

Utah G.P.S. Reference Station Network

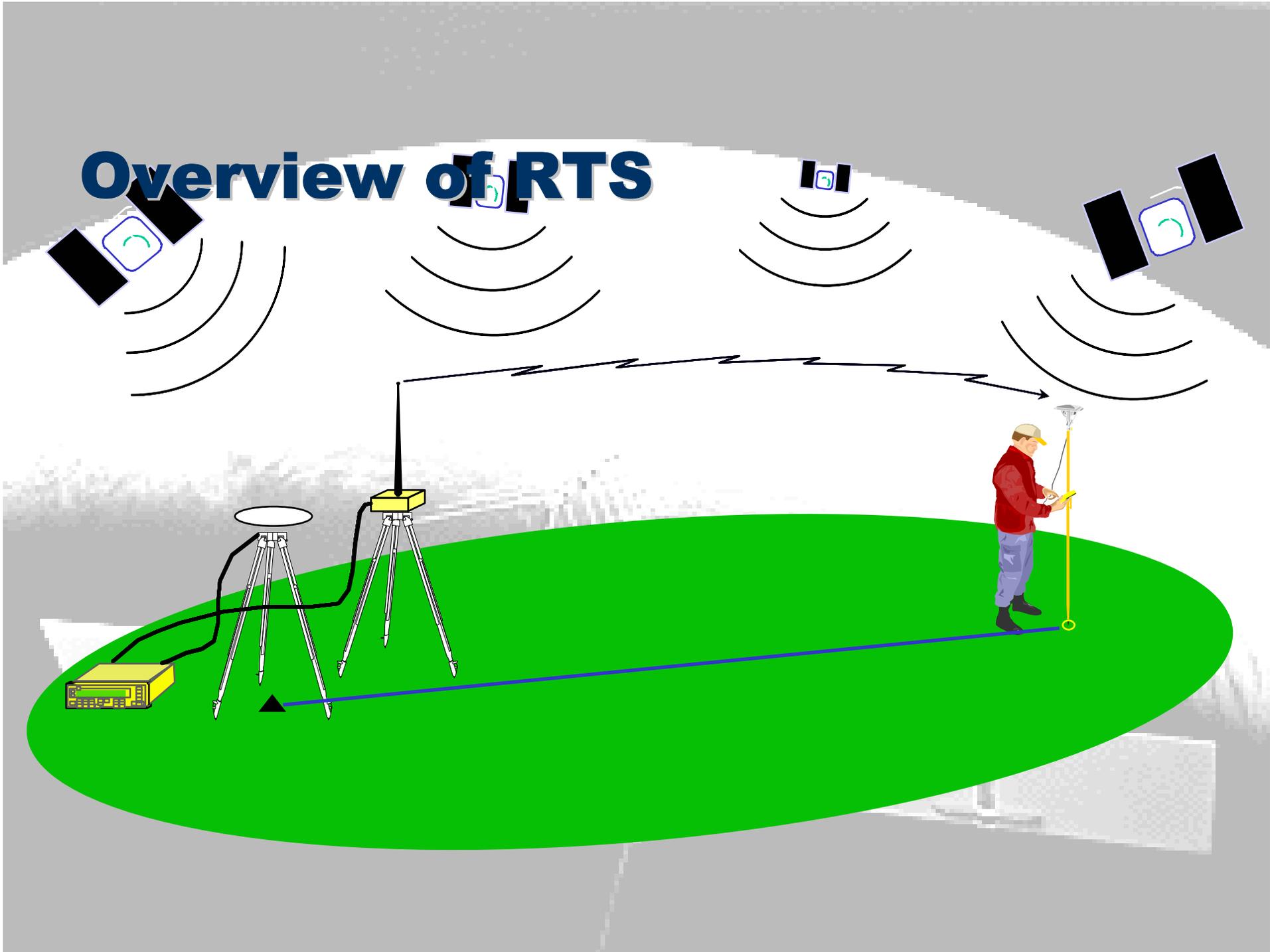
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GPS in UDOT

