



SGSLR Site Preparation and Deployment Plans for the First Set of SGSLR Systems

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TALK: Co-locations and other intra- and inter-technique calibrations

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Preparations for site development and eventual deployment of NASA's first SGSLR systems are underway. Many of these sites will be core sites consisting of SLR, VLBI, GNSS and VTS systems. We have carefully considered the site infrastructure design to accommodate not only the SGSLR system design but also any interaction with other space geodesy techniques that will be co-located at each site.

We will present a review of the Site Selection requirements and summary that led to the current locations. We will also present the site designs, implementation plans and current status for each location. The sites being actively planned and worked are the Goddard Geophysical and Astronomical Observatory (GGAO) in Greenbelt, Maryland, the McDonald Observatory in Texas, the Norwegian Mapping Authority site in Ny-Ålesund, Norway, and the Haleakala Observatory site in Hawaii.



Site Selection Process



- ◆ Existing and new sites were considered for supporting a core station
- ◆ Used the GGOS Site Requirements Document for Requirements
- ◆ Each potential site was examined and scored
- ◆ Site selection reports were generated
- ◆ First sites for SGSLR:
 - GGAO (for development / integration and test via Collocation)
 - McDonald Observatory, near Ft. Davis, Texas
 - Ny-Ålesund Geodetic Observatory, Ny-Ålesund, Svalbard
 - Haleakala Observatory, Maui Hawaii



Key Site Requirements



Level 3 Requirements

SIT3.3.2.3: 30 kW available power, with a 110-120 VAC nominal service

SIT3.3.2.5: Sites shall have a 10 Ohm path to local ground

SIT3.2.6.1: SGSLR sites lase down to 10 degrees (TBR) El over 95% (TBR) of the horizon

SIT3.3.3.1.2: A minimum distance between SGSLR and VLBI of 228.6 m (TBR) when using a radar

SIT3.3.3.1.6: Three calibration targets 120 deg apart at a distance of $\leq 250'$

SIT3.3.1.1.1: Minimum internet connectivity from 10 Mbps to 1Gbps

Level 3 Compliance

GGAO, McDonald, Maui and Ny-Ålesund all can meet requirements

GGAO, McDonald and Ny-Ålesund all can meet requirements. Maui requires work

GGAO, McDonald, Maui and Ny-Ålesund all can meet requirements

- GGAO is ~ 160 m with obstacles to help with RF blocking.
- Texas is > 800 m
- Ny-Ålesund and Maui are NA with no radar at site

Multiple targets (≥ 3) at each site with azimuth limits to each due to topography

GGAO, McDonald, Maui and Ny-Ålesund all can meet requirements



Other Environmental Considerations



◆ Snow

- Max snow fall/event expected to be < 1m
- All systems mounted on stands/shelter > 1m off the ground
- Snow removal from dome/Met systems if required done by on site caretaker

◆ Arctic day/night

- Mount stability is expected to hold mount model for months
- New technique developed for daytime starcal

◆ Dust

- Potential impacts on
 - Telescope
 - Dome
 - Gimbals
 - Met stations
 - Optical table
- Dust storm impacts mitigated by closing dome
- Sealed telescope system
- Dust mostly likely to affect rate of maintenance

