

2020

Defiance ETFs:

Investment Case for FIVG:

The Defiance Next Gen Connectivity ETF

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5G describes the technological innovation and infrastructure that will likely support the next era of mobile connective technology. Its adoption should provide faster speeds, more functionality and lower latency (the delay between input into a system and the desired outcome, i.e. the time for data to travel between two points), facilitating substantial innovation in a much wider number of use cases than previous mobile technology. 5G applications do not focus purely on the consumer; they can also transform work practices and production in industry, healthcare, transportation and manufacturing, gaming, retail, business and education.

Major market actors, including telecommunications companies, governments, infrastructure providers and hardware firms, have been researching and developing 5G capacities for years and are now on the cusp of, or have already launched. Rising mobile data traffic and the increased adoption of virtual networking architecture in telecommunications continues to push the technology to fruition. The Global Mobile Suppliers Association (GSA) reported that as of May 2020, 799 operators are running LTE (4G) networks that provide mobile and/or Fixed Wireless Access (FWA) services in 229 countries worldwide. (Of these 799, 95 operators in 50 countries/territories have announced the deployment of 5G within their live network).¹ The LTE networks can act as a foundation for future 5G network upgrades, demonstrating existing market interest and commitment to progress in this field.

Expansion of 5G infrastructure has an impact potential far beyond the smartphone industry. One analyst stated that it “will spread far beyond the confines of the tech industry, impacting every aspect of society and driving new economic activity.”² 5G could support institutional change that fosters the emergence of new business models and transforms industries and economies. This will spur advances in the whole ecosystem of technologies and industries that engage in its wide use-functions. For example, businesses will better harness the potential of their data through the combined functionality of 5G and cloud/edge computing. In the semiconductor industry, for which smartphones are by far the largest consumer with \$87.7 billion in global revenue in 2019, 5G expansion could spur demand and boost the microchip business.³ A bi-partisan measure to provide more funding for domestic semi-conductor research and production reached the US House of Representatives in June 2020. This clearly demonstrates the importance of 5G capability and independence (from China) to US strategic interests.⁴

¹ “Evolution from LTE to 5G,” May 27, 2020, <https://gsacom.com/reports>

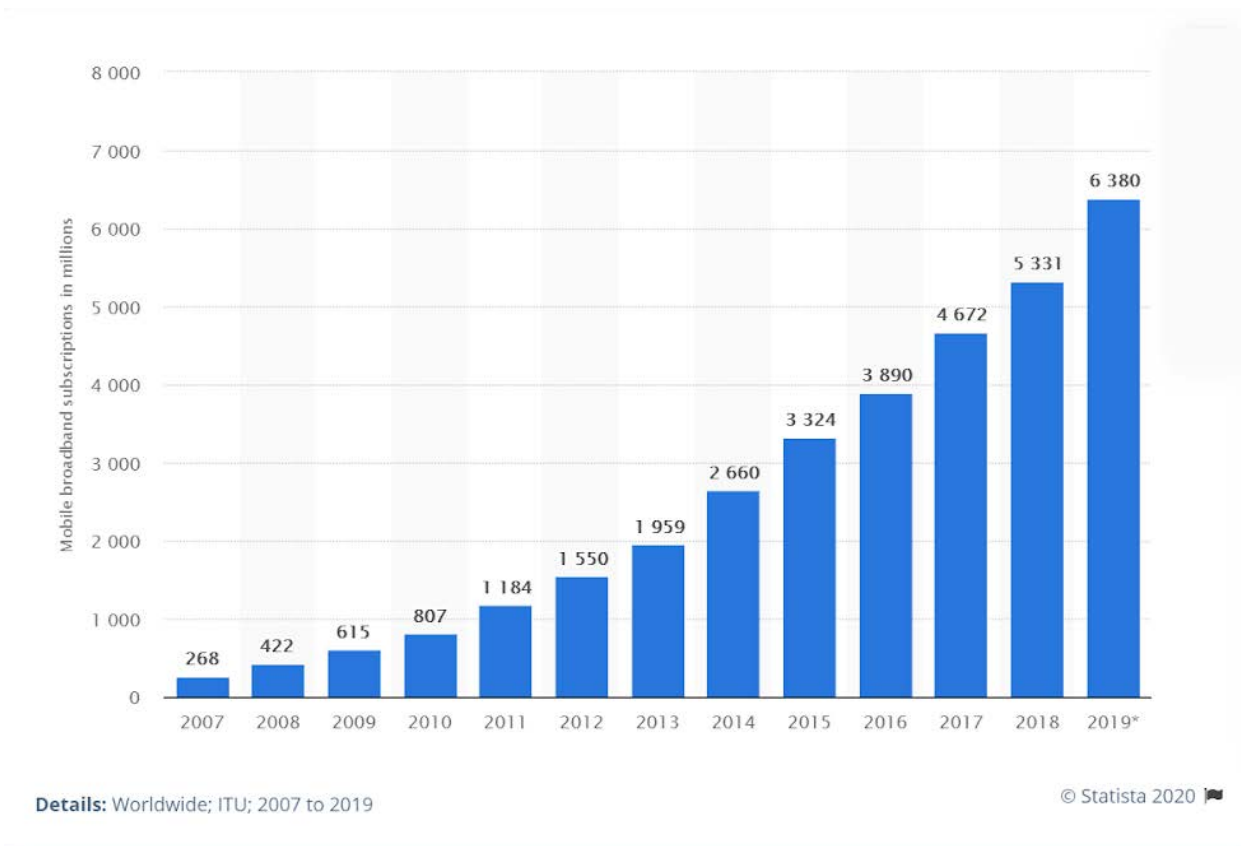
² Len Jelinek, senior director of semiconductor manufacturing for IHS Markit, cited in “5G’s rise set to break the semiconductor market’s fall in 2020,” October 18, 2019. <https://technology.ihs.com/618002/5gs-rise-set-to-break-the-semiconductor-markets-fall-in-2020>

