CFACT ISS Site Survey

March 18 - 19, 2021, Bill Brown

A number of potential sites around the Heber Valley were visited for the ISF equipment for CFACT. The project will have two supersites about 5 km apart, the PR (Provo River) supersite at the north end of the valley and the DC (Deer Creek) supersite at the south end. ISFS will have a 30 m telescoping tower at each supersite, plus eight satellite sites with simple 3-m towers scattered around the valley. Most sites will likely be within a 10km X 10km area. One ISS is requested with one wind profiler, ceilometer, wind lidar and sounding system. This document discusses sites that may host ISS equipment. The ISS deployment appears feasible but for various reasons the ISS will likely be scattered around 2 or 3 sites because no individual site appears ideal to host a complete system. Some factors to consider are:

- Accessibility, particularly during winter weather events and at setup / teardown
- Availability of power
- Soundings should be near the DC supersite, for scientific and logistical reasons
- The wind profiler will run RASS so we prefer no houses within 300 m
- The wind lidar needs a clear view of much of the valley

The ISS sites are all within about 10 minutes drive of each other. There is good cell phone coverage throughout the valley.

Google Earth view of the valley. The blue markers indicate potential locations of ISS equipment, the red flags indicate the locations of the two supersites. Provo is about 25 miles to the south, Park City is about 20 miles to the north. The view is about 4 miles across.

Deer Creek Supersite / SP01 (possible sounding site)

S Center St, Midway, UT
40.4896°N 111.4652°W 1660

This area near the south end of the valley has farms operated by Grant Kohler (of Heber Milk and Artisan Cheese) and Steve considers it ideal for the 30-meter ISFS tower since it has good fetch and (mostly) clear fields for ~200 - 300 meters in each direction (good for radiative flux divergence measurements). There is a power line along a dirt access road (presumably to power pumps), although ISFS would need to install one of their long lines with variable transformers approx 400 m into the tower.

ISFS are considering putting their base trailer down the dirt access road adjacent to the power line. They will need to trim some trees and have a gravel pad installed, but even then it'll be a tricky operation to get the trailer placed and there is some risk it may be difficult to get out if there is a wet or snowy winter. The PIs plan to operate a tethersonde at the supersite, which would be a clutter target for the wind profiler, and the surrounding trees make this area non-ideal for the lidar. For these reasons it is not considered a good site for the ISS, however if the ISFS base trailer is positioned there we may install a sounding system in that trailer so that the sounding students can operate both the tether and the soundings.

View from S Center St looking east along the dirt access road to the SP01 supersite.

Railway Service Pad (possible sounding and lidar site)`

210 Tate Lane, Midway UT, 84049
40.4865 111.4729 1660m

View looking west across the gravel lot at the railway service area. The shed in the background appears to be a utility shed or a pump station and has power.

The local historic railway has a gravel pad and shed with power at the corner of Tate Lane and Center Rd, approximately 800 meters SW of the SP01 site. The pad is approx 75m x 10m and about 20% is occupied by train wheels, rails and other items for the railway. There often seems to be 2 or 3 cars parked there, perhaps by hikers walking on the US Bureau of Reclamation land south of the tracks. There are houses nearby so it is not a good site for the profiler, however it is being considered for the ISFS base trailer. It would be a good site for soundings and perhaps the lidar although the view to the northern valley area is somewhat limited.

Pivot Fields (good profiler sites and possible lidar site)

Southfield Road, Heber City, UT 84032
40.4879°N -111.4332W° 1700m

The Heber Valley Special Services District (SSD) manages the valley's wastewater treatment. Our contact there is Dennis Gunn DGUNN@hvssd.org (435) 901-2257. They own several large fields with pivot irrigation just west of Heber airport, and offered the use of these fields for the

campaign. They use the fields to dispose of water after being processed through the treatment plant. There is power available at the pivot points and at a couple of power drops along South Field road (also known as South 1200 West St). This seems to be a good site for the ISS. There are wide gates into the fields at the power drops, and the northern drop has a dirt road with a little gravel. It should be possible to readily pull out the trailer in winter although we should add some more gravel to the access to ensure a firm surface for the truck. The nearest house is about 400 meters away so RASS shouldn't be a concern. There are power lines so the profiler will need to be set 20 - 30 meters back from those. We will likely need to leave the profiler in place until the thaw since disassembling the antennas in winter will be difficult. The site could be used for soundings although we would need to be careful of the power lines and it is further from the supersite than is ideal. There is a good view in most directions for the lidar. The west side pivot might partly obstruct the view to the western hills, although we can probably ask that it is reoriented to minimize that obstruction, and there are a few trees to the north. It is about 2.7 km east of the SP01 site. There are also wide shoulders to the road where cars can be parked.

