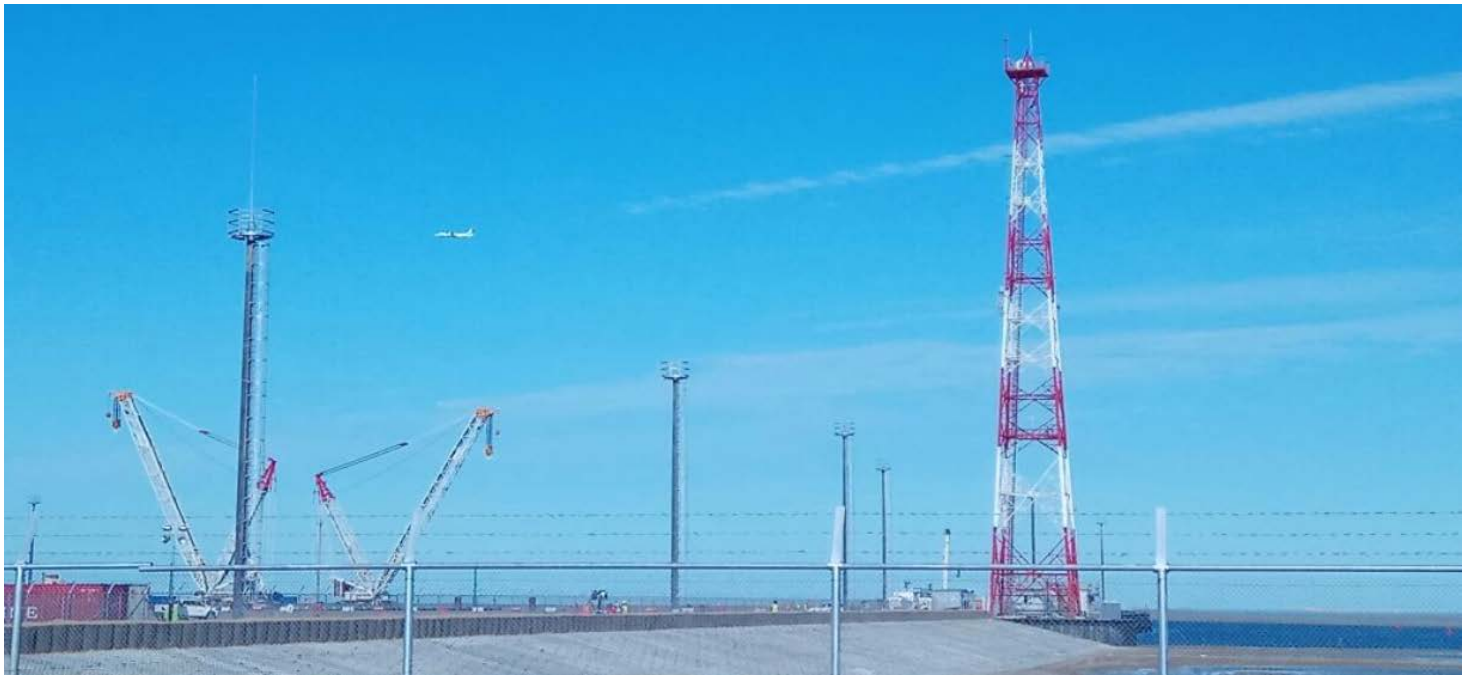


VESSEL TRAFFIC MANAGEMENT SYSTEM FOR CARGO TRANSPORTATION ROUTE (CATRO) PROJECT

SERVICES PROVIDED

Designing, configuring, fabricating, supplying, delivering, supervising the installation, testing and commissioning the Vessel Traffic Management system.

CLIENT

TenizService, an affiliate of TCO partner KazMunaiGas NC JSC, is responsible for CaTRo build and its further operation.

PRODUCTS USED

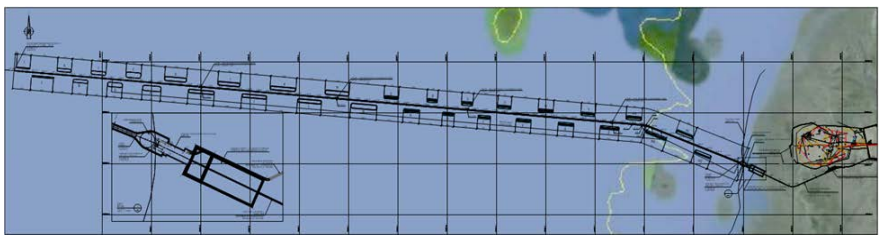
- Airbus Defence and Space
- Navicom Dynamics
- Windkinetic
- Redline Communications
- Inshore Systems
- Hydroshere
- Cisco
- Topan
- Metakon
- Knurr
- Jotron
- Motorola

PROJECT OVERVIEW

The Cargo Transportation Route (CaTRo) is a part of Tengizchevroil (TCO) FGP-WPMP Project. Its objective is to transport large cargo to oil fields located in south-eastern part of Atyrau Oblast. This route is designed to transship cargo carried by river/sea transport to the Caspian Sea's north-eastern shore near the Prorva field and deliver them further by land transport to oil fields. Paul Hargreaves, TCO FGP CaTRo Construction Manager at Chevron, named CaTRo “The Gateway for Future Growth”. CaTRo comprises a marine channel, a Cargo Offloading Facility (COF) and a haul road to transport modules, connecting, among other places, the COF with Tengiz. The Cargo Storage Facility (CSF) is designed for the storage of cargo and materials and as a support base for cargo transportation operations.

