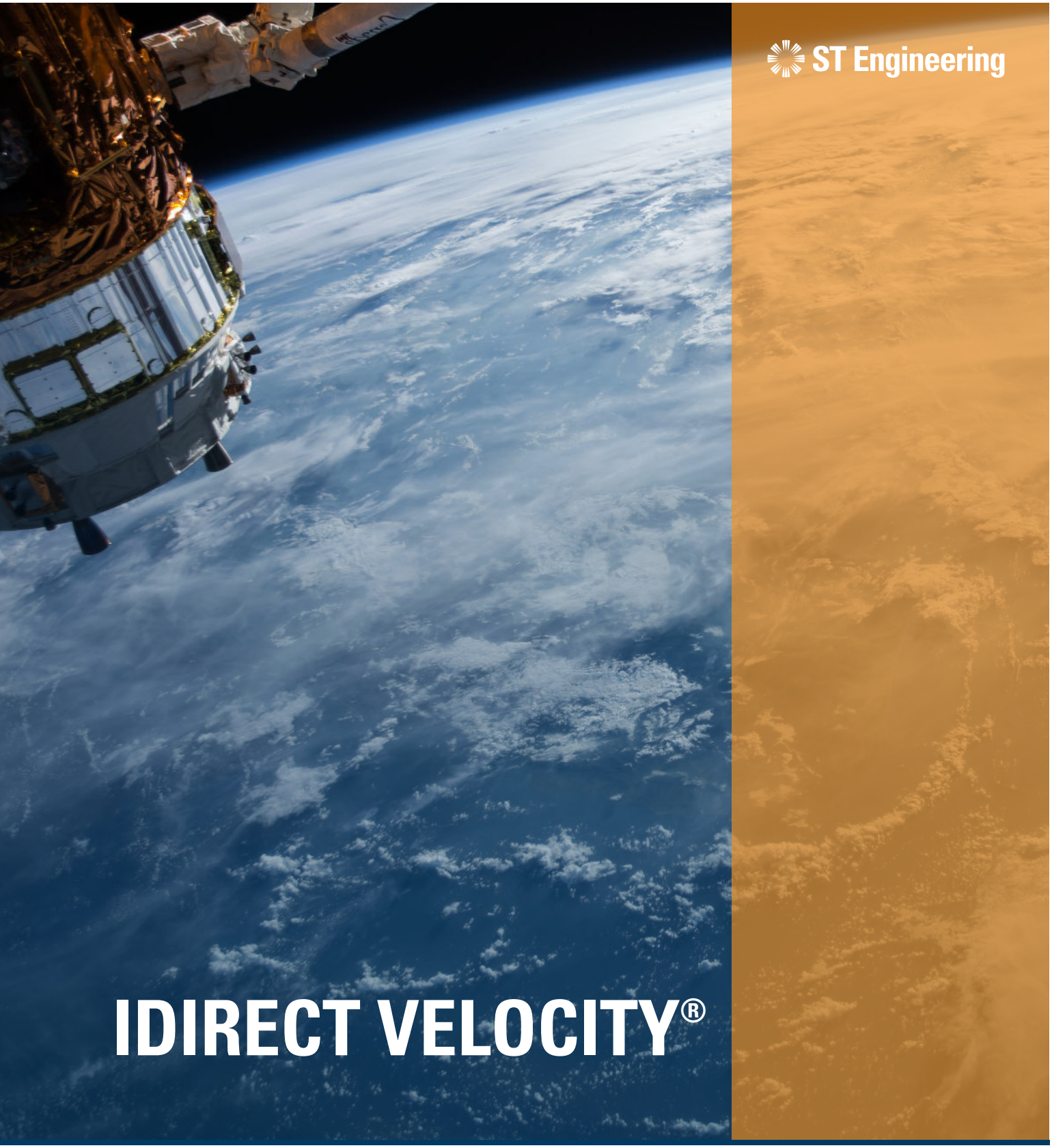


ST Engineering

# IDIRECT VELOCITY®

iDIRECT

High Throughput Satellite (HTS) technology is ushering in a new era in satellite communications. It is one that will introduce new capacity, greater technology innovation, less expensive hardware and a higher degree of service diversification. For satellite operators, this means more flexibility, coupled with better value, to create greater opportunity.

