Blink Astro's IoT Products: Bringing Space Home

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2021 Public Release

Introducing SpaceWorks Enterprises

- SpaceWorks Enterprises is dedicated to advancing the state-of-the-art in the aerospace sector
- For 21 years, our Atlanta-based small business team has helped shape new commercial space markets, designed and built complex flight systems, developed cutting-edge software, been a leader in hypersonics, and pioneered revolutionary low-cost space hardware

Our Brands and Business Units

SpaceWorks®

- Independent advanced aerospace systems design and analysis
- Aerospace market research, forecasting, and M&A support
- QuickShot and REDTOP commercial aerospace software tools
- FuseBlox modular design & assembly connectors

Generation Orbit®

- X-60A/X-60C hypersonic flight test services
- Hypersonic flight technologies and mechanisms
- Advanced in-space propulsion stages

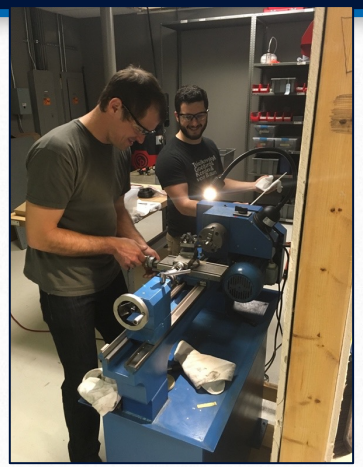
Terminal Velocity Aerospace

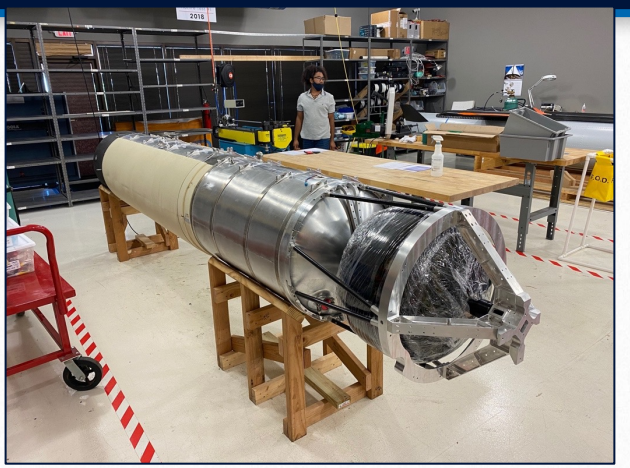
- RED-4U/RED-25/RED-50 recoverable space return capsules
- Nova heat shield materials
- RED-Data2 telemetry-based TPS testbeds

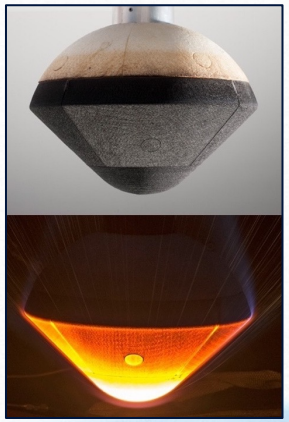
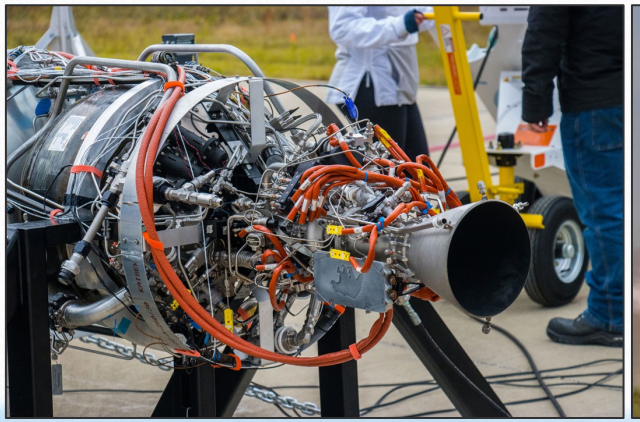
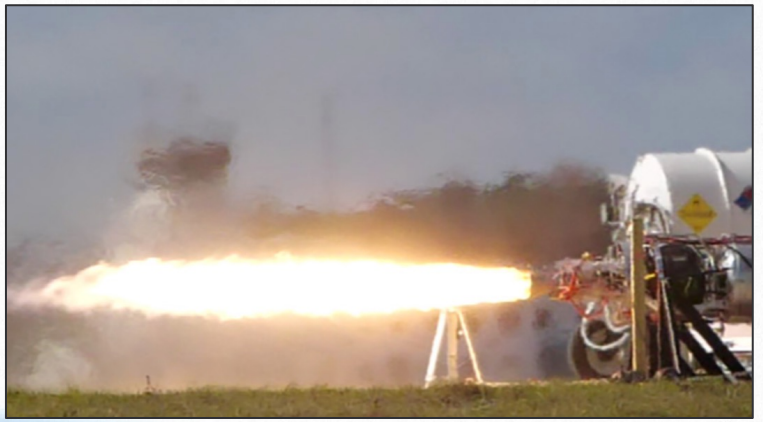
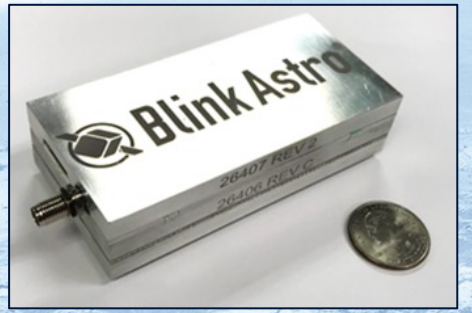
Blink Astro®

