Optical Laser Communication

Identifying the disruptions/disruptors

NASA LADEE Interplanetary Mission	Sep' 2013	2 way| Pulsar laser beam | Moon to Earth|
EADS Cassidian & Mynaric Jet/Flight platform mission	Nov' 2013	flight speed of 800 km/h, fast flight maneuvers, strong vibrations
EDRS	Nov' 2014	1st Gigabit laser-based communication relay network LEO <-> EDRS <-> GEO <-> Ka-band <-> Earth
NASA OPAL Space to Ground mission	Dec' 2014	Breakthrough in Space to Ground mission
NICT SOCRATES Micro-Satellite mission LEO to Ground	2014	First LEO to Ground mission
Google X Loon Stratspheric Ballons	Feb' 2016	2 balloons 100 kms aways
Facebook Aquilla + Mynaric Air-to-Ground mission	2018	Flight 9 kms away from ground
Psyche mission	2022	Deep space optical comm
NICT HICALI GEO to Ground	2022	Fastest bidirectional lasercom link HICALI (High-speed Communication with Advanced Laser Instrument) first intersatellite link at the same high speed between a CubeSat in LEO and HICALI in GEO

2 Sections

1. Disruptions Scanning
2. Airbus Focus areas

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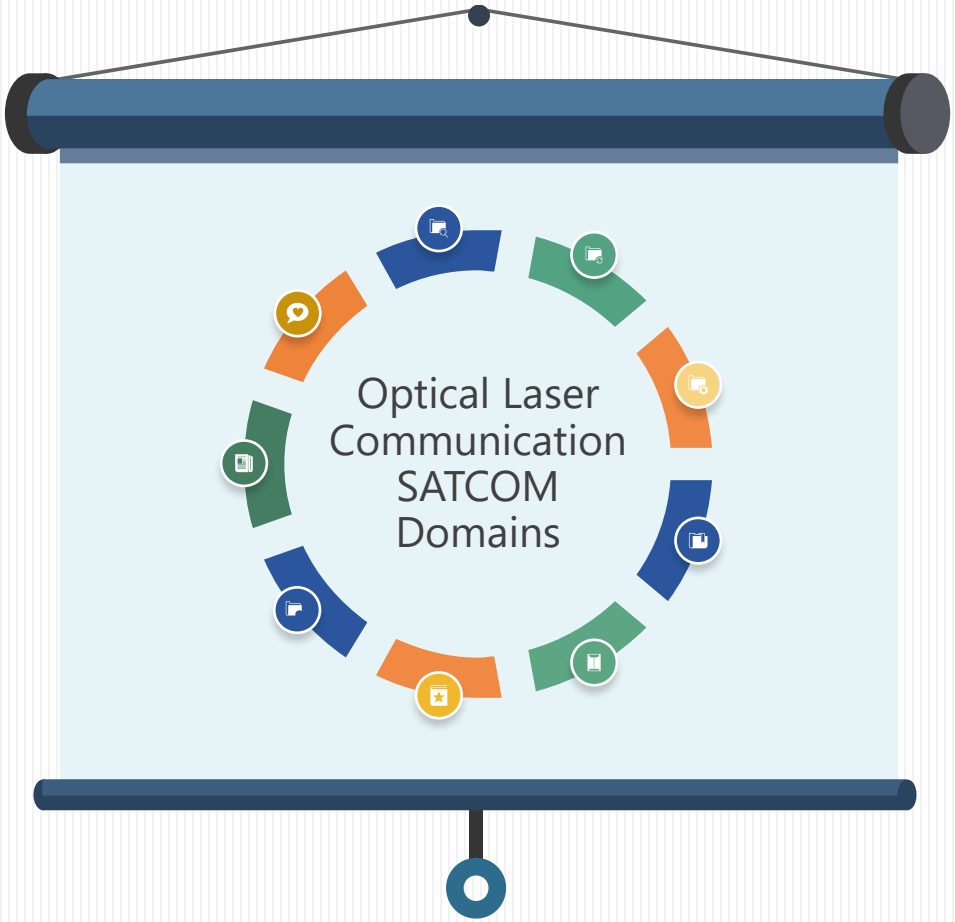
SECTION-1 DISRUPTIONS SCANNING

