MONTANA STATE REFERENCE NETWORK (MTSRN)

ABOUT

It provides a centimeter level real time positional accuracy

The system runs on Trimble Pivot Platform, v. 5.1.0 and hosted in Trimble cloud server

From July 01, 2024, a fee-based user subscription will be required to use this service

PARTNERS & RECEIVERS

Tribal Nations (18, 13 given to MDT, 2 to UNAVCO, 3 maintained by own), MDT (40, including 13), UNAVCO (20 including 2), Academia (04), City/County (03) and Private Party (02)

Total count: 72. Trimble: 58, Septentrio: 13, Leica: 01

About 212 stations will be required for full coverage

Station build-out this year planned: 22

RTN DETAILS

A group of reference stations networked to a central processing center

Real time solutions are compared with reference stations and errors are computed

Corrections are propagated either by virtual reference station (VRS) or direct

Corrections streams available for 5 subnets and all stations individually in standard and vendor proprietary formats

User are given caster address with login credentials transported over the internet

Once logged in, users find list of corrections streams (mountpoints) and select one based on area

USER & STATISTICS

Pilot user accounts: 242, pilot logins: 520, major commercial sectors identified: 10

Top 4 industries: Engineering & Surveying, agricultural, land surveying and aerial/drone

RTN SCHEMATIC
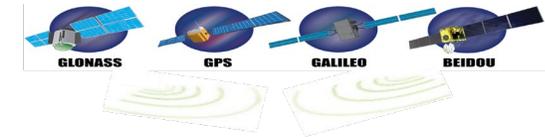
Source: Modified from internet

USER POTENTIALS

Other indsutries identified: water, environmental & geotechnical, utilities, equipment reseller and excavation

Cities & counties also present potentials for RTN use

Solitcitation might be useful to expand the user base

Kazi Arifuzzaman, RTN Coordinator

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RTN Coordinator

Montana State Reference Network (MTSRN) (www.mtsrn.org)

Montana State Library

Digital Services

MONTANA
STATE LIBRARY
A GREATER STATE OF KNOWLEDGE

About

- A system that provides a centimeter level real time positional accuracy

- Runs on Trimble Pivot Platform, v.5.1.0 and hosted in Trimble cloud server

- From July 01, 2024, a fee-based user subscription will be required

USE:

- **Engineering & Surveying**
- **Construction & Machine Guidance**
- **Land Surveying**
- **Agricultural**
- **Transportation**
- **Location-based works**

RTN Technique

- 72 Reference Stations

- Represent true positions in national datum

- Censors receive real time GNSS observations and send to a central processor center

