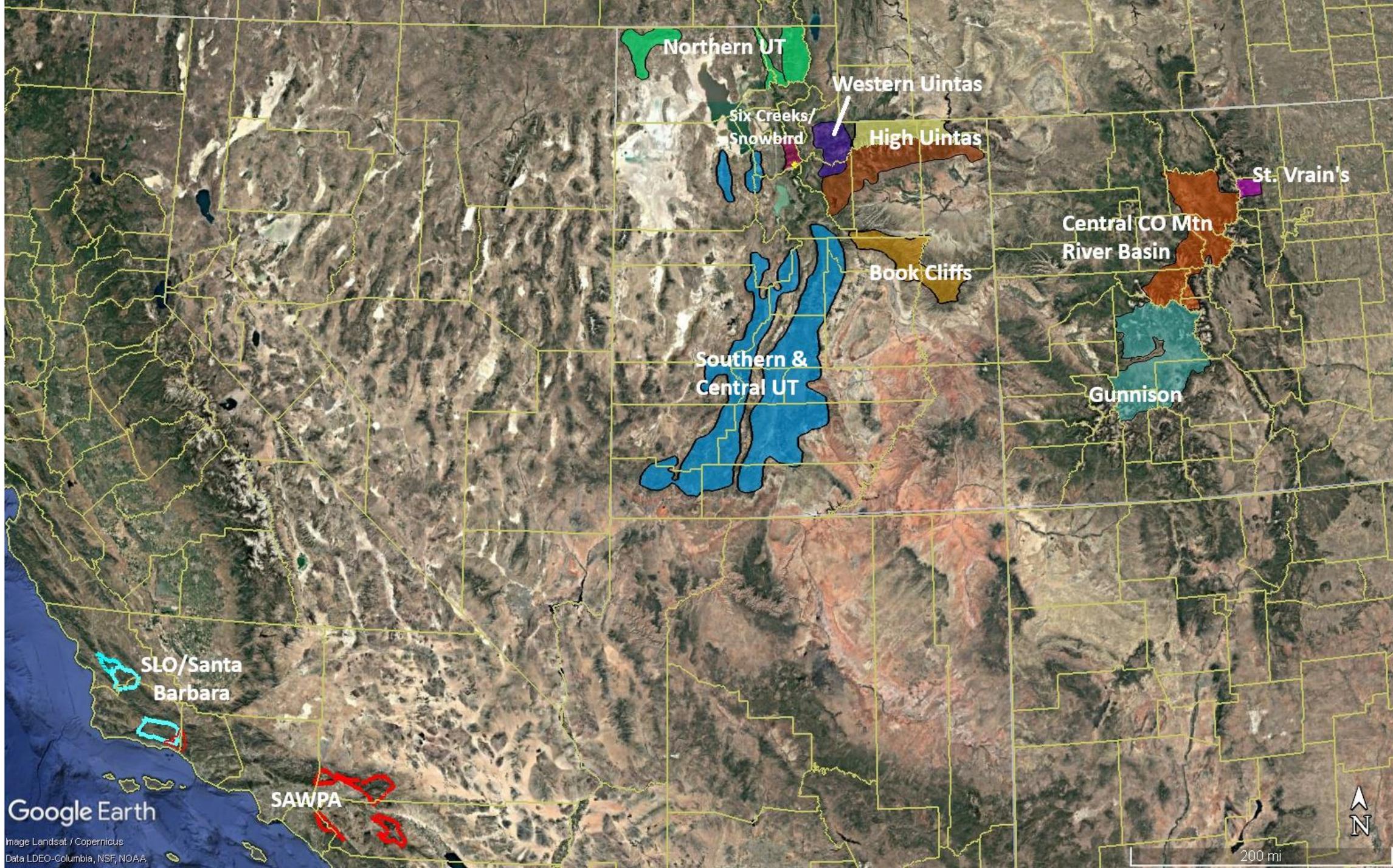
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# **North American Weather Consultants, Inc.**

- **Incorporated in 1950 in Santa Barbara, CA**
- **Founded as a weather modification company (operations, research) but also provides consulting in applied meteorology (forecasting, forensics, air quality, extreme precip – PMP, climatology)**
- **Weather modification (rain/snow) programs in the U.S. as well as internationally (Europe, Central America)**
- **Offices moved to Salt Lake City, UT in 1980**
- **One manager/engineer, three meteorologists, eight field techs, one full-time fabricator, one full-time welder**
- **Company recently purchased by Rainmaker (El Segundo, CA)**