All considerations can be mitigated



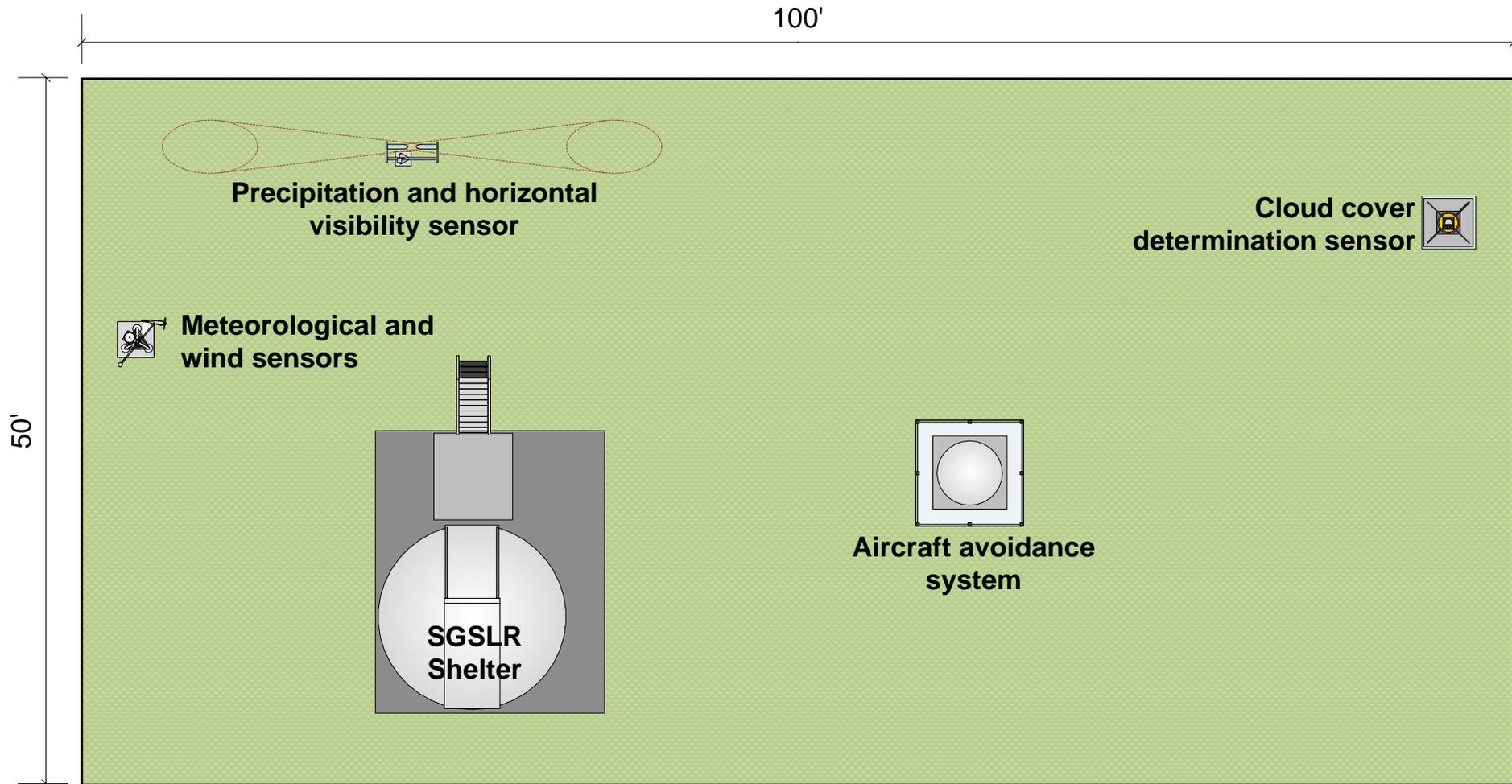
First SGSLR Systems



- ◆ SGSLR is being developed at the Goddard Geophysical and Astronomical Observatory (GGAO)
- ◆ Once completed the systems will be deployed to Texas, Norway and Hawaii.
- ◆ The first Gimbal Telescope Assembly (GTA), GTA 1 will be positioned at the GGAO where the system hardware will be built and tested for Texas, Norway and Hawaii
- ◆ The GGAO has a long and rich history in collocation with two or multiple systems for NASA and other international systems
- ◆ The GGAO will utilize the existing infrastructure to place and develop SGSLR on a new pad
- ◆ GTA 2 will also be positioned at the GGAO for Site Acceptance before deployment of one of the GTA's to Norway
- ◆ GTA 3 will be direct shipped to Texas for integration into their facility
- ◆ Finally, the GGAO remaining GTA will be shipped to Haleakala for integration into the Maui site
- ◆ Each site has both common and unique site conditions that will be accommodated in the design

