PETROBRAS	TECHNICAL SPECIFICATION	Nº:	I-ET-3010.2Q-5514-76A-PPT-001
	CLIENT: MARLIM LESTE E SUL		SHEET: 1 of 20
	JOB: BASIC DESIGN – REVIT I		
	AREA: MARLIM LESTE E SUL		
TIC	TITLE: OIL SPILL DETECTION SYSTEM		INTERNAL
			OI/CS

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1. SUBJECT

1.1 The subject of this document is to establish the criteria and basic characteristics for the detailed design, supply and installation of the OIL SPILL DETECTION MONITORING SYSTEM and IR CAMERA, that shall be installed in PETROBRAS FPSO Unit.

2. GENERAL CRETERIA

2.1. PETROBRAS already has this system installed and operating on other platforms. As PETROBRAS will be responsible for the remote operation of this system, it is mandatory that the solution be MIROS equipment and software.

3. ABBREVIATIONS

ABNT	Associação Brasileira de Normas Técnicas (Brazilian Association of Technical Standards)
AC	Alternating Current
ANATEL	Agência Nacional de Telecomunicações (Brazilian Telecommunication Authority)
ANSI	American National Standards Institute
ART	Anotação de Responsabilidade Técnica (Technical Responsibility Note)
ASTM	American Society for Testing and Materials
ATS	Automatic Transfer Switch
AWG	American Wire Gauge
CAP	Project Approval Certificate
CAT	Category
CCR	Central Control Room
CREA	Conselho Regional de Engenharia e Agronomia (Brazilian Engineering Counsel)
DECEA	Departamento de Controle do Espaço Aéreo Brazilian Department of Airspace Control
DC	Direct Current
DIO	Dispositivo Intermediário Óptico (Optical Distribution Drawer)
FPSO	Floating, production, storage and offloading
IEC	International Electrotechnical Commission
IEEE	Institute of Electric and Electronic Engineers
INMETRO	Instituto Nacional de Metrologia (National Institute of Metrology)
IMO	International Maritime Organization
IP	Internet Protocol
IS	Intrinsic Safe
ITU	International Telecommunication Union
LAN	Local Area Network
LSZH	Low Smoke Zero Halogen
MODU	Mobile Offshore Drilling Unit
OSI	Open Systems Interconnection
PLL	Phase Locked Loop
PoE	Power over Ethernet
PTT	Push To Talk
RF	Radio Frequency
TIA	Telecommunications Industry Association
SOLAS	Safety of Life at Sea

UPS	Uninterruptible Power Supply
UTP	Unshielded Twisted Pair
VSWR	Voltage Standing Wave Ratio

4. REFERENCE DOCUMENTS, CODES AND STANDARDS

4.1 International Standards

a. IEC 60079: Electrical apparatus for explosive gas atmospheres - all parts

b. IEC 60092-502: Electrical installations on ships

c. IEC 60331: Tests for electric cables under fire conditions - circuit integrity – all parts

d. IEC 60529: Degrees of protection provided by enclosures (IP code)

e. IEC 60533: Electrical and electronic installations in ships - electromagnetic compatibility

f. IEC 60945: Maritime navigation and radiocommunication equipment and systems – general requirements – methods of testing and required test results

g. IEC 61000: Electromagnetic compatibility (EMC) series - all parts

h. IEC 61892-7: Mobile and fixed offshore units - electrical installations - part 7: hazardous area

i. IEC 61892-1: Mobile and fixed offshore units – Electrical installations – Part 1: General requirements and conditions

j. IMO Harmonization of GMDSS Requirements for Radio Installations on Board SOLAS Ships.

k. IMO LSA Code – International Life-Saving Appliance Code.

l. IMO MODU Code - Code for the Construction and Equipment of Mobile Offshore Drilling Units.

m. IMO Resolution A.1021 – Codes on Alerts and Indications.

n. IMO Resolution A.801 – Provision of Radio Services for the Global Maritime Distress and Safety System.

o. IMO Resolution A.888 – Criteria for the Provision of Mobile-Satellite Communication Systems in the Global Maritime Distress and Safety System (GMDSS).

p. IMO SOLAS – International Convention for the Safety of Life at Sea.

q. MODU Code 11.6 and IMO MSC.80(70) as required in MODU Code 11.8.

r. ISO 7240-19 – Fire Detection and Alarm Systems - Design, installation, commissioning and service of sound systems for emergency purposes.