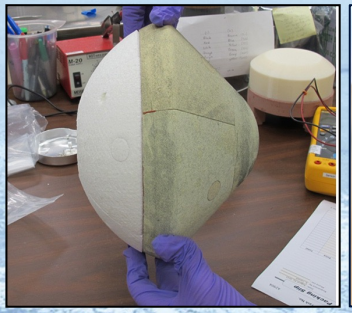
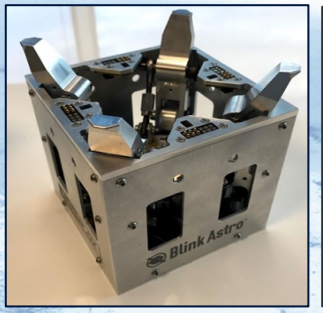
- BlinkSats for M2M/IoT
- BlinkR family of low power direct-to-space IoT ground transmitters
- DTN-ready space radios/transceivers

SpaceWorks' Facilities & Hardware Development Activities



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Blink Astro and IoT

- How CubeSats are enabling low-cost global IoT from Low Earth Orbit

IoT-Enabled Devices and Applications are Growing Rapidly

Commercial/Consumer

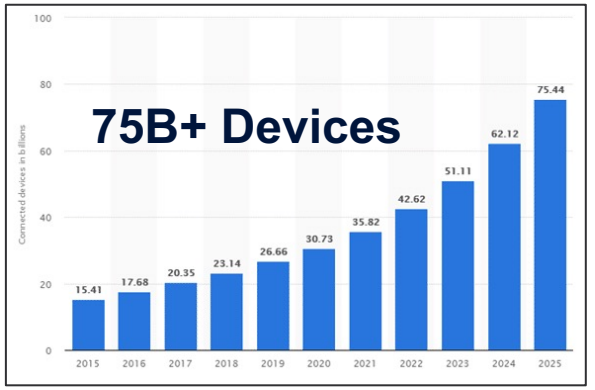
Industrial

The IoT Market Forecast

- **The global Internet-of-Things (IoT) is a rapidly growing marketplace with billions of emerging devices**
- **Despite high accessibility to existing terrestrial/cellular networks, only <u>fraction</u> of the Earth's surface is supported for <u>terrestrial</u> connectivity**
  - Cellular networks only provide limited coverage for certain IoT market verticals (agriculture, shipping, oil and gas, and transportation), which need to operate in remote areas
- **Existing satellite network services are expensive (e.g. Iridium, OrbComm)**
- **Launch provider costs have dropped significantly and CubeSat technology has rapidly matured**
  - CubeSat platforms are suddenly very nicely suited for a <u>disruptive IoT satellite solution</u> due to their low cost and low data rate needs
  - Applications include commercial, civil, and DoD users