View from pivot irrigation field looking west at the North pivot power drop across S 1200 W St (South field Rd) to a half-circle pivot on the west side of the road.

Heber Airport CAF Museum (good profiler site)

2265 W Airport Rd, Heber City, UT 84032
40.4792°N -111.4298°W 1712m

View looking east at CAF Air Museum building. The wind profiler would be located to the left on the tarmac and the trailer would either be behind it, or on the parking lot in front of the building.

The airport also has good sites for the ISS. The best site is adjacent to the CAF Air Museum at 2265 W Airport Rd. We could get power from the museum and there is public access parking next to it. The trailer could be parked in the parking lot, or better in an adjacent parking lot behind the fence or behind the museum building. There is one house 250 meters away, but no other close houses and the profiler could be positioned either behind the museum building or behind the trailer to block the RASS noise. We would need to get access behind the security fence but the manager seems to be agreeable to that. The airport AWOS station (KHCR) is nearby (350 m to the SW) and the SP01 site is 3.2 km WNW. There is a good view for the lidar to the north, west and south, although it would be blocked by the museum and hangers to the east. It is too far from the supersite for soundings. The contract at the museum is David Gorrel (435-513-3214). The airport manager is Travis Biggs tbiggs@heberut.gov (435) 657-7949.

Midway Fish Hatchery (possible profiler site)

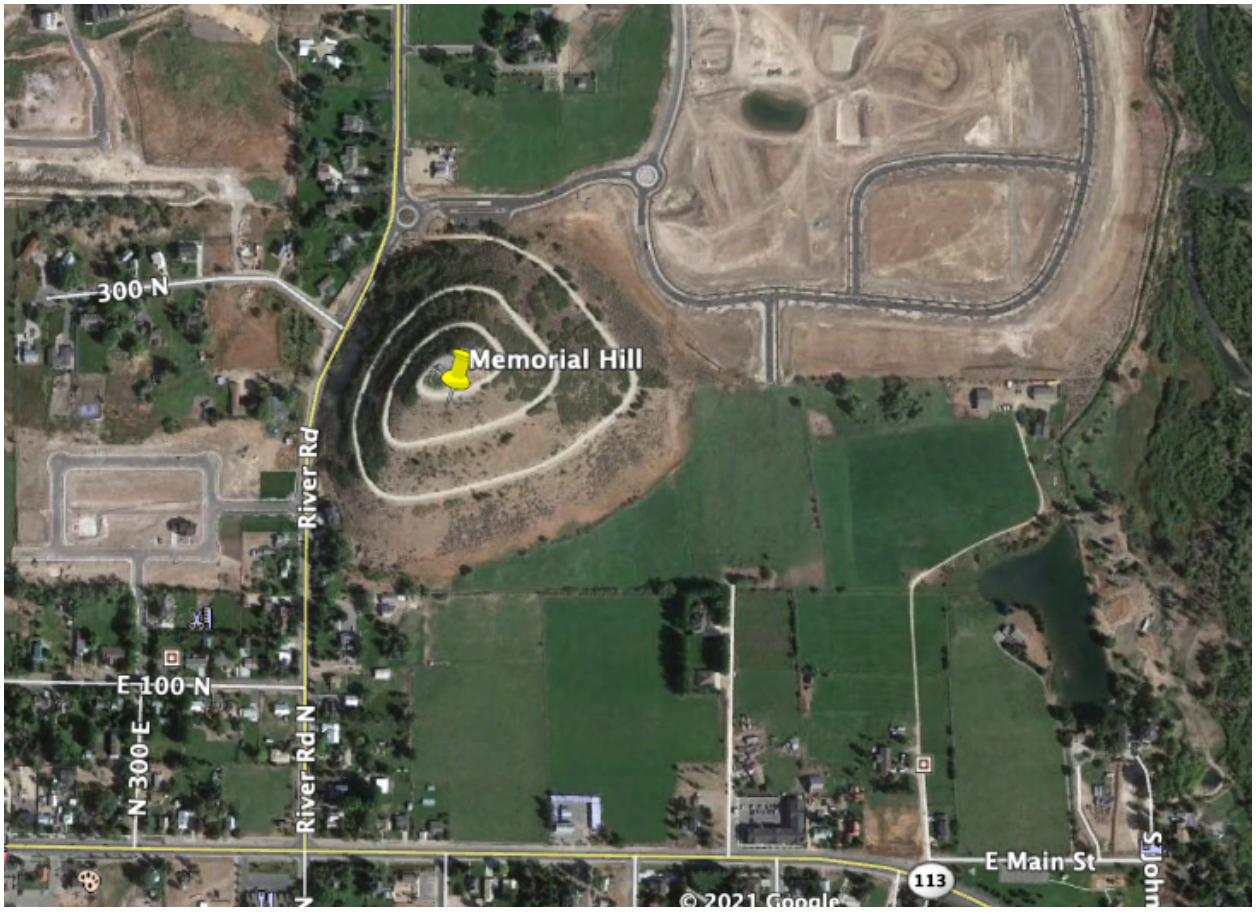
140 East 850 South St, Midway, UT 84049
40.4933°W 111.4684°N 1663m

