Base Load Power Hub (BLPH)

TELECOM SYSTEM SPECIFICATION & PHILOSOPHY

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1. INTRODUCTION

1.1 PROJECT OVERVIEW

Crosswind, a Shell and Eneco joint venture, was awarded the tender to develop the offshore Hollandse Kust Noord (HKN) wind farm, located 18.5km off the coast of Netherlands near the town of Egmond aan Zee. The consortium plans to have HKN operational in 2023 with an installed capacity of 759MW generating at least 3.3TWh per year. This is sufficient renewable power to supply more than 1 million Dutch households with green electricity.

Offshore wind farms produce intermittent electricity and balancing these dips and peaks and integrating this electricity into the national energy system requires new technologies. For this reason, the offshore wind farm will include several new technologies that could be implemented at full-scale in the future. The new technologies being explored include a floating solar park, a short-duration battery storage as well as long-term storage via green hydrogen produced by water electrolysis and subsequently consumed in a fuel cell. The combination of these individual measures, herein referred to as the Base Load Power Hub (BLPH) will ensure a continuous power supply regardless of the wind situation.

1.1.1 Project Location

The Hollandse Kust Noord (HKN) wind farm is located 18.5km off the coast of the Netherlands near the town of Egmond aan Zee.

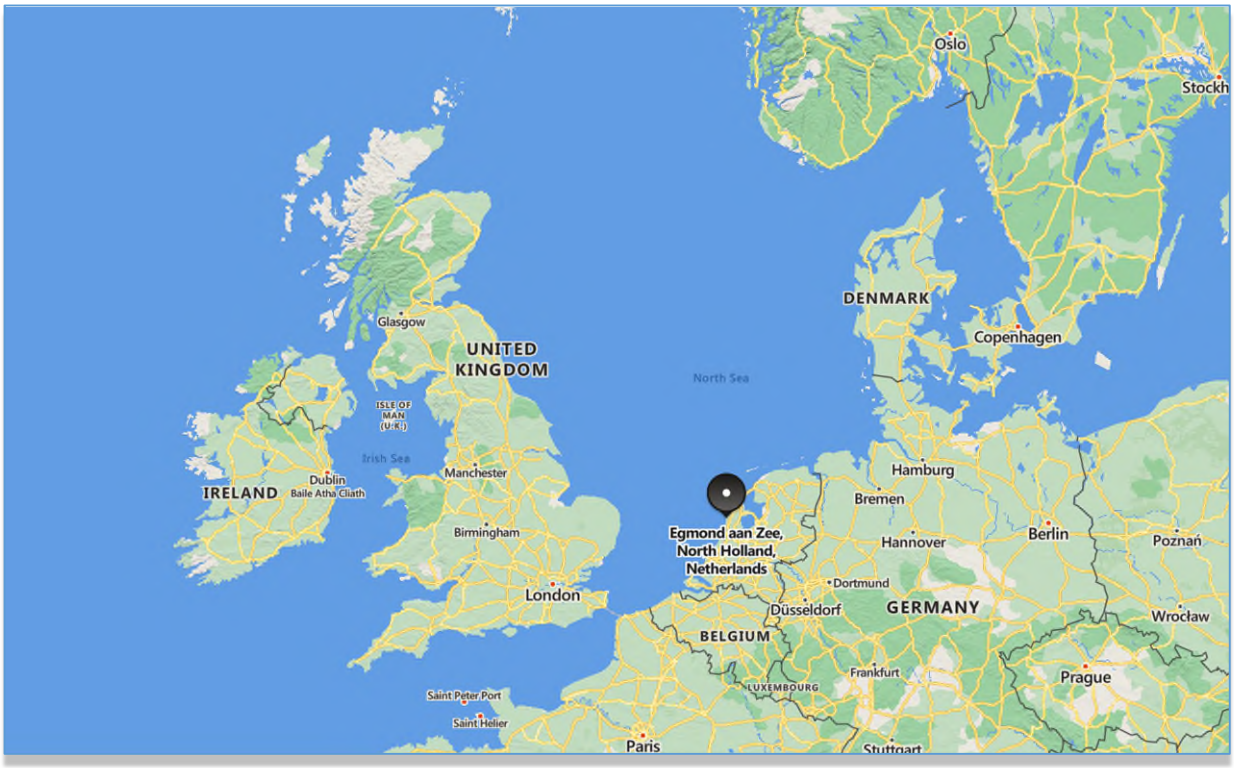


Figure 1 - HOLLANDSE KUST NOORD WIND PARK Location Map

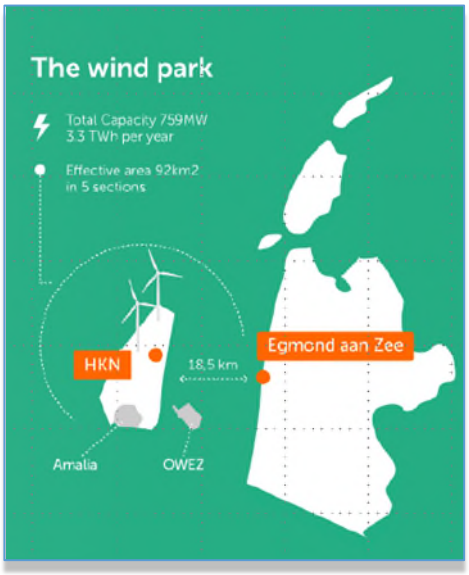


Figure 2 - Wind Park Details

The wind farm will consist of No. 69 x 11.5MW wind turbine generators each to be installed on a dedicated monopile structure. A 70th monopile located on coordinates E 590719.1, N 5841602.3 is reserved for installing the platform accommodating the BLPH. The monopile structure was designed and installed by Van Oord Offshore Wind (VooW) and therefore not part of the BLPH scope.

1.1.2 Project Concept