The Utah Department of Transportation Design Survey Unit made the transition to a satellite based Global Positioning (GPS) surveying system in 1998. The transition to GPS surveying has resulted in efficiencies of more than ten to one over traditional survey methods. Over the last six years UDOT was able to reduce the number of survey crews from 20 to 4 while producing 10 times the number of location and right of way surveys at one fifth the staff we previously had. With all of the benefits that GPS has provided the department, there are still ways to significantly improve efficiency and accuracy. There is also opportunity to expand and enhance the benefits of GPS to many other areas of government and the private sector outside of UDOT.

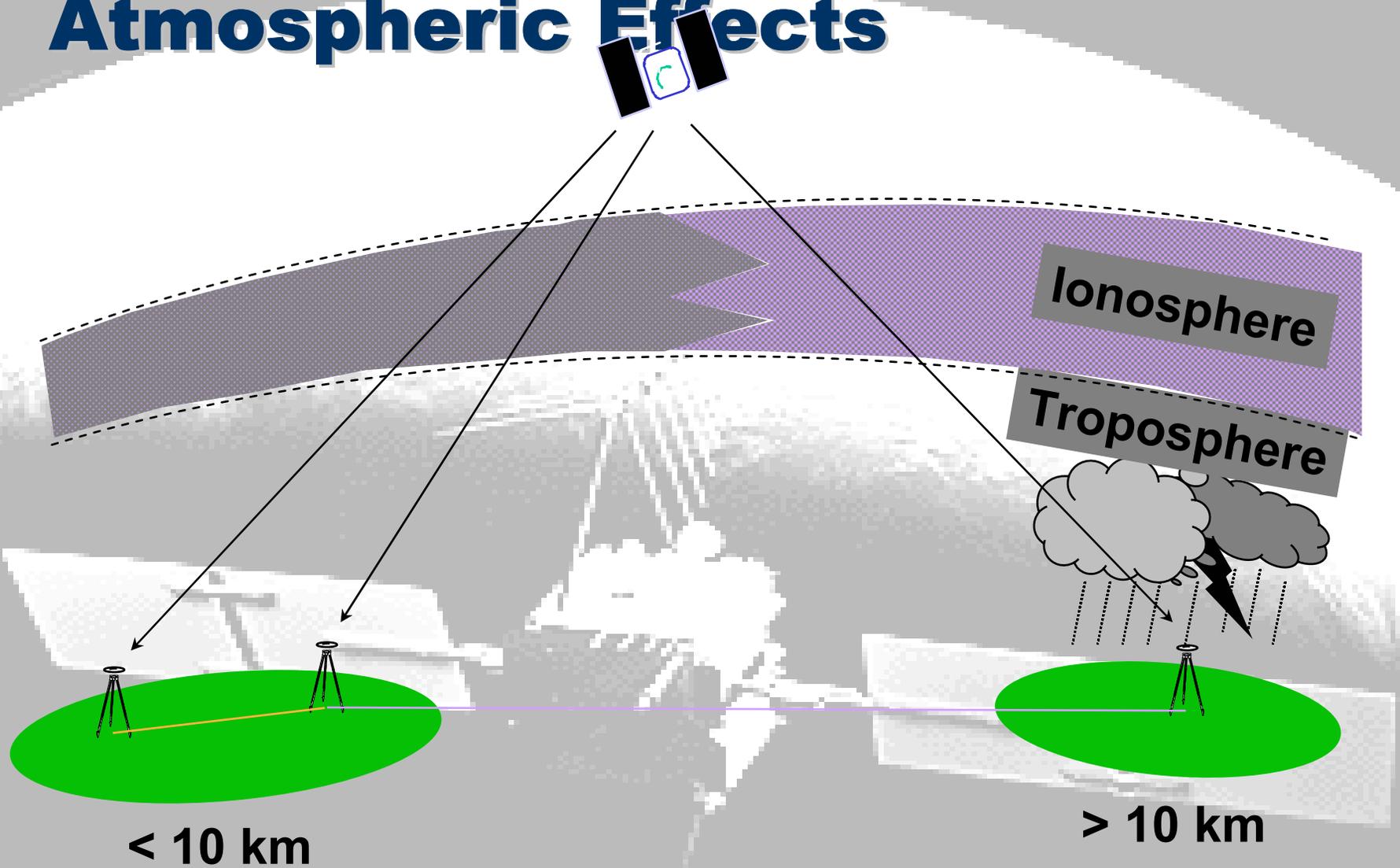
Overview of RTS



Current Issues

- One of the difficulties with GPS is that the atmosphere creates inaccuracies in the signal from the satellites which create errors in the survey on the ground when surveying at large distances from a base station.
- Real Time GPS users are currently using UHF Radio to transmit corrections from a base station to a GPS Rover with limited coverage of about a 5 mile radius from a base station.
- UHF Radio signals are continually being blocked by voice transmitting in heavy populated areas, causing Real Time GPS to delay until frequencies are clear.