Yet, HTS also signifies a new set of challenges. Challenges that range from the ability to manage capacity in a spot-beam environment to handling new requirements associated with ground infrastructure require the need to offer capacity via a managed service model.

Successfully moving ahead centers on the right platform for HTS. That means satellite operators must consider both the fundamental system design, as well as its ability to handle unique HTS challenges.

**ST Engineering iDirect Velocity® is specifically designed to enable HTS operators to deliver a managed service model to capitalize on the benefits of these new satellites.**

With Velocity, satellite operators are able to deploy a single, modular and scalable platform capable of supporting a range of terminals. This platform is designed specifically around the unique attributes of HTS spot-beam architecture and helps support the ability to offer fully or partially managed services on a large scale. With this, satellite operators can quickly address market requirements for fixed and mobile applications with maximum flexibility and the lowest level of risk.

# iDirect Velocity Overview

**Velocity is an IP-based satellite communications system engineered to deliver high-quality broadband connectivity wherever and whenever it is needed. Velocity consists of an operating software, hub platform, network management system, and modem portfolio.**

## Operating Software

Velocity is the underlying operating software and manages all aspects of the platform. It builds specifically designed for satellite operators to deploy managed HTS architectures. It consists of three main differentiators; an ability to manage a single bandwidth pool across multi-spot beam capacity globally, mobility capabilities in a multi spot-beam environment and the support for carrier-grade reliability and resiliency.

## Flexible Hub Architecture

Velocity is comprised of a powerful, modular hub architecture to manage large HTS satellites consisting of more beams and frequencies, along with higher throughput. The hub architecture supports multiple satellite bands including Ka, Ku, C and X bands, enables multiple networking technologies and is optimized for offering different forms of managed service offerings. The line cards and hub components can handle much higher aggregate symbol rates, and feature very efficient MODCODs.

## Network Management System

ST Engineering iDirect Pulse™ enables satellite operators and service providers to expertly manage complex, large-scale networks; run an efficient, reliable and profitable network operation; and continually improve customer satisfaction. Pulse features open APIs to easily integrate with other OSS/BSS systems.

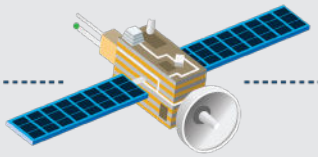
## Modem Portfolio

The platform offers a range of satellite modems designed to meet distinct end-user requirements supporting larger throughput and speeds. Our modems come in multiple form factors, including desktops, rack-mounts and router boards that can be integrated into aeronautical, portable and other specialized communications systems.

### Hub System

- Support for high aggregate Msps rates and highly efficient MODCODs
- Manage blended portfolio of frequencies and beam sizes
- Provides total hub redundancy due to centralized infrastructure

### High Throughput Satellite



- Support for larger frequency ranges/Ka-/Ku-/C-/X-band
- DVB-S2/ACM and Adaptive TDMA
- Mobility/faster beam switching
- Global Bandwidth Management of SLAs across multi-spot beams

### Modem

- High performance modems
- Dual mode–modem to operate on blended portfolio

### Network Management System


- Scalability and efficient NOC operation
- Higher visibility for customers through Portal
- Open APIs for OSS/BSS integration

# Differentiating Features

**Managing HTS bandwidth across multiple spot beams presents a distinct set of challenges for satellite operators. With Velocity, satellite operators can rely on the renowned features of our platform plus additional differentiating features that allow them to transform their business in order to meet the unique requirements of operating in an HTS environment.**

