FAQ for NSL and Globalstar

1. **Who is Globalstar?**

Globalstar operates a low-earth-orbit (LEO) constellation of 40+ satellites and provides mobile satellite voice and data products and service packages. Customers around the world in industries such as government, emergency management, marine and oil & gas rely on Globalstar satellites constellation to be smarter and faster. The Globalstar radios operate on a commercial network unlike the Ham Radio market which can only be used for non-profit educational activities.

2. **Who is NearSpace Launch Inc. (NSL)?**

NearSpace Launch Inc. is an innovative producer of affordable Globalstar radios and complete CubeSats and ThinSat satellite buses. We were the first to pioneer Globalstar radios in orbit back in 2013. Customers around the world include those in industries such as government (AFRL, NASA, DOD), education (CU, BU, NNU, others) and industry (Millennium, NanoRacks, NovaWurks). We are the only certified provider for Globalstar radios: flight approved, fight quality assembled, and extensively tested in space. Learn more about NSL at www.nearspacelaunch.com

3. **How did NearSpace Launch and Globalstar partnership start?**

NSL is Globalstar's first and primary partner to successfully modify the Globalstar radios for spaceflight communications and the only VAR with FCC and flight certified data. NSL has 100% mission success record of 27 NSL EyeStar Radios and first in space that use the modified Globalstar modems (TRL=9). NSL partnered with Globalstar in 2013 to prove that satellites in LEO could communicate 24/7 with the Globalstar constellation. All of our now 90+ radios have been FCC and Globalstar approved.

4. **Why use an EyeStar Simplex radio in space? (A "Mighty Mouse" of success)**

The NSL/Globalstar radios provide continuous connectivity for your satellite in orbit no matter where in space it is, and anytime (24/7 coverage). Real-time data at low latency of a few seconds is critical for mission success during conops, discovering satellite health problems early, making real-time data available for payload trigging, failure analysis, or monitoring attitude performance. The Simplex radios have worked well in polar and lower inclinations and for tumbling spacecraft up to 12 rpm. Packet throughput is over 90%, over 90% of the earth (see AIAA Papers #11). No ground station is necessary with the NSL radio since all secure data is available on the internet in near real-time from the Globalstar professional ground stations.

5. **What types of radios do you offer?**

EyeStar-S3: The EyeStar Simplex is your solution for quick, low power (0.2W), reliable beaconing from your satellite. From research to health and safety data, the EyeStar Simplex delivers your data 24/7 anywhere and anytime without a hitch. Max data rates are 8 Bytes/s but can operate all the time.

EyeStar-BB series: The EyeStar BlackBox (newest NSL product) is like an autonomous airplane Black Box for failure analysis but is much more as a real-time redundant low power data rate link with critical data and health monitoring. Three size options are available: a thin surface patch, a PC104 PCB, and a Box. Other options include GPS, horizon IR grid array, camera, particle detectors, extra battery, solar cells and DOD custom options. It greatly reduces risk, insurance cost, and JSpOC tracking needs.

EyeStar-D2: The EyeStar Duplex gives you higher speed command and file data transfer up to 700 Byes/s over about 50% of earth coverage. It has flight heritage on 5 NSL FastBus satellites and two DOD satellites. To make connections the Duplex requires a stabilized satellite or low rotation.

6. **Why should I use NSL when seeking a Globalstar radio?**

NSL will work with you to make sure your NSL radio, firmware, and processor are working for you for spaceflight. We do not just sell you a radio, we want to see you succeed. The EyeStar radio includes many features besides the radio: a TRL9 flight processor with firmware options for redundant link, access to the ground console dashboard to plot your data and download it, redundant professional servers on the east and west coast to securely store all satellite data, direct read analogs and digital I/O. All EyeStar radio parts are Mil Spec rated and built on a robotic precision assembly line.

7. **Has your radio been FCC Licensed?**

Yes, all our Simplex and Duplex FCC and Globalstar licenses have been approved when going through NSL consultants. Over 90+ FCC licenses have been approved this year, including constellations. NSL has made many modifications to the radios and invested over a man year of effort to meet all of the recent new FCC and Globalstar requirements. In the future we expect the license cost to be reduced as we work with the FCC, ITU, and Globalstar. The FCC cost is the same or less as flying any spaceflight radio.

8. **Do I need a ground station system with EyeStar radios?**

No. You are already taken care of via Globalstar's 24 global ground stations, which serve as a bridge between LEO satellites and traditional communications infrastructure on six continents. This connection provides communications to over 120 countries throughout the world. The second-generation ground infrastructure is based on the Internet Protocol Multimedia Subsystem (IMS) configuration to allow engineers to continually adapt to changing user needs.