All components included in the BLPH will be integrated onshore on a topsides and installed in an offshore location within the boundaries of the HKN wind farm. At its simplest, the BLPH will store energy during periods of high electricity generation from renewable sources (a wind turbine generator and the floating solar PV farm) and release it during periods of low generation. In practice. It is expected that the energy stored will supplement generation from renewable sources to ensure that at least 1.0MW of power is exported to the electrical grid regardless of wind/solar availability.

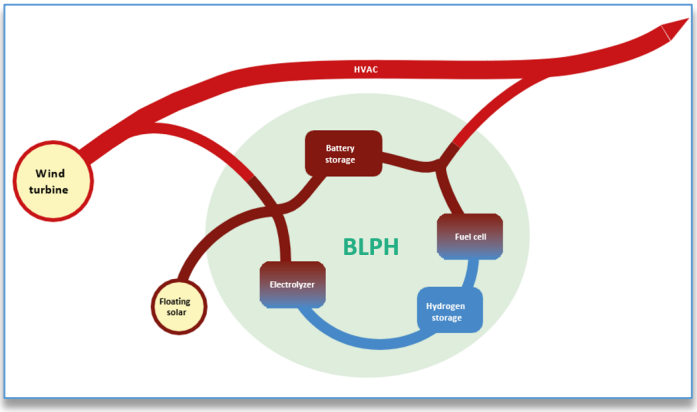


Figure 3 – BLPH Concept

Electricity in the BLPH will be stored in the form of electrons in a battery energy storage system (BESS) as well as converted into green hydrogen via water electrolysis. When the power output from the connecting wind turbine drops to below 1 MWe, the BLPH will return its stored energy to supplement the remaining power output. This will be by discharging the BESS, while stored hydrogen will be converted back into electricity using a fuel cell to extend the discharge duration.

The purpose of the BLPH s to function as a testbed for the integration of energy storage technologies with renewable generation. It is expected that equipment installed on the BLPH will operate as Normally Unmanned Installation for at least two (2) years with no or minimal maintenance and it will have its own independent control room with the ability to communicate with Crosswind's control room.

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2. DOCUMENT SCOPE

Scope of this document is to define the general philosophy and minimum requirements of Project's Telecommunication System.

2.1 REFERENCES

Doc. No.	Description
K559-2254-IC-SPE-002	Telecommunications Specification
K559-2254-IC-REP-003	Cyber Security Assessment
DEP 32.01.20.12-Gen	IACS Security

Table 1 - Reference Documents

Note: due to the nature of the Project, Design Engineering Practices (DEP) have a limited rollout on BLPH. The DEP 32.01.20.12-Gen has been identified as being fully applicable to the Project and shall be applied in full, in conjunction with IEC 62443, for the cybersecurity design.

