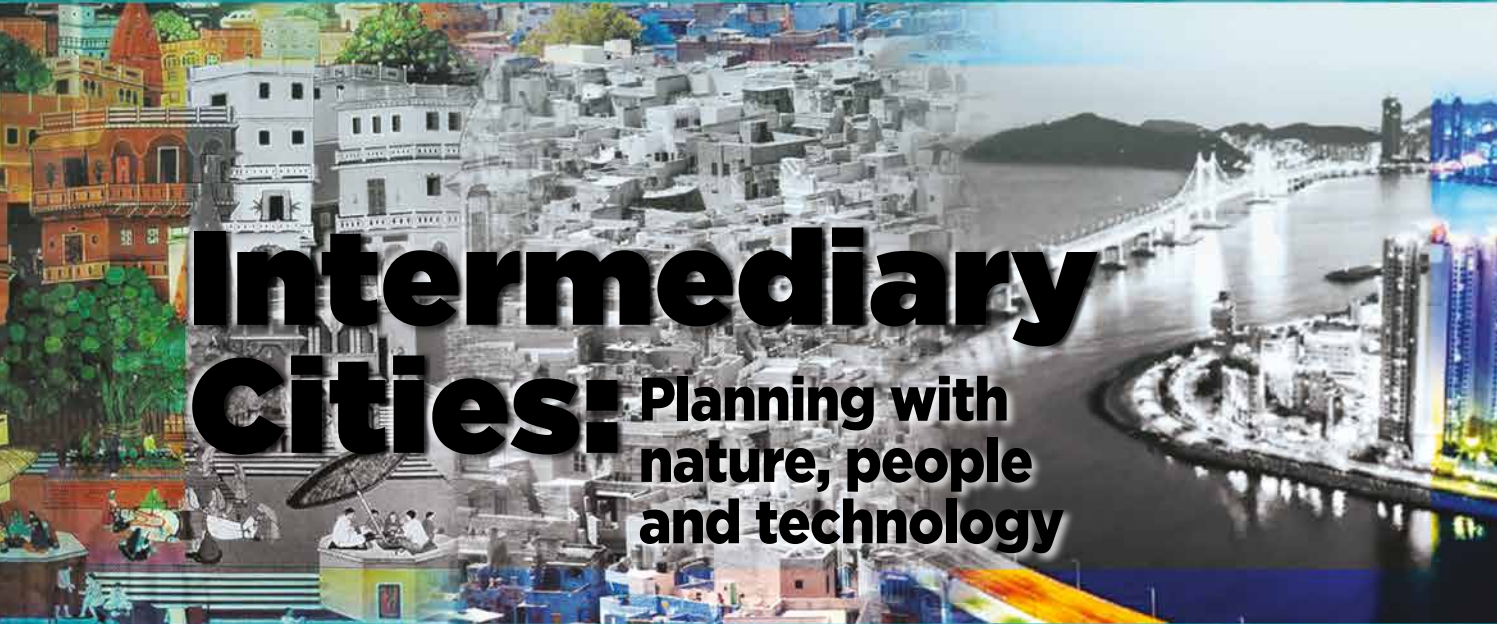


Coordinates

Volume XX, Issue 1, January 2024

THE MONTHLY MAGAZINE ON POSITIONING, NAVIGATION AND BEYOND



Intermediary Cities: Planning with nature, people and technology

GNSS constellation specific monthly analysis summary

RIEGL VZ-600i

RIEGL'S NEW ERA OF TERRESTRIAL LASER SCANNERS

- ▶ broad range capability (0.5 m up to 1000 m)
- ▶ 5 sec scan time for low resolution overview scans
- ▶ 30 sec scan time for 6 mm resolution @ 10 m distance
- ▶ 60 scan positions per hour (with image acquisition)
- ▶ 3D position accuracy up to 3 mm @ 50 m
- ▶ precise real-time onboard registration
- ▶ internal cameras & GNSS receiver
- ▶ weight 6 kg / 13 lbs
- ▶ prepared for mobile use

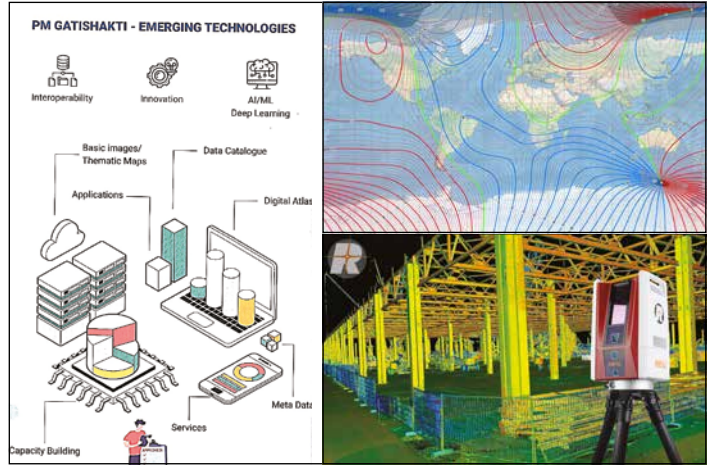


extreme versatility | high productivity | ultimate performance | prepared for mobility



RIEGL VZ-600i Video
www.riegl.com





In this issue

Coordinates Volume 20, Issue 1, January 2024

Articles

Intermediary Cities: Planning with Nature, People and Technology A K JAIN 5 **Land administration and Geospatial information hard talk: Reviewing the posted comments** DR. ANTHONY BECK, VLADIMIR V. EVTIMOV AND DR. KEITH CLIFFORD BELL 14 **GNSS constellation specific monthly analysis summary: December 2023** NARAYAN DHITAL 20 **Spin axis** DAVID LEARMOUNT 23 **Galileo HAS will be the most significant game-changer for mobile GIS users** JEAN-YVES 26 **Future Advanced Air Mobility – The next big challenge for GNSS & GeoSpatial Industries** GRAEME HOOPER 27

Columns

My Coordinates EDITORIAL 4 **His Coordinates** NIKOLAUS STUDNICKA 30 **News** UAV 28 GIS 31 GNSS 32 LBS 33 INDUSTRY 33 **Mark Your Calendar** 34

This issue has been made possible by the support and good wishes of the following individuals and companies

A K Jain, Anthony Beck, David Learmount, Graeme Hooper, Jean-Yves, Keith Clifford Bell, Narayan Dhital, Nikolaus STUDNICKA and Vladimir V. Evtimov; GPSat Systems, Riegl, SBG System, and many others.

Mailing Address

A 002, Mansara Apartments
C 9, Vasundhara Enclave
Delhi 110 096, India.
Phones +91 11 42153861, 98102 33422, 98107 24567

Email

[information] talktous@mycoordinates.org
[editorial] bal@mycoordinates.org
[advertising] sam@mycoordinates.org
[subscriptions] iwant@mycoordinates.org

Web www.mycoordinates.org

Coordinates is an initiative of CMPL that aims to broaden the scope of positioning, navigation and related technologies. CMPL does not necessarily subscribe to the views expressed by the authors in this magazine and may not be held liable for any losses caused directly or indirectly due to the information provided herein. © CMPL, 2024. Reprinting with permission is encouraged; contact the editor for details.

Annual subscription (12 issues)

[India] Rs.1,800* [Overseas] US\$100*

*Excluding postage and handling charges

Printed and published by Sanjay Malaviya on behalf of Coordinates Media Pvt Ltd

Published at A 002 Mansara Apartments, Vasundhara Enclave, Delhi 110096, India.

Printed at Thomson Press (India) Ltd, Mathura Road, Faridabad, India

Editor Bal Krishna

Owner Coordinates Media Pvt Ltd (CMPL)

This issue of Coordinates is of 36 pages, including cover.

Taming the genie

In a landmark agreement,
European Union officials have reached a provisional deal on
The world's first comprehensive laws
To regulate the use of artificial intelligence.
The proposed law contemplates,
To prohibit cognitive behavioural manipulation of people,
Classifying people based on behaviour, socio-
economic status or personal characteristics,
Biometric identification and categorisation of people,
Real-time and remote biometric identification systems, such as facial recognition.
It also endeavours to ensure safeguards the citizens
Against any abuses of technology even by public authorities.
And why not, when at stake is the democracy,
And the fundamental rights.

Bal Krishna, Editor
bal@mycoordinates.org

ADVISORS Naser El-Sheimy PEng, CRC Professor, Department of Geomatics Engineering, The University of Calgary Canada, George Cho Professor in GIS and the Law, University of Canberra, Australia, Professor Abbas Rajabifard Director, Centre for SDI and Land Administration, University of Melbourne, Australia, Luiz Paulo Souto Fortes PhD Associate Professor, University of State of Rio Janeiro (UERJ), Brazil, John Hannah Professor, School of Surveying, University of Otago, New Zealand

Intermediary Cities: Planning with nature, people and technology

The planning of intermediary cities needs to refocus on the emerging issues of sustainability, economy, energy and climate and disaster resilience



A K Jain

Worked as Commissioner (Planning), Delhi Development Authority and as a member of the Committee of

the Ministry of Housing and Urban Affairs on the DDA (2015). He was a member of UN Habitat (2007-12). Author of several books, he is visiting faculty in planning and architecture. He was awarded 2nd Urban Professional Award 2014 at World Urban Forum in Medellin, Colombia and IBC Lifetime Achievement Award (2023), Living Legend (2022) by the Indian Institute of Architects (NC) and the Lifetime Achievement Award by the Smart Habitat Foundation (2022)

Abstract

Of the 7935 cities and towns in India, 468 are class 1 cities (each with a population of 1 lakh and above) which constitute 70.30% of total urban population. The Class 1 cities include 65 Metropolitan cities (+10 lakh population). According to URDPFI Guidelines (2014), Medium towns comprise the population between 50,000 to 5 lakh and a large city between 5 to 10 lakh. As such, 403 cities in India fall under Medium or intermediary cities. These intermediary cities, having about 27.57 % of urban population, play a critical role in urban dynamics and act as the link between the urban and rural areas. With much focus on metropolitan cities, these have often been overlooked. The colonial master planning has been slow and often does not address the critical issues of pollution, climate change, environmental sustainability,

public health, socio-economic equity and inclusion. The paper suggests adoption of five-year strategic plans for intermediary cities by focusing on the nature (climate, air, water and greens), the people (socio-economic, gender, informal sector, circular economy, culture, education, health, mobility, community participation) and new technologies (digital planning, smart, intelligent and interconnected processes, SCADA, blockchain, discreet optimisation, algorithm, AI, big data, etc.).

Introduction

The 21.8 km long Mumbai Trans Harbour Link (MTHL) or the Atal Setu built at a cost of Rs. 1,250 crore and inaugurated by Prime Minister Narendra Modi on 12th January 2024 will help the development of a third Mumbai. The 16.5 km part of the bridge is over the sea, which is the longest in India (Fig. 1). It will scale up its economy from existing \$ 140 billion to \$ 250 billion and enable the development of 323 sq.km in the Mumbai Metropolitan Region.

This takes us back to 1898, that was the beginning of the planned development of Mumbai, when Bombay Improvement Trust Act was notified. In the year 1915 the Bombay Town Planning Act was passed, that was inspired by the British Town Planning Act, 1909. These Acts provided for preparation of the Town Planning Schemes for orderly urban development, land use, zoning, provision of amenities and services, including roads, sewer, and drains. This was followed by Punjab Town Improvement Trust Act (1920), UP Improvement Trust (1919), and Madras Town Planning Act, 1920.

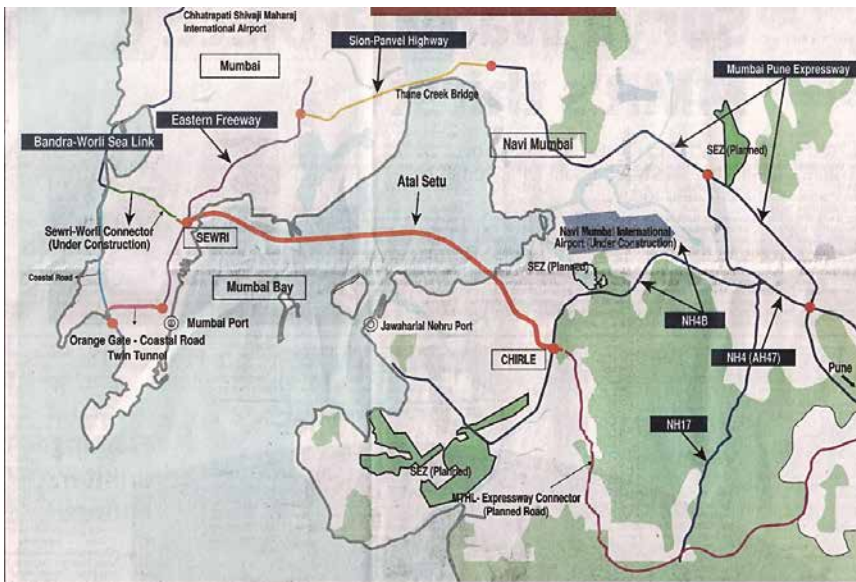


Fig. 1: Plan of Mumbai Trans-Harbour Link (MTHL)/Atal Setu inaugurated by the Prime Minister Narendra Modi on 12th January 2024

Source: MMRDA, 2024

After the Independence several Indian States promulgated their Town Planning legislation based on Town and Country Planning Act (1947) of the United Kingdom. It relegated and devalued the traditional Indian cities and their planning, which manifested a rich variety and unique identity, such as Varanasi (Fig 2) and Jodhpur. By and large, the Indian city was seen as an unplanned slum.

Since 1947, about 120 new cities and 400 odd industrial townships have been planned and developed in India, such as Chandigarh, Bhubaneswar, Gandhinagar, Bokaro, Faridabad, New Mumbai, New Town Kolkata, Amravati, Noida, etc. The Delhi Development Authority was created in 1957, which took up the planning of Delhi with the help of Ford Foundation and Town Planning Organisation. The Master Plan for Delhi was given a statutory shape on September 1st, 1962. It assessed the existing deficiencies in housing, community facilities, services, etc. and projected the requirements of 4.6 million (revised to 5.3 million) population in 1981 (Fig. 3). The Delhi Development Act and the Delhi Development Authority became the models of city planning and development, and more than 50 such Acts and Authorities were created in various cities in India.

During the third Five Year Plan (1962-1967) the planning of State Capitals, industrial townships, port towns, etc. was accelerated. In 1979-80, the Ministry of Urban Development floated the scheme of Integrated Development of Small and Medium Towns, which covered 235 cities and towns across the country. In 2005 this was subsumed within the Jawaharlal Nehru National Urban Renewal Mission (JNNURM) (Fig. 4). The Sub-Mission on Urban Infrastructure Development Scheme for Small and Medium Towns (UIDSSMT), Integrated Housing and Slum Development Programme (IHSDP) and Sub-Mission on Basic Services for the Urban Poor covered 5098 towns and cities.

After the economic liberalisation policies (1991), the Parliament enacted the 73rd and 74th Constitutional Amendment Acts

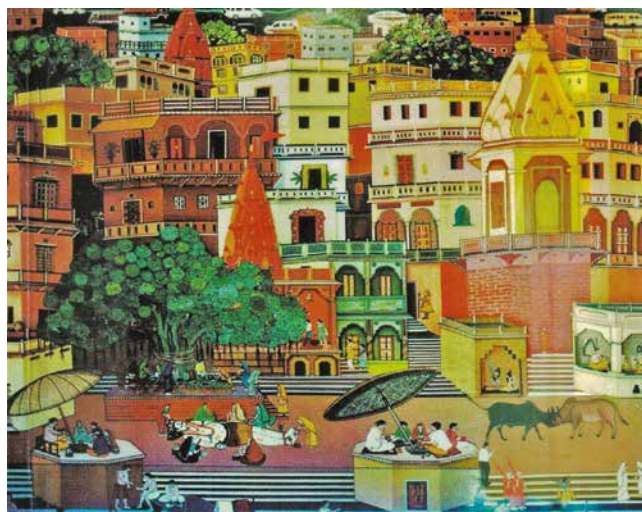


Fig 2: Varanasi is symbolic of cultural richness and a unique identity of Indian City
Source: INTACH/Mural by Jayendra Shankar Mishra and Daya Shankar

(1992), which provided for the constitution of District and Metropolitan Planning Committees for decentralisation and democratisation of the planning process. It empowered the urban local bodies to prepare District and Local Plans. However, many States perpetuated with conventional Master Planning. Under the Special Economic Zone Act, 2003, about 417 SEZs have been planned of which 349 have been developed. Several private sector townships have also come up, which include Amby Valley and Lavasa in Maharashtra.

Intermediary Cities

Of the 7935 cities and towns in India with a population of 377 million (2011), 468 are class 1 cities (each with a population of 1 lakh and above), including 65 million plus cities. The million plus cities constitute 42.63% of total urban population while all the Class 1 cities have 70.20% of total urban population. As such, 403 cities in India fall under Medium or intermediary cities. These intermediary cities, having about 27.57% of urban population, i.e. about 104 million, play a critical role in urban dynamics and act as the link between the urban and rural areas. The cities between 1 lakh to 10 lakh population qualify for Central assistance under the Integrated Development of Small and Medium Towns and now under the Atal Mission for Rejuvenation and Urban transformation (AMRUT). The UN Habitat along with OECD has underlined the importance of intermediary cities (having a population between 50,000 and 1 million) for focused attention on planning, climate resilience and sustainable infrastructure (OECD & UN Habitat, 2022).

To accelerate regional development, and to bridge the gap between smaller towns and mega cities during last decades, the thrust has been on development of public transport infrastructure, national highways, ports and airports and railway corridors. These include the “Golden Quadrilateral” network of National Highways linking Delhi, Mumbai, Chennai and Kolkata, North-South and East-West Corridors. The 1,483 long kilometre Delhi-Mumbai Industrial Corridor (DMIC) and 1,279 kilometres long Delhi-Kolkata Rail Freight Corridor are at advance stage of progress.

The Delhi-Mumbai Industrial Corridor (DMIC) has been planned to create 24 smart cities and 7 Industrial Regions spanning six States- Uttar Pradesh, Haryana, Rajasthan, Madhya Pradesh, Gujarat and Maharashtra. The key features of these new cities on this corridor include digital planning and governance, compact and vertical development, new technology, smart grids, civic infrastructure and green spaces (Fig. 5).

