

Hirokazu Mori

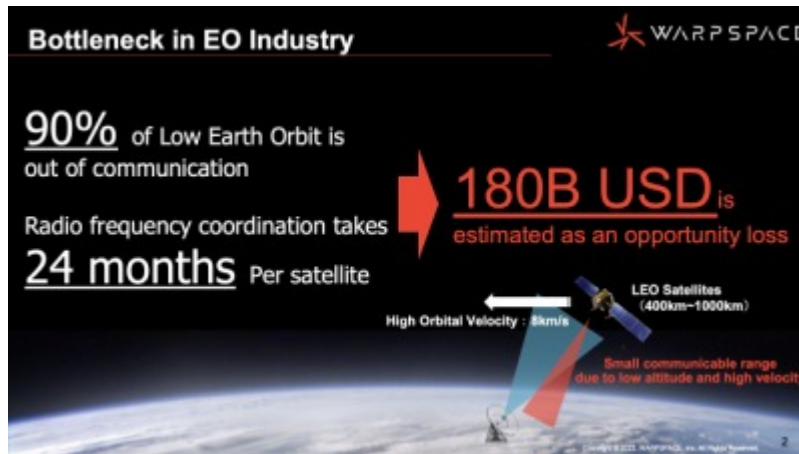
WARPSPACE Inc. Chief Strategy Officer, WARPSPACE USA CEO.

EO Industry Overview&Issue

Along with technological advancements, a lot of organizations have been launching satellites into low Earth orbit (LEO) for various types of missions and this brings exponential growth to the space industry as a whole.

When looking at space-based applications, Earth observation (EO) has been booming as it's utilized in multi-sectors such as the primary sector, logistics, finance, national security, and most importantly disaster management, and it will keep growing for the next decades.

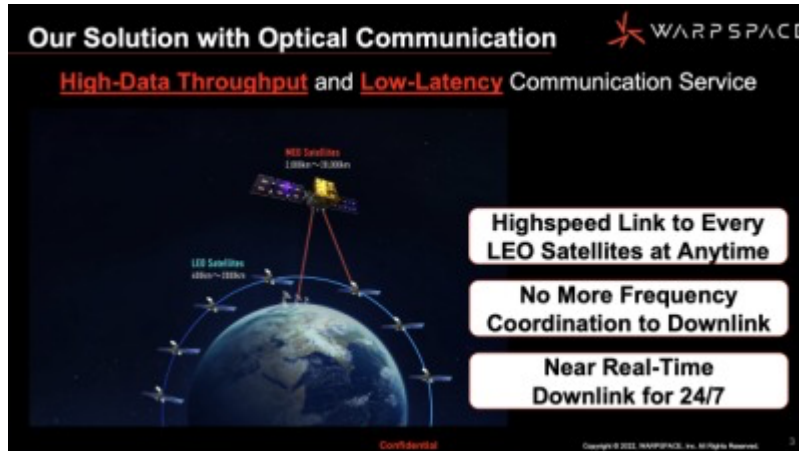
And yet, since the amount of data downlinked from EO satellites increases, the current communication infrastructure is not capable of leveraging further market growth so Optical Inter-Satellite Links (OISLs) get more attention than ever for two major reasons.



One is that communication opportunity is lacking as the visible time of ground stations from each satellite is limited (10 mins out of 90 mins), and the other is that it takes satellite operators 2 years on average for radio frequency coordination per satellite. These communication issues bring a huge opportunity loss.

Solution

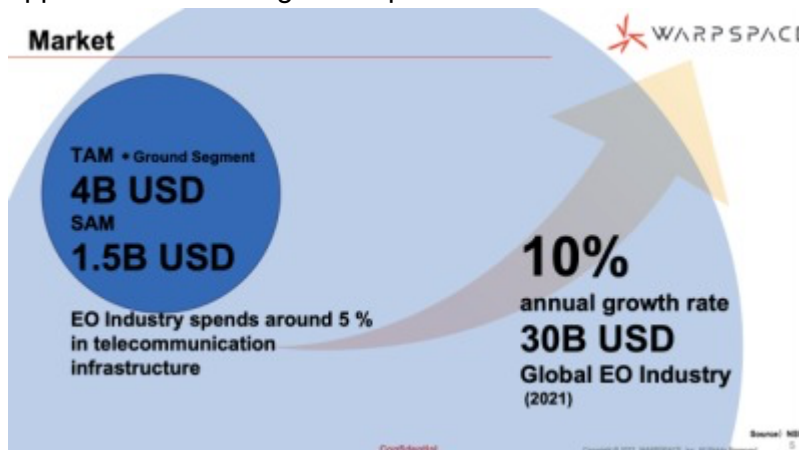
WARPSPACE develops "WarpHub InterSat", an optical inter-satellite data relay network as a service that enables LEO satellites to communicate in near real-time at a high data throughput.