2025 Forecasts

Credit: Statista 2019



Credit: Statista 2019

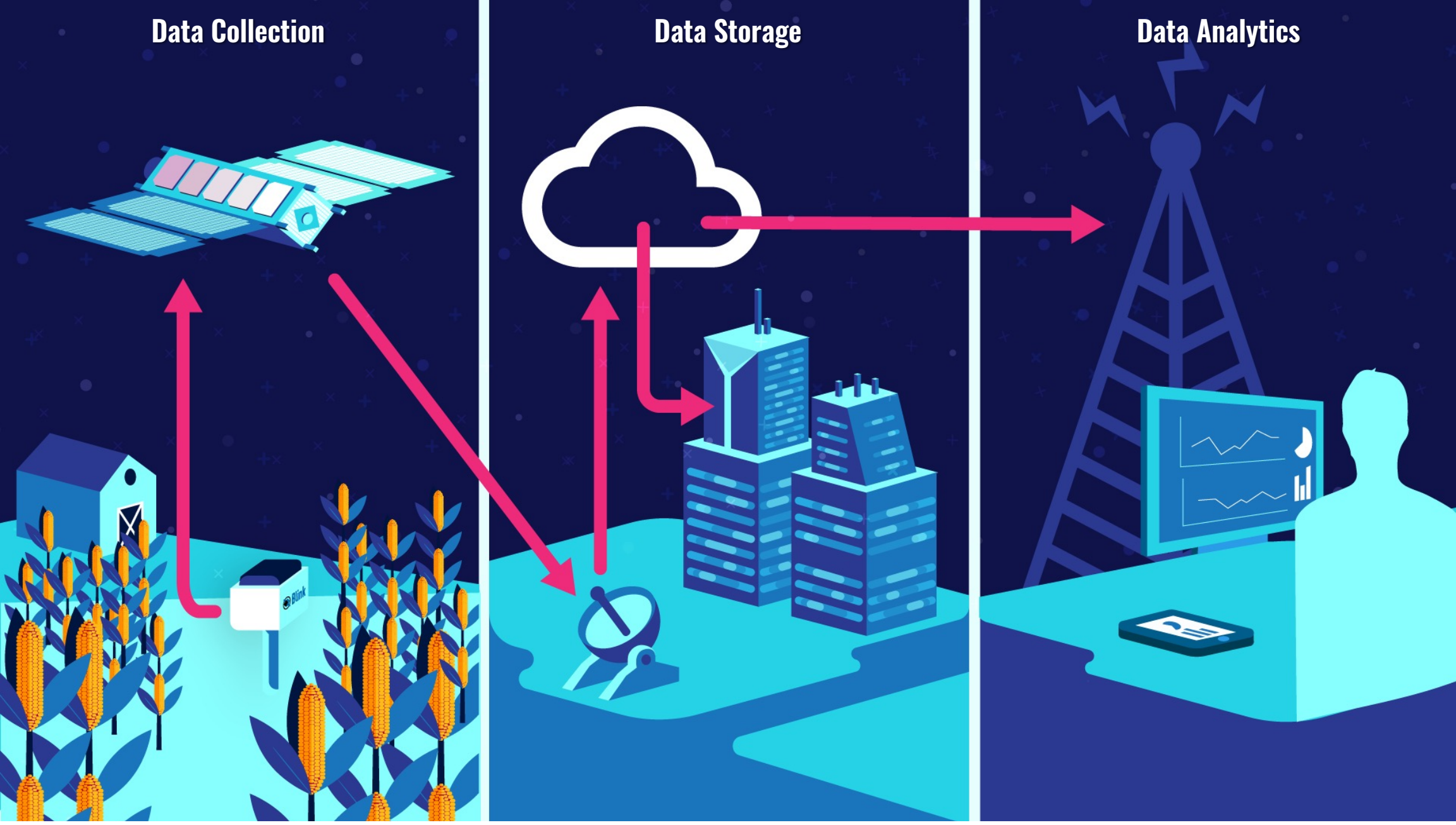
SpaceWorks' internal studies in 2014-2015 identified emerging IoT as a significant opportunity for space-based network capabilities. We have received two US Patents on our CubeSat-based IoT approach to date