- Central processing center calculates real time solutions and computes errors

- Sends correction to rovers located within bounds

- Sometimes solutions are computed on a subset of reference stations

**Montana State Reference Network (MTSRN) (www.mtsrn.org)**
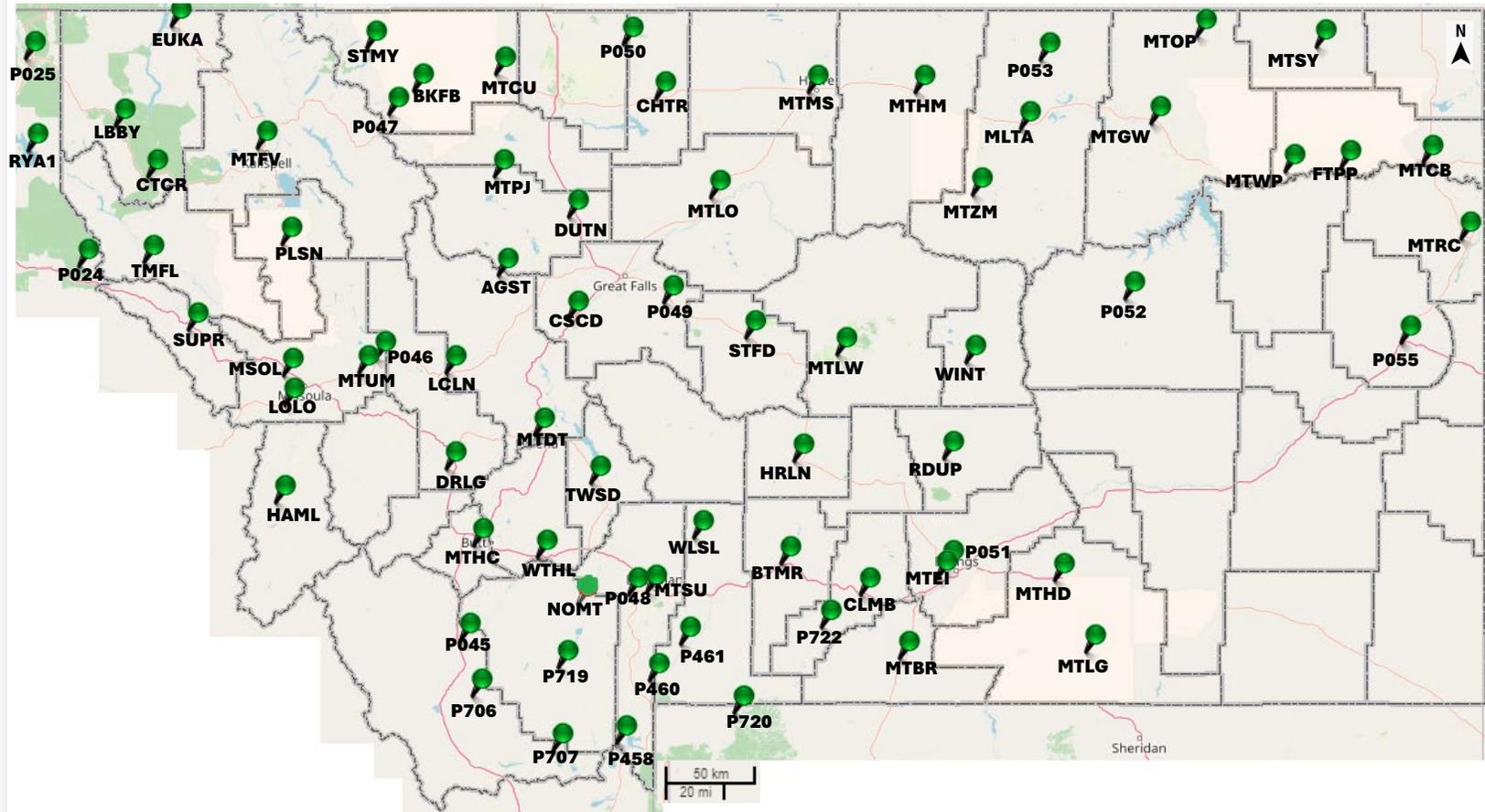
RTN Solutions

- 5 subnets & all stations individually
- Propagation technique: VRS & Direct
- Solution for each subnet as well as solution with reference to each station
- Correction output in standard format (RTCM) & Trimble proprietary formats (CMR)
- Correction streams for each subnet solution
- Correction stream that each station provides
- Correction streams compatible for GPS+GLN only devices & GPS+GLN+GAL+BDS devices

