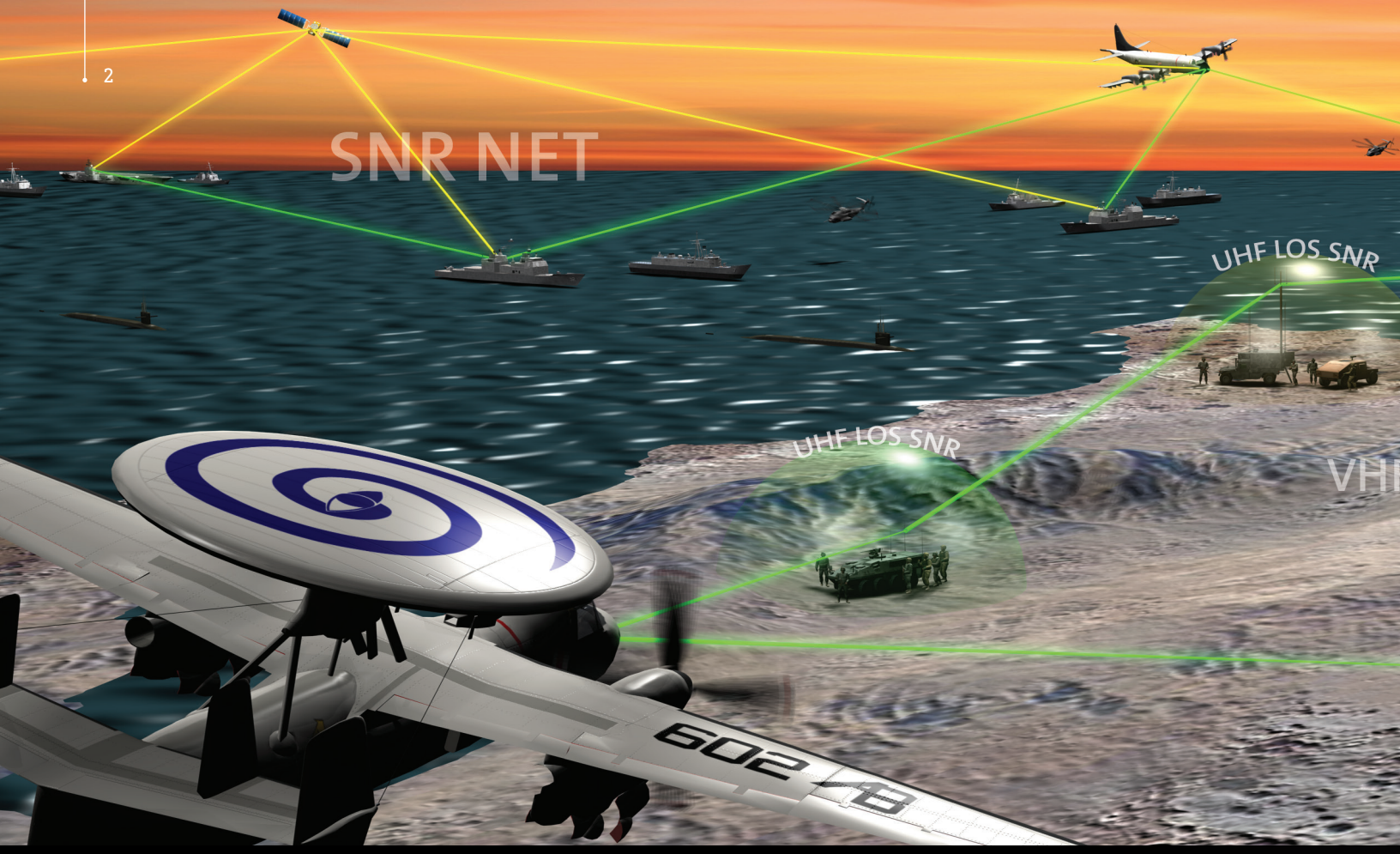
SubNet Relay networking technology

A CONTINUOUS COMMUNICATIONS FLOW ACROSS YOUR COALITION

The first fully mobile, cross-platform, ad hoc IP network using legacy radio systems

Collins Aerospace



NETWORKING IN A FAST-CHANGING BATTLESPACE

In today's sophisticated, multinational military environment, mission commanders are faced with the increasing need to provide a continuous flow of reliable, high-speed data communications to national and multinational forces. In fact, fleet commanders have identified effective coalition communications as their primary C4I warfighting priority.