## Global Bandwidth Management

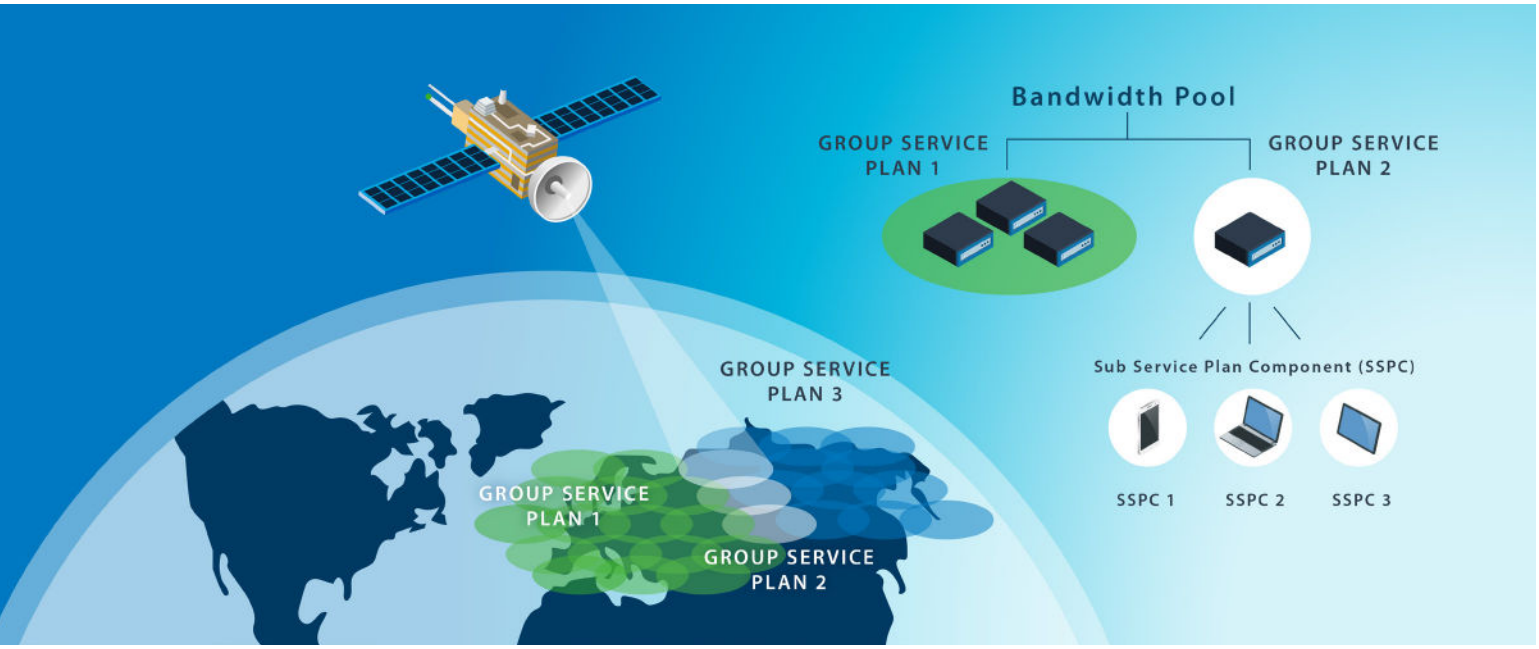
Global Bandwidth Management (GBWM) enables satellite operates to manage a single bandwidth pool across a large coverage area spanning multiple spot beams.

GBWM consists of Quality of Service (QoS) management features that allow for bandwidth partitioning into multiple service tiers across the entire payload, managing contention among service providers and end-customers. A satellite operator offering managed bandwidth can create sub-networks and groups of modems based on Mbps with various levels of service plans.

Often, the beams will not be evenly loaded in all parts of the coverage at all times, in which case the operator also has the flexibility to restrict a service offering to certain geographic areas, or to certain times of the day. Such features as Load Balancing, Service Scheduling, Geoscope and Fair Access Policy (FAP) help to better manage congestion and optimize fill rates.

Multiple spot beams can be grouped into Global Service Plans (GSP) and further partitioned into sub GSPs for different service providers. Each service provider can be in control of setting their own service parameters and divide its bandwidth pool further into subscriber service plans for their offerings to end-customers.

