

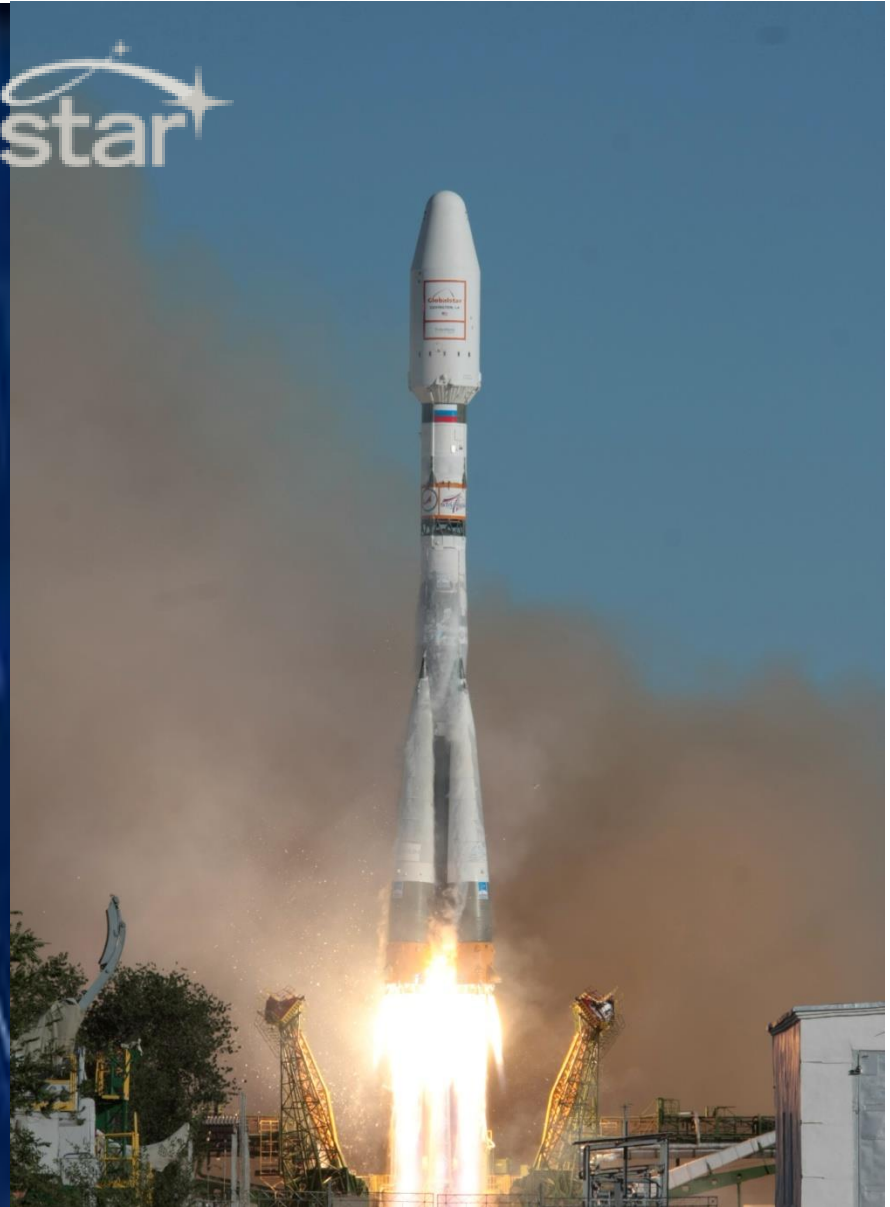
Globalstar

Launching The Future

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Kuala Lumpur

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SPACE-BASED TRACKING & PERFORMANCE MONITORING

THINK OUTSIDE THE “PING”!

What do we need, and how often do we need it? What if we could combine real-time tracking with a number of performance-related discretely?

With 1-second reporting and more than twenty data elements available, ADS-B may be the most efficient all-purpose aircraft tracking system available.