³ “5G’s rise set to break the semiconductor market’s fall in 2020,” October 18, 2019. <https://technology.ihs.com/618002/5gs-rise-set-to-break-the-semiconductor-markets-fall-in-2020>

⁴ “Lawmakers Push to Invest Billions in Semiconductor Industry to Counter China,” Ana Swanson and Don Clark, June 17, 2020. <https://www.nytimes.com/2020/06/11/business/economy/semiconductors-chips-congress-china.html>



Cooperation between the supply and demand sides of the market (telecom companies versus industry/energy/transport businesses and consumers) comprises a robust value and supply chain and contributes to the expected success of the 5G market. The consistent and steep worldwide growth in broadband subscription reflects the strong underlying demand for ever-improving data access and processing. (see graph below).



<https://www.statista.com/statistics/273016/number-of-mobile-broadband-subscriptions-worldwide-since-2007/>

International governments' commitment to the 5G rollout has also been demonstrated recently, with President Trump's statement in April 2019⁵ and the centrality of 5G technology companies like Huawei in the trade war between China and the US.⁶ Europe lags behind China, the US, Korea and Canada in its readiness for 5G, but the European Commission expressed similar priorities to make this technological leap by the end of 2020⁷ and will launch eleven new Public-Private Partnerships in September 2020 to foster 5G hardware innovation and to trial 5G-based connected and automated mobility.⁸ Indeed 5G became a global phenomena in 2019 – South Korea was the first country to achieve a nationwide network in April, with 1 million subscribers counted within 69 days of launching.⁹

⁵ "Remarks by President Trump on United States 5G Deployment," April 19, 2019

<https://www.whitehouse.gov/briefings-statements/remarks-president-trump-united-states-5g-deployment/>

⁶ See "5G and The Trade Truce," Defiance ETFs, July 18, 2019 at <https://news.defianceetfs.com/investment-cases/5g-the-trade-truce>

⁷ "5G for Europe Action Plan," 22 August 2018, <https://ec.europa.eu/digital-single-market/en/5g-europe-action-plan>

⁸ "EU boosts investment in 5G hardware innovation and trialling 5G-based connected and automated mobility," European Commission, June 16, 2020. <https://ec.europa.eu/digital-single-market/en/news/eu-boosts-investment-5g-hardware-innovation-and-trialling-5g-based-connected-and-automated>

⁹ "South Korea hits 1 million 5G subscribers in 69 days, beating 4G record," Jeremy Horowitz, June 12, 2019. <https://venturebeat.com/2019/06/12/south-korea-hits-1-million-5g-subscribers-in-69-days-beating-4g-record/>



Many countries (Canada, Japan, Singapore) announced that 2020 would see their leap into next-generation wireless connectivity.¹⁰ Indeed Telia launched its 5G network in Sweden and Norway in May; Vodafone, Ziggo and Ericsson also unfurled 5G in more than half of the Netherlands that month; and Vodacom brought 5G to South Africa. Meanwhile Telus began its first 5G rollout in Canada in June.¹¹

What is 5G?