Optical Laser Comm domains

Disruptors/Startups



01 Connectivity – High bandwidth solutions

02 Connectivity – 'As-a-Service' solutions

03 Connectivity – for IoT solutions

04 Security - Conventional

05 Security – QKD based

06 Data Analytics & Monetization, Storage

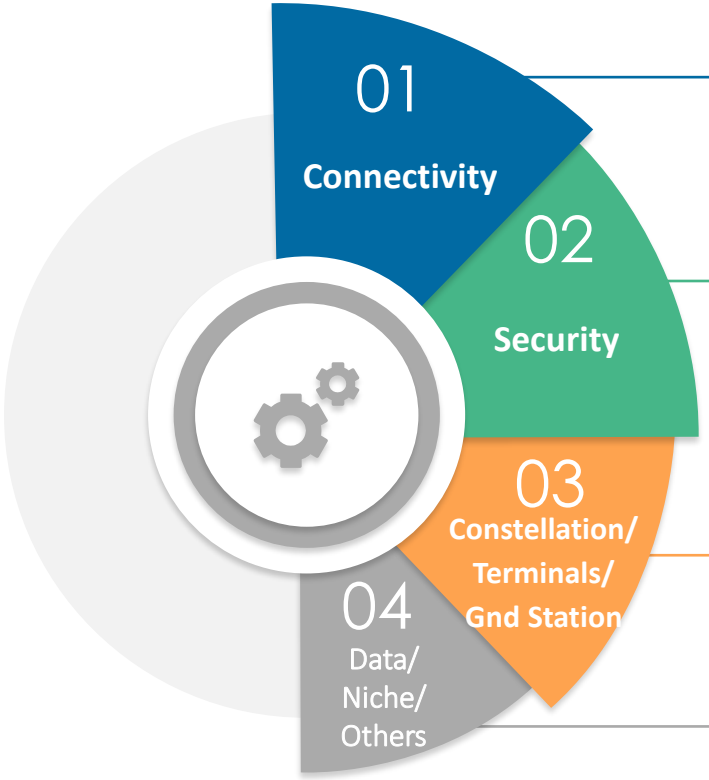
07 Satellites, Terminals & Ground station

08 Operations-'As-a-Service' solutions

09 Niche & Others

IDC Spending guide' 2019

Disruptors



Ball AeroSpace, BridgeComm, mBryonics, Mynaric, Sinclair Interplanetary, Transcelestial Technologies, Empower Space Alliance *(Atlas Space Operations, Laser Light Communications, Xenesis),* LaserFleet

Archangel Lightworks, BridgeComm, SpeQtral, QEYnet

Odysseus Space, ICEYE – BridgeComm, KSAT + ASTELCO + Tesat + GomSpace, Transcelestial Technologies, Astrogate Labs, Mostcom, Space Micro

RBC Signals & EXA & GomSpace, Analytical Space, Archangel Lightworks, ATLAS Space Operations, Cloud Constellation, LyteLoop

SECTION-2 AIRBUS FOCUS

Primary – Connectivity, Security

Secondary - Constellation/Terminals/Ground Station

Connectivity Disruptions – based on applications

	High Bandwidth	As-a-Service	IoT & Remote Sensing Solutions
Disruptors	**Ball Aerospace, BridgeComm, Mynaric, Empower Space Alliance, Transcelestial Technologies, Sinclair Interplanetary**	**Ball AeroSpace (Laser Light Communications), mBryonics**	**LaserFleet**
Use-case/ Vertical	Commercial Data relay, rural/remote internet, High-altitude UAV, Satellite broadband, Commercial Aircraft, Earth Observation	Global enterprises, data centers, media companies, financial institutions, carriers, and government entities, HALO Direct Connect Service, Global SD-WAN	inter-satellite link of the Internet of Things constellation | downlink data transmission of remote sensing satellites
Fields/ Technologies	space-based laser comm, precision pointing, acquisition and tracking systems, high-power optical amplifiers and high-bandwidth optical comm terminals, rapid point-to-point data transmissions via beams, steered infrared laser beam, Flight grade Optical Transceiver, Software configurable, Global Optical Multi-layered Mesh network	200 Gbps optical crosslinks, 100Gbps optical bidirectional links, patented StarBeam™ operating system, proprietary extended ground network, ArcLight® software defined optical onboard modem, seamless, re-programmable system of systems, seamlessly integrated with the terrestrial cellular and wired networks	star-to-ground laser communication terminal, inter-satellite laser communication terminal and optical ground station

