STARCONTROLS

Application Note

Telemetry System for LNG Bunker/Transport Barge

Overview / Background

The application note covers a very-high-availability, cyber-secured IP-based wireless communication system for mission critical applications.

The use of wireless IP-based networks for industrial applications, such as Oil & Gas and Utilities, has been a common option. The IP networks offer different modulation technologies, RF band, licensed unlicensed frequencies, different RF power, and coverage. The common use of the IP protocol simplifies the integration of the end points for different applications, such as remote monitoring and control, remote video surveillance, and connectivity between smart sensors and controllers.

The two main "show stoppers" from using IP wireless networks for mission critical applications are the availability of the "data link" (i.e. caused by RF interference) and cyber-security, compare to the traditional "wire" based IP networks. Seaboard Controls and Star Controls have joined efforts in the design and implementation of a wireless IP-based system that addresses the two "show stoppers". The system is based on multiple layers of hardware hot-standby (i.e. communications processors, wireless devices in different band), combined with advanced IIoT (Industrial Internet of Technology) OSI-7 Layer protocol that enables "cluster" communications service. Every component of the system complies with highest Cyber Security requirements.

The system was designed for an offshore application, to communicate between unmanned Liquefied Natural Gas (LNG) transport barge and the towing vessel. The system leverages today's advanced technologies, ready for tomorrow's, while addressing the challenges that are associated with wireless communications for mission critical applications.

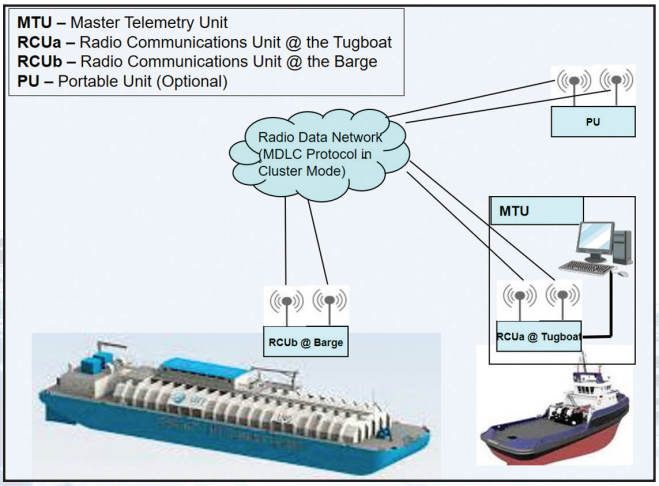
The barge is a double hull liquefied gas tank barge with a trunk deck. It is designed to be pushed from the stern, on the hip or towed on a wire hawser. It is designed for "unmanned" operation in an inland waterway, coastal or offshore service.

System Architecture and Requirements

Telemetry System Configuration and Design Considerations

The vessel is equipped with a Control and Monitoring System (CAMS) that allow the vessels equipment to automatically manage the BOG (Boil off Gas) during transit of the vessel. The system incorporates a radio frequency telemetry system to transit monitoring and control functions between the LNG barge and towing vessel. The system will allow both passive monitoring and active control of the system from the tug control panel. See below the system architecture.through the RTUs the "Pumping Permitted" signal.

Following are the main points that were considered during the design:



- Design for Mission Critical
- Provides Real Time, Accurate, Secured, and Trusted information
- Data Integrity and Cyber Secured
- High Availability of all components at all conditions, including redundancy
- Wireless Network in Hot-Standby
- RTUs – Redundant Sub-RTUs at each side; Each Sub-RTU with Redundant Hot-Standby CPU and Power Supply
- Best of Breed Products and Solution
- Field Proven Technologies and Products
- Seamless Integration with the CAMS
- Operation & Maintenance – provide the O&M team with simple, yet powerful troubleshooting tools to accomplish low MTTR (Mean Time To Repair)

Detailed Design System Architecture and Requirements

The System is based on modularity that allows future upgrades, and the introduction of new applications and technologies.

Maintainability – the system includes powerful diagnostics and troubleshooting tools.

Wireless Network

The wireless Network was designed for the highest availability and resiliency. The network Topology is based on a “Cluster IP”, where messages are sent SIMULTANEOUSLY through TWO Radio Links. That means that the system doesn’t need the Switchover Time that usually is required in redundant network.

Two data radios at each point. Each radio is in a different and RF bands, far in the spectrum; VHF and 5.2-5.8 GHz. The separation will reduce the probability that RF interference will impact both bands.

The over the air protocol is the Motorola MDLC, which was designed for REAL TIME applications, with instantaneous response to alarms and event. The Motorola MDLC has been used in Mission Critical applications. The Motorola MDLC was designed is Cyber Secured.

The bit rates are different for each link. The VHF link satisfies the telemetry requirements. The 5.2-5.8GHz can also support video streaming and other applications that require broadband.