2.2 DEFINITIONS AND ABBREVIATIONS

COMPANY or Client (CPY):	Crosswind
CONTRACTOR (CTR):	ROSETTI MARINO S.p.A.
PROJECT:	HOLLANDSE KUST NOORD WIND PARK Project
TSI:	Telecom System Integrator
By Others:	Means equipment and/or documents provided by an Organization other than CTR
Shall:	An absolute requirement
Should:	This word indicates a recommendation that whilst preferred may not be implemented provided some equivalent is proposed and agreed by COMPANY. The full implications must be understood and carefully weighed before choosing a different course
PACO:	Process, Automation, Control and Optimisation (PACO) is the term used to describe all functionality required for the monitoring and controlling of all process, safety and fire and gas systems selected for the project
HV SCADA:	The given name for the COMPANY's control system for the HKN wind farm infrastructure. BLPH's control system shall operate autonomously but will interface with HV-SCADA

Table 2 - Definitions and Abbreviations

2.3 PROJECT REGULATIONS

Doc. No.	Document title
1999/92/EC	ATEX 153 Workplace Directive
2011/65/EU	Directive on the restriction of the use of certain hazardous substances in electrical and electronic equipment
2014/30/EU	Electromagnetic Compatibility (EMC) Directive
2014/34/EU	ATEX Directive
2014/35/EU	Low Voltage Directive
94/9/EC	Equipment intended for use in Potentially Explosive Atmospheres
99/92/EC	Minimum requirements for improving the safety and health protection of workers potentially at risk from explosive atmospheres

Table 3 - Project Regulations

2.4 INDUSTRY STANDARDS

Doc. No.	Document title
EN 1127	ATEX 153 Workplace Directive
ISO 11801	Directive on the restriction of the use of certain hazardous substances in electrical and electronic equipment
EN 61131	Electromagnetic Compatibility (EMC) Directive
IEC 60079	ATEX Directive
IEC 60331	Low Voltage Directive
IEC 60332	Equipment intended for use in Potentially Explosive Atmospheres
IEC 60364	Minimum requirements for improving the safety and health protection of workers potentially at risk from explosive atmospheres
IEC 60529	Degrees of Protection Provided by Enclosures (IP Code)
IEC 60794	Optical fibre cables
IEC 61034	Measurement of smoke density of cables burning under defined conditions (both parts)
IEC 61158	Industrial communication networks
IEC 61508	Functional safety of electrical/electronic/programmable electronic safety-related systems
IEC 61511	Functional Safety - Safety Instrumented Systems for the Process Industry Sector – Framework, Definitions, System, Hardware, and Application Programming Requirements
IEC 62305	Protection Against lightning
IEC 62443	Cyber Security for Industrial Automation and Control Systems
ISO 14001	Environmental Management System
ISO 9001	Certifications of Quality Management System
TIA/EIA-568-C	Commercial building telecommunications cabling standard (all parts)
TIA/EIA-569-D	Telecommunications pathways and spaces

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TIA/EIA-606-B	Administration standard for telecommunications infrastructure
EN 1127	Degrees of Protection Provided by Enclosures (IP Code)

Table 4 - Industry Standards

2.5 CONFLICTS

Any conflict between documents or any doubts regarding the specified requirements shall be communicated immediately to COMPANY in writing. Related work shall not proceed until CTR/TSI receives clarification from COMPANY in writing.

For resolution of conflict the following order of precedence of documents shall apply:

1. Regulations
2. Selected DEM-1 and DEM-2 requirements
3. Industry Codes and Standards

All works and equipment supplied for the BLPH Project shall conform to the latest issues of the following Industry Standards.