Connectivity Disruptions – based on scenario

	Space-to-Space/Ground (GEO/MEO)	Space-to-Space/Ground (LEO)	Air-to-Air/Ground
Disruptors	Ball Aerospace& Honeywell| Tesat-Spacecom|Astrogate Labs| Empower Space Alliance	BridgeComm| Starlink| Telesat| Analytical Space| Transcelestial Technologies| Astrogate Labs	Mynaric | Google X Loon| Astrogate Labs| KSAT + ASTELCO + Tesat + GomSpace, mBryonics
Solutions/ Use-cases	near and deep space exploration | high-security solutions for unique applications, satellites & UAV to the ground	near and deep space exploration| satellite broadband services for businesses and governments, hard-to-access environments| Weather forecasting, Asset tracking, Hyperspectral Imaging, Synthetic Aperture Radar	Data transmission wirelessly between airplanes, drones and satellite|operational Optical downlink tech
Fields/ Technologies	Precision pointing, acquisition and tracking systems| high-power optical amplifiers, high B/W optical comm terminals| interplanetary, inter-satellite and space-to-ground communication; compact optical communication terminals, ground receiver stations, space relay systems, related software systems| Flight grade Optical Transceiver, Software configurable, Xenesis Global Optical Multi-layered Mesh network| 200 Gbps optical crosslinks, 100Gbps optical bidirectional links	rapid point-to-point data transmissions via beams of light| Compact high B/W Laser Comms Terminals| FAST PIXEL relay network, hybrid of radio and laser	Optical laser communication system for Space, Air & Ground, Flight terminals, steered infrared laser beam| optical ground station, multi- mission network operation| ArcLight® software defined optical onboard modem seamless, re-programmable system of systems, optical satellite software defined network architecture

Security Startups

	Conventional	QKD based
Startups	Archangel Lightworks, BridgeComm	SpeQtral, QEYnet, Archangel Lightworks
Use-case/ Vertical	AeroSpace, hard-to-access environments, high-altitude UAV to the ground, satellite broadband services for businesses and governments	banks and financial institutions, telecommunication companies, AeroSpace
Fields/ Technologies	space-air laser communication terminal, Hybrid networks, rapid point-to-point data transmissions via beams of light	commercial space-based QKD, entanglement-based QKD and daylight QKD. Quantum internet, global QKD connectivity, QKD constellation, space-based QKD payload | space-air laser communication terminal Hybrid networks

Infrastructure Startups

	Terminals/Ground Stations	Satellite Constellations
Startups	**Astrogate Labs, RBC Signals & EXA & GomSpace, ICEYE – BridgeComm, KSAT + ASTELCO + Tesat + GomSpace, Odysseus Space**	**ICEYE – BridgeComm, KSAT + ASTELCO + Tesat + GomSpace, Odysseus Space, Transcelestial Technologies**
Use-case/ Vertical	near and deep space exploration, Serving satellite operators with data processing/delivery	Actionable Information for Industries & Governments, industrialized optical ground station for regular service| automatization and remote operations, capability to support multiple missions|cost-optimization, solar system exploration| ultra-high bandwidth wireless laser communication
Fields/ Technologies	Optical Comm systems for interplanetary, inter-satellite and space-to-ground communication; compact optical communication terminals, ground receiver stations, space relay systems, related software systems, optical ground station, compact and integrated module	first commercial constellation of micro-class EO satellites, operational Optical downlink technology for nanosatellites, multi- mission network operation, Micro-satellites for duplex inter-satellite & space-to-ground communications, autonomous navigation

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9. Company websites of all disruptors

Thank you!

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