

Institute Of Navigation GNSS+ 2022

SURVEYING, MAPPING, AND GEOSCIENCES SUBCOMMITTEE

Exploring Uses of GNSS in Utah

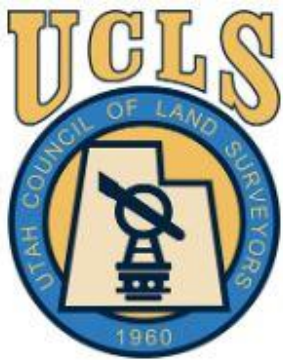
Sean Fernandez, PLS
State Cadastral Surveyor
Utah Geospatial Resource Center (UGRC)
Division IT Manager




Introduction



Location matters.



Member Login 

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Past Chair:

[Todd Jacobsen](#)



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[Dale Robinson](#)



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Wed Feb 8, 2023

[UCLS Annual Conference
February 8-10, 2023 in St.
George](#)

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National Geodetic Survey

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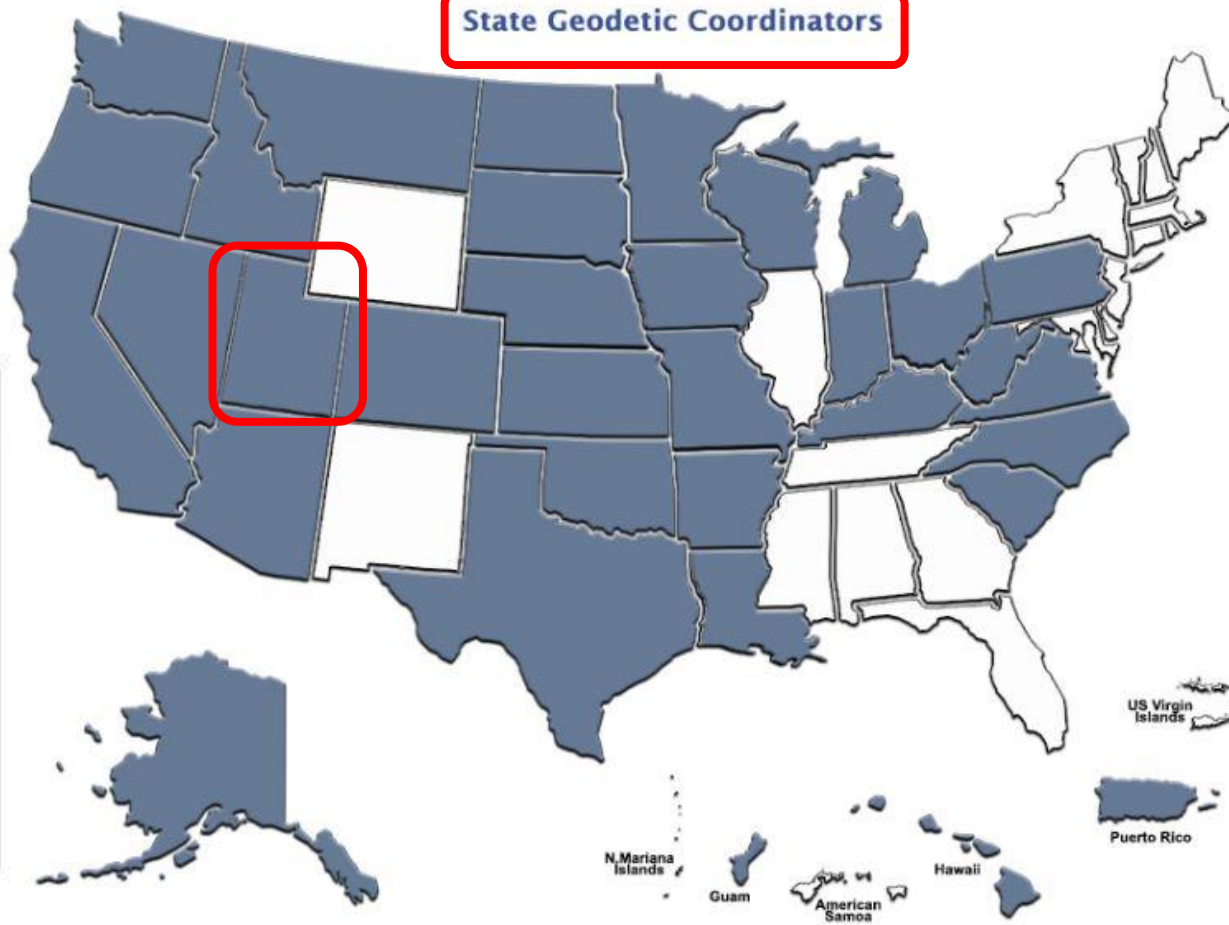
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State Geodetic Coordinators

The State Geodetic Coordinator is a designee of a state government agency or university and is not an NGS employee. The Coordinator serves as a liaison between the state and NGS. State Coordinators should have technical expertise in geodesy to make informed decisions and provide guidance for geospatial activities that benefit from connecting to the NSRS. The State Geodetic Coordinator is a primary point of contact for the **Regional Geodetic Advisor** in their state.

State Geodetic Coordinators



Utah

Sean Fernandez

State Cadastral Surveyor/Division
Manager

State of Utah AGRC/DTS
Capitol Complex

1 State Office Building Room 5130
Salt Lake City, UT 84114

Office: (801) 209-9359

TURN GPS

sfemandez@utah.gov

Manage The Utah Reference Network GPS

Current Employer

State of Utah

Utah Geospatial Resource Center
(UGRC)

About UGRC

Our Background

The Utah Geospatial Resource Center (UGRC) is the State of Utah's map technology coordination office. UGRC staff ([directory/contacts](#)) have knowledge of and experience with geographic information system (GIS) desktop software, hosted map- and web-services, mapping data resources, and GIS professionals and their activities around the state. Since 1984, we have been [encouraging and facilitating](#) the effective use of geospatial information and technology for Utah. Read more about how we aim to continue this mission in our [strategic plan](#), last updated in 2020.

We are located on the 4th floor of the Taylorsville State Office building. You can follow these ([directions to find parking](#)). UGRC is within the [Division of Technology Services](#) within the [Department of Government Operations](#).

UGRC is directed under [mapping-related sections of Utah statute](#) to coordinate GIS resources within state government including the management of the State Geographic Information Database (SGID) and the operation of [The Utah Reference Network for Global Positioning Systems \(TURNGPS\)](#) that provides high precision correction services for surveying, mapping, and machine control.

UGRC was one of the first geospatial information offices in the country, established a few years before its formal adoption in code in 1984. At 30+ years old, our full name may sound like its from a by-gone era. But UGRC is how people know us, so we're sticking with it. Years may pass, but our storefront remains located at the intersection of geography, technology, and the quest for enterprise-wide efficiency.

UGRC is funded through a combination of State general and restricted funds and cost-recovery revenue sources from project work and grant awards. This hybrid approach ensures some stable base for SGID and coordination activities but keeps us on our toes by requiring us to keep up with the latest developments in our field so we can offer cutting edge GIS consulting services to those in need.

Quick Links

- [UGRC Contacts](#)
- [UGRC Mission](#)
- [GIS-related Utah Statute](#)
- [UGRC Policies](#)
- [UGRC Staff Presentations](#)
- [Utah GIS Resources](#)
- [UGRC Media Resources](#)
- [UGRC Directions and Parking](#)
- [Contributing to this website](#)



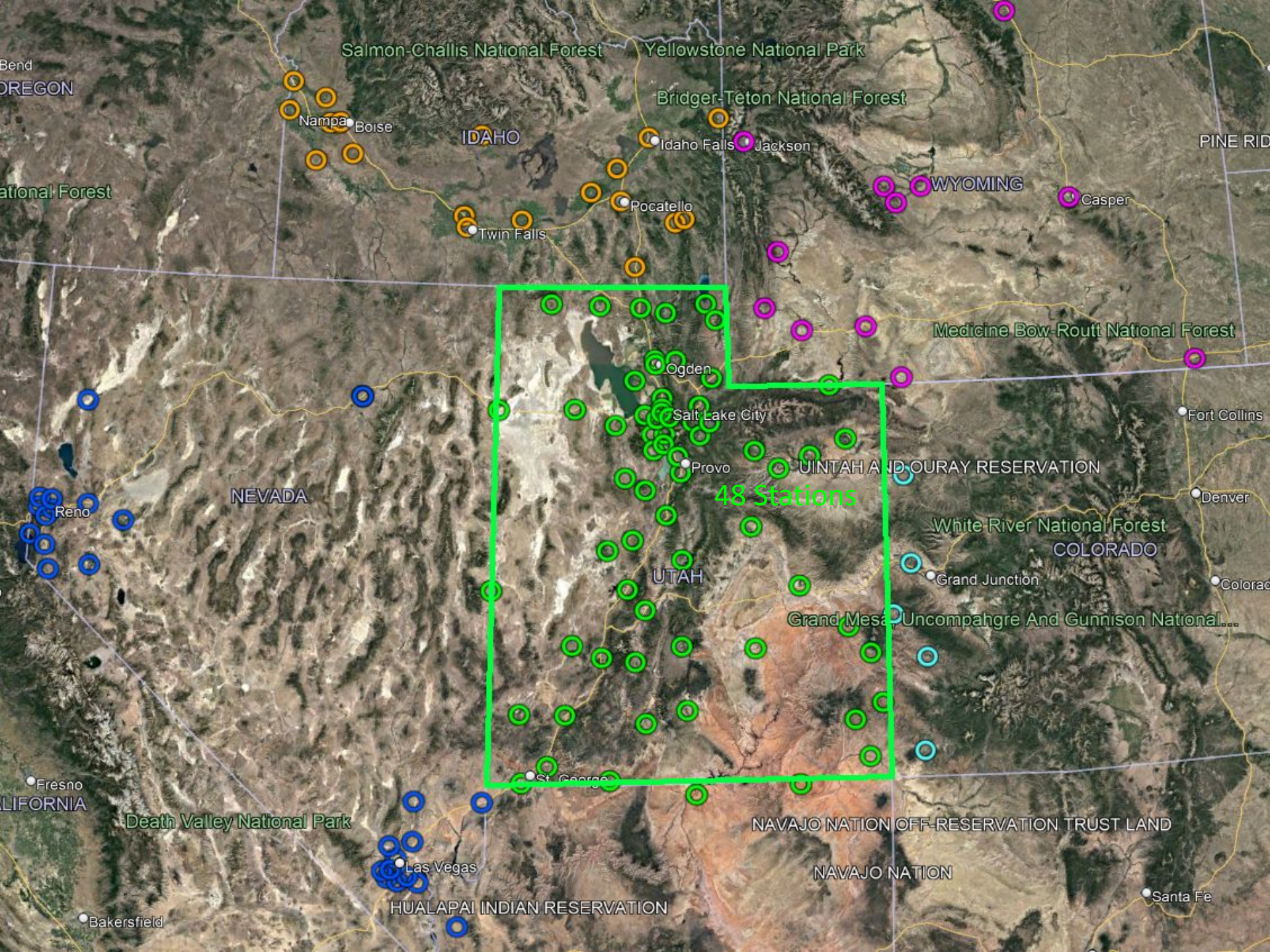
Utah State Code

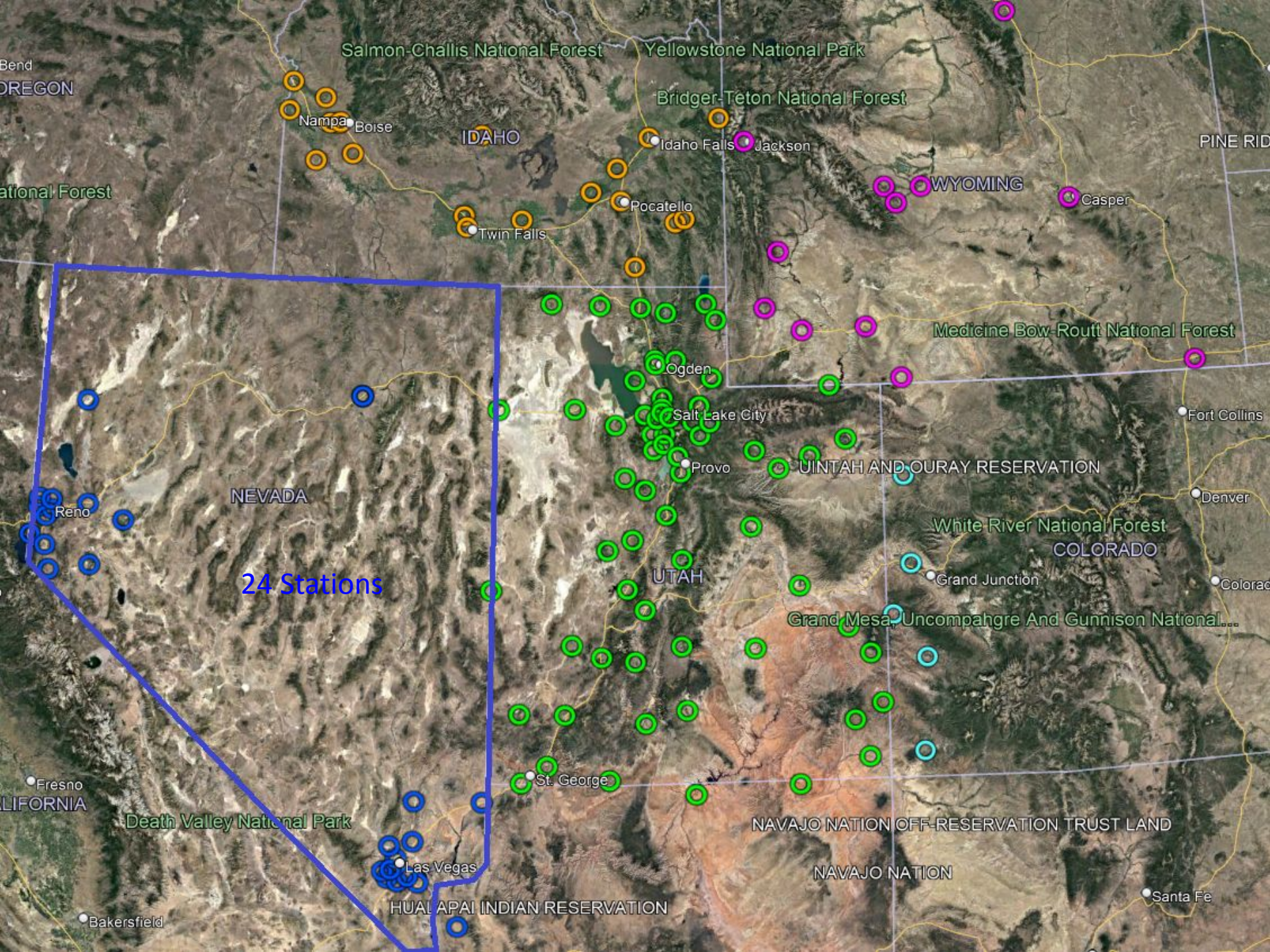
63A-16-508. Statewide Global Positioning Reference Network created