The network consists of three data relay satellites in MEO equipped with optical communication terminals (OCT). Those MEO satellites relay the data from LEO satellites and downlink to the ground stations via both radio and optical laser links.

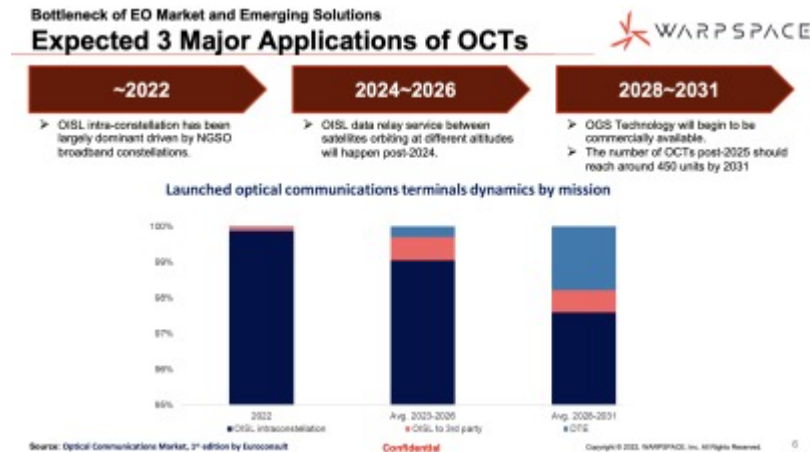
Market Growth of EO Industry and Optical Communication in Space

Looking at the market, it'll keep growing for the next decades as various types of EO-based applications are being developed.



Also, Euroconsult has issued the latest report about Optical Communication Terminals (OCTs) and their expected applications. According to the report,

1. OISL data relay service between satellites orbiting different altitudes will happen post-2024.
2. OCTs are expected to surpass 70,000 units in orbit by 2031.
3. The number of OCTs post-2025 should reach around 450 units by 2031.



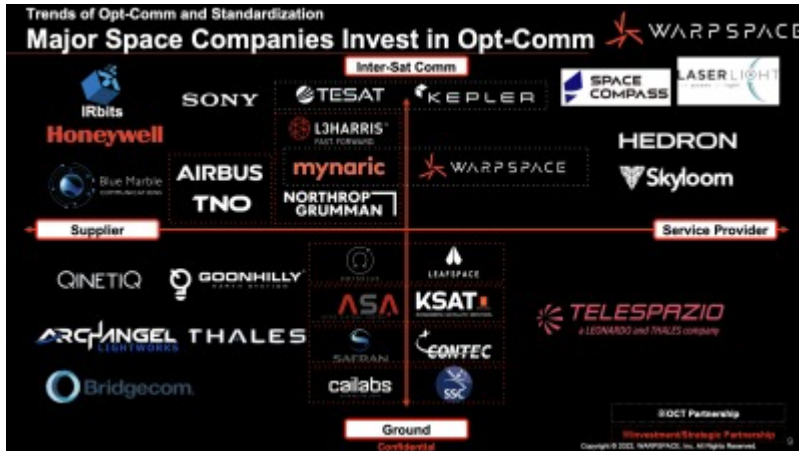
Near Real-time EO-based Applications

By having access to the near real-time network connecting EO satellites and ground, we will be able to leverage the EO data-based applications such as disaster management, national security, logistics, etc.



Trends of Optical Laser Communication and its Standardization

Since 2021, numerous companies have been investing in optical communication technologies and the Space Development Agency of the Pentagon has been actively leading the standardization of optical communication by publishing the standards for optical communication terminals.

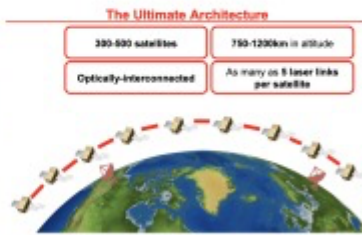


Standardization is led by the Department of Defense for national security purposes and the architecture is segmented layer basis. Some U.S. companies have been awarded and manufactured satellites.