3. ACRONYMS

AIS	Automatic Identification System
ALARP	As Low as Reasonably Possible
ATEX	ATmosphères EXplosibles
AtoN	Aids to Navigation
BESS	Battery Energy Storage System
BLPH	Base Load Power Hub
CAPEX	Capital Expenditure
CAT	Category (SCS)
CCN	Central Control Network (ICSS Network)
CCR	Central Control Room
DSC	Digital Selective Calling (VHF Marine)
DE	Detailed Engineering
DMZ	DeMilitarized Zone
EMC	Electromagnetic Compatibility
EPIRB	Emergency Position Indicating Radio Beacon
ESD	Emergency ShutDown system (part of the ICSS)
Ex	Explosion Proof
FAT	Factory Acceptance Test (usually performed at the Vendor premises to verify that provided package/system works as expected in full compliance with Project's requirements)
FB	Flashing Beacon
FEED	Front End Engineering Design
F/FTP	Foiled Twisted Pair
FGS / F&G	Fire & Gas System
FM	Frequency Modulation
FO	Fibre Optic
FOPP	Fibre Optic Patch Panel
GB	Gigabyte
Gbps	Gigabit per second
GMDSS	Global Maritime Distress and Safety System
GPS	Global Positional Satellite
GRP	Glass Reinforced Plastic

GUI	Graphical User Interface
HA	High Availability
HKN	Hollandse Kust Noord
HV	High Voltage
HW	Hardware
IACS	Industrial Automation and Control Systems
ICSS	Integrated Control and Safety System
IDCS	Intrusion Detection Control System
IDU	InDoor Unit
IEC	International Electro Technical Committee
IMO	International Maritime Organization
Inmarsat	International Maritime Satellite
INS	Instrument network
IP	Internet Protocol (TCP/IP) / Ingress Protection (IP rating)
Iridium	Satellite network for mobile communications in alternative to Inmarsat
ISO	International Organization for Standardization
ITER	Instrument & Telecoms Equipment Room
JB	Junction Box
LAN	Local Area Network
LHVS	Land High Voltage Station
LV	Low Voltage
MAC	Main Automation Contractor
MDF	Main Distribution Frame
Mbps	Megabit per second
MMSI	Maritime Mobile Service Identity
MW	Microwave
ODU	OutDoor Unit
OHVS	Offshore High Voltage Station
OS	Operating System
OWS	Operator Workstation
PACO	Process, Automation, Control and Optimisation
PA/GA	Public Address and General Alarm System

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PBX	Private Branch Exchange
PoE+	Power Over Ethernet Plus
PSU	Power Supply Unit
PTT	Push To Talk
RAID	Redundant Array of Independent Disks
RAM	Random Access Memory
RCU	Remote Control Unit
RF	Radio Frequency
SART	Safety And Rescue Transponder
SAT	Site Acceptance Test (usually performed at the construction Yard to verify that provided package/system when wired and installed in its final location still works as expected in full compliance with Project's requirements). Final act of the Commissioning activities
SCADA	Supervisory Control and Data Acquisition
SCS	Structured Cabling System
SFP	Small Form factor Pluggable transceiver
SM	Single Mode
SoHo	Small Office Home Office
SOLAS	Safety of Life At Sea
SOW	Scope Of Work
SS	Safety System
SW	Software
TCP/IP	Transmission Control Protocol / Internet Protocol
TB	Terabyte
TBA	To Be Announced
TBD	To Be Determinated
TBC	To Be Confirmed
TLC	Telecom
ToIP	Telephone over IP
TR	Technical Room
TSI	Telecom System Integrator
UC	Unified Communications
UHF	Ultra High Frequency
UPS	Uninterruptible Power Supply

UTP	Unshielded Twisted Pair
VHF	Very High Frequency
VLAN	Virtual Local Area Network
WAN	Wide Area Network
WDM	Wavelenght Division Multiplexing
WTG	Wind Turbine Generator

Table 5 - Acronyms

4. ENVIRONMENTAL CONDITIONS

A special attention shall be paid to the harsh atmospheric conditions for the design and installation of outdoor telecom devices and structures:

- Extreme wind speed up to 41 m/s
- Air temperature -15°C up to +40°C

All outdoor located equipment shall be protected against the corrosive effects of salt laden atmosphere (marine applications) and the presence of hydrocarbon.

5. HAZARDOUS ATMOSPHERE AREAS

Equipment installed within the ITER does not require to be certified for use in Hazardous Atmospheres.