4.2 Brazilian Standards

a. INMETRO PORTARIA Nº 115 (21/março/2022): regulamento de avaliação da conformidade de equipamentos elétricos para atmosferas potencialmente

explosivas, nas condições de gases e vapores inflamáveis e poeiras combustíveis;

b. NR-10: Segurança em instalações e serviços em eletricidade;

c. NR-37: Segurança e saúde em plataformas de petróleo;

d. ANATEL: Resolutions of Agência Nacional de Telecomunicações;

e. ICA 63-10: Estações Prestadoras de Serviços de Telecomunicações e Tráfego Aéreo;

f. ICA 63-25 – Preservação e Reprodução de Dados de Revisualizações e Comunicações AST;

g. NORMAM 201/DPC – Embarcações Empregadas na Navegação em Mar Aberto;

h. NORMAM 223/DPC – Homologação de Helideques Instalados em Embarcações e em Plataformas Marítimas.

i. MCA 101-1: Instalação de estações meteorológicas de superfície e de altitude (2018).

4.3 Classification Society

4.3.1. The detailed design shall be submitted to approval by Classification Society. The design and installation shall take into account their requirements and comments.

5. GENERAL REQUIRMENTS

5.1 For more technical requirements details regarding antennas mounting and cables launching, CONTRACTOR shall consider, at least, the guideline on item 5 of “HARMONIZATION OF GMDSS REQUIREMENTS FOR RADIO INSTALLATIONS ON BOARD SOLAS SHIP”, issued by IMO and IEC standards.

5.2 For more technical requirements details regarding electromagnetic and electrical subjects, CONTRACTOR shall consider, at least, the guideline on items 6 up to 8 of “HARMONIZATION OF GMDSS REQUIREMENTS FOR RADIO INSTALLATIONS ON BOARD SOLAS SHIP”, issued by IMO and IEC standards.

5.3 For PETROBRAS detailed design requirements for installation, configuration, tests training and commissioning, CONTRACTOR shall comply with the DESCRIPTIVE MEMORANDUM I-MD-3010.00-5510-760-PPT-001 – GENERAL CRITERIA FOR TELECOMMUNICATIONS DESIGN.

5.4 For telecommunications symbols, the Detailed Design shall comply with the Technical Specification: I-ET-3000.00-0000-940-P4X-002 – SYMBOLS FOR PRODUCTION UNITS DESIGN.

5.5 For telecommunications TAGs, the Detailed Design shall comply with the Technical Specification: I-ET-3000.00-1200-940-P4X-001 – TAGGING PROCEDURE FOR PRODUCTION UNITS DESIGN.

5.6 All electrical requirements for telecom package shall be in accordance with I-ET-3010.00-5140-700-P4X-003 – ELETRICAL REQUIREMENTS FOR PACKAGES

FOR OFFSHORE, I-ET-3010.00-5140-700-P4X-001 - SPECIFICATION FOR ELECTRICAL DESIGN FOR OFFSHORE UNITS, I-DE-3010.00-5140-700-P4X-003 - GROUNDING INSTALLATION TYPICAL DETAILS and I-ET-3010.00-5140-700-P4X-005 - REQUIREMENTS FOR HUMAN ENGINEERING DESIGN FOR ELECTRICAL SYSTEMS OF OFFSHORE UNITS.

6. OSD SYSTEM DEFINITIONS

6.1 The OIL SPILL DETECTION MONITORING SYSTEM shall be able to monitor the oil spill around the 360º degrees of the FPSO and transmitter in real time all information demanded by PETROBRAS and IBAMA (Brazilian Institute for the Environment and Renewable Natural Resources).

6.2 The system must be composed by the following parts:

6.2.1. **Radar (1)** – Set consisting of a rotating radar antenna on a motorized base and signal transmission to the processing center up to 500m away through electrical cable or optical fiber;

6.2.2. **Integrated video digitizer (2)** - Comprises a custom radar interface board and a radar image processing board.

6.2.3. **Thermal Camera (3)–** Set consisting of a thermal camera on a rotating base with reception remote control (pan/tilt) and image signal transmission to the Central of Processing;

6.2.4. **OSD Interface Unit (4)** - The system consists of 2 OSD Interface Units. The OSD Interface Unit is used in installation sites as a common connection point to connect signals from an X-Band radar and a FLIR camera.

6.2.5. **Processing Center Server (5)** - Server that receives information from Radar, IR Camera, GPS, Rotation and Anemometer, processes the signals and interfaces directly with the HMI;

6.2.5.1. **HMI (Human Machine Interface)** – composed of monitor and keyboard installed, through which the operator receives the information and commands the Processing Center.

6.2.5.2. **KVM** – It will used to connect the monitor, keyboard and mouse, installed in the CCR to Server (processing Center) installed in the existing PETROBRAS TELECOM rack.

6.2.5.3. **DESKCAMERA SOFTWARE** – It will be installed in the HMI and be responsible to export the screen information from workstation (HMI) to PETROBRAS onshore monitoring center.