Blink Astro®

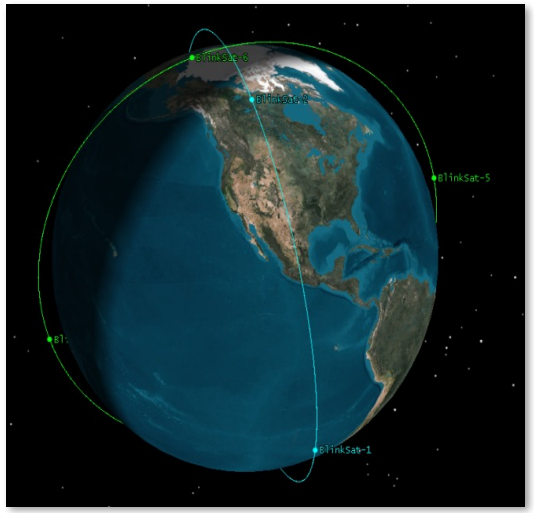
- 10,000's of Globally Deployed BlinkR™ Transmitters
- 100 CubeSats form a LEO Network (BlinkSats™)
- All Devices Support Direct-to-CubeSat Communications
- 1 Single-Provider Integrated Global IoT Network

Using active signal collection rather than imagery (we're ears, not eyes), our patented CubeSat small satellite network will be an affordable global network for satellite-IoT


Small BlinkR™ transmitters/ground terminals actively send secure data to satellites.
Constellation of BlinkSats™ receives data directly from sensors, providing global coverage from Low Earth Orbit.
No relay hubs are needed.
Blink's network accommodates sensors from many industries
Blink
Patent No. US 10,368,251 B1

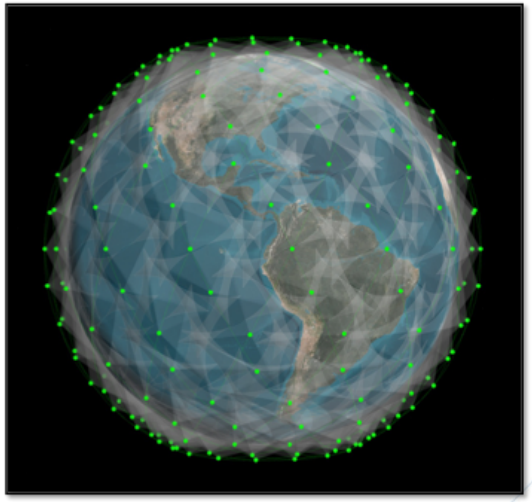

Data Collection
Data Storage
Data Analytics

Proposed Gen1 and Gen2 Blink Astro LEO Networks



Generation 1 BlinkSat™ Constellation

- 8 Satellites
  - 2 orbital planes, 4 satellites per plane, 700 km altitude
- Four passes per ground target per day (worst case)
  - One pass every 6 hours
  - Over flight of any ground site +/- 90° latitude



Generation 2 BlinkSat™ Constellation

- 100+ satellites (depending on altitude)
- Walker style LEO constellation (similar planes)
- Continuous global coverage
- Can be deployed incrementally to achieve final coverage goal

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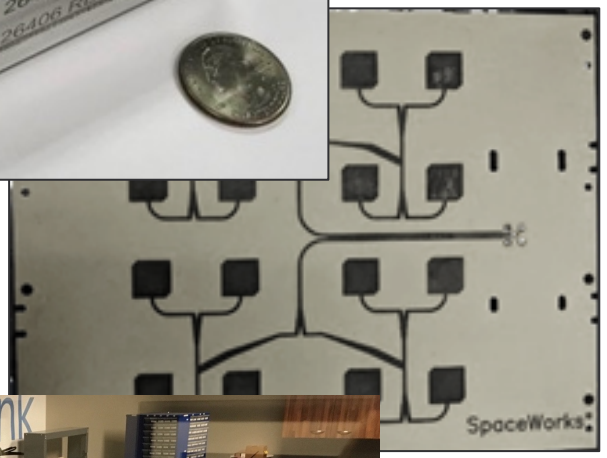
How are We Doing?