India's Urban Missions

During 2014-15, the Government of India launched several new urban missions, viz. Smart Cities Mission (100 cities), Atal Mission for Rejuvenation and Urban Transformation

(AMRUT) (500 cities), Pradhan Mantri Awas Yojana, Historic City Development and Augmentation Yojana (HRIDAY) and Swachh Bharat Mission (SBM). These missions aim at low carbon and inclusive urbanisation and the provision of core infrastructure services, like water supply, sanitation and solid waste management, efficient urban transport, housing, 24x7 power supply, IT connectivity and e-governance, with emphasis on participatory planning and providing better education, healthcare, urban safety and smart services.

National Monetisation Pipeline has a budget of Rs 6 lakh crore during 2022-25, of which the share of the Railways is Rs. 1.52 lakh crore. Railways Infrastructure Investment Trust (InvITs) is being anchored by the Dedicated Freight Corridor Corporation (DFCC) for redevelopment of railway stations, warehousing, commercial and entertainment hubs. In the budget (2023-24) 1275 railway stations are being redeveloped through EPC contracts. The funds have also been allocated for Rapid Train Projects, Railway Bridges, High-Speed Railway Corridors, Dedicated Freight Corridors (3581 km), Hydrogen Powered Trains, Gati Shakti Units and Transit Oriented Development. This envisages to trigger urban growth mainly of medium and small towns with better connectivity.

The PM Gati Shakti Master Plan, launched in 2021, provides valuable lessons for planning of sustainable infrastructure for seamless movement of people, goods and services. It leverages new technologies, breaking the silos of departmentalisation to achieve ease of doing business. PM Gati Shakti Master Plan is



Fig. 3: Delhi Land Use Plan (1962-1981) covering 44000 Ha of urban area for a population of 5.7 million (1981) provided a policy framework for development of land uses, transport networks, services, parks and greens, regional decentralization, urban renewal, housing, slum rehabilitation and conservation of heritage and natural environment.
Source: Delhi Development Authority

based on the six core principles, incorporating infrastructure such as laying utilities during the planning phase, enhancing connectivity to help seamless movement, ensuring ecological focus on conservation of forest, biodiversity, rivers, etc., faster land acquisition and expeditious clearances (Figs. 6 & 7).

The outcome is made possible by focussing on each aspect of a project in granularity on one platform, with visibility across stakeholders. This also helps drive faster prioritisation and easier synchronisation to avoid delays. The detailed analysis from the data layer and the tools ensures better optimisation of project and quick interventions for closure.

The Whole Government platform enables easier collaborations across departments, dramatically simplifying the planning process while ensuring the design that is mindful of all economic and social aspects. The Smart Cities Mission, Gati Shakti Master Plan and the National Monetisation Pipeline are for a horizon of 5 years, replacing the 20-year colonial model of Master Planning. The circular economy is the basis of these missions. These projects provide important lessons for urban planning, such as better synchronisation, leveraging, bridging gap between planning and implementation, adoption of new technology and public-private partnerships.

Sustainable Development Goals-2030

In view of threats of climate change, pollution and disasters, the sustainable development goals were adopted by the United Nations in 2015. Climate change has become an imminent

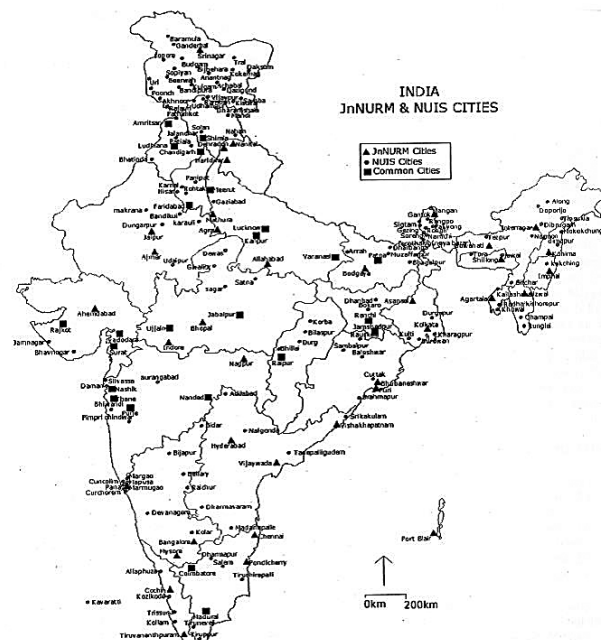


Fig.4: JNNURM and National Urban Information System (NUIS) Cities
Source: Ministry of Urban Development (2005)

reality with a rise in global temperatures, changes in rainfall, floods, droughts and intense heat waves. A drastic increase in atmospheric concentrations of water vapours, carbon-dioxide, methane and nitro-oxide, and other greenhouse gases help trap heat near the earth's surface. The increasing emissions, heat, fossil fuel usage, urban growth, and growing air conditioning demand are affecting health and productivity. The Sustainable Development Goals (SDGs) aim at integrated social and economic development along with climate resilience and environmental conservation of land, water and air and reduced carbon emission and effluents. The SDGs are indispensable in the process of urban development and the Conference of Parties provide agenda and targets at the global and national levels.

UN Conference of the Parties (COP 26, COP 27 and COP 28)

The United Nations Conference of the Parties (COP 26, Glasgow, 2021) deliberated upon various measures to limit

global warming to 1.5 degree Celsius by the year 2100. Indian delegation led by PM Narendra Modi put forward the need to scale up clean technologies and renewable energy. The International Solar Alliance (ISA), One Sun-One World -One Grid envisions an interconnected trans-national solar energy grid. The COP 26 agreed to reduce the use of fossil fuels and coal by new sources, such as green hydrogen, green metals, carbon capture, solid state batteries, electric fuels, heat pumps, electric and hydrogen powered transport and next generation solar PV. PM Modi put forward his five-point agenda at the conference, and informed that India's non-fossil fuel energy will be raised from 160 GW at present to 500 GW by 2030 and 50% of the power requirement will be met by renewable energy. Solar modules will reduce the carbon intensity of the economy to less than 45%. India is committed to achieve net zero emissions by 2070 by clean technologies, like electric transport, ethanol blending in gasoline, solar photovoltaic and batteries, which would play a critical role in its decarbonisation.

At the COP 27 (2022, Sharm-el-Sheikh, Egypt), India launched its long-term Low Emission Development Strategy (LT-LEDS). It focuses on transition towards expanding renewable energy, strengthening power grid, and energy conservation, rational use of fossil fuels, nuclear energy, green hydrogen, fuel-cells, and biofuels for low carbon growth. Discussions at COP 27 encompassed the plans, financial interventions, technological innovations, ideas, and investments towards building a cleaner, safer and more productive path of development. It was emphasised to triple the flow of finances within five years by multilateral banks. India's LiFE (Lifestyle for the Environment) Mission was seen as a necessity to deal with climate change at local level. The formation of the global Coalition for Disaster Resilient Infrastructure (CDRI) and Clean Energy Ministerial Industrial Deep Decarbonisation Initiative (IDDI) seek to strike a balance among infrastructure development, resilience and environment.

The 28th Conference of the Parties (COP28) was held from 30 November to 12 December 2023 in Dubai. The conference concluded the global stocktake of climate action under the Paris Agreement and agreed to accelerate short-term climate actions. Other significant achievement has been the operationalization of the Loss and Damage Fund (\$ 700 million against the estimated requirement of \$194 to 366 billion per year), Nationally Determined Contributions (NDC) and adoption of a framework for the Global Goal on Adaptation (GGA) to strengthen collective action in building climate resilience.

The deliberations focused on global climate action and sustainability challenges in achieving net-zero climate goal in the urban sector, building and construction industry. Within the overarching Government of India's roadmap towards achieving net zero emissions by 2070, 50% of energy from the renewables by 2030, and reducing emissions by 45%, India is moving towards a developed economy of \$36 trillion

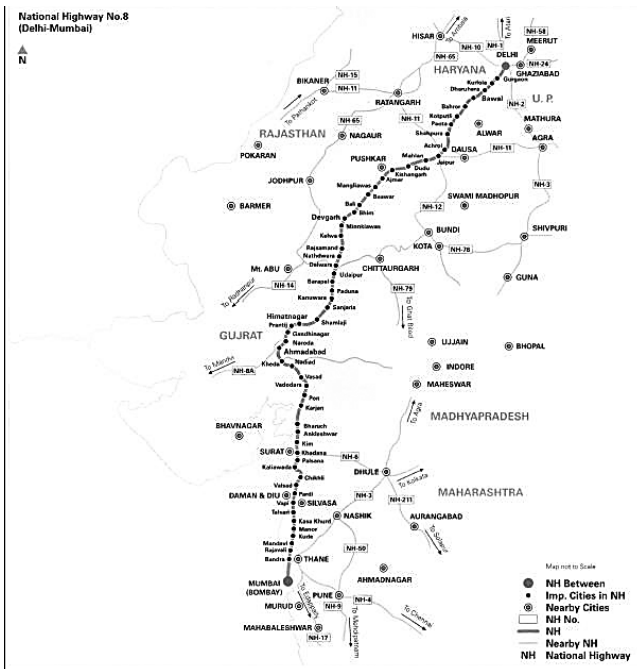


Fig. 5: Delhi Mumbai Industrial Corridor
Source: DMIC Ltd.

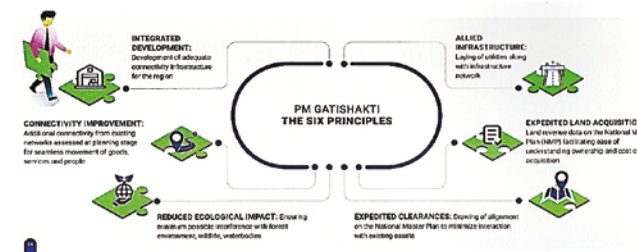


Fig. 6: The Six Principles of PM Gati Shakti Master Plan
Source: Ministry of Commerce and Industry, GOI 2023

by the year 2047. It underlined the measures for sustainable, resilient habitat and inclusivity by adoption of new policies, reforms and the launch of new Coalition of High Ambition Multi-level Partnerships (CHAMPs) to advance the discourse on sustainable, green transportation, energy efficient cities and decarbonising the construction and building practices.

Planning Dilemma

The recently published Report of NITI Aayog (2022) on reforms on Urban Planning Capacity in India, noted that a city Master Plan is a statutory requirement and essential tool for socio-economic development, better liveability, inclusion, citizen engagement, environment sustainability and climate change related aspects. According to the report, India's cities occupy 3% of area while contributing a massive 60% to the country's GDP. Furthermore, Indian cities are growing fast, as Oxford Analytics noted (2018), of the 20 global cities expected to grow the most by 2035, 17 are in India. According to the World Bank, only about one-third of India's population lives in city, which will grow from 377 million in 2011 to 820 million in the year 2047. It is projected that 75% of the GDP and new jobs will be created in the cities. Keeping in view of the potential of intermediary cities, it is necessary to have a dedicated focus on their planning and development.

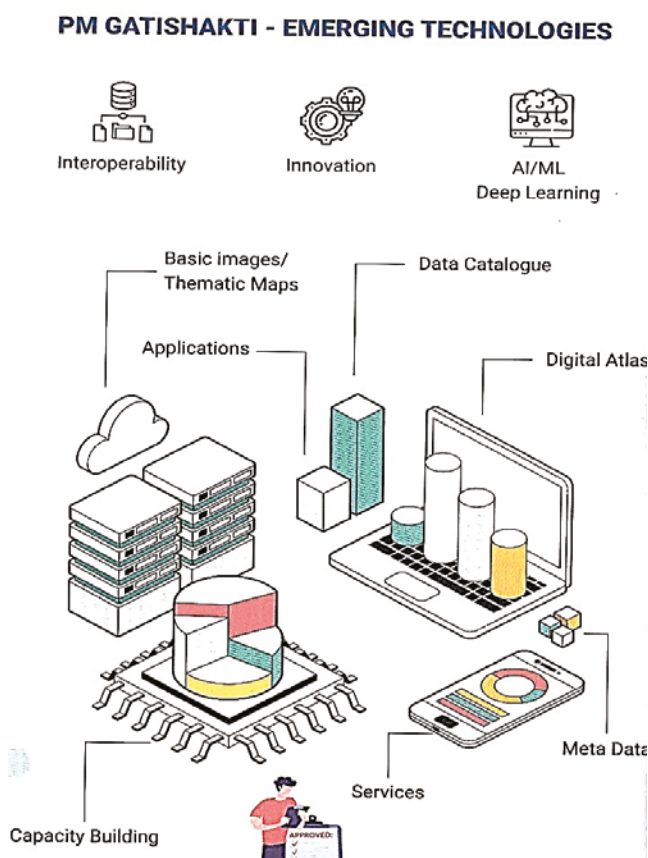


Fig. 7: Emerging Technologies for PM Gati Shakti Master Plan
Source: Ministry of Commerce and Industry, GOI 2023

Planning Intermediary Cities

The planning of intermediary cities needs to refocus on the emerging issues of sustainability, economy, energy and climate and disaster resilience. This means an interdisciplinary and integrated approach that addresses and links the SDG 1 (no poverty), SDG 2 (zero hunger), SDG 11 (Sustainable cities and Communities) and SDG 13 (Climate and Disaster Resilience). The cornerstone of making a city resilient and low carbon is to adopt an integrated approach towards the nature (climate, air, water and greens), the people (socio-economic, gender, informal sector, circular economy, culture, education, health, mobility, community participation) and new technologies (digital planning, smart, intelligent and interconnected processes, SCADA, blockchain, discreet optimisation, algorithm, AI, big data, etc.). This involves a paradigm shift in urban planning which addresses the following:

Planning with Nature

- Biodiversity, Greenery and Amenity Spaces
- Urban Heat Mitigation
- Water Conservation and Management
- Air Quality Management

Planning with People

- Local Economic Promotion and Jobs
- Reducing urban footprint
- Decentralised and Intelligent Services
- Clean Transport and Transit-Oriented Development
- Green Energy
- Green and Resilient Buildings
- LIFE- Lifestyle for the Environment

Planning with New Technology

ICT Enabled Planning, Design and Construction, including Energy, Public Utilities, Mobility, Public Safety and Urban Management

Planning with Nature

- Biodiversity, Greenery and Amenity Spaces

A study of the present land use pattern in India indicates an alarming shortfall of land under forests and greens, as the lands under agricultural use are being increasingly converted for the highways, airports and settlements. It is estimated that an additional 2 to 3 million hectares would be required for human settlements during next 10 years. Sacrificing agricultural land for habitation implies reduction of land for producing food. The lands that sustain agriculture, biodiversity, surface water and groundwater, fragile and sensitive areas, coastal zones, etc. need protection and conservation.

In a city an overall area of 10 sq. m of greens per capita should be reserved for public greens at city, zonal and local levels. A system of landscaped linkages connecting various parts

of the city, water bodies and monuments can provide a sense of oasis and shelter from oppressive climate. Peripheral green belts can act as wind breakers, filters of SPM and dust-storms. The green buffers with indigenous trees, land formations, mounds, embankments, etc. also provide effective barriers to transmission of noise.

The development of greenways can be integrated with the water bodies, drainage corridors and harvesting ponds, reservoirs and by sediment traps in the catchment zones. In water deficient, dry areas the landscape can be in form of Xeriscaping, which can reduce total water demand by as much as 50 to 90% by micro- just- in -time irrigation. Vertical gardens and urban farming can provide relief in dense areas.

In built-up areas, reservation of open space can be done by adopting appropriate regulations for redevelopment. The Government of Maharashtra has notified the regulations for Provision of Amenity Spaces and Open Recreational Spaces under Unified Development Control and Promotion Regulations (UDCPR 2020). These oblige that a minimum 10% of space is reserved in plots more than 4000 sqm against additional FSI or TDR for garden, playground, and/or for a municipal school, hospital, fire brigade and housing for affected people.

b. Urban Heat Mitigation

In a dense built-up area air rises over the warmer city and settles down in the cooler environs. The hot air dome and its effect on microclimate may persist until wind or rain disperses it. Increased aerodynamics of built-up areas cause rapid deceleration of wind compared with open countryside. It has been calculated that wind velocity within a city is half of what it is over open land. At the town's edge, it is reduced by a third. The mutations and reservation of greenery and open space in windward direction and cooler surface materials (roads, parking, buildings, roofs, etc.) help in mitigating the effects of urban heat island. This needs preparation of a city-wide Heat Mitigation Plan and mandatory use of heat reflective and permeable materials for rooftops, pavements and roads, insulated

with white paint and cavity walls. Water pools, fountains, vegetation and cross ventilation can also mitigate the urban heat.

c. Water Conservation and Management

Water scarcity has become a persisting problem in Indian cities due to climate change, pollution of rivers, water bodies and massive construction. Several cities in India have become water stressed. Only 18% of the renewable water resource is being recycled, and only 10% of the annual rainfall is being harvested in India. The issues of concern are increasing coliform levels and Bio-chemical Oxygen Demand (BOD) in surface waters and increased concentration of nitrates in the groundwater. To overcome these problems, water sources need to be protected by sanitation/sewerage interception, and by recycling and treatment of wastewater. Water resources can be augmented through recharging of groundwater and by rainwater harvesting (not only in buildings, but also on roads, parks and parking areas). Zero run-off drainage needs the provision of swales, retention ponds, etc. Besides the conservation of rivers and water bodies, water efficient taps/fittings, dual plumbing, curbing Non-Revenue Water, recycling of wastewater and adoption of new technologies, such as Blockchain and SCADA systems, can help in a more efficient water management.

d. Air Quality Management

Air quality in Indian cities is deteriorating due to indiscriminate use of fossil fuels and vehicular and industrial emissions. According to the surveys conducted by the Central Pollution Control Board (CPCB) ambient air quality in more than 20 Indian cities have reached a very critical situation. Relatively high levels of suspended particulate matter (SPM), dust, SO₂, NO₂, CO₂ and heavy metals, including lead content in the exhaust of automobiles and scooters, have been observed. The recent changes in the fuels like electric and hydrogen powered vehicles, adoption of clean technologies, new emission norms, development of shared taxis, school buses and trucks, Non-motorised Transport

(NMTs) and mass rapid transport system can reduce the pollution levels due to vehicular emissions. Airshed planning, continuous ventilation, use of cooler and light shaded surfaces/materials and water spray are some other methods to reduce air pollution. The use of prefabricated and recycled materials, including construction and demolition wastes in construction and repair of roads and buildings, can help in reducing air pollution and dust.

