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A Unique Mind On The Markets

This SR highlights the increased risk of a "space war" due to heightened geopolitical tensions and the critical role of space-based technologies for essential terrestrial technologies. It ponders which key application areas are best positioned to benefit, and provides compelling portfolio candidates that deliver direct exposure for investors.

SPECIAL REPORT

July 10, 2024

The Intensifying Space Race: Key Insights For Investors

The U.S., China, and Russia are locked in an escalating race for space dominance across both commercial and military domains. Formerly confined to science fiction, space has now become indispensable for commerce on Earth. **Weather forecasting, remote sensing, navigation systems (GPS), missile defense/detection, and long-distance communication systems are all essential terrestrial technologies that rely critically on space infrastructure.** Space is now woven into both civilian and defense applications, making securing space leadership paramount for global powers.

Recently, China flexed its space muscle by becoming the first nation to successfully return soil samples from the far side of the moon. The completion of this mission is concrete evidence that dominance in space is there for the taking. As underscored by Troy Meink, principal deputy director of the National Reconnaissance Office, "For the first time in decades, U.S. leadership in space and space technology is being challenged."

The implications are broad and significant. Control of space, from a defense perspective, has become as important as dominance across land, sea, and air. We believe the "first shots" of the next major conflict could likely be "fired" in space.

A "Space Resilience" Strategy Will Outperform

We argue that investors looking to include space technology in their portfolios should prioritize companies offering solutions that proactively strengthen and mitigate space infrastructure vulnerabilities against the threat of space warfare (**Chart 1**). Specifically, investors should prioritize

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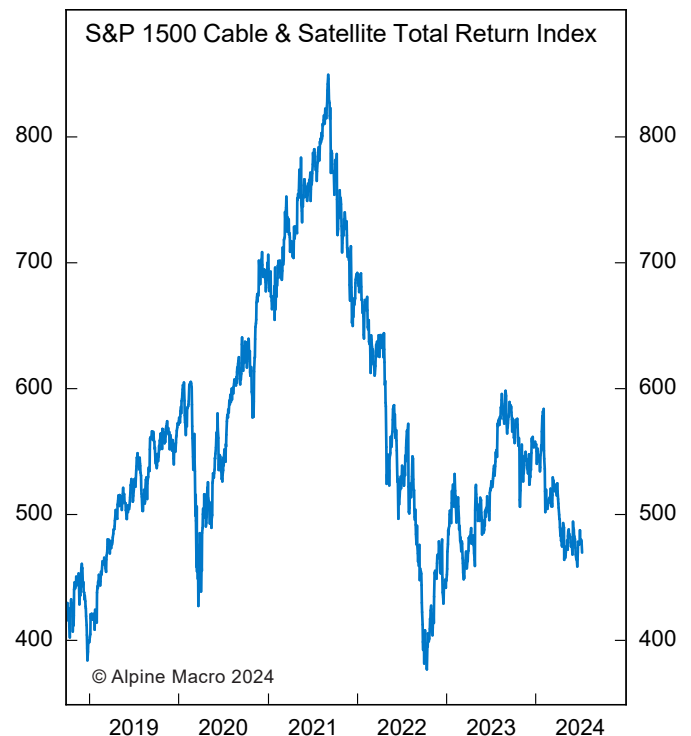
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Chart 1

Legacy Communication Technologies Underperforming



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Tipping Point In Financial Markets: A Melt-up or Meltdown?