- **Progress and Accomplishments to Date**

Blink Technology Demo 1 (BTD-1)

BTD-1 | Mission and Hardware Development Timeline

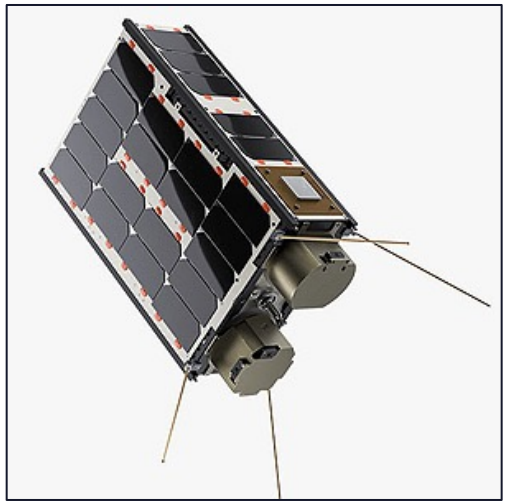
- **SpaceWorks developed a customized radio receiver system for an orbital flight test (designated the BTD-1 / Blink Technology Demonstration 1)**
- **Flight hardware was shipped 125 days after project initiation**
- **BTD-1 demonstrated key Blink network technologies:**
  - Low noise, high performance IoT receiver
  - Tunable from 1 GHz to 6 GHZ
  - Many-to-1, multiple access technologies
  - Doppler compensation
  - Flexible data rate, modulation, and encoding



Our Ride | M6P Hosted Payload Opportunity

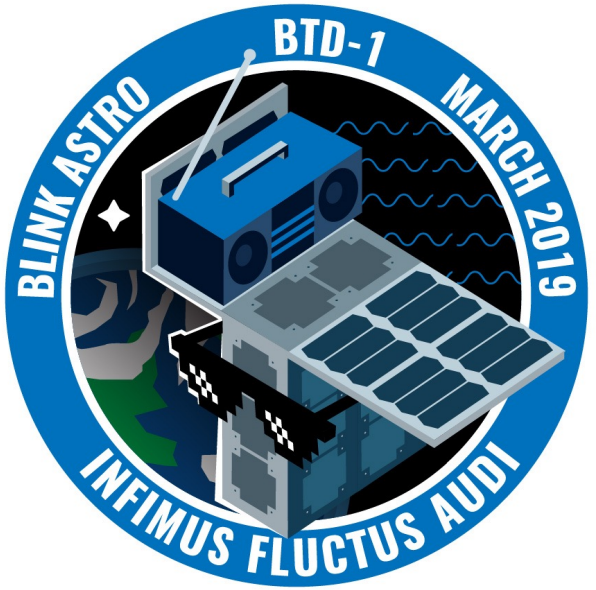
- NanoAvionics Multipurpose Platform Spacecraft Bus
  - Nanosatellite bus manufacturer based in Lithuania
- 6U CubeSat Form Factor (aka M6P)
  - Empty Bus Mass: 4,570 g
  - Max Payload Mass: 7,500 g
  - Payload Volume: up to 4U
  - CAN/UART Data Interfaces
- Launched on a PSLV (India) in March 2019
- Downlink services provided by NanoAvionics
- Provided 3 – 4 uplink contacts with each of our BlinkR test devices per week
  - 5 test BlinkR locations positioned across CONUS

NanoAvionics M6P Spacecraft



BTD-1 | Key Mission Accomplishments

- Designed and qualified a radio payload **optimized for IoT Application**
- Designed and tested prototype ground transmitter for technology demonstrator
- Successfully transmitted and received messages from ground transmitters by the hosted radio payload
- Characterized **link performance capability** during demonstration
- Successfully demonstrated signal reception by hosted radio payload from multiple sites across the United States as well as simultaneous access of multiple ground transmitters in a single location

