# Connectivity as an Operational Reality

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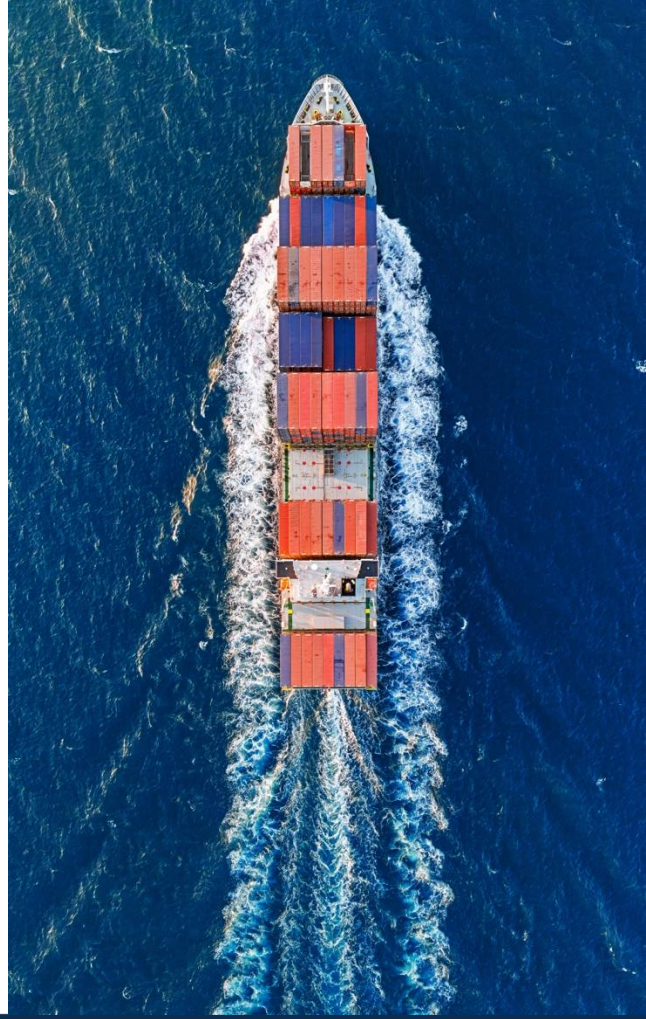
# Connectivity as an Operational Reality

Connectivity is No Longer Optional – It's Operational

- **Shipping has moved from periodic to continuous connectivity**
  - Previously, GEO had been used as and when needed, mostly for operational needs
  - Now, with the advancements of LEO satellites, connectivity is used continuously for both operations and crew welfare
- **Disconnection now creates operational risk, not just inconvenience**
  - Having a ship down because of comms leads to a potential loss of income
- **Connectivity underpins safety, efficiency, and decision-making**
- **The vessel is becoming part of a live enterprise network**



# From Isolated Vessel to Connected Node

The Vessel Has Been Redefined

- **Traditional model: isolated, delayed, autonomous**
- **New model: real-time, connected, integrated**
- **Shore teams now interact continuously with vessels**
- **Decision cycles reduced from days to minutes**

# The Bandwidth Battle

Demand Has Outpaced Traditional Connectivity Models

- **Explosion of onboard demand:**
  - Crew welfare
  - Operational data
- **Competing Priorities:**
  - Operations – IoT, sensors, onboard computing / mapping, general shipping operations
  - Crew – Crew welfare, VOD, streaming
  - Cost – Balancing the cost of the above to fit within budget
- **Legacy GEO networks struggle with latency and flexibility**
- **Bandwidth is no longer the only constraint**

# LEO Changes the Equation

Low Earth Orbit Enables Real-Time Maritime Operations

- **Low Earth Orbit delivers low latency and high throughput**
  - Starlink – Launched in 2022
  - OneWeb – Launched in 2023
  - Amazon – Coming soon
- **Enables near-terrestrial user experience at sea, resulting in cheap, high performing, reliable connectivity at sea**
- **Still introduces complexity (coverage, handovers)**
- **Changes to the industry**
  - Changed CIR to MIR
  - Changed bandwidth management to data management
  - Changed long contracts to short contracts

# Maritime 5G Enters the Picture

5G Extends High-Performance Connectivity to Coastal Operations

- **5G delivers ultra-high bandwidth near shore**
  - Speeds as fast as 300+ Mbps
- **Ideal for ports, terminals, and offshore zones**
  - Enabling lower cost, higher speed connectivity further out from land, bridging the gap between shore-side and satellite connectivity
- **Lower cost per GB compared to satellite**
  - Data as low as $1 per gigabyte
- **Complements – not replaces – satellite connectivity**