Agenda

- 08:10 - 08:30 **Opening Remarks : The Shifting Macro Landscape: Opportunities & Risks**
Chen Zhao, Chief Global Strategist
- 08:30 - 9:30 **Emerging Mega Trends: How Should Investors Be Prepared?**
Ruchir Sharma, Chairman of Rockefeller International and Founder and Chief Investment Officer of Breakout Capital
- 09:30 - 10:30 **Inflation, Disinflation and Fed Policy: Are We on the Right Path?**
Mike Dooley, Professor Emeritus at University of California, Santa Cruz and Chief Economist at Figure Technologies
- 10:30 - 10:45 Coffee Break
- 10:45 - 11:45 **Fireside Chat: Bull Bear Debate**
Francois Trahan, Founding Partner of The Macro Institute Versus
Jim Paulsen, Author of the Paulsen Perspectives research newsletter on Substack
- 11:45 - 12:30 **The Long and Shorts of U.S. Equities**
Gina Martin Adams, Bloomberg Intelligence Global Director of Portfolio Strategy, Chief Equity Strategist
- 12:30 - 14:15 **Luncheon Speaker: Biden Vs Trump: How The World Will Be Changed**
Greg Valliere, Chief U.S. Policy Strategist AGF Investments
- 14:15 - 15:00 **How Is AI Reshaping the Money Management Business?**
Gareth Shepherd, Co-Head of Voya Machine Intelligence (VMI) & Portfolio Manager, Voya Investment Management
- 15:00 - 15:15 Coffee Break
- 15:15 - 16:30 **Commodity Panel: Secular Trend, Energy and Prospect of ESG**
Tavi Costa, Partner/Macro Strategist at Crescat Capital
Lenka Martinek, Managing Partner, Sustainable Market Strategies, Nordis Capital
Adam Rozencwajg, Managing Partner, Goehring & Rozencwajg
- 16:30 - 17:30 **Cocktails & Networking**

Guest Speakers + Alpine Macro Strategists



**Ruchir
Sharma**



**Mike
Dooley**



**Francois
Trahan**



**Jim
Paulsen**



**Gina Martin
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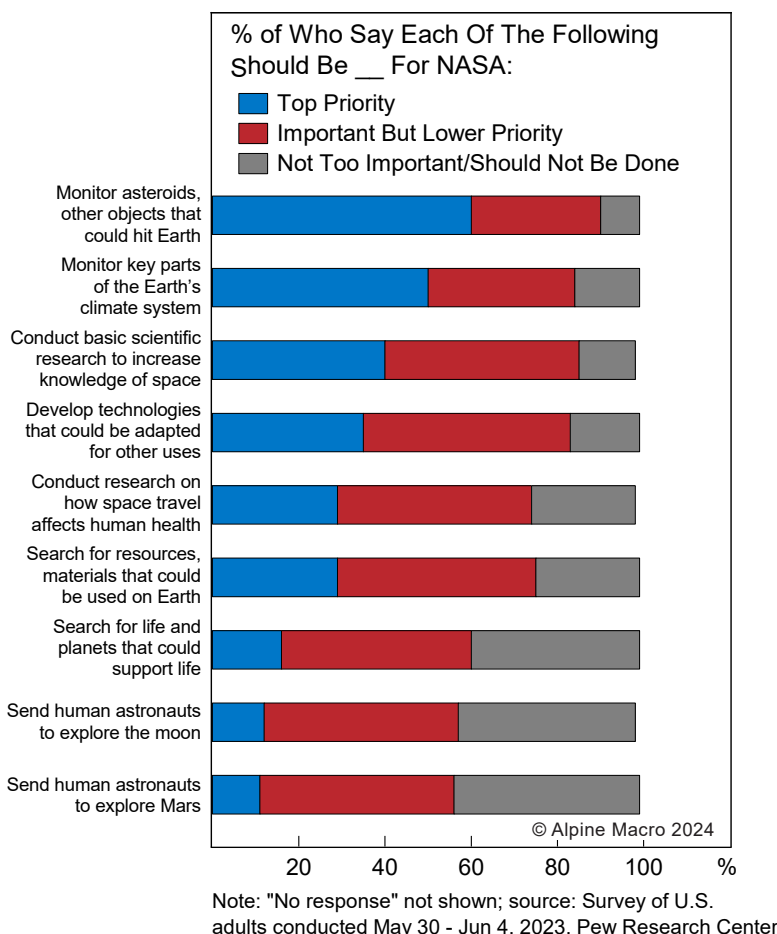
**Tavi
Costa**



**Lenka
Martinek**



**Adam
Rozencwajg**

Chart 2 Public Supports Earth Observation

Earth-oriented solutions, known as space-for-Earth services ([Chart 2](#)). This includes next-generation communication systems, Earth Observation (EO) technology, and non-GPS positioning systems that will augment or replace current space-based assets in the event of a space war ([Box 1](#)).