The Utah Division of Wildlife Resources (DWR) runs the Midway Fish Hatchery just north of the DC supersite. There is a gravel road that runs between two creeks/ditches down towards the supersite and there is an area there with power (at a pump) that might be good for the profiler. The site area is a long narrow strip between the road and the creek, only about 7 m at the widest point. There appears to be just enough room for the profiler. Since there is no place large enough to turn a rig and trailer around, our trucker would likely need to back in the trailer approx 300 m down the gravel road. The hatchery does plow the road after snow, however access may be limited at times which makes the site not ideal for soundings. Also, there are too many trees nearby for the lidar. This area is about 500 m N - NE from the proposed supersite and the nearest houses are about 400 meters away.

View looking north at fish hatchery power station. The ISS would be located in this narrow grassy area between the gravel road and the creek.

Memorial Hill (potential wind lidar site)

38 River Rd, Midway, UT 84049
40.5164°N 111.4618°W 1770m



View of Memorial Hill from the east.

Memorial Hill is a prominent hill rising about 200-feet near the north of the valley with excellent views in all directions. Because of this, and the fact that OFAP reviewers recommended positioning the lidar where it can see flows across the valley, the PIs are very keen to locate our

wind lidar at the top of this hill. The site is about 4 km north of the DC supersite, and about 1.3 km from the PR supersite at the north end of the valley.

View at top of Memorial Hill looking east. The lidar would likely be placed beyond the flag poles and power drawn from the light pole at left, although there also appears to be power in the stone structure to the right.

There is a good gravel access road circling around up to the top of the hill and there are lights and power at the memorial structure on top. However there are challenges to this location. The access road is restricted and special permission will be required. We will likely need to use an ATV with a small trailer to carry the lidar up. The road is in good condition however if there is deep snow or rain then access may be difficult. The preferred location is at the east end of the hill top, beyond a set of flag poles. The trailer would need to be no more than about 200 cm (75 inches) wide to fit between the concrete bases of the flag poles. The lidar should be elevated a couple of meters so that no one can look into the beam (it is eyesafe, but there are often hikers at the top and we don't want someone to stare directly into it). A power cable would need to run approx 50 meters back to a light pole for power. The lidar would be placed by itself with a data link or cell modem for communications. A basic met sensor might be placed there or nearby (eg, either a Lufft/WXT or the PI's Hobos or a simple ISFS satellite station).

Midway Crest Development (possible lidar site)

South Fox Den Lane, Midway UT
40.5017°N 111.4647°W 1682m

At the south end of Fox Den Lane (also known as S 500 E St) land is being prepared for the Midway Crest development project. The site has a good view to the west, south and east, although not to the north. So far (spring 2021) no houses have been built but a good road and power boxes have been installed. The road is a wide empty cul de sac so there is plenty of room to position an ISS trailer and if we were to site there, we might put the lidar up on top of an ISS trailer. There are existing houses nearby so the site is not suitable for the wind profiler. The downside to this site is that the area is being prepared for development and it is unknown if the site will be available for the campaign. The developer is Brad Pelo Benevolence LLC of Heber City.