All "outdoor use" telecom equipment shall be certified for use in hazardous areas. Design shall comply with IEC 60079 and be ATEX rated for IIC or rated for IIB + H2. All equipment specified for use in a hazardous area shall be suitable for hydrogen production. All equipment have to be suitable for zone 1 environments.

People boarding the Platform will find available onboard both ATEX DMR UHF portable radios and ATEX VHF marine portable radios (with their ATEX accessories) but personnel shall bring with them ATEX 4G mobile phones as not available onboard.

6. POWER SUPPLY

Most of the Telecom equipment are portable and self-battery powered. Power supply of Telecom equipment (battery chargers) shall be AC 230 V - 50 Hz (non-necessarily from UPS) and provided by ITER's local electrical distribution for non-essential purposes.

7. ELECTROMAGNETIC PROTECTION & IMMUNITY

The specifications, design, testing, installation, operation and maintenance of all electrical power systems, electrical / electronic instrumentation and control equipment / systems shall comply with EMC directives.

This is to ensure that the requirements for electromagnetic compatibility are considered during the various stages of design, construction, and installation. All as aspects of the control system shall be certified to 2014/30/EU.

8. INGRESS PROTECTION RATING

The Ingress Protection code, for equipment exposed to the environment, shall be IP66 in accordance with IEC 60529.

All cabinets inside environmentally controlled rooms, e.g., control or equipment rooms, shall be rated for IP42 (excluding air filters & fans), in accordance with IEC 60529.

9. TELECOM CABLES

As telecom system shall be limited to:

- IDCS sensors directly connected to ICSS cabinet(s)
- EPIRBs, SARTs, VHF Marine GMDSS portable radios & accessories
- UHF DMR portable radios & accessories

no dedicated telecom cables are necessary as:

- IDCS sensors shall be connected to ICSS using multi-pair cables provided by Instrumentation discipline
- EPIRBs, SARTs don't need of any cable as they are self-battery powered equipment and don't require any charging (equipment have to be serviced, by an authorized lab, every 2 years and built-in batteries replaced if necessary)
- VHF & UHF portable radios, in regular operations, are kept charging locked into their own battery chargers located at ITER (standard desktop battery chargers) and powered by AC service sockets

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10. DESIGN LIFE & DESIGN GUIDELINE

Being a proof-of-concept Project, the design life is limited to 2 years. For this reason, following ALARP, Project's telecom system shall be able to combine cost effectiveness with the respect of: safety recommendations, of the specifications, of the relevant regulations, the performances and the reliability required to a system exposed to a harsh offshore environment.

11. CABINETS AND HOUSINGS

No Telecom cabinets and/or housings are now foreseen for the Project as most of the Telecom equipment with 19" rack mount installation (such as switches, servers and so on) have now been moved to ICSS' SOW and hosted by ICSS cabinets.

12. SHUTDOWN OF TELECOM SYSTEMS

All equipment to be used outdoor (EG all portable radios) shall be ATEX certified. Indoor equipment (generally NON ATEX certified) such as battery chargers for the portable radios, shall be permanently located inside the ITER, powered by local electrical distribution and so suggested to the Project's shutdown philosophy for non-essential equipment located inside the ITER.

IDCS sensors shall be directly connected & powered by ICSS cabinet(s), they are for safe area, they will be installed indoor at all shelters and will follow the ICSS shutdown philosophy for the indoor.

EPIRBs & SARTs have built-in batteries with no need for battery chargers (equipment have to be serviced, by an authorized lab, every 2 years and built-in batteries replaced if necessary). This kind of equipment shall be activated only during emergency evacuation (platform abandon). They are for safe area (ATEX certified versions of these equipment are not available on the market). They shall be stored indoor at ITER and collected by the personnel during the emergency evacuations following the relevant safety procedures.

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13. LICENCES AND AGREEMENTS

No software licenses are actually foreseen with the telecom equipment supply.

14. LABELS AND TAGS

All equipment shall be tagged with a unique identification number in accordance with Project's tagging procedure.

15. GENERAL DESCRIPTION OF THE TELECOM SYSTEM

All provided telecom equipment for BLPH Project shall comply with International, National and Company codes and standards. BLPH is an unmanned facility with planned maintenance schedules expected to be at six (6) month intervals. The platform must be capable of autonomously operating without the need for local operator intervention for that period, with the remote operator largely providing oversight only. With a lifespan of only 2 years, the Telecom System will comply with all the relevant rules & regulations being able to guarantee performances & reliability but keeping in consideration its cost-effectiveness.

