

Technical White Paper

TIGHTBEAM Terminal SOLUTION



TIGHTBEAM Terminal

Executive Summary

The Problem

- Insufficient degrees of freedom to point antennas, payload, and solar arrays, leading to performance tradeoffs.
- Separate units from multiple vendors requiring more program management.
- Heritage pointing solutions are often high SWaP-C solutions with singularities.

The Solution

- TUI's TIGHTBEAM Terminal

TUI's Benefits

- Up to 50% more data downloaded during a single pass
- Lower operation costs due to more efficient ground contacts
- Ease of integration and control

Problem Definition

Organizations are often limited when sending payloads to orbit. These limitations include high SWaP-C, insufficient degrees of freedom for pointing mechanisms, and separate units from multiple vendors requiring more time and program management. The problems listed often result in acceptance of lower functionalities. This compromise can lead to slow data transfers, limited functionality, high operation costs, and communication loss with ground stations. Particularly, the inability to communicate with the ground station due to payload pointing and power generation can be an impactful hindrance.

Tethers Unlimited has created a solution that minimizes the impact of payload data collection and solar array operations. TIGHTBEAM Terminal is a radio communications system that integrates a RF pointing mechanism, necessary controllers, and encryption. This solution reduces the comm system's SWaP-C, allows for ground communication, and increases data transfer volume.

When developing spacecraft communications, there is limitation with size, weight, and power (SWaP). While keeping the priority of payloads, freedom in pointing mobility, and communication at the forefront, TUI has designed and developed the TIGHTBEAM solution with these problems in mind. TUI's TIGHTBEAM offers a full communications solution for a multitude of space mission needs.

Spacecraft attitude control is based on payload pointing, solar array pointing, thermal constraints, and communications. Due to cost and volume limitations, communication antennas are often fixed. This can lead to an inability to communicate with ground stations and transfer mission data because the communication system is not pointing to the ground. TUI created a solution that integrates a small pointing mechanism with an RF transmitter. This configuration simplifies spacecraft pointing by providing extra degrees of freedom to enable independent antenna pointing. TUI's different antenna and band options offers full flexibility and customizability to gain easy integration and control. The TIGHTBEAM solution is a union of TUI's best-in-class products to create the most flexible space communication.

TIGHTBEAM Terminal's Full Communication Solution

SWIFT Software Defined Radios

Tethers Unlimited provides high performance radios in several wave bands. Being software defined allows a high degree of customization and flexibility even on-orbit. Tethers Unlimited is known for delivering high performing Software Defined radios on time and providing the customer service required to integrate with your spacecraft.

COBRA Gimbals

Tethers Unlimited pointing mechanisms offer unprecedented control in the most extreme environments. We offer several variations of COBRA gimbals. TUI's COBRA HPX has a Canfield Joint carpal-wrist design which provides 160-degree partial hemisphere pointing capabilities. Our COBRA K gimbal is a 2DOF gimbal built with classic pan and tilt functionalities. Overall, TUI's gimbals are highly precise, small, low weight and power impacts.

COBRA Commander

The COBRA Commander is a driver for TUI's COBRA gimbal, designed to provide pointing and positioning capabilities for robotic systems. COBRA Commander supports singularity free and continuous full hemispherical pointing and slew rates of greater than 30 degrees per second for the COBRA Gimbal.

Business Benefits

The TIGHTBEAM Terminal integrates TUI's high-performance Software Defined Radios with a compact, high-precision gimbal mechanism and an antenna to provide a turnkey solution for steered high-gain communications. With a range of options for frequencies, the TIGHTBEAM Terminal can help close the gap between high-cost solutions and limited budgets for demanding missions. This solution offers quick durations to launch with TUI's 100% on time delivery, smaller size, high adaptability, and is an easy-to-implement solution across multiple missions.

TUI's TIGHTBEAM solution reduces the pain of dealing with several vendors. By doing so, there are fewer control documents, user manuals, and vendors to consult with when implementing communications onboard spacecraft. With TUI's speed of delivery, ease of use and configuration, implementing TUI'S TIGHTBEAM system for your next mission is the perfect solution!

Summary

TUI's TIGHTBEAM solution offers a high level, full communication solution with advanced technology and movement in limited spaces. The gimbals pointing mechanisms offer unprecedented control in the most extreme environments. With a full communication solution with easy integrability, multiple band and antenna options, this offers more capabilities without the compromise of functionalities, and lower operating costs.

TIGHTBEAM is a fully integrated radio, gimbal, commanding electronics, and antenna system. We want to offer you this adaptable and implementable solution. Contact bizdev@tethers.com to use Tethers Unlimited TIGHTBEAM for your next mission.