Although in many instances, SATCOM has become the "go to" remote networking and communications delivery technology, it has its drawbacks, such as system complexity and "available airtime."

In addition, relying too heavily on SATCOM may also create communications breakdowns when enemy forces disable key satellites or during operations with coalition forces that do not have satellite capability.

The bottom line is, while SATCOM does have its place in modern military operations, it is not the most viable way to meet mobile networking needs for today's military forces.

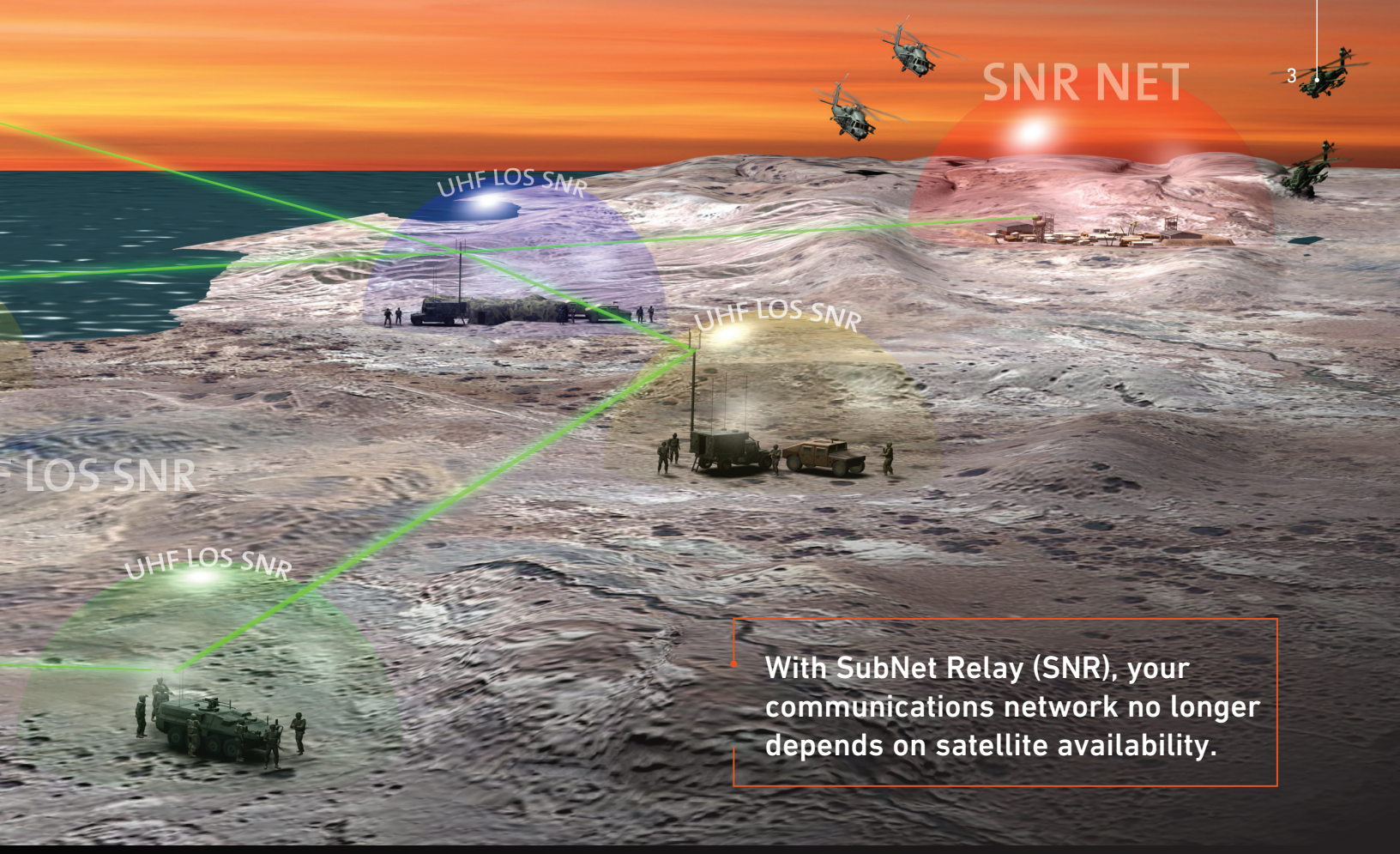
SUBNET RELAY: STRENGTH AND SIMPLICITY

Developed for the navies of Australia, Canada, New Zealand, the United Kingdom and the United States (AUSCANNZUKUS), Collins Aerospace's SubNet Relay is the first truly masterless, self-configuring data networking technology that works with currently fielded HF/VHF/UHF radios.

This breakthrough capability gives task commanders what they need – a simple and cost-effective solution to providing reliable, mobile, ad hoc IP networking capabilities between a diverse grouping of national or coalition ships. A SubNet Relay network can also include other types of platforms such as aircraft, ground vehicles or fixed sites.

This network is not only efficient and cost effective to use, it is easy to install. Components are designed to easily integrate with your legacy or modern cryptographic and radio equipment to provide a variety of benefits, including:

- Masterless, self-organizing, distributed operation independent of radio types
- Automatic traffic relay to extend communication range



With SubNet Relay (SNR), your communications network no longer depends on satellite availability.

- Dynamic bandwidth allocation in response to reported requirements
- Unicast and efficient broadcast delivery services

SubNet Relay is tested and field proven. It uses legacy or modern HF/VHF/UHF line-of-sight radios to create self-configuring tactical internet networks. Any IP data transmission (e.g., C2, text chat, collaborative planning, web browsing, email or other internet applications) is supported.

When all radio, modem or crypto and protocol overhead are taken into account, TCP throughput is about 75 percent of the modem data rate. As such, TCP throughputs of about 7 kbps and 1.5 Mbps are possible for 9.6 kbps HF links and 1.92 Mbps UHF links, respectively.

LOS, ELOS – COVERAGE WHERE YOU NEED IT

With its dynamic, traffic-relaying capability, SubNet Relay extends operational coverage of line-of-sight (LOS) and extended-line-of-sight (ELOS) communication bearers. By strategically placing SubNet Relay-equipped ships, submarines, aircraft, UAS or land vehicles, SubNet Relay's automatic relay capability can literally extend your LOS and ELOS coverage area well beyond the horizon.