We believe that investing in the space sector, particularly through “mainstream” avenues such as rocket-launch providers, in-orbit manufacturing, and space mining, offers long-term potential but carries increased volatility and enormous risks for investors. In addition, these mainstream investment vehicles could fall victim to boom/bust hype cycles.

Box 1: Space War

Space has emerged as our most essential war fighting domain.

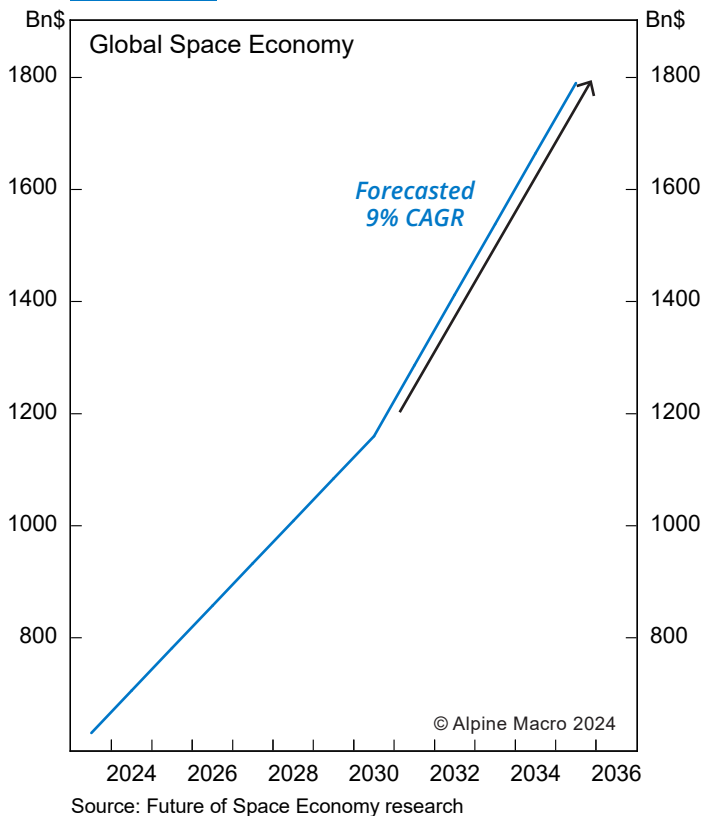
- Admiral Christopher Grady, Vice Chairman of the Joint Chiefs of Staff

A space war would revolve around crippling an adversary's terrestrial systems reliant on space-based assets. Space warfare has already influenced the battlefield in Ukraine, rendering sections of the frontlines inoperable due to GPS disruption and satellite system incapacitation. Proven space weaponry includes electronic warfare systems, directed energy weapons, and anti-satellite (ASAT) missiles. Russia, India, China, and the U.S. have all conducted tests using ASATs to intentionally destroy their own satellites. The technology can easily be used to destroy adversaries' space-based assets.

The ultimate space weapon is detonating a nuclear weapon in space, known as an electromagnetic pulse (EMP) attack. An EMP could destroy all electronic circuitry in satellites and terrestrial computing and communication equipment. Evidently, a space war would not only destroy assets in orbit, but could cripple life on Earth as well.