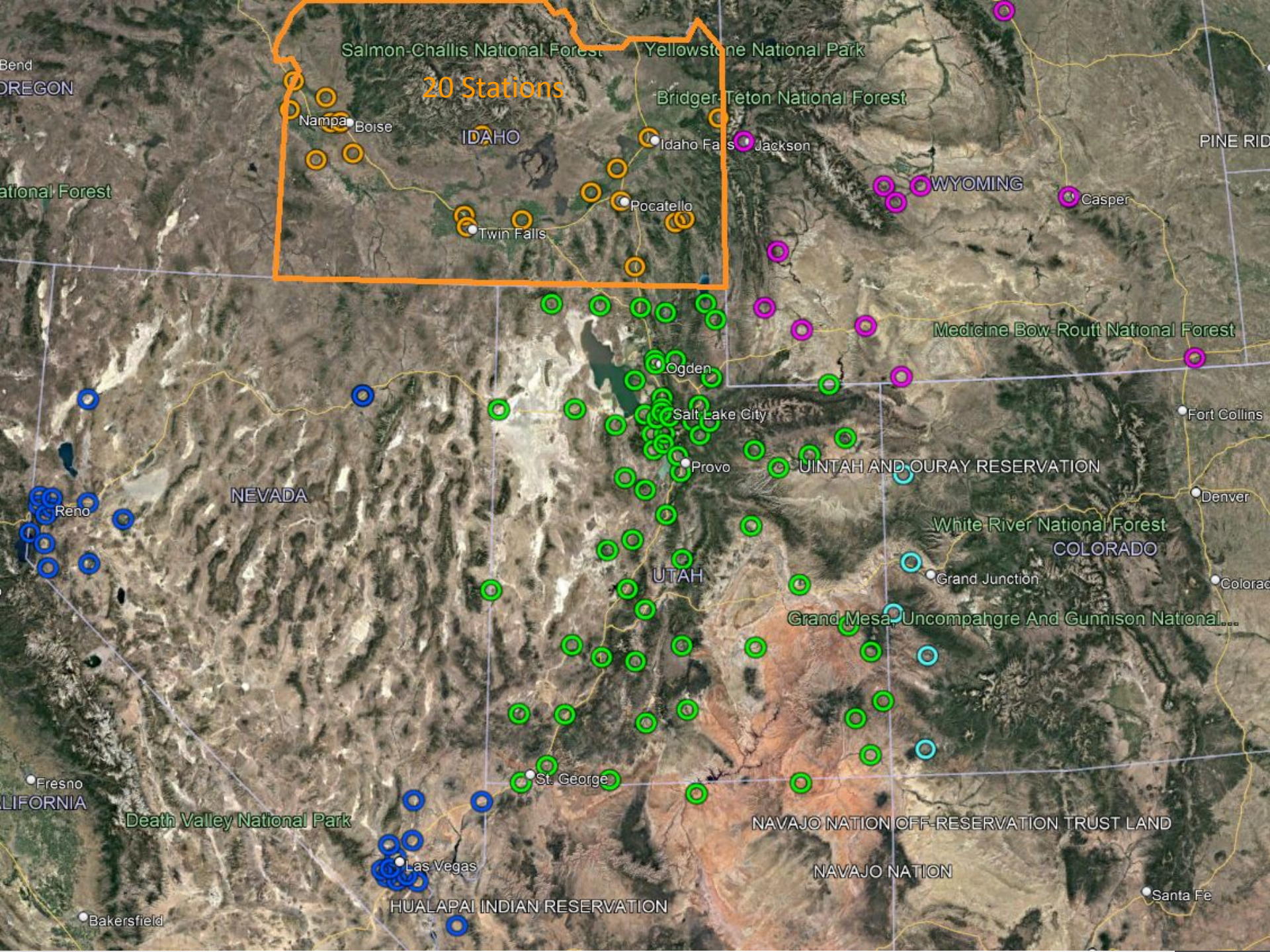
(1) (a) There is created the Statewide Global Positioning Reference Network to improve the quality of geographic information system data and the productivity, efficiency, and cost-effectiveness of government services.

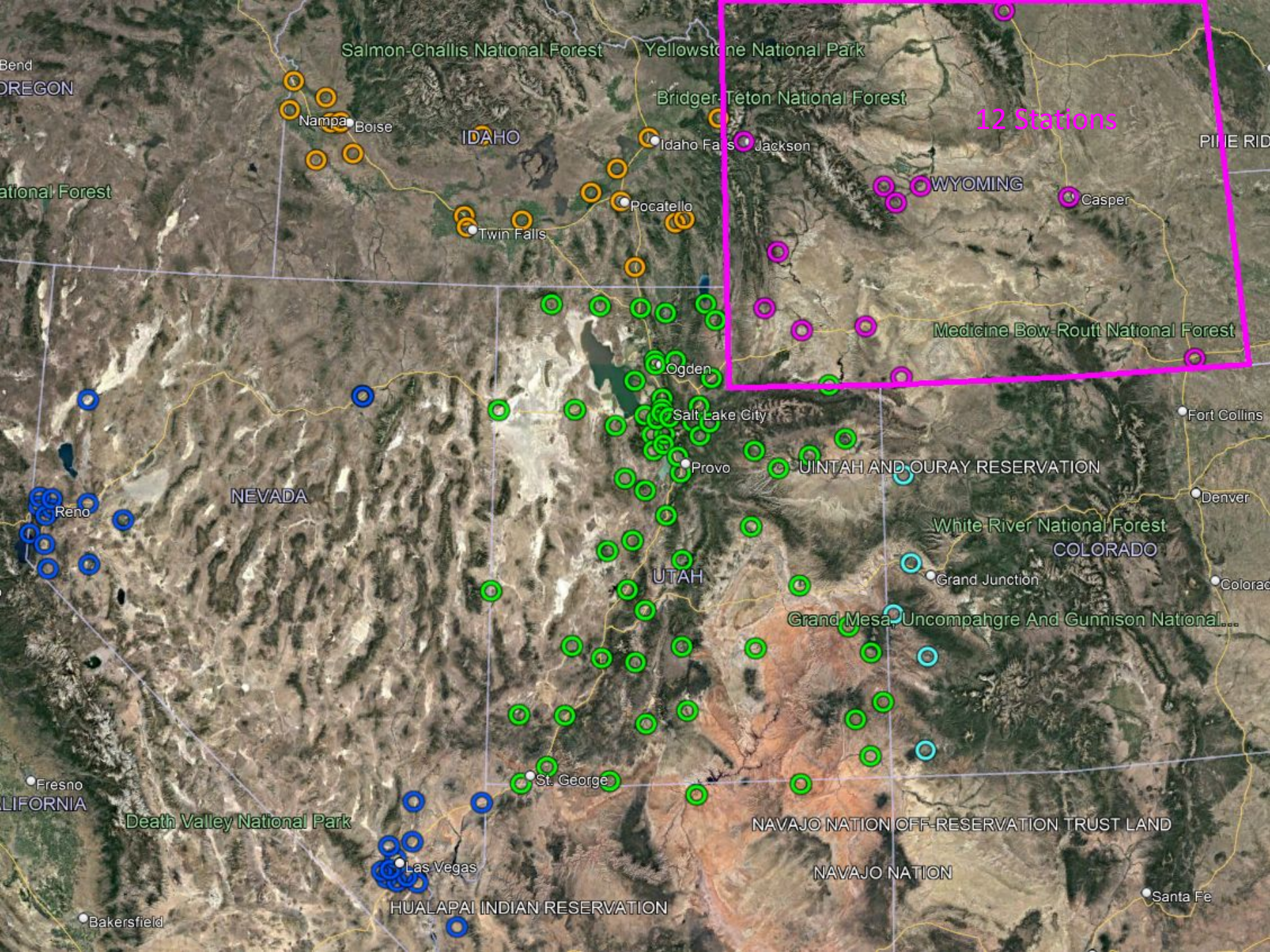
(b) When making rules under this section, the chief information officer shall consider:

- (i) network development that serves a public purpose;
- (ii) increased productivity and efficiency for state agencies; and
- (iii) costs and longevity of the network.









12 Stations

Providing the Best Solution Possible

Nevada GPS
GPS
GLONASS

TURN GPS
Should be called
TURN GNSS
GPS
GLONASS
GALILEO
BeiDou
QZSS (kinda)

Special **Thanks** to
59 TURN GPS and
7 NevadaGPS
and **12 New**

Partners

Strength in Unity



Also **Thanks** to
our many Customers
and Vendors

Idaho Transportation Department
Wyoming BLM
City of Burley Idaho

TURN GPS Partners	TURN GPS Partners Cont.	NevadaGPS Partners
Organization	Organization	Organization
ADOT (Arizona Dept. of Transportation) Blaine County	Monsanto Mine MolyCorp Mine	Carson City Monsen Engineering Reno
Blanding City	Monsen Engineering Nevada	NDOT (Nevada Dept. of Transportation)
Bulloch Brothers Carbon County GIS City of Emmett	Monsen Engineering Salt Lake City Ogden City Engineering Orem City	Reno City Sparks City Washoe County Public Works
City of North Las Vegas	Owyhee County	Washoe County Water Resources
Clark County	Park City MC	
Coyote Springs Golf Club	Payson City	
Diamondback Land Surveying	Piute County	
Dominion Energy (Questar)	Salem City	
Duchesne County	Salt Lake County Surveyor	
E.G. Radig Inc.	Salt Lake Public Utilities	
Electronic Data Solutions	San Juan Co Survey Office	
Frontier Precision	Sanpete County	
Grand County	Southern Idaho Solid Waste	
Henderson City	Spanish Fork City	
Herriman City	Springville City	
Hurricane City	Rich County	
Idaho State Universtiy	Tintic School District	
Jackson Hole	Tooele County GIS	
Juab County	Twin Falls	
JUB Engineering	UDOT (Utah Dept. of Transportation)	
Kamas City	Uintah County GIS	
Kane County	UNAVCO	
Land Solutions Meridian	University of Nevada	
Logan City	Utah State Parks	
Mesa County Colorado	Wasatch County	
Manti City	Wayne County	
Millard Countv		

New Locations

- Driggs Idaho
- Wind River Ft Washakie WY
- Emmett Idaho
- Wind River Lander WY
- Frontier Boise
- Wind River Riverton WY
- Jerome Idaho
- Jackson Hole Wyoming
- Murphy Idaho
- Cheyenne Wyoming
- Roswell Idaho
- Casper Wyoming
- Clark County 1 Nevada
- Sheridan Wyoming
- Clark County 2 Nevada
- Elko Nevada
- Ontario Oregon

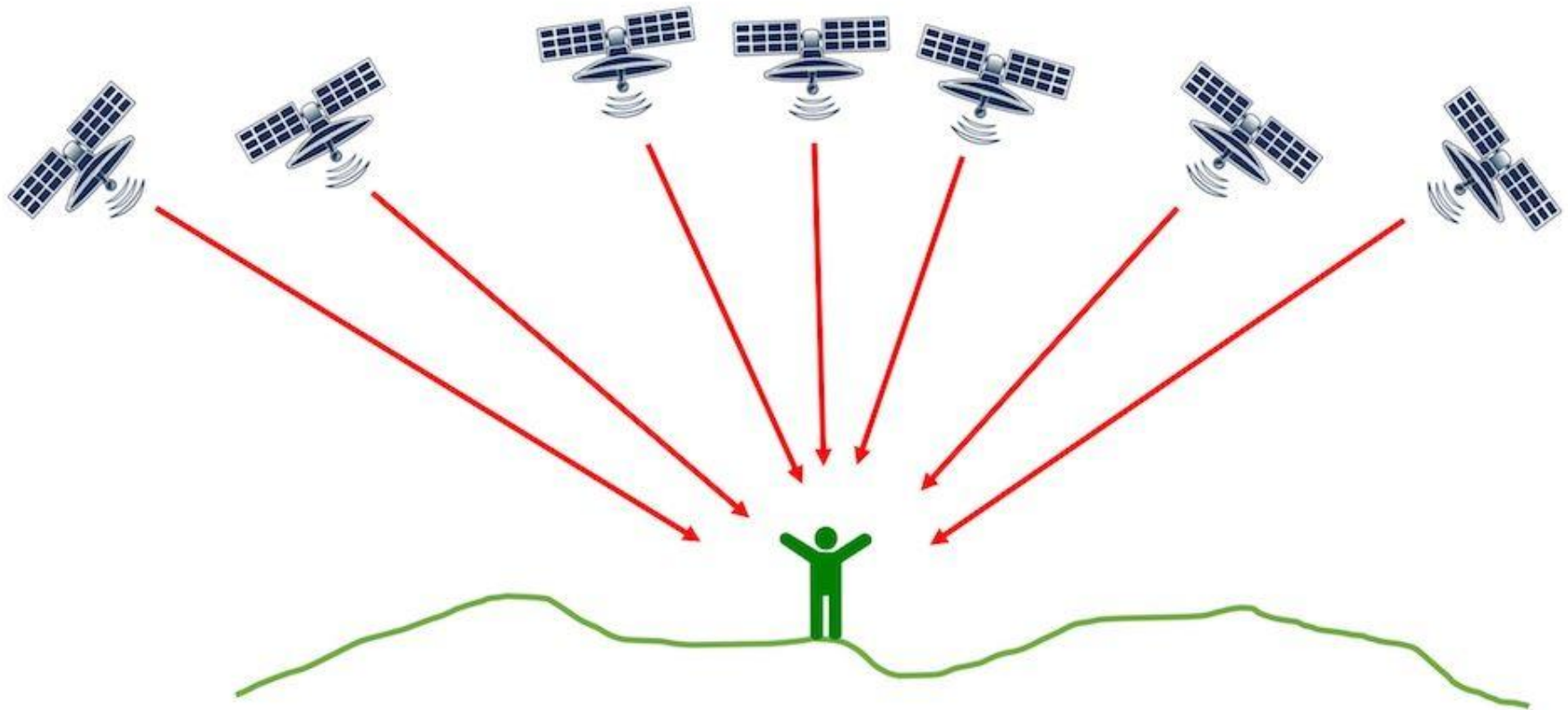


Location matters.