Our ADS-B Link Augmentation System (ALAS) could also stream full FDR reports on a set schedule, or trigger reports over other providers like Inmarsat.

Perhaps a hybrid system that smoothly extrapolates from Radar-like Critical Services, to flight following to FDR backhaul will be the ultimate solution?



ADS-B ROUTINE MESSAGE FORMAT (Available every second!)

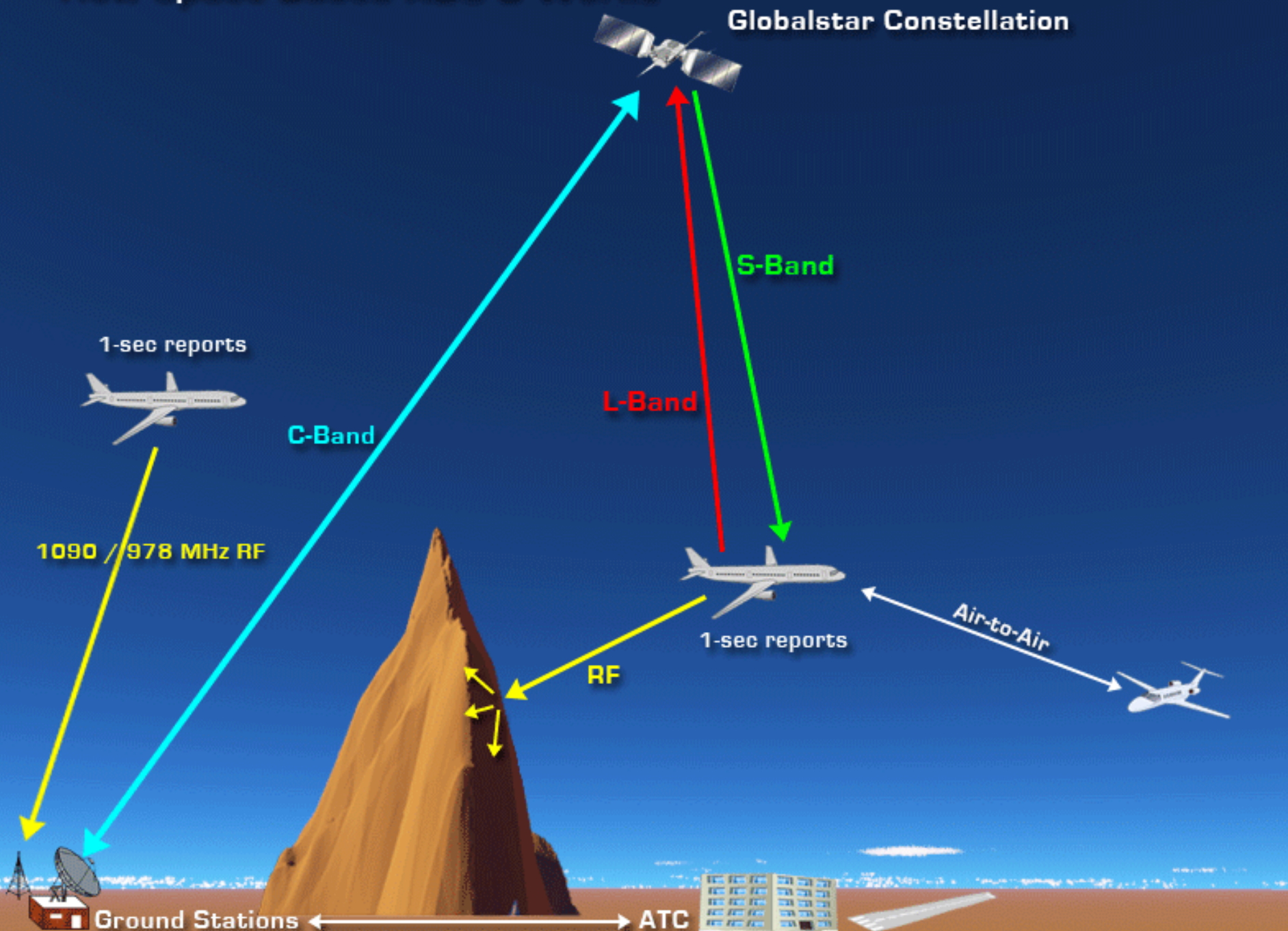
PARAMETER	DATA TYPE
Aircraft ID	ICAO Code, Callsign, 4096
Time of Report	In Milliseconds
Latitude & Longitude	<100 meters
Altitude	GPS and/or Barometric
Heading an/or Ground Track	Magnetic or True
Ground Speed	
Vertical Speed	
Category Aircraft	Emitter Category (small, large, heavy, UAS, etc)
Target Status	Emergency, no comm, hijack, medevac, etc
Airborne Status	On Ground or Airborne
Integrity and Accuracy	For position, altitude, velocity, NIC/NAC/SIL

