



Network Simulations and Analyses “Position Paper”

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Present Networks



- Space techniques are **indispensable** for the development of the terrestrial reference frame and for geodetic metrology
- The current state-of-the-art does not meet science requirements due to **poor area coverage** and **aging equipment**
- To meet the stringent future requirements (e.g. GGOS), we need to **design a new network** and deploy **modern hardware systems**





GGOS ITRF Accuracy Goal



- Future ITRF^{*} should exhibit consistently and reliably accuracy, stability and accessibility at the level of:

<1 mm at epoch position, and
< 0.1 mm/y in secular change

^{*} **Current performance: ~ 10 mm and ~ 1 mm/y**





Multiple techniques to solve the puzzle

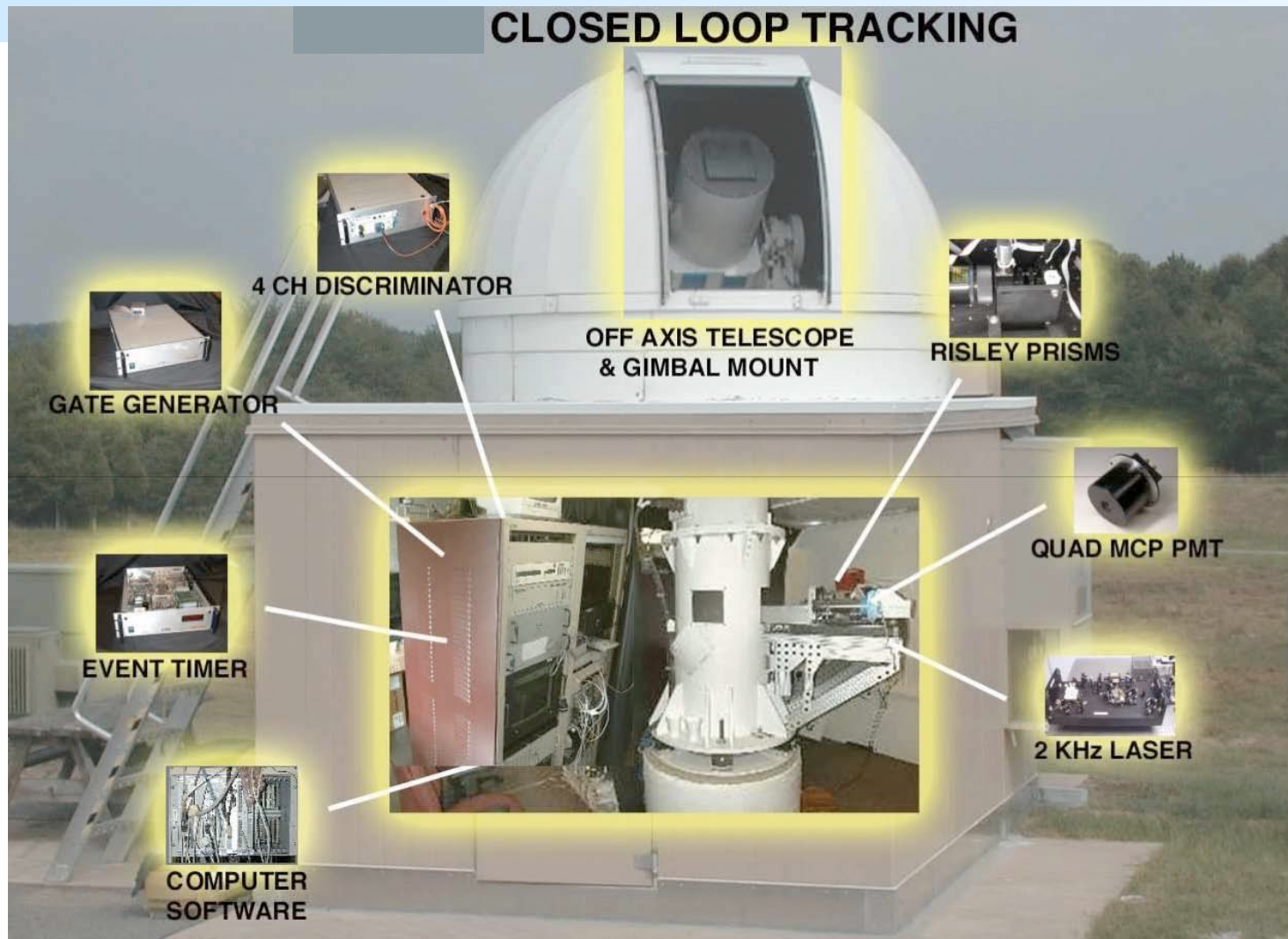


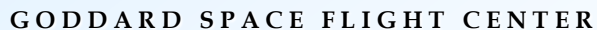
- High precision geodesy is very challenging
 - 0.1 mm/yr stability required for sea level monitoring
 - Fundamentally different observations with unique capabilities
 - Together provide redundancy, cross validation, increased accuracy and access to the TRF
 - Strength from improvement of techniques and integration of techniques
- Fundamental prerequisite:
Well-distributed, co-located network with accurate ties