GNSS Makes a Difference

	Station Na	Station	Track	Processed	Solved	GPS Prozesse	GPS Solve	GLN Prozesse	GLN Solve	GAL Track	GAL Proc	GAL Solv	BDS	BDS Tra	BDS Solved	Not
Land Solutio	IDMN	30	27	26	8	8	5	5	8	7	7	7	8	8	6	R18[
Monsen Las	NVLV	29	27	19	7	7	5	4	8	8	8	8	7	7	0	G31[
Calvin Ram	UTCR	29	27	11	8	0	5	4	8	7	7	7	7	7	0	G03[
Heber	UTHE	29	27	23	8	7	5	4	8	7	6	6	7	7	6	G06[
Region 1 Ud	UTR1	29	27	19	8	8	5	4	8	7	7	7	7	8	0	R02[
Rich County	UTRC	29	27	19	8	8	5	4	7	7	7	7	7	8	0	G22[
Clark Count	NVC1	29	27	25	7	7	5	4	8	8	8	8	7	7	6	G31[
Cheyenne	WYLC	29	20	16	8	7	5	3	7	0	0	7	7	7	6	E05[
Grassy Knol	UTGK	28	27	23	8	6	5	4	8	7	7	7	7	7	6	G06[
Junction	UTJU	28	26	23	8	7	5	4	7	6	6	6	7	7	6	E13[
Logan	UTLN	28	27	25	8	8	5	4	7	7	7	7	7	8	6	R02[
Manila	UTMN	28	26	22	8	6	5	4	7	6	6	6	7	7	6	E13[
Park Valley	UTPV	28	27	25	8	8	5	4	8	7	7	7	7	7	6	R02[
Tabiona	UTTA	28	26	22	8	6	5	4	7	6	6	6	7	7	6	E13[
Clark Count	NVC2	28	26	17	7	6	5	4	8	7	7	7	7	7	0	G31[
Richfield	UTRI	27	23	20	8	7	5	4	8	6	6	6	4	4	3	E13[
Hurricane	UTHN	26	26	17	7	0	5	4	7	7	7	7	7	7	6	G03[
Huntsville	UTHU	26	25	22	7	7	4	4	8	7	6	6	7	7	5	E13[
Uintah Coun	UTUC	26	22	20	7	7	5	4	7	6	6	6	4	4	3	E13[
Kanab	UTKA	25	25	16	7	0	5	4	6	6	6	6	7	7	6	G03[
Milford	UTMI	25	24	21	8	7	5	4	8	7	7	7	4	4	3	G06[
Ogden City	UTOG	25	24	21	8	7	5	4	8	7	7	7	4	4	3	G06[
Spanish For	UTS2	25	23	17	8	7	5	4	8	6	6	6	4	4	0	E13[
Beaver	UTBR	24	20	17	8	7	5	4	8	6	6	6	1	1	0	E13[
Cedar City	UTCE	23	21	17	8	7	5	3	8	7	7	7	1	1	0	G06[
Herriman	UTHR	23	21	18	8	7	5	4	8	7	7	7	1	1	0	G06[
Duchesne2	UTD2	23	20	17	8	7	5	4	7	6	6	6	1	1	0	E13[
Mesa Count	CNC1	22	18	17	7	7	5	4	7	6	6	6	0	0	0	G06[
Mesa Count	MC09	22	18	16	7	7	5	4	7	6	5	5	0	0	0	G22[
Antelope Isl	UTAI	22	21	19	8	8	5	4	8	7	7	7	1	1	0	R02[
Fillmore	UTFI	22	20	17	8	7	5	4	8	6	6	6	1	1	0	E13[
Grantsville	UTGR	22	21	18	8	7	5	4	8	7	7	7	1	1	0	G06[
Kamas	UTKM	22	20	16	8	6	5	4	8	6	6	6	1	1	0	E13[
Lehi 2	UTL2	22	21	18	8	7	5	4	8	7	7	7	1	1	0	G06[
Nephi	UTNE	22	19	17	7	7	5	4	8	6	6	6	1	1	0	E13[

GNSS Makes a Difference

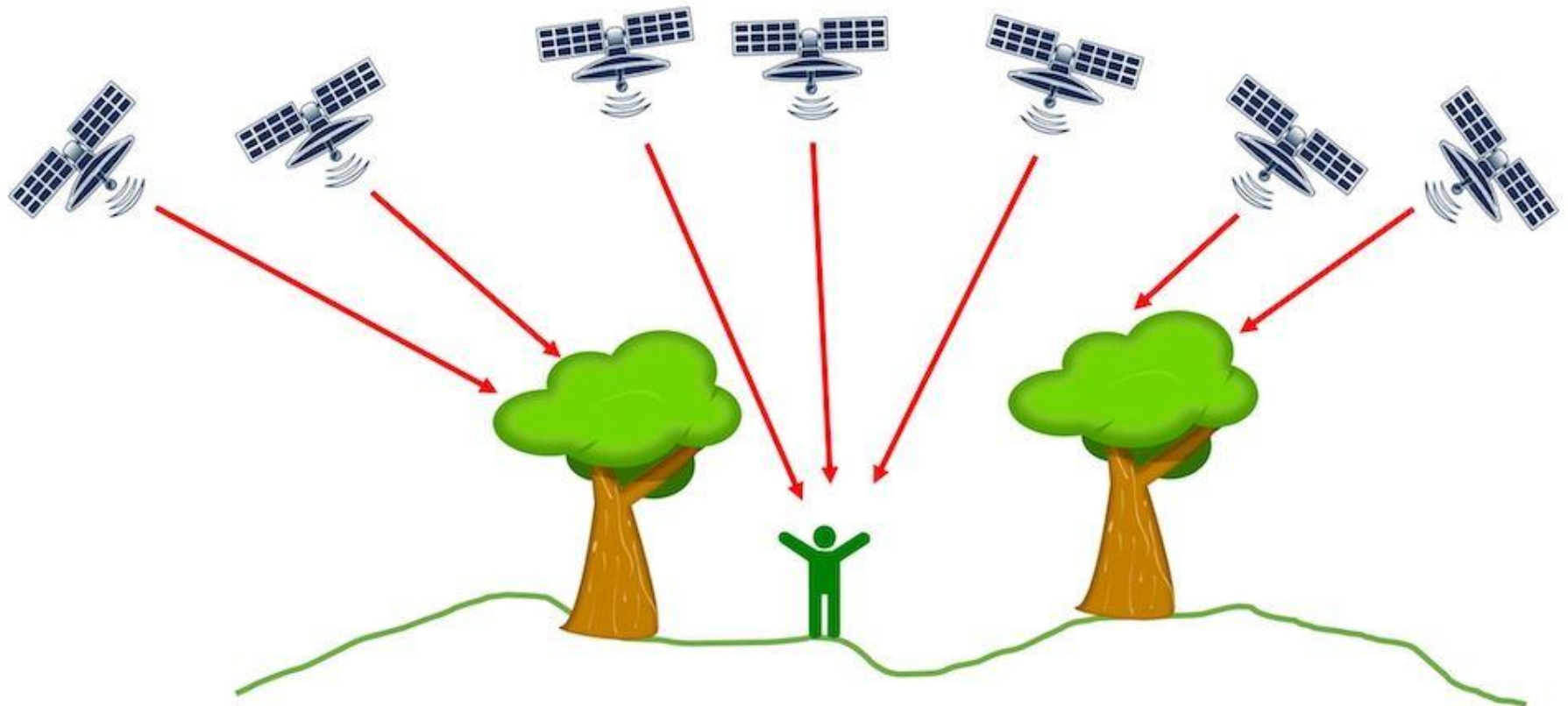


Good PDOP and Good Visibility

Good Accuracy

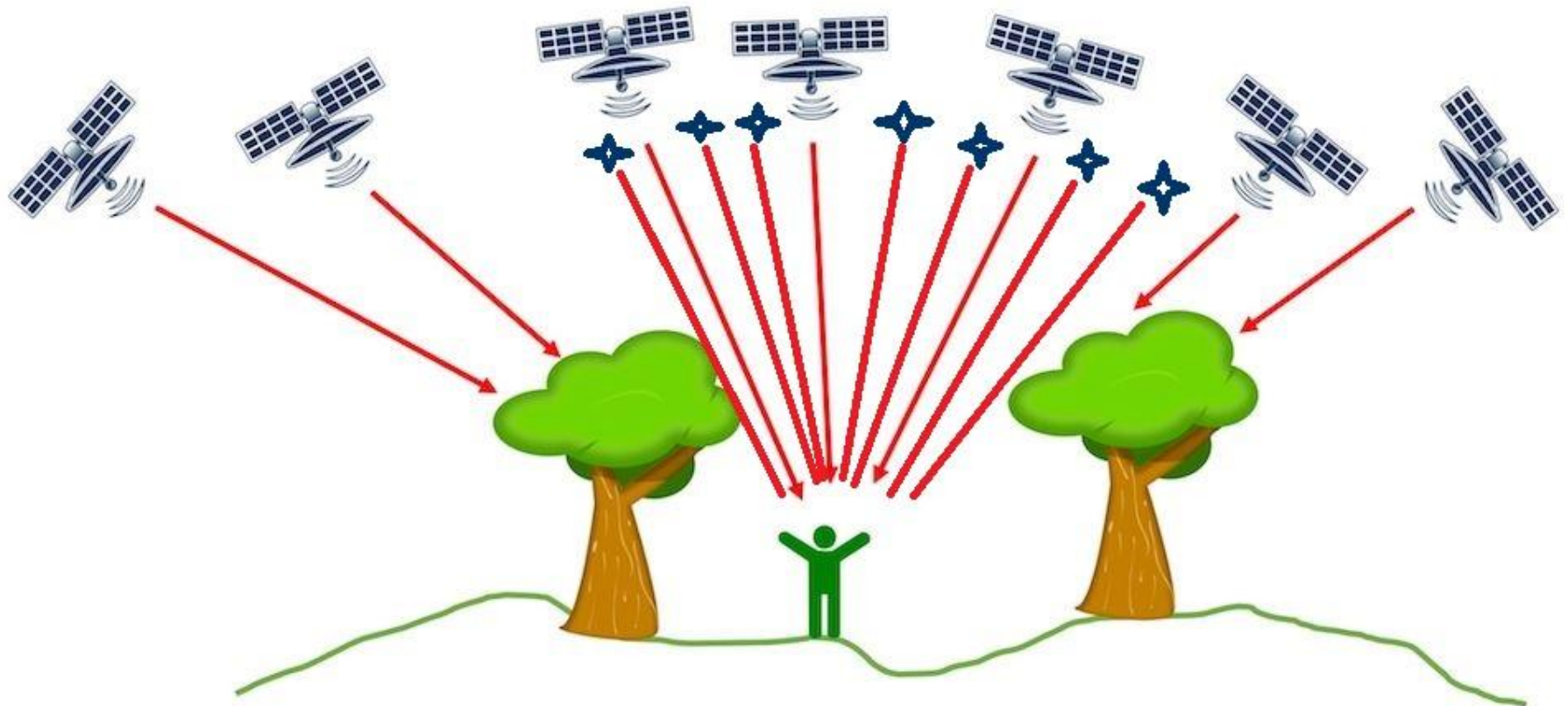
In this scenario a GPS only solution will provide excellent results.

GNSS Makes a Difference



A common GPS only scenario of 7-10 satellites makes it very difficult to get a good position in Tree Canopy.