Additional parameters that are possible within the 1090ES and/or UAT Payload

- Selected Altitude
- Altimeter Setting
- Selected Heading
- Autopilot Engaged
- VNAV Mode Engaged
- Altitude Hold Engaged
- Approach Mode Engaged
- LNAV Mode Engaged
- Capability Codes (has UAT RX, TCAS/ACAS Operational, etc)
- Operational Modes (Receiving TCAS/ACAS, IDENT, etc)

How Space-Based ADS-B Works

Globalstar Constellation



C-Band

S-Band

L-Band

1-sec reports

1090 / 978 MHz RF

1-sec reports

Air-to-Air

RF

Ground Stations

ATC

Bent-Pipe Architecture

Why it Works

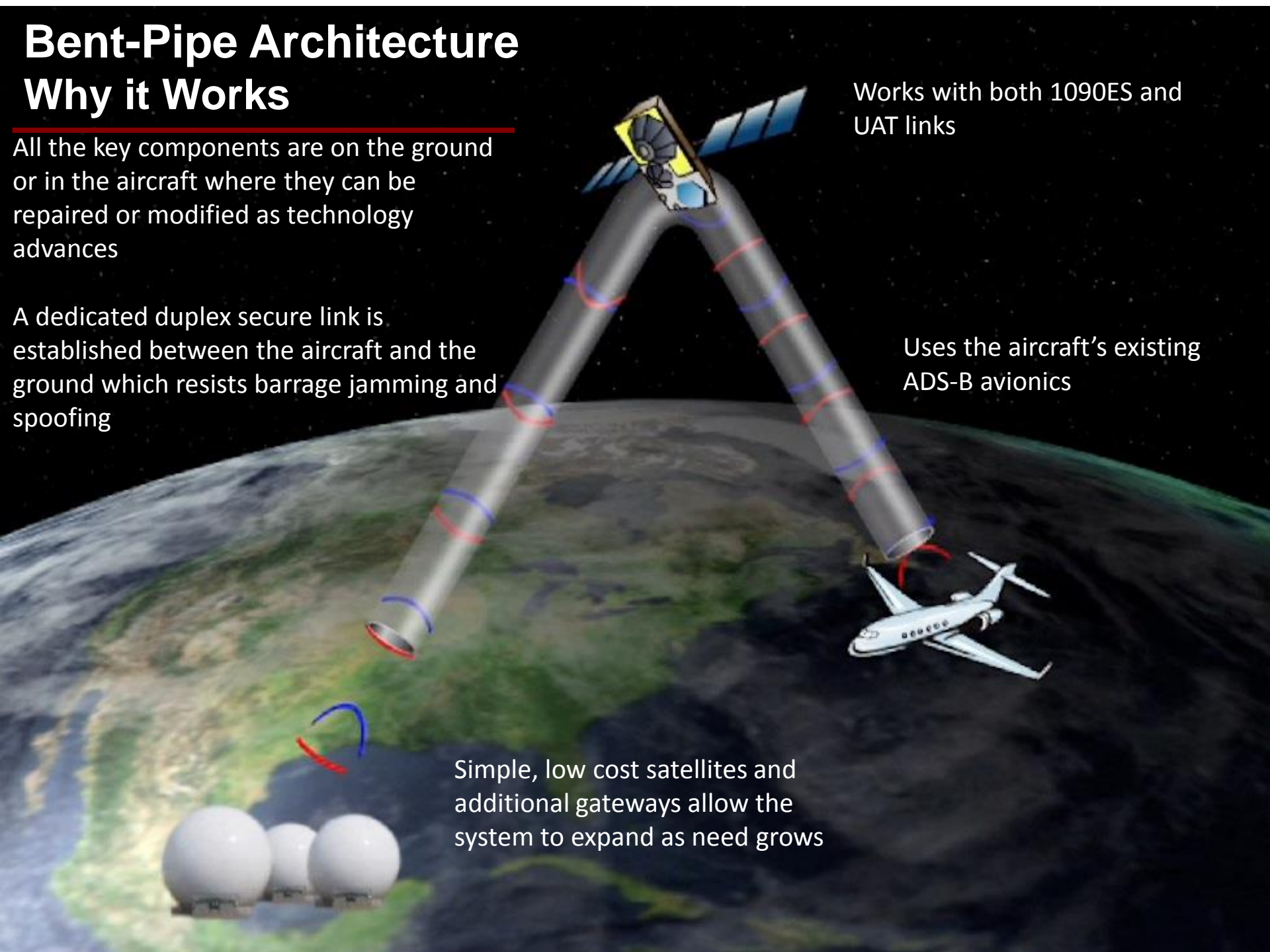
All the key components are on the ground or in the aircraft where they can be repaired or modified as technology advances