6.2.6. **Miros System Software (6)** - System software comprises a number of software modules, each performing a specific set of tasks.

6.2.7. **Concentration Box (8)** – receive field fibers, converts them and connects them to a switch.

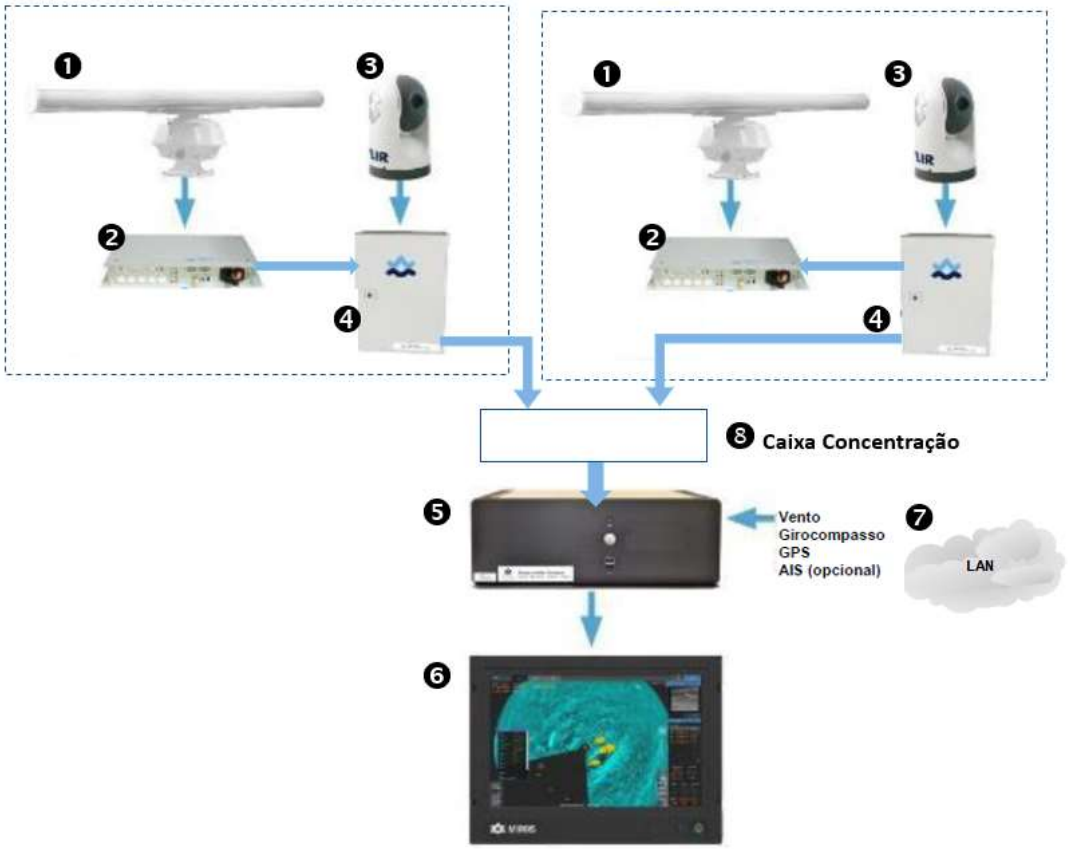

Figure 01 – Typical topology

7. OSD TECHNICAL REQUIREMENTS

The System shall be able to perform the following functions:

7.1 To monitor the presence of oil at sea in 360º around the FPSO;

7.2 To inform the length, from the platform, of the water plume discharged and alarm from a predetermined “setpoint”;

7.3 Automatically target suspicious spillages (this feature shall be disabled when necessary), identify and alarm possible areas of oil spillage at sea and allow export to “shapefile”;

7.4 To integrate on a single screen the composition of the image from so many radars as necessary for 360º monitoring;

7.5 To estimate the amount of oil in the identified and confirmed area, through the composition of the radar image and thermal camera;

7.6 To identify, through AIS (Automatic Identification System) presence of boats within reach, with the possibility of disabling their presentation in the image;

7.7 To allow duplicated operation in remote control room;

7.8 To transmit data “online” to other locations, from the FPSO;

7.9 To automatically generate monitor screen image history (“prints-screen”), in jpeg

file, with definition (bps) and frequency configurable by the operator;

7.10 To allow to be turned off by ESD, without prejudice to any of the equipment.

7.11 The Oil Spill Detection System will be permanently on, however the equipment in the field must be turned off in case of ESD-3.