Air quality data is significant to gaining a thorough understanding of local air pollution, its causes and effects. Recent technological advancements have made it possible to gather data, with low-cost monitoring devices and advanced methods of collating and analysing it. Now-a-days smart electricity poles with sensors are available to monitor pollution parameters along with light, CCTV, wi-fi, etc. The New Delhi Municipal Council (NDMC) has been using them in New Delhi. Citywide air quality mapping and monitoring networks can provide street by street air pollution levels. The active sensors can measure CO₂, CO, NO_x, NO₂, ozone and particulate matter. CEMS and Air quality Data can be used to identify major components, sources, quantification and projects. It can also help the government to apply monetary incentives and penalties for polluting companies and enforcing a cap-and-trade system. The data can be used to analyse the issues, project various options and schedule to assign the responsibilities, timelines and monitoring.

Planning with People

a. Local Economic Promotion and Jobs

In India, the cities generate the country's 60% of GDP and 70% of the jobs. With Covid 19 pandemic, climate change and diminishing jobs, the factors of public health, creation of jobs, environmental sustainability and climate resilience have emerged as the key issues. A target of 10 million jobs in urban areas can be achieved in next five years by development of janta markets, workshops/ sheds, kiosks, shops, small offices, etc. At least 10 per

cent area of shopping/commercial centres may be reserved for the informal sector (street vendors, kiosks, fruit and vegetable stalls, etc.). The residential areas also need a higher level of mixed use and the rationalisation of FAR/FSI, height and densities.

b. Reducing Urban Footprint

The urban footprint can be reduced by optimum densities/floor area ratio that will also reduce consumption of land, leading to travel reduction, economy of services and conservation of agricultural areas. The Indian cities have an overall density of 100 to 240 PPHa, which can be selectively doubled along public transit corridors, excluding the archaeological, heritage and conservation zones. The focus has to be on redevelopment of the brownfields, infrastructure services, transportation, public greens and facilities. The urban ecosystem must be compact and dense. The urban processes need to be compatible to circular economy.

c. Decentralised and Intelligent Services

Surveys reveal that approximately 40% of urban population in India, especially in intermediary cities, is not covered by sewerage, sanitation, drainage and solid waste disposal. As a result, the intermediary cities often face the issues of insanitation, flooding, diseases, poor hygiene and services. Various alternative technologies, based on decentralized systems can be explored. The use of IT, simulation, blockchain and automation can make the services smart and intelligent. The common method of land filling for solid waste disposal is an environmental disaster. Instead, decentralized systems based on 5 R strategy of reduce, refuse, reuse, recover and recycling should be explored. Three bins provide separate bins for trash, recyclable and compost. Collection charges drop as trash drops. Biotechnology, enzyme based STP, bio-remedial treatment, vessel system, sludge gas/energy recovery, vermiculture, fossilization and composting options can be adopted for solid and

liquid waste management. Underground pneumatic conveying systems can be adopted, which are more hygienic, economical and avoid movement of trucks for transportation of wastes.

Common utility ducts or tunnels carrying electricity, water, sewerage, wastes, cables and broadband internet minimize damage from traffic, road repairs, rains, etc. A series of low carbon zones across the city with co-located tri-generation energy systems (combining renewable power, cooling and heating), district cooling and recycling can lead to bundling 'green infrastructure' together.

d. Clean Transport and Transit Oriented Development

The basis of the clean transport is the use of clean energy. As urban transport contributes nearly two-thirds of the total suspended particulate matter and 18 per cent of carbon emissions, it is necessary to provide clean modes of transit run by alternative fuels, like electric batteries, green hydrogen, biofuels, ethanol blended gasoline, etc. With a view to conserve transport, the MOHUA has issued the Metro Rail Policy (2017) and Transit Oriented Development Policy (2017), which provide guidelines for promoting public transit with private sector participation.

Integrated Transit Corridors (ITC), integrating BRT, Metro and trains together with pedestrian and cycle lanes can be flanked by public, semi-public, high-density developments. Metro, trains, and primary roads can run underground for easy bike and pedestrian traffic on the grade. Multi-modal integration, last mile connectivity and e-governance are the pillars of sustainable urban mobility. River/water transport and ropeways can be explored which are almost pollution free and cost-effective. Besides controlling growth of private vehicles, it is necessary to explore parking space in stilts, multi-level puzzle/skeleton structures, on roofs and in underground spaces. Seamless multimodal public transport system comprising bus rapid transit and rail-

based mass transport system would work better by adoption of single ticketing and restructuring of land uses by transit-oriented development. Subterranean garages near commuter destination reduce the need for ground parking. Digital parking meters tell mobile phone when a space opens up, reducing traffic caused by drivers trolling for space. The concept of walk to work should be the basis of urban structure and city size.

The concepts of cordon pricing, minimum occupancy vehicles, ceiling on new registration of private vehicles and establishment of a Unified Metropolitan Transport Authority in every city can effectively contribute towards a sustainable and clean urban transport.

e. Green Energy

Energy scenario in India is characterised by its increasing demand, which has been growing at the rate of about three times the population growth rate in the last two decades. Low carbon energy can be derived from renewable sources, such as biofuels, wind, tidal and solar power. The concept of energy efficiency, renewable energy and Zero-fossil Energy Development (ZED) can reduce the energy demand and consequential pollution. The renewable energy not only helps in energy generation, but also in a pollution-free environment. Smart Micro-Grids, Distributed Energy Systems (DES), Micro-Districts and Anchor Microgrids should be linked with renewable energy network and energy efficiency.

The energy guzzling air-conditioning can be mitigated by innovative methods like Net Zero Energy Design, variable refrigerant volume (VRV) system, earth air tunnel (EAT), thermal storage, and Passive Evaporative Draught Cooling (PEDC) systems. Lower ambient synchronised lighting, bionic controls and integration of natural light with high performance glazing, combined with light sensors can save energy use in a building, which is segmented into multiple zones to allow intelligent controllability. Green roof, ventilation, circulation, light coloured

finishes and insulation also help in reducing energy demand

f. Green and Resilient Buildings

A low carbon and green building aims to be resilient, sustainable, and net zero. The heating, lighting, cooling, ventilation, and powering of buildings are responsible for approximately 40% of the total energy use. As buildings are the largest energy users, incorporating energy storage into them will increase their resilience and enable widespread use of renewable energy.

By passive design the buildings can be more climatically comfortable. It is necessary to specify building materials which are locally sourced and recycled from construction and demolition wastes, that have low embodied energy and require less energy for production and transportation to the site. Such materials include carbon-negative cements, low carbon steel, fibre, gypsum, basalt, fibre composite bars, bamboo, etc. Prefabricated and pre-engineering systems contribute immensely to lower the carbon emissions and dust footprints, time and costs in construction.

Building Information Modelling (BIM) can simulate the entire construction sequence beforehand addressing sustainability issues and reducing carbon emissions. Computer-Aided Manufacturing (CAM) and Computer Integrated Manufacturing (CIM) are useful in reducing emissions, dust and GH Gases. The simulation of construction process enables better control of time, machine, expenditure and the manpower, and could reduce carbon emissions, costs and time by half to one-third.

After the chronic pandemic, the trend is shifting towards healthy spaces and work from home (WFH), open office, biophilic design with natural light, greenery, atrium and courtyards. The biophilic design helps in better indoor air quality. The building must mandatorily conform to accessibility standards for people with disabilities. The space design must prioritise sustainability and health by way of light and ample

ventilation. The Power-Over-Ethernet (POE) lighting system enables smart lighting from a solar grid.

g. LIFE- Lifestyle for the Environment

India and the United Nations have initiated the LiFE or Lifestyle for the Environment Mission (2022). It aims at mindful living, production, and consumption and not mindless and destructive consumption. Low carbon lifestyle is a cluster of habits, embedded in a social context and enabled by efficient infrastructures that minimize the use of natural resources and generation of emissions, wastes and pollution. This requires a change in social norms and rethinking the ways of living based on the principles of organicity, non-accumulation (*aparigraha*), minimalism and slowing down. It is also about caring, sharing, recycling and living in balance with the natural environment. The reuse and repair culture needs to be promoted by provision of repair workshops in all the localities. Education, capacity

building and participation of civil society, especially students and women, are necessary to develop pragmatic practices of sustainable lifestyles.

Low carbon urban strategies can not work without involving the women, who comprise nearly half of the population and work every day in homes, offices, schools and fields. However, they often face the ‘gender service gap’ in terms of access to energy, water, and toilets. A low carbon city has to be gender and disabled sensitive with adequate, safe and accessible spaces for living, working and vending.

Planning with New Technology

In this digital age, the 20-year model of Master Planning does not address the urgent issues of climate change, air and water pollution, public health, employment and disasters. It is also incongruent with the objectives of speed, scale and sustainability. It is necessary that the



Fig. 8: Key Drivers for Digitisation for Sustainable, Inclusive and Resilient Urban Planning and Data Driven Decision Making
Source: NIUA (2023)

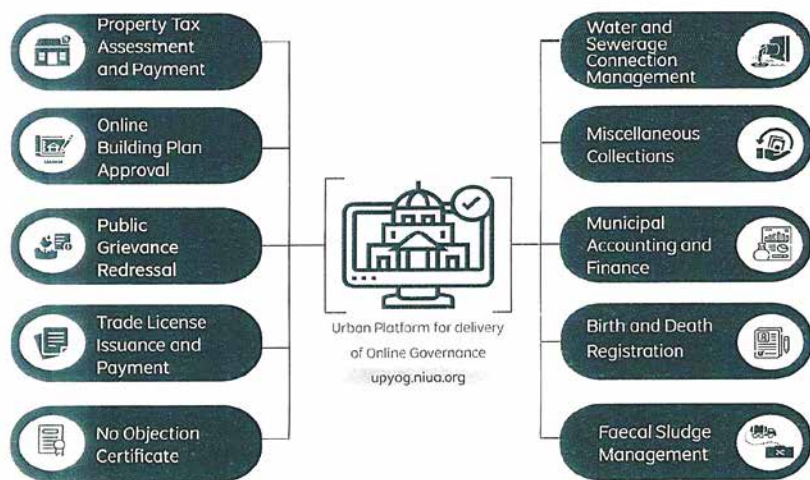


Fig. 9: Urban Platform for Delivery of Online Governance (UPYOG)
Source: NIUA (2023)

urban and regional plans are prepared for a five-year horizon, while their vision may extend to 20 years. The ICT can be a game changer in this transition towards a green and clean economy, smart, resilient, and low carbon infrastructure services, transport and community. Keeping in view the widespread disaster vulnerability of urban areas in India, it is necessary to invoke new technologies and establish Integrated Command and Control Centres in all intermediary cities. This would enable effective mitigation, preparedness, emergency response, surveillance, communication and recovery from potential disasters.

The city plan needs specialised inputs for ICT enabled urban planning by domain experts in GIS, GPS, EIA, SDI, big data analytics, ERP solutions, digital dashboard, blockchain, etc. The National Institute of Urban Affairs and Ministry of Housing and Urban Affairs have identified the key drivers to propel digitisation for sustainable, inclusive and resilient urban planning and data driven decision making (Fig 8). The urban platform for online governance (UPYOG) developed under the National Urban Digital Mission of the Government of India aims to assist the municipal bodies towards delivery of better, faster and more transparent public services (Fig. 9).

Conclusions

Prime Minister Narendra Modi while addressing the Mayor's Conference on 20th September 2022 stated that there is a huge potential in smaller towns and cities to develop as the economic centres. There is a need to focus on intermediary cities as the centres of economic activities and social transformation. This needs a paradigm shift in urban planning which addresses the impending issues of climate change, air and water pollution and a shift from work from home to work from hometown. The provision of the state-of-the-art public infrastructure in intermediary cities with a focus on nature, people and new technologies would help in making urban India viksit, sustainable and vibrant. While we envy the financial development and tourist attraction of the cities like Singapore,

Dubai and Bangkok, there is no reason why the intermediary Indian cities, each with its own unique identity and potential, can not compete with them. It is time to take off.

References

- Central Pollution Control Board (2018) Reports on Air Pollution in India, New Delhi.
- CPHEEO (2014) Water Supply and Sanitation, New Delhi.
- DDA (2007) Master Plan for Delhi-2021, Delhi Development Authority, New Delhi
- IGBC, (2007) LEED - India, Green Building Rating System, abridged reference guide for new construction and major renovations (LEED-India NC), version 1.0. Indian Green Building Council, Hyderabad. http://www.igbc.in/site/mmbase/attachments/48344/LEED.Abrid_Ver.pdf.
- IPCC (2021) Climate Change Working Group III, 6th Assessment Report, Cambridge University Press, UK and New York
- Jain A.K. (2023) Climate Resilient, Green and Low Carbon Built Environment, Springer Nature, Singapore
- Jain A.K. (2021) Environment, Urbanisation and Development, Discovery Publishing House, New Delhi
- Jain A.K. (2018) City Planning for a Changing India, Bookwell Publishers, New Delhi
- Jain A.K. (2016) The Significance of Shahjahanabad and Lutyens Delhi, International Journal of Environmental Studies, Vol 73, No. 4, UK
- Jain A.K. (2014) ICT as a Catalyst of Urban Transformation, My Coordinates, March
- Jain A.K. (2020) Digital Blockchain for Land Pooling in Delhi, My Coordinates, November
- Jain A.K. (2022) Spatial Analytics for a Resilient and Low Carbon Urban India, My Coordinates, March
- Jain A.K. (2022) Planning for Resilient and Low Carbon Urban India, ITPI, Journal 19x1 Jan-March 2022, New Delhi
- Jain A.K. (2023) How Prepared is Delhi for a 7 Intensity Earthquake, My Coordinates, June
- Jain, A.K. (2015) Smart Cities: Vision and Action. Discovery Publishing House, New Delhi,
- Jain A.K. (2011) Making Infrastructure Work, Discovery Publishing House, New Delhi.
- Klaus, Daniels, (1994) The Technology of Ecological Building. Birkhauser, Verlag, Berlin.
- McKinsey Global Institute (2010) India's Urban Awakening, Mumbai
- MMRDA (2024) Mumbai Trans-Harbour Link (MTHL)/Atal Setu, MMRDA, Mumbai
- MOHUA (2015) Guidelines for Smart Cities, New Delhi
- Ministry of Housing and Urban Affairs (2015) Urban and Regional Planning Development: Formulation and Implementation (URPDFI) Guidelines, MOHUA, New Delhi
- Ministry of Housing and Urban Affairs (2021) National Transit Oriented Development (TOD) Policy, MOHUA, New Delhi
- Ministry of Housing and Urban Affairs (2022) ICCM Maturity Assessment Framework, MOHUA, New Delhi
- NASSCOM- McKinsey (2022) Sustainability Opportunity for Tax Services and Solutions, NASSCOM Mumbai
- National Institute of Urban Affairs (2023) Urban 20 Priorities, MOHUA, New Delhi
- NCAER (2020) Land Records and Services Index (N-LRSI-2020) NCAER New Delhi
- Niti Aayog (2022) Lifestyle for Environment (LiFE), Government of India, New Delhi
- Pune News, (2024) Mumbai Trans-Harbour Link (MTHL): Transforming connectivity and Unlocking Opportunities, Pune 12th January
- TCPO (2011) Status of Town and Country Planning Departments and Acts in different States and UTs in India. Spatio-Economic Development Record, Vol 18, No. 5, New Delhi,
- UNESCO & MGIEP (2017) Textbooks for Sustainable Development, A Guide to Embedding, UNESCO and Mahatma Gandhi Institute of Education, Peace and Sustainability, New Delhi
- UN Habitat (2021) Blockchain for Urban Development, UN Habitat, Nairobi
- UN Habitat and NIVA (2022) Leaving No One Behind, UN Habitat, Nairobi
- UN Habitat (2022) Intermediary Cities and Climate Change, UN Habitat, Nairobi

Land administration and Geospatial information hard talk: Reviewing the posted comments

Panelists



Dr. Anthony Beck

An independent consultant who specialises in digital transformation using the Land Administration

Domain Model (LADM), formerly with Registers of Scotland and Ordnance Survey International.



Vladimir V. Evtimov

Land Tenure Officer with the Food and Agriculture Organization (FAO), a land professional experienced in

land reforms and land administration.



Dr. Keith Clifford Bell

International Development Consultant for Land, Geospatial Information and Disaster Resilience

(freelance); Industry Advisor to The University of Melbourne Center for Spatial Data Infrastructures and Land Administration; Formerly staff of the World Bank, Surveyor-General of the Australian State of Victoria and senior public sector manager in various roles in Australia including national mapping, NSDI and Territory land administration.

1. Introduction

Coordinates was especially pleased to publish the *Hard Talk* interview with the expert panel of Dr. Anthony Beck, Mr. Vladimir V. Evtimov and Dr. Keith Clifford Bell in the November 2023 issue. As per our approach, soon after the issue is published, including its posting online as pdf, we also post the individual articles online with the facilities to vote and rate the article from one to five and also to post comments, which are in effect a blog.¹ What has followed has been the posting of significant comments, to praise the interview and to also delve further into the issues raised. Overall, the posted comments and reactions from other means, including postings on the social media platform *LinkedIn*, have been extremely positive and congratulatory. However, they have gone further, expanding on some of the topics raised by the panel and backing up comments with authoritative citations. In effect, this crowdsourcing of opinions has produced a very substantial document. Given the scope and depth of comments, *Coordinates* felt it would serve the public interest to post a synopsis of the blogger comments and to also seek any reactions from the expert panel. As an aside, and by way of word count, the published interview is around 11,000 words and the posted comments are almost 5,000 words.

What a way to end 2023 with the *Hard Talk* and then to enter 2024 with a review of the comments! This also ensures that the much-appreciated contributions of commenters are captured in a further issue of *Coordinates* and shared.