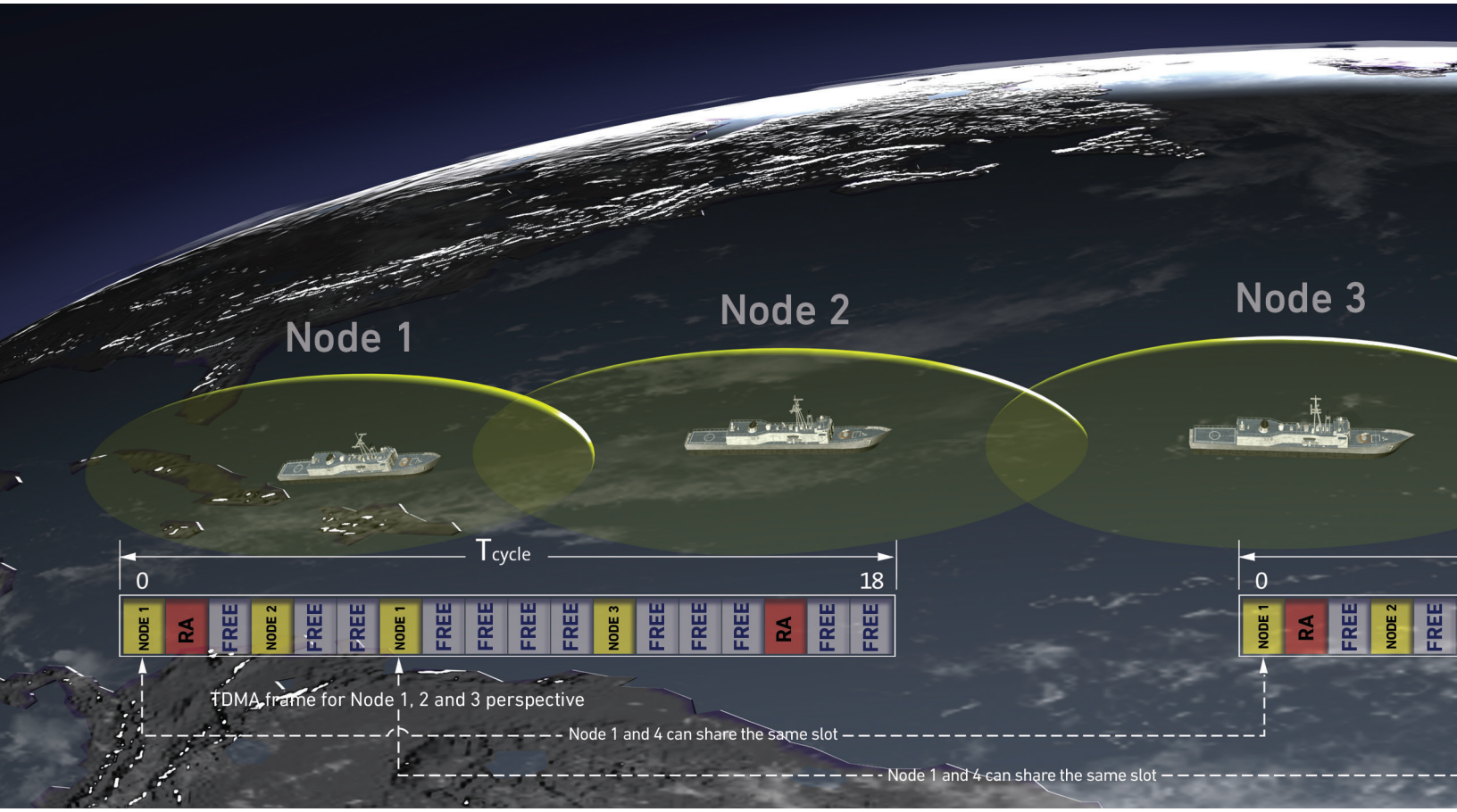
But no matter how broad the network's reach, SubNet Relay helps keep your data secure. It is compatible with standard security and encryption devices, which operate with all current and future security architectures, including KG-84, KIV-7 and HAIPE.

SubNet Relay can support multiple platforms and automatically enable radios from different operational domains to be used within the same network. Its components have also operated flawlessly with a wide variety of current and legacy radio systems, including WSC-3, Collins AN/ARC-210, PRC-150, Collins 721S Blade ground radio, Collins 721S fixed site UHF-VHF radio transceiver and many others – all while operating on standard channels.

Once the system is configured, no operator interaction is required to create and maintain an ad hoc network.

With its unmatched ability to provide tactical commanders a reliable, sustainable and flexible ad hoc IP wireless network, SubNet Relay is another example of our ongoing commitment to provide allied military forces with the most advanced capabilities at the lowest possible acquisition and operational costs.

FLEXIBLE IP SOLUTION, ONE RELIABLE SOURCE



PROVEN PERFORMANCE AROUND THE WORLD

SubNet Relay is standardized as NATO STANAG 4691 – Mobile Ad Hoc Relay LOS IP Networking (MARLIN). The system is already in use by the U.S., Canadian, Australian and many NATO navies and provides a new, naval operational capability to these nations.

Its components have operated flawlessly with a wide variety of current and legacy radio systems. These include WSC-3, Collins ARC-210, Collins 721S and others – all while operating on standard channels.

A number of at-sea trials have proven SubNet Relay's automatic relay capability to deliver well beyond LOS communications. Communication ranges in excess of 100 NM at UHF frequencies and 1,000 NM with HF ELOS are possible with SubNet Relay-equipped ships. The presence of similarly equipped airborne platforms further extends these communication ranges.