7.12 The Oil Spill Detection System shall be powered by UPS.

7.13 CONTRACTOR will be responsible for interfacing signals from other systems, such as AIS, Giro, Wind, HMS, GPS.

7.14 If there is a need to adapt signal data from the existing database of signals from other systems, such as AIS, Giro, Wind, HMS, GPS, it will be the contractor's responsibility to develop.

7.15 Contractor shall perform any software adaptation on the existing data base formats to be used by the OSD system or even shall supply any hardware devices such as serial interface converters.

8. GENERAL TECHNICAL REQUIRMENTS

8.1 For each RF cable, before it ingresses to radios consoles, it shall be protected by Coaxial RF Surge Protector/Arrestor (Figure 1) due to atmospheric discharge.

RF Surge Protector/Lighting Arrestor

8.2 The equipment and accessories installed in outdoor or industrial areas shall be suitably rugged and their external bodies shall be made in non-metallic material, suitable for harsh environments and in accordance with IEC and ABNT standards, apart from the ones whose classification area require to be metallic as Ex-d junction boxes.

8.3 Brackets, bolts, nuts, washers and any other mechanical fixing elements shall be made in stainless steel.

8.4 In case of difficulty for supplying some equipment and accessory with external body made with non-metallic materials, CONTRACTOR shall submit them for analysis and approval of PETROBRAS.

8.5 It shall be avoided equipment and accessories with their external bodies built in aluminum alloy. Anything different shall be submitted to PETROBRAS approval. In case of approval, this alloy shall not contain in its composition more than 0.25 % of copper and shall comply with the ASTM-B-179 standard (ANSI alloy 356.1).

8.6 The equipment and accessories shall attend the ingress protection degree standard IEC 60529, protection type defined in IEC 61892, and IEC 60079 for electrical devices installed in hazardous areas.

8.7 All equipment that will make part of technical proposal shall have type approval certificate by Classifying Society and technical conformity with the International and National standardization organism: IMO, ABNT, DECEA, IEC, INMETRO and ANATEL.

8.8 The equipment and materials shall be supplied packed suitable for long periods of storage and be protected against mechanical impact and adverse weather conditions.

8.9 All RF cables shall be tested and certified with appropriate instrument. All tests results shall be submitted to PETROBRAS. The parameters tested shall be at least:

a. VSWR;

b. Distance to fault (VSWR);

c. Return Loss;

d. Cable Loss.

8.10 In outdoor areas, exposed to a marine atmosphere, CONTRACTOR shall beware to mitigate the galvanic corrosion of equipment, antennas, panels, boxes, coaxial cables fixing accessories. For reference only, follow the example in Figure 2.

Figure 2: Insulation to avoid galvanic corrosion.

8.11 CONTRACTOR shall utilize tubing term-contractile materials (adhesive lined heat shrink tube) as a sealant form for ending, cable splices or bundling of cables (Figure 3). It shall create a barrier against water, moisture, dirt and other environmental contaminants.

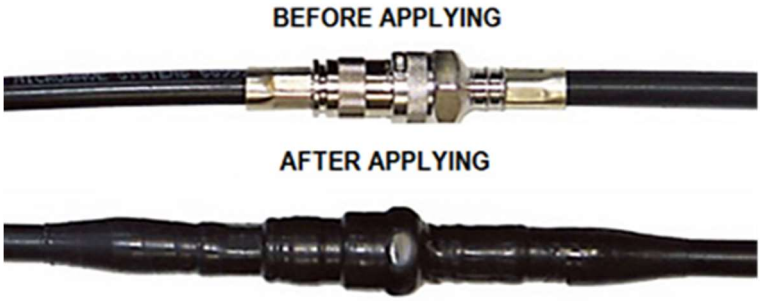

Figure 3: Connections protection

8.12 In order to avoid extra efforts on the connection of the RF cable to the antenna, the use of a flexible RF tail shall be mandatory to make this connection (Figures 4 and 5).

Figure 4: RF flexible tail

Figure 5: RF cable and RF flexible tail connection

9. OSD INTERCONNECTION REQUIREMENTS

9.1 This system shall be connected exclusively to the PETROBRAS data network to guarantee the transmission of all signals required by IBAMA to PETROBRAS onshore CONTROL ROOM and to the IBAMA department, through the VSAT PETROBRAS circuit.

9.2 PETROBRAS will inform the IP addresses that must be configured in this system during the detailed design.

10. OSD TECHNICAL CHARACTERISTICS

10.1 **Radar:**

10.1.1. The system shall be composed for at least two radars, in order to cover 360º around the FPSO.

10.1.2. Each radar must have a rotating antenna with the following characteristics:

a. Wingspan ..... Suggestion: 8';

b. Frequency band ….. “X” band;

c. Polarization ..... vertical;

d. Power ..... enough to measure features up to 7 km away

e. Exclusion areas ..... allow programming of shutdown of the emission of the pulses in exclusion areas, at each turn;

f. Motor ..... without brushes (brushes are a source of sparking and in a FPSO, can cause an explosion. in addition to require frequent maintenance).