2. The main blog/comment themes

Frameworks and their mandates

The comments raise questions about the mandates of endorsed frameworks, their respective values and why they have been created and promoted. Three of the frameworks specifically raised in posted comments are the *Global Geodetic Reference Framework* (GGRF), the *Integrated Geospatial Reference Framework* (IGIF) and the *Framework for Effective Land Administration* (FELA). All three are outcomes of the United Nations Committee of Experts on Global Geospatial Information Management (UN-GGIM). The fourth framework raised in the interview, from the World Bank, is the *Land Governance Assessment Framework* (LGAF). Although not a framework per se, the *Voluntary Guidelines on the Responsible Governance of Tenure of Land, Fisheries and Forests* (VGGT) was also considered in comments.

GGRF is fundamental for monitoring changes to the Earth including the continents, ice caps, oceans, sea level and the atmosphere. It is also fundamental for mapping, navigation and universal timing. It was adopted by the United Nations General Assembly, on February 26, 2015, after its 2014 endorsement by UN-GGIM.

On IGIF, it is clear that it is a repackaging of the National Spatial Data Infrastructure (NSDI) concept and framework. Drilling down, especially into long published US Federal Geographic Data Committee publications on NSDI since the early

1990s, there is no doubt that IGIF has done some thoughtful restructuring of NSDI, but it largely remains the same. Arguably, the nuance of IGIF from NSDI was targeted at the Sustainable Development Goals (SDG) agenda. It does seem that the promotion of IGIF has been wide at global and regional levels, but uptake has been little. Developed countries seem to have stuck to NSDI/SDI agendas and a relatively small number of developing countries seem to have been exposed to IGIF, largely through donor pushing. As of 2023, it seems that some twenty countries were reported by UN-GGIM to have embarked on IGIF and are at various stages of the initial preparatory work, viz. Burkina Faso, Cameroon, Chile, Dominican Republic, Eswatini, Ethiopia, Fiji, Guatemala, Honduras, Mongolia, Morocco, Mozambique, Nepal, Panama, Rwanda, Senegal, South Africa, Saint Lucia, Tonga and Tunisia.² These are mostly countries dependent on international donor funding for NSDI development. So, as reported in the interview it is consistent with supply-driven rather than country needs in order to secure investment funds.

We should also not forget that IGIF was the renamed Overarching Framework for Geospatial Information which was conceived by the World Bank with support from FAO and its consultant team, with piloting in Guyana and presented to UN-GGIM by the World Bank and adopted as IGIF. The Guyana IGIF experiences have had mixed success given reported governance issues and it seems is no longer mentioned since the controversial departure of the former Commissioner and Chief Executive Officer of the Guyana Lands and Surveys Commission, who represented Guyana on UN-GGIM.³

Coordinates notes the experiences of two of the panelists in pursuing rapid NSDI assessment rather than IGIF. Nonetheless, IGIF may provide a useful reference to consider when designing NSDI investments, and that would also seem to be a consensus of the interview panel.

Regarding FELA, it is clear from the posted comments, that land administration

does not fall within the UN Economic and Social Council (ECOSOC) mandate for UN-GGIM. Furthermore, the composition of UN-GGIM members is largely geospatial rather than land administration.

Although not raised by the bloggers or by the panel, it is noted under the United Nations Statistics Division (SD), and its parent the United Nations Department of Economic and Social Affairs (DESA), there have been established two global centres concerned with promotion of two of the frameworks:

- United Nations Global Geodetic Centre of Excellence in Bonn Germany – which is concerned with GGRF.
- United Nations Global Geospatial Knowledge and Innovation Centre (UN-GGKIC), Statistics Division (SD), Department of Economic and Social Affairs (DESA), based in Deqing, China – which is concerned with IGIF.

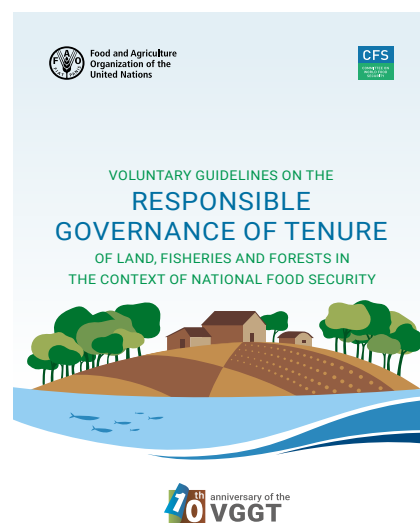
For sure, we all look forward to hearing of the progress of these centres. But will these centres make any real difference?

On LGAF, it is understood it was implemented, or rather assessments were undertaken in around 40 countries. Whilst some countries and sub-national LGAFs have provided useful information, it is unclear as to whether there has been much impact on investment in land administration reform arising from LGAF. Further, LGAF does seem to have all but fallen off the radar now. Nonetheless, and again the consensus of the interview panel, the respective LGAF modules do provide useful checklists for consideration in land administration system design.

It is also worth briefly mentioning the *Land Administration Domain Model* (LADM) which is currently under review since its formalization by the International Standards Organization (ISO) in 2012. LADM did go through quite an exhaustive process of development and consultation over several years before its approval by ISO. So, this is yet another framework that has gone through a different process. It is claimed that around forty so-called LADM ‘country profiles’ have

been created. However, it is unclear how many of these profiles have been endorsed by the official land agencies in the respective land administration ecosystem and are operational.⁴

The VGGT is worthwhile mentioning as an exemplary set of internationally recognised principles that form an international “soft law”, even though it is not a framework per se. The so-called “soft law”⁵ is an integral part of the international legal system that is often generated through formal UN bodies, like CFS. The VGGT – often in tandem with the regional Framework and Guidelines on Land Policy in Africa⁶ by the Consortium of the African Union, the UN Economic Commission for Africa, and the African Development Bank – proved helpful to inspire good practices and directly influence land tenure governance and land administration, and to serve as a baseline for further policy discourses, – notably on water tenure governance and administration⁷, which was skipped out in the VGGT process. The CFS and FAO report on the VGGT uptake that “*VGGT has been very influential as a progressive land tenure standard that influenced policy making in more than 20 countries (examples of*



Voluntary Guidelines on the Responsible Governance of Tenure of Land, Fisheries and Forests in the Context of National Food Security

Source: FAO, Rome, 2012

<https://www.fao.org/tenure/voluntary-guidelines/en/>

uptake: Awareness raising and capacity development on the VGGT in 78 countries; Land policies and programmes based on the VGGT elaborated in 34 countries; Land laws and policies based on the VGGT enacted in 9 countries)”⁸.

Panel Conclusions: There is no doubt that GGRF is a very important framework to support global change monitoring. Regarding IGIF and FELA, such frameworks would seem to provide useful information, but they are quite time-consuming and expensive to implement. From the reports from UN-GGIM, framework progress over the past few years has been slow and would seem to be at the preparatory stages. More rapid and cost-effective approaches are required. Importantly, demand should be driven by the countries themselves rather than imposed by donors as conditional of investment support. Similarly, for LADM and LGAF, both have demonstrated their capacity to provide useful information and referencing. On LADM, the creation of a country profile should not be taken as meaning implementation. Regarding VGGT, it is very apparent that VGGT efforts have been appropriately directed at awareness raising, policy and programme development and capacity building.

Framework endorsement

Endorsement of the frameworks is paramount to the legitimacy of the



The Nine Pathways of the Framework for Effective Land Administration
Source: UN-GGIM, May 2020, E/C.20/2020/29/Add.2

frameworks. Only VGGT and GGRF have been endorsed by the United Nations General Assembly. United Nations mandates are very important, and any endorsements do follow the highest-level processes. Mr. Evtimov has explained the process very clearly in his own posted response to the blog comments where he provided considerable detail of the processes of UN endorsement of both VGGT and also GGRF:

“To sum up this comment: being UN-GGIM endorsed does not make a document UN endorsed. It would need to follow a similar process to what took place with GGRF and VGGT. The process is extensive and requires high-level decision making from the highest level of UN member state representatives.”

Coordinates commends Mr. Evtimov’s posted response as an invaluable reference, especially given he is an FAO expert.

Neither IGIF nor FELA have been endorsed by the United Nations General Assembly for endorsement and remain as UN-GGIM outcomes, that is, approved by UN-GGIM. The difference in rigor and importance of these endorsements is significant. However, it is unfortunate that UN SD, DESA and UN-GGIM have wrongly reported that IGIF and FELA are UN endorsed. For example, in the November 2023 recruitment of positions for UN-GGKIC, these agencies have advised that:

“... The Centre’s overarching goal is to work towards the ambitions of implementation of the United Nations Integrated Geospatial Information Framework (UN-IGIF) set by Member States, to develop capacity, promote and support the required innovation, leadership, coordination and standards to develop, strengthen, integrate and deliver national geospatial information policy, data, systems, tools, services and capabilities into their national government development policies, strategies and arrangements.”

So clearly, it is these agencies which have incorrectly reported on the endorsement of IGIF, and this may also have occurred with FELA.

Panel Conclusions: The broader community may not understand the differences between the official UN General Assembly endorsement from an agreement reached by a designated expert committee such as UN-GGIM. It would be appropriate for DESA, UN SD and UN-GGIM to correct any misreporting of framework endorsement.

Vested interests

The term “vested interests” arose in the comments. The nature of any vested interest in the thematic areas of land administration and geospatial information is varied. Vested interests could be of a research nature or in the public interest including safety and welfare, disaster resilience, conflict resolution and reduction. A bilateral donor’s foreign policy may include support for another country through financial support for housing and land, infrastructure, mapping and so forth. A multilateral may wish to engage in specific country sectors as it has inherent advantages over other multilaterals and bilaterals. So, in both such cases they could be considered vested interests. Civil society organizations (CSO) may also engage and advocate reforms they feel strongly about, such as the land rights of Indigenous Peoples. Again, such activities should be considered as vested interests. Academics may pursue research interests and collaborate with donors, CSO and vendors. On the other hand, there are organizations who may promote land administration or geospatial information agendas in accordance with their business organizational objectives and mandates.

Panel Conclusions: The Interview Panel has not interpreted any posted comments raising vested interests as implying corruption. Having said that, lobbying and advocacy should see anyone undertaking such activities declare their interests transparently, especially when

working with public funds and alongside those working in the public interest.

Sustainable Development Goals (SDGs)

The Millennium Development Goals (MDGs), of which there were eight, were deemed to be aspirational and had no targets. The SDGs were a much-considered new approach with 17 goals and 169 targets determined from baselines. The intention of the SDGs was to be better than MDGs, to be more than just aspirational. Now, we see our world leaders also referring to the SDGs as *aspirational* and some even as *inspirational* – and that was clear from the recently concluded COP28 – the 2023 United Nations Climate Change Conference or Conference of the Parties of the UNFCCC held, November 30 to December 12 in Dubai.

UN DESA has advised that:

“The 2030 Agenda for Sustainable Development, adopted by all United Nations Member States in 2015, provides a shared blueprint for peace and prosperity for people and the planet, now and into the future. At its heart are the 17 Sustainable Development Goals (SDGs), which are an urgent call for action by all countries – developed and developing – in a global partnership. They recognize that ending poverty and other deprivations must go hand-in-hand with strategies that improve health and education, reduce inequality, and spur economic growth – all while tackling climate change and working to preserve our oceans and forests.

The SDGs build on decades of work by countries and the UN, including the UN Department of Economic and Social Affairs.”⁹

The widely recognized failure of the SDGs is in no doubt and both the interview and comments raised the grave concerns of the UN Secretary-General, Mr. Guterres himself in the July 2023 SDG report published by UN DESA:

“Halfway to the deadline for the 2030 Agenda, the SDG Progress Report; Special Edition shows we are leaving more than half the world behind. Progress on more than 50 percent of targets of the SDGs is weak and insufficient; on 30 percent, it has stalled or gone into reverse. These include key targets on poverty, hunger and climate. Unless we act now, the 2030 Agenda could become an epitaph for a world that might have been.”¹⁰

But, less than one month later, at the Thirteenth session of UN-GGIM, August 2-4, 2023, it was reported:

“The Economic and Social Council (ECOSOC) resolution 2022/24, adopted on 22 July 2022, reiterated the importance of strengthening and enhancing the effectiveness of the United Nations Committee of Experts on Global Geospatial Information Management particularly for the achievement of its operations focused on the Sustainable Development Goals and the United Nations Integrated Geospatial Information Framework, to strengthen and ensure its continued effectiveness and benefits to all Member States. The thirteenth session of the Committee of Experts focused on the urgent needs to enhance national geospatial information management to support accelerated achievements of the Sustainable Development Goals, leveraging the Committee’s adopted norms, frameworks, principles and guides as strategies and mechanisms to develop, integrate, strengthen and maximize geospatial information management and related resources and leadership in all countries.”¹¹

It is extraordinary that UN-GGIM would be issuing statements about supporting the acceleration of achieving SDGs which leverage of amongst other

things the frameworks. The midpoint of SDGs is now passed, and they are all definitely failing. Both bloggers and the panel would seem to agree that geospatial information can support the monitoring of SDGs – but geospatial information cannot accelerate the achievement of SDGs. Furthermore, in terms of the frameworks, especially IGIF and FELA, progress is very limited to the early preparatory stages and only in a small number of countries. Sadly, the UN institutions have failed to heed the early advice of the Special Rapporteur, Philip Alston – whose advice if taken on board, may have enabled a timely course correction by restructuring of the SDG goals and targets and revisiting of baselines.¹²

In the UN News article published July 17, 2023, the UN warns *the world is “woefully off track” to achieve the Sustainable Development Goals (SDGs) by the 2030 deadline.*¹³ Seriously, something is very wrong and that has come through profoundly in the blog comments. Ironically, as aforementioned, we read the UN-GGIM’s Resolution from its most recent global forum of August 2023 continuing to advise that it is working



INTEGRATED GEOSPATIAL INFORMATION FRAMEWORK

A STRATEGIC GUIDE TO DEVELOP AND STRENGTHEN NATIONAL GEOSPATIAL INFORMATION MANAGEMENT

PART 1: OVERARCHING STRATEGIC FRAMEWORK

0 Integrated Geospatial Information Framework

IGIF: Overarching Strategic Framework
Source: UN DESA and World Bank, July 2018

on the accelerated achievement of SDGs through its frameworks and maximizing geospatial information management. This just doesn't make any sense. At least one blogger even proposed there should be an official investigation.

Panel Conclusions: In spite of significant investment, it does seem that many of the SDGs were poorly formulated, both in terms of baselines and targets. The warnings and recommendations of UN Special Rapporteur Alston were ignored by the responsible UN agencies. The repeated rhetoric over the past several years concerning accelerating or improving achievement of the SDGs through geospatial information is not working. With less than seven years left, it may be all too late. So, will the UN and international community learn from the mistakes of the SDGs to design what will follow 2030?

Hypes and myths

Stakeholders hold key UN bodies, multilaterals such as the World Bank, the major bilaterals, professional bodies such as the International Federation of Surveyors (FIG) and key CSOs in the highest esteem and will regularly cite statements from such bodies as being authoritative. However, through this *Hard Talk*, we have clearly established, beyond any doubt, that there seem to be many examples of institutions, publishing misleading information of which at times they may not be aware. For example, *Doing Business*, through the World Bank's own independent investigation by law firm Willmer Hale in 2021 found data irregularities and unethical conduct by Bank officials in the preparation of *Doing Business*, across many of its indicators.

Similarly, *Coordinates* notes that the *Zombie myth*, that 70 percent of land parcels in the world are not titled, or one of its many variants is often attributed to major institutions including the World Bank, albeit because officials from such institutions, or their consultants, or associated research partners cite it repeatedly. *Hard Talk* has established that there is no substance to

this statistic, or other variants. Responsible international development and also research on land administration should avoid the family of *Zombie myths* and call them out when so-called experts present them. FAO with partners initiated the setup of a global land observatory, and periodic publication of a global land report that would hopefully establish a sound baseline and monitoring mechanism for the state of the land sector.

Although not raised in the interview, the panel has alerted *Coordinates* to other theories such as those of Hernando de Soto in his bestseller *The Mystery of Capital* which attributes the failure of capitalism in the Third World to the lack of property titles. De Soto was very influential over the World Bank and even lobbying US President Clinton. His theories are often discredited or refuted by land economists. Perhaps this is a topic for a deep dive in a future issue of *Coordinates*.

In the blog comments, one of the panel has responded by recommending two interesting books, for those engaged in international development:

- Catherine Caulfield, 1996, "*Masters of Illusion: The World Bank and the Poverty of Nations*".
- William Easterly, 2014, "*The Tyranny of Experts: Economists, Dictators, and the Forgotten Rights of the Poor*".

Caulfield and Easterly are eminent researchers and authors, with Easterly being a former economist and senior adviser at the World Bank.

Panel Conclusions: It is very important to check the validity of sources, rather than just re-cycle them. Some of the myths emanate from weakly-founded research, or poorly developed assumptions. At times deductions are also drawn from correlation rather than proof of causality. Eminent agencies do make mistakes in research.

Impacts of Misguided International Agency Interventions

Panelist Dr. Bell raised the experiences of major project failures in Afghanistan, all largely due to a single donor failing to design and supervise the investments, viz. two land administration projects and a CORS network. Three commenters specifically agreed with Dr. Bell's reporting of those failures. The donor failed to appreciate the institutional arrangements that had existed prior to 2013, where there were multiple land-related agencies and also the legal framework was grossly deficient. A further issue raised by commenters on the failed Afghanistan experiences concerned land-related studies undertaken by international agencies which failed to understand the history and resulted in causing tension and conflict



As Kabul fell to the Taliban, the UNDP SDG wall mural was picked up by international news. Source: CNN, Aug 17, 2021

between tribal and ethnic groups. Such failures are not unique to Afghanistan.

Panel Conclusion: International development interventions, both investments projects and studies, should always take into account the social, cultural and historical contexts of the country and also be cognizant of the political economy to avoid the risks of doing harm.