### Global Bandwidth Management



## Mobility Capabilities

Velocity features advanced mobility capabilities that enable fast-moving modems to automatically cross multiple spot beams within a short period of time, maintaining a constant IP session.

These capabilities include: Automatic Beam Selection (ABS) technology features beam switching with no manual intervention across multiple satellite footprints to enable global connectivity.

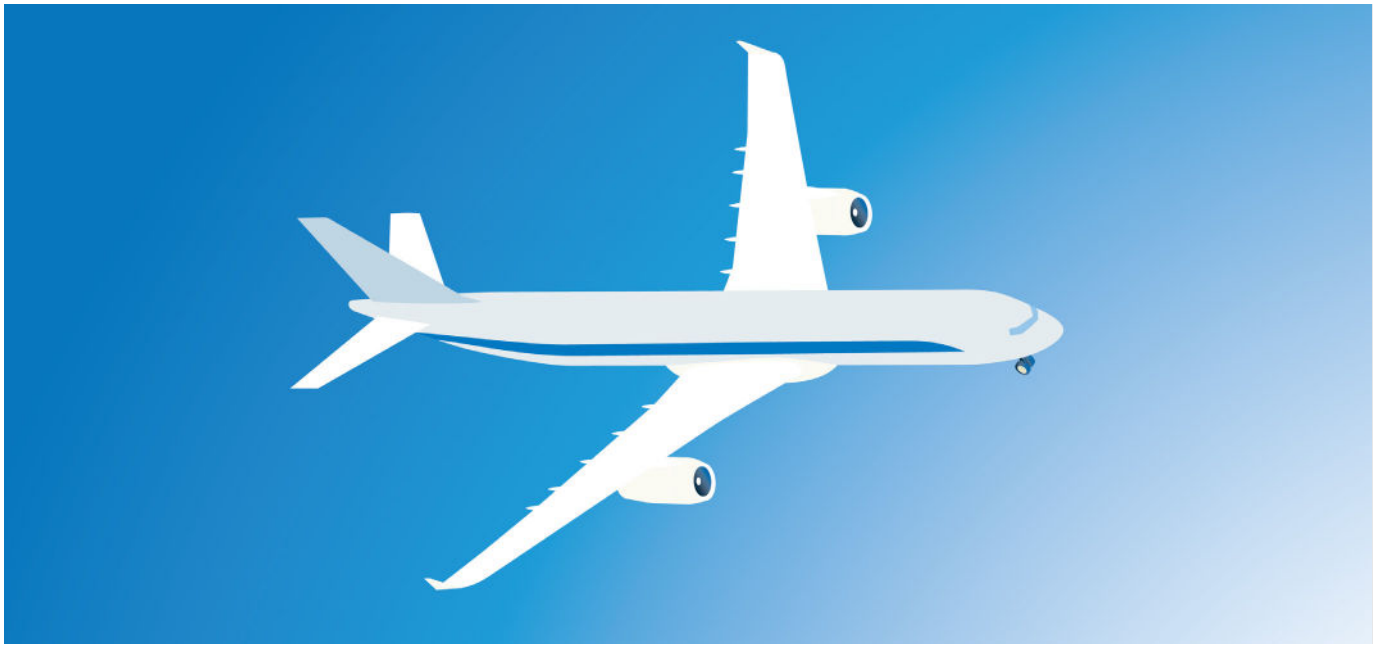
Another feature, called Spread Spectrum waveform, supports very small antennas on aircraft, maritime and land-based vehicles. High-speed Communications on the Move (COTM) features include Doppler compensation, fast reacquisition after blockage and fast beam-switching.

Mobility modems are optimized around size, weight and power (SWaP), with ruggedized router boards that can be integrated into aeronautical, portable and other specialized mobility systems. These modems feature contention-based acquisition and a second DVB-S2 receiver to enable make-before-break switching resulting in faster, more secure beam switching.

**OpenAMIP®**
Protocol that facilitates the exchange of information between the airborne antenna and satellite router.

**Spread Spectrum**
Diffuses high rate signals by "spreading out" the transmissions in order to minimize the interference to adjacent satellites.

