Implementation of the VGOS Trials

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Introduction

In February 2014, the VGOS Project Executive Group (VPEG) presented the VGOS Observing Plan, which outlined possible steps on how to go from initial VGOS broadband tests to intermediate observing scenarios to the fully operational VGOS system. The document introduced VGOS trial campaigns as the initial means to accustom the VGOS stations as well as the subsequent component types to the VGOS processing load: scheduling, data taking, data transport, correlation, and analysis. Three different trial campaigns of 6–8 weeks each were envisioned. The Coordinating Center—in conjunction with the Observing Program Committee (OPC)—was tasked with their implementation. This poster describes the progress made on implementing the trial campaigns.

VGOS Broadband Test Sessions

Starting in calendar year 2015, test sessions were organized on the baseline Westford to Goddard using the installed broadband signal chains at both sites. These sessions were initially 1-hour long and were observed every two weeks. After gaining some experience with and steadily improving the system, the observing time was increased to two hours, then to six hours, and, eventually, to a full 24-hour session. The two-week rhythm was only interrupted to perform necessary repairs at the antennas (e.g., azimuth motor repair at the GGAO12M telescope at GSFC). These test sessions are being continued in 2016; the network will be expanded to include new telescopes as they become available: Kokee Park, Wettzell, Yebes, and Ishioka.

Trial Operations of the VGOS Network

In the original VGOS Observing Plan (Petrachenko *et al.*, 2014), three trial VGOS campaigns were foreseen to be observed during 2015:

Trial 1: *Sustained weekly 24-hour sessions, Jan.–Feb.*
- all available VGOS stations
- optimized for very fast slewing
- observe on Sunday
- observe UT days (0–24 UT)
- ship modules

Trial 2: *Sustained daily VGOS EOP sessions, May–Jun.*
- all available VGOS stations
- optimized for very fast slewing
- daily sessions with reduced duty cycle (four one-hour bursts); observe UT days (0–24 UT)
- ship modules

Trial 3: *Sustained daily VGOS EOP sessions with timely transmission of data, Sep.–Oct.*
- same as Trial 2, but…
- e-transfer of data as much as possible

2015

Jan	Feb	
	May	Jun
		Sep
Oct		

The planning of the trials was based on information available by February 13, 2014. Since then, several local VGOS projects have slipped in time (e.g., due to delays in getting broadband feeds). For this and other constraints, the trials are currently foreseen to be observed as follows:

2016 2017

			Jan	Feb	
				May	Jun
Jul	Aug	Sep			

Trial 1: *Jul.–Sep. 2016*

Trial 2: *Jan.–Feb. 2017*

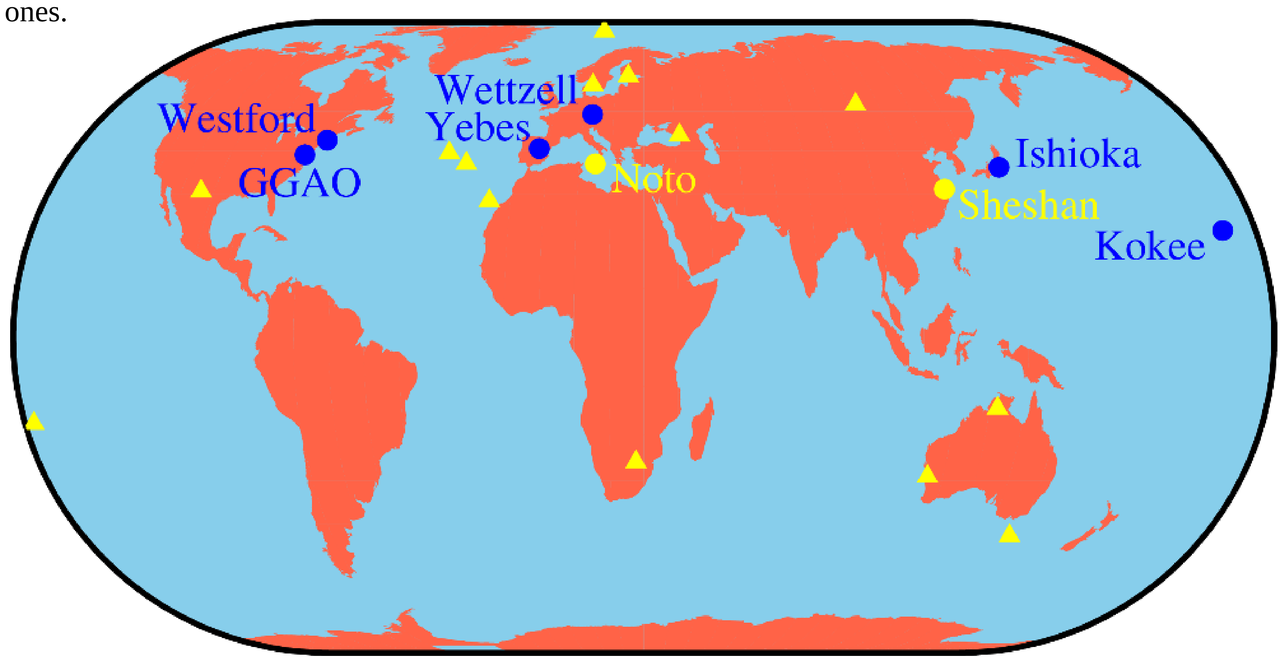
Trial 3: *May–Jun. 2017*

Hence, the first trial campaign will start 1.5 years later than initially anticipated. The test sessions have shown that a two-week turnaround time is still needed to complete the cycle from observing to correlation to analysis. Thus at least Trial 1 will be observation-free every other week.

Network of the VGOS Trials

The network for the VGOS trial campaigns was anticipated to consist of eight stations. Two stations will not be ready for the first trial campaign and likely also not for the two subsequent ones.

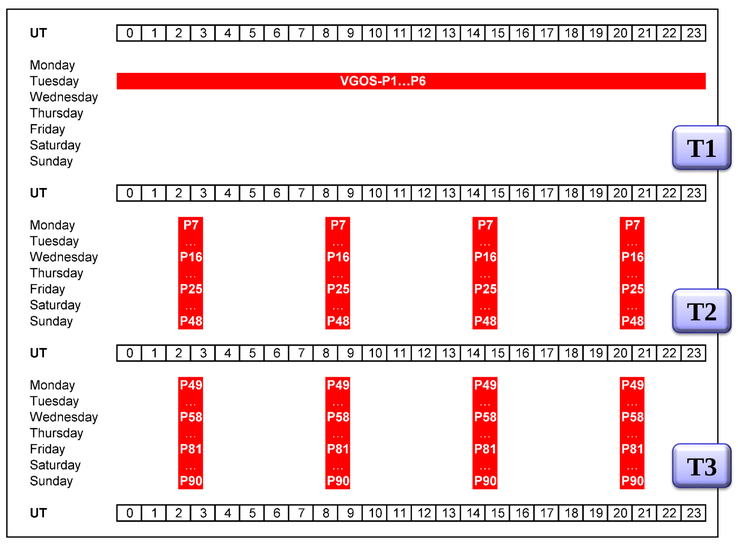
- VGOS stations observing in the trial campaigns: GGAO, Westford, Kokee Park, Wettzell, Yebes, and Ishioka.
- Stations not ready yet: Noto and Sheshan.



The trials only have stations in the northern hemisphere. However, some southern hemisphere stations (e.g., HartRAO) will come online in subsequent years. The VGOS network expansion until 2020 is indicated by yellow triangles.

Observing Scenario of the Trials

The observing scenario for the actual trials (T1, T2, T3) is depicted in the following chart:



Unlike initially planned, T1 will be observed as a UT day on a Tuesday (not Sunday) and every two weeks starting in July 2016 until six 24-hour sessions have been observed.

The observing of the trials T2 and T3 are not finalized yet. There will be four 1-hour bursts on a daily basis. However, the start and duration (including whether to observe every other week only) still need to be determined.