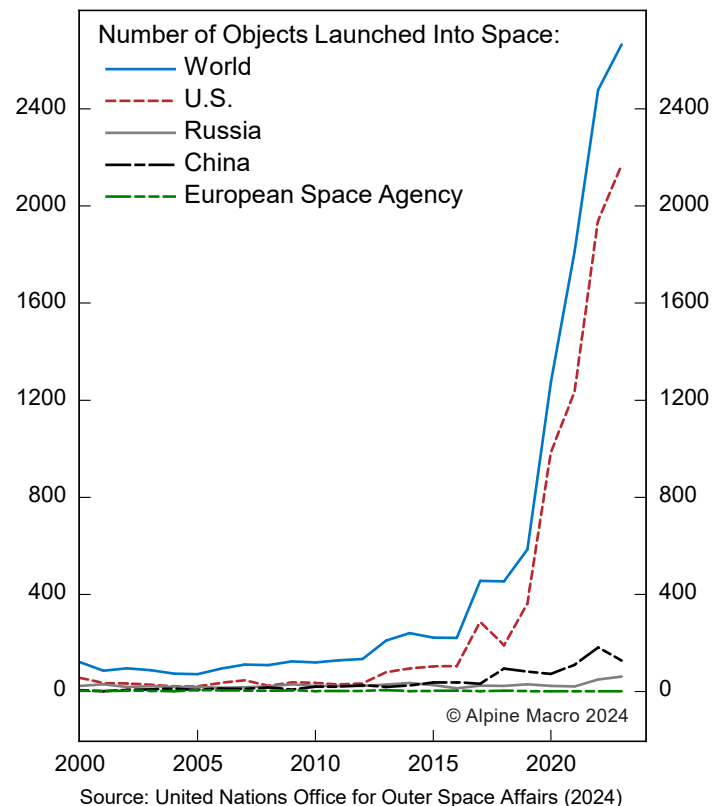
A Booming Space Economy

The global space economy is at an inflection point. Over 80 nations now have a space presence. In 2023, the global space economy topped \$630 billion while realizing a 9% average yearly growth

Chart 3 Space Economy Boom

rate. By 2035, the space economy is set to reach \$1.8 trillion (Chart 3). Space equity investment in Q1 of 2024 totaled \$6.5 billion, a 33% increase from Q4 2023 levels.