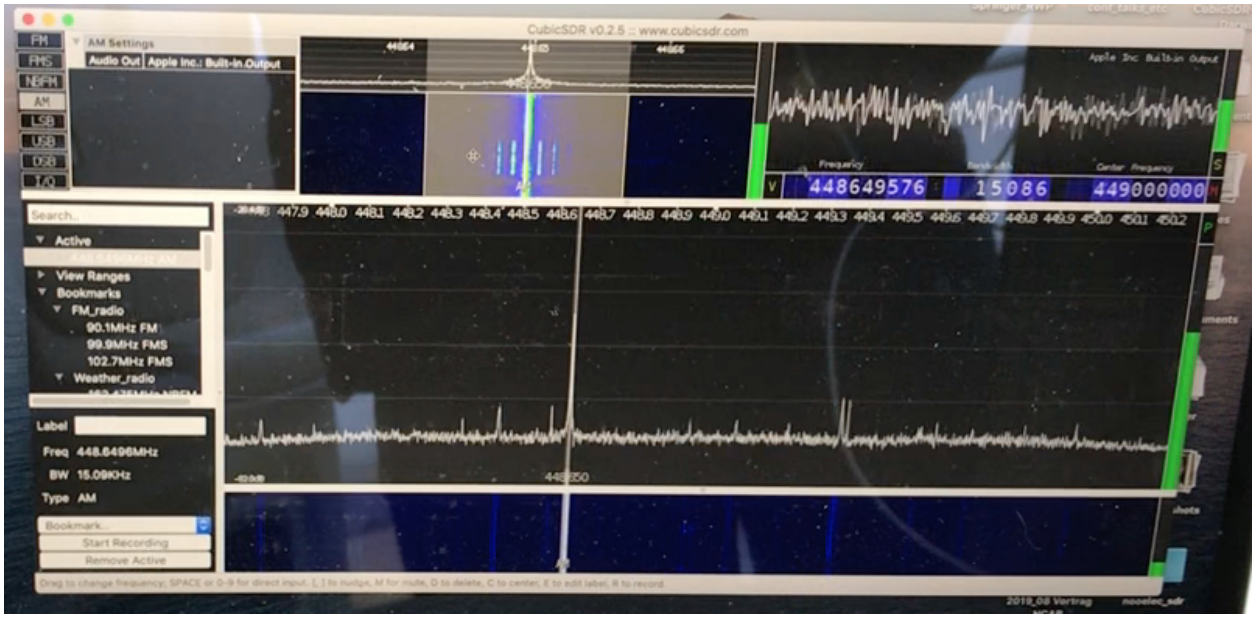
View to the west of the Midway Crest development site.

Other possible sites

There are other possible sites such as the wastewater treatment plant (east of the Midway Crest development), a municipal service facility (east of the fish hatchery), and another house development area on the west side of South Center St near the SP01 site. None of these sites were as good as the sites above, but could be reexamined if we cannot proceed with the above sites.