9. **What is the heritage and test of EyeStar Radio?**

NSL has a heritage of 27 of 27 EyeStar radios in orbit (TRL=9) with 100% success on orbit and over another 100 manifested to launch by April 2019.

10. **There is rumor of an issue with the Duplex, is it true?**

We have heard of other institutions having issue with the Globalstar Duplex unit. One can purchase a Duplex directly from Globalstar but the product has not been adapted to all the space flight calibrations and modifications as the NSL Duplex product has. NSL built Duplex units currently have a 100% mission success although the satellite needs to be stabilized with antenna pointing zenith for best results.

11. **Do you have any published papers for the EyeStar/Globalstar radio?**

Yes, several papers have been written. Read the papers on NSL resources page
SmallSat Conference 2016: Globalstar Link: From Reentry Altitude and Beyond.
SmallSat Conference 2015: Globalstar Communication Link for CubeSats
SmallSat Conference 2014: TSAT Globalstar ELaNa-5 Extremely Low-Earth Orbit (ELEO) Satellite

12. **Do you have to use EyeStar radio when using NSL Fastbus structure and subsystems?**

No, NSL wants to build the satellite you want and need. We currently have FastBus options for 1U, 2U, 3U and 6U. NSL has built complete satellites for AFRL, NASA, Asgardia-1, and several universities, with a 100% success rate in orbit.

13. **What are the frequencies for the Simplex and Duplex?**

Our Simplex is a 1.61625 Ghz which does not interfere with the radio astronomy channels. The Duplex uses several adjacent channels CDMA but also do not interfere.

14. **Where can I buy an EyeStar radio?**

You can buy directly from NSL at https://www.nearspacelaunch.com/collections/comm-solutions, or call 765.998.8942 or our distributor Pumpkin. If you purchase via Pumpkin, please fill out forms: *NSL Standard Radio Form* and *RF Spectrum Data Template Form* before contacting NSL.

15. **Doesn't Iridium do the same thing?**

Yes and no. Globalstar and Iriduim both have constellations that can be used for communication but the Iridium constellation is half the altitude (700 km vs 1400 km) of the Globalstar constellation, thus causing lower connectivity and lower throughput for certain LEO orbits. NASA Ames published report on Iriduim in 2017 at SmallSat Conference to learn more.

16. **What are the advantages of an EyeStar radio compared to a Ham radio?**

- Ham radio links require the expense for a ground station and its operation.
- Data transfer usually requires store and forward software on the satellite to burst all data down during an infrequent satellite pass overhead.
- A tumbling satellite and weather may also affect the link margin of Ham radios.
- The Ham radio requires the operators to have a license.
- The link can only be used for nonprofit/noncommercial applications.
- Many Ham transmitters require a deployable antenna for 2 m and 70 cm links.
- Ham radio links can be very good for education for students. NSL have built Satellite Ham radios and maintains several Ham licenses.

17. **How do EyeStar radios compare with other satellite radios?**

There are several good TRL9 high-speed links available that complement the lower speed of the Globalstar link (~8 bytes/sec for Simplex and about 700 Bytes/s for the Duplex but these links operate 24/7 for much more downlink time). Other satellites using these radios must employ a store and forward software processor system on the satellite to send high speed data down over infrequent ground station passes. High-gain antennas on these satellites also require expensive pointing and attitude control capability. The qualified S-band, X-band radios are usually much more expensive, larger, and require more power than the Simplex radio. For high data and imaging applications high data rates are required, but the redundant, 24/7 Simplex link provides critical mission success at all times and attitudes.

18. **What is the Simplex data cost?**

The data cost varies from 0.33 cents per byte to 1 cent per byte depending on data usage or one can pay a flat data usage rate of $50/month. Simplex Data cost includes 24 professionally operated ground station, live 24/7 access to NSL console with back-up servers. Please email us at nsl@nearspaceclaunch.com for further information.

19. **What questions one should ask before purchasing a radio for my spacecraft?**

A few questions one could ask…

- What is my connectivity while in orbit?
- Is there heritage and lineage with the system? Show me real data if available
- How many radios are in orbit from your company?
- What is my cost? Radio, ground station, software, data…
- What is my downlink rate and frequencies?
- Do you have any papers published or detailed product sheet available?

20. **If I have question not listed who do I contact?**

Please visit our website at www.nearspacelaunch.com or send us an email at nsl@nearspaceclaunch.com