GNSS Makes a Difference



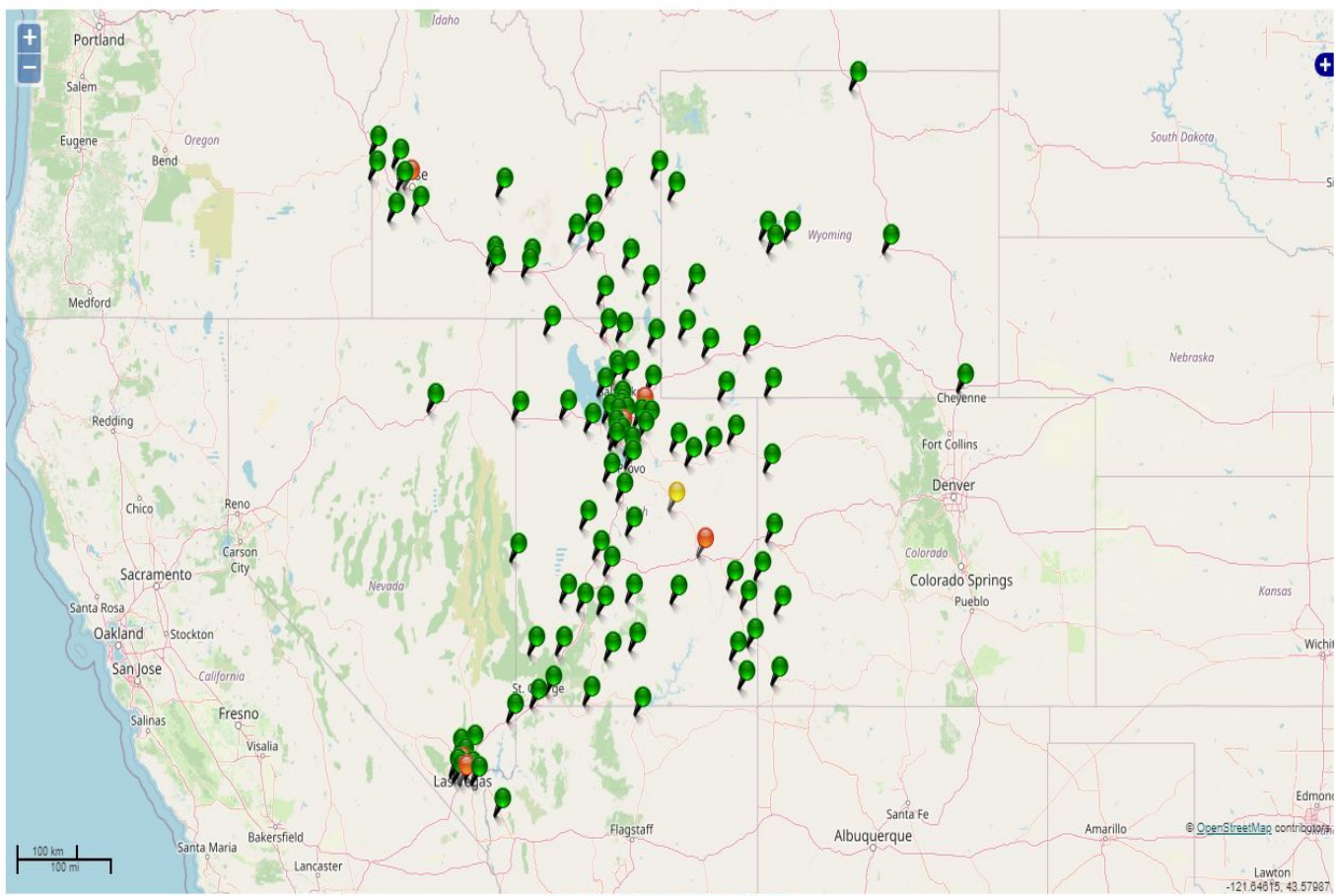
A GNSS solution including GPS, GLONASS, Galileo and BeiDou allows for good positioning in Tree Canopy, In Between Buildings, and in Deep Valleys.

The Utah Reference Network GPS

> Home > Sensor Map

- Home
- Sensor Map
- Position Scatter Plot
- Status Messages
- Network Information
 - 195 Ionosphere
 - IRIM/GRIM
- Online Post Processing
- Reference Data Shop
- Atmospheric Conditions
 - TEC Contour Map
 - TEC Surface Map
 - TEC Surface Map Animation
- My Account
 - Personal Data
 - Change Password
 - Logins
 - Sessions
- VRS iScope
- VRS iScope Level
- Active Subscriptions
- Organization Details
 - Active Subscriptions
 - Expiring Subscriptions
- Administration
 - Status Messages
 - Add Status Messages
 - Edit Status Messages
 - Regions
 - Add Regions
 - Edit Regions
 - User Management
 - User Management
 - Create User
 - Approve Users
 - Export e-mail addresses
 - Extended User Info
 - Extended User Info
 - Info Fields
 - Add Field
 - Extended Login Info
 - Info Fields

Sensor Map



[SITE_LOGS](#) [CONTACTS](#) [OPUS_PROJECTS](#)

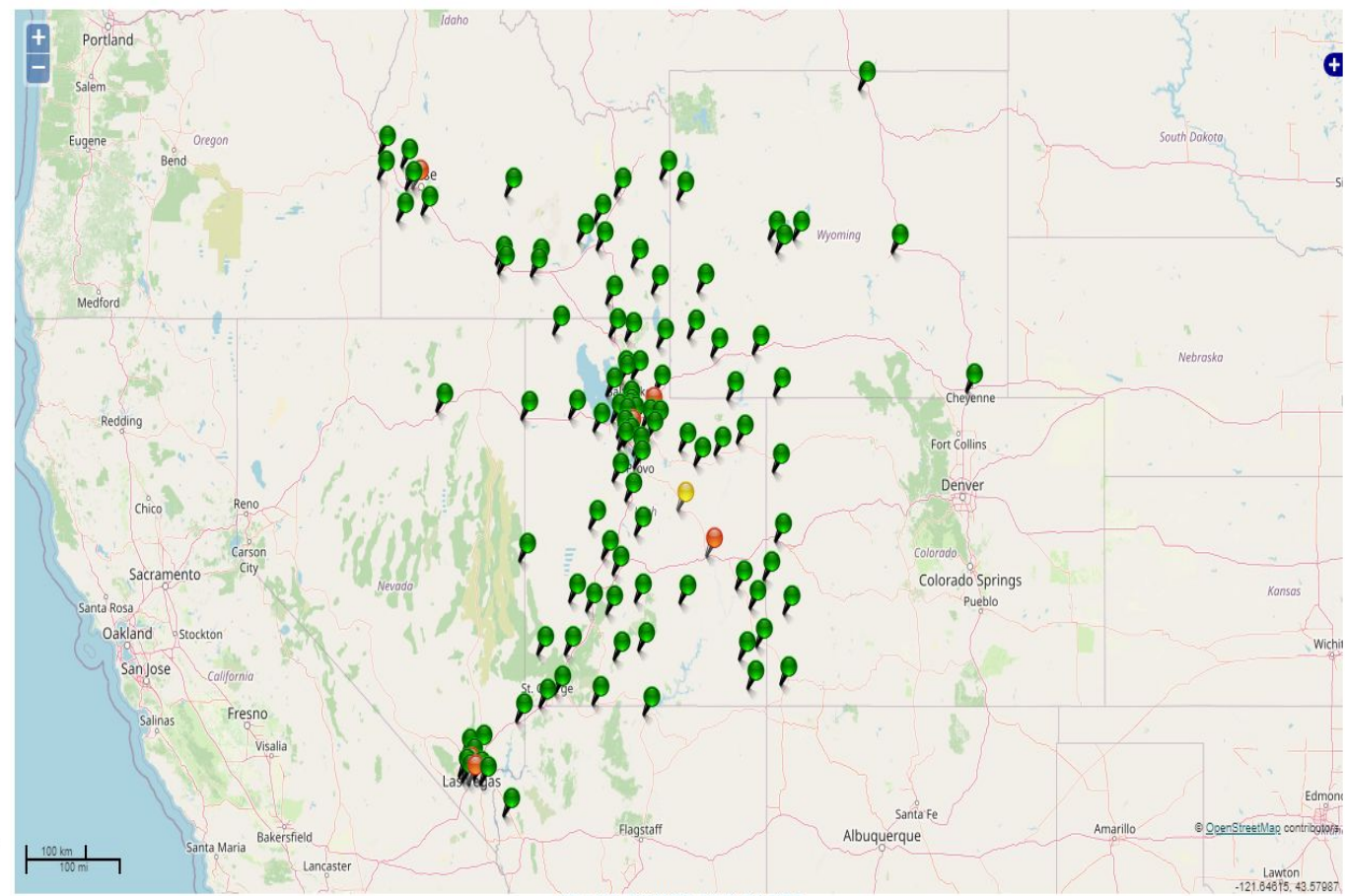
- 109 sensors:
- Beaver
 - Beryl
 - Blacks Fork Wyoming
 - Blanding
 - Bountiful
 - Calvin Rampton
 - Casper Wyoming
 - Cedar City
 - Cheyenne Wyoming
 - Clark County 1
 - Clark County 2
 - Cortez Colorado
 - Delta
 - Diamond Back West Las Vegas
 - Dolan Springs
 - Draper
 - Driggs Idaho
 - Duchesne2
 - Eagle Mountain
 - Eastland
 - Echo Port of Entry
 - EG Radig Boulder City
 - Elko Nevada
 - Emmett Idaho
 - Escalante
 - Eureka 2
 - Fillmore
 - Frontier Boise
 - Garrison
 - Grantsville
 - Grassy Knoll
 - Green River
 - Hailey Idaho
 - Hanksville
 - Heber
 - Hen1
 - Hen2
 - Horriman

Redundancy allows for continued use when some stations are offline.

The Utah Reference Network GPS

- > Home > Sensor Map
- Home
- Sensor Map
- Position Scatter Plot
- Status Messages
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 - 195 Ionosphere
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Sensor Map



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 - Hen2
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[SITE_LOGS](#) [CONTACTS](#) [OPUS_PROJECTS](#)

Current Active TURN GPS stations. This changes daily, but we work hard to repair outages quickly.

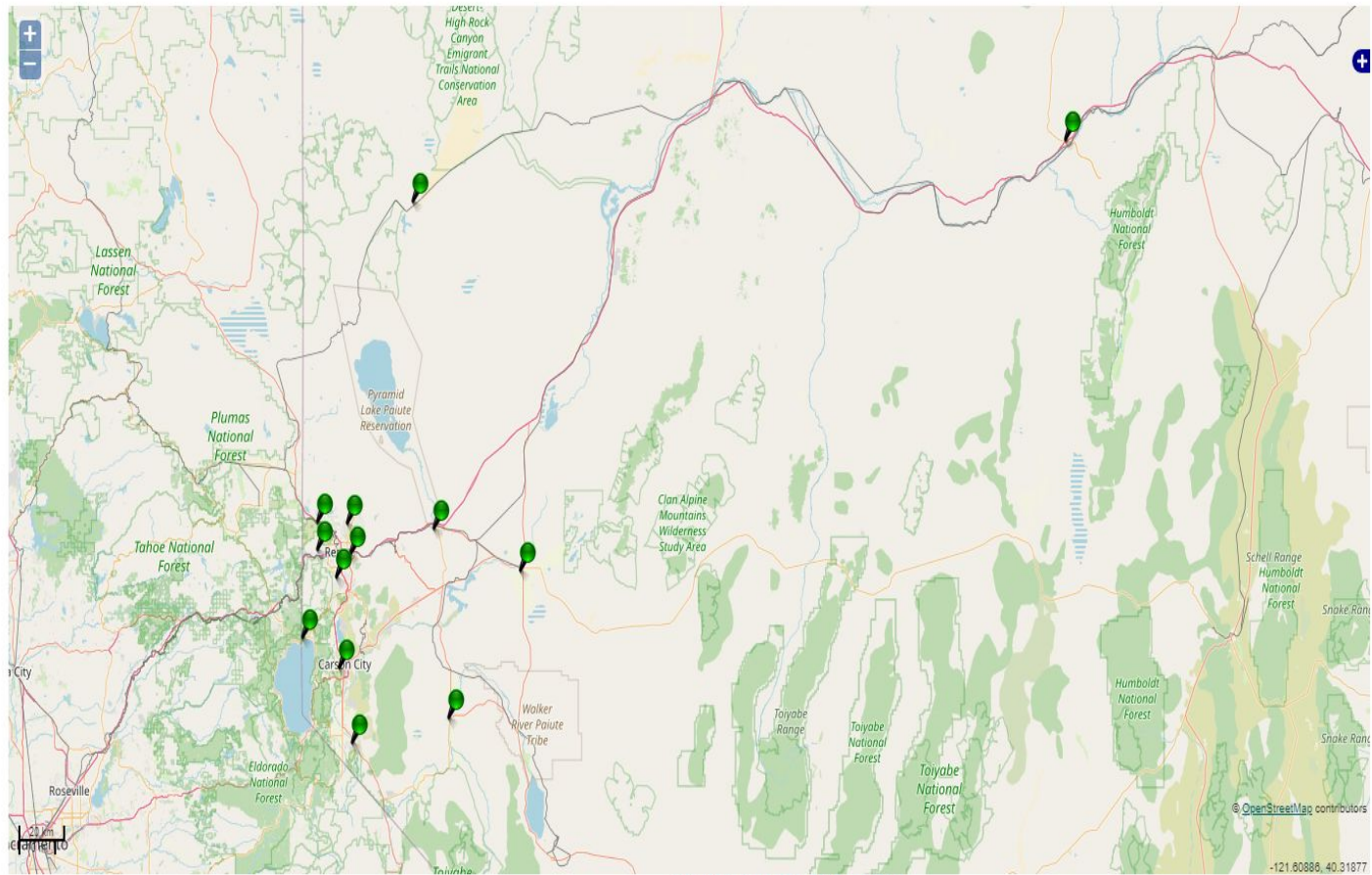
Nevada GPS

> Home > Sensor Map

- Home
- Sensor Map
- Login
- Register
- External Links
- Trimble



Sensor Map



- 13 sensors:
- Carson City
 - Elko
 - Fallon
 - Fernley
 - Gardnerville
 - Gerlach
 - Incline Village
 - Monsen Marty
 - Northwest Reno
 - Reno
 - Sparks
 - Sparks Spanish Springs
 - Yerington


More redundancy is needed for the NevadaGPS. If one station goes down in certain areas the solution is not reliable and repeatable.



Location matters.

How do we decide where to upgrade stations?

- iScope has provided some useful insight on where the network is being used most.