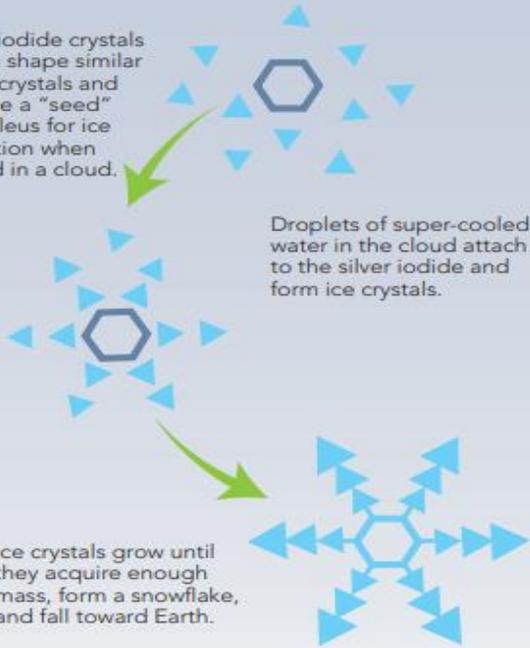
# **Snowpack Augmentation in the West**

- **Six ground-based seeding programs in Utah**
- **Two ground-based programs in California**
- **Three ground-based programs in Colorado**
- **Two aerial-based programs in UT (first 2022-23), first DRONE program in the United States (2025)**
- **Most mountain ranges targeted**
- **Great Salt Lake, Green River, Colorado River, Lake Powell, Lake Mead (last 3 costs shared by Lower Basin States)**



## Inducing the formation of ice crystals in a cumulus cloud

Silver-iodide crystals have a shape similar to ice crystals and provide a "seed" or nucleus for ice formation when placed in a cloud.



- ▲ Super-cooled water
- ⬡ Silver-iodide crystal
- ❄ Ice crystal

## WEATHER MODIFICATION

### Cold Season Cloud Seeding

#### The Science

The cloud-seeding process aids precipitation formation by enhancing ice crystal production in clouds. When the ice crystals grow sufficiently, they become snowflakes and fall to the ground.

Silver iodide has been selected for its environmental safety and superior efficiency in producing ice in clouds. Silver iodide adds microscopic particles with a structural similarity to natural ice crystals. Ground-based and aircraft-borne technologies can be used to add the particles to the clouds.

#### Safety

Research has clearly documented that cloud seeding with silver-iodide aerosols shows no environmentally harmful effect.

#### Effectiveness

For cloud seeding to improve snowfall, super-cooled droplets—moisture and clouds—must be present, but studies have documented cloud seeding's ability to increase the frequency and amount of snowfall, given the right atmospheric conditions. The effects of cloud seeding can sometimes be seen within 30 minutes, but more generally between 30 minutes and an hour.



#### Snowpack/Water Enhancement

1. Moist air rises as it flows over the mountains, cooling and creating clouds composed of super-cooled water droplets.
2. Minute amounts of silver iodide in solution are sprayed across a propane flame or released from an aircraft-mounted flare. The air flow up the mountain barrier carries the particles into the clouds.
3. The silver-iodide crystals provide nuclei for the formation of ice crystals.
4. By freezing of droplets and deposition of vapor, ice crystals form and grow progressively larger, forming snowflakes large enough to precipitate to the ground.

To find out more about weather modification and participating agencies, visit the North American Weather Modification Council online at [www.nawmc.org](http://www.nawmc.org)