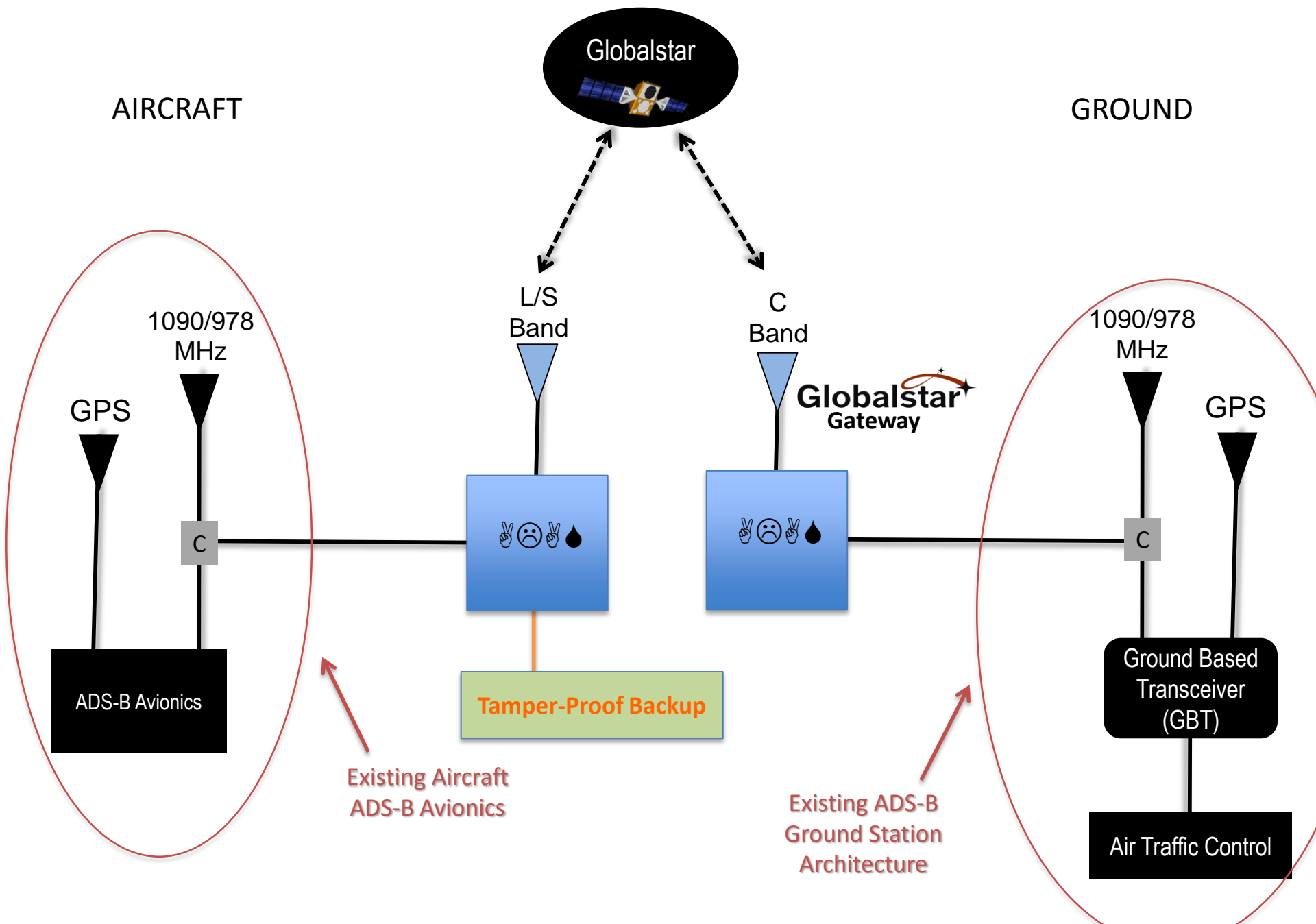
A dedicated duplex secure link is established between the aircraft and the ground which resists barrage jamming and spoofing