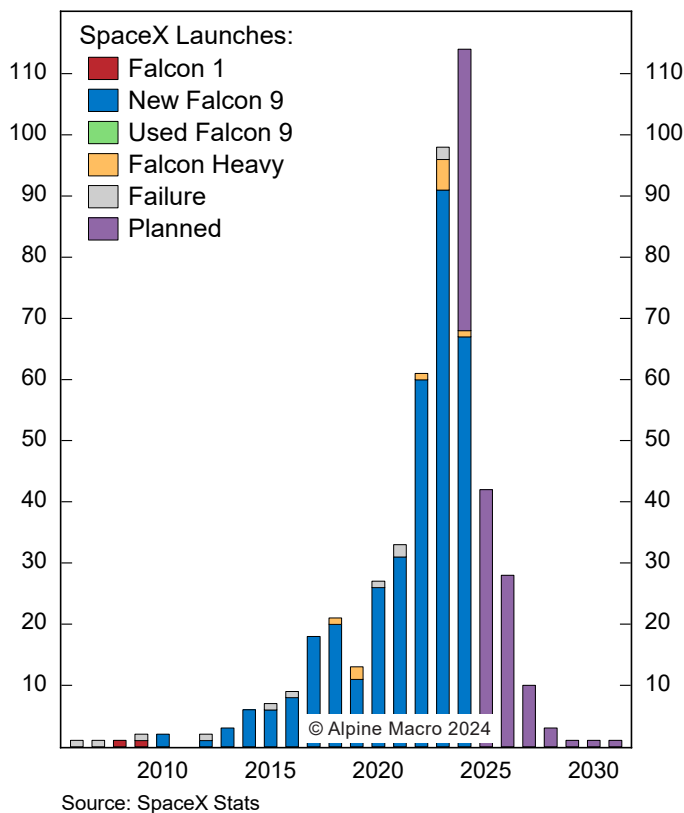
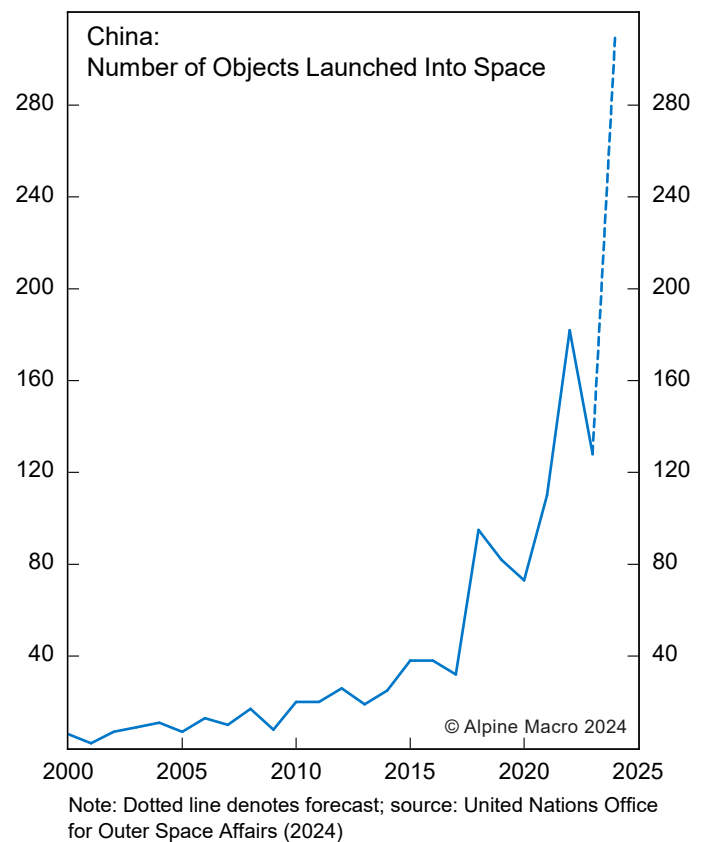
Last year, a record 2,911 satellites were launched globally. Satellite launches have grown by 50% yearly over the past two decades (Chart 4). Today, over 11,000 active satellites are positioned in various orbits and over 1 million satellites are registered with the International Telecommunications Union to be launched in coming years. Most importantly, per-kilo payload launch costs have declined to \$1,520/kg and are forecasted to drop 40% by 2025. Declining launch costs are the catalyst to this new space era.

Chart 4 Objects Launched Rapidly Increasing

Satellite Proliferation

Satellite constellation networks, where groups of satellites operate as a system, are exploding in scale.

Currently, Starlink has the largest constellation that totals over 6,220 satellites (Chart 5) and expects to form a “mega-constellation” with over 42,000 satellites. To rival American constellation dominance, China has plans to launch three 10,000-plus satellite mega-constellations. China is planning 100 rocket launches in 2024, a 40% increase from 2023 (Chart 6). A single SpaceX rocket can transport up to 143 individual satellites. A key strategy to improve space resiliency is to transition from having a few large satellites to controlling a myriad of smaller ones. This “built in resiliency” allows for minimal disruption if one is

Chart 5 SpaceX Launch Dominance**Chart 6** Chinese Launching Record Objects

lost or jammed. In addition, smaller satellites can be produced faster and cheaper than ASAT missiles.

Earth's growing dependency on space infrastructure, including constellations, is driving a global race to secure favorable satellite positioning and escalating tension in the cosmos. For example, Low-Earth Orbit, known as LEO, is a highly desirable orbit due to its proximity to Earth which reduces launch distance and offers the fastest connection speed to Earth-based assets (Chart 7).