If 1G describes the technology that enabled the first cellphones, 2G brought text messaging, 3G internet access to the cell phone and 4G higher speeds (albeit in an overloaded network); then 5G could bring the industry the capacity for even lower latency, more sophisticated apps, instantaneous availability of information and more structured and relevant capabilities. 5G is the bundle of technological advances that will likely enable autonomous driving, the internet of things (IoT), cloud computing, mass participation in eSports and significant developments in the use of virtual or augmented reality (VR/AR) products.

While the configuration and collaboration of technologies that comprise 5G is not yet final, the core features will include:

1. Leveraging of new **bandwidths** – The range of millimeter wave frequencies currently in use (usually up to 6Ghz) are becoming overcrowded, resulting in slower service and mixed connections. 5G will exploit a much greater spectrum (30-300 GHz) of shorter waves, greatly increasing network capacity. The European Commission for the EU, the Asia Pacific Telecommunity for the Asia Pacific (APAC) region, and the Federal Communication Commission (FCC) in the United States are already pursuing initiatives to open up other bandwidths to 5G.
2. **Small Cell Antennae** – The shorter millimeter waves don't travel well through buildings and are absorbed by rain and plants. They therefore require a network of thousands of small, low powered mini base stations to work in relay to pass data around obstacles and maintain service.
3. **Massive MIMO** – Multiple Input Multiple Output cellular antennae stations – MIMO stations would have around 100 ports (in contrast to 4G's 12) and could increase capacity of networks by a factor of 22 or more.
4. **Beamforming** – In contrast to 4G dispersed wave signals, MIMO stations strategize the best route for a focused stream of data from the base to a specific user. This increases efficiency and avoids interference, resulting in a coherent, personalized data stream.
5. **Full duplex** – Radio waves are reciprocal – they travel forward and back on the same frequency, meaning that today's antennas can only either send or receive data at any one time. To avoid this, researchers are formulating scalable orthogonal frequency-division multiplexing (OFDM): using silicon transistors to create high speed switches that momentarily hold back signals, so they can pass on the same frequency. This should bring lower latency and forward compatibility.¹²



¹⁰ "An Update On What's Happening With 5G And The Global Rollout And What Stocks To Consider," Matt Bohlson, November 22, 2019. <https://seekingalpha.com/article/4308583-update-on-happening-5g-and-global-rollout-and-what-stocks-to-consider>

¹¹ "The latest and greatest that's happening in the world of 5G," Tim Fisher, June 19, 2020. <https://www.lifewire.com/5g-news-4428066>

¹² The 5G Economy: How 5G Technology will Contribute to the Global Economy, IHS, January 2017, p.13. <https://www.qualcomm.com/media/documents/files/ihs-5g-economic-impact-study.pdf>



2020 Latest 5G Developments

Many 5G milestones were reached in 2019, and companies continue to press ahead with the rollout in the first quarter of 2020. Notwithstanding the effects of Covid-19, the telecom giants continue to create new revenue streams from 5G communications.

Sprint was an early leader when it launched 5G in Atlanta, Chicago, Dallas-Fort Worth, Houston, Kansas City, Phoenix, Los Angeles, New York City, and Washington, D.C in 2019. Verizon was also among the first introducers in 2019, and its 5G ultra-wideband mobility service is now available in 24 stadiums and arenas and 34 US cities (including Cincinnati Little Rock and Kansas City) via seven 5G-enabled devices.¹³ AT&T followed in a 2019 launch, with its fast millimeter wave-based networks servicing 21 and by January 2020 35 US cities (including Birmingham, Ala., Indianapolis, Los Angeles, Milwaukee, Pittsburgh, Providence, R.I., Rochester, N.Y., San Diego, San Francisco and San Jose, Calif.)¹⁴ By the end of January 2020 its low-band 850MHz network covered 50 million people in the US and should extend nationally to include 200 million people by the middle of the year, with priority cities being Boston, Bridgeport, Conn., Buffalo, N.Y., Las Vegas, Louisville, Ky., New York City.¹⁵ T-mobile's low-band LTE network now covers 99% of the US population, including rural areas, and its 5G rollout is using this infrastructure to currently provide 5G signal coverage to more than 5,000 US cities and towns.¹⁶ April 2020 saw T-mobile complete its merger with Sprint, boosting its valuation as the sector's top performer.¹⁷ Until now 5G networks have been accessible only via a limited range of 5G-enabled Samsung, Verizon and Huawei smartphones. Apple is set to launch the first 5G-compatible iPhone 12 later in 2020,¹⁸ which will seriously increase consumer access to 5G, as well as competition with Samsung, who will continue to offer a broader price-range for 5G smartphones.¹⁹ T-Mobile also expects to release 15 new 5G phones in 2020 at varying price points.²⁰ In July 2019 Apple confirmed plans to buy Intel's 5G modem business. This effectively erased Intel as a competitor for Apple in the 5G cellphone sector and brought around 2,200 Intel employees, along with their intellectual property, equipment and leases under Apple's purview. Combined with the anticipated 5G -compatible iPhone, Apple seem committed to the success of the 5G rollout.