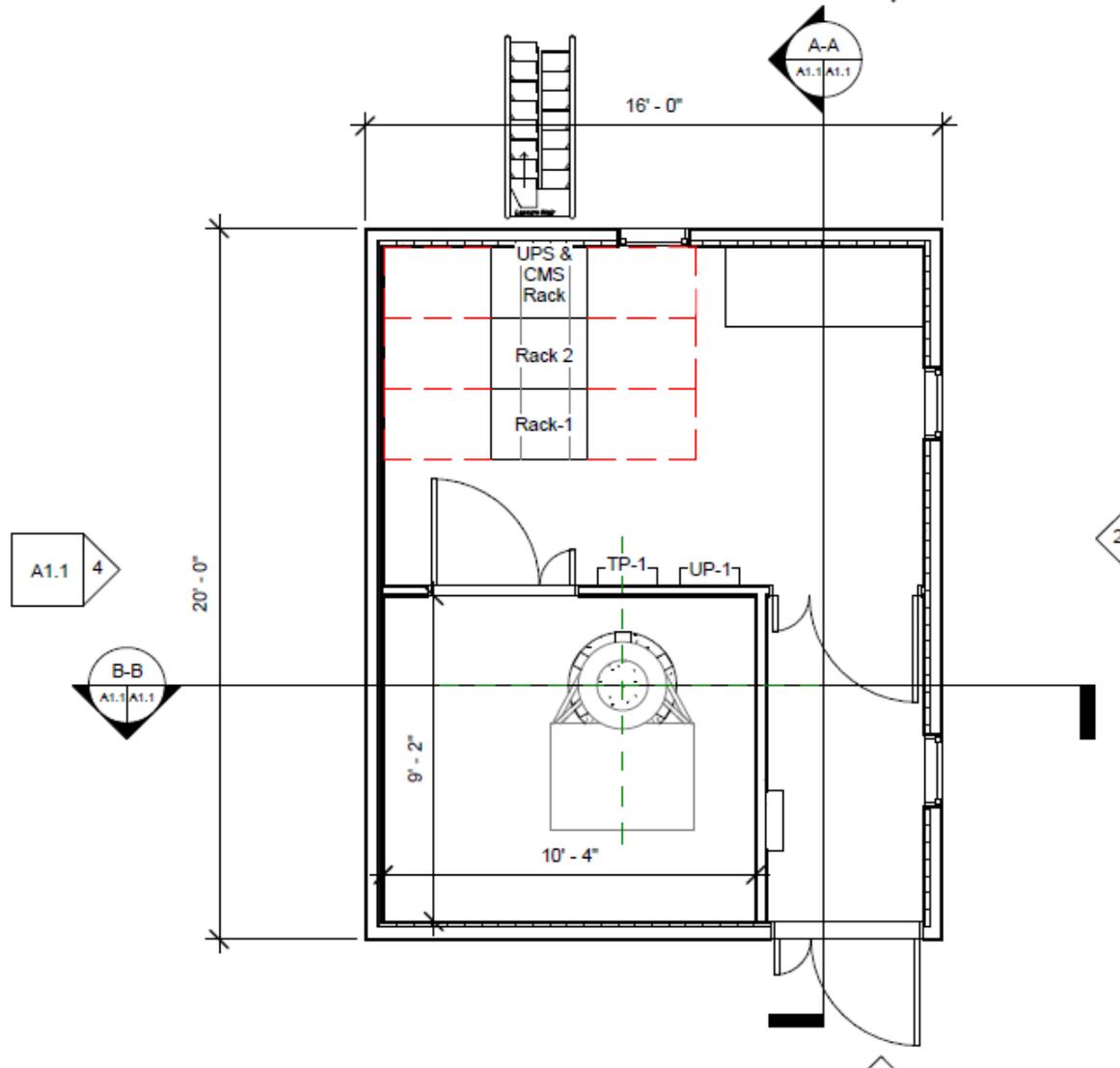


- Development to occur at Greenbelt, at the Goddard Geophysical and Astronomical Observatory (GGAO).
- First deployments to occur at McDonald, Texas, Ny-Alesund, Norway and Haleakala, Hawaii