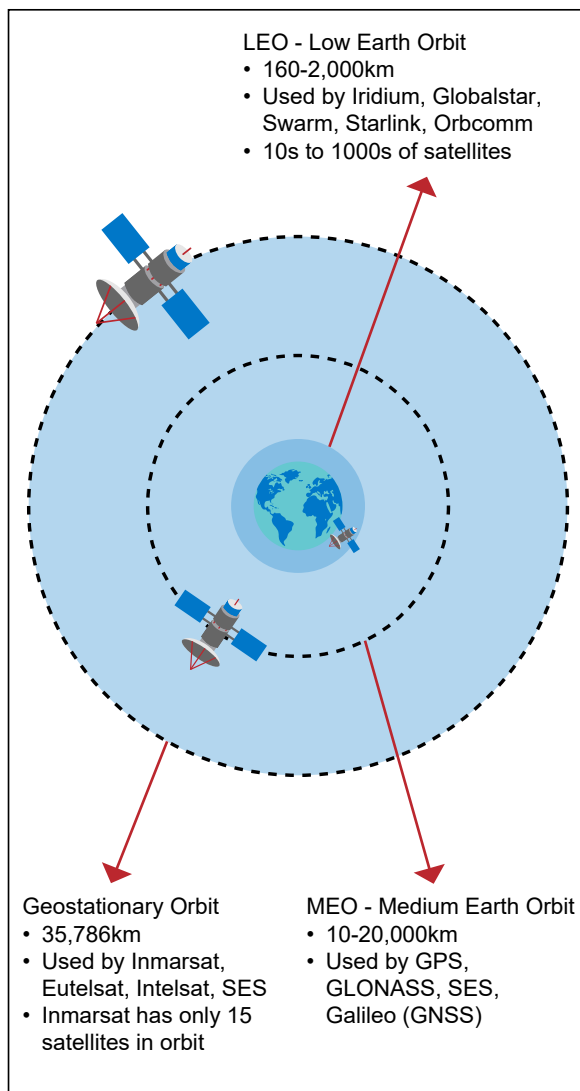
Globally, a lack of consensus over how many satellites can be safely "parked" in LEO is resulting in international tension. This positioning race has the potential to become a growing geopolitical flashpoint.

Deteriorating Geopolitical Stability On Earth Is Destabilizing Space

Rapidly shifting geopolitical dynamics on Earth coupled with Earth's increasing reliance on space-based assets have resulted in a new space age defined by weaponization. China, Russia, and the U.S. are "doubling down" on space weaponry and defense systems. Space is in the midst of a full-blown arms race. Noteworthy escalatory developments from global powers in space include:

- China: In the spring of 2024, Chinese President Xi Jinping announced a major reorganization of the People's Liberation Army to prioritize strengthening China's military presence in space. China is already a global leader in ground-based space

Chart 7 Orbit Diagram



Source: Ground Control

weaponry including electronic warfare systems, directed energy weapons, and ASAT weapons. The nation has also unveiled cutting-edge satellite technology, including satellites with “grappling arms” capable of plucking adversarial satellites out of orbit. The Middle Kingdom also operates over 300 remote-sensing satellites that can track military movements on Earth with precision.

- **Russia:** Similar to China, the Kremlin has showcased advanced ground-based lasers that can jam satellites and electronic warfare systems designed to cripple GPS. Russia’s space program has also developed novel “kill satellites” that are deployed from larger satellites capable of kinetically disabling a target. Recently, Russia vetoed a UN Security Council resolution that would have affirmed a treaty banning the use of nuclear weapons in outer space. This comes on the heels of a U.S. intelligence report confirming that Russia is developing a nuclear space-based weapon designed to target American satellites.
- **U.S.:** To strengthen space assets from rising adversarial threats, the U.S. Space Force is accelerating the deployment of next-gen GPS and communication satellite systems. In addition, the agency is improving satellite defense capabilities to combat satellite jammers, directed energy weapons, and spacecraft threats. Rapid response satellites, in which a satellite can deliver space hardware for military use “on demand” is another key priority area. AI and data collection are also beginning to provide value in space. DARPA recently partnered with Slingshot Aerospace to create an AI-enabled system capable of detecting harmful space vehicles and weapons.

Bottom Line: Increased weaponization in space directly threatens national security, the \$300+ billion of private capital invested into space over the last decade, and essential infrastructure on Earth reliant on space assets.