¹³ "Verizon 5G Ultra Wideband service available in more cities," January 30, 2020. <https://www.verizon.com/about/news/verizon-5g-ultra-wideband-service-available-more-cities>; "Verizon 5G rollout: Everything you need to know," Ed Oswald and Christian de Looper, May 28, 2020. <https://www.digitaltrends.com/mobile/verizon-5g-rollout/>

¹⁴ "New Year, New Ways for AT&T Customers to Connect," Scott Mair, January 3, 2020. https://about.att.com/innovationblog/2020/01/2019_5g_recap.html

¹⁵ "AT&T's 5G Service Live in 10 Markets," Light Reading, December 13, 2019. <https://www.lightreading.com/mobile/5g/atandts-5g-service-live-in-10-markets/d/d-id/756373>

¹⁶ "The only nationwide 5G network is here," <https://www.t-mobile.com/coverage/4g-lte-5g-networks>

¹⁷ "T-Mobile US: The Sprint Merger So Far," Roger Conrad, Forbes, Jun 23, 2020. <https://www.forbes.com/sites/greatspeculations/2020/06/23/t-mobile-us-the-sprint-merger-so-far/#4d793758271b>

¹⁸ "New iPhone 12: Everything we know about Apple's 2020 iPhones," Adam Ismail, December 17, 2019. <https://www.tomsguide.com/news/latest-iphone-12-news>

¹⁹ "Apple to capture top spot in 5G smartphones in 2020: Report," November 15, 2019. <https://www.outlookindia.com/newscroll/apple-to-capture-top-spot-in-5g-smartphones-in-2020-report/1663528>

²⁰ "T-Mobile Just Turned on Its Nationwide 5G Network," Ellen, December 2, 2019. <https://www.droid-life.com/2019/12/02/t-mobile-just-turned-on-its-nationwide-5g-network/>



These developments blaze the trail for future smart cities, automated driving and telemedicine. Further development is needed in both the hardware and technology aspects, but recent market movements indicate progress in all areas. For example, AT&T and Verizon are turning their attention to 5G mobile hotspots, with AT&T's Netgear and Verizon's Inseego device as their pilots in this area. Companies such as Qualcomm and Intel are advancing 5G modems that will be compatible with network operators and serve smart-home and other devices whose design has not yet been finalized. 20 device manufacturers have already confirmed their use of Qualcomm's 5G components in their tech.

On the infrastructure side, companies such as American Tower and Crown Castle continue to develop their large portfolios of strategic rooftop sites to streamline the connectivity that 5G expansion requires. American Tower for example, manages access to 5,500 rooftops; and CC's over 40,000 towers, 70,000 on-air or under-contract small cell nodes, and more than 75,000 route miles of fiber connections are strategic elements in the 5G rollout.²¹ In early 2020 CC announced its backing of Vapour IO's \$90m nationwide edge rollout,²² further demonstrating its commitment to digital transformation for the U.S.²³

Covid-19: Ericsson's November 2019 prediction of 100 million global 5G subscribers by the end of 2020, was recently adjusted to 190 million.²⁴ So while the global pandemic may have pushed off the mainstreaming of 5G connectivity in Europe and North America, it has not derailed it. Indeed, lockdown has only highlighted the need for fast, high quality, low latency connectivity, to support remote work solutions and a growing range of online entertainment.