 **TURN GPS**
real-time precision
turngps.utah.gov

News and Information

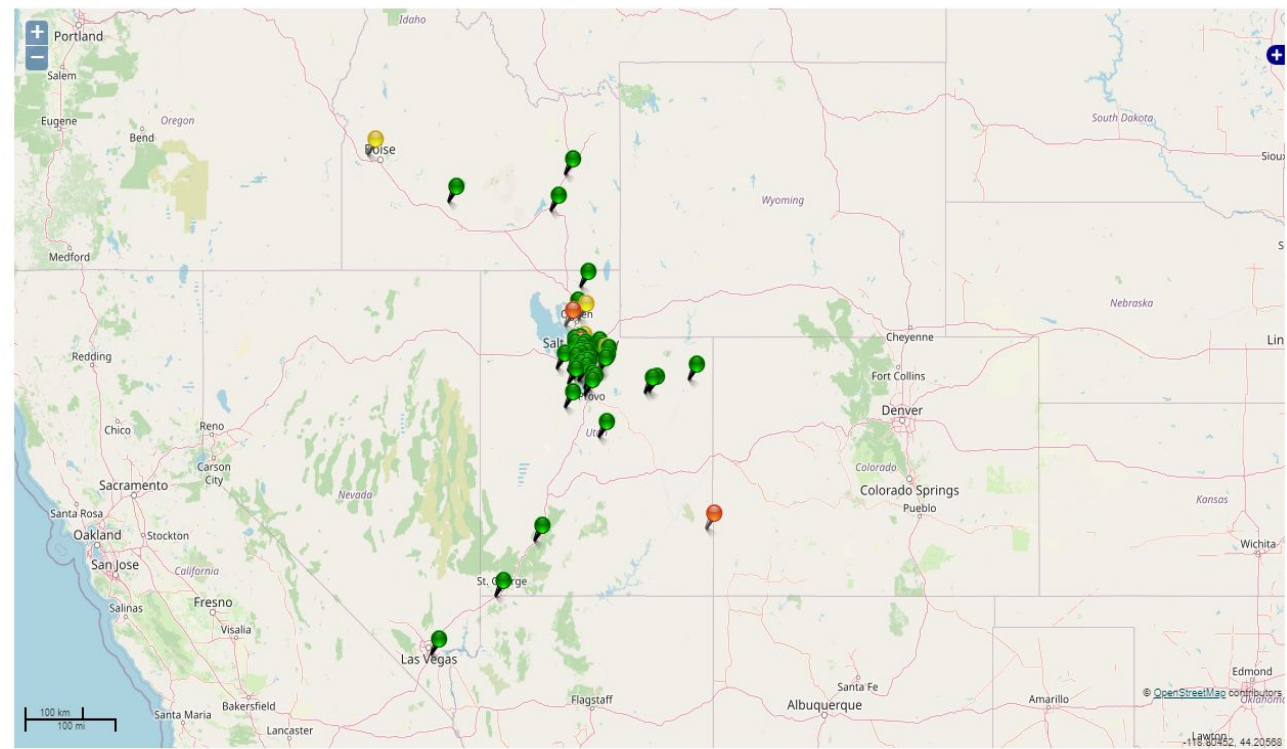


the Utah Reference Network GPS

Home > VRS iScope Live!

- Home
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 - Extended User Info
 - Info Fields
 - Add Field
 - Extended Login Info
 - Info Fields
 - Add Field

VRS iScope™ Live!



- 50 active logins:
- accent11 (RTK Fix)
 - accent14 (RTK Fix)
 - Alliance 7813 (RTK Fix)
 - ALMSurveying (RTK Fix)
 - binghameng (DGNSS)
 - BlackForestPaving2 (RTK Fix)
 - BTCURTIS (RTK Fix)
 - cgalati3 (RTK Fix)
 - CIR2 (RTK Fix)
 - cis01 (RTK Fix)
 - diamondlandsurveying (RTK Fix)
 - dwilding3 (RTK Fix)
 - dwls2020 (RTK Fix)
 - Extreme (RTK Fix)
 - focus17-6 (RTK Fix)
 - focus20_11 (RTK Fix)
 - FOCUS21_13 (RTK Fix)
 - HLEBLKFT1 (RTK Fix)
 - joewittconstruction (RTK Fix)
 - kbishop (RTK Fix)
 - Legend1234 (RTK Fix)
 - LVMC5 (Single-Point)
 - Outlaw (RTK Fix)
 - parfow2 (Single-Point)
 - PCMountainBuilders (RTK Float)
 - Primex0609 (RTK Fix)
 - questar11 (RTK Fix)
 - questar30 (RTK Fix)
 - questar40 (RTK Fix)
 - questar48 (RTK Fix)
 - questar5 (RTK Fix)
 - questar55 (RTK Fix)
 - questar68 (RTK Fix)
 - RALLRED (RTK Fix)
 - RMESRTN1 (RTK Fix)
 - RMSNED (RTK Fix)
 - Rosey (RTK Float)
 - SLsurvey1 (RTK Fix)
 - SPANORPHERE (RTK Fix)

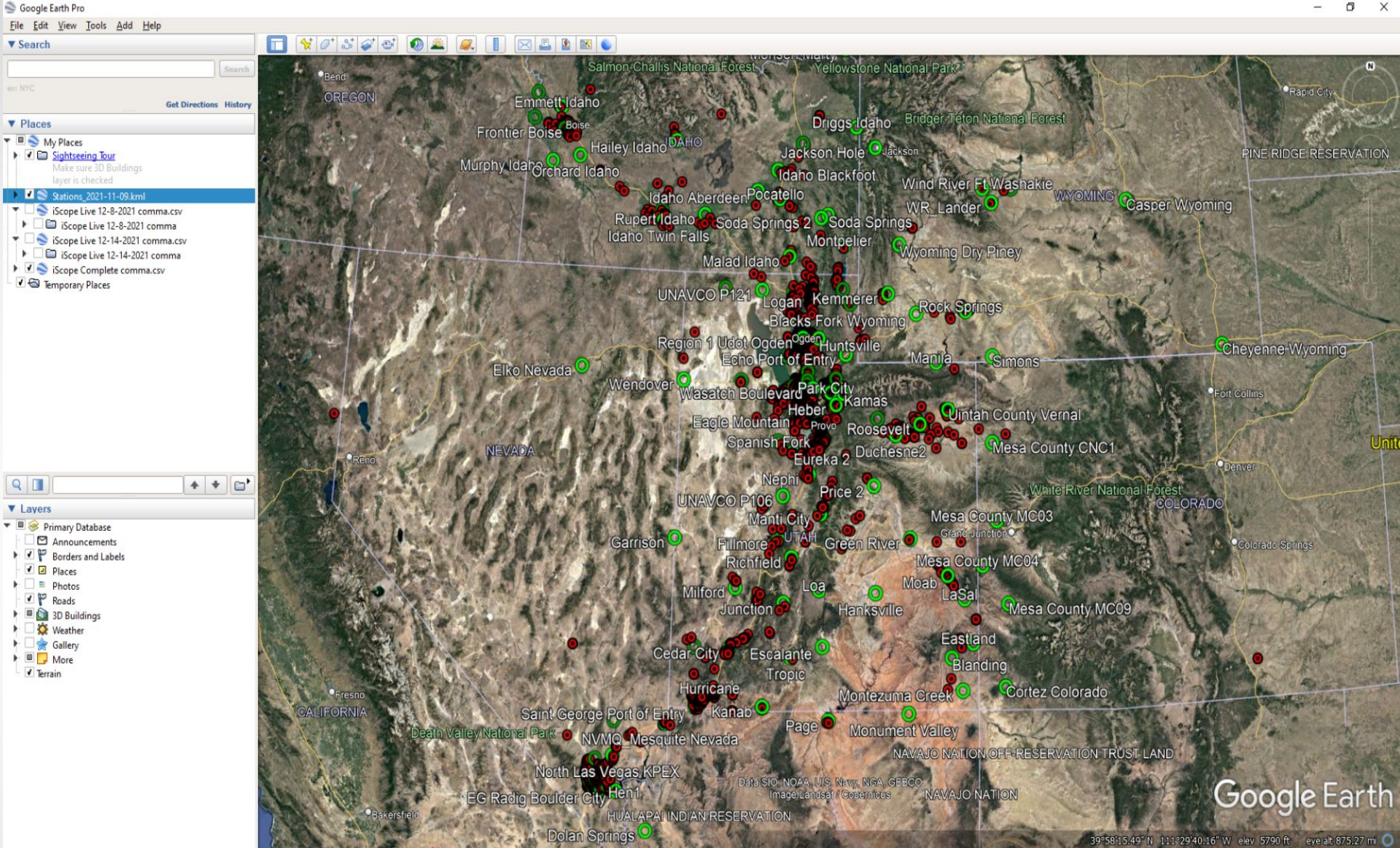


	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X		
1	LogTimeUTC	Userid	Latitude	Longitude	Height	SolutionTy	TrackedSa	PDDP	MountPoi	NtripUser/Connectio	FixedPerce	ClientIP	FixedGPS	FixedGLON	FixedGALII	FixedBEID	FixedQZSS	FixedIRNS	DistToPhy	PhysicalBase	Static	Station name4	Frequency		
2	12/11/2021 23:52	28	38.28158	-112.648	1778.752	4	20	0.782624	GNSSVRSR	NTRIP	21294	94.12099	158.106.5	8	4	6	0	0	0	792.0607	Beaver	Beaver	1		
3	12/14/2021 15:49	2517	41.58033	-109.734	1889.302	4	11	1.229837	GNSSVRSR	NTRIP Gen	1985	96.09756	166.230.1	6	6	0	0	0	0	26837.84	Blacks Fork Wyo	Beryl	0		
4	12/9/2021 23:39	1847	37.28539	-109.543	1301.374	4	11	1.229837	MS_CMR	NTRIP Gen	73	20	174.216.8	9	7	0	0	0	0	39515.87	Blanding	Blacks Fork Wyoming	0		
5	12/11/2021 18:27	1564	38.96323	-111.869	1549.061	4	14	0.782624	VRSCMRX	NTRIP Gen	6576	42.56329	174.204.1	8	6	0	0	0	0	549.0815	Blanding	Blanding	1		
6	12/13/2021 21:56	1130	40.5932	-111.971	1407.235	1	5	23.34455	MS_RTCM	NTRIP Top	1558	45.65218	107.72.98	9	5	0	0	0	0	9206.082	Calvin Rampton	Boise Idaho	0		
7	12/7/2021 20:55	1391	37.67839	-113.07	1746.445	4	12	1.006231	VRSRTCM:	NTRIP Carl	156	93.75	174.204.3	6	6	0	0	0	0	3252.698	Cedar City	Bountiful	0		
8	12/7/2021																					Calvin Rampton	0		
9	12/8/2021																						Casper Wyoming	0	
10	12/8/2021																						Cedar City	18	
11	12/9/2021																						Cheyenne Wyoming	1	
12	12/9/2021																						Clark County 1	4	
13	12/11/2021																						Clark County 2	4	
14	12/11/2021																						Cortez Colorado	2	
15	12/13/2021 19:34	1943	37.14455	-113.307	870.891	4	10	0.782624	GNSSVRSR	NTRIP Gen	1343	99.02080	12.123.23	7	3	7	0	0	0	0	6698.98	Cedar City	Delta	0	
16	12/13/2021 20:25	308	37.16536	-113.432	946.898	2	13	1.006231	GNSSVRSR	NTRIP Carl	586	88.98306	174.205.9	6	2	6	0	0	0	0	67093.43	Cedar City	Diamond Back West L	10	
17	12/13/2021 21:12	1162	37.10034	-112.375	1594.262	4	16	0.894427	GNSSVRSR	NTRIP Gen	756	42.68293	174.240.0	7	4	5	0	0	0	0	92016.06	Cedar City	Dolan Springs	0	
18	12/13/2021 22:30	2368	37.17152	-113.328	1004.998	4	20	0.559017	GNSSVRSR	NTRIP	375	100	158.106.4	7	4	6	0	0	0	0	62886.87	Cedar City	Draper	22	
19	12/13/2021 23:24	2606	37.6808	-113.1	1704.611	5	5	1.118034	GNSSVRSR	NTRIP	1822	88.01997	158.106.5	8	4	6	0	0	0	0	3602.238	Cedar City	Driggs Idaho	3	
20	12/13/2021																						dar City	Duchesne2	5
21	12/14/2021																						dar City	Eagle Mountain	10
22	12/14/2021																						dar City	Eastland	0
23	12/14/2021																						dar City	Echo Port of Entry	2
24	12/14/2021																						dar City	EG Radig Boulder City	1
25	12/14/2021																						dar City	Elko Nevada	0
26	12/14/2021																						dar City	Emmett Idaho	0
27	12/14/2021																						dar City	Escalante	0
28	12/13/2021																						eyenne Wyoming	Eureka 2	4
29	12/10/2021																						ark County 1	Fillmore	3
30	12/13/2021																						ark County 1	Frontier Boise	0
31	12/13/2021 21:21	1795	36.06473	-115.197	670.121	4	11	1.118034	GNSSVRSR	NTRIP Gen	833	92.22222	174.205.1	8	4	6	0	0	0	0	6963.92	Clark County 1	Garrison	0	
32	12/14/2021 15:29	1757	36.09824	-115.15	605.224	5	4	3.913119	GNSSVRSR	NTRIP Gen	3385	57.26744	174.205.1	8	2	4	0	0	0	0	10937.57	Clark County 1	Grantsville	16	
33	12/8/2021 21:22	1447	36.31584	-115.326	876.548	4	12	1.006231	VRSCMR	NTRIP Gen	6655	98.95678	174.205.9	8	5	0	0	0	0	0	10679.51	Clark County 2	Grassy Knoll	0	
34	12/9/2021 19:31	1088	36.31699	-115.327	878.141	2	12	0.894427	VRSCMR	NTRIP Gen	4555	95.68034	174.205.6	7	5	0	0	0	0	0	10776.79	Clark County 2	Green River	1	
35	12/14/2021																								2
36	12/14/2021																								0
37	12/8/2021																								16
38	12/13/2021																								0
39	12/7/2021 19:21	1705	36.12853	-115.195	652.529	1	10	0.782624	VRSCMRX	NTRIP Gen	1	0	106.171.1	0	0	0	0	0	0	0	10359.54	Diamond Back We	Henderson	0	
40	12/9/2021 16:43	234	36.12979	-115.149	590.088	4	10	1.229837	GNSSVRSR	NTRIP Gen	4643	39.67093	166.170.5	5	8	0	0	0	0	0	7852.854	Diamond Back We	Herriman	32	
41	12/13/2021 16:45	731	36.07772	-115.261	729.794	5	7	2.347871	VRSCMRX	NTRIP Gen	1530	66.66667	174.205.3	7	4	0	0	0	0	0	2430.797	Diamond Back We	Huntsville	7	
42	12/13/2021 21:42	906	36.08427	-115.21	672.039	4	11	1.118034	GNSSVRSR	NTRIP Gen	4323	97.94989	174.205.9	8	3	0	0	0	0	0	6947.325	Diamond Back We	Hurricane	5	
43	12/13/2021 23:50	2405	36.06993	-115.247	726.467	4	15	0.782624	GNSSVRSR	NTRIP Gen	349	82.92683	174.205.9	9	6	0	0	0	0	0	3719.856	Diamond Back We	Idaho Aberdeen	1	