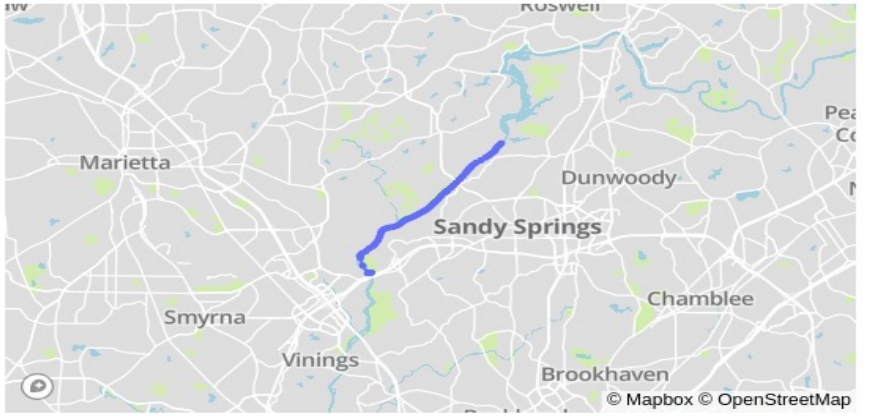


Verified key technical aspects of our Space-Based IoT solution *and* showed team's ability to rapidly develop novel, low-cost space hardware