Montana State Reference Network (MTSRN) (www.mtsrn.org)
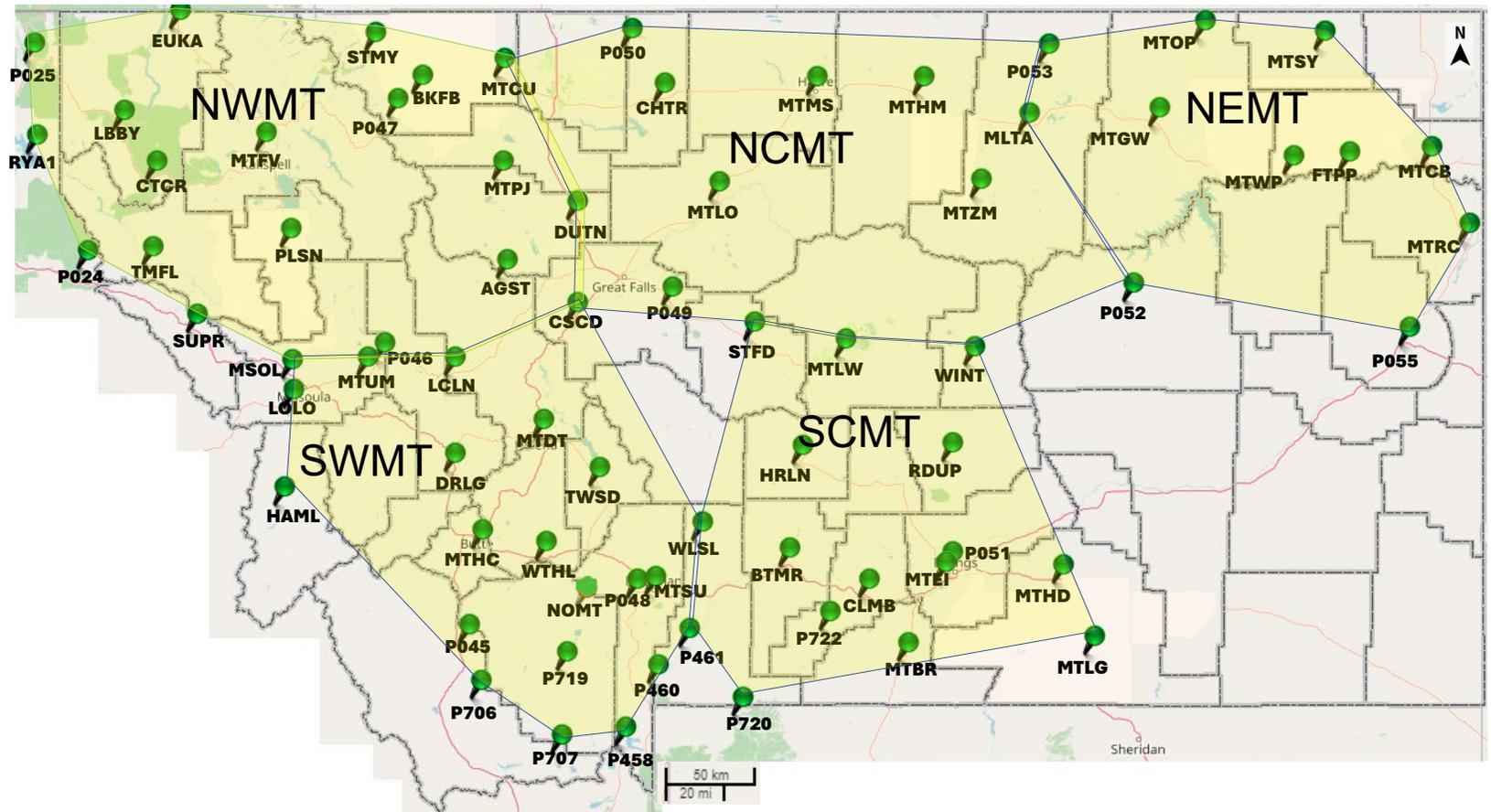
RTN Access

- Users create MTSRN account (request through www.mtsrn.org)

- Users receive login credentials and NTRIP Caster address (IP & Port)

- After logged in, users can see list of correction streams (called mountpoints)

- Users select a correction stream that is suitable for their work area and device