Trends of Opt-Comm and Standardization

Standardization of Opt-Comm is Led by U.S. WARPSPACE

- The Space Development Agency (SDA) develops the United States' future resilient satellite architecture and is investing in OISL as a key element of its initial "Transport Layer" constellation including the ground segment.
- Transport Layer is primarily focused to provide an assured, resilient, and low-latency data network with the OISL.

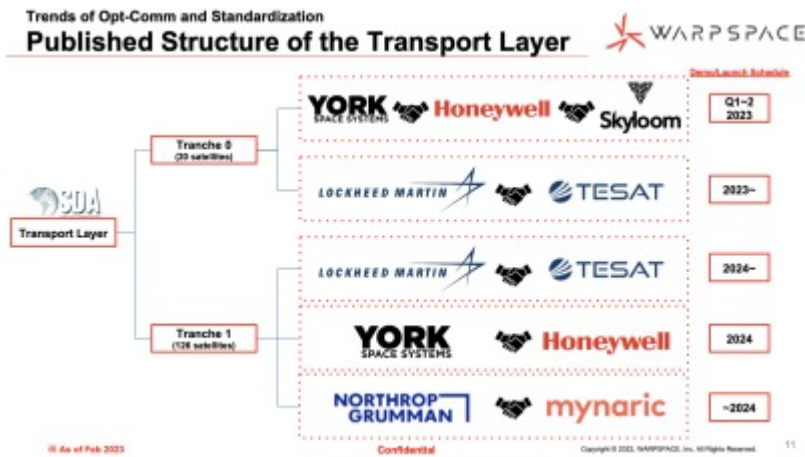


TM PWSA, a trademark of WARPSPACE, Inc. Technical resource: SDA's "Transport 1" Optical Communications Standard

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Why Optical?

Compared to conventional RF communication, optical has 4 major advantages. Especially, as highly sensitive data are being transmitted via the network, counter-measurement against cyberthreat is critically important to protect the data. For that sake, an optical link has an advantage rather than RF.

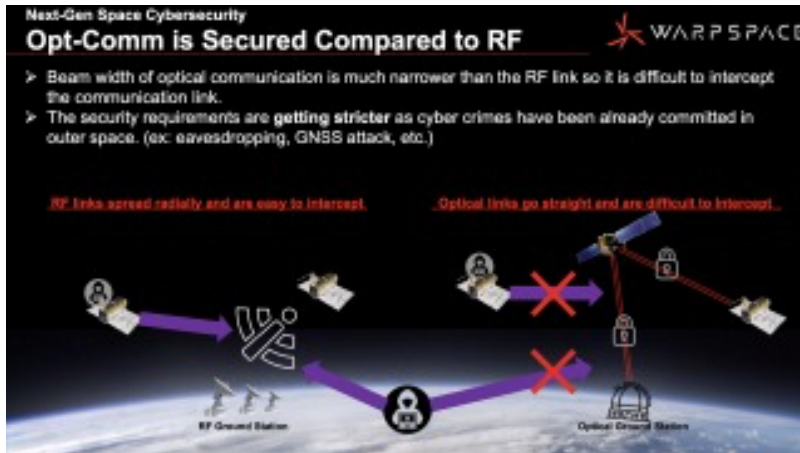
Emerging Opt-Comm-Related Players
Optical Has Four Major Advantages 

	RF	Optical
Data Rate	~1Gbps	1Gbps ~ 100Gbps
SWaP (Size, Weight, and Power)	-	50% less Mass, 25% less Power (Compared to the RF)
License/ Coordination	✓ (It takes approx. 2 years)	Not Necessary (as of Today)
Cyberattack Risk	Relatively High	Low
Atmospheric Disturbance	Small	Big

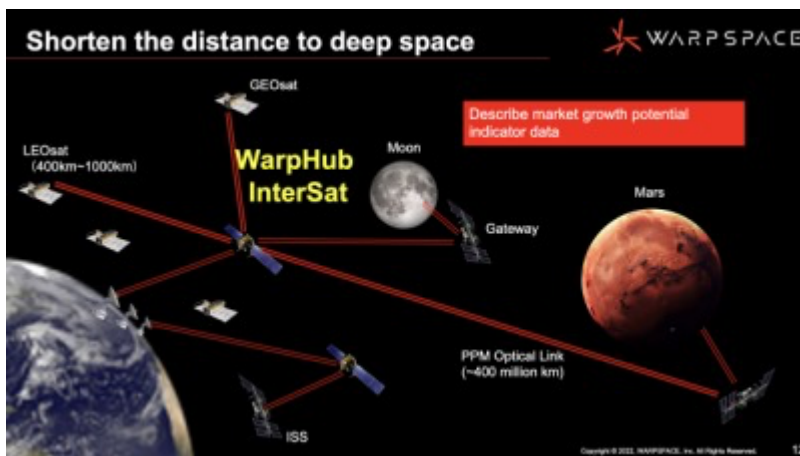
Major Advantages of Opt-Com are:
**High-Data Throughput, Communicable Distance,
 High-Security, & Smaller SWaP**