As the area where BLPH platform will be installed is generally well covered by main field's radio systems:

- Odido's 4G RF base stations
- DMR UHF RF repeaters

and other radio standards in use operate in direct mode (portable-to-portable with no need of radio repeaters) for short range communications such as the VHF Marine (personnel onboard to communicate with nearby vessels), CPY decided to base the onboard communications on portable radios.

Onboard there shall be available, permanently, UHF DMR & VHF Marine portables with their accessories while the Personnel will arrive with their own 4G mobile phones with no need for additional 4G mobile phones to be found onboard.

Onboard telecom SOLAS equipment shall consist in EPIRBs and SARTs.

IDCS has been simplified: indoor microwave sensors and door contact sensors shall now be connected with ICSS and the relevant statuses coming from the sensors shown by ICSS' GUI with no need for additional servers and workstations or dedicated software.

Onboard WAN / LAN connectivity, based on submarine FO cables, shall remain but not to be used by Telecom equipment, as they don't need anymore to get access to onshore through these data communication channels.

BLPH platform telecom equipment list includes:

IDCS / Field equipment:

- Qt. 9 indoor microwave motion detectors
- Qt. 18 indoor door contact sensor

Electronic Navigation Aids & Safety Apparatuses / Field equipment:

- Qt. 2 EPIRB
- Qt. 2 SART
- Qt. 2 ATEX GMDSS VHF Marine portable radios and relevant accessories

Radio system / Field equipment:

- Qt. 2 ATEX DMR UHF portable radios and relevant accessories

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16. TELECOM SUB-SYSTEMS DESCRIPTION

16.1 RADIO SYSTEM

16.1.1 General Requirements

ATEX UHF DMR portables shall be main Platform's radio communication equipment. CTR/TSI shall deliver radios programmed upon CPY instructions.

16.1.2 ATEX DMR UHF Hand Portable Radio Requirements

Hand portable radio shall comply with the following requirements:

- ATEX certification
- Offshore use grade
- Frequency range: UHF
- Channel spacing: 12,5 / 20 / 25 kHz
- Keyboard & LCD display
- RF output power: 1 W
- Built-in antenna: rubber omnidirectional
- Accessories: carrying case, ATEX certified headset with microphone, ATEX certified spare battery and desktop single unit battery charger (for use in safe areas)

  CPY's suggested model: Motorola Mototrbo DP4801Ex

16.2 IDCS SYSTEM

16.2.1 General Requirements

Onboard BLPH platform there shall be an Intrusion Detection Control System. This sub-system will include door contacts and motion detectors connected to the ICSS and with relevant statuses displayed by ICSS GUI pages. Scope of this sub-system is to monitor, from remote, all 9 offshore shelters hosted by the BLPH platform against unauthorized access. The part of this system, provided by Telecom discipline, shall be limited to the following equipment:

- Qt.18 door contacts
- Qt.9 motion detectors

16.2.2 Door Contact Sensor Requirements

Equipment shall comply with the following requirements:

- Construction: AISI 316L for harsh marine environment
- Contact: normally closed with anti-tamper loop
- Device grade: industrial

16.2.3 Motion Detector Sensor Requirements

Equipment shall comply with the following requirements:

- Technology: microwave Doppler
- Construction: AISI 316L for harsh marine environment
- Coverage pattern: minimum 72° horizontally and 36° vertically
- Additional functionalities: ambient light level sensor, adjustable switch-on time
- Adjustable sensitivity and detection range
- Device grade: industrial

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16.3 LIFERAFT'S TELECOM EQUIPMENT

16.3.1 General Requirements

BLPH platform shall host two liferafts in according with SOLAS standards. Liferafts shall include SOLAS telecom equipment. As these equipment cannot be hosted in the liferafts, they shall be stored (and kept charging where it needs) inside the ITER.