Figure -06 Typical radar antenna

10.2 **Thermal cameras:**

10.2.1. The system shall be composed with thermal cameras (one for each radar) to be installed next to the radars in order to allow 360º monitoring around the FPSO.

10.2.2. The thermal cameras shall have the following characteristics:

10.2.2.1. Functionalities:

a. Capture and transmit thermal image of the sea surface;

b. Automatic brightness control (electronic shutter);

c. Automatic iris control;

d. Allow configuration to transmit good quality image with at least 256 Kbps;

e. Keep off (de-energized) being energized only when demanded for verification of suspected leak images.

10.2.2.2. Technical requirements:

a. Image: monochrome;
b. Resolution: minimum 640x512, or equivalent;
c. Definition: enough to visualize oil spots with 100m of diameter at 5 kms away;
d. Video Output: Ethernet TCP/IP;
e. IR Operating Range: LWIR (long-wavelength IR)
f. Electronic shutter: automatic;
g. Iris Control: automatically controlled by the camera;
h. Base: motorized, with manual remote controls for “pan” and “tilt”;
i. Focus control: motorized, automatic;
j. Mechanical shutter: Automatic;
k. Brightness and Contrast Control: Automatic;
l. Lens Material: Compatible with the operating thermal range;
m. IP: At least IPX6 (heavy seas, power jets of water)

Figure 07 – Typical camera

10.3 **Processing Center Server**

10.3.1. The Processing Center shall be a Server with Ethernet interfaces for connect all sensors, the PETROBRAS network and where be installed the MIROS software packet and the DeskCamera software and other networks where the complementary signal are available (AIS, GYRO, GPS, HMS).

10.3.2. Technical requirements:

a. Central Processing Unit (CPU): 2x processors of minimum (16) sixteen and maximum (32) thirty-two core from AMD EPYC, Intel Xeon Scalable, x86 of 64bits, 3rd Gen. or higher;

b. Random Access Memory: RAM: 256GB installed - DDR4;

c. Storage (disks and controllers): SAS RAID Controller: SAS Array controller or SATA with minimum of 6Gbps, capable of implementing, independently, RAID 0, 1, 5, 6, 10, or better, with interfaces to fit minimally 10 (ten) SSD SAS disks or SFF format SATA (2.5"); Available interfaces shall be filled with 02 (two) hot-swap SSD disks (SAS or SATA), mixed use, with 600GB each or greater, and also 04 (four) hot-swap SSD (SAS or SATA), mixed use, with 1.2TB each or greater;

d. Display Adapter: Integrated Graphics Controller - 1024 x 768 minimal resolution.

e. Remote management interface: Ethernet/IP-based integrated graphical remote console.

f. Interfaces: 4x USB 3.0, 1x HDMI, 1x SVGA (DB-15 connector), 1x COM Port (RS-232 x DB-9);

g. Network Interface: 4x gigabit-ethernet (RJ-45);

h. Power supply: 2 (two) AC power supplies with one redundant, hot-plug, 110 ~ 220V, 50 ~ 60Hz;

i. Operational System: The server shall be certified by Microsoft (HCL), Red Hat and VMware for the following products at delivery time:

- Windows Server 2022 License (operating system compatible with the last two major versions);

10.3.3. The Processing Center Server must perform the following functions:

a. Interface with all Radars, making acquisition, converting and packaging the signals.

b. Interface with all thermal Cameras, making acquisition, converting and conditioning the signals.

c. Processing of radar signals, in order to compose a single image, in 360º, for display on the HMI monitor.

d. Composition of Radar Images with those of thermal cameras, in order to estimate volume of leaked oil, when the spillage is confirmed by the operator.

e. Receive GPS, Gyro and Anemometer information that will be sent by serial communications (RS-232) from existing weather stations.

f. Capacity to store data for at least 30 days.