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Especially, sensitive data captured by satellites are being transmitted via networks so cybersecurity is a key factor to be considered. An optical link is more secure as the bandwidth is narrower than the RF.




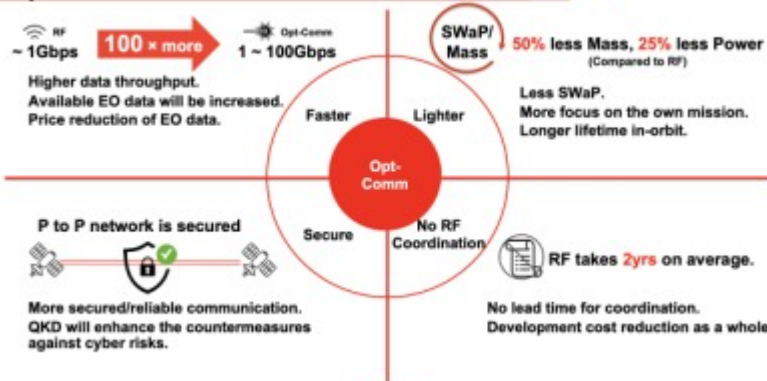
Future of OptComm in Space



Some nations have announced that they will invest in deep space exploration such as the Moon and Mars including the Artemis Program. In order to accelerate the Lunar mission, optical communication is a must-have to connect the Earth and the Moon at a 384,400 km distance with a stable communication link, accurately manoeuvre spacecraft and communicate with astronauts.

Summary

Conclusion
Opt-Comm will Cover the RF's Weakness 



RF - 1Gbps **100x more** **Opt-Comm** 1 ~ 100Gbps

SWaP/Mass 50% less Mass, 25% less Power (Compared to RF)


Faster Higher data throughput. Available EO data will be increased. Price reduction of EO data.

Lighter Less SWaP. More focus on the own mission. Longer lifetime in-orbit.

Secure P to P network is secured. More secured/reliable communication. QKD will enhance the countermeasures against cyber risks.

No RF Coordination RF takes 2yrs on average. No lead time for coordination. Development cost reduction as a whole.

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Conclusion
Today's Key Takeaways 

- 1 Market Growth and Issues**
 - > Space-ground comm via RF link has become a huge bottleneck.
 - > EO sat operators/end users seek low latency, high data throughput, and a secured network.
 - > RF coordination takes a huge economical and human resource cost.
- 2 Opt-Comm Gets Attention**
 - > Large corporations as well as emerging startups started investing in DCTs.
 - > Standardization is ongoing mainly led by the Space Development Agency (SDA).
- 3 What Opt-Comm Brings**
 - > Low latency, high-security, and high data throughput networks will be available.
 - > Enhance the QKD implementation.
 - > No lead time for the frequency coordination.

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Team

Core Members 

CxO

 CEO Satoru Tsunematsu (Entrepreneur, LL.M.)	 CTO Akhiro Nagata (Ex. JAXA Lab)	 COO/General Manager Hiromitsu Azuma (Entrepreneur, Cyber Security Specialist)	 CFO Akira Kitahara (Ex. Credit Agricole)	 CSO Hirotaka Mori 20% Space Startup Co-Founder
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Engineering

 Satellite Engineer Daniele Inorta (Ex. SE Manager at EUMETSAT)	 Mission Engineer Raafat Ahmad (Ex. AI/ML Robotics Startup, etc.)	 Field Application Engineer Andrea Gianfermo
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Hands-On Advisory

 Cosmonaut Takashi Hirasawa (Ex. Director of JAXA)	 Technical Advisor Kazuhide Todome (Ex. PM of OICETS Project)	 Technical Advisor Prof. Hisanobu Takayama (Ex. Optical Communication Researcher at JAXA)
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