- Solution from nearest station is available

Source: modified from internet
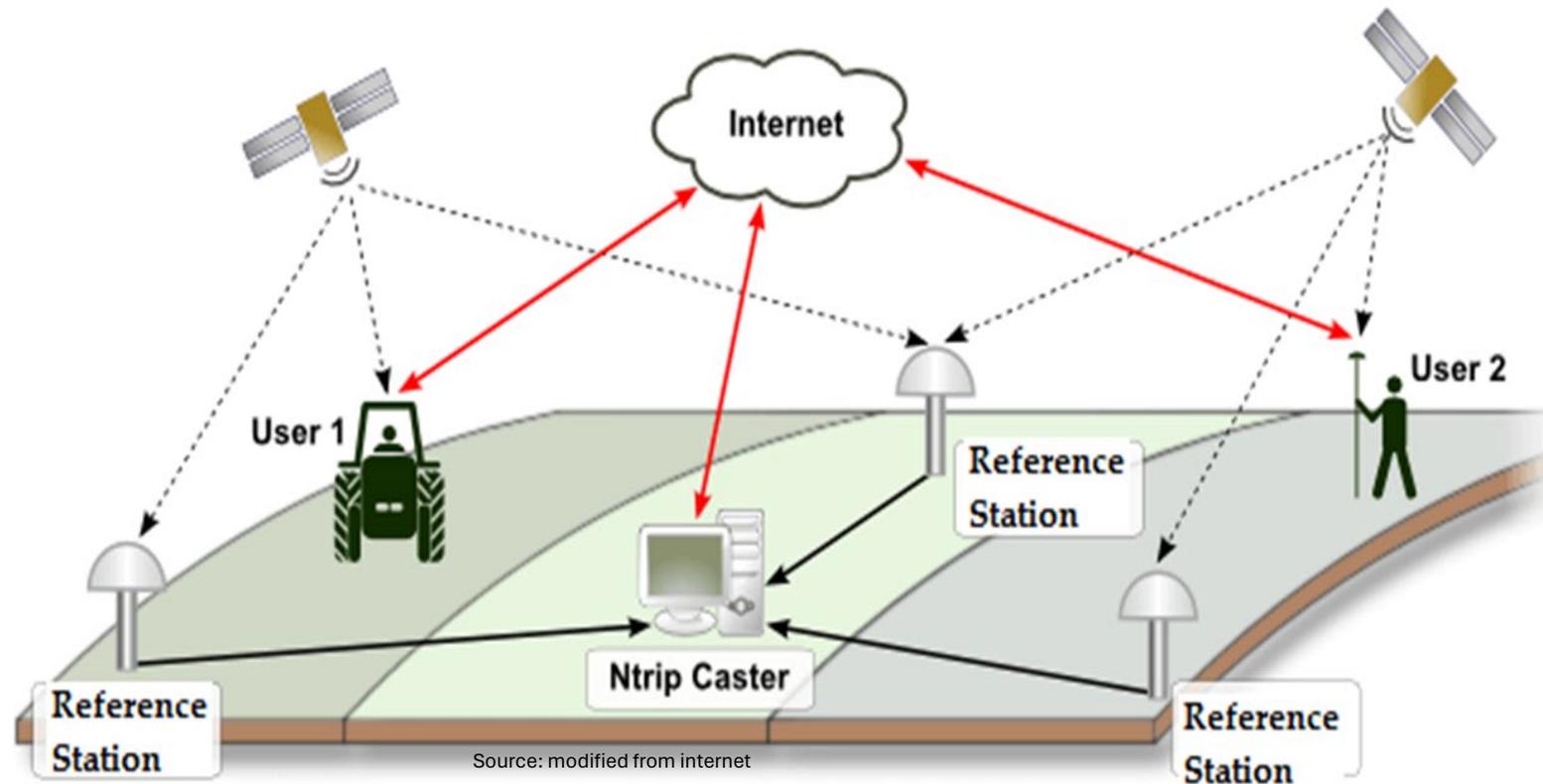
Station Contributors