MAXIMUM NETWORK EXPANDABILITY

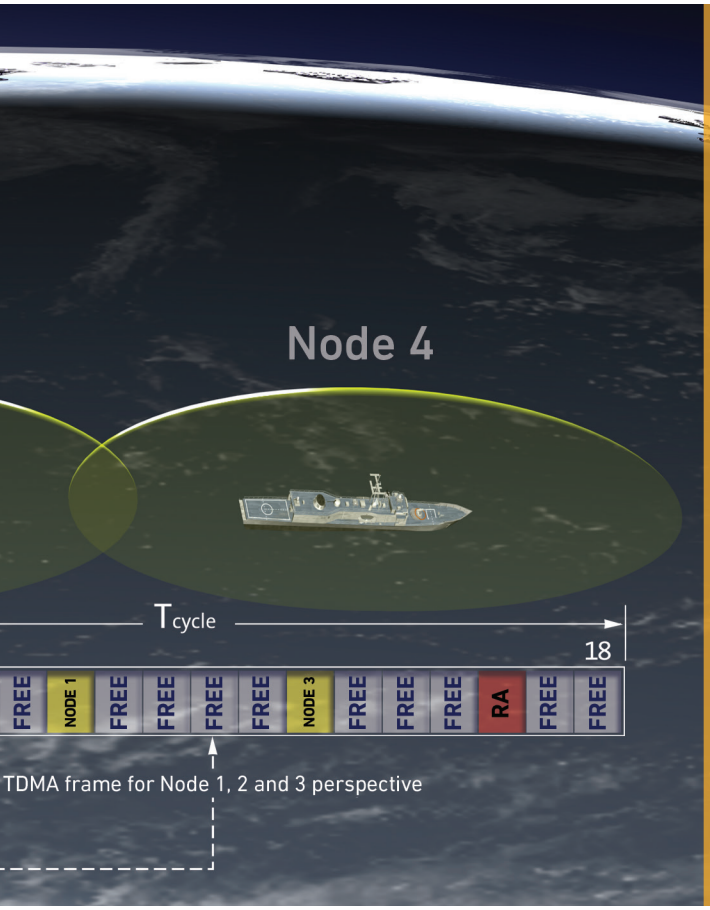
SubNet Relay extends operational radio coverage via automatic relay (naval, ground or airborne) without user intervention. The system dynamically determines optimum relays for up to seven radio "hops."

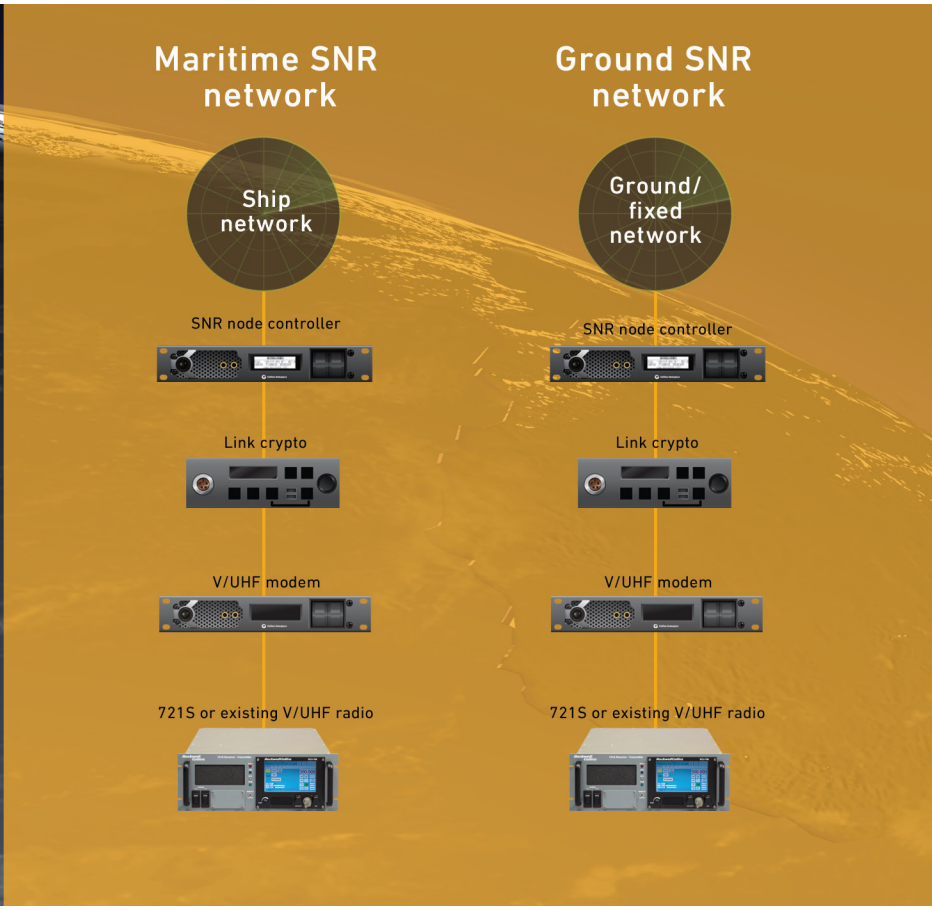
Its intelligent relay mechanism ensures that there is only one active relay possible for each source/destination pair. To maintain optimum system performance, the total number of relays required by the system in any configuration is constantly minimized.