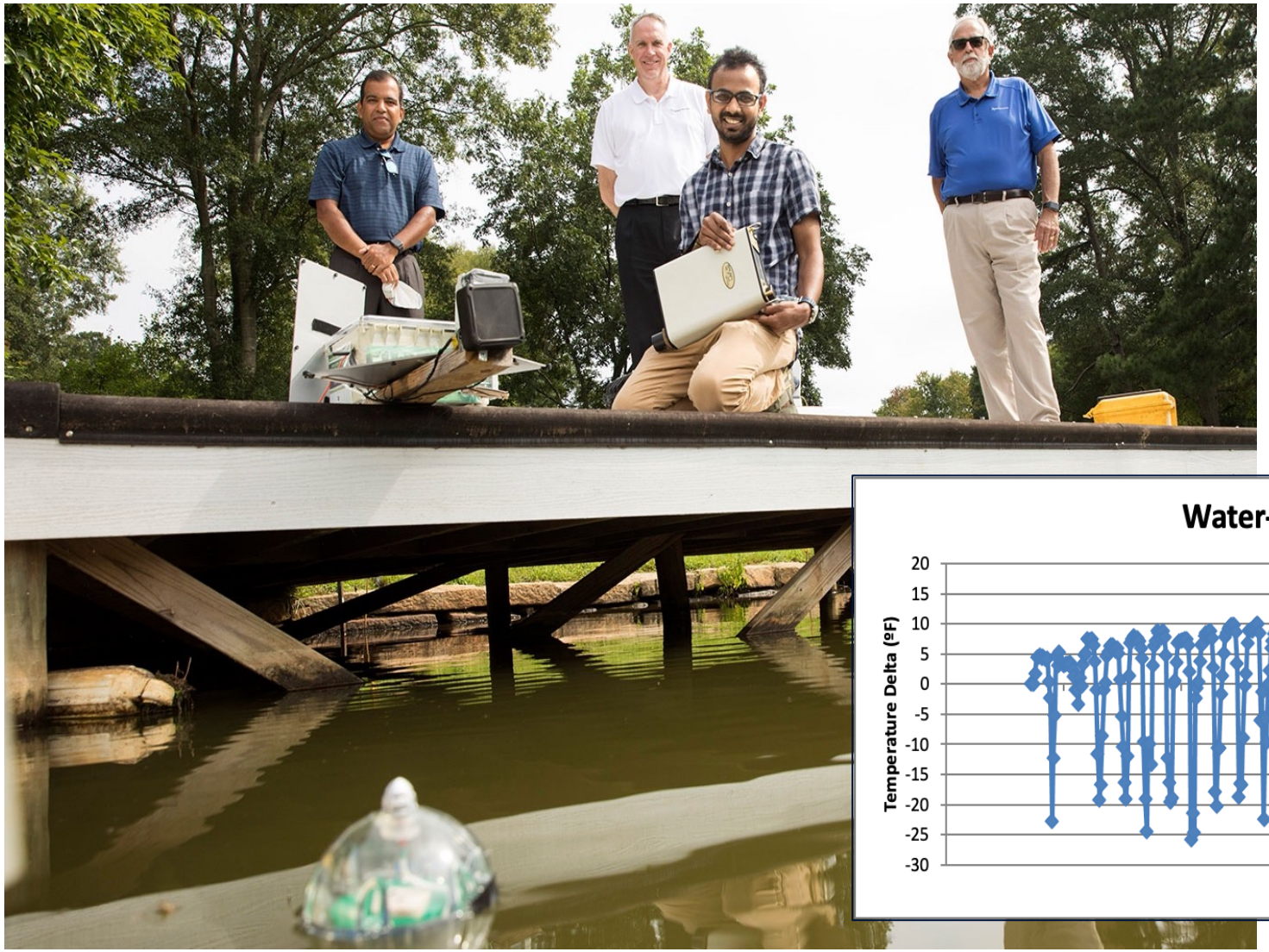
Real-world BlinkR™ Application Examples

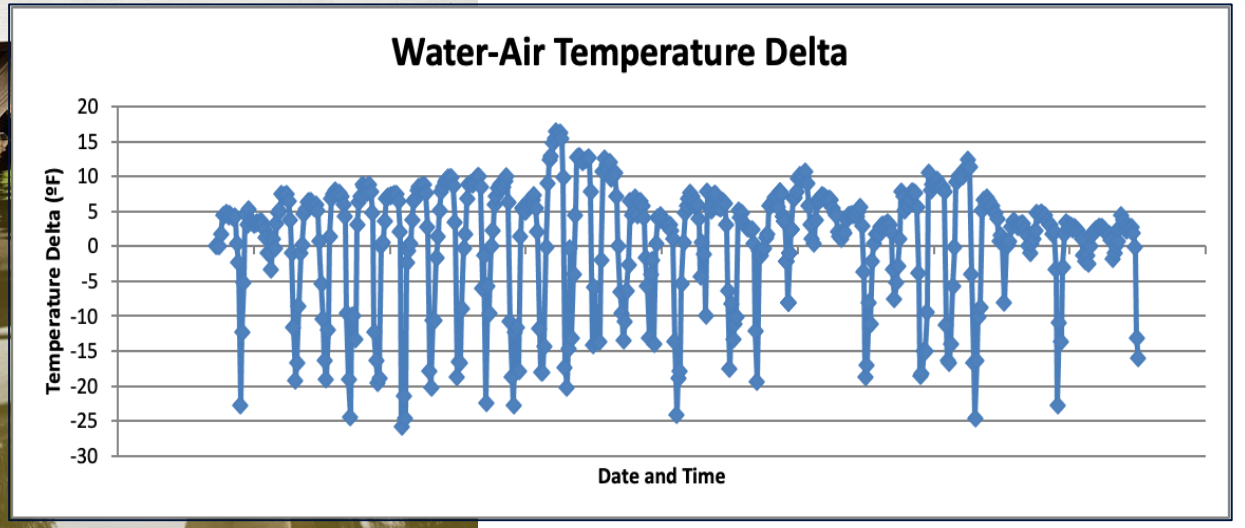
- AquaBlinkR Chattahoochee River Flow Monitoring
- AquaBlinkR Lake Oglethorpe Cyano-algae Bloom Monitoring
- AgriBlinkR South Georgia Row Crop Soil Moisture Management

AquaBlinkR Chattahoochee River Application Demonstration

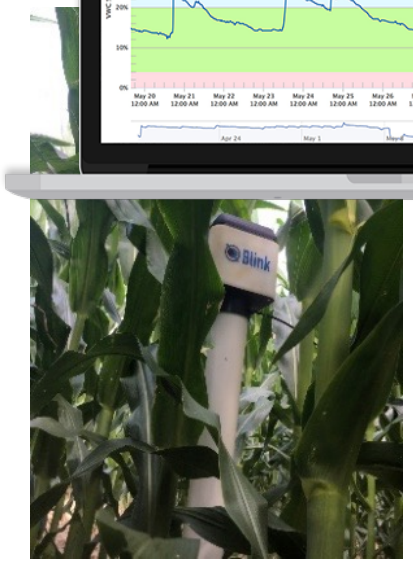


AquaBlinkR Lake Oglethorpe Application Demonstration





AgriBlinkR Cordelle GA Row Crop Application Demonstration



Summary

- **Space technology really does benefit all of us at home on Earth in tangible ways!**

- **At 5% of the total IoT market, space-based IoT will be a $80B market by 2025**
  - Global coverage leads to competitive advantages for unique markets
  - Service price and indoor locations (building shielding) remain barriers to larger adoption