Proposed Overhead View of SGSLR Site

Tentative SGSLR Shelter Layout



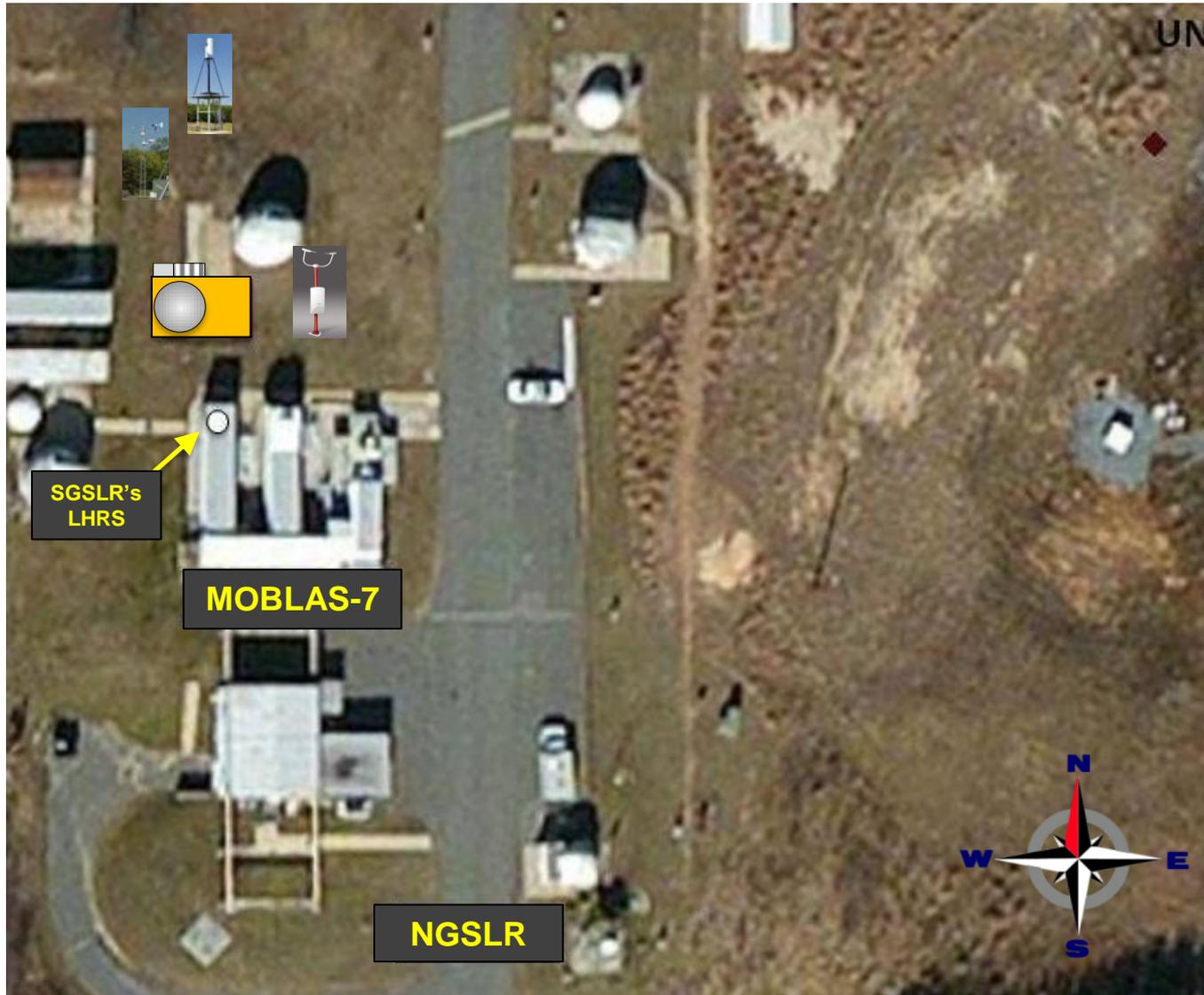
GGAO Site Layout

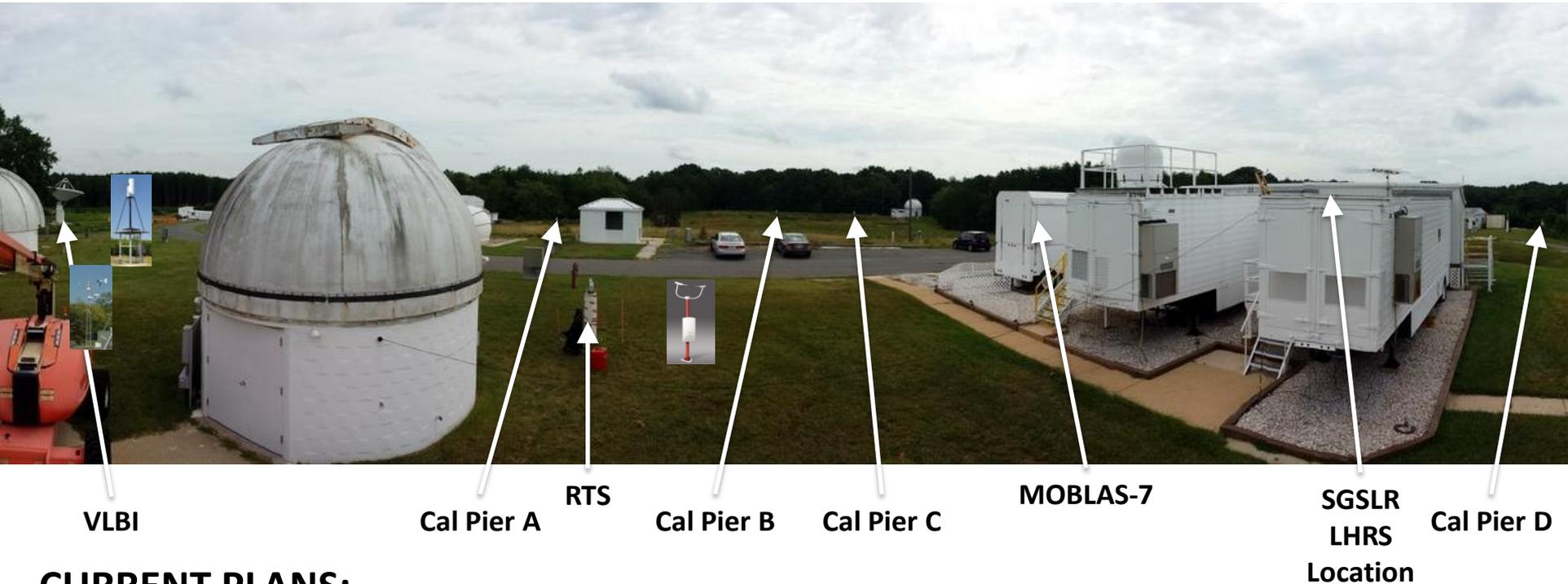


Source: <http://www.bing.com/maps/>

- ◆ SGSLR located near MOBLAS-7
- ◆ Utilize MOBLAS-7's Support Van roof for LHRS
- ◆ Site provides best masking of SGSLR LHRS to VGOS site with existing structure (need for RFI analysis/testing)
- ◆ Approximately 190° azimuth coverage for calibration targets
- ◆ Good existing infrastructure
 - Pad – small addition needed
 - Power – existing 200Amp Service
 - Comms in place
 - Grounding in place (to improve)
 - Good view of common ground targets to MOBLAS-7 and NGSLR
 - Direct survey to MOBLAS-7

Closer look at SGSLR at the GGAO





CURRENT PLANS:

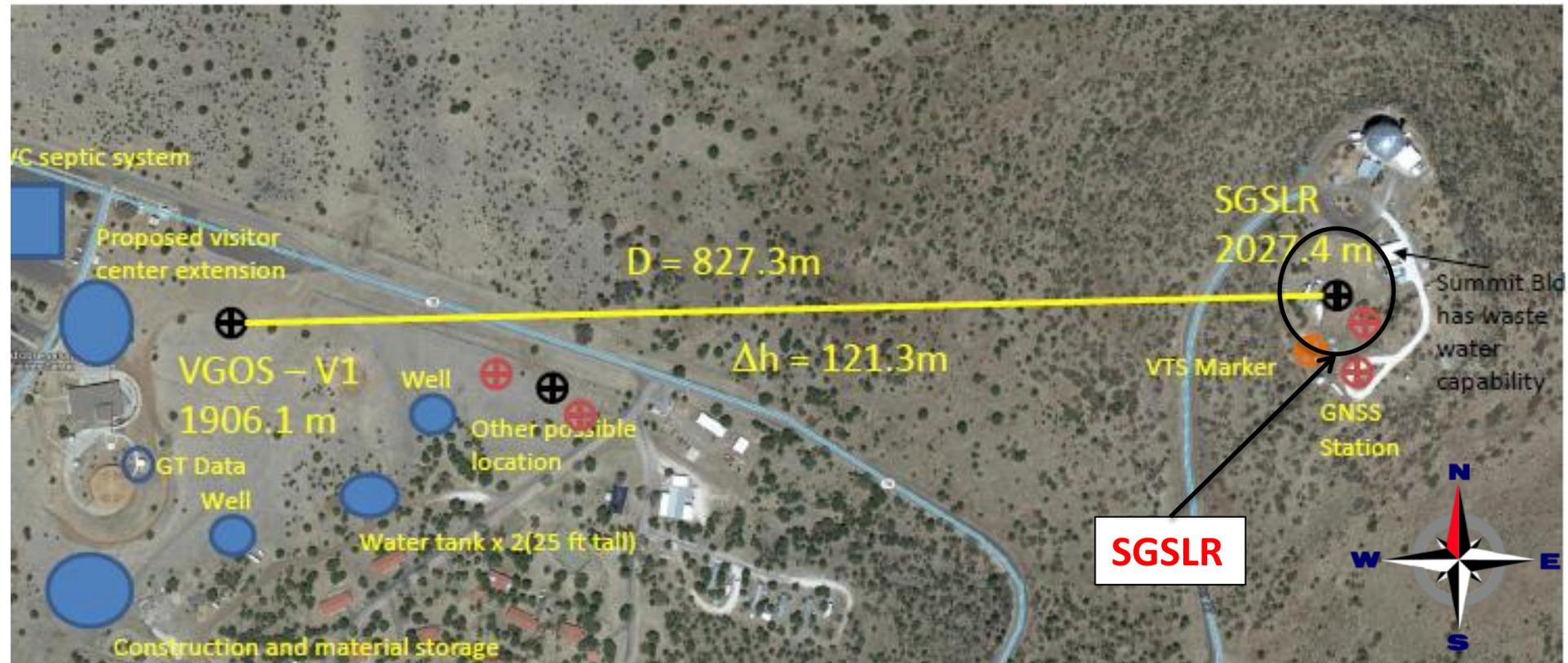
- ◆ Complete the GGAO site design based on project requirements by end of 2016
- ◆ Begin construction of the site in early 2017
- ◆ SGSLR site construction completed and shelter installed by May 2017
- ◆ SGSLR GTA to be installed in July 2017

McDonald SGSLR Site





Deployment # 1: McDonald Observatory (Texas)



- Located within 30 meters of the existing MLRS system
- LHRs located a sufficient distance and angle to not impact VLBI based on first RFI monitoring results. More testing to come.





Unique Features of the Texas SGSLR Site



- ◆ Texas site is a slightly modified SGP Core site
- ◆ SGSLR and VLBI are separated by 827 meters and by 120 meters in height
- ◆ SGSLR located near existing MLRS site
- ◆ Most of the infrastructure is very compatible with SGSLR
- ◆ RFI impact to VLBI is not an issue with SGSLR due to locations and positioning of SGSLR and radar
 - ◆ First RFI monitoring indicates no significant issues
 - ◆ More monitoring to follow



Texas Plan for Deployment



- ◆ GNSS receivers may be deployed to summit location soon
- ◆ Early deployment of pier, shelter, Met Subsystem, timing subsystem to make site ready for deployment of GTA and to start obtaining data at site
- ◆ GTA is directly shipped to MCD post-FAT for FSAT
- ◆ Remaining system hardware shipped to MCD post-collocation and PSR at GGAO
- ◆ Once system integration is complete commissioning will commence and end with ORR

Ny-Ålesund Site





Deployment #2: Ny-Ålesund (Norway)