When the end destination cannot be reached using only SubNet Relay, the traffic can be routed through other tactical or strategic networks. This can create seamless bridging of the LOS SubNet Relay back into the global wide-area network and extend the reach of a battle group's communications around the world.

SYSTEM THROUGHPUT VERSUS LATENCY

SubNet Relay is a TDMA-based system. As in any TDMA system, there is a trade-off between efficiency, which argues for longer slots to increase the proportion of data relative to overhead, and responsiveness, which favors shorter slots to reduce latency between transmissions.





The system achieves both efficiency and responsiveness through automatic merging of short slots. When a node owns two or more adjacent slots, it has the option of merging the adjacent slots to make a bigger slot with reduced overhead and greater data carrying capacity.

This mechanism lets SubNet Relay adapt to network traffic and to efficiently support both applications with high throughput or low latency requirements.

HIGH CAPABILITY AND FLEXIBILITY

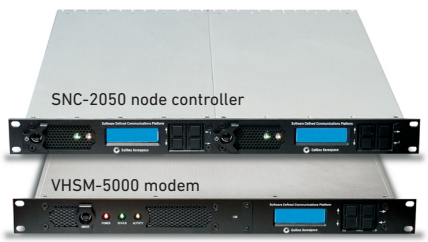
SubNet Relay offers true plug-and-play capability. It works with many HF/VHF/UHF radios and data cryptographic equipment already installed on ships, in aircraft and in ground vehicles.

To ensure optimum performance and capabilities, the system features software-defined functionality. This makes it easy to upgrade in the field using a laptop, Ethernet cable and CD-ROM.

To help ensure the system's functionality and flexibility in operational deployments, all of SubNet Relay's components can be managed remotely. This minimizes the need for local system administrator.

Because the system is based on a masterless architecture, there is no critical point of failure. Should a node be lost, the system will automatically reconfigure the network and continue its operation.

The system adds the advantage of automatically extending its network's coverage area. When two SubNet Relay networks, using the same frequency and cryptographic key, come within communication range of each other, they will merge. Similarly, any single platform or platform group that leaves the communication range of an associated network will form its own SubNet Relay network.



ADAPTABLE BY DESIGN

RESPONSIVE TO CHANGING CONDITIONS

The IP Traffic Manager (IPTM) is our TCP Performance Enhancing Proxy (PeP), developed to meet SubNet Relay's wireless networking needs. The IPTM has proven to significantly outperform other TCP PeP-based protocols. Unlike other PePs, it can automatically adapt to changing network conditions.

IPTM uses a TCP connection-splitting approach, which splits a TCP connection into multiple segments and delivers TCP traffic either to the next proxy or to the destination. The connection management function is transparent to the end user. Unlike many deployed TCP PeP implementations, IPTM also ensures data integrity.

IPTM translates into immediate cost savings by dramatically improving overall TCP throughput over a given link. This eliminates the need to pay for more expensive bandwidth channels.