3. Last Words from the panel

Anthony Beck: I am grateful for being included in the panel – this has been a wonderful opportunity and I have learnt much in the process. Thanks to *Coordinates*, Keith and Vladimir. My contribution has been mainly focused on digital transformation and LADM. The frameworks provide pathways to support digital transformation. However, there is the danger that implementation occurs in a vacuum following a utopian, or happy, path. Land matters are complex and can become emotive, there is no one-size-fits-all approach. The legal, social, economic, political and operational contexts profoundly influence implementation and change. Inevitably there will be competing agendas and different power relationships between stakeholders. These can lead to less-than-ideal outcomes. Guidance should not become dogma: what works in one context may not work in another. Hence, there is a need to be critical to develop strategies and approaches that deliver an inclusive and, dare I say it, “fit-for-purpose” outcome. To do this we must challenge ways of working and of perceived wisdom. The online debate fits in to this category. This is a good thing.

Vladimir Evtimov: The interview and the blog comments have been a very encouraging and rewarding experience for me. Thanks to *Coordinates* and the comments authors for the constructive approach and positive attitude. I would plead *Coordinates* to keep on organizing and publishing similar interviews and believe that some strategic topics have already popped up, like the global land observatory and a periodic global land

report; integration of land and water tenure governance; global centres of excellence and wider capacity building on the importance of the land and geospatial sector for sustainable development and social, economic and environmental resilience; addressing housing, land and property rights issues for building back better during post-disaster or post-violent conflict situations, and others. Once again, my heartfelt gratitude to *Coordinates* and to Keith and Anthony for the opportunity.

Keith Clifford Bell: Overall, this has been a great experience, and it’s so humbling to be so well received by *Coordinates* readers, including those who published public comments and also those who reached out offline. The interview enabled me to reconnect with colleagues with whom I have worked in various countries. It was really nice to see a few comments from esteemed colleagues posted in the blog. I am very grateful to *Coordinates*, which provided me with the opportunity to respond to a very solid set of questions on land administration and geospatial information. Most definitely, I learned a lot from the published interview comments, especially concerning mandates, for example I had thought all the frameworks through UN-GGIM were UN endorsed. Now I know that it is only GGRF. Whilst I have never spoken out on the potential for those with vested interests engaged in international development, I was intrigued to see bloggers raise such concerns. This may give rise to the old idiom “where there is smoke there is fire.” It was great to be on the panel with Vladimir and Anthony. Finally, I do hope that *Coordinates* will periodically do further *Hard Talks* with other panels. My encouragement is with the caveat of expert panel composition being objective, enabling “truth to power”.

4. Final thoughts

The interview and the ensuing published comments have shown there is definitely strong demand for candid articles in *Coordinates* that provide opportunities

for public comments from around the globe to be published online. It is clear that leading agencies engaged in land administration and geospatial information may at times diverge and need to be called out. Respectfully, *Coordinates* appreciates that conferences, workshops and other fora may not be suitable for candor, owing to the agendas of the convening bodies and also sponsors. Also, individual experts and small agencies may lack the financial means to participate in person. *Coordinates* will consider future *Hard Talk* opportunities for expert panels enabling public comment. Stay tuned!

Endnotes

- ¹ <https://mycoordinates.org/land-administration-and-geospatial-information-hard-talk-a-critical-evaluation/>
- ² <https://www.cepal.org/sites/default/files/presentations/unggim-americas-session-9-unsds-igif-implementation.pdf>
- ³ <https://guyanachronicle.com/2021/05/15/trevor-benn-slapped-with-third-misconduct-charge/>
- ⁴ https://ggim.un.org/meetings/2022/4th-EG-LAM/documents/2.2_Chris_Body.pdf
- ⁵ <https://www.mdpi.com/2071-1050/12/23/9896>
- ⁶ https://www.un.org/en/land-natural-resources-conflict/pdfs/35-EN-%20Land%20Policy%20Report_ENG%20181010pdf.pdf
- ⁷ cf. <https://sdgs.un.org/partnerships/global-dialogue-water-tenure>
- ⁸ <https://www.fao.org/cfs/workingspace/workstreams/uptake/en/> and https://www.fao.org/fileadmin/templates/cfs/Docs/2324/Uptake/VGGT_speaking_points_CFS_meeting_18th_Dec_2023.pdf
- ⁹ <https://sdgs.un.org/goals>
- ¹⁰ <https://unstats.un.org/sdgs/report/2023/>
- ¹¹ <https://ggim.un.org/meetings/GGIM-committee/13th-session/>
- ¹² <https://www.ohchr.org/en/documents/thematic-reports/ahrc4440-parlous-state-poverty-eradication-report-special-rapporteur>
- ¹³ <https://news.un.org/en/story/2023/07/1138777> 

GNSS constellation specific monthly analysis summary: December 2023

Coordinates starts a regular column on the accuracy assessment of satellite orbits and atomic clocks on board of all GNSS constellations (GPS, Galileo, Glonass, Beidou, QZSS and IRNSS).



Narayan Dhital

Is actively involved to support international collaboration in GNSS-related activities. He has regularly supported and contributed to

different workshops of the International Committee on GNSS (ICG), and the United Nations Office for Outer Space Affairs (UNOOSA). As a professional employee, the author is working as GNSS expert at the Galileo Control Center, DLR GfR mbH, Germany.

The global push for economic, political and strategic power have led to the build up of multiple independent satellite navigation systems. Right now, there exists a mixture of legacy and gradually modernized navigation satellites with varying performances. The new initiative in this column will attempt to regularly characterize the system performance and evolution of each state program. As a starter, a couple of remarks can already be made on the recent progress of the Indian GNSS. The IRNSS recently entered the phase of second generation satellites. In May 2023, the first NAVIC satellite, NVS-01 (PRN: I10) was launched and the satellite clock performance is already showing promising results in comparison to the 1st generation IRNSS satellites. Also, it is the first IRNSS satellite with a L1 signal allowing dual frequency navigation. This column will attempt to regularly highlight such progresses

and more importantly highlight the performance evolution of all systems and whenever deemed essential, will provide a separate article to dissect into details the detected performance improvement or an anomaly.

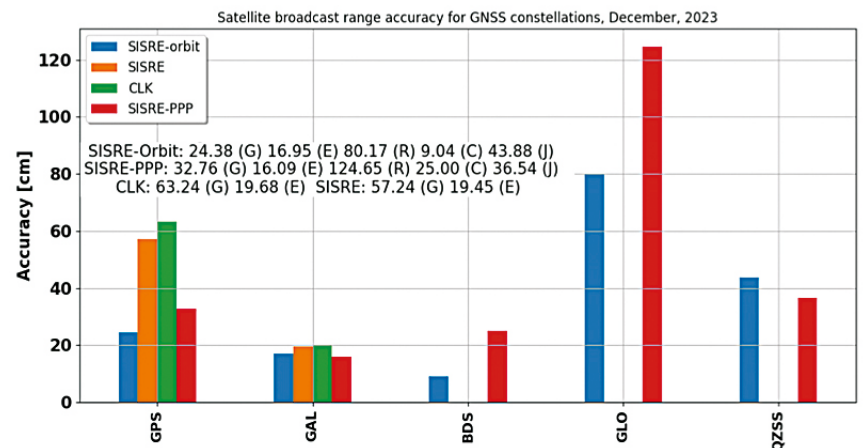
The analysis performed in this report is solely his work and own opinion.

State Program: U.S.A (G); EU (E); China (C) “Only MEO- SECM satellites”; Russia (R); Japan (J); India (I)

Introduction

The compatibility and interoperability of the GNSS is a key to the digital transformation of the global economy driven by GNSS based PNT solutions. In that regard, it is indispensable to have a continuous monitoring of relevant system parameters of all GNSS in a single view.

(a), (b) Satellite Clock and Orbit Accuracy (montly RMS values)



The pioneering services provided by GPS system have demonstrated a range accuracy improvement from 4.5 m rms to below 1 m rms. For GLONASS, the improvement has seen the range accuracy brought down to below 2 m rms from 20 m rms. The latest development of Galileo has seen its performance vastly improved in comparison to the legacy system. Currently, the Galileo system provides below 0.5 m range accuracy (Hauschlid et. al, 2020). In parallel to Galileo, the global constellation of the Beidou system has also provided highly accurate ranging services comparable to Galileo. A new addition to the GNSS, the Japanese QZSS has also started to provide a strong performance. From the Indian region, the first generation of IRNSS and the second generation (NAVIC) are also on their way to achieve strong range accuracy. With such continuous evolution and modernization of legacy GNSS, mostly in terms of atomic clock stability, upgrade in mission segment prediction of the satellite orbits and stable system timekeeping, it is foreseen to have a gradual improvement in the system performances.

The range accuracy, as mentioned herewith, is interpreted as the Signal in Space (SiS) Range Error (SISRE). The SISRE describes the statistical uncertainty of the modeled pseudorange due to errors in the broadcast satellite orbit and clock information. It is driven by the space segment characteristics (e.g., clock stability and predictability of orbital motion), as well as the mission control segment capabilities (orbit and clock determination algorithm, distribution of monitoring stations, and upload capacity). The positioning accuracy at the user level is directly dictated by the SISRE in conjunction with the dilution of precision (Montenbruck et. al, 2010).

The range accuracy, as mentioned herewith, is interpreted as the Signal in Space (SiS) Range Error (SISRE). The SISRE describes the statistical uncertainty of the modeled pseudorange due to errors in the broadcast satellite orbit and clock information

Stable time keeping is the main aspect of the GNSS that drives the services and for this, the atomic clocks onboard each satellite are vital. Even though they are highly stable, there are numerous factors like ageing, sudden breakdowns, radiation or temperature that impact the synchronization between the satellite broadcast signals derived using the atomic clock and the GNSS system reference time. It is important to have a continuous monitoring of the performance of satellite atomic clocks and mission segment clock prediction to leverage the full benefits of multi-GNSS systems. Such monitoring can also generate valuable information for the optimization of PNT algorithms, for example a priori assumption on the noise characteristics of satellite clocks and pseudorange errors. Besides, a continuous monitoring of the stability of steered GNSS time to predicted UTC, through GNSS-UTC information, can aid users of PNT services.

The system performance is also characterized by two additional parameters: i) URA, which is a prediction of the minimum standard deviation of the unbiased Gaussian distribution, which overbounds the SISRE prediction. In a case of larger URA values, the system can be considered either unusable or degraded with high range error and ii) the clock discontinuity which is the offset in the clock prediction between two batches of messages during the

handover. A larger clock discontinuity can violate the assumption of short-term variation in satellite clock offset process noise and degrade the PNT solution.

Analyzed Parameters

- a. Satellite Broadcast Accuracy, measured in terms of **Signal-In-Space Range Error (SISRE)**
- b. **SISRE-Orbit** (only orbit impact on the range error), SISRE (both orbit and clock impact) and **SISRE-PPP** (as seen by the users of carrier phase signals, where the ambiguities absorb the unmodelled biases related to satellite clock and orbit estimations. Satellite specific clock bias is removed)
- c. **Clock Discontinuity**: The jump in the satellite clock offset between two consecutive batches of data uploads from the ground mission segment. It is indicative of the quality of the satellite atomic clock and associated clock model.
- d. **URA**: User Range Accuracy as an indicator of the confidence on the accuracy of satellite ephemeris. It is mostly used in the integrity computation of RAIM.
- e. **GNSS-UTC offset**: It shows stability of the timekeeping of each constellation w.r.t the UTC
- f. **Modified Allan Deviation**: The stability of each satellite atomic clock. It is indicative of short term and long-term stability

(c) Satellite Clock Jump per Mission Segment Upload

Const	Mean [ns]	Max [ns]	95_Percentile [ns]	99_Percentile [ns]	Remark	
					Best Satellite	Worst Satellite
IRNSS	3.48	243.7	6.36	22.8	I03 (95%: 3.36 ns)	I06 (95%: 9.4 ns)
GPS	0.48	15.81	0.84	3.76	G15 (95%: 0.46 ns)	G08 (95%: 5.97 ns)
GAL	0.08	4.91	0.17	0.41	E07 (95 %: 0.15 ns)	E18 (95 %: 0.21 ns)

of each type of atomic clock used on-board the satellite

they broadcast only 1 frequency which does not allow the dual frequency combination required in precise clock and orbit estimation; as such, only URA and Clock Discontinuity is analyzed)

Monthly performance remarks

A greater performance of the satellite atomic clock and the mission control segment can be attributed to the best SISRE achieved by the Galileo system. The Allan deviation plots also demonstrate the greater stability of atomic clocks of Galileo satellites. Their achieved performance is closely followed by Beidou and GPS. QZSS system is right up there, albeit a fewer number of satellites. GLONASS system is lagging a bit behind. The performance of the IRNSS system, detected to have larger clock discontinuities and some instances of degraded URA, suggest there is enough room for improvement. The addition of new frequency and the launch of 2nd generation satellites look promising.

References

Hauschlid A, Montenbruck O (2020) Precise real-time navigation of LEO satellites using GNSS broadcast ephemerides, ION

Montenbruck O, Steigenberger P, Hauschlid A (2014) Broadcast versus precise ephemerides: a multi-GNSS perspective, GPS Solutions

Data sources

<https://cddis.nasa.gov> (Daily BRDC)
http://ftp.aiub.unibe.ch/CODE_MGEX/CODE/ (Precise Products)

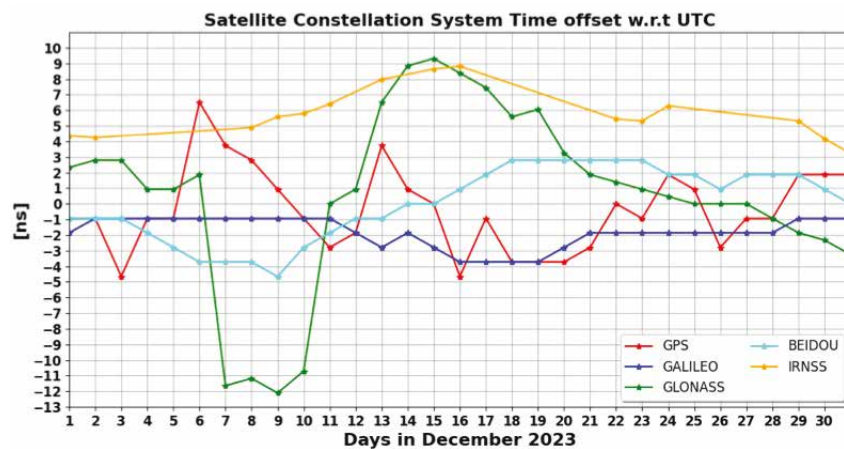
(The monitoring is based on following signals- GPS: LNAV, GAL: FNAV, BDS: CNAV-1, QZSS:LNAV IRNSS:LNAV GLO:LNAV (FDMA))

(Note: for India's IRNSS there are no precise satellite clocks and orbits as

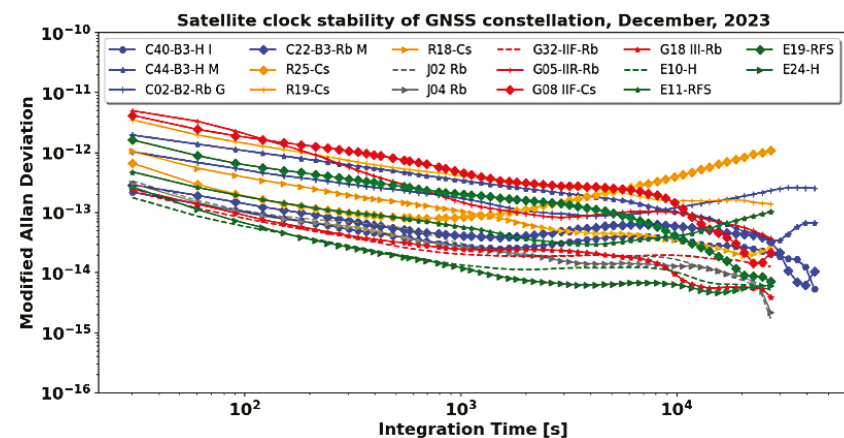
(d) User Range Accuracy (Number of Occurances in Broadcast Data)

IRNSS-SAT	URA= 2 [m]	URA= 2.8 [m]	URA= 8 [m]	URA=8192 [m]	URA =9999.9
I02	2997	6	2	1	6
I03	433	-	1	-	-
I06	435	3	1	-	-
I09	372	1	-	-	-
I10	497	-	1	-	-

(e) GNSS-UTC Offset



(f): Modified Allan Deviation (atomic Clock stability of best and worst performing satellites from each system) H=Hydrogen Maser; Rb/RFS=Rubidium; Cs=Cesium; I=IGO; M=MEO; G=GEO



GNSS	Integration Time [s] and Modified Allan Deviation		
	100 s (Best Satellite, Worst Satellite)	1000 s (Best Satellite, Worst Satellite)	10000 s (Best Satellite, Worst Satellite)
GPS	G32: 7.2x , G05: 2.3x	G32: 1.7x ,G08: 4x	G18: 8x ,G08: 1.6x
GAL	E10: 5.7x ,E19: 6.2x	E24: 1.1x ,E19: 1.1x	E24: 6x ,E11: 4.3x
GLO	R25: 1.6x , R19: 1.3x	R25: 5.1x ,R19: 4.5x	R18: 3.2x ,R19: 1.7x
BDS	C40: 9.6x , C44: 1.1x	C40: 5.1x ,C44: 3.4x	C22: 1.1x ,C02: 1.2x
QZS	J04: 8.4x , J03: 1.4x	J04: 2.5x ,J03: 4.1x	J03: 1.3x ,J02: 2.2x

Spin axis

The global industry is preparing to change its navigational heading reference from Magnetic North to True North. This article examines the issues involved, and provides an update on the progress of research into options for managing the transition process.



David Learmount
Private pilot Former pilot and Qualified Flying Instructor in the Royal Air Force Independent aviation journalist, London, UK

It may seem unlikely that any full-time aviation professionals still do not know that the global industry is preparing to change its navigational heading reference from Magnetic North to True North (Mag2True). In reality, however, there may be many such people, employed by airlines, airports, air navigation service providers, and even some at national civil aviation authorities.

Using data gathered by a working party of the International Association of Institutes of Navigation - known as the Attitude and Heading Reference Transition Action Group (AHRTAG) - this article examines the issues involved, and provides an update on the progress of research into options for managing the transition process. AHRTAG's work is being overseen by the International Civil Aviation Organization (ICAO).