Technique Signal Source Obs. Type	VLBI Microwave Quasars Time difference	SLR Optical Satellite Two-way range	GNSS Microwave Satellites Carrier phase
Celestial Frame UT1	<u>Yes</u>	No	No
Scale	<u>Yes</u>	<u>Yes</u>	Yes
Geocenter	No	<u>Yes</u>	Yes
Geographic Density	No	No	<u>Yes</u>
Real-time	No	No	<u>Yes</u>
Decadal Stability	<u>Yes</u>	<u>Yes</u>	Yes



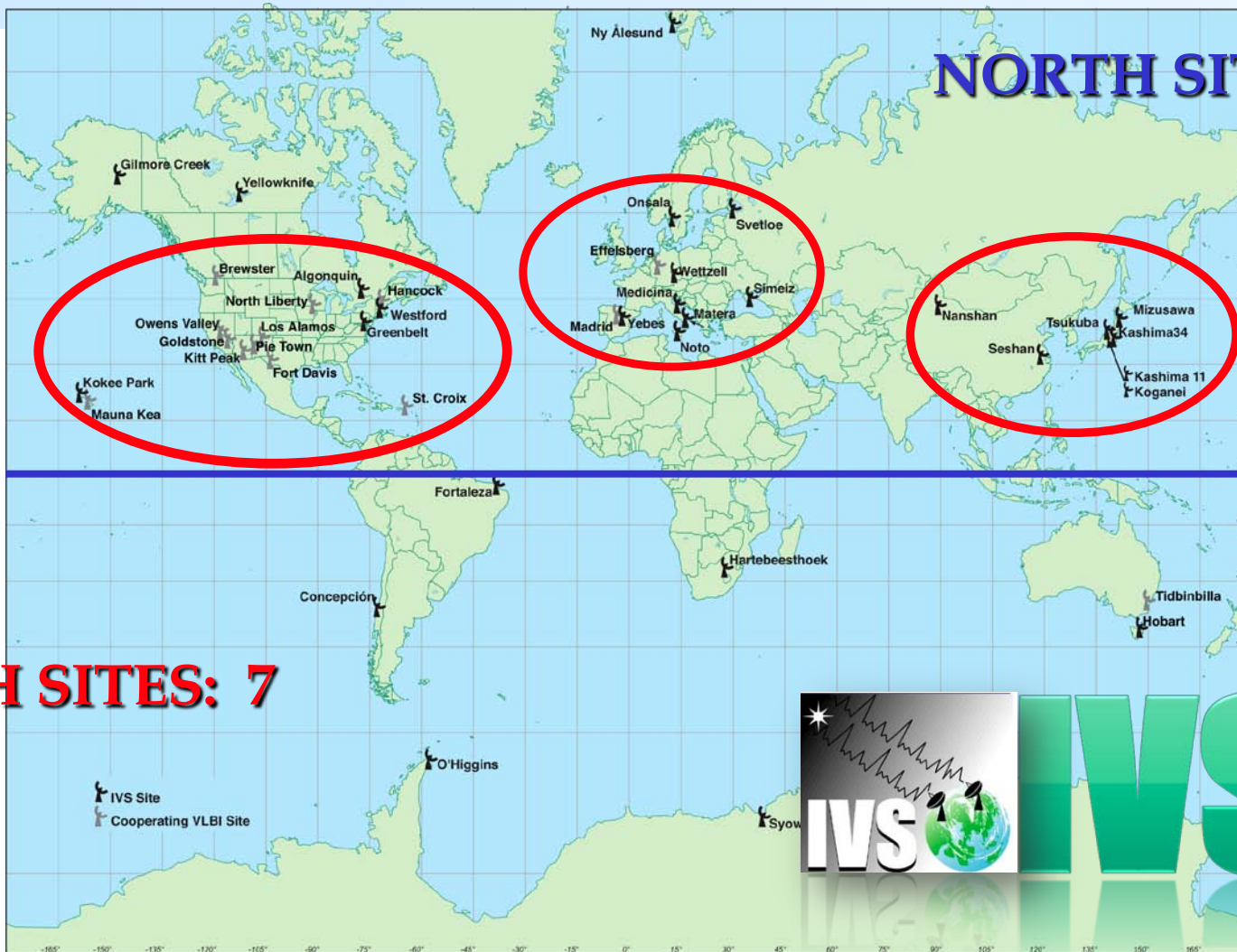
New Field Equipment (e.g. NGSLR)







The IVS Network



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Work Package:



- **Simulation studies to:**

- Scope the size and the optimum geometry of the required global network;
- Provide input into and recommendations to agencies' selection process;
- Determine possible tradeoffs of using existing versus new sites;
- Understand the impact of likely phased deployment of new stations;
- Determine impact of vector tie errors of different observing systems at each site;
- Study the possible benefit provided by a space-based implementation;
- Determine the benefit resulting from adding corner cube reflector arrays on GNSS satellites for SLR tracking; and
- Quantify the anticipated degradation in our ability to determine the ITRF if the network is not modernized (i.e., if next generation systems are not used).