Photo Credit: NMA

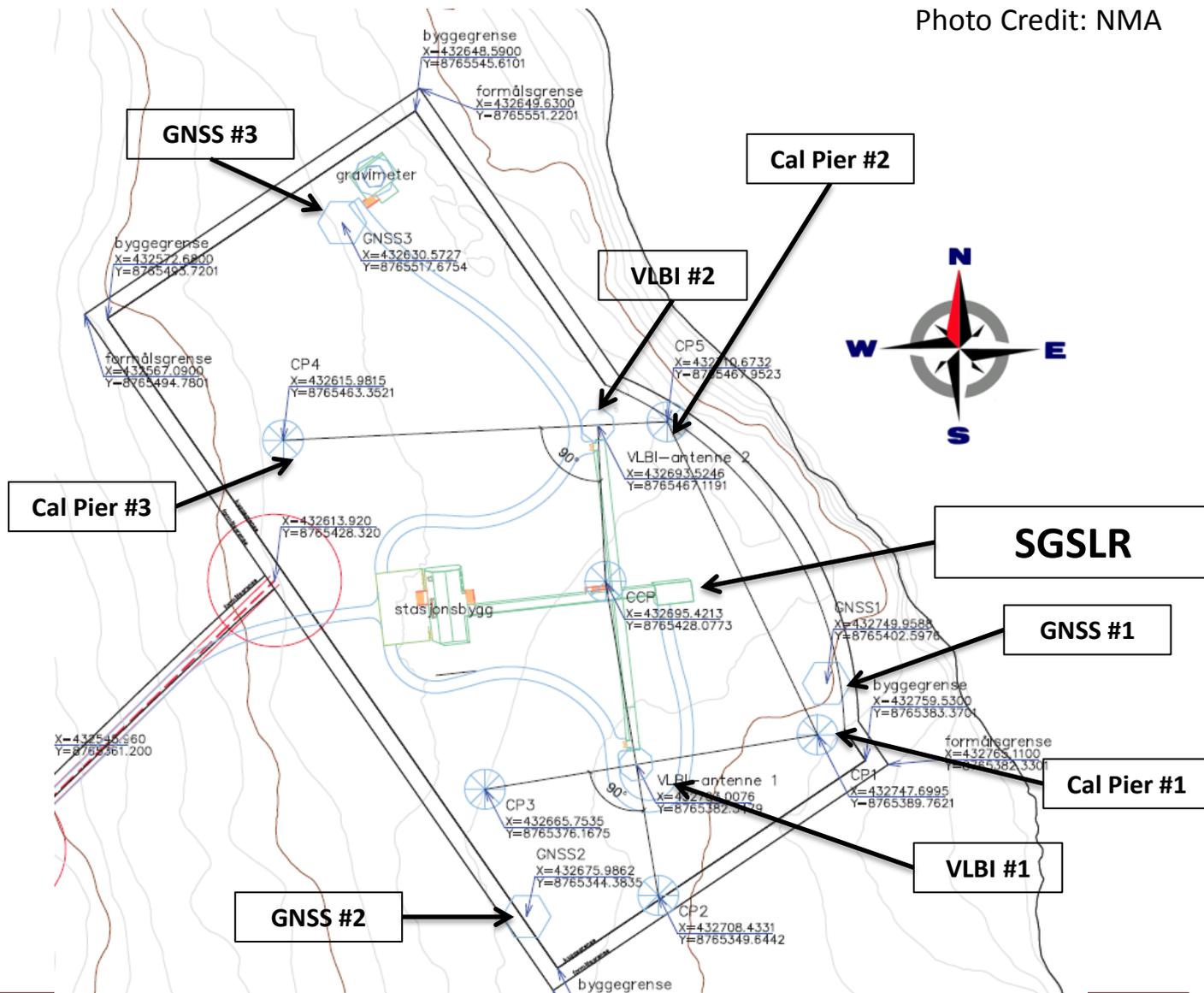
SLR Building



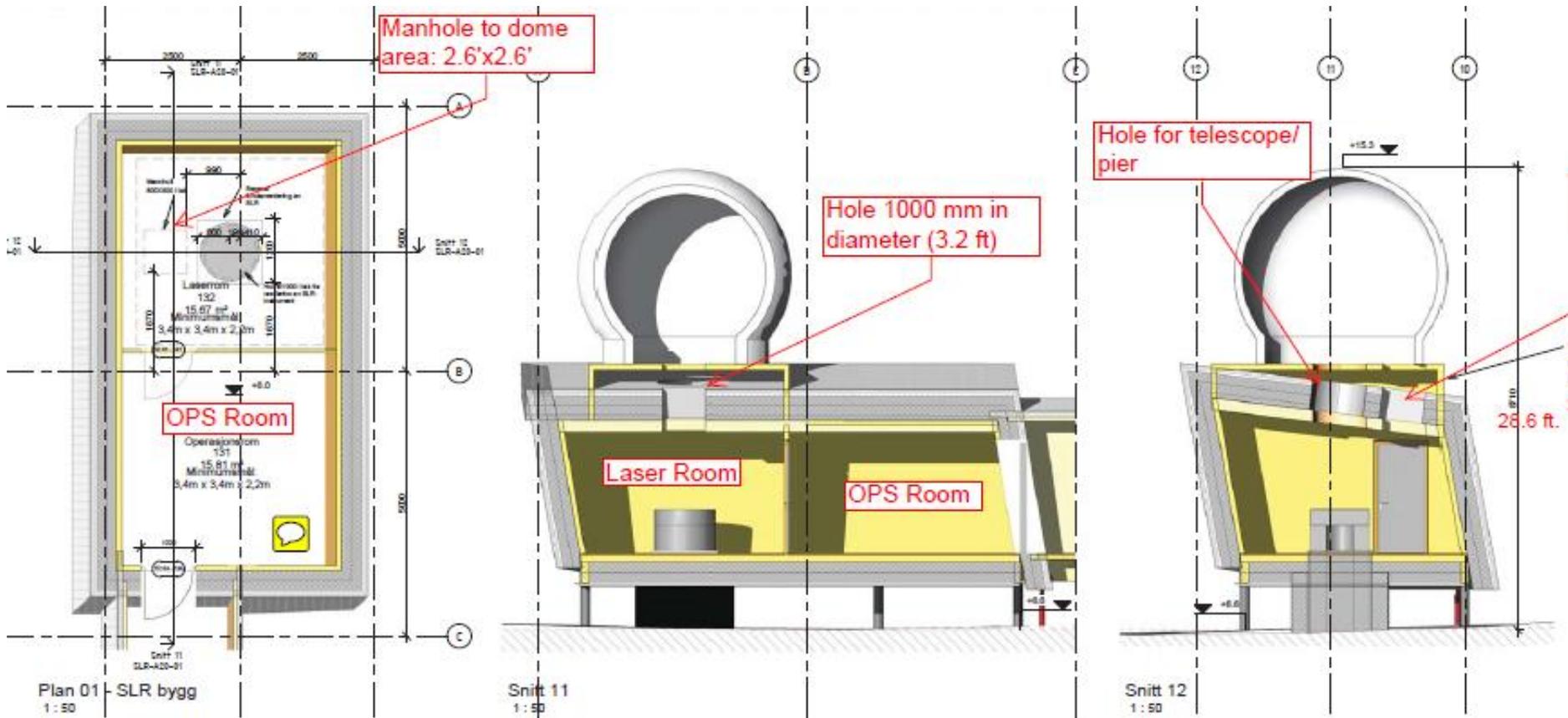
Ny-Ålesund Site Layout



Photo Credit: NMA



Ny-Ålesund SGSLR Shelter



Drawing Credit: NMA



Unique Features of the Ny-Ålesund Site



- ◆ Shelter already built by the Norwegian Mapping Agency (NMA), so different from other systems. Will probably require a different GTA riser (to accommodate shelter height)
- ◆ No RFI allowed due to location of SGSLR to VLBI, so no radar (or transponder based detection). Aircraft avoidance will be handled by a No Fly Zone established by CAA and NMA and a kill switch for use by local airport control tower personnel
- ◆ Colder than any site currently in operation for NASA SLR Network:
 - reaches -30°C
 - average minimum for coldest month is about -20°C
- ◆ Snow accumulation requires raising everything off of ground. NMA is handling this
- ◆ Still looking for dome solution. However, GTA should be able to handle these temperatures
- ◆ All of our external equipment will be on walk-way roof except for visibility & precipitation monitor and ground targets.



TLRS -4 Calibration Target



View of TLRS -4 from SGSLR





Unique Features of the Haleakala Site



- ◆ System to have line of sight to existing TLRs-4 and share common calibration pier for collocation
- ◆ Shelter to be similar to Texas site
- ◆ No RFI allowed due to location of SGSLR on Haleakala, so no radar. Aircraft avoidance will be handled by a transponder based detection
- ◆ Unique weather and altitude conditions at summit that require unique solutions for wind, rain, snow and altitude issues
- ◆ Unique cultural understanding of the summit are understood and are sensitive to concerns



Haleakala Project Team



Thank You!