- **Tribal Nations**: 18 (partnered with MDT & distributed 13 over MDT and 02 distributed with UNAVCO); currently maintains 03
- **MDT**: 40 (included 13 from Tribal Nations)
- **UNAVCO**: 20 (included 02 upgradation from Tribal Nations)
- **Academia**: 04
- **City & County**: 03
- **Private**: 01
- **Other**: 01
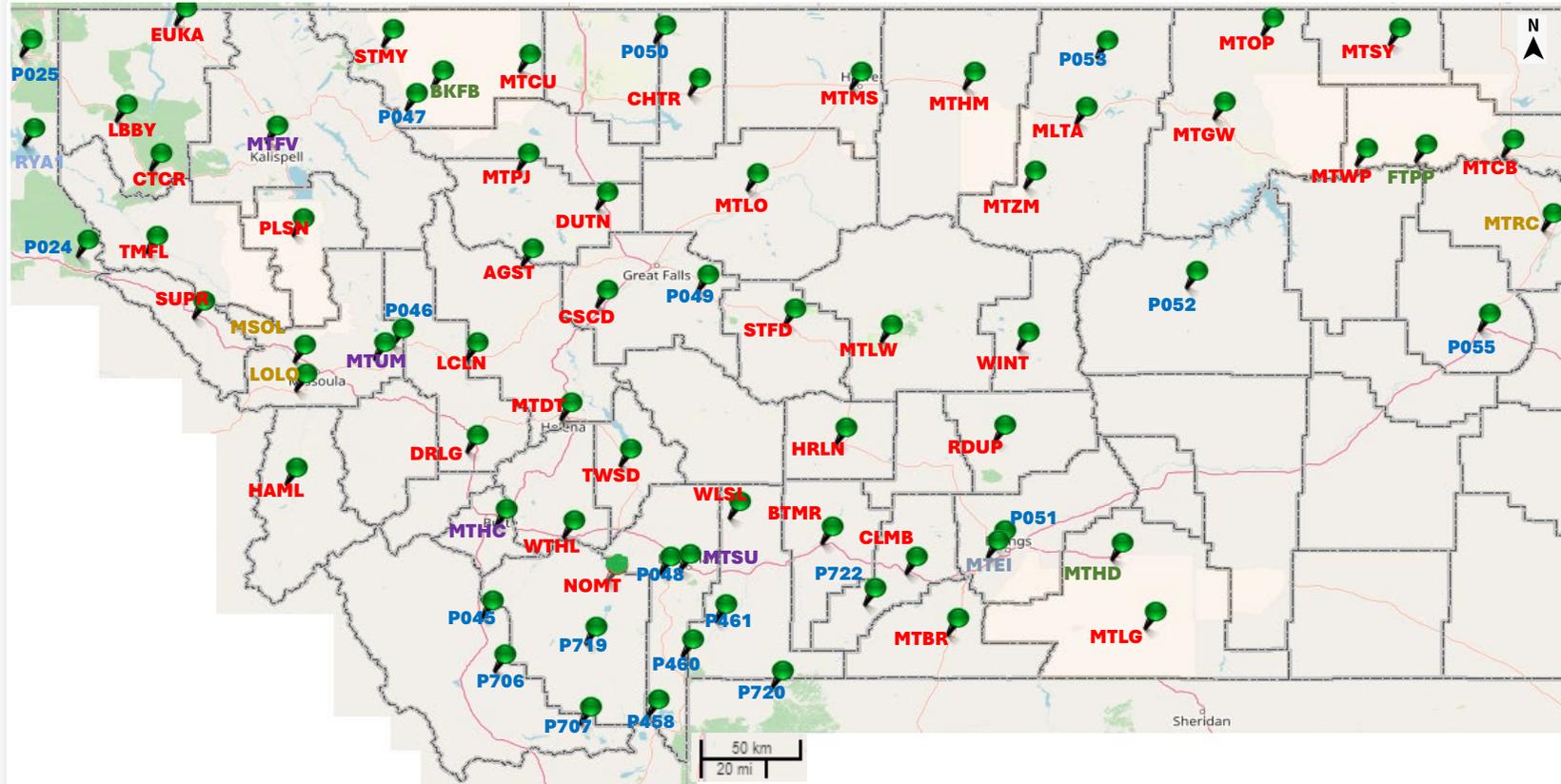
Vendors & Receivers

- Trimble: 58
- Septentrio: 13
- Leica: 01
- Not all stations are GPS+GLO+GAL+BDS capable