The Marine Channel consists of a 74km long channel, 61.0m wide and 4.8m deep. The channel has four (4) contingency waiting places along its length. The channel terminates into a turning basin of 300m diameter which allows maneuvering and access to the COF berths.

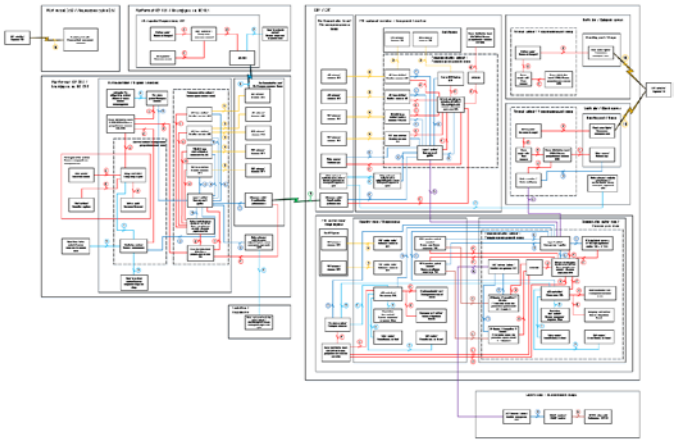
The Vessel Traffic Management (VTM) system shall ensure the safety of navigation from the entrance of 74 kilometers Marine Access Channel until Cargo offloading Facility (COF).

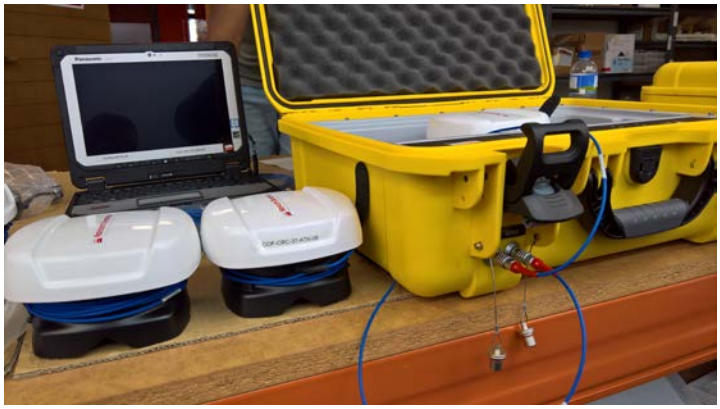


AVENCOM PROJECT SOLUTIONS

VTM system consists of:

- Navigational Safety System (NSS);
- Communication and Surveillance System (CSS);
- Marine Environmental Monitoring System (MEMS);
- Two marine platforms to accommodate AIS and VHF repeater stations;
- 70 meters communication tower and VTM control room.





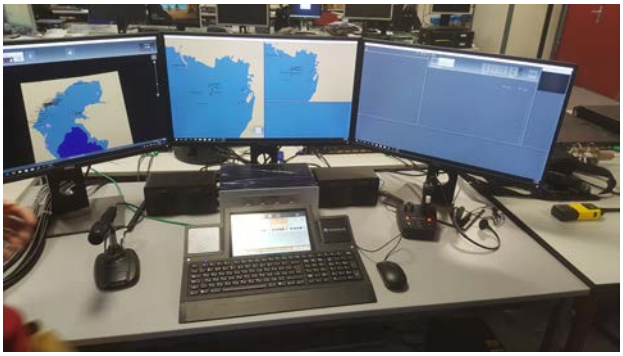
Navigation Safety System (NSS)

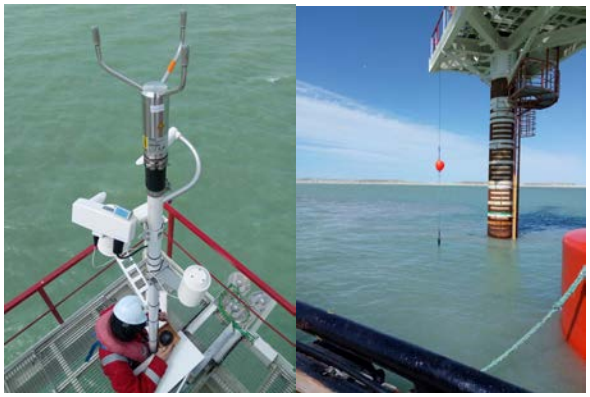
- Fixed Sector Lights (Hydrosphere) with posts to provide all vessels entering the turning basin and maneuvering within, a greater level of situational awareness;
- Portable Pilot Units (PPU) (Navicom) as an aid to the safe navigation of vessels under pilotage.