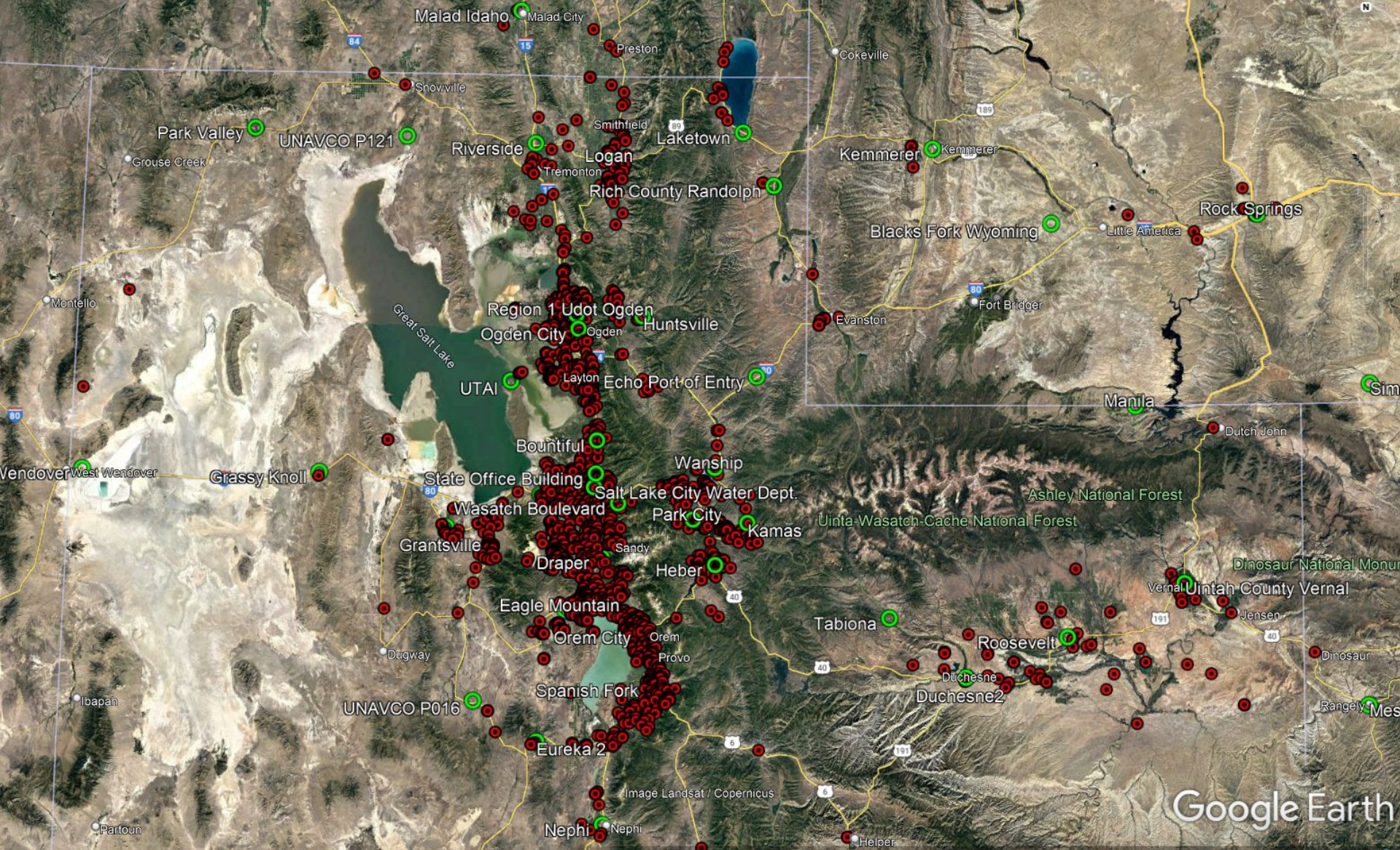
Use Latitude and Longitude to Display Session Start Location in GIS or Google Earth

Can see the primary station being used for a specific session and which satellite constellations are being used

Use a Pivot Table to Calculate Frequency for a Chart

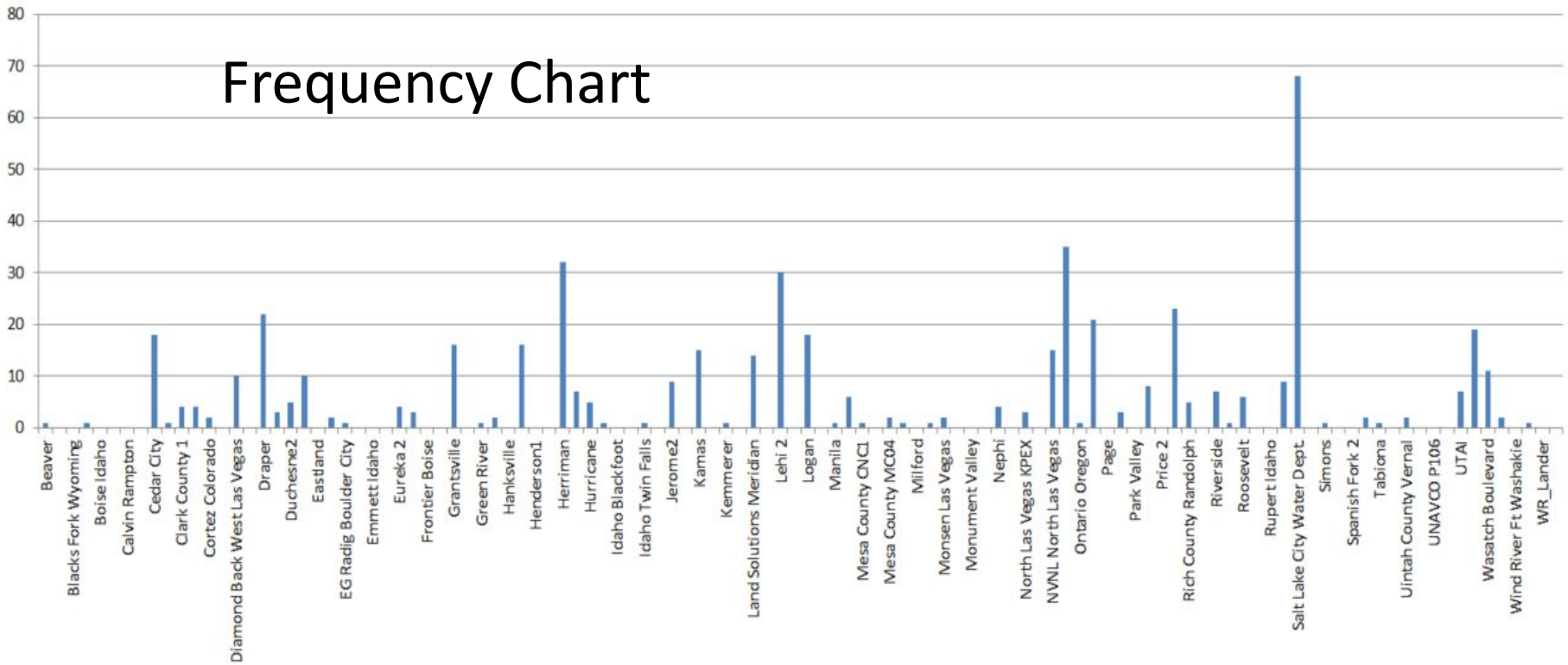


Green Circles = TURN GPS Stations
 Red Circles = Start of a GNSS Session



Focus upgrades and maintenance in areas of heavy use.
 Example – between Ogden and Logan
 Between Nephi and Orem, between Grantsville and SLC.

Frequency Chart



Date Range – 12/7/2021 to 12/14/2021 (1week)

Some of the most used stations:

Salt Lake City Water Dept.

North Las Vegas City

Herriman City

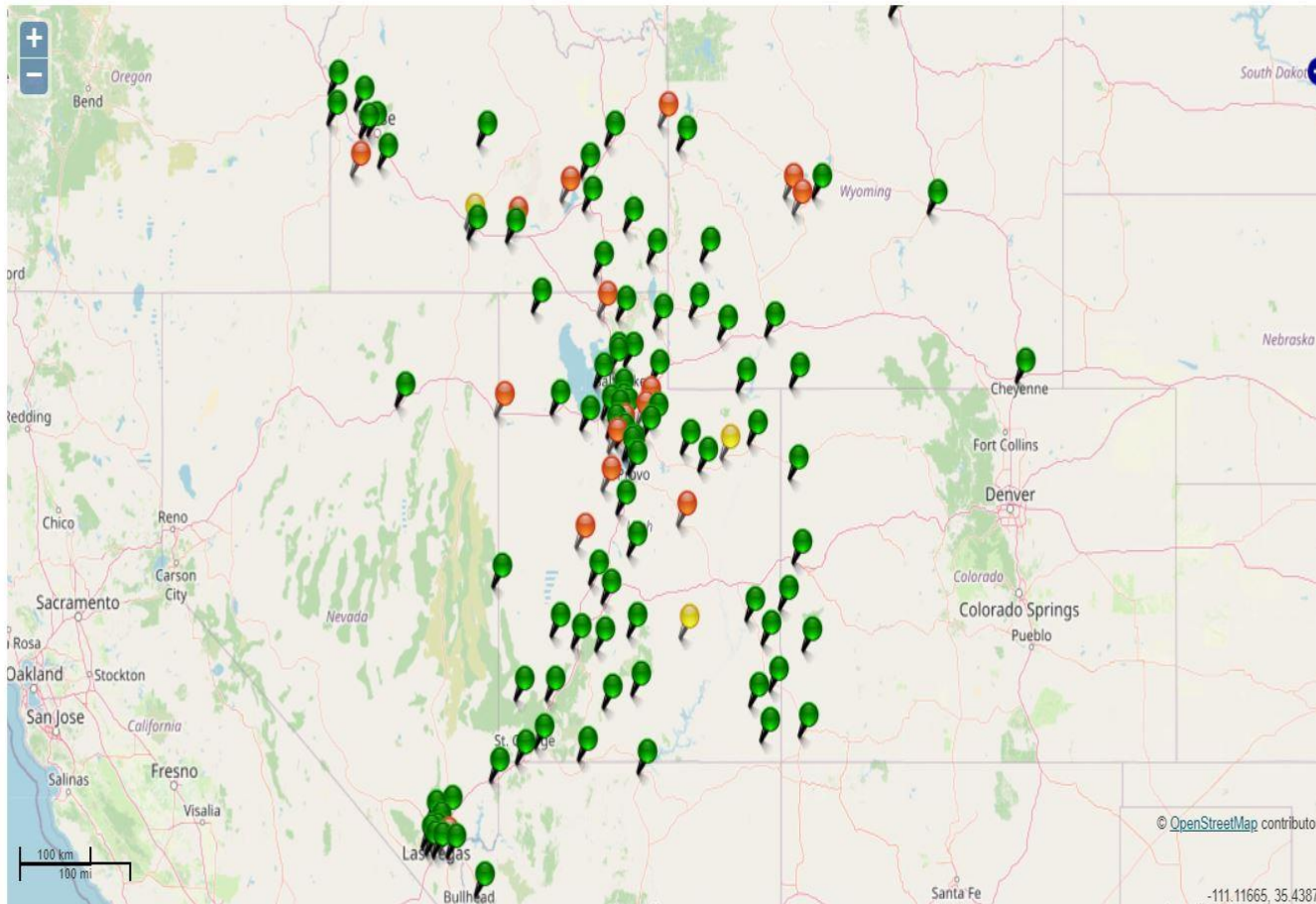
Lehi



Location matters.

Sensor Map

- Home
 - Sensor Map
 - Login
 - Register
- External Links
 - Trimble



- 108 sensors:
- Antelope Island
 - Beaver
 - Beryl
 - Blacks Fork Wyoming
 - Blanding
 - Bountiful
 - Calvin Rampton
 - Casper Wyoming
 - Cedar City
 - Cheyenne Wyoming
 - Clark County 1
 - Clark County 2
 - Cortez Colorado
 - Delta
 - Diamond Back West Las Vegas
 - Dolan Springs
 - Draper
 - Driggs Idaho
 - Duchesne2
 - Eagle Mountain
 - Eastland
 - Echo Port of Entry
 - EG Radig Boulder City
 - Elko Nevada
 - Emmett Idaho
 - Escalante
 - Eureka 2
 - Fillmore
 - Frontier Boise
 - Garrison
 - Grantsville
 - Grassy Knoll

Working with partner IT departments to configure their firewall to allow connections to the new Cloud Server. Nearly Complete

Cloud Server NTRIP Caster Mountpoints.

Trying to Simplify by reducing the number of un-necessary options.

The screenshot displays the Trimble Pivot Platform interface. The main window shows a tree view of system components on the left and a central table of mountpoints. A configuration window for 'NtripCaster [Config2]' is open on the right, showing various settings like ports, accounting, and source table. A status messages window is also visible at the bottom.

