Pulsar Astrophysics the Next Fifty Years
Proceedings IAU Symposium No. 337, 2017
P. Weltevrede, B.B.P. Perera, L.L. Preston
& S. Sanidas, eds.

doi:10.1017/S1743921317008602

Status of the Thai 40-m Radio Telescope

Phrudth Jaroenjittichai

National Astronomical Research Institute of Thailand,
260 Moo 4, Donkaew, Maerim, Chiangmai, 50180, Thailand
email: phrudth@narit.or.th

Abstract. Since the first light of the 2.4-m Thai National Telescope in 2013, Thailand foresees another great leap forward in astronomy. A project known as "Radio Astronomy Network and Geodesy for Development" (RANGD) by National Astronomical Research Institute of Thailand (NARIT) has been approved for year 2017-2021. A 40-m radio telescope has been planned to operate up to 115-GHz observation with prime-focus capability for low frequency and phased array feed receivers. The telescope's first light is expected in late 2019 with a cryogenics K-band and L-band receivers. RFI environment at the site has been investigated and shown to be at reasonable level. A 13-m VGOS telescope is also included for geodetic applications. Early single-dish science will focus on time domain observations, such as pulsars and transients, outbursts and variability of maser and AGN sources.

Keywords. telescopes, site testing, pulsars: general, masers

1. Introduction

Astronomy in Thailand has been rapidly developed in the past decade due to the establishment of NARIT and the 2.4-m Thai National Telescope (TNT). NARIT also plays an important role as regional centers, e.g. South East Asia Astronomy Network†, the South East Asia Regional Office of Astronomy for Development‡ and International Training Centre for Astronomy under the auspices of UNESCO¶. NARIT has initiated a 5-year plan to build the "Thai National Radio Observatory" (TNRO), under the RANGD project from 2017-2021, which will host the 40-m Thai National Radio Telescope (TNRT) and the 13-m VLBI2010 Global Observing System (VGOS) telescope.

In addition to the goal to accelerate research in astronomy, RANGD project will have great impacts in the development of advanced engineering, as well as contributions to the trend of global changing in atmospheric and geophysics. The establishment of TNRO marks the first step towards "Thai VLBI Network" (TVN) in the foreseeable future.

2. Site Selection and TNRT

Extensive Radio Frequency Interference (RFI) surveys have been carried out several candidate locations in the Northern part of Thailand, where the weather condition is most suitable for high frequency observation. The selected site is located inside the Huai Hongkhrai Royal Development Study Centre, located 40 km from Chiangmai city centre, where the RFI survey results are at considerably low level of -120 dB(W/m2/Hz) for mobile telecommunication with -160 dB(W/m2/Hz) baseline (Jaroenjittichai *et al.* 2017). RFI considerations for the backup power systems and appliances, and shielding if needed

† http://www.narit.or.th/en/index.php/seaan
‡ http://www.narit.or.th/en/index.php/sea-road
¶ http://www.narit.or.th/itca

Table 1. General characteristics (left columns) and timeline (right columns) of TNRT.

Location	18.86417N:99.21691E	Design review	2017
Optics	Cassegrain-Nasmyth	Telescope site installation	2018-19
Diametre	40 m	1.0-1.8 GHz (L-band) Rx	2018-19
f/D ratio	0.375	18-26 GHz (K-band) Rx	2018-19
Total Surface error (rms)	< 0.200 mm	Spectral line/Continuum Backends	2018-19
Pointing error (rms) @ 5m/s wind	< 6 arcsecs	Commissioning	2019-20
Primary Focus Receivers	300 MHz - 4 GHz	first VLBI fringes	2020
Nasmyth Focus Receivers	4 - 115 GHz	13-m VGOS telescope	2019-21

will be carefully implemented. Land contour survey and soil investigation are currently being investigated.

The design of TNRT has been selected to be a 40-m Cassegrain-Nasmyth telescope with extensive frequency coverage from 300 MHz to 115 GHz. Modified from the design of the 40-m Yebes Telescope in Spain (López Fernández *et al.* 2006), TNRT's characteristics are shown in Table 1. One key difference is the capability to use the primary focus point for low frequency or phased array feed systems. Installation of the telescope will begin in late 2018 until late 2019, where the commissioning will start. Two sets of cryogenics receivers, 1.0-1.8 GHz and 18-26 GHz, will be developed in parallel and set up in the second half of 2019. Subsequently, VLBI test observations and additional receiver systems covering 2-14, 35-50 and 86-115 GHz are foreseen in later phases of RANGD project.

With the advantages of covering a wide frequency, TNRT's single-dish operation will focus on time-domain variables and monitoring of several sources, such as pulsars, magnetars and Fast Radio Bursts, masers and molecular clouds, and flaring AGNs, including simultaneous optical-radio observations between TNRT and TNT. The fact that TNRT situates in an ideal latitude location provides excellent opportunity to conduct all sky surveys with a reasonably good coverage of the Galactic Plane. And at a very unique geographical location, TNRT is able to participate in several VLBI networks, e.g. East Asia VLBI Network, the Long Baseline Array, European VLBI Network. UV simulations indicate great improvements in array performance.

3. Summary

We are currently in the first year of the project, where human expertise has to be prepared. TNRTs final design review is due later in 2017. The telescope site has been concluded, and site preparation and foundation work will commence in 2018. Feeds and receiver and processing systems are currently in early design phase, and will be delivered together with the telescope for commissioning stage in late 2019 to early 2020.

References

López Fernández, J. A., Gómez González, J., & Barcía Cáncio, A. 2006, *Lecture Notes and Essays in Astrophysics*, 2, 257L

Jaroenjittichai, J., Bandudej, K., Kempet, P., Punyawarin, S., Singwong, D., Somboonpon, P., Poshyachinda, S., & Kramer, B. H. 2017, *Journal of Physics: Conference Series*, 901, 1, p.12062

https://doi.org/10.1017/S1743921317008602 Published online by Cambridge University Press