Atmospheric Effects

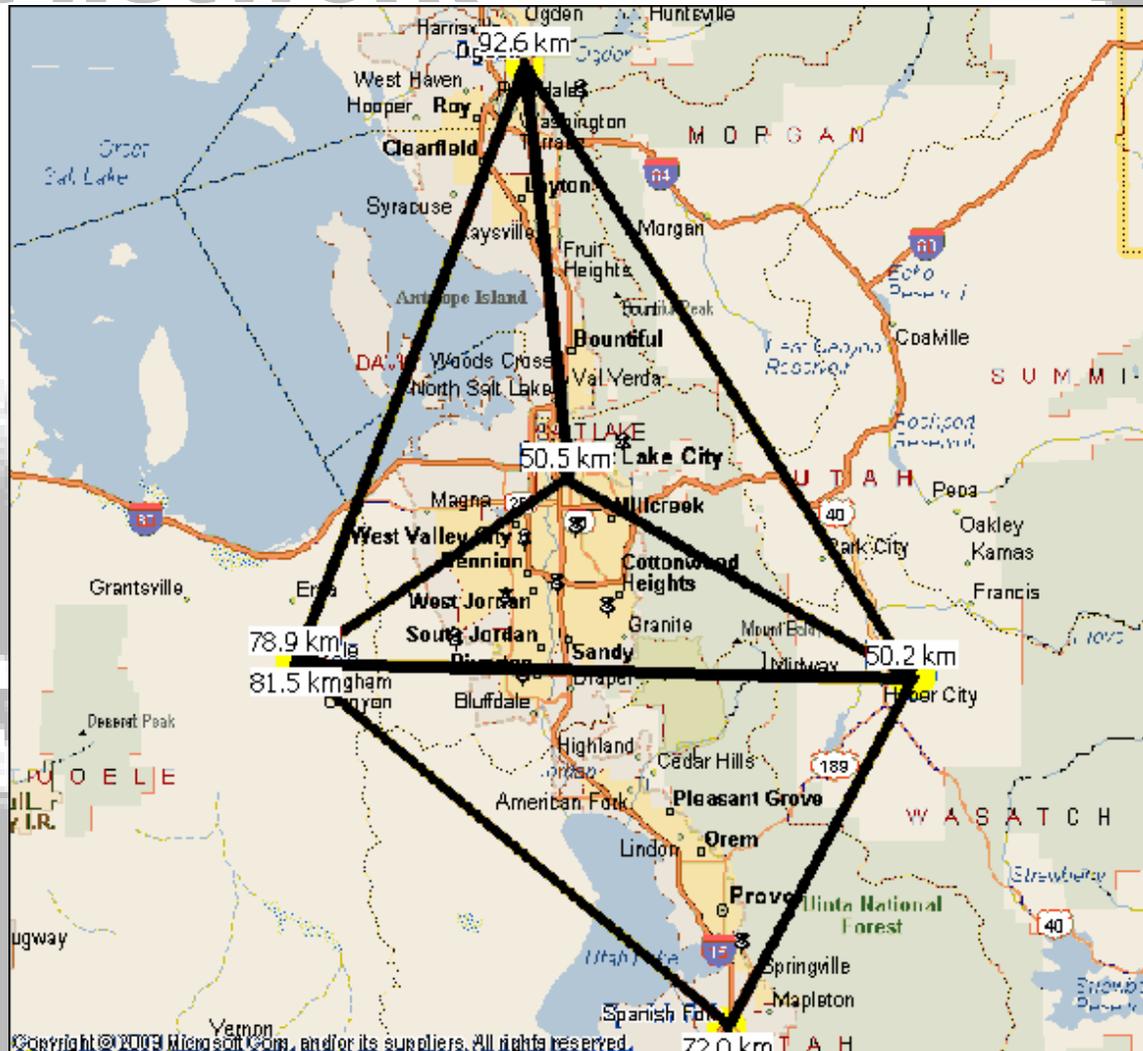


Solution:

- New GPS Technology creates a solution to link 'GPS Reference Stations together to create a complete network solution.



Pilot network



Utah's Pilot Network Defined

Made up of existing Community Reference Stations:

- *Monsen Engineering/SLC
- *Heber City
- *Spanish Fork City
- *Tooele City
- *Ogden City

