THESIS : SSA (Space Situational Awareness) Tracking using SLR (Space Laser Ranging)

Orbital Space is getting congested day by day. Currently there are about 11,000 satellites (LEO+GSO) orbiting earth - LEO satellites makes up 90% of it. Considering India's space sector growing at a rapid rate especially with the private players (Pixxel, Bellatrix, Skyroot and much more) building satellites, number of india made satellites will reach ~450 by the end of this decade and near earth satellites count globally estimated to reach 40,000 by 2035.

Along with spatial debris count growing at near exponential rate - there's a critical need for SSA Tracking based solutions that help satellites detect, avoid catastrophic solutions and maneuver safely.
Current tracking based solutions for Indian satellites are satisfied by US Space Force, western players : LeoLabs, ExoAnalytic Solutions. But their services are delayed (high latency), resolution limited, lower accuracy and highly expensive.
With space increasingly being seen as a critical warfighting domain, sovereign SSA tracking solutions are necessary and currently the only startup working on this is : Digantara.

SSA Tracking is currently dependent on :
1) Ground based multitude system of powerful telescopes and radars.
2) Constellation of space surveillance satellite SCOT (Space Camera for Object Tracking) - This is where Diganatara fits in.
3) Satellite Laser Ranging ground stations.

Legacy players operate in the 1st and 2nd ways, whereas no companies in APAC region solve this with SLR Technology.
Conventional ground based approach (radars and telescopes) is cheap but highly non-precise and delayed.
Satellite based solution is effective in tracking but highly expensive both in Capex and maintenance terms.

Opportunity:
Satellite Laser Ranging (SLR) is a proven, high-precision space surveillance technique that measures the exact distance to orbiting satellites, The process involves transmitting powerful, ultrashort laser pulses from ground station toward a satellite's retroreflectors; the pulse bounces back, and is repeated at high frequencies. This outputs a stream of data points and round trip time that gives a satellite's precise orbit achieving mm to cm level precision (200x more precise), and is far more cost-efficient than conventional methods.

SSA Tracking Method through	Investment	Precision	Est cost
System of ground radars and powerful telescopes	LOW	LOW	LOW
Space surveillance satellites	HIGH	HIGH	HIGH
System of SLR ground stations	**MEDIUM**	**HIGH**	**VERY LOW**

This leaves a white space gap in SSA surveillance and tracking - SLR based solution thats ultra-high precise and cost-effective at the same time.
Fact: There is no single startup in entire APAC space which uses SLR for SSA tracking.

Why now?

1) Sovereign Capability Mandates and government regulation tailwind :
India is aggressively investing in sovereign SSA capabilities to reduce their reliance on foreign data sources. India's **Project NETRA** is a cornerstone of this strategy.
Foreign players are not allowed to enter Indian market individually and requires them to form JVs/Partnerships with ISRO or local players to provide their services.
The idea of 'self-reliance' signifies a major green flag.

2) Explosive market growth and surging commercial demand:
Global SSA systems market is projected to grow from $ **1.7 bn** in 2025 to **$2.5bn** by 2030 Basis1. The Asia-Pacific region is the primary driver of this expansion, with a forecasted CAGR of **9.25%**.
The rapid deployment of LEO mega constellations for broadband and Earth observation has created a massive commercial market for flight safety services.

3)Technological Breakthrough and viability :
The economics of SLR are becoming more favorable. The development of compact, lower-cost "miniSLR" systems is reducing the capital expenditure required to build a network.

Market Size: Global SSA market stands at $1.7 bn. Considering bottom-up TAM build for India + rest of APAC :

Segment	No of satellites (est.)	Price/sat/yr	ARR
APAC	1200 (Present)	$40,000	$50 mn
ISRO	130 (Present)	$40,000	$5.2 mn
India	450 (by 2030)	$40,000	$18mn
APAC	5000 (by 2030)	$40,000	$200 mn

Within next 5 years Indian SSA market (only 1 SSA player as of now) will alone by worth $18 mn and APAC (no SLR firm as of now) at $200 mn.

Ideal Customer Profile (ICP)

Customer Persona	Target	Use case
Government and Defence Agencies	INDIA : DRDO,ISRO (NETRA) ,JAXA APAC : MYSA	Augmenting with national SSA networks, satellites maintenance
Private Indian and APAC Satellite operators	Pixxel, Skyroot, Agnikul Bharti Aritel (OneWeb)	Precise Orbit Determination, collision avoidance, anomaly tracking
Space Insurers	New India Insurance, TATA AIG, Aon	Accurate risk modeling for underwriting, verifying orbital insertion and claims processing

Competitive Landscape :

1) *SLR Vendors* : In APAC region, there are no companies yet solving SSA tracking with SLR stations. Globally, few exist :

DiGOS Gmbh - A German emerging company that develops turnkey Satellite & Space Debris Laser Ranging Stations - no APAC presence yet.

EOS - A legacy Australian defence company designing and operating SLR stations for in-house vertical use cases only.

2) *Non-SLR Solutions:*

India : Diganatara - Building 2 component system of ground observatories and constellation of nano-satellites in LEO to monitor orbital space.

Global : LeoLabs - Operates a global network of phased-array radars for tracking.

ExoAnalytic Solutions - Operates an ocean of commercial optical telescope network.

Slingshot Aerospace - Utilizes both network of optical sensors and focuses on data analytics to provide SSA products.

Risks and Mitigations :

1) Initial Capex Heavy : Laser Transmitter and high-power optics cost thousands of dollars. Each station set up might cost $400-700K.

Mitigation : But once the initial investment, later on maintenance and operational expense is very minimal. With IN-SPACe and TAF, CAPEX could be subsidized upto 40-50%.

2) SLR is weather dependent and needs near-clear skies. Indian monsoon season and regional atmospheric conditions could significantly reduce station uptime and data availability.

Mitigation : Deploy a distributed network with stations in geographically and meteorologically distinct locations (like Mount Abu in the west, Ponmudi in the south). Develop sophisticated network scheduling software to dynamically allocate tracking tasks to the station with the best weather forecast.

CONCLUSION:

India and APAC are entering a phase of explosive satellite growth, yet the region lacks high-precision, sovereign SSA infrastructure. SLR-based tracking uniquely delivers centimeter-level accuracy at far lower operating costs than radar or space-based sensors, making it the optimal solution for next-generation orbital safety.

With strong regulatory tailwinds (Project NETRA, self-reliance mandates), rapid commercial deployment of LEO constellations, and no existing SLR players in APAC, the market presents a clear white-space opportunity.

As demand for real-time orbit intelligence surges, an India-led SLR network can become a strategic, defensible, and highly recurring SSA business.

References :