Magnetic North, aviation's traditional heading reference, has always been shifting but, for reasons unknown, the shift has accelerated in the last three decades. The industry has long coped with the navigational anomalies that arise from measurable variations in the earth's magnetic field, but having to cope with this uncertainty has now become an expensive distraction. This is ironic considering that modern navigation technologies already enable an alternative – using True North as the heading and azimuth reference - that eliminate the problems, the inaccuracies, and the associated ongoing costs of this constantly shifting reference.

Canada's air navigation service provider (ANSP), Nav Canada, is the world's expert in coping with navigation difficulties resulting from massive local variations between Magnetic and True North. This is because the geographical location of Magnetic North has traditionally been in its far north domestic territory, but this has recently changed, with the magnetic pole now lying in the eastern hemisphere. Rates of change may now become more of a European problem, and Mag/True variation can change significantly when aviators are operating in the vicinity of the geographic magnetic north pole.

The maximum possible value of the variation between the two norths – 180deg - occurs on the line between the geographic surface positions of Magnetic North and True North: anywhere on that line, an aircraft's magnetic compass will show north as south, and vice versa. For these reasons, Canada divides its domestic airspace into two sectors: Northern Domestic Airspace (NDA) and Southern Domestic Airspace. In the NDA the heading reference is True North, and the ANSP and all ground-based navigational aids

US/UK World Magnetic Model - Epoch 2020.0
Main Field Declination (D)

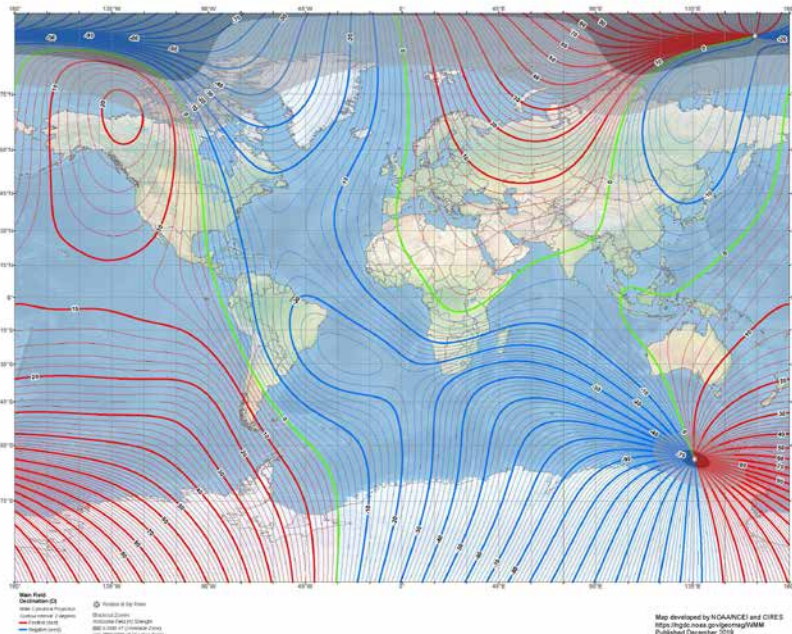


Image credit: www.ncei.noaa.gov

and PBN procedures, along with charts and airports, reflect this fact. Meanwhile in Canada's SDA, where changes in Mag/True variation are less pronounced, the heading reference used is Magnetic.

If this sounds like a problem peculiar to Canada that others could happily ignore, a chart of global Mag/True variations shows burying one's head in the sand is not an approach that would work everywhere. And the crews of long-haul flights in particular cannot ignore the inevitable changes in variation during a journey if they are navigating by Magnetic.

Canada's example provides a useful study for the rest of the world in how aviators, including general aviation pilots, can – and do – cope, routinely operating with the two different heading references, and managing the transition from one to the other.

Canada's aviators cope by a variety of means according to their aircraft's equipment. Basically, the crews of aircraft with the latest avionics – including the latest triplex inertial reference units (IRU) as well as GPS – have no problems. Pilots flying classics, on the other hand, have to be familiar with the techniques of flying in an area where variation can change considerably on a single leg, especially flying across lines of longitude rather than along them. But this can be done, even with old equipment, and traditional navigation skills prevail.

Because of this long experience of managing airspace encompassing huge differences between Magnetic and True North, Nav Canada leads the multinational AHRTAG which has been engaged for more than three years in a detailed study of the Mag2True transition and all its implications, technical and operational. Indeed, with AHRTAG taking on the research role, ICAO's specialist resources like the Air

Navigation Commission (ANC) are freed to oversee the proposals and processes.

Nav Canada has its own True North Sub-Working Group, and it has produced a Concept of Operations (ConOps) for transitioning the whole of Canadian airspace onto True North as employed in its NDA. This ConOps is, effectively, a blueprint for the methodology that the rest of the world could adopt during transition to True North. Nav Canada has used the year 2030 in the ConOps simply as a target, because it needs a proposed transition date for costing purposes.

The ConOps rationale for the change to True North reference is spelled out with stunning simplicity in this statement: "After the 1980s, as aircraft systems became more tightly integrated and digital systems developed, minor magnetic variation errors have become more than a mere distraction, driving a mismatch between the various navigation systems." Whatever risks might be involved in transitioning to True, the growing risks just described by Nav Canada's ConOps will outweigh them. Meanwhile the multinational AHRTAG - which has met monthly via webinars for several years – recently conducted a face-to-face meeting at the Royal Institute of Navigation (RIN) in London, England (5 June 2023), and the Group reports a growing international awareness of the desirability of change.

Indeed, Dai Whittingham, a member of AHRTAG and chair of the UK Flight Safety Committee, observed at the RIN meeting that failure to transition would be to ignore the definition of the duty to ensure flight safety adopted by the UK Civil Aviation Authority (CAA). The CAA says organisations have a duty to make aviation "as safe as reasonably practicable". Whittingham points out that, by staying with the Magnetic

heading reference, "We are accepting errors that we can easily eliminate."

There are still voices expressing reluctance, but they are becoming fewer and, rather than stating outright opposition, they are mostly posing questions to bodies like AHRTAG about how to overcome anticipated transition problems and costs.

Some academic bodies are starting from fundamentals in considering the transition to True. For example, the Polytechnic University of Bucharest's Faculty of Aerospace Engineering has proposed an examination of whether the recent acceleration in the rate of migration of the geographic Magnetic North pole might be a precursor to a reversal of the earth's magnetic poles, stating that contingency planning for such an event must be carried out. Existing geological evidence that the University is studying suggests that such a polar "flip" might take about 100 years at the rate of 3deg per year. Depending on the outcome of the Bucharest study, the case for a move to True in advance of such a historic reversal would seem compelling. And no-one, even among the assembled experts, knows how soon such a cataclysmic event might happen.

Factors that have to be considered in the event of the Mag2True transition include aircraft equipment, airport signage, ground navigation beacon orientation, ANSP/ATC procedures, meteorological reporting, and aviation information service (AIS) updating.

Changes, where necessary, may often be adopted in advance, or switch-over prepared beforehand. Nav Canada, which has carried out airborne trials of options for transitioning to True, makes this observation: "In its simplest form, changing from Magnetic to True could be done in many aircraft avionic systems by setting the magnetic variation or declination to '0'. Since all procedures and systems have been built by original equipment manufacturers (OEM) to a stable common reference (TRUE NORTH) and then converted to magnetic for end use, setting the correction to '0' will set the reference

Magnetic North, aviation's traditional heading reference, has always been shifting but, for reasons unknown, the shift has accelerated in the last three decades

Given this chance to voice their concerns to ICAO, the industry's two most important demands were for a clear transition plan supported by regulation and guidance, and for the transition to be well-coordinated across states, stakeholders and the military

to TRUE. Databases for navigation now using standard 424-23 have recognized this concept since the publication of ARINC 424-20 many years ago.”

Speaking at the RIN meeting, Susan Cheng of Boeing paints a picture of the potential for data mismatches that exists within all modern commercial air transport category aircraft when they use the Magnetic heading reference for navigation. As the Nav Canada ConOps paper has already stated, there is a potential for “mismatch between the various navigation systems”. Cheng, who is a flight deck crew operations engineer at Boeing, points out that the main sources of potential mismatch are the magnetic variation (MagVar) tables that are part of both the inertial reference system (IRS) and the flight management computer system (FMCS). There is a need for the operator to update the MagVar tables regularly in both these complex interacting systems, so if they are updated late - or not at all - or if one table is updated and the other is not, the outputs can differ, confusing the autoflight systems. Also, other pilot tools like synthetic vision systems can be affected by mismatches. Nav Canada reports that it has investigated several operational incidents caused by just such inputs, but fortunately - so far - they have not led to accidents.

Operators of older aircraft with less sophisticated navigation systems clearly worry about the Mag2True transition challenge, but rather than threatening to veto it they have appealed for time and consultation to work out how best to cope. No-one is demanding that they – nor indeed the major airlines – give up their standby magnetic compasses,

but organisations like GAMA (General Aviation Manufacturers’ Association) and AOPA (Aircraft Owners and Pilots’ Association) warn against forcing GA pilots – while flying - to read their standby compass, apply the local magnetic variation, and set their gyro-driven directional indicators (DI) to True. The potential for error, they argue, is high. Both are also nervous about GA aircraft fitted with horizontal situation indicators (HSI) slaved to flux valves that provide Magnetic headings. Their concern is the expense of fitting converters to make the HSI read True. Indeed, like other organizations, GAMA and AOPA say they would want to see a proper ConOps from ICAO for transition well before the Mag2True transition phase, to enable the industry to prepare. Meanwhile there are also those who accuse detractors of exaggerating the problems, and of ignoring input from Global Navigation Satellite Systems (GNSS), widely used by all sectors of GA.

ICAO has, meanwhile, conducted a survey to measure the support for a Mag2True change. The Organisation reported that it received a robust response from more than half the contracting states. Among these respondents - which ICAO confirms came from all sectors of industry, including regulators – less than 10% were resolutely opposed to it. Those most in favour included ANSPs and flight procedure designers. Air operators provided varied levels of support, but less than 15% actually opposed change. Interestingly, the particularly high reported level of appreciation of “foreseen benefits” and “additional foreseen benefits” appeared to be at odds with the level of nervousness about managing the transition.

ICAO also confirmed that many air operators report already operating True North procedures in remote and oceanic airspace, and also in polar regions.

Given this chance to voice their concerns to ICAO, the industry’s two most important demands were for a clear transition plan supported by regulation and guidance, and for the transition to be well-coordinated across states, stakeholders and the military. In terms of timescale for implementation, most respondents said five to ten years to prepare is acceptable.

Right now a set of four objectives to prepare for transition have been mooted: development of a global ConOps; development of strategies for implementing True North; analysing the potential safety risks and identifying mitigations; and finally identifying the ICAO Air Navigation Commission Panels that will be impacted and propose tasks accordingly.

Nav Canada’s own ConOps argues that the move to True is unquestionably beneficial – indeed essential - for aviation’s future: “The case for converting to True as the datum for aviation instructions, procedures, and surveillance is clear, and the only problems would be those of practically implementing it. Whilst it would be a large-scale undertaking, it would also be a one-off operation which, once completed, would be final, unlike the present situation, which is also costly and constantly with us, requiring resources to manage it.”

Chairman of the AHRTAG, Nav Canada’s Anthony MacKay, sums up the Group’s conclusion: “The risks of change are known and manageable. The transition will require careful planning and implementation, most likely through ICAO. To remain on magnetic continues to allow a latent threat to safety to reside within our aviation safety system.” Finally, ICAO’s survey found that there is a very high understanding of the many benefits of a True North reference, including more accurate navigation and “eliminating errors caused by MAGVAR”. ▽

Galileo HAS will be the most significant game-changer for mobile GIS users

Once it is more widely adopted, we anticipate that various industry professionals will discover additional use cases where Galileo HAS can fill a crucial gap left by SBAS and RTK



Jean-Yves
Lauture, CTO, Eos
Positioning Systems

Arrow Gold+™, immediately capitalized on this new corrections source, broadcast directly from the Galileo constellation GNSS satellites. Looking ahead as 2024 is upon us, we predict that Galileo HAS will be the most significant game-changer for mobile GIS users globally. This is based on two factors: Firstly, EUSPA has planned operational improvements and enhancements that will drastically boost the performance of Galileo HAS. Secondly, the increased availability of Galileo HAS will enable various industries to explore even more use cases, surpassing our previous expectations.

Let's explore the improvements EUSPA plans in the next phase of Galileo HAS. Currently, Galileo HAS is in Phase 1, termed "Initial Service." With a lot of deployment work happening in 2024 towards Phase 2, we can anticipate a range of performance improvements in preparation for the "Full Service" (date unknown). One of the most exciting enhancements will undoubtedly be the improved convergence time. In the current initial service phase, convergence outside of Europe takes about 30 minutes to achieve approximately 20-centimeter accuracy globally, based on our initial tests. Within the European Union, convergence time is already much shorter than this, down to about 5 minutes. In Phase 2 of Galileo HAS, EUSPA has stated that convergence time will drop to an impressive 5 minutes worldwide, and under 2 minutes within the European Union! This improvement could come relatively soon, and we eagerly await to

see if it will happen (or part of it) during 2024. For more details on what to expect in Phase 2, refer to the EUSPA website for Galileo HAS here: <https://www.euspa.europa.eu/european-space/galileo/services/galileo-high-accuracy-service-has>.

Another exciting expectation we have for Galileo HAS is the proliferation of its use worldwide. Once it is more widely adopted, we anticipate that various industry professionals will discover additional use cases where Galileo HAS can fill a crucial gap left by SBAS and RTK. For instance, imagine georeferencing drone imagery on a remote island in the Galápagos Archipelago, which lacks an RTK network, internet, and SBAS. Galileo HAS's decimeter-level accuracy can prove invaluable here — as demonstrated by one of our customers who has already piloted this workflow on Santa Fe Island. Now, envision the need to map a newly installed water distribution system in a remote African village, also without RTK, internet, and SBAS. Once again, Galileo HAS could provide essential GNSS corrections in such an environment. We can imagine infinite use cases where free, decimeter-level accuracy could prove truly impactful.

Of course, utilizing Galileo HAS will necessitate the use of a compatible GNSS receiver. When Galileo HAS entered its initial service phase, the Arrow Gold+, designed by Eos was the only receiver on the GIS market to support its use. We had designed it with Galileo HAS in mind, way before it entered Phase 1. ▽

The new year holds great promise for GIS users who utilize global navigation satellite systems (GNSS) technology. In 2023, many of us followed closely the announcement by the European Union Agency for the Space Programme (EUSPA) about the initiation of the first testing phase for their new Galileo High Accuracy Service (HAS). This development has made worldwide positioning accuracy at the 10-20 centimeter level accessible as a completely free service. Our latest GNSS receiver, the

Future Advanced Air Mobility – The next big challenge for GNSS & GeoSpatial industries

For the geospatial and navigation professionals, all future flight approach and departure corridors designs will require detailed 3D modelling and navigation vulnerability assessments before final flight certification



Graeme Hooper
Managing Director
GPSat Systems

guests, ferrying passengers from downtown city centre vertiports out to large outlying international airports.

While much global media attention has focused on eVTOL aircraft development for future electric environmentally sustainability, very little has been written about the supporting vertiport infrastructure development and regulatory planning / certification required. However, this is about to change as Melbourne city Australia in late 2023, also introduced a bold new vision to be an early developer/ adopter for supporting AAM infrastructure development and certification. Stimulating job and expertise growth in this new and vibrant adjunct industry.

For those of us in the geospatial and navigation industries what does this future opportunity mean? For some it represents a huge fresh “green field” opportunity to finally blend existing high fidelity city-wide 3D building geospatial surface models with those of multiple eVTOL aircraft, into advanced 3D Spatial Artificial Intelligence (3D-SAI) environments. Real time 3D-SAI delivering essential information into Augmented Reality pilot wearable headsets providing critical 3D spatial situational awareness. This type of technology has been a huge part of 3D games for decades, but now, there is finally a solid need to breakout this SD-SAI technology out of the gaming universe and introduce it into real world broadscale usage.

Real time 3D high fidelity situation awareness of the spatial relationships between multiple operational urban AAM aircraft operating in close proximity near the vertiports and static surrounding urban building structures will be safety critical. City / urban planners and government aviation regulators will need to work closely to devise operational corridors and new flight operations regulations/ Minimum Operational Procedures (MOPs). Potentially, a huge force driving rapid growth in navigation and geospatial sciences jobs and expertise.

There is also a huge precision navigation industry need. Arguably only radio based navigation technologies such as GNSS etc, will be sufficiently evolved to deliver the necessary precision positioning in the tightly confined flight corridors. To overcome reduced satellite visibility due to terrain and urban obstructions, multi constellation GNSS (GPS, Galileo, Beidou) and possibly 5G navigation sciences will be required. Aviation industry will need to cease sole reliance on GPS and embrace both Galileo, Beidou and possibly 5G to maintain signal availability. The other important factor here, is that a very significant percentage of eVTOL development is being undertaken by countries outside the US (Europe, Japan, China etc.), so they’ll be keen to incorporate local sovereign navigation infrastructure in their certified flight operations.