Vendor & Receiver Types

Receiver Types	Vendor: Trimble				Vendor: Septentrio	Vendor: Leica	Total
	Trimble ALLOY	Trimble NETR9	Trimble NETR8	Trimble NETRS	SEPT POLARX5	LEICA GR10	
MDT	17	23					40
UNAVCO		4		4	12		20
Academia	1	1	1			1	4
City/County	1	2					3
Tribe		3					3
Private & Other		1			1		2
Total	19	34	1	4	13	1	
	58				13	1	72

Station Planned

- Currently about 22 Stations
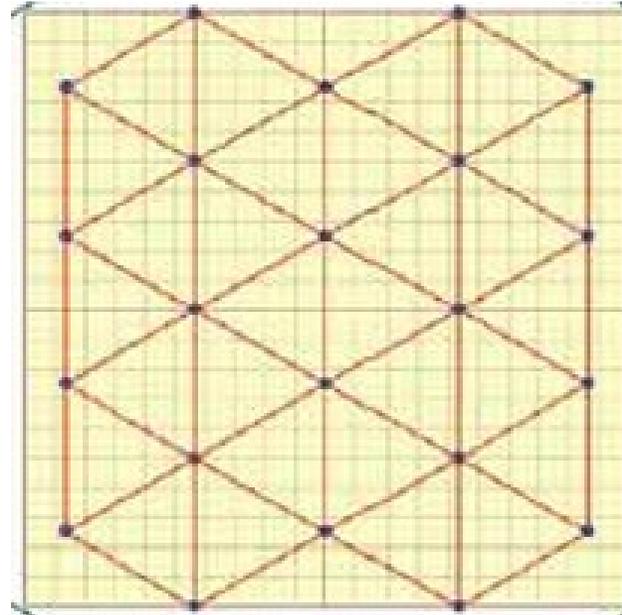- MDT: 17
- MSL MGIA: 03
- Tribe: 01
- UNAVCO: 01
- BLM: 01
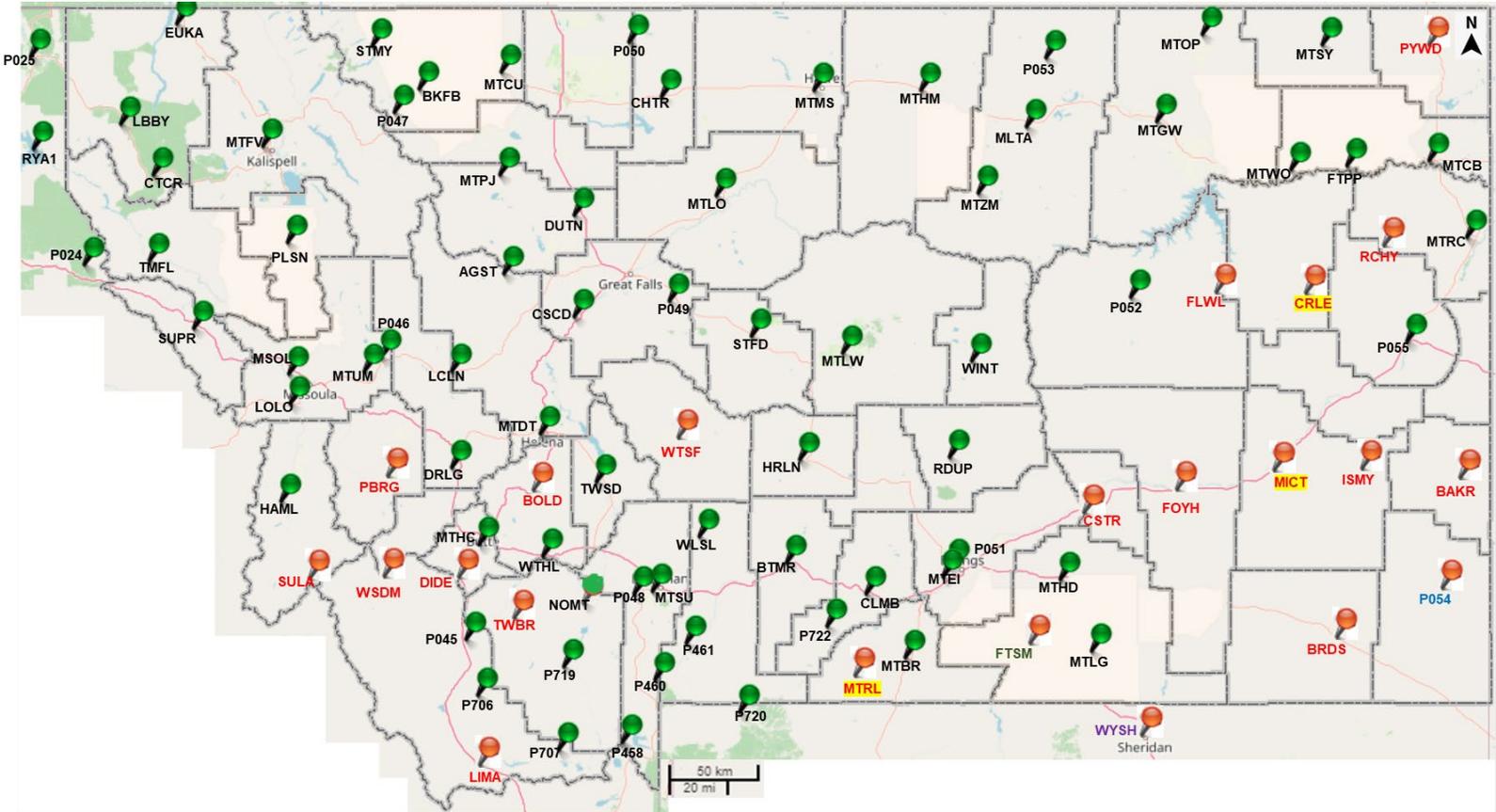
Stations Required

