

Use Case: Broadband Satellite Communications for Maritime Border Security with Unmanned Surface Vehicles (USVs)

I 1. Objective

Deployment of broadband Satellite Communications (SATCOM) on Unmanned Surface Vehicles (USVs) to enhance maritime border security and combat illegal activities such as human trafficking, arms smuggling, and drug transportation. Focus is placed on achieving persistent, wide-area coverage and enhanced operational security.

I 2. Operational Challenge

Conventional manned patrol vessels and radio frequency (RF)-based unmanned surface vehicles (USVs) are inherently constrained by line-of-sight communication limits and are thus restricted in their operational range. These platforms often suffer from significant performance degradation due to terrain masking—such as coastal formations, islands, or even large vessels blocking signals—as well as electromagnetic interference (EMI) arising from nearby radar systems, communication hubs, or natural atmospheric phenomena. Additionally, adverse weather conditions, including heavy rain, fog, or sea state disturbances, can further compromise signal integrity, reduce situational awareness, and limit mission effectiveness.

I 3. Role of Broadband Satellite Communications

Broadband SATCOM plays a critical enabling role in this concept by providing:

- Beyond-Line-of-Sight (BLOS) coverage for open-sea and offshore surveillance
- Encrypted, secure, real-time data transfer of video, sensor feeds, and vessel telemetry
- Reliable command & control (C2) continuity, even in GPS-degraded or jammed areas
- Interoperability with central government systems, including military and civil agencies
- Integration of advanced anti-jamming features through CTECH's Anti-Jamming Modem to maintain link availability in contested environments

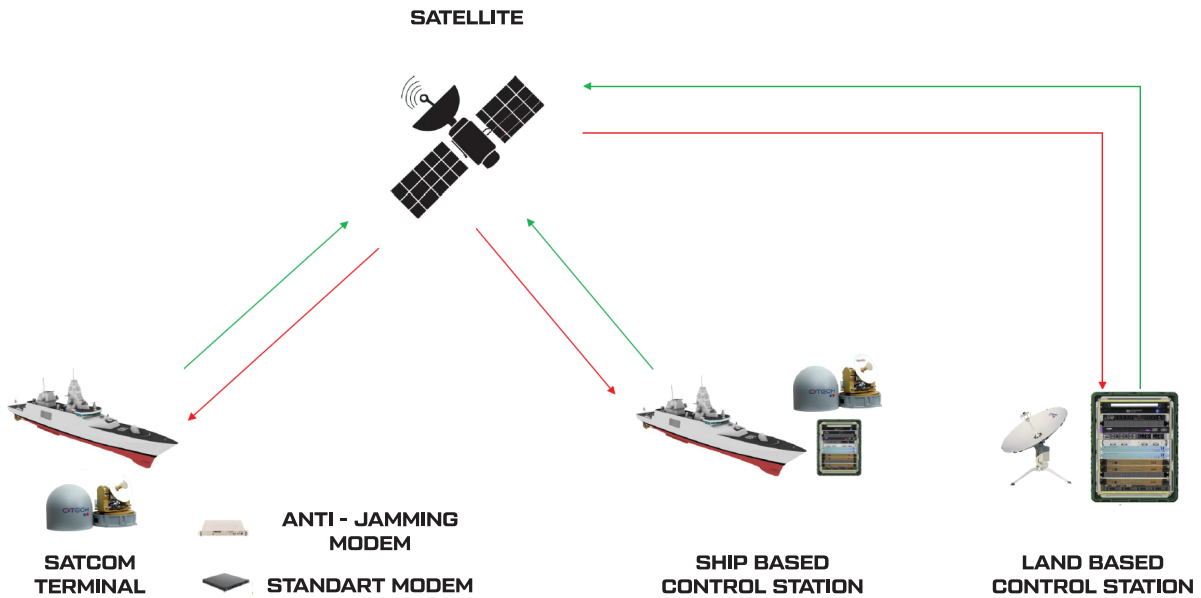
I 4. System Architecture

USV Subsystems:

- Maritime-qualified SATCOM antenna
- Anti-jamming Modem
- Standard Modem with AES-256 data encryption

Ground Segment Subsystems:

- Ship-Based Ground Control Station
- Land-Based Ground Control Station
- Data routing to Naval Command and Coast Guard HQ



5. Key Benefits

Benefit	Description
Persistent Surveillance	Continuous maritime patrol up to thousands of nautical miles
Advanced Anti-Jamming Capability	CTech's Anti-Jamming Modem ensures link resilience in contested electromagnetic environments
High-Bandwidth Data Streams	Transmission of high-bandwidth sensor data, live video feeds, telemetry, and remote command instructions
Operational Autonomy	USVs can operate independently with mission updates over SATCOM
Encrypted Data Transmission	Secure end-to-end communication prevents interception or spoofing
Joint Operations Support	Enables coordination between Navy, Coast Guard, and Ministry of Interior
Low Manpower Requirement	Reduces reliance on crewed vessels for routine patrol

6. End Users

- **Military:** Naval Forces, Joint Maritime Command, Electronic Warfare Units
- **Government Agencies:** Coast Guard Command, Ministry of Interior, Customs Enforcement
- **Public Security:** Maritime Surveillance Centers, National Intelligence Units

7. Conclusion

Broadband SATCOM-equipped USVs, enhanced by CTech's Anti-Jamming Modem, provide a sovereign, future-ready solution to overcome line-of-sight limitations and deliver secure, persistent maritime domain awareness for border security and counter-smuggling operations.