5G applications

Widespread 5G connectivity won't just cut download times and enhance online leisure such as eSports. It has the potential to make information universally accessible, foster a digitalized sharing economy, transform diverse industries and enhance people's quality of life. From smart cars to VR/AR functions; from manufacturing to the automotive industry to medicine and healthcare, the impact of 5G could be felt across many spheres, including:

Enhanced Mobile Broadband (EMBB) – Cellphone coverage will be increased and made more efficient, facilitating a lower cost-per-bit for data transmission. The network will be capable of handling many more devices requiring media and data intensive uses (such as AR/VR), especially in specific areas. This will drive the use of broadband apps on mobile networks.

Massive Internet of Things (MIoT) – 5G's economies of scale and deeper more flexible internet coverage will drive down costs and allow for the vastly increased scale of IoT and greater uptake of relevant technologies. Research suggests that there are currently over 26 billion IoT devices worldwide, which could increase to 31 billion connections between people, things, and organizations by the end of 2020.²⁵ Such interconnectedness results in and supports new requirements for communication networks.²⁶

²¹ "Endless opportunity through a diverse network," Crown Castle. <https://www.crowncastle.com/network-infrastructure/#2>. See also "Viewpoint: The case for better connectivity in D.C.," John P. Drew, January 14, 2020. <https://www.crowncastle.com/news/viewpoint-the-case-for-better-connectivity-in-d-c>

²² "Crown Castle-backed Vapor IO raises \$90M for nationwide edge rollout," Monica Allevan, January 22, 2020. <https://www.fiercewireless.com/wireless/crown-castle-backed-vapor-io-raises-90m-for-nationwide-edge-rollout>

²³ "Crown Castle on Cutting Edge of 5G Innovation" Diane Rusignola, REIT magazine, November 15, 2020. <https://www.reit.com/news/reit-magazine/november-december-2019/crown-castle-cutting-edge-5g-innovation>

²⁴ "COVID-19 isn't slowing down the 5G rollout – at least not in China," Shara Tibken, June 16, 2020. <https://www.cnet.com/news/covid-19-isnt-slowing-down-the-5g-rollout-at-least-not-in-china/>

²⁵ "How Many IoT Devices Are There?", Nick G, TechJury Blog, February 19, 2019. <https://techjury.net/blog/how-many-iot-devices-are-there/>

²⁶ 5G Opening Up New Business Opportunities, Huawei White Paper, December 2016, p.4.



Mission Critical Services (MCS) – 5G will support applications that rely on low latency, high reliability, strong security and availability, enabling the operation of remote devices where failure is not an option. For example, in autonomous vehicles or remote surgeries.



3 examples of 5G applications:

Smart driving: A 2016 Huawei White Paper reported the estimation that if 90% of vehicles in the United States were automated, the number of traffic accidents would decrease by nearly 80% and the number of fatalities by about 60%. The same paper reported the US National Highway Traffic Safety Administration's prediction that light and medium-sized vehicles with vehicle-to-vehicle communications (V2V) could avoid 80% of accidents, and large vehicles with V2V could avoid 71% of the accidents.²⁷ Furthermore, Accenture have suggested that all new cars will be connected by 2025.²⁸ Smart driving is a clear example of how strong consumer and industry interest and uptake of 5G technology could encourage telecom companies to invest in the necessary research and development (R&D) and infrastructure to partner with industry for market share.

Indeed Nokia was a founder of the “5G Automotive Association” (5GAA)” established in 2016 with 120 plus members. This body aims to unite automotive and telecommunications to accelerate the introduction of intelligent transport and communication solutions. 5GAA expects the earliest deployments of the most advanced 5G automotive technology, which could reduce accidents and allow vehicles to travel closer together and therefore save road space, to come in 2023.²⁹ In January 2020 Qualcomm announced its first “Car-to-Cloud Service” would be available in the second half of the year. This first taste of smart driving will support “actionable analytics and insights through data collection correlated from multiple sources at the edge,” secure communication between cars and a personalized user experience for passengers.³⁰

²⁷ 5G Opening Up New Business Opportunities, Huawei White Paper, December 2016, p8.