Mountpoint	Connection Type	Total Connect...	Connections P...	Mode	Connected	Sourc
GNSS-VRS-ITRF2014-CMRx	Control Line (Parallel)	0	0	Single data source	To 1 source	10.2C
GNSS-VRS-ITRF2014-RTCM32	Control Line (Parallel)	0	0	Single data source	To 1 source	10.2C
GNSS-VRS-NAD83-2011-CMRx	Control Line (Parallel)	0	0	Single data source	To 1 source	10.2C
GNSS-VRS-NAD83-2011-RTCM32	Control Line (Parallel)	2	2	Single data source	To 1 source	10.2C
MS-ITRF2014-CMRx-GNSS	Control Line (Parallel)	0	0	Single data source	To 1 source	10.2C
MS-ITRF2014-RTCM32-GNSS	Control Line (Parallel)	0	0	Single data source	To 1 source	10.2C
MS-NAD83-2011-CMRp	Control Line (Parallel)	0	0	Single data source	To 1 source	10.2C
MS-NAD83-2011-CMRx-GNSS	Control Line (Parallel)	0	0	Single data source	To 1 source	10.2C
MS-NAD83-2011-RTCM31	Control Line (Parallel)	0	0	Single data source	To 1 source	10.2C
MS-NAD83-2011-RTCM32-GNSS	Control Line (Parallel)	0	0	Single data source	To 1 source	10.2C
VRS-ITRF2014-CMRp	Control Line (Parallel)	0	0	Single data source	To 1 source	10.2C
VRS-ITRF2014-CMRx	Control Line (Parallel)	0	0	Single data source	To 1 source	10.2C
VRS-ITRF2014-RTCM31	Control Line (Parallel)	0	0	Single data source	To 1 source	10.2C
VRS-ITRF2014-RTCM32	Control Line (Parallel)	0	0	Single data source	To 1 source	10.2C
VRS-NAD83-2011-CMRp	Control Line (Parallel)	0	0	Single data source	To 1 source	10.2C
VRS-NAD83-2011-CMRx	Control Line (Parallel)	0	0	Single data source	To 1 source	10.2C
VRS-NAD83-2011-RTCM31	Control Line (Parallel)	0	0	Single data source	To 1 source	10.2C
VRS-NAD83-2011-RTCM32	Control Line (Parallel)	0	0	Single data source	To 1 source	10.2C

Properties - NtripCaster [Config2]

- Port Settings**
 - Ports: 2101 (TCP/IP Server)
 - Enable throttling: Yes
 - Throttling time [ms]: 40
- Accounting**
 - Enable accounting: No
- Source Table**
 - Mountpoints: 18 Mountpoint(s)
 - NtripCasters: 0 NtripCaster(s)
 - Networks: 0 Network(s)
 - Enable HTTP 404 error: No
- Redundancy**
 - Detect gaps interval [sec]: 30
 - Switch datasource after [sec]: 60
- History**
 - Log history to file: No
 - Clear history: No
- Rover Integrity**
 - Rover Integrity support: No
- Diagnostic Output**
 - Diagnostic output: Off
 - Diagnostics level: 0
 - Diagnostics path:
- iScope**
 - iScope Support: No

Status Messages: Last 200 Items

Type	Event Time [UTC]	Source	Group	Message Text
i	3/28/2022 8:46:39...	Cbc:FrequencyGroupDefinition	Framework	For satellite G14 with frequency type L1 using tracking type BOC_PD no CBC group was found. To ensure the re-use feature of CBC the combination of satellite, frequency and tracking...
!	3/28/2022 9:08:02...	Storage [Rinex_1h_5s_NGS]	Storage	RINEX writer could not store to C:\inetpub\wwwroot\4NGS\RefData 22\Month\Mar\Day22\UTWA081T.22o. Reason: Could not find a part of the path 'C:\inetpub\wwwroot\4NGS\RefData...

RTCM32 is the only format capable of all constellation outputs. GPS, Glonass, Galileo, Beidou 1,2,3

The NTRIP protocol (Network Transport of RTCM via Internet Protocol) enables the Rover to access data from the GPS Network over the internet.

Production Server Mountpoints

Lefebure NTRIP Client

Empty GG

Serial Port:

NTRIP Stream:

NTRIP Status:

Welcome to Lefebure NTRIP Client

10:32:16 AM - NTRIP Stream: SB_UTHR_RTCM32_Herriman

10:32:21 AM - NTRIP Stream: VRSCMRX

10:32:21 AM - NTRIP Stream: VRSRTCM23

10:32:21 AM - NTRIP Stream: VRSRTCM31

10:32:21 AM - NTRIP Stream: VRSCMR

10:32:21 AM - NTRIP Stream: VRSRTCM32

10:32:21 AM - NTRIP Stream: VRSCMRP

10:32:21 AM - NTRIP Stream: VRSCMRXtest

10:32:21 AM - NTRIP Stream: SB_UTS2_RTCM32_SpanishFork

10:32:21 AM - NTRIP Stream: GNSSVRSCMRX

10:32:21 AM - NTRIP Stream: GNSSVRSRTCM32

10:32:21 AM - NTRIP Stream: VRSCMRXDEG

10:32:21 AM - NTRIP Stream: SB_IDHA_CM Rx_Hailey

10:32:21 AM - NTRIP Stream: SB_UTMB_RTCM31_Moab

10:32:21 AM - NTRIP Stream: SB_WYJA_CM Rx_JacksonHole

10:32:21 AM - NTRIP Stream: SB_WYJA_RTCM31_JacksonHole

10:32:21 AM - NTRIP Stream: VRS_Development_RTCM31

10:32:21 AM - NTRIP Stream: SB_AZPG_CM Rx_Page

10:32:21 AM - NTRIP Stream: SB_NVH1_CM Rx_Henderson1

10:32:21 AM - NTRIP Stream: SB_IDMN_CM Rx_Meridian

10:32:21 AM - NTRIP Stream: SB_IDDR_CM Rx_DriggsID

10:32:21 AM - NTRIP Stream: SB_WRFW_RTCM32_FtWashakie

10:32:21 AM - NTRIP Stream: SB_WRRI_RTCM32_Riverton

10:32:21 AM - NTRIP Stream: SB_WRLA_RTCM32_Lander

10:32:21 AM - NTRIP Stream: SB_NVEK_RTCM32_Elko

10:32:21 AM - NTRIP Stream: SB_UTBE_CM Rp_Beryl

10:32:21 AM - NTRIP Stream: WGS84_GNSSVRSRTCM32

10:32:21 AM - NTRIP Stream: WGS84_GNSSVRSRTCM23

10:32:21 AM - NTRIP Stream: SB_UTKA_RTCM32_Kanab

10:32:21 AM - NTRIP Stream: MS_RTCM32

Options

Connect Edit

Connect Edit

History

Clear

Cloud Server Mountpoints

All Single Base Mountpoints Removed

MS Mountpoints replace Single Base

Mountpoints Offered in Multiple Coordinate Frames NAD83 (2011) and ITRF (2014) which is more or less the same as WGS84

The screenshot shows the Lefebure NTRIP Client interface. At the top, it displays "Empty GGA data Age:N/A" and an "Options" button. Below this, the "Serial Port" is "Disconnected". The "NTRIP Stream" dropdown menu is open, showing a list of options. The "NTRIP Status" is also "Download Source Table". To the right of the dropdown are "Connect" and "Edit" buttons. Below these are "History" and "Clear" buttons. A red oval highlights the "GNSS-VRS-ITRF2014-RTCM32" option in the dropdown menu.

Serial Port: Disconnected

NTRIP Stream: Download Source Table

NTRIP Status: Download Source Table

Welcome to Lefebure
5:21:05 PM - NTRIP

Download Source Table

- MS-NAD83-2011-CMRp
- MS-NAD83-2011-CMRx-GNSS
- MS-NAD83-2011-RTCM32-GNSS
- MS-NAD83-2011-RTCM31
- MS-ITRF2014-CMRx-GNSS
- MS-ITRF2014-RTCM32-GNSS
- VRS-NAD83-2011-CMRx
- VRS-NAD83-2011-CMRp
- VRS-NAD83-2011-RTCM31
- VRS-NAD83-2011-RTCM32
- VRS-ITRF2014-CMRp
- VRS-ITRF2014-CMRx
- VRS-ITRF2014-RTCM31
- VRS-ITRF2014-RTCM32
- GNSS-VRS-NAD83-2011-CMRx
- GNSS-VRS-NAD83-2011-RTCM32
- GNSS-VRS-ITRF2014-CMRx
- GNSS-VRS-ITRF2014-RTCM32

Connect Edit

Connect Edit

History

Clear

TURN GNSS Customers - Interesting Stats

Private business, Surveyors, Engineers, Cities, Counties, Utility Companies, Universities, Federal Departments, etc.

Reno network has another 49 companies from NV, 6 from California, and 1 from New York.

TURN has companies from 27 different states that use the network.

Most Common Uses - Surveying, Construction, Mapping

The Utah PLSS Grant Program recommends the use of a GNSS Network to collect Section Corner Locations

History of MRRC Grant Funding

Common Coordinate Frame

County	2016-2017			2017-2018			2018-2019			2019-2020			2020-2021			2021-2022			2022-2023			Total		
	Amount Requested	Amount Received	Number of Corners Surveyed	Amount Requested	Amount Received	Number of Corners Surveyed	Amount Requested	Amount Received	Number of Corners Surveyed	Amount Requested	Amount Received	Number of Proposed Corners	Amount Requested	Amount Received	Number of Corners Surveyed	Amount Requested	Amount Received	Number of Corners Surveyed	Amount Requested	Amount Received	Number of Corners Surveyed	Amount Requested	Amount Received	Number of Corners Surveyed
Beaver	\$ 7,700.00	\$ 7,700.00	88	\$ 6,922.00	\$ 6,922.00	25	\$ 8,500.00	\$ 8,500.00	13	\$ 9,500.00	\$ 9,500.00	20	\$ 8,500.00	\$ 8,500.00	9				\$ 20,000.00	\$ 20,000.00	24	\$ 61,122.00	\$ 61,122.00	179
Box Elder												17	\$ 12,500.00									\$ 32,500.00	\$ 19,000.00	17
Cache	\$ 12,000.00	\$ -		\$ 6,000.00	\$ 6,000.00	20	\$ 7,000.00	\$ 7,000.00	18	\$ 7,000.00	\$ 7,000.00	15	\$ 7,000.00	\$ 7,000.00	11	\$ 9,000.00	\$ 9,000.00	11	\$ 31,000.00	\$ 31,000.00	29	\$ 79,000.00	\$ 67,000.00	103
Carbon																			\$ 21,500.00	\$ 21,500.00	45	\$ 21,500.00	\$ 21,500.00	45
Daggett	\$ 8,000.00	\$ -								\$ 15,000.00	\$ 15,000.00	14	\$ 14,000.00	\$ 9,035.71	18				\$ 20,000.00	\$ 20,000.00	24	\$ 57,000.00	\$ 44,035.71	58
Davis	\$ 100,000.00	\$ -																				\$ 100,000.00	\$ -	0
Duchesne	\$ 8,000.00	\$ -		\$ 8,000.00	\$ 8,000.00	45	\$ 20,000.00	\$ 20,000.00	37	\$ 27,300.00	\$ 19,000.00	43	\$ 22,400.00	\$ 9,035.71	15	\$ 17,000.00	\$ 13,698.41	33	\$ 30,100.00	\$ 30,100.00	63	\$ 132,800.00	\$ 99,834.12	239
Emery				\$ 15,000.00	\$ 15,000.00	43	\$ 16,400.00	\$ 8,125.00	9	\$ 30,083.00	\$ 19,000.00	29	\$ 38,083.00	\$ 9,035.71	17	\$ 33,325.00	\$ 13,698.41	31	\$ 35,000.00	\$ 35,000.00	80	\$ 187,891.00	\$ 99,859.12	179
Garfield	\$ 15,000.00	\$ 6,480.00	37																			\$ 15,000.00	\$ 6,480.00	37
Grand																						\$ -	\$ -	0
Iron	\$ 10,000.00	\$ -		\$ 10,000.00	\$ 10,000.00	68													\$ 52,400.00	\$ 52,400.00	67	\$ 72,400.00	\$ 62,400.00	135
Juab																						\$ -	\$ -	0
Kane	\$ 10,000.00	\$ -		\$ 12,000.00	\$ 12,000.00	78				\$ 13,000.00	\$ 13,000.00	61	\$ 31,800.00	\$ 9,035.71	34				\$ 20,000.00	\$ 20,000.00	51	\$ 88,800.00	\$ 54,035.71	224
Millard										\$ 20,000.00	\$ 19,000.00	47				\$ 20,000.00	\$ 13,698.41	73	\$ 25,000.00	\$ 25,000.00	44	\$ 85,000.00	\$ 57,698.41	164
Morgan	\$ 50,000.00	\$ 15,000.00	16	\$ 40,000.00	\$ -		\$ 40,000.00	\$ 20,000.00	8	\$ 40,000.00	\$ 19,000.00	51	\$ 55,000.00	\$ 9,037.71	5	\$ 40,000.00	\$ 13,698.41	20	\$ 40,000.00	\$ 40,000.00	31	\$ 305,000.00	\$ 116,736.12	131
Plute	\$ 20,800.00	\$ 6,480.00	6	\$ 13,600.00	\$ 13,600.00	32				\$ 60,800.00	\$ 19,000.00	35	\$ 40,000.00	\$ 9,035.71	24	\$ 32,000.00	\$ 13,698.41	40				\$ 167,200.00	\$ 81,794.12	137
Rich	\$ 6,000.00	\$ 6,000.00	13	\$ 8,000.00	\$ 8,000.00	9	\$ 9,000.00	\$ 9,000.00	15	\$ 11,000.00	\$ 11,000.00	16	\$ 8,000.00	\$ 8,000.00	11	\$ 8,000.00	\$ 8,000.00	11	\$ 10,000.00	\$ 10,000.00	0	\$ 60,000.00	\$ 60,000.00	75
Salt Lake																						\$ -	\$ -	0
San Juan	\$ 16,200.00	\$ -																				\$ 16,200.00	\$ -	0
Sangre				\$ 13,100.00	\$ 13,100.00	34	\$ 34,200.00	\$ 8,125.00	11	\$ 29,100.00	\$ 17,525.00	13	\$ 17,000.00	\$ 9,035.71	24				\$ 40,000.00	\$ 40,000.00	85	\$ 133,400.00	\$ 87,785.71	167
Sevier	\$ 41,400.00	\$ 6,480.00	18	\$ 24,425.00	\$ 21,478.00	29	\$ 30,525.00	\$ 8,125.00	28	\$ 28,125.00	\$ 18,975.00	31	\$ 39,600.00	\$ 9,035.71	28	\$ 35,000.00	\$ 13,698.41	70	\$ 70,800.00	\$ 45,031.25	69	\$ 267,875.00	\$ 122,803.37	271
Summit	\$ 13,200.00	\$ 6,480.00	10	\$ 9,600.00	\$ 9,600.00	16	\$ 13,000.00	\$ 8,125.00	10	\$ 18,000.00	\$ 18,000.00	17	\$ 25,000.00	\$ 9,035.00	11	\$ 15,000.00	\$ 13,698.41	14	\$ 75,000.00	\$ 75,000.00	61	\$ 168,800.00	\$ 139,918.41	139
Tooele	\$ 30,000.00	\$ 30,000.00	34	\$ 30,422.50	\$ -		\$ 52,100.00	\$ 20,000.00	45	\$ 91,249.00	\$ 19,000.00	49	\$ 66,650.00	\$ 9,035.71	122	\$ 82,980.84	\$ 13,698.41	108	\$ 107,898.75	\$ 107,898.75	225	\$ 463,251.09	\$ 199,602.87	583
Uintah	\$ 10,597.00	\$ -		\$ 10,800.00	\$ 10,800.00	17	\$ 13,000.00	\$ 13,000.00	32	\$ 38,200.00	\$ 19,000.00	32	\$ 14,200.00	\$ 9,035.71	27	\$ 9,750.00	\$ 9,750.00	15	\$ 45,100.00	\$ 45,100.00	88	\$ 141,647.00	\$ 106,685.71	181
Utah																						\$ -	\$ -	0
Wasatch	\$ 9,000.00	\$ 9,000.00	11							\$ 25,000.00	\$ 19,000.00	50	\$ 12,700.00	\$ 9,035.71	16	\$ 9,000.00	\$ 9,000.00	13	\$ 12,000.00	\$ 12,000.00	12	\$ 67,700.00	\$ 58,035.71	102
Washington																						\$ -	\$ -	0
Wayne	\$ 13,000.00	\$ 6,480.00	14	\$ 15,500.00	\$ 15,500.00	23	\$ 20,150.00	\$ 20,000.00	23	\$ 37,600.00	\$ 19,000.00	50	\$ 23,100.00	\$ 9,035.71	17	\$ 18,500.00	\$ 13,698.41	58	\$ 20,000.00	\$ 20,000.00	80	\$ 147,850.00	\$ 103,694.12	245
Weber																						\$ -	\$ -	0
Total	\$ 380,897.00	\$ 100,000.00	247	\$ 223,369.50	\$ 150,000.00	430	\$ 283,875.00	\$ 150,000.00	247	\$ 518,957.00	\$ 300,000.00	590	\$ 437,533.00	\$ 140,965.52	389	\$ 329,535.84	\$ 159,035.69	497	\$ 675,768.75	\$ 850,000.00	697	\$ 2,829,806.09	\$ 1,650,001.21	3408