**Skew Angle Mitigation**
Allowing a terminal to take advantage of high skew situations while ensuring compliance with adjacent satellite interference limits.



**Doppler Effect**
The change in the frequency of a wave, as perceived by a receiving station, as either the transmitter or the receiver moves.

**Global Bandwidth Management**
Provides the ability to better manage congestion and optimize fill rates with fast moving mobility modems.

**Automatic Beam Selection**
Fast switching between multiple spot beams with no manual intervention.

## Carrier-Class Service Reliability

This feature supports full redundancy, rain diversity and resiliency of the network infrastructure to ensure SLAs under any weather condition. This is particularly relevant in the case of Ka-band, as its frequency has a higher susceptibility to rain fade compared to Ku-band and C-band.

Protecting the network from service degradation, service interruptions or from catastrophic events is key to ensuring a very high availability and reliability of the HTS network.

Since Ka-band frequencies are particularly prone to rain fade, Velocity leverages adaptive modulation techniques, such as Adaptive Coding and Modulation (ACM) and Adaptive TDMA to achieve the maximum data throughput and optimized traffic in changing weather conditions.

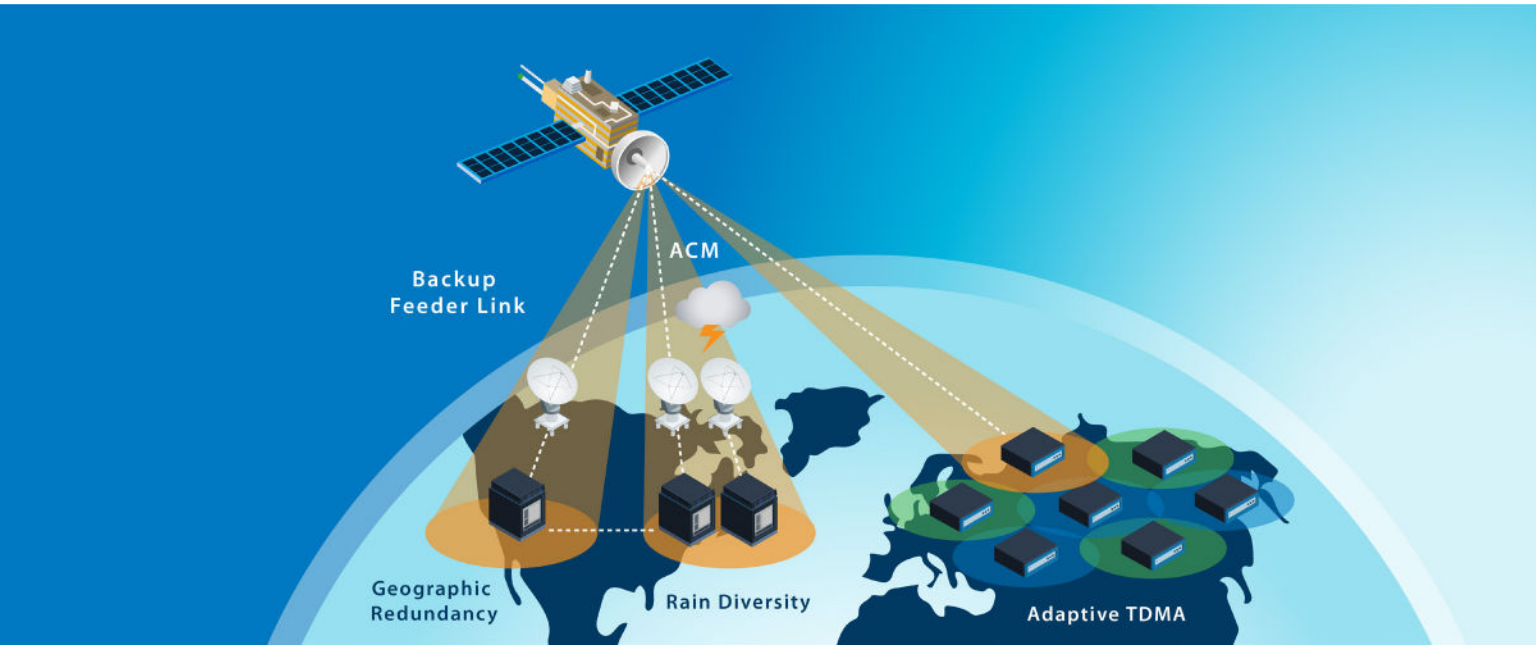
The platform features built-in high reliability on all aspects of hub infrastructure, ranging from very high line card availability and hub component redundancy, to rain diversity and complete gateway redundancy.