The Paris 2024 Olympics is evolving as the first mainstream event to showcase the broad-scale usage of crewed Advanced Air Mobility (AAM) to transport passengers around the city. Apart from the usual athletic competitions in the field, eVTOLs from Volocopter, Ehang, Joby, Eve, and Lilium etc, will potentially be the other high visibility competition that captures global interest. Ushering in the future of new forms of urban transportation, for senior executives and other luxury seeking

E455 VTOL

Event 38 Unmanned Systems, Inc. has announced the launch of its latest aircraft model, the E455. It is as a premier fixed wing, vertical takeoff and landing (VTOL) drone. At 55lbs, the E455 offers a 2-hour flight endurance on battery power alone, it is designed to carry a diverse range of payloads, including mapping sensors, LiDAR, and EO/IR surveillance sensors, meeting the demands of various applications while remaining under the 55lb Part 107 limit. One of its key features is its open protocol payload bay. event38.com

Virtual Surveyor unveils Photogrammetry App

The Terrain Creator app photogrammetrically processes UAV images to generate survey-grade terrains that then transfer into the traditional Virtual Surveyor workspace. Terrain Creator aims to simplify the aerial photogrammetry process by offering a visual and intuitive application to produce an orthomosaic and a digital surface model (DSM) from UAV photos. The software was originally developed to bridge the gap between UAV photogrammetric processing applications and engineering design packages. Prior to this new release, users had to rely on third-party software to generate elevation models and an orthomosaic on which they could work with the Virtual Surveyor toolset. virtual-surveyor.com

Advancing drone thermal mapping

Topodrone recently completed its R&D and released a new drone thermal mapping solution - TOPODRONE PT61 camera can perform detailed surveys and deliver thermal orthomosaic maps obtaining accurate 3D models. It is a camera with 61 MP resolution and a built-in thermal imager, RGB lenses with different focal lengths, a built-in GNSS module and IMU, as well as API for integration with any UAV. The new photogrammetry solution was initially developed in collaboration with AGROWING. <https://topodrone.com>

The obvious challenges for GNSS / radio based navigation operating in these RF congested environments is the threat of intermittent RF Interference. In the short term, eVTOL assured navigation will be augmented with contemporary MEMS IMUs, however, their holdover limitations for a few minutes in dynamic vibration environments means they can't be used exclusively for high Safety and Integrity navigation in piloted eVTOL applications. Alternate sole / primary navigation utilising Quantum IMUs may become significant in the far future, but mass production and affordability won't be achieved anytime soon.

So for now, irrespective of which radio based navigation sensor technology is adopted as a primary PNT function, other supporting GNSS RADAR technologies for RFI signal detection and source geolocation will be essential ingredients for safe urban vertiport operations. Effectively policing the RF spectrum environs particularly in the critical vertiport departure and arrival terminal areas, will be essential. The output of such a system will be instantaneous regional RF Spectrum SA 3D heatmaps, delivered in real time to future pilot 3D-AR headsets. Quantifying where the problem RFI areas are, and how/ where to approach intended a vertiport safely, substantially minimising RFI effects to eVTOL flight operations. Like eVTOL aircraft development, these supporting GNSS RADAR technologies (GRIFFIN) will also enter the market in 2024.

For the geospatial and navigation professionals, all future flight approach and departure corridors designs will require detailed 3D modelling and navigation vulnerability assessments before final flight certification. Vulnerability flight assessment/ modelling will need to be performed in high fidelity 3D synthetic simulated environments well before actual flights are allowed. Matching different aircraft operating constraints/ characteristics to the intended urban vertiport environments. Different buildings with their metalized glass/ façade surfaces

will need to be assessed for both GNSS signal multipath sources and signal obscuration will also need to be included the 3D synthetic simulation mix.

Fortunately, the GNSS industry already has the required laboratory GNSS signal simulation equipment available and is routinely used by the existing avionics industry to perform this type of work. What's new, is the need to combine advanced 3D building induced multipath propagation models that combine RF Ray Tracing source from the high fidelity urban 3D geospatial models. These GNSS simulation tools also have the ability to inject multi source RFI threats into the synthetic modelling sequence. So fortunately, with modern computers and the right GNSS simulation tools, all vulnerability and certification assessment work can be effectively completed from the comfort of an office. Well before needing external validation of real eVTOL flight trials.

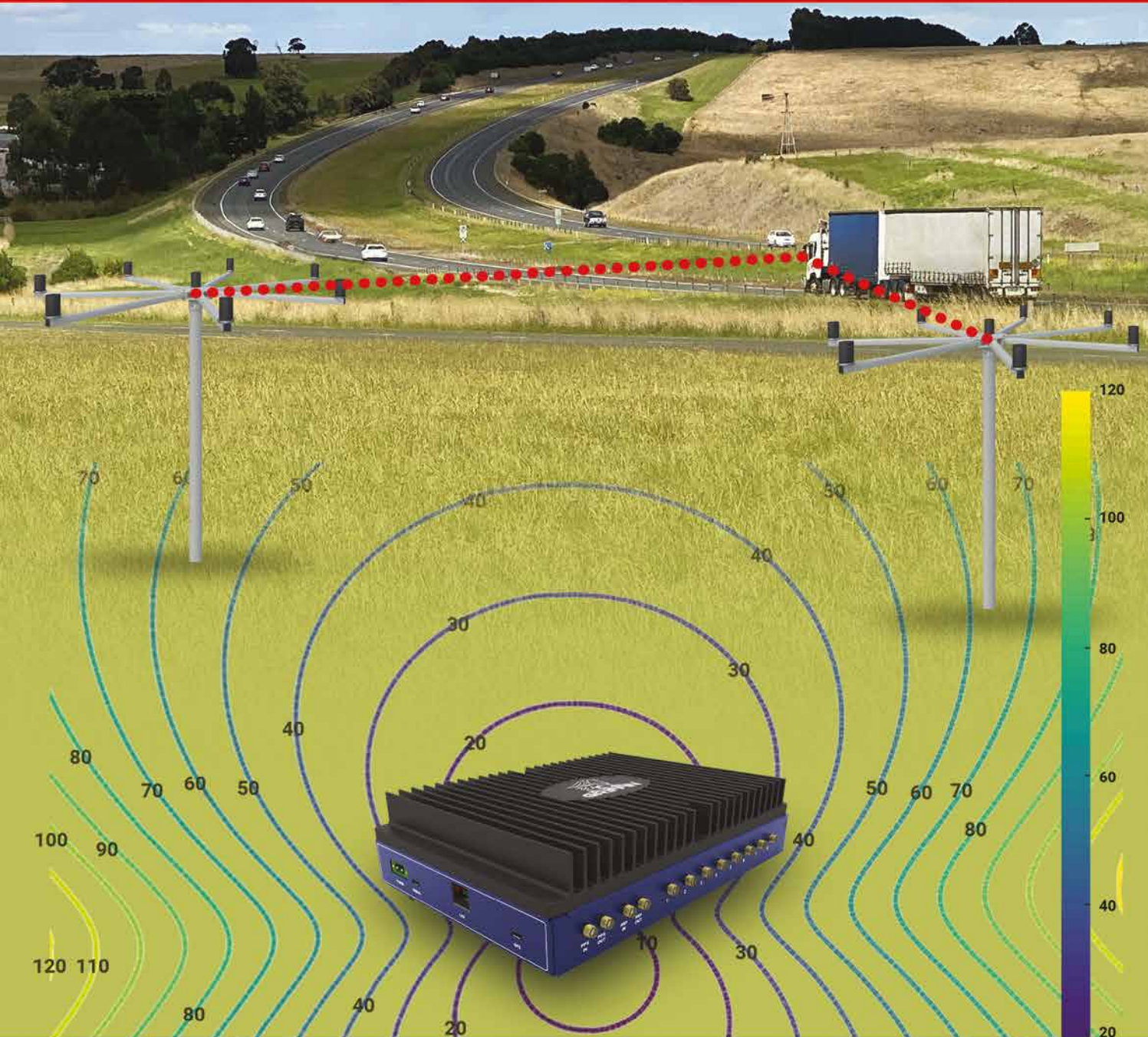
However, to fully support global eVTOL / vertiport vulnerability assessment / development there is a need for real world urban environment building induced wind turbulence analysis and the effects it will have on vertiport operations, impacting multiple aircraft in congested airspace. The good news here is that the civil/ construction urban planning community have these advanced 3D wind models already available. Just like RFI threats the GNSS simulation equipment manufacturers will need to incorporate this 3D information into their synthetic simulation tool suites.

Presumably, for defining future eVTOL dynamic corridor flight paths/ tunnels, the new analysis work will require GNSS signal availability overlaid with RF Multipath, RF Interference, plus changing wind hazards will all need to be combined during detailed 3D analysis. Certainly, exciting times for both the 3D navigation, geospatial communities and avionics manufacturers all working together to deliver safe future AAM flight operations in global city environments. ▽



EMBASSY

PRECISION GEOLOCATION OF MULTIPLE GNSS
JAMMING & SPOOFING THREATS GNSS SPECTRUM PROTECTION



- Single box AOA & TDOA Signal Processing for precision Geolocation
- Dual 8 Channel phased antenna arrays for long range signal detection and tracking
- State of Art weak RFI signal multiple threat processing & array calibrations
- Suitable for permanent building roof top or mobile surveillance van installs

griffin@gpsatsys.com.au



The advantages of BIM technology are particularly evident on large construction sites

Says Nikolaus STUDNICKA, RIEGL Business Division Manager Terrestrial Laser Scanning in an interview with Coordinates



Nikolaus STUDNICKA

under difficult environmental conditions. Once transferred to the office, the georeferenced scan data can be compared with the BIM models.

How quick is the turn-around of data acquisition and processing with this new laser scanner? Please give example of an application where speed becomes critical component.

The RIEGL VZ-600i with its 60 scan positions per hour (6 mm resolution at 10 m distance / 30 million measurements per scan & image acquisition) is currently the fastest scanner in its class.

With an average distance of 10 meters between two consecutive scan positions, e.g., almost five kilometers of road can be surveyed in one working day. With the synchronized CF-Express card, the project can be further processed within 24 hours immediately after the field work on a laptop with the fully

automated “One Touch Processing Wizard” – even if it consists of hundreds of scan positions.

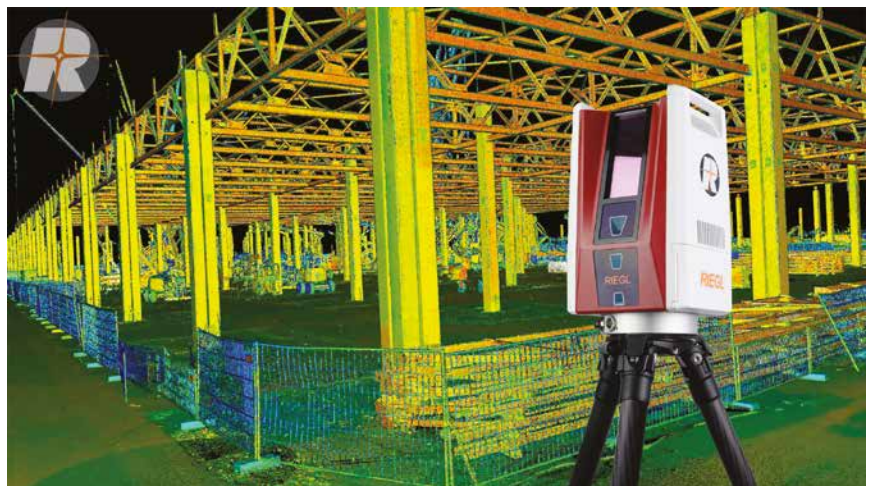
This speed of the RIEGL VZ-600i is a real “game changer” in the daily surveying of construction sites. With so much up-to-date data, the accuracy of the construction work can be permanently checked, the construction progress documented and compared with the BIM model. Due to the speed of the workflow, the surveying work also has hardly any impact on the other work and the use of construction machinery on the construction site.

Describe a few unique challenges that your customers have faced that RIEGL VZ-600i scanner provides and answer to.

Ease of use: If you work with a laser scanner day in, day out, all day long, it should be easy to use for hours on end. You need to be able to rely on the measurement data even under difficult conditions. The 6 kg lightweight

How do RIEGL plan to survive in the “BIM Age” market with the recently launched RIEGL VZ-600i Laser Scanner?

With the extremely fast RIEGL VZ-600i 3D terrestrial laser scanner, we now have the right laser scanner for professional surveying, especially for the requirements of large-scale projects. In addition to extremely fast data acquisition in the field, the robust real-time registration of the scan data – even under demanding conditions – takes place simultaneously during the acquisition of the scan data and the image data on board. The scanner is moved every minute from one scan position to the next and a high-resolution scan is started. The advantages of BIM technology are particularly evident on large construction sites. The RIEGL VZ-600i laser scanner enables the daily measurement of the site even



RIEGL VZ-600i laser scanner achieves a 3D position accuracy of at least 3 mm and has three internal cameras and an integrated (RTK) GNSS receiver. Each complete scan position is triggered at the touch of a single button.


All components are designed for daily use in harsh environments: IP64 device protection class, integrated 1TByte SSD hard disk for maximum data security, additional CFexpress card for high-speed data transfer to the PC.

High-speed workflow: Speed is very important for scan-to-BIM surveying! Project examples completed in record time demonstrate the high productivity and superior performance of the *RIEGL VZ-600i* with spectacular results. Additional tools facilitate the user's work in the field. With the "VZ-i Project Map" app, for example, the progress of data acquisition and registration can be continuously tracked on a mobile device.

The high-precision point clouds can also be evaluated in record time. With the "One-Touch Processing Wizard" in the RiSCAN PRO processing software, various process steps (import / filter / coloring / block adjustment / homogenization / export) can be carried out automatically on the laptop. An automatically generated PDF report provides an overview of the entire project and the accuracies achieved.

Please highlight few examples wherein particularly the newly launched laser scanner provides cost effective solution.

The *RIEGL VZ-600i* is a very versatile 3D terrestrial laser scanner. It is perfectly suited for both outdoor and indoor applications. The construction sector with AEC, BIM, construction site monitoring and management – of course – benefits from the highly precise and fast performance. Other areas of application are tunnel surveying or forestry, as even in these challenging environments the scan positions can already be registered in the field with the robust "voxel registration".

Also worth mentioning: A modern ROS (Robot Operating System) interface is available for the efficient integration of the *RIEGL VZ-600i* on robot platforms, which further increases the scanner's usability. 

Data privacy risks in child-targeted Android apps worldwide

With many children's apps lacking transparency in the data-safety and privacy practices, these apps may also be engaging in invasive practices, potentially exposing children to exploitative advertising and even criminal activity. Incogni analyzed the 10 most popular child-targeted apps from 59 countries and found that half of these apps extensively collect children's data, and many don't follow the best data privacy guidelines. It yielded a total of 74 unique apps—primarily games. The investigation focused on the data safety sections of these apps on the Google Play Store.

The 34 data-collecting apps gather data from an average of 5.7 data points and share from an average of 2.8 data categories. Notably, 11 apps were recognized as particularly data-hungry, collecting 7 or more data points, with five collecting 10 or more, mainly their users' approximate location (4), email addresses (8), photos (2), and purchase histories (8). incogni.com

NHAI signs MoU with NRSC for "Green Cover Index"

The National Highways Authority of India (NHAI) has entered into an MoU with the National Remote Sensing Centre (NRSC) under the Indian Space Research Organization (ISRO) for a period of three years to develop and report a "Green Cover Index" for the extensive network of National Highways in India.

Using the capabilities of emerging technologies to enhance in-situ data collection and supplement plantation management and monitoring, including performance audits conducted by NHAI, the NRSC will undertake a comprehensive pan-India estimation of green cover, referred to as the "Green Cover Index" for National Highways using high-resolution satellite imagery. This innovative approach promises to be a robust and reliable mechanism, providing a time-saving and cost-effective solution to generate a macro-level estimate of the degree of greenness along National


Highways. It will also facilitate targeted interventions in regions that are reported to lack adequate green cover. pib.gov.in

National-scale mapping of soil erodibility in India

Researchers at Indian Institute of Technology (IIT) Delhi have developed a national-scale mapping of soil erodibility, a first of its kind in the country. It highlights specific areas where the soil is most prone towards erosion. The researchers in their study have found that out of the 50 districts with the most erodible soil, 29 are in Uttar Pradesh, 13 are in Bihar, 3 in Gujarat, 2 each in Haryana and Rajasthan, and 1 in Punjab.

The study by Mr. Ravi Raj (PhD Scholar), Prof. Manabendra Saharia and Prof. Sumedha Chakma from the Hydrosense Lab, Department of Civil Engineering at IIT Delhi, exploring the spatial variation of soil erodibility and its relationships with soil properties in India was published in CATENA. The dataset has been freely released as the Indian Soil Erodibility Dataset (ISED, <https://zenodo.org/record/8011445>) at a spatial resolution of 250 m.

The study estimated the national average soil erodibility factors for India as 0.028 and 0.034 t-ha-h/ha/MJ/mm using Nomograph and EPIC models, respectively. The researchers found histosols soil type as least susceptible to soil erosion, having the lowest average K-factor (0.011 t-ha-h/ha/MJ/mm), while the Xerosols soil type was observed as most susceptible to soil erosion, having the highest average K-factor (0.034 t-ha-h/ha/MJ/mm) corresponding to the soil classes in Indian conditions.

In addition to this, the researchers conducted a comprehensive statistical analysis of the soil erodibility map to visualize its distribution over the national territory in terms of the different soil types, textures, and percentage ranges of erodibility values. The results indicated that the K-factor, estimated using the Nomograph approach, exhibited a stronger correlation with the observed K-factors retrieved from the literature. iitd.ac.in 

EU publishes new Galileo Open Service Signal

The European Union Agency for the Space Program (EUSPA), in collaboration with the European Commission, has published a new version of the Galileo Open Service Signal in Space Interface Control Document (OS SIS ICD).

The latest version, denoted v2.1, introduces new elements supporting the improvement and enlargement of the Galileo service portfolio. OS SIS ICD v2.1 is available along with a corresponding new version of the OS Service Definition Document (OS SDD).

New elements in v2.1 include the definition of OS Extended Operation Mode (EOM) and criteria for identifying when it is activated; description of a new ARAIM Integrity Support Message (ISM), and a new annex detailing a numerical example for the computation of its 32-bit checksum; and a new annex detailing the Galileo PRN Codes Assignment process, including codes belonging to the families E1 B, E1 C, E6 B, E6 C, E5a I, E5a Q, E5b I, E5b Q are now available.

The annex dealing with the authorization of Galileo trademarks, now obsolete, has been removed.