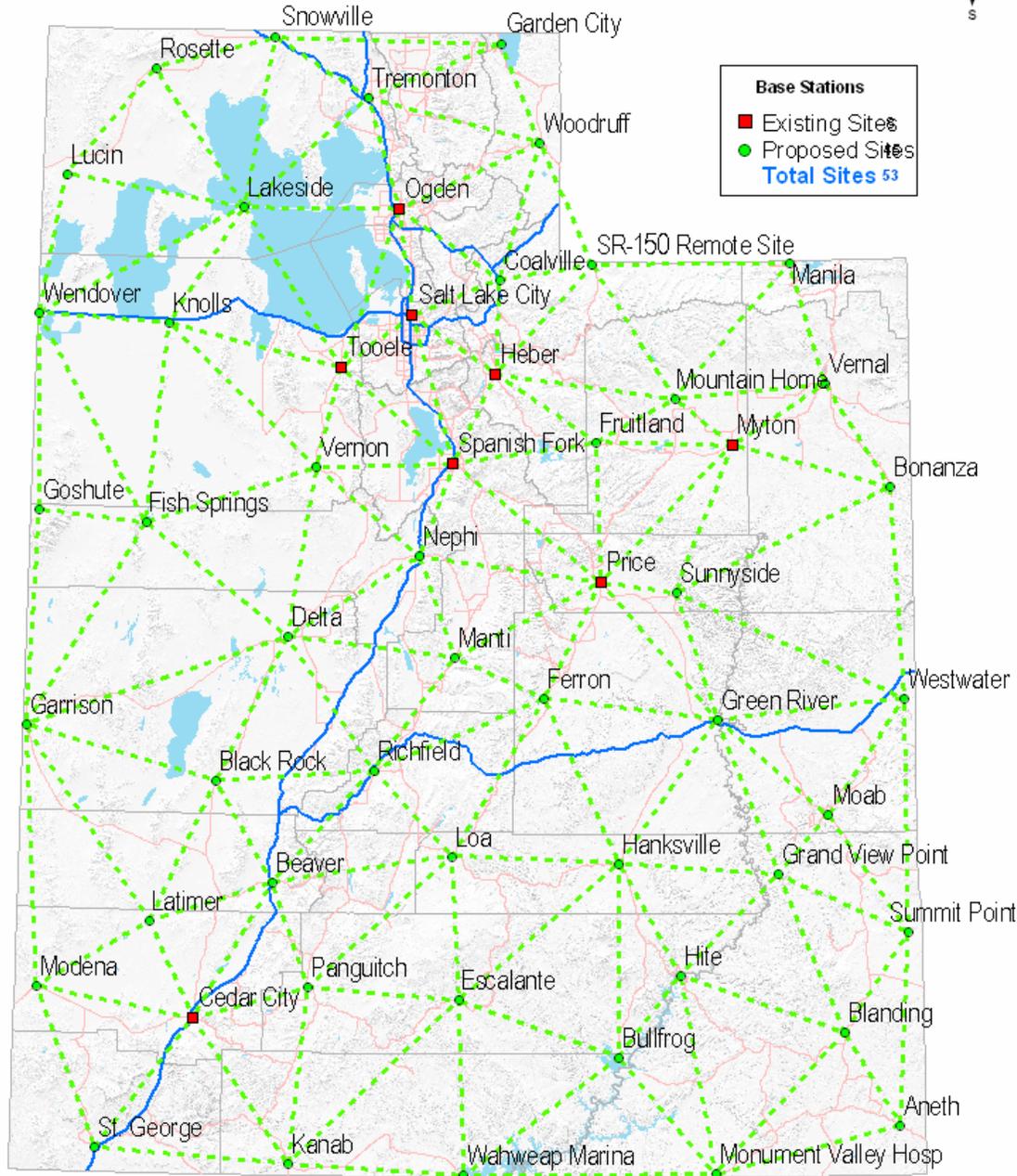
Central Server/GPSnet/RTKnet Hub

- *UDOT/Calvin Rampton Bldg. In SLC

Project Objectives

- Build an interlinked system of approximately 55 strategically located, permanently mounted, continuously operating G.P.S. receivers. Establish a computer and communications network linking these GPS stations;

Utah's GPS Reference Network



Project Objectives

- Record, monitor, verify and post raw GPS data for processing mapping grade positions, at a central location accessible from the web.
- Allow central access to and graphical monitoring of the data stream and the ability to manipulate and adjust receiver settings from a central location.
- Provide alarms to a designated resource in the event of invalid data or other system malfunction.
- Broadcast Real Time Kinematic (RTK) corrections that can be utilized by any capable survey device anywhere in the state and yield centimeter precision.



Indirect and Potential Benefits

There are and incredible amount of potential uses for this infrastructure once it is in place. Though most of the uses that we are suggesting would require additional resources and development time, the potential benefits are well worth the investment effort.

Example: Boy Scouts wearing GPS necklace to assist in potential rescue.