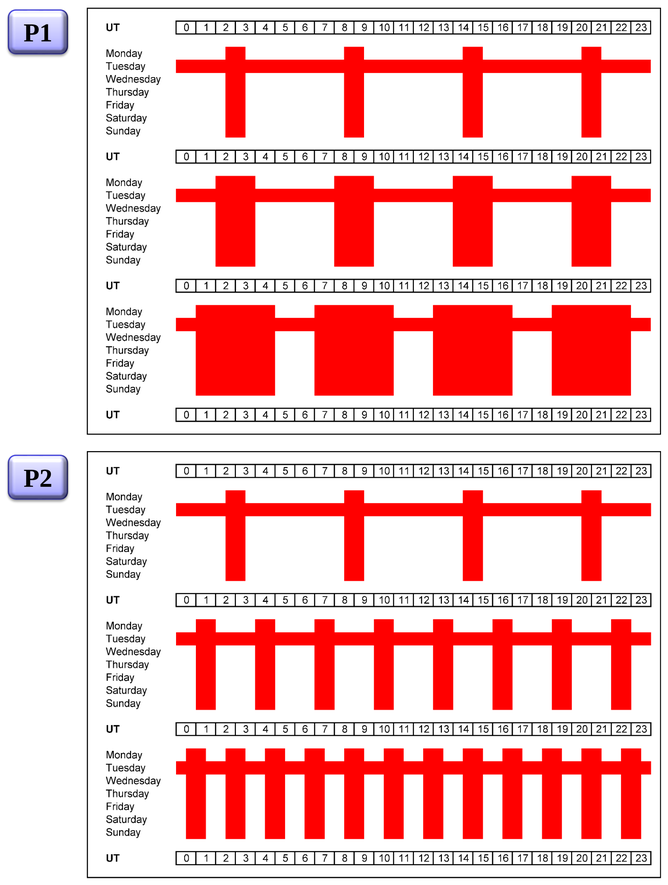
Resource Management

In addition to the station time, the resources necessary for the success of the trials include recording media, data transport, correlation and fringe fitting, and analysis. In order to address these needs, the Coordinating Center has commenced holding monthly teleconferences with the various groups involved in the effort. The teleconferences are also helpful in addressing technical issues that may need to be resolved.

The resources for Trial 1 include:
- **Mark 6 modules:** a media pool with Mark 6 modules has been started; each station needs to contribute at least as many modules as required for the trials; the module size is preferably at 48 TB in order to fit a single session onto one module (test schedules indicate a need of 37 TB per 24-hour session per station)
- **Correlation and fringe-fitting:** Haystack Observatory is developing the correlation and fringe-fitting capability based on the DiFX software correlator; Haystack will do the correlation/fringe-fitting
- **Analysis:** the analysis is based on *vgosDB* as the storage format; the analysis work will be done at Haystack and Goddard using *nuSolve*

Pilot Project

After the successful completion of three trial campaigns, a pilot project can commence. The main purpose of the pilot is to gain experience with the operational mode but without making a full commitment to product delivery. The pilot will be a combination of the observing scenarios of the trials with steadily increasing observing load over time. In order to get to 24/7 observing one of two avenues will be followed: either increasing the burst lengths or increasing the number of bursts.



Outlook

In the next several years a substantial number of new VGOS antennas will come online. By the year 2018 we expect some 18 VGOS sites altogether. The new stations will be integrated into the trials (if possible) as well as the pilot project. The pilot project will eventually culminate into full VGOS operations by 2020.

Reference

B. Petrachenko, D. Behrend, J. Gipson, H. Hase, C. Ma, D. MacMillan, A. Niell, A. Nothnagel, X. Zhang: VGOS Observing Plan. *IVS 2014 General Meeting Proceedings 'VGOS: The New VLBI Network'*, edited by D. Behrend, K. D. Baver and K. L. Armstrong, Science Press (Beijing), ISBN 978-7-03-042974-2, pp. 16-19, 2014.

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