Communication and Surveillance System (CSS)

- Electronic Chart Display and Information System (ECDIS) – STYRIS (Airbus Defense and Space);
- Automatic Identification System (AIS) (Kongsberg, Pharos Marine);
- Marine VHF Communication System (Procom);
- Electro-Optical System - Surveillance Camera System (FLIR);
- Microwave link (Redline Communications);

Automatic Identification System and VHF solutions are fully resilient.





Marine Environmental Monitoring System (MEMS)

To monitor conditions at two locations – COF and mid-channel (Vaisala).

Accurately measure Air Met Data consisting of:

- Wind Speed and Direction;
- Air Temperature;
- Air Humidity;
- Dew Point;
- Air Pressure;
- Visibility.

Accurately measure Met Ocean Data consisting of:

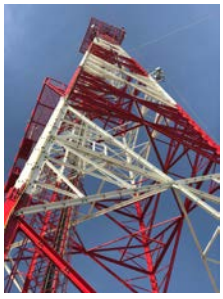
- Water level;
- Sea current speed and direction;
- Water temperature;
- Wave height, period and direction.

Marine platforms

- Platform at KP 37.2 was designed to accommodate one redundant AIS system with aerial, two VHF radios & DSC with YAGI antennas, one MET & HYDRO station, 10-ft equipment container, 14 solar panels (Sunergsolar), 4 wind turbines, batteries and associated power controllers, 12 meters telecom tower, microwave link to COF.
- Platform at KP 10.1 was designed to accommodate one AIS repeater only. This AIS repeater is a standalone solution that includes an AIS repeater itself, solar panels and batteries.

Platforms are mounted on piles of 1200 mm diameter and coated with special marine coating, which has the 17 years warranty and required the special coating equipment and specific competencies and coating standards.

The long distance between platforms (more than 30km) required the non-standard solution in connectivity. Yagi VHF antennas with PTP link over the marine surface were installed.
Platforms steel structures were designed and built by TOPAN



70 meters communication tower - the key point of telecommunication at the COF. The tower was specially designed and fabricated for CaTRo project. It supports VHF radio, AIS, antennas for microwave systems, cellular systems, weather sensors, surveillance camera system.

VTM control room. Bespoke designed and built by TOPAN fully functioning containerized solution.

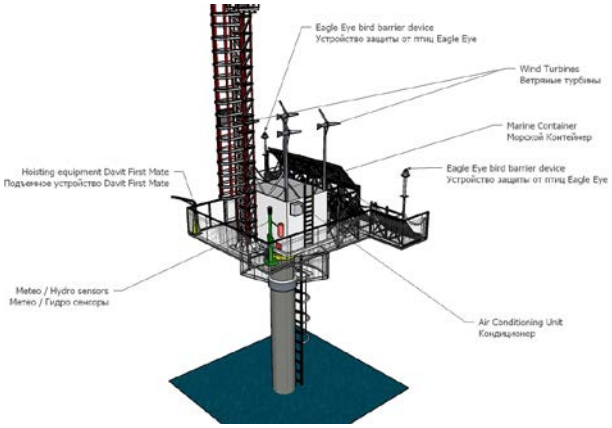
PROJECT CHALLENGES

VTM project consisted of onshore and offshore parts from the beginning. Offshore works are unique for Kazakhstan as onshore country and only few companies have competencies and capabilities for such works.

All engineering and design works were performed by AVENCOM and local companies as the standard solutions did not meet the requirements of the project.

The offshore platforms had to be designed and produced in the way to meet:

- The road police cargo height limitations on trucks for all modules otherwise it would be impossible to deliver them to port using KZ roads;
- That all modules should be assembled and mounted at site;



- Placement of solar panels and energy generating equipment on restricted platform area. It entailed the thorough planning and calculation of energy consumption, integration and compliance of all the equipment;
- The weather operational requirements between -36° and +44° degrees.

Every offshore platform is fully independent from infrastructure power sources.

All equipment had to be designed, planned, selected and installed in order to meet the requirement of full operability during the year and possibility of maintenance only during navigational season. It also resulted in installation of bird scare systems on each platform.
70 meters telecommunications tower had to be strengthened and standard design solutions did not meet the requirement of the customer (the type of steel in particular).

Harsh weather conditions during winter 2017-2018 challenged the tower erection schedule, but the dates were met.

The VTM control room located next to the tower was fully engineered and manufactured in Uralsk by local resources and is the individual customized and unique solution.

KEY DATA:

Location	:	RoK, Atyrau region, Prorva
Customer	:	TenizService
Total Value	:	7 000 000 USD
Incidents	:	0
Time elapse	:	2017 – 2018
Manpower	:	
Engineering	:	8016 mh
Installation	:	2626 mh