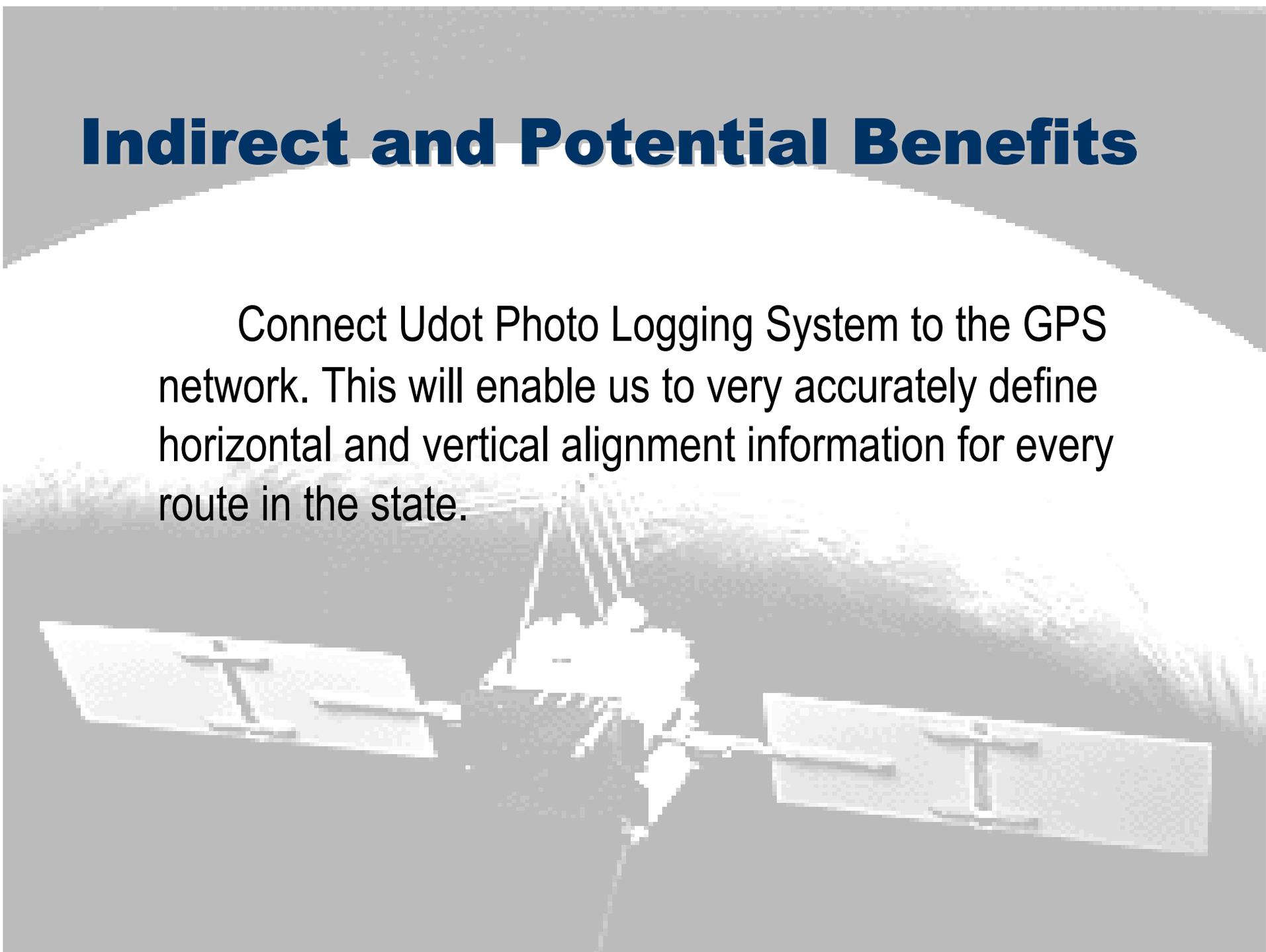
Indirect and Potential Benefits

Use GPS tracking and transmitting to improve snow plow routing, improve safety and optimize resources on the fly.



Indirect and Potential Benefits

Connect Udot Photo Logging System to the GPS network. This will enable us to very accurately define horizontal and vertical alignment information for every route in the state.



Indirect and Potential Benefits

Asset management; faster more accurate collection of feature inventory information.



Indirect and Potential Benefits

Weather, Avalanche, forecasting and alerts.



Indirect and Potential Benefits

Be able to track and monitor highway truck traffic 24/7 in particular hazardous loads, where you could set automated alarms for when the truck deviated from an assigned route, stopped for longer than a specified time or any other constraint that you could want. Have the alarms automatically alert Highway Patrol.