Note: Number of Corners Surveyed is approximate, data used is conflicting

University of Utah - GNSS Drone Delivering Medical Supplies



@THEU

Keep flights within a
designated flight
corridor



Agriculture - GNSS Navigation to save fuel and fertilizer costs



Great Salt Lake Railroad Causeway GNSS Monitoring - Water Level and Causeway Movement

Working with USGS Michael Freeman and
NGS Lynda Bell on how best to set up the project.



SUREPATH - GNSS Lawn Mower



Decorative mower lines within Daytona Speedway

Monsen Engineering - GNSS Tiny Robotic Surveyor



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Efficiently manage the movement of goods in-and-out of a distribution center through the adoption of ASI Logistics' Smart Yard Shifting™ solution.

[LEARN MORE](#)

Traqnology - GNSS Sports Field Painting



SPORTSTRAQ | PAINTTRAQ | TRAQSTER | TURFTRAQ | DEALER MAP | VI

Support Call -

Customer: I am at a high school trying to mark the field lines and I am no longer receiving corrections.

Support: is there a large number of students leaving the school while using their cell phones?

Customer: Yes

Support: They are flooding the internet service in your area and you should be back online shortly.

traqnology

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- High torque assisted steering system.
- 2.5 Gallon clean water tank for easy clean up
- Universal high-pressure, airless paint system. 17 HP gas engine.
- 50 Gallon Paint Tank
- Adjustable & removable high-pressure paint gun. 25 feet of hose.
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Potato Wart

Last Modified: Apr 5, 2022



Potato Wart: A Fungal Disease of Tubers

This soil borne disease of potatoes is caused by a fungus called *Synchytrium endobioticum*. The disease appears mainly on stolons and tubers. It reduces yield and can make potatoes unmarketable. Symptoms on above-ground growth are not often visible. Young potato warts are white in color and soft and pulpy in texture. They darken and decay as they age.

S. endobioticum thrives in wet conditions. It produces a thick-walled structure known as a winter sporangium which can remain viable for up to 30 years. It can survive at depths of 50 cm in the soil. In spring, at high temperature and moisture, overwintering sporangia germinate to release mobile zoospores which infect suitable host cells. The infected plant cells swell, divide and surround the dividing zoospores resulting in the wart.

This disease can be spread by infected tubers, infected soil, machinery, implements used in infested potato fields, potato cultivation, footwear, and manure from animals that have fed on infested tubers.

Smoke and Mirrors

Definition:

1. the obscuring or embellishing of the truth of a situation with misleading or irrelevant information.

“Autonomous vehicle development is an exercise in smoke and mirrors”



Autonomous Vehicle

- The Utah Department of Transportation is looking at options for future Autonomous Vehicle Infrastructure.
- October 2021 – Field Test – TURN GPS with the NORWHAL Group Autonomous Vehicle System.



- The Narwhal Group is a full-service technology firm serving the broader transportation sector. They provide innovative products and services for the highway operations, planning, research, construction, intelligent transportation systems (ITS), road weather operations, and maintenance areas.

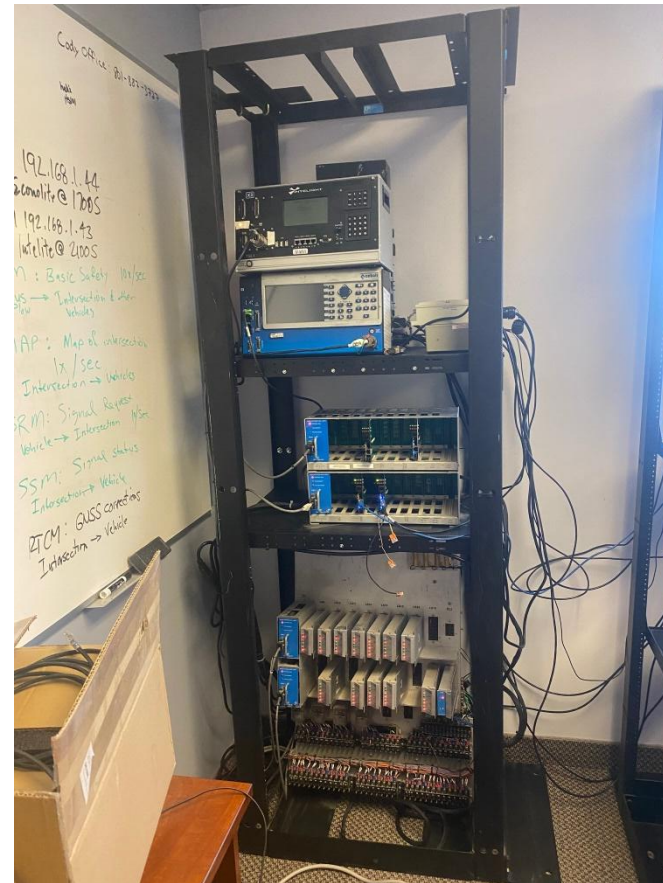
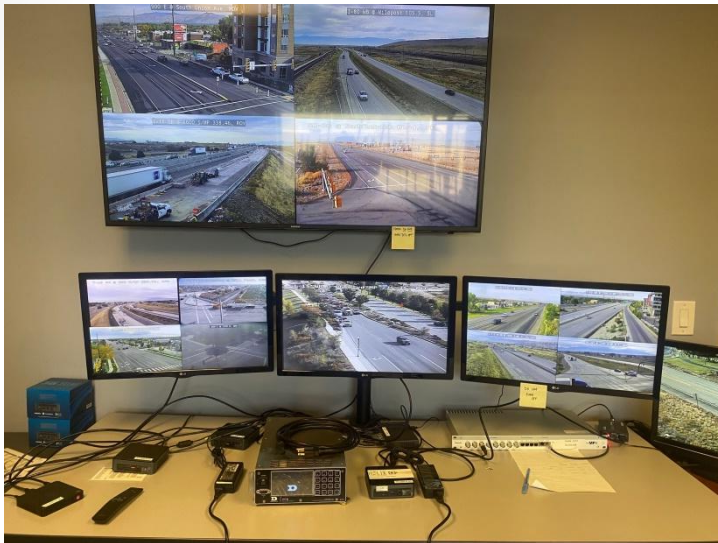
Jonny Turner – NARWHAL Group

Ralph Koeber – NARWHAL Group

Blaine Leonard - Udot



NORWHAL Group Office



Test area near this office – Along Redwood Road around California Avenue

Field Test Video

- Vehicle equipped with 2 separate GNSS antenna's and 2 separate GNSS receivers. Once receiving RTK corrections and the other is not.
- Infrastructure , Owners and Operators STANDARDS – UTA, Udot , City, County, etc.

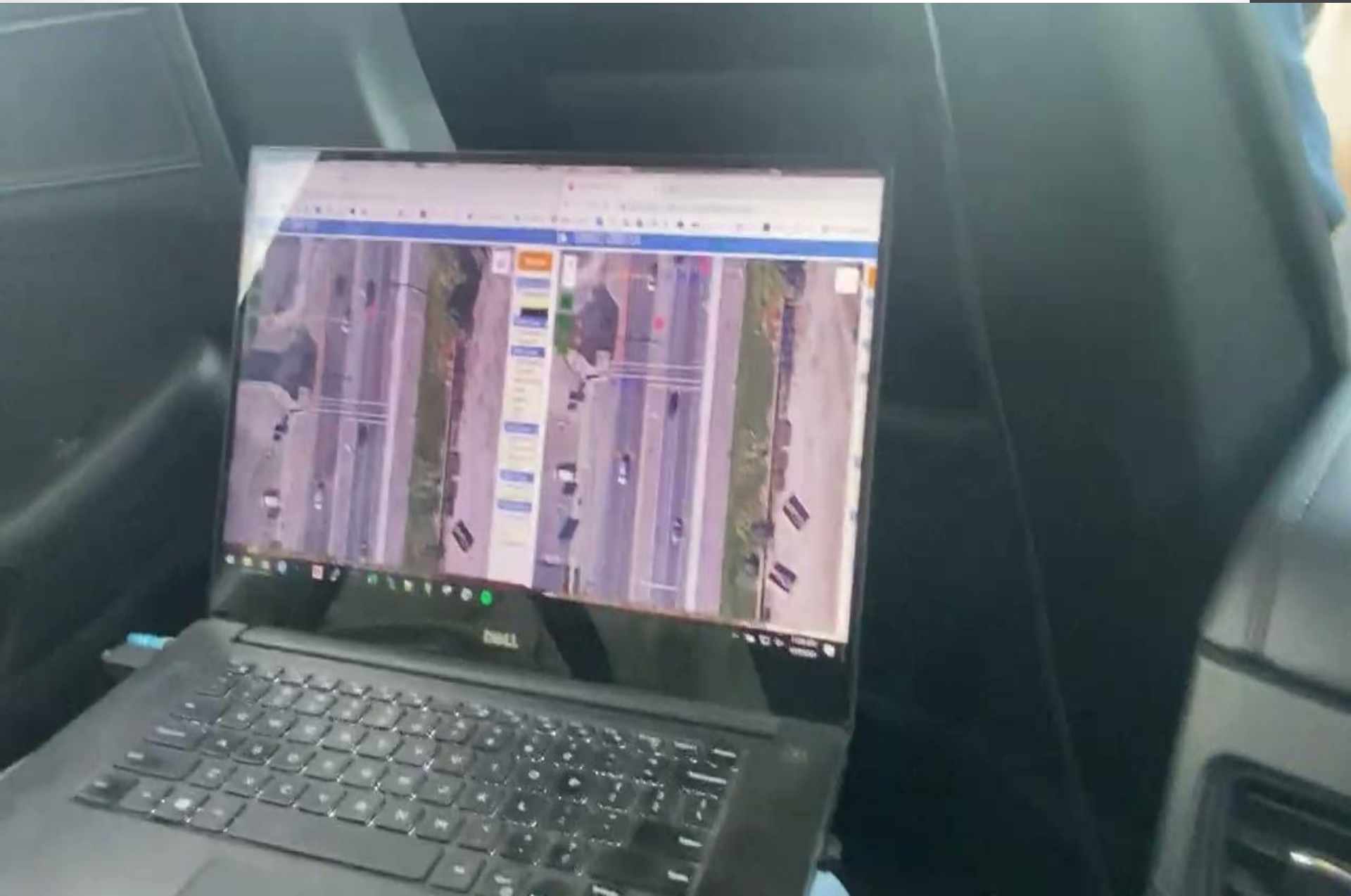
3 Transportation Requirements for Autonomous Vehicle Systems:

1. Signal, Phase and Timing - standards require signal controller tells lights what to do and broadcast this information to vehicles.
2. RTCM GNSS Correction – greater accuracy at the intersection less than 20 cm
3. Map message – geometry of the intersection – lanes and crosswalks-lights about to change. What's going to happen with light changes.

Warnings to slow down

- Automakers - need vehicle to vehicle applications and communication through RTCM messages
- BSM or Basic Safety Message - sent out from vehicle

Field Test Video



Traffic Control and GNSS Unit



Questions?