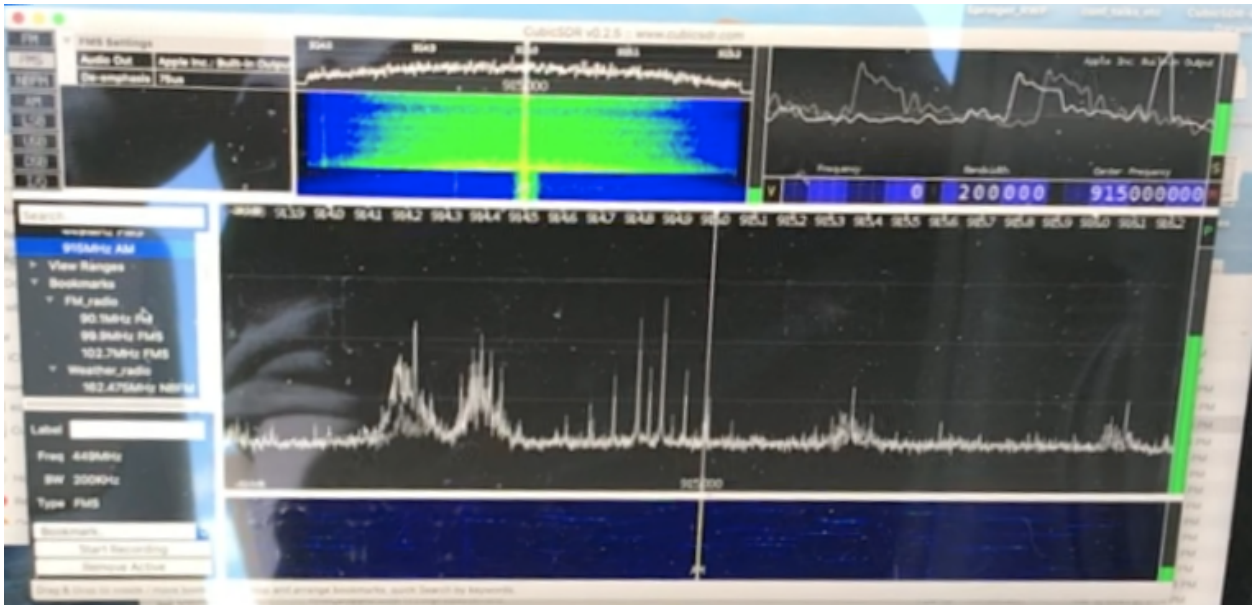
Radio Frequency Interference

The radio spectrum in the valley was examined using a USB SDR (Nooelec NESDR SMArt device) and a handheld spectrum analyzer (RF-Explorer WSUB3G). There was potential interference found at both 449 MHz and 915 MHz. The 400 - 405 MHz band seemed to have little interference.



Screenshot from CubicSDR centered on 449 MHz scanning about 2 MHz. There is a prominent signal at 448.65 MHz where voice communication was recorded.

449 MHz: The 449 MHz region frequently had spikes in the spectrum, typically at about 448.5m 449.2, 449.4, & 454.3 MHz. The signal wasn't strong but sounded like a data link. A directional antenna was used in an attempt to trace the source. The results were inconclusive but hinted at sources to the north and near the airport. On one day a strong voice signal was heard at 448.65 MHz (pictured), but the direction was not clearly determined. These signals would likely show up as vertical RFI features in the Doppler spectra, but it may be possible to filter them out.



Screenshot from CubicSDR centered on the 915 MHz scanning about 2 MHz. There were many signals in this range constantly appearing and disappearing.

915 MHz: The 915 MHz region was dominated by regular bursts of signal jumping around the spectrum, probably some spread spectrum data link such as a Freewave modem or similar. These signals would cause problems for the 915 MHz profiler, likely raising the noise floor in the Doppler spectra. Again the direction was not clearly determined but may have come from the central valley such as the wastewater treatment plant, fish hatchery or city maintenance facility.

Local Services

There are two towns with services in the Heber Valley, Heber City and Midway. The towns are about 40 minutes drive from Provo, 45 - 60 minutes drive from Salt Lake City, and 25 minutes drive from the Park City ski resort.

Heber City (pop 16k) has many services, hotels including Best Western and Holiday Inn Express hotels, a Walmart, lumber yards, Ace hardware, supermarkets, hospital, equipment rental (includes forklifts), and multiple restaurants. There is an airport, however there are no scheduled flights, mainly just charter flights and private jets. Heber City is about 5 miles drive to the DC Supersite and about 3 miles to the Pivot Field site.

Midway (pop 5k) is smaller, has a few restaurants and services. There are a couple of resorts with lots of condos, many available for rent on AirBnB. The supersite landowners, Grant Kohler and family, are based in Midway where they operate a dairy farm and cheese factory. Midway is only a couple of miles from the DC supersite and about 4 miles to the Pivot Field site.

Conclusion

There are good sites to deploy the ISS in the valley for the CFACT campaign, and it does appear that the landowners will be willing to lease those sites to us. Locals tell us that the conditions during the winter are variable with some years being very cold and snowy and others being mild. Given the risk that there may be adverse conditions, it would be prudent to plan on installing as much equipment as we can in the fall before the winter gets too harsh. We should also plan on leaving some equipment in place until later in the spring. Since we need to set up ISS at SWEX in March, we will need to ensure we have duplicates of items that might remain at CFACT. Under the current plans, this likely includes the Modular Wind Profiler antennas, RASS, and the surface tower.