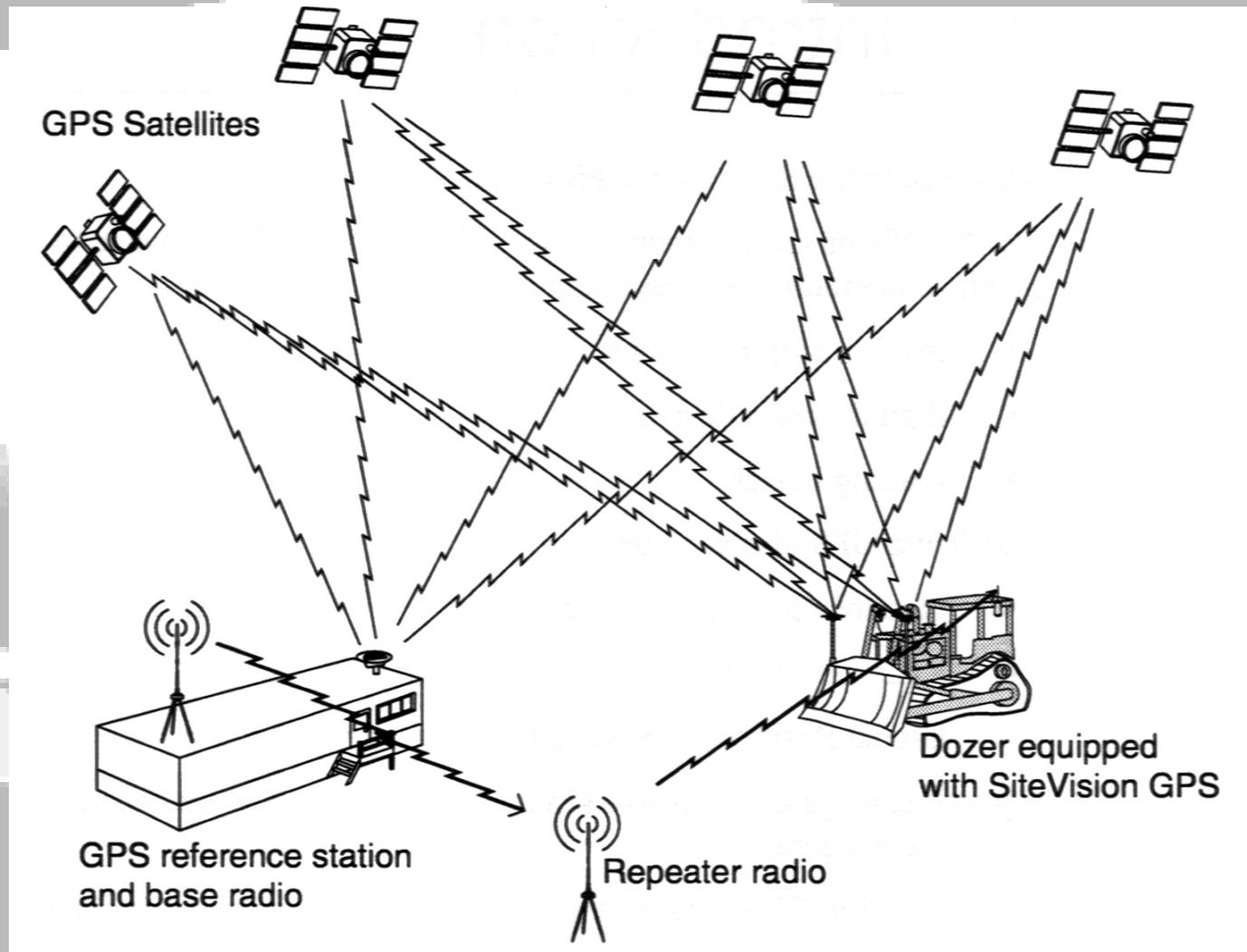


Indirect and Potential Benefits

GPS on the Grader is a solution eliminate high costs from survey crews re-staking roadway points multiple times.