- To attain an optimal geometry of equilateral triangle, about 212 Stations at 40-50 km spacing

Depending on the,

- Availability of suitable sites

- Topographic variation

Pattern of equilateral triangle provides optimal geometry

Users & Statistics

- Pilot Accounts: 242

- Pilot Logins: 520

- 10 commercial sectors

- Top 4 users: engineering, agricultural, land surveying, and drone

- Biggest user group: Professional Land Surveyors

Industry	Counts	Percent
Engineering and Surveying	40	17%
Agricultural (including Precision Ag)	26	11%
Land Surveying	25	10%
Aerial/Drone	23	10%
Water, Environment and Geotechnical	21	9%
Construction	19	8%
Transportation	20	8%
Utilities	14	6%
Equipment Reseller	13	5%
City/County	12	5%
Academia	9	4%
Excavation	8	3%
Miscellaneous	8	3%
Ranch	4	2%
	242	100%

Engineering and Surveying	17%
Land Surveying	10%
Construction	8%
Transportation	8%
Professional Surveyors	43%

In-State Accounts	Out-of-State Accounts
207	35

MONTANA STATE LIBRARY
A GREATER STATE OF KNOWLEDGE

...ers & Statistics

- ...ther high potential ...ectors: water & ...nvironment, utility, ...quipment reseller, city & ...unty and excavation

- ...ity & County offers ...otential

- ...itation might be useful

Water, Environment and Geotechnical	Water/Hydrology	Environmental	Geotechnical	
	9	8	4	

Utilities	Locating Underground	Internet & Telecommunication	Utility Software	Oil & Gas, Pipeline
	5	4	3	2

Equipment Reseller	Construction	Agriculture & Forestry	GNSS	Drone
	6	4	2	1

City/County	City Public Works	GIS	Police/Sheriff	
	5	3	2	

Excavation	Excavating	Dredging	Quarrying	
	6	1	1	

Miscellaneous	Robotic mower manufacturer	Hunting	Boat Race	Personal
	1	1	1	4

MONTANA