## Sand Ledges

INFO

Altitude **7368'**

STATUS

State **Off**

Temperature **15.34°C**

Battery **13.95V**

Hours Active (30d) **7**

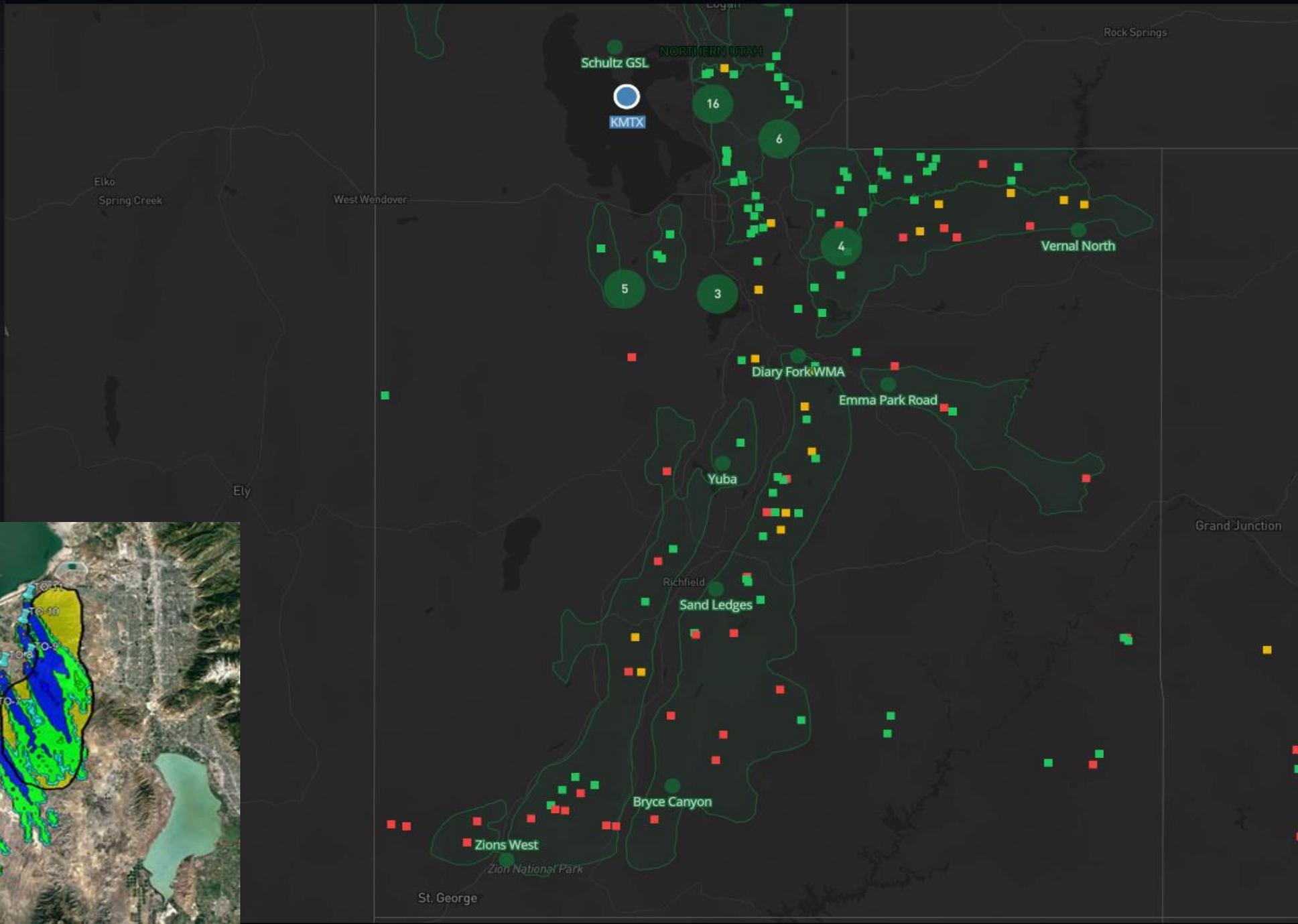
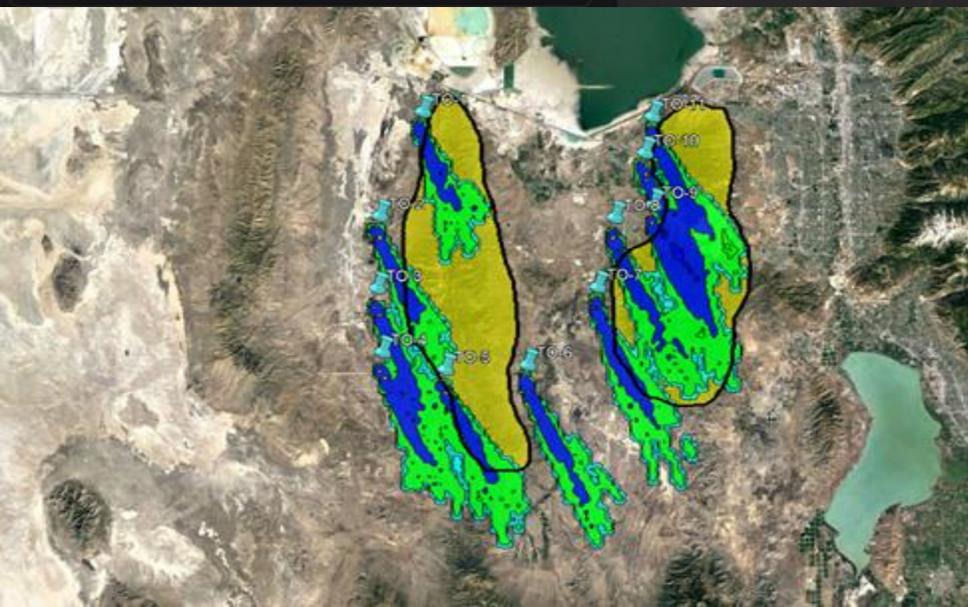
Last Update **2/25/2025, 2:05:17 PM**

### CONTROL PANEL

Start Stop E-Stop

### HYSPLIT CONTROL

Run HYSPLIT Analysis





# Burning Flare





**UAS (Unmanned Aerial System)  
used in Cache Valley Drone Pilot  
Program, disperses silver iodide  
into cloud base (w/limitations)**

# Looking ahead...

- Warm season cloud seeding in Texas
- Experimental program working with NCAR in Bear River Range ID/UT
- Additional cold season programs (e.g., central California/Sierras)

NAWC

INC