Real Time Kinematic GPS



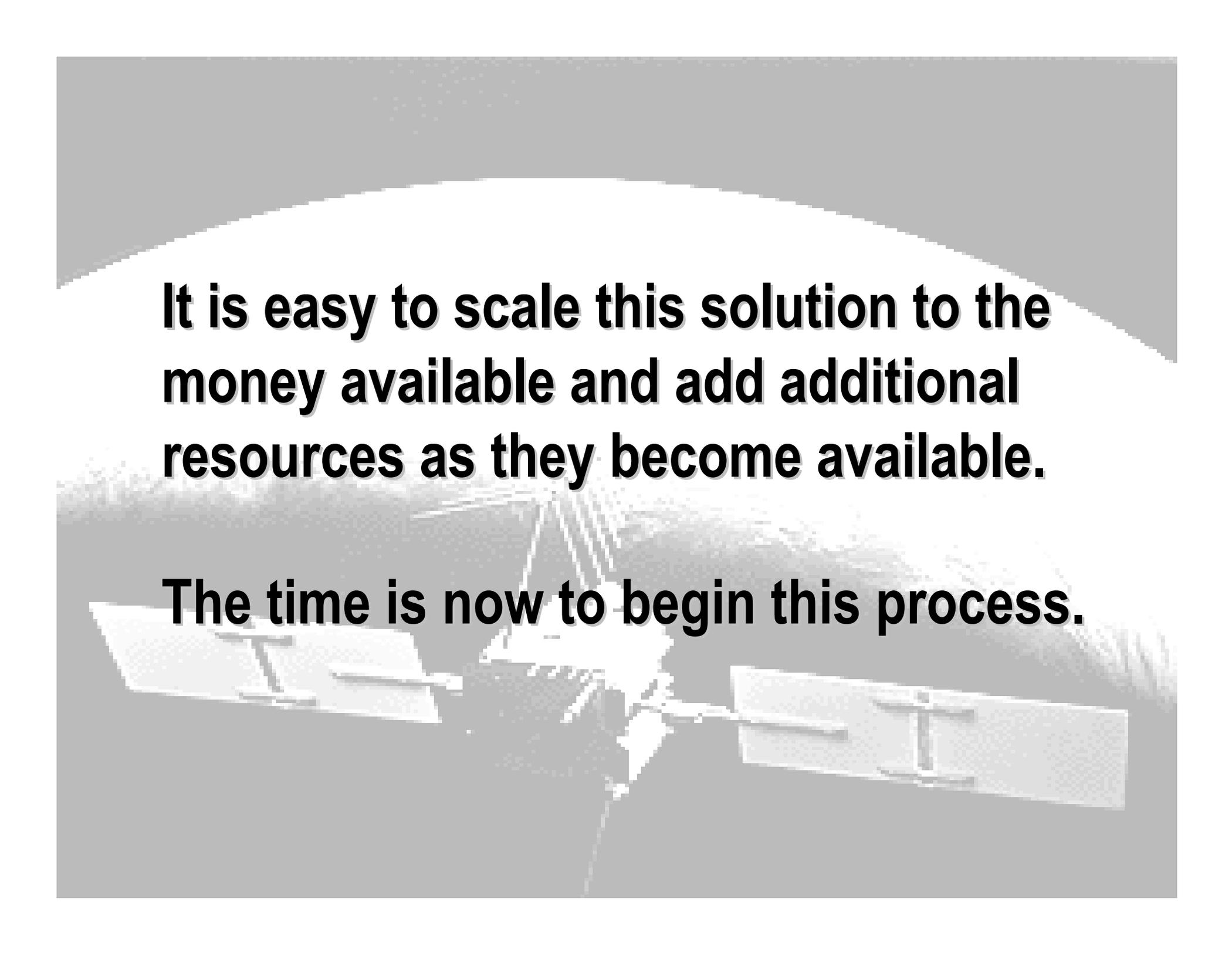
Repeater for difficult terrain

GPS Technology Gains Construction Phase

GPS technology	Compared with	Estimated savings
Grade Checking	Manual method	Up to 66%
Reduction or Elimination of Stakes	Using stakes	Up to 85%
Improved material yields/select fills/undercutting	Overruns using manual methods	3% to 6% in volume
Un-interrupted earth moving production under any weather conditions (24/7)	Daytime / fine weather operation only/night work	30% to 50%
RTK, robotics stakeout	Traditional survey stakeout	More than 100% in speed and 66% in staffing

- Other savings from:
 - Improved utilization of equipment/30%
 - Lower skill level required realize over 100%
 - **Erosion control as you go** productivity gains





It is easy to scale this solution to the money available and add additional resources as they become available.

The time is now to begin this process.



Thank you.