# The Rise of Hybrid Connectivity

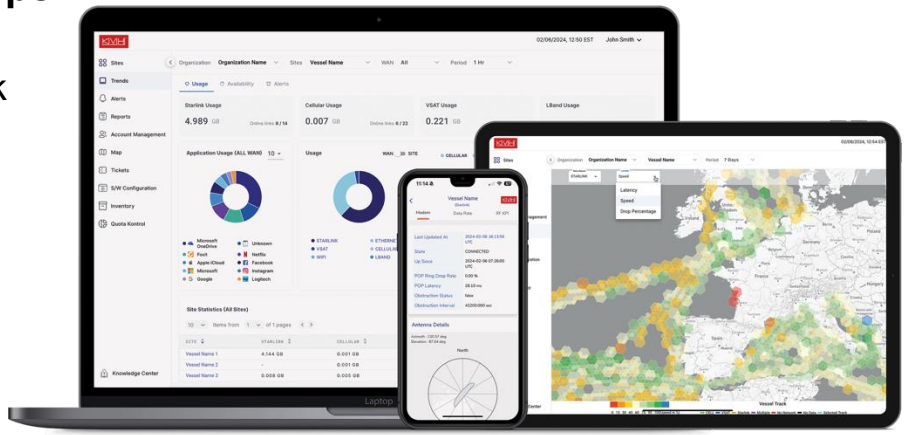
Multi-Network Integration Becomes the New Standard

- **Combining LEO, GEO, and 5G into one architecture**
- **Hybrid connectivity gives many benefits including:**
  - Seamless switching between networks
  - Reduces hardware purchase costs and service requirements
  - Best of both worlds for both speed and coverage
  - Intelligent routing based on application needs
  - Automation replaces manual network management
  - Enables separation of crew and operations connectivity

# From Bandwidth to Optimization

Abundance of Bandwidth Shifts the Challenge

- **Bandwidth availability is increasing rapidly**
  - With data being cheaper and faster than ever, ships now have more bandwidth at their fingertips. It's now more important than ever to control usage to stop data consumption and costs from running away.
- **Inefficient usage becomes the main risk**
- **Application-aware routing becomes essential**
- **Policy-driven connectivity replaces static setups**
  - The ability to set policies for onboard usage, prohibiting the use of certain sites, or setting network management rules to enable switching from GEO to LEO etc.



# Business Impact on Fleet Management

Connectivity Directly Drives Operational Performance

**Connectivity is now a direct driver of operational and commercial performance. It can help reduce costs, improve uptime, improve crew morale, and create more efficient operations.**

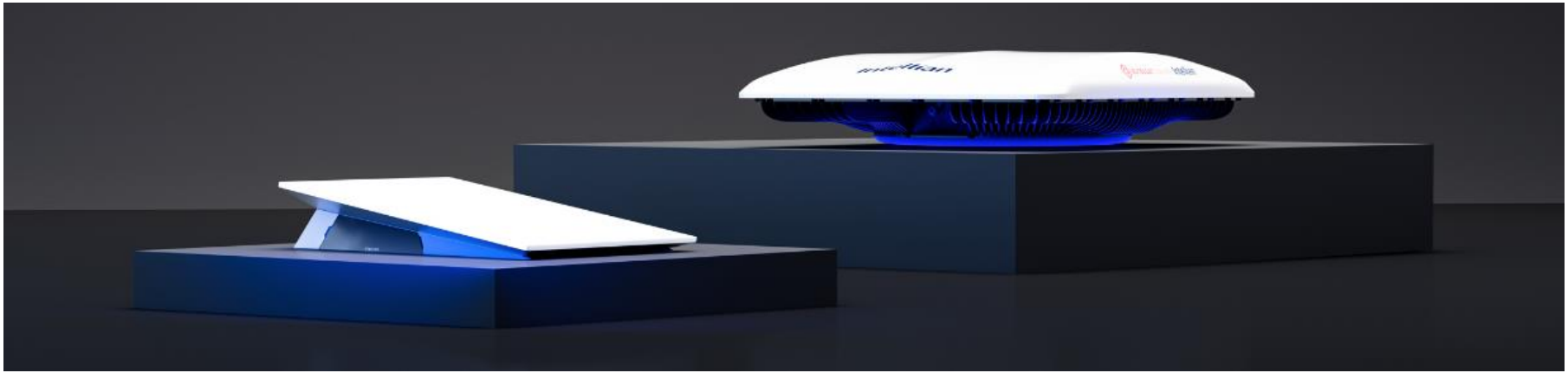
**Connectivity can improve operational performance via:**

- **Real-time fleet visibility and decision-making**
- **Predictive maintenance reduces downtime**
- **Enhances crew welfare and improves retention**
- **Enables centralized fleet operations**

# The New Reality

The Always on Vessel is Here

- **Ships are fully integrated in enterprise networks**
- **Connectivity is continuous, not conditional**
- **Multi-network strategies are becoming standard**
- **The question is not about access to connectivity, it's how effectively it is used**

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