Liferaft's Telecom equipment includes the following equipment:

- Qt.2 ATEX GMDSS VHF marine portable radios & accessories
- Qt.2 SART
- Qt.2 EPIRB

16.3.2 ATEX GMDSS VHF Marine Hand Portable Radio Requirements

Hand portable radio shall comply with the following requirements:

- ATEX certification
- Offshore industry grade
- GMDSS
- Frequency range: VHF Marine
- Built-in antenna: rubber omnidirectional
- Accessories: carrying case, ATEX certified headset with microphone, ATEX certified spare battery and single unit battery charger (for use in safe areas)

16.3.3 SART AIS Requirements

Transponder shall comply with the following requirements:

- Equipment class: offshore grade in according with IMO SOLAS requirements
- Working band: 9 GHz / VHF Marine
- Battery: built-in with no need for charging during the service intervals (2 years)
  Minimum operating life: 96 h
  Storage life: 2 years
- Environment requirements: outdoor use
  Operating temperature: -20°C up to +55°C
  Ingress Protection: IP67
- Additional features: built-in GPS

16.3.4 EPIRB Requirements

Beacon shall comply with the following requirements:

- Equipment class: offshore grade in according with IMO SOLAS requirements
- Frequency range: VHF / UHF
- Battery: built-in with no need for charging during the service intervals (2 years)
  Minimum operating life: 48 h
  Storage life: 2 years
- Environment requirements: outdoor use
  Operating temperature: -20°C up to +55°C
  Ingress Protection: IP67
- Additional features: built-in GPS

16.4 SPARE PARTS AND TEST EQUIPMENT REQUIREMENTS

16.4.1 Spare Parts Lists

Commissioning & Start-Up spares to be identified and supplied by CTR/TSI. Spare parts recommendation for 2 years operativity shall be provided as a recommendation.

16.4.2 Test Equipment and Special Tools

Test Equipment & Special Tools shall be limited to programming software & cables (usually equipped with proprietary connectors) for UHF DMR portable radios only (VHF Marine portable radios operate on standard channels and usually don't need of programming).

16.5 EQUIPMENT AND SYSTEM VALIDATION

16.5.1 Inspecting and Testing General Requirements

CTR shall submit a procedure for testing. In addition, a Quality Assurance document shall be submitted showing review stages of the entire Contract telecom works programmer.

The period of notice required following CPY review of the test procedure and Quality Plan will be defined in the Special Terms of Contract.

16.5.2 Factory Acceptance Testing - FAT

Each Supplier of sub-system packages under contract to CTR shall arrange a FAT at their work premises.

A FAT procedure shall be submitted to CPY for review. After this document has been accepted as final with no further comments, a FAT test date shall be arranged with CPY.

CPY representatives shall then attend the sequence of tests as witness they have been carried out successfully and meet all requirements of the specification.

Any deficiencies noted shall be registered in a Punch List attached to the FAT Report, and these shall be cleared to CPY satisfaction prior to packing for shipment.

16.5.3 Fabrication Yard Acceptance Tests - SAT (Commissioning)

As there are no real interactions of Telecom equipment with other systems and considering that they are mostly standalone equipment, SAT at fabrication Yard shall include functional tests just to verify that equipment are working and they did not get damaged between FAT & SAT.

16.6 DOCUMENTATION

16.6.1 General Design Documents

PROCUREMENT DOCUMENTS	
1	Telecom System Philosophy & Specifications
2	Telecom System Material Requisition
3	Telecom System TBE
QUALITY DOCUMENTS	
4	Telecom System FAT Procedure And Report (*)
5	Telecom System SAT Procedure And Report (*)
ENGINEERING DOCUMENTS	
6	Telecom Equipment Data Sheets Collection (*)
7	Telecom Equipment List (*)
8	Telecom Equipment Manufacturer's Manuals Collection (*)
CERTIFICATES	
9	Telecom System Atex Register & Atex Certificate Collection (*)
SPARES & MAINTENANCE DATA	
10	Telecom System Commissioning & Start-Up Spare Part List (*)
11	Telecom System 2 Years Operativity Spare Part List (*)

Table 6 - Document List

Above mentioned document list is only indicative and to be updated.
(*) = documents provided by the TSI

16.7 CYBER SECURITY OF THE TELECOM SYSTEM

16.7.1 General Requirements

Telecom equipment are not affected by cyber-attacks and so it is not requested to comply with cyber-security requirements.