Works with both 1090ES and UAT links

Uses the aircraft's existing ADS-B avionics

Simple, low cost satellites and additional gateways allow the system to expand as need grows

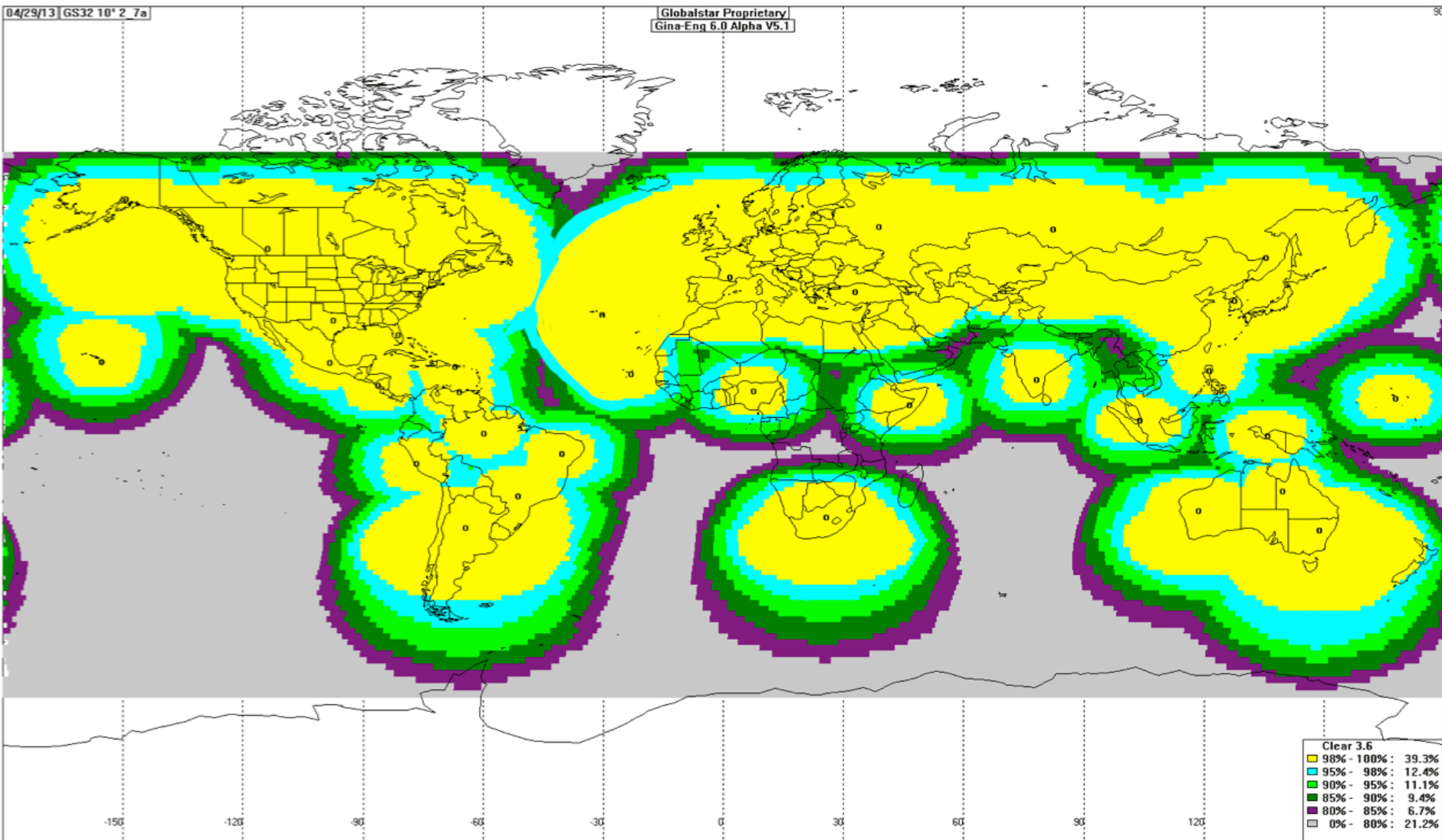




- Coverage Area** > 100% of CONUS, GOMEX, Caribbean, NAT & NOPAC by 2015
100% of the remaining FAA and Eurocontrol requirements by late 2017
- Availability** > 99.99% by 2014; 99.999% by late 2017
- Capacity** > 3,000+ aircraft per 425sm radius spot beam
- Latency** > 300ms aircraft-to-ground
- Update Rate** > 1 second
- Integrity** > 10^{-6}
- Accuracy** > Demonstrated Position Correlation between RF line-of-sight delivered positions and Space-Based ALAS delivered position for the same target in the same UTC second is <30M more than 98% of the time
- Scalability** > HIGH. The relatively low cost and simplicity of the system architecture makes enhanced coverage, availability, redundancy and capacity possible with the addition of more satellites and gateway ground stations
- Enhanceability** > EXTREMELY HIGH. Since all of the ADS-B components are located on the ground, the Globalstar portion of the system is quite accessible and can be easily modified. Possible future enhancements using the same ALAS link are:
 - Two-way voice
 - ADS-B IN; TIS/FIS uplinks
 - Flight data recorder real-time backhaul
 - TAMDAR, UAS Sensor, Weather Vision
 - Enhanced Encryption
 - Cellular Data Transmission as an Emergency Backup
- Cost** > EXTREMELY LOW. Avionics and installation should not add more than 10% to existing ADS-B equipage costs. ANSP F&E and O&M should be very reasonable.

