

## In a nutshell



Maritime



Transport



Surveying

### Snapshot of the Singapore

Singapore is considered by many as the financial centre of South-East Asia, offering global investors a very good access to global markets. Over 200 banks are present in the city-state, and its capital market is regarded as an important source of funding for the growth and development of the region. Moreover, Singapore is increasingly becoming attractive as a politically neutral ground. Despite the high cost of living, all these elements transformed the island into a magnet for international industry and internationally minded employees who appreciate the attractive tax situation. Companies which find it attractive to be on politically neutral ground, move to Singapore: e.g. Acronis for IT solutions or the Japanese space debris cleaning startup AstroScale moved their headquarters to Singapore.



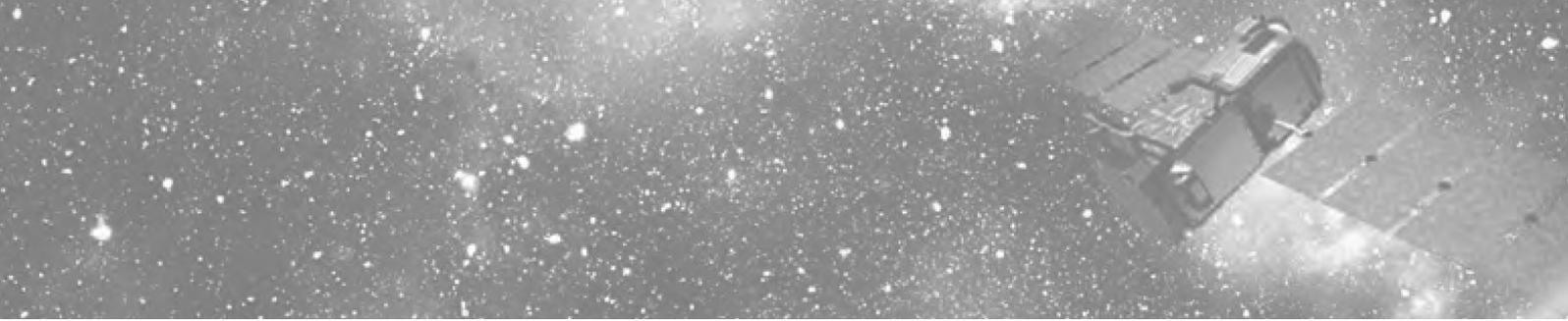
### GNSS opportunities for Singapore

Whilst there is no political ambition to create an indigenous GNSS industry, Singapore remains vital for South-East Asian businesses in a wide variety of sectors including shipping, environmental solutions, security, finance, etc. Singapore has been at the forefront of new solutions, implementing a sophisticated Intelligent Transport System (ITS) to monitor and manage traffic flows. Despite having already one of the most advanced systems, Singapore is moving on with two projects, Smart Mobility 2030 and the Singapore Autonomous Vehicle Initiative (SAVI), to pave the way towards an even more comprehensive and sustainable ITS ecosystem. To support programs like these, the authorities of Singapore have shown interest in cooperating with other nations on GNSS programmes.

### Existing GNSS stakeholders

Given the ongoing development of a national GNSS capability, there are only a few public institutions active in the domain. These only consider GNSS as a tool rather than as a capability to develop. This is for example the case for the Singapore Land Authority (SLA) for surveying or the Land Transport Authority (LTA) for roads. It should be noted that Singapore has a space programme, which for now is mostly limited to Earth Observation through its Centre for Remote Imaging, Sensing and Processing (CRISP).

There is no indigenous GNSS industry, and no political ambition to create one. One of the sole actors is Space-Time Technology Pte Ltd. Founded in 2015, it is the first company in Singapore to provide PNT solutions and to promote the use of GNSS through tourism, LBS, social and IoT applications, etc. It was appointed as the Centre of Excellence for GNSS and LBS technologies, supported by the Singapore Economic Development Board and GLAC (GNSS & Location Based Services Association of China). As proof of the GNSS collaboration established between Singapore and China, Spacetime and ST Electronics (Satcom & Sensor Systems) signed a memorandum of understanding to “develop in Singapore an interference-resistant BeiDou satellite positioning system.” The purpose of the collaboration is to work against unintentional jamming of BeiDou signals in urban environments in which wireless devices occasionally overstep their radio-frequency boundaries. The agreement includes the opening of a centre to develop applications.



Japan is also competing to use its technology on Singaporean soil. The next-generation electronic road pricing system project, which uses GNSS and is valued at S\$556 million, was awarded to a consortium led by NCS, a wholly-owned subsidiary of Singtel Group, and a local subsidiary of Mitsubishi Heavy Industries.

There are, however, Singaporean companies active in the GNSS industry. Examples of local downstream actors are Avago Technologies Ltd. which now has GNSS semiconductors in its portfolio through its recent acquisition of Broadcom. Downstream actors include Singtel for telecommunications or Neptune Orient Lines for container shipping. Larger actors in the aerospace landscape have kept a presence in Singapore for a long time: Thales, SES, Intelsat, etc.

Academic entities involved in GNSS include the National University of Singapore (NUS) and the Nanyang Technological University.

## Existing PNT systems

A network of Continuously Operating Reference Stations (CORS), the Singapore Satellite Positioning Reference Network (SiReNT) was implemented by the Singapore Land Authority. It currently consists of nine GPS based stations supporting GPS, GLONASS, QZSS, BeiDou and Galileo and a data control centre. It was installed as part of a collaborative R&D effort between the University of New South Wales (Australia) and the Nanyang Technological University. It has been used for a variety of purposes, including surveying and mapping, vehicle tracking and navigation, but also geodetic, geodynamics and research.

## Opportunities for EU-Singapore cooperation

- ▶ Singaporean corporations and the financial market place of Singapore are active all over South-East Asia and beyond, incl. companies in shipping, logistics, land management and construction. Key industries that could benefit from GNSS, in particular Galileo differentiators can be engaged at the APRSAF workshop.
- ▶ Smart city and tourism applications will find interesting multi-GNSS applications in particular Galileo differentiators. With its maze of underground shopping alleys and mega shopping malls it is a prime application territory for indoor location and retail oriented solutions.
- ▶ The GNSS.asia partnership with Space-Time and SSTA Association can open many doors, also the presence of European companies interested in GNSS can be leveraged.

## Upcoming GNSS events in Singapore

- ▶ GNSS.asia Workshop in Singapore on 18th November in cooperation with BELS and Space-Time (TBC)