- **The SpaceWorks team is working steadily to advance our Blink Astro technologies to flight!**
  - BlinkR field tests and market demonstrations are being conducted
  - Two US Patents issued to date on our overall architecture
  - Space-segment technologies have been demonstrated with more demos on the way
  - Our first two markets (waterways and agriculture) are just the tip of the iceberg. There are additional BlinkR devices currently in development for even more IoT applications

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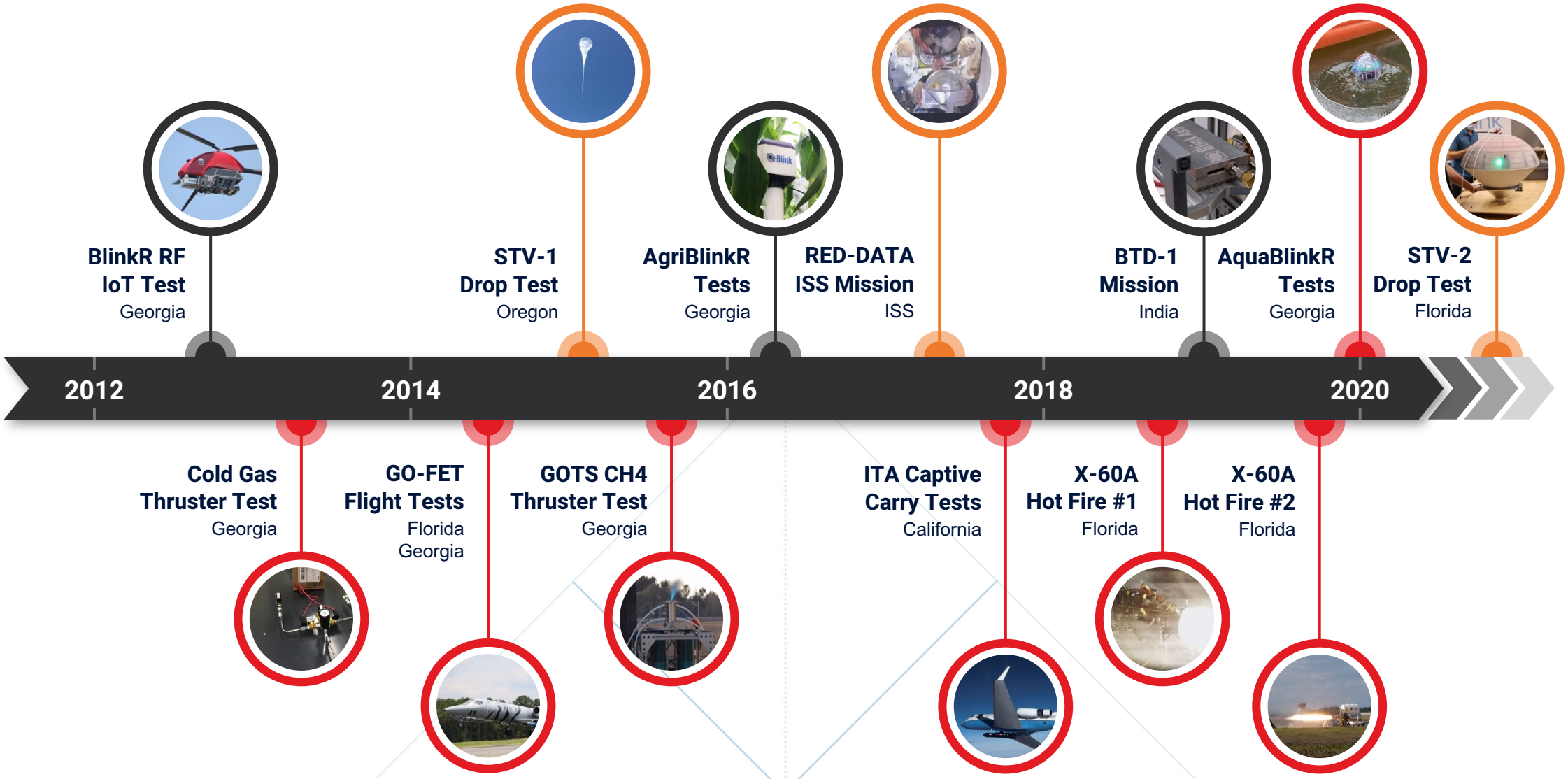
SpaceWorks' Hardware Accomplishments



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