The Galileo OS SIS ICD provides the information required by receiver and chipset manufacturers, application developers and service providers to process the open service signals generated by Galileo satellites. It specifies Galileo signal characteristics; characteristics of Galileo spreading codes; Galileo message structure and data contents; and OS Signal in Space flags. www.euspa.europa.eu

China launches two new BeiDou satellites

China added a new pair of satellites to its BeiDou positioning and navigation system recently, but spent stages from the launch landed within inhabited areas. A Long March 3B equipped with a Yuanzheng-1 upper stage lifted off from

the Xichang Satellite Launch Center at 10:26 p.m. on Dec. 26 successfully delivering two Beidou satellites into medium Earth orbit (MEO). The spacecraft are the 57th and 58th Beidou satellites to be launched. spacenews.com

Silicon-to-cloud locationing solution using Wi-Fi, cellular IoT, and GNSS

With the introduction of the nRF7000 Wi-Fi companion IC, Nordic Semiconductor is now established as the world's first sole supplier of a complete silicon-to-cloud locationing solution with Wi-Fi, cellular IoT, and GNSS.

Nordic's SSID-based Wi-Fi locationing enables the acquisition of accurate location fixes in an extremely power-efficient manner both indoors and outdoors, in urban and suburban areas. This is a valuable complement to GNSS, especially in buildings and in dense urban areas where GNSS can fail due to signal fading and interruptions. www.nordicsemi.com

savvy navy, ProtectedSeas enhance marine navigation app

savvy navy has partnered with ProtectedSeas to bring ProtectedSeas Navigator data to boaters through the savvy navy app.

ProtectedSeas Navigator provides boaters with 22,000 marine protected and managed areas in more than 220 countries. These areas include speed-limit zones to protect marine mammals, fisheries management areas and more. It compiles marine protection information into the Navigator database of marine protected areas (MPAs). savvy-navy.com

Rakon releases two new GNSS Receivers

Rakon announced two new NewSpace GNSS Receivers to complement its GNSS Receiver Daughter Board (DB) released last year. The GNSS Receiver SINGLE and GNSS Receiver DUAL are advanced Commercial Off-The-Shelf (COTS) GNSS Receivers with low power

consumption and are specifically designed for small and nanosatellite platforms and LEO PNT payloads. Both pieces of equipment feature multi-band and multi-constellation support (including the newly released E6 signal) and can process signals from up to 448 channels simultaneously to provide high-performance position, velocity and timing. <https://rakon.com>

Qualcomm supports NavIC L1 signals

Qualcomm Technologies, Inc, in collaboration with the Indian Space Research Organisation (ISRO), has announced support for the new and recently launched L1 signals of India's navigation satellite system NavIC (Navigation with Indian Constellation) in select chipset platforms across the Company's upcoming portfolio.

Qualcomm Location Suite now supports up to seven satellite constellations concurrently, including the use of all of NavIC's L1 and L5 signals for more accurate location performance, faster time-to-first-fix (TTFF) position acquisition, and further improved robustness of location-based services. www.qualcomm.com

TW5394/TW5794 precise heading antenna by Tallysman

Tallysman Wireless has introduced the TW5394 Smart GNSS Precise Heading Antenna, which supports moving-base RTK precise heading and PPP-RTK high precision location capability via L-Band. The TW5394/5794 combines Tallysman Wireless' multi-band Accutenna technology with u-blox's Zed-F9P GNSS and NEO-D9S L-Band receivers. The integrated L-Band receiver allows operators to deploy an augmented position solution when operating outside of terrestrial communications range by receiving PPP-RTK augmentation directly from the satellite. Deployment of two TW5394/5794 devices as a moving base + rover antenna pair enables a precise heading solution, yielding 0.4° heading accuracy when deployed with a minimum 1-meter baseline. Communication interface options include USB or RS-232 to the host system. tallysman.com

ESP introduces ESP Ocean

ESP Logistics Technology (ESP is excited to introduce its ESP Ocean platform, tracking 250,000 ships daily. It was designed to enable companies to better understand the flow of ocean cargo, facilitating enhanced business and resource planning based on cargo ETAs, and mitigating disruptions. It goes beyond cargo visibility by offering recommendations and alternative actions to avoid potential issues. The platform integrates with 7000+ Esri Living Atlas data layers, including current and projected weather impacts, geopolitical risks, seasonal peaks, shipping lane congestion, and port congestion. www.esplasticstech.com

Introducing 5G and IoT innovation in India

BITS Pilani and Airlinq announced a collaboration to lead the charge in 5G and IoT innovation. Airlinq USA, specialises in telecommunications and Internet of Things (IoT) solutions. The collaboration is a part of the recently launched '5G Use Case Labs' at the recently concluded Indian Mobile Congress 2023

AI tugboat navigation & monitoring solution

Seadronix has launched its cutting-edge real-time remote ship navigation assistance and monitoring service 'NAVISS Admin.' NAVISS (Ship Monitoring and Navigation System) represents a game-changing development for tugboat fleet operations. For the first time, AI-powered navigation assistance and monitoring are enhancing operational safety and efficiency while mitigating the risks associated with navigating congested port waters and towage operations. The NAVISS system comprises both onboard and onshore components, seamlessly connecting tugboat fleets to onshore operators. Onboard sensor modules provide a real-time 360° top-view video of the tugboat with AI-enabled maritime object detection capabilities, offering tugboat operators complete situational awareness during navigation and towage maneuvers. www.seadronix.com

DeepRoute.ai partners with Tencent Map

DeepRoute.ai has announced a collaboration with Tencent in the field of maps. The joint solutions will be integrated into consumer vehicles set to debut in 2024, encompassing a range of car models such as sedans, SUVs, and MPVs. This marks the first commercial implementation of both the Driver 3.0 Mapfree solution and Tencent Standard Definition map (SD map).

Uber names HERE Technologies as global location provider

HERE Technologies and Uber Technologies announced a long-term collaboration to enhance Uber's mapping capabilities globally for rideshare and food deliveries. The agreement builds on HERE and Uber's existing partnership and will help bring further advanced location-aware tools and functions to the Uber platform. www.here.com

Mapbox and Hyundai Autoever to cooperate on 3D navigation

Mapbox announces its collaboration with Hyundai Autoever. Together, Mapbox and Hyundai Autoever are set to redefine the driving experience by developing an AI-powered digital ecosystem centered around Mapbox MapGPT, a location-intelligent AI voice assistant capable of natural and actionable conversations within vehicles and mobile applications. The parties have demonstrated the viability of the solution in a proof of concept and are now taking joint steps to commercialize the solution. www.mapbox.com

SiTime solves critical challenges in GPS-enabled defense systems

SiTime Corporation has announced its Endura Epoch Platform™ built for robust and resilient positioning, navigation and timing (PNT) services critical in defense operations. The ruggedized MEMS oven-controlled oscillator (OCXO) boosts the resilience of PNT systems and other equipment, such as radars, field and airborne radios, satcom terminals and

avionics against spoofing, jamming and other disruptions in GPS signals. sitime.com

Trimble partners with HALO Trust

Trimble and the Trimble Foundation Fund have partnered with The HALO Trust - landmine-clearing non-profit organization, to help expand its de-mining operations across Ukraine. The Foundation Fund directed grant focuses on strengthening the HALO Trust's capacity to locate and remove landmines, unexploded ordnance, and other explosive hazards from civilian areas to create safer communities. www.trimble.com

Firmware Version 4.3.00 by JAVAD

JAVAD GNSS releases GNSS firmware version 4.3.00, with support for newly designed receivers and receiver's revisions, new features for improved performance of JAVAD receivers, as well as enhancements and bug fixes. Full details are available in the release notes and specifications are included in the GNSS Receiver External Interface Specification (GREIS) www.javad.com

Antenova releases L1 GNSS ceramic antenna

Antenova has released the Admotus antenna, the latest addition to its product line of ceramic antennas. It is a surface-mount ceramic antenna designed for connectivity on L1 GNSS signals on all constellations, including GPS-L1 at 1575.42 MHz; GLONASS L1, 1602MHz; Galileo L1, 1575.42 MHz; BeiDou (B1); and QZSS. The compact antenna offers comparable performance to a small patch antenna on a small ground plane. antenova.com

Harxon launches HX-CSX600A

Harxon has launched HX-CSX600A antenna. It has a pre-filtered low noise amplifier (LNA) offering out-of-band rejection, ensuring strong anti-interference performance even in challenging environments. The antenna offers reliable and consistent satellite signal tracking

across a wide range of frequency bands, including GPS, GLONASS, Galileo, BeiDou, QZSS, IRNSS, SBAS, as well as L-band correction services. harxon.com

CHC introduces H3

CHC Navigation (CHCNAV) has announced the launch of its H3 GNSS monitoring receiver. The H3 integrates millimetre accuracy positioning, communications, and sensor technology in a single enclosure. The H3 seamlessly combines a GNSS antenna and module, a high-end MEMS sensor, and a 4G modem into one integrated system. This eliminates the need for external components beyond a power supply, streamlining field installation. The built-in MEMS sensor provides additional tilt and vibration data for comprehensive monitoring. chcnv.com

Exail launches Atlans 3

Atlans 3 is an inertial navigation system (INS) designed for land and air mobile mapping applications. The device is an all-in-one positioning and orientation system integrating unique micro-electro-mechanical systems. MEMS-FOG hybrid technology and a dual-antenna real-time kinematic GNSS receiver are housed within one compact device. The Atlans 3 offers north-keeping capability at FOG-level performance across a variety of land and air mobile mapping applications. It delivers real-time heading, even in GNSS-challenging environments such as urban canyons, mountainous terrain, or forested areas. exail.com

Trimble to provide advanced positioning systems to Sabanto

Trimble's Dual Antenna GNSS receiver and real-time positioning service will provide centimeter-level accuracy for farmers utilizing autonomous equipment. Trimble and Sabanto have announced the integration of Trimble BX992 Dual Antenna GNSS receivers with Trimble CenterPoint® RTX into Sabanto's autonomy solutions. Trimble will act as Sabanto's key autonomous technology provider, delivering high-accuracy positioning to its fleet. www.trimble.com

ANELLO Photonics launches ANELLO X3

ANELLO Photonics has unveiled the ANELLO X3, a 3-Axis optical gyroscope Inertial Measurement Unit (IMU). Leveraging the ANELLO SiPhOG (Silicon Photonics Optical Gyroscope) technology, this tri-axial optical gyroscope promises high accuracy, performance, and reliability, catering to autonomous applications. www.anellophotonics.com

Syrlinks selected to equip LeoStella's LS-300 satellite buses

Safran has secured a contract to equip LeoStella's LS-300 satellite buses with their N-SPHERE GNSS receiver. This collaboration strengthens the partnership between Syrlinks, a producer of radiocommunication and geolocation systems for the space industry acquired by Safran in 2022, and LeoStella, a manufacturer of small satellite constellations in the United States. The N-SPHERE solution's positioning and synchronization techniques aim to enable real-time precise onboard orbit determination (P2OD). It can synchronize with various GNSS systems, offering high-precision positioning at an accuracy level of around 10 centimeters. www.syrlinks.com

Kinetica launches Quick Start for SQL-GPT

Kinetica, the real-time database for analytics and generative AI announced the Quick Start for deploying natural language to SQL on enterprise data. It is for organizations that want to experience ad-hoc data analysis on real-time, structured data using an LLM that accurately and securely converts natural language to SQL and returns quick, conversational answers. Its database converts natural language queries to SQL, and returns answers within seconds, even for complex and unknown questions. It converges multiple modes of analytics such as time series, spatial, graph, and machine learning that broadens the types of questions that can be answered. www.kinetica.com

MARK YOUR CALENDAR

February 2024

Geo Week 2024

11 - 13 February
Denver, CO, USA
<https://www.geo-week.com>

MENA Geospatial Forum

14 - 15 February 2024
Dubai, UAE
<https://menageospatialforum.com>

March 2024

Geo Connect Asia

06 - 07 March 2024
Singapore
<https://www.geoconnectasia.com>

DGI 2024

11 - 13 March
London, UK
<https://dgi.wbresearch.com>

Munich Satellite Navigation Summit 2024

20 - 22 March
Munich, Germany
www.munich-satellite-navigation-summit.org

April 2024

GISTAM 2024

02 - 04 May
Angers, France
<https://gistam.scitevents.org>

IGRSM Conference 2024

29 - 30 April
Kuala Lumpur, Malaysia
<https://conference.igrsm.org>

May 2024

FIG Working Week 2024

19 - 24 May
Accra, Ghana
www.fig.net/fig2024/Welcome.htm

June 2024

GEO Business 2024

05 - 06 June
London, UK
<https://www.geobusinessshow.com>

July 2024

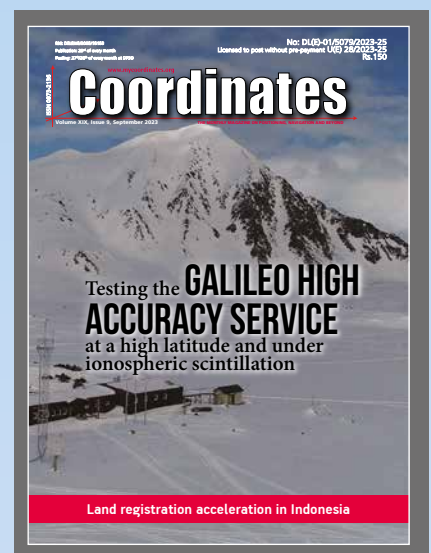
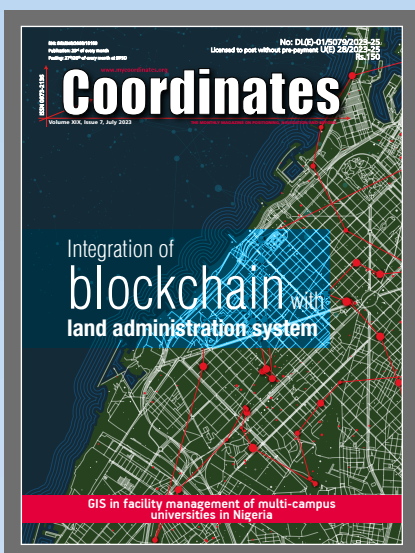
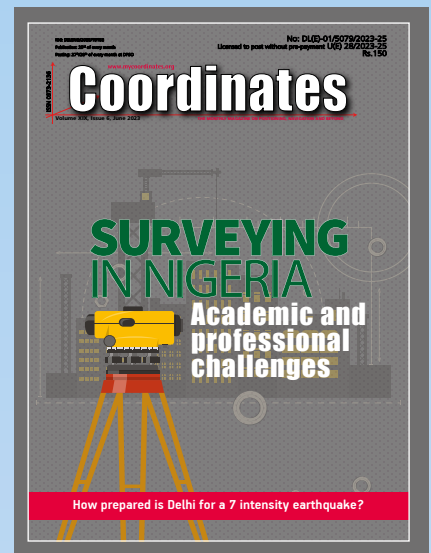
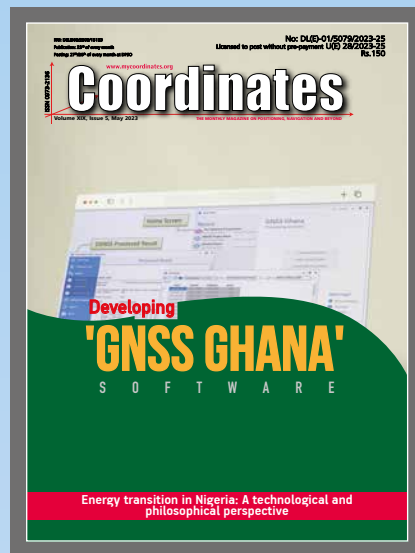
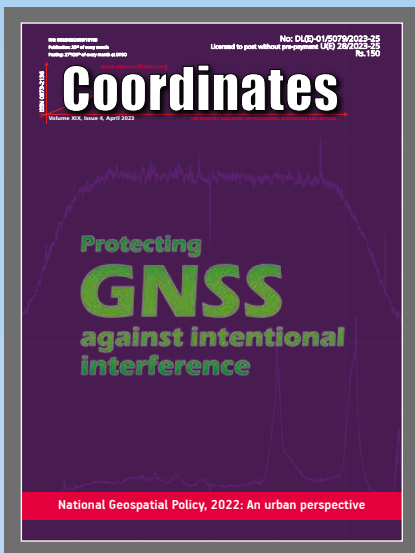
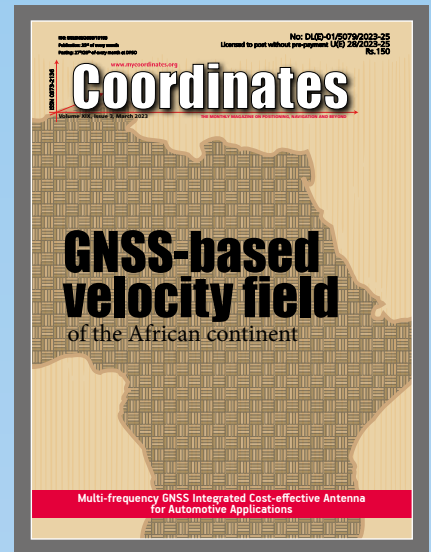
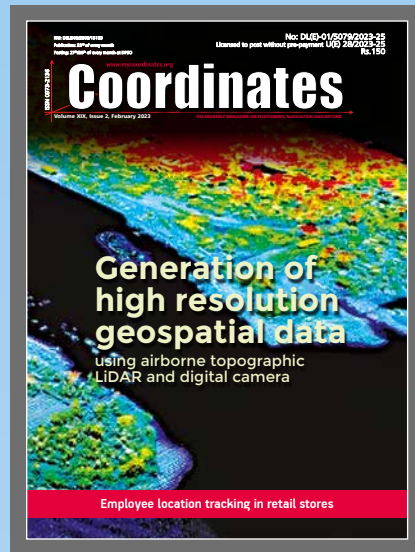
Esri User Conference

15 - 19 July 2024
San Diego, CA, USA
www.esri.com

August 2024

International Geographical Congress 2024

24 - 30 August
Dublin, Ireland
<https://igc2024dublin.org>



“The monthly magazine on Positioning, Navigation and Beyond”
Download your copy of Coordinates at www.mycoordinates.org



0.05°
ATTITUDE

0.02°
HEADING

1 cm
POSITION

NEW ELLIPSE-D

The Smallest Dual Frequency & Dual Antenna INS/GNSS

- » RTK Centimetric Position
- » Quad Constellations
- » Post-processing Software



Ellipse-D
RTK Dual Antenna



Ellipse-N
RTK Single Antenna



OEM
RTK Best-in-class SWaP-C