Investment Implications

While space weaponization is undoubtedly a boon for large defense contractors (which we believe remain overbought in a hype cycle), ample profit-making opportunities exist through employing a “space resilience” investor strategy. The possibility of an attack on space-based assets essential to Earth has never been higher. As a result, governments and private companies alike are plowing full steam ahead to improve resilience through bolstering infrastructure and rolling out new agile technologies capable of strengthening infrastructure vulnerabilities posed by the threat of a space war.

Key application areas positioned to benefit include:

- Non-GPS reliant positioning, navigation, and timing (PNT) technologies. **Currently, GPS runs off only 31 satellites – a huge vulnerability.** Leading PNT solutions include advanced inertial sensors and quantum-based clocks and sensors. Quantum technology detects motion through changes in electric and magnetic fields at the atomic level. As a result, **quantum sensing technology** offers improved resiliency and is uniquely positioned to disrupt legacy navigation technology for positioning and mapping. We believe location-based services will become a key driver for the space economy. Use cases will include personalized tracking, last-mile delivery, and improved supply chain management visibility. The production of devices equipped with chips capable of functioning as “receivers” is expected to rise from 2 billion today to 3 billion by 2035. This expansion is projected to drive

the addressable PNT market to grow by more than 30% within the next decade, propelling the space PNT market to exceed \$95 billion, notes the World Economic Forum (WEF).

- Space-borne Earth Observation (EO) technologies and data collection. Currently, Commercial EO data and services represent a small segment, approximately \$2 billion, of the space economy. Yet, the market is likely at a tipping point as demand for improved data processing, data fusion, and tailored products increases, according to the WEF. We believe this market could rapidly triple in size because EO insights will soon become essential for decision-making on Earth. **Advanced EO systems** can collect valuable data including imagery, weather, and pressure measurements. Agriculture, energy production, and electric grid monitoring are all key application areas primed to benefit. For example, McKinsey data shows 29% of row-crop farmers and 45% of specialty-crop farmers already rely on such data to improve yields. For clean energy production, EO can help reduce intermittency. For example, highly-acute microlevel weather forecasting can improve wind and solar energy production through proactive predictive forecasting. Lastly, for utilities, EO can anticipate surges in demand from inclement weather, like high heat, and proactively monitor vulnerabilities to grid infrastructure in real time.
- Next-generation communication systems. This includes **space-based quantum communication and quantum key distribution (QKD)**. Both technologies leverage the principles of quantum mechanics to achieve secure and hackproof

communication over vast distances. Although highly nascent, these technologies are positioned to revolutionize how sensitive information is protected and transmitted across the globe. China has already successfully relayed QKD signals from space to ground-based assets. The European Space Agency (ESA) plans to launch a QKD satellite within the next two years. We anticipate that next-generation communications will evolve into one of the largest revenue drivers of the space race. By 2035, demand for space data in gigabits per second is forecasted to grow by 60%. Data from the WEF indicates the commercial space communication market is currently valued \$133 billion but could double in size by 2035.

Compelling portfolio candidates that provide investors direct exposure to the key application areas listed above include:

- **Thales** (HO, FP): provides next-generation space solutions across telecommunications, navigation, EO, and space exploration.
- **Exail Technologies** (EXA, FP): is a technology leader across engineering, robotics, drones with a suite of quantum-sensing instruments and key partner to the ESA's QKD plans.
- **Spire Global** (SPIR): is a global leader across space-to-cloud data and analytics solutions.
- **Trimble** (TRMB): produces software and hardware that connect the physical and digital worlds. Trimble is primed to leverage space-based solutions to help industries including building & construction, agriculture, geospatial, natural resources, utilities, and transportation.
- **L3Harris Technologies** (LHX): offers essential space-Earth solutions including command and control and both terrestrial and spaceborne antennas for government, defense, and commercial clients.
- **SK Telecom** (017670KS): is South Korea's largest mobile carrier and leading early adopter of quantum technologies including QKD technology and quantum sensing.
- **QuantumCTek** (688027CH): is a Chinese supplier to quantum-safe communications networks, including QKD. The company manufactures over 1,000 quantum-related products capable of securing communication across 6,000km.

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