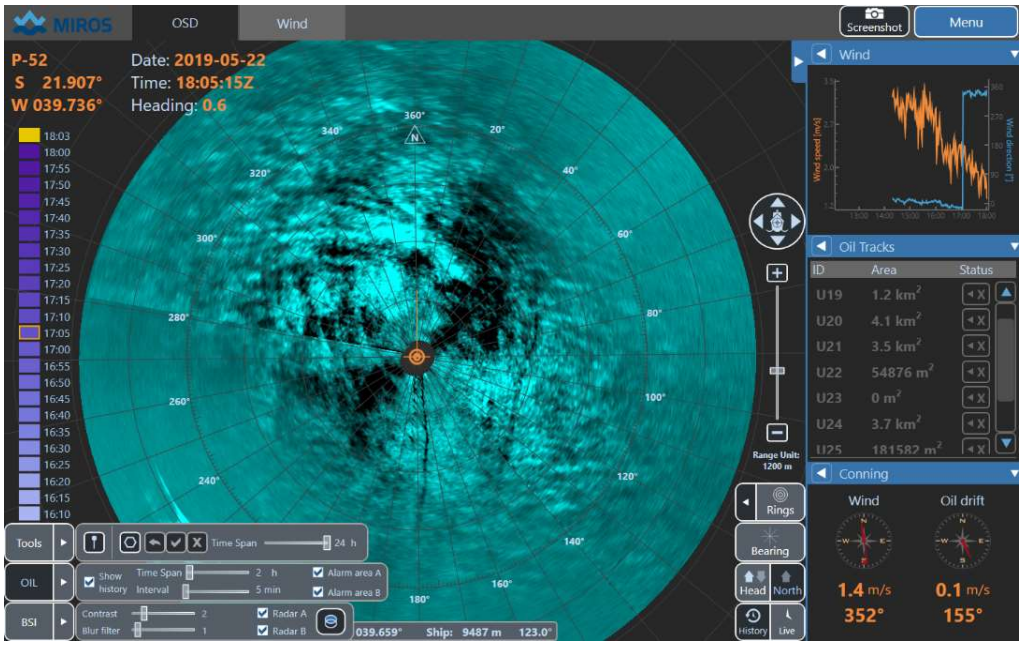

Figure 08 – Typical processing center screen

10.4 Miros System Software

10.4.1. System software comprises a number of software modules, each performing a specific set of tasks, as:

- MirPresBridge Data Presentation - is the graphical user interface;
- MirAdm04 System Manager Miros - monitor system status and manages software modules.
- MirSip41 Rolling service - connects cameras to OSD software.
- MirAdm23 Communication service - connects different Bridge clients to track oil spill alarms

10.5 OSD Interface Unit

10.5.1. This unit shall have requirements according to the classification area where it will be installed.

10.5.2. The size shall be suitable for all devices intended to be installed inside this box.

Note: PETROBRAS recommends install the OSD interface unit in indoor area, for strong simplification of the operation and maintenance procedures.

Figure 09 – Typical OSD interface unit

10.6 Concentration Box

10.6.1. This unit shall have requirements according to the classification area where it will be installed.

10.6.2. The size shall be suitable for all devices intended to be installed inside this box.

Note: PETROBRAS recommends install the OSD interface unit in indoor area.

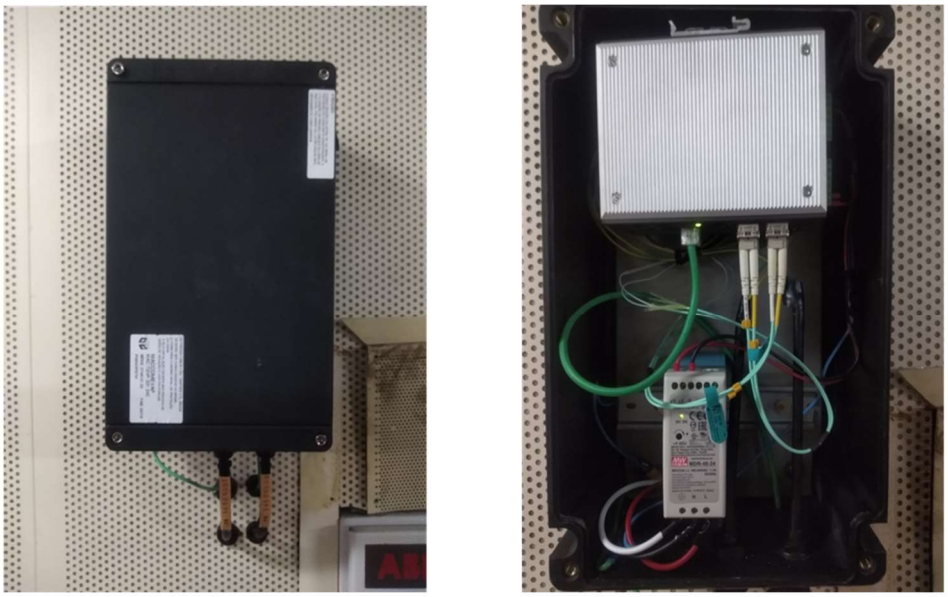

Figure 10 – Typical concentration box

10.7 **HMI**

10.7.1. All monitoring functions, command of radars and cameras must be done through the HMI composed by monitor, keyboard and mouse, installed in the CCR.