IN THE WIDEBAND HF ENVIRONMENT

Another significant advantage of SubNet Relay is its ability to transmit accurate, secure data over standard, surface wave HF communications bearers in a naval environment.

SubNet Relay can also take advantage of advancements in HF communications. HF bearers compliant with MIL-STD 188-110D Appendix D can provide up to 240 kbps in a 48 kHz channel (possible with the Collins Aerospace RT-2200A WBHF radio), and using surface wave propagation can enable a variety of applications, including:

- Long-range, ship-to-ship or ship-to-shore, medium data rate communications networking
- Monitoring of coastal waters through two-way communications with vessels in these areas

SYSTEM COMPONENTS

System hardware components include the IPTM, SubNet Relay and HF/VHF/UHF modems. IPTM can be embedded in the SubNet Relay controller or operate as a stand-alone. To maximize ease of integration with existing radio racks, SubNet Relay's components are available in two form factors:

Half rack

- IPTM stand-alone (IPTM-2050)
- SubNet Relay node controller (SNC-2050)
- 96 kbps HF/VHF/UHF modem (audio I/F) (HSM-2050)

Full rack – VHSM-5000

- 1920 kbps HF/VHF/UHF modem (70 MHz IF)
- Tested with Collins' 721S radio transceiver at 1.92 Mbps

WHEN TECHNOLOGY ADVANCES, SO DOES YOUR NETWORK

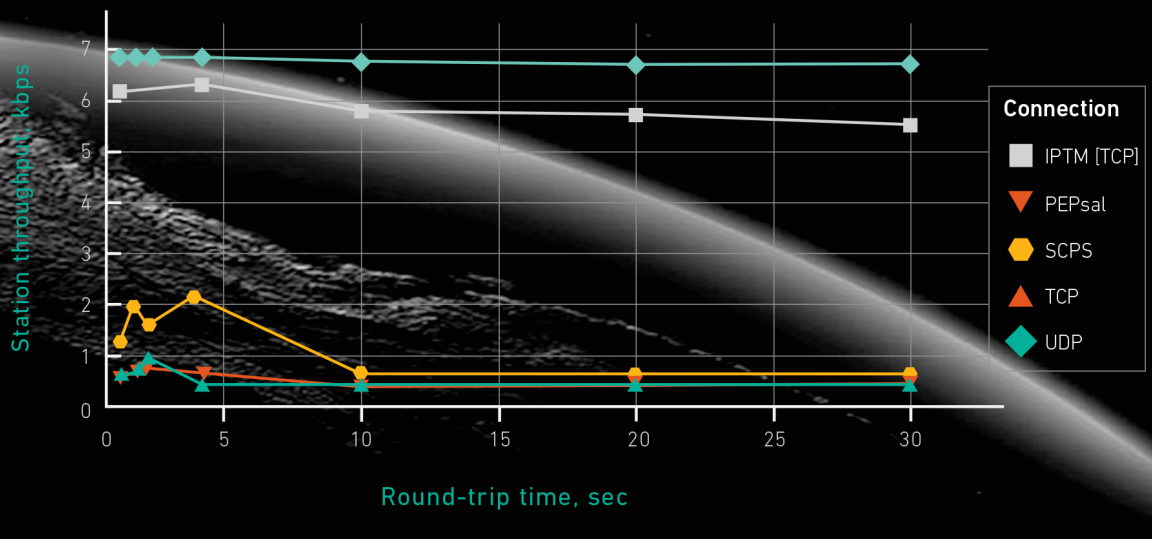
Although providing exceptional wireless data communications networking in a non-satellite dependent environment is critical to the value our SubNet Relay delivers to today's military leaders, it is equally important that the system be continually upgradeable to meet emerging needs.

To that end, we have determined an in-depth life-cycle upgrade path for the SubNet Relay hardware and software. No matter how the technology evolves, you can rest assured that the SubNet Relay system you select today will continually evolve to provide tomorrow's naval warfighters the fastest, most capable and most secure wireless ad hoc wireless IP network possible.




Application throughput vs. RTT

(on 16 kbps link with 10-4 BER)



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