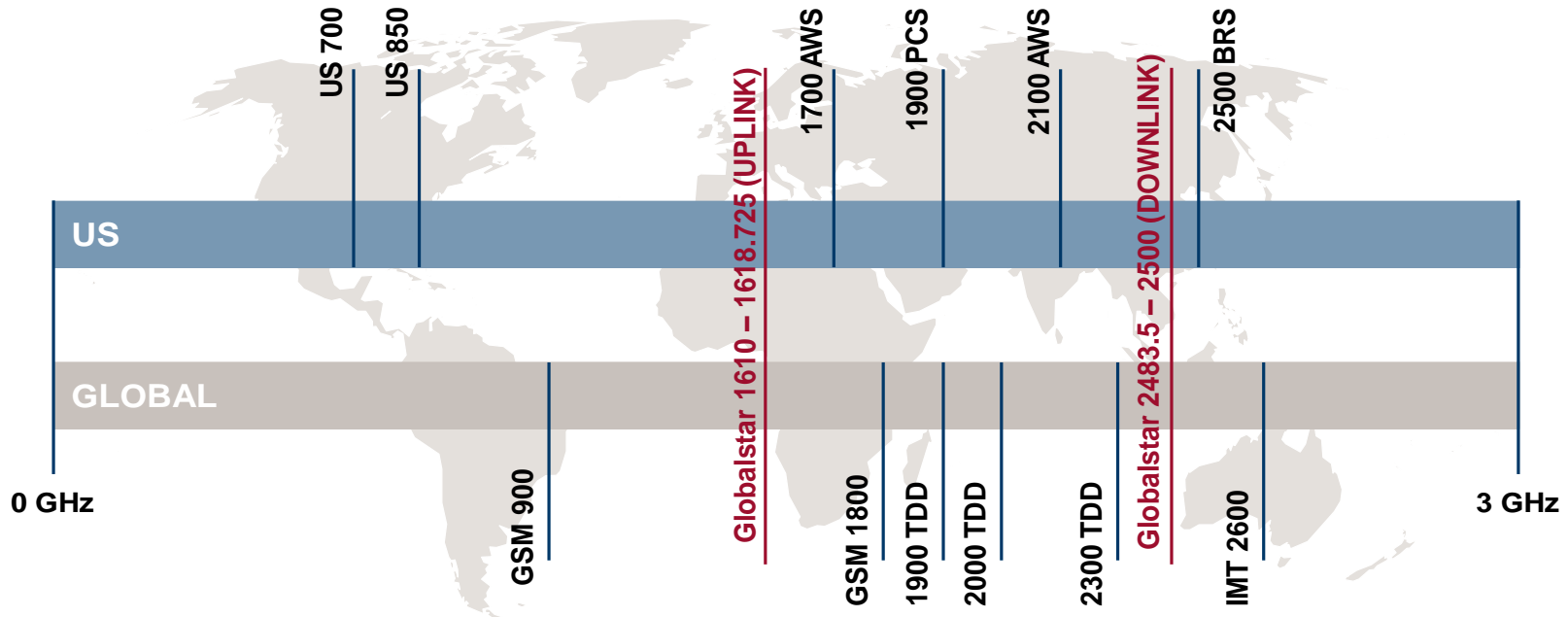
Globalstar Duplex Coverage – 32 Walker Constellation

Globalstar's current 24 Gateways plus 9 more Gateways
Duplex ADS-B coverage over more than 80% of the most important airways



GLOBALSTAR'S SPECTRUM AUTHORITY

- Globalstar maintains internationally recognized frequency assignments from the International Telecommunication Union (“ITU”), a specialized agency of the United Nations, including:
 - 1610-1626.5(1) MHz – uplink communications from mobile / fixed earth terminals to satellites
 - 2483.5-2500 MHz – downlink communications from satellites to mobile / fixed earth terminals



- Additionally, Globalstar has an ITU authority to operate gateway feeder links at 5091-5250 and 6875-7055 MHz
- The ITU provides the allocation of the radiofrequency spectrum to various uses in addition to registering frequency assignments and orbital positions / characteristics
- 193 of the world’s 195 countries, including all countries in the Asian continent, are Member States of the ITU and follow the ITU’s guidelines

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