10.7.2. The HMI is where the images from radars and IR cameras will be presented on a single screen, in addition to the GPS, Giro, Wind, spill alarm and leaked volume.

10.7.3. The HMI shall have a monitor, keyboard and mouse for local operation in FPSO.

10.7.4. The Desk Camera software shall be installed in the Processing Center Server.

10.8 **DESKCAMERA SOFTWARE**

10.8.1. DeskCamera is a virtual ONVIF-IP camera which allows one to easily include PC workstations in the surveillance system of an organization. The software captures computer screens and webcams, then streams as real-time live video feeds from a virtual IP camera. Using ONVIF standard means thar DeskCamera is compatible with many Video Management Systems (VMS) or Network Video Recorders.

Figure 11 – Typical deskcamera topology

11. OSD OUTDOOR INSTALLATION REQUIREMENTS

11.1 CONTRACTOR shall carry out a study to identify the best places to position the radar and IR camera, to guarantee 360º coverage.

11.2 If it is not possible to guarantee 360 degrees coverage with the use of 02 sets of radar and thermal camera, the CONTRACTOR shall forward the study identifying the shadow zones to PETROBRAS so that PETROBRAS can formalize an assessment with IBAMA.

11.2.1. IBAMA may approve the study or request the installation of a third set of equipment to eliminate shadow areas.

11.3 Following two alternatives for a preliminary study of radar and thermal camera position.

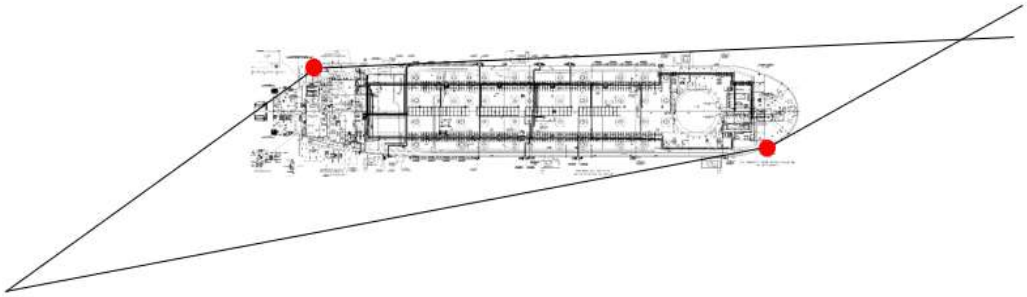

Figure 12 – Typical arrangement - starboard bow

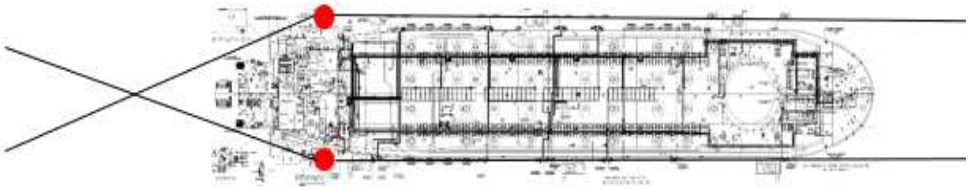

Figure 13 – Typical arrangement - portside aft

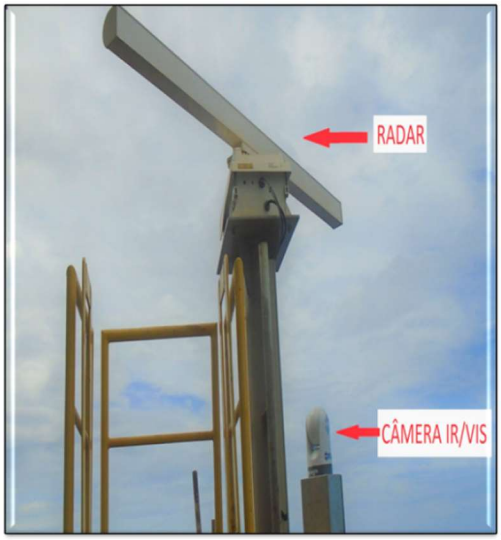

Figure 14 – Outdoor Typical Installation

11.4 The equipment (radar + infrared camera) to be supplied does not have certification for classified areas. Therefore, it cannot be installed in the process area.

11.5 The location chosen for the installation of the radar antennas must have a free diameter of 3 meters, due to the 2.5 meter rotating antenna.

11.6 Physical bulkhead/barrier required to mitigate risk to people (emission of high power waves).

11.7 Considering that the objective is to monitor the sea, it is necessary to guarantee the direct view of the antenna and camera.

11.8 360º sweep of the Offshore Unit required (IBAMA requirement).