²⁸ “Accenture, Connected Vehicle,” April 2016. https://www.accenture.com/_acnmedia/Accenture/Conversion-Assets/DotCom/Documents/Global/PDF/Dualpub_21/Accenture-digital-Connected-Vehicle.pdf

²⁹ “Building the 5G highway for connected cars,” Uwe Pützschler, Jan 23, 2020. <https://www.nokia.com/blog/building-5g-highway-connected-cars/>

³⁰ “Qualcomm Introduces Car-to-Cloud Service for Over-the-Air Vehicle Updates and On-Demand Services & Features,” January 6, 2020. <https://www.qualcomm.com/news/releases/2020/01/06/qualcomm-introduces-car-cloud-service-over-air-vehicle-updates-and-demand>



Smart Grids: Based on the principle that everything in the grid is connected, monitored and controllable, smart grids are now regarded as an indispensable component of national energy strategies in many markets, including China, Europe and the United States. They integrate information, telecommunication and automation into traditional power systems, revolutionizing the way energy is stored, delivered and sold. They require 5G's intelligent, comprehensive and reliable network which would provide very low latency for immediate data sharing and wide coverage, high bandwidth and a massive web of connections to millions of smart meters. In return 5G could enable significant social and environmental benefits due to the reduced power usage.³¹



Healthcare: From remote controlled telemedicine to EMT's having immediate access to information on a patient, there is wide acknowledgment of the potential of eHealth to increase the availability and decrease the cost of medical services. Mobile devices are already being used as part of medical diagnosis or treatment all around the world, with 5G advances promoting market potential in telehealth services, personal health monitoring, remote surgery and commercial wearables.

Catalysts for growth

While consumer enthusiasm is important, full commitment by telecom companies to the required investment for the leap to 5G, will be determined by the regulatory framework, market innovation and their cooperation and shared vision with industry partners.

If telecom operators are able to position themselves as the 'best enablers' for industry applications, then both partners will have the confidence to invest in R&D and infrastructure to make the move to 5G effective, sustainable, innovation-welcoming and profitable. For example, automotive manufacturers could see the potential in 5G networks as a platform to open up new revenue streams and business models, including in-car entertainment or flexible rental charges based on the car/route used. Their industry-centered technological advancements would propel further investment by 5G providers.

³¹ 5G Opening Up New Business Opportunities, Huawei White Paper, December 2016, p5.



Governments that support private investment in 5G through intellectual property protection, availability of risk capital, spectrum licensing and the facilitation of R&D position themselves to embrace the innovation and potential associated with 5G's ubiquity in the economy.

Consumer demand should grow with the understanding that people will benefit from wireless, untethered, immersive experiences that enable them to watch movies and live sports programs, play games, shop online and work remotely with convenience, freedom and efficiency. Such services could also enhance cooperation and interaction in fields like education, training, construction, city planning and oilfield exploration.

Benefits of ETF investing:

The Defiance Next Gen Connectivity ETF-FIVG:

- Is a diversified basket of stocks that can potentially benefit from the expansion of the 5G market and the success of 5G-investing company stocks. Rather than buy one or two individual equities focused on this sector, investors can invest in a way that provides diversification while maintaining a targeted view for their portfolio.
- Will be exposed to those leading the market, including Verizon, AT&T, Nokia, T-mobile, Ericsson, Qualcomm, Skyworks Solutions, Cisco, Broadcom and Xilinx.
- Is a cost-effective way to access this market at 0.30% gross expense ratio.



Fund holdings and sector allocations are subject to change at any time and should not be considered recommendations to buy or sell any security.

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Investing involves risk. Principal loss is possible. As an ETF, the fund may trade at a premium or discount to NAV. Shares of any ETF are bought and sold at market price (not NAV) and are not individually redeemed from the Fund. The Fund is not actively managed and would not sell a security due to current or projected under performance unless that security is removed from the Index or is required upon a reconstitution of the Index. A portfolio concentrated in a single industry or country, may be subject to a higher degree of risk. The value of stocks of communications services, information technology and defense sector companies are particularly vulnerable to rapid changes in technology product cycles, rapid product obsolescence, government regulation and competition. The Fund is considered to be non-diversified, so it may invest more of its assets in the securities of a single issuer or a smaller number of issuers. Investments in foreign securities involve certain risks including risk of loss due to foreign currency fluctuations or to political or economic instability. This risk is magnified in emerging markets. Small and mid-cap companies are subject to greater and more unpredictable price changes than securities of large-cap companies.

The possible applications of 5G technologies are only in the exploration stages, and the possibility of returns is uncertain and may not be realized in the near future.

Diversification does not assure a profit, nor does it protect against a loss in a declining market.

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