Our Velocity hub components features high line card availability using a cluster architecture with failover and load sharing schemes between components within the hub network architecture.

Rain diversity is a form of switchover to a geographically diverse hub location during a time of service degradation at the primary location due to changing weather conditions. The moment weather conditions improve, the rain diversity architecture automatically shifts back to the prime hub location without any noticeable service interruption to the end-users since the terminals stay in the network the entire time.

Velocity also enables complete geographic redundancy protecting the network from a loss of service for an extended period of time in the event of a catastrophic failure at the primary gateway. This requires access to a fully equipped failover hub system in a geographically different location to enable a complete, fast switchover at the IP interface level between the subsystems.

### Velocity Redundancy



# HTS Market Impact

**More than 2 Tbps of HTS capacity is projected to fill the sky over the next 10 years. That presents new opportunities across nearly every market.**

## Aeronautical

Increased bandwidth available on HTS meets the data-hungry demands of passengers and crew, with enough power to provide operational improvements aboard the aircraft to help minimize repairs, decrease fuel consumption and improve cockpit services.

## Cellular Backhaul

HTS delivers smaller, more focused beams providing increased capacity through frequency reuse to meet high-speed demands of 3G, 4G and soon 5G data. This increase in capacity also lowers the cost of satellite bandwidth, the most expensive part of using satellite for backhaul.

## Government and Military

HTS provides the option of full coverage in the sky for the ministries of defense with choices of using various WGS, Ka- and traditional C-, Ku- and X-band constellations. In addition, militaries increase battlefield intelligence, strengthen mission coordination and deploy networks anywhere they operate.

## Maritime

Higher bandwidth applications improve operations, productivity and crew welfare for commercial shipping, while also rapidly fulfilling passengers' desire to stay connected using their personal wireless devices for social media, video, retail, business conferencing and mobile calling services aboard cruise vessels.

## Oil and Gas

Sending large data files such as seismic images, operating ROVs, and supporting greater use of video for multiple applications is streamlined with HTS.

# Moving Forward

**The path to success with HTS must be guided by a strategic plan that addresses both the technical and business aspects of managing high throughput satellites.**

Velocity enables an HTS operator to quickly address market requirements for fixed and mobile applications with maximum flexibility and the lowest risk.

Velocity helps satellite operators move forward with a best in-class ground infrastructure system designed specifically around the attributes of HTS spot beams architectures to support their plans to offer managed services.

A number of major HTS satellite operators around the globe are using iDirect Velocity to bring their solutions to market, helping them meet the high- speed broadband requirements of their customers across a range of different markets.

INTELSAT

"We rely on Velocity to give our IntelsatOne Flex enterprise network the boost in scalability, performance and throughput we need to deliver our HTS shared service."

**- Intelsat**

inmarsat

"Velocity underpins Inmarsat's Global Xpress network. We can integrate capacity across multiple spot beams to deliver seamless broadband connectivity and provide tiered service options to our distribution partners. And Velocity ensures carrier class redundancy to protect Inmarsat's worldwide network reliability."

**- Inmarsat**

telenor

"There's no better platform than Velocity to bring our HTS capacity to market. Velocit gives us the tools we need to develop flexible service offerings, capture a broad range of high-value markets, whilst offering the possibility for roaming between Ku and Ka band satellites in the future."

**- Telenor Satellite Broadcasting**

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