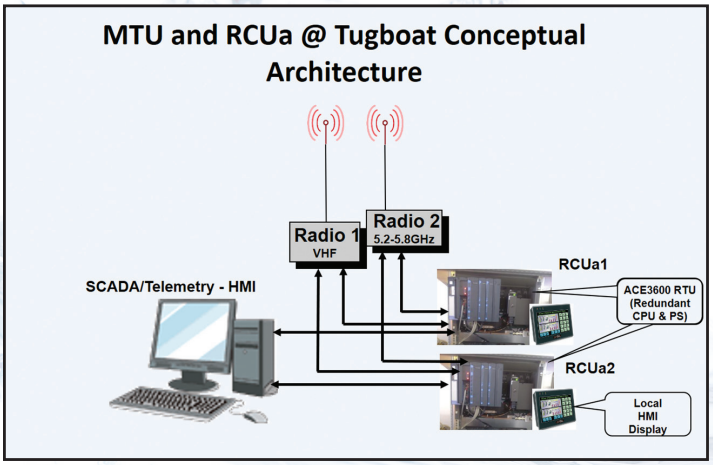
Remote Communications Units (RCUa and RCUb)

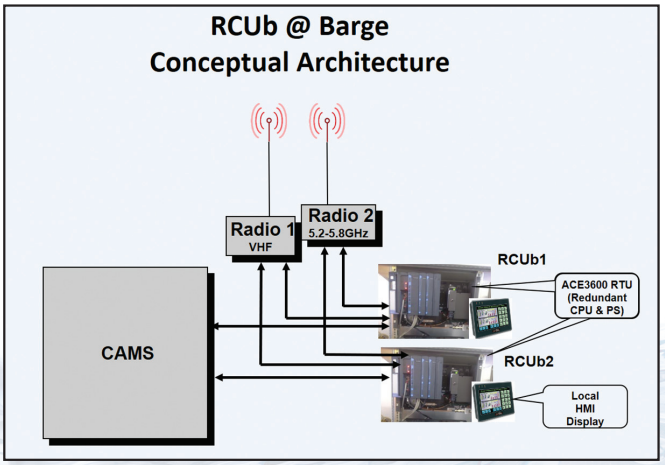
The Remote Communication Units (RCUs) include the following main components and features.

- Real team embedded powerful and open platform.
- The RCUs are based on Motorola ACE3600 RTU, with unparalleled reliability
  - Each RCU is based on Redundant CPU and Power Supply, and have a backup battery.
- The system has four (4) RCUs; two (2) on tug and two (2) on barge.
- The RCUs transmit the signals for two (2) completely separate networks, VHF and 5.2-5.8MHz.
- Each RCU has access to each radio.
- Each RCU equipped with a local HMI that enables access to operational and maintenance information
- The Motorola ACE3600 RTU are configured with a complete Cyber Security mode.
- To reduce the risk of RF interference, one network is on the low band of the RF spectrum, and the other on the high band.
- The radios are IP based, so the system can accommodate wireless technologies that will be available in the future.
- Cyber Security – every component complies with the highest level of cyber security requirements.
- The interface between the RCUs and CAMs and MTU is Modbus/TCP protocol. The interface can also be based on DNP3.0 her industry standard protocol (e.g. DNP3.0)

Master Terminal Unit (MTU)

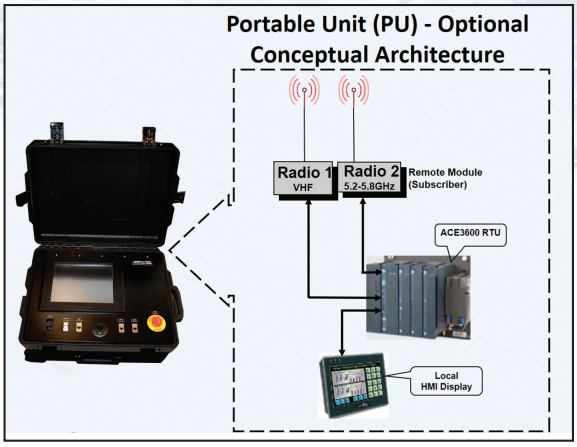
SCADA server with advanced monitoring and controls capabilities The MTU is based on off-the-shelf SCADA software, such as VTScada or Wonderware.





Portable Unit (PU, Optional)

The Portable Unit is optional, providing remote access to the barge in the case that the access from MTU fail to access the barge (pictured right).



Solution Features and Conclusions

Since the Telemetry System for LNG Bunker/Transport Barge serves a Mission Critical application, the following design and implementation guidelines were incorporated.

- High Availability – The system architecture and all components that are included in the system are designed and tested for very High Availability and resiliency.
- High availability of wireless network
- Cyber Secured
- Maintainability – provide the crew in the field with powerful troubleshooting software tools.

About Seaboard Controls

Seaboard Controls was started in 1982 by Philip Muro who was taught a discipline and code of ethics by his years of service in the U.S. Marines. For the last 30 years he has been at the helm of his company and has built the company under the same discipline and code of ethics.

About Star Controls

Star Controls is a leading provider of Industrial IoT (IIoT) and M2M solutions, including SCADA and Communications systems for the Water and Electric Utilities, Oil & Gas, Public Safety, and other markets. The solutions that Star Controls offers are also major components in the Smart City and Smart Grid projects.

Projects / References

Star Controls and Seaboard Controls developed several systems that aim Mission Critical applications, and was able to deliver them to the full satisfaction of the customers. The team is experts in Industrial Internet of Things (IIoT), SCADA/Telemetry, Wide area Wireless Data Networks and Cyber Security.

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