11.9 The radar must be installed at a height greater than 25 meters from the water depth.

11.10 To reduce maintenance, the installation of connection junction boxes in external areas shall be avoided.

12. OPERATING PROCEDURES

12.1 PETROBRAS will be responsible for the operation system.

12.2 PETROBRAS has a CAR Room - Response Action Coordination Room, located at the Macaé base. This center serves all of Brazil, 24/7, with more than 30 Oil Recovery vessels distributed at strategic points.

12.3 In this CAR Room there is a Geoprocessing team responsible for monitoring oily features through satellite images and on-board radar, complying with the TOG commitment term with the Environmental agency - IBAMA.

12.4 Once an anomaly on the sea surface is detected by the radar system, an alarm is triggered, and the Geoprocessing team initiates a verification through the IR cameras installed on board.

12.5 In case of confirmation of the existence of any oily feature, the flow of actions will be initiated.

12.6 Before the Oil Spill System starts operation, PETROBRAS will present to the CONTRACTOR the detailed procedures that must be followed in case of any oily feature is detected.

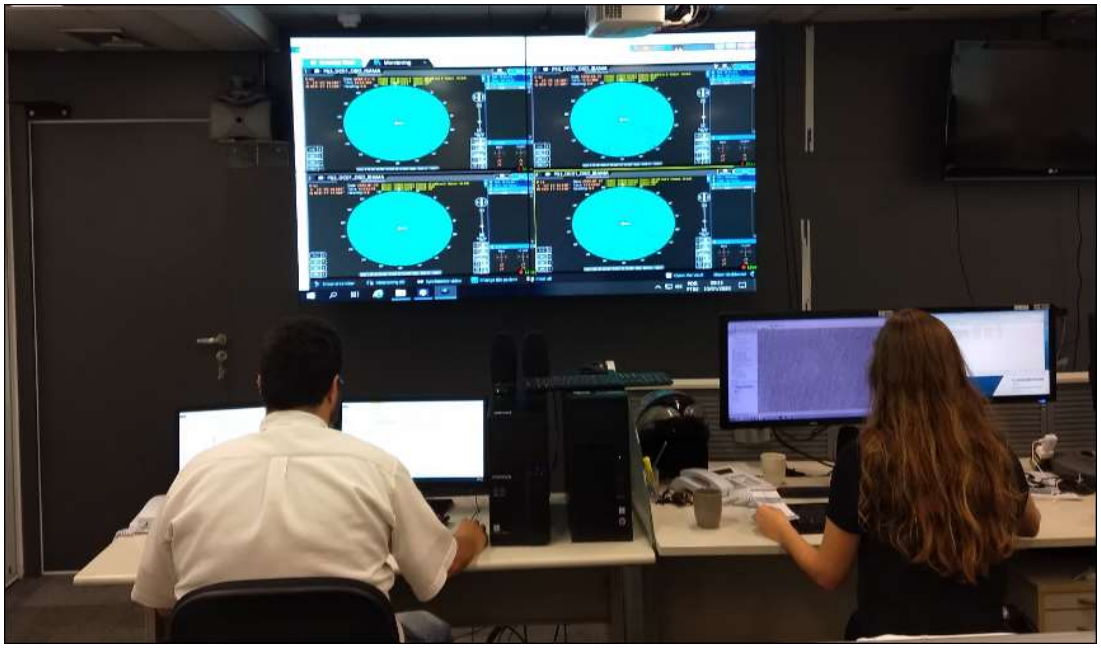

Figure 15 – Response Action Coordination Room

13. SCOPE OF SUPPLY

The OIL SPILL DETECTION MONITORING SYSTEM shall be composed by devices specified in this technical specification in quantity described below:

13.1 Radar - At least two sets, depending on the IBAMA project approval.

13.2 Thermal Camera - At least two sets, depending on the IBAMA project approval.

13.3 Integrated video digitizer - At least two sets, depending on the IBAMA project approval.

13.4 OSD Interface Unit - At least two sets, depending on the IBAMA project approval.

13.5 Processing Center Server – It shall be provided 01 (one) server.

13.6 Concentration Box – 01 (one) unit

13.7 Miros System Software - Composed of all modules described in this specification.

13.8 01 (one) KVM Extender - To extend video and USB signals (keyboard, video and mouse) from server to CCR.

13.9 Desckcamera software – 01 (one) license.

14. COMMISSIONING

14.1 CONTRACTOR shall be responsible to realize a technical commissioning activity, check, test and evaluate the operation of equipment, panels, installations, protections and RF covering, in order to permit or authorize their use under normal operating conditions.

14.2 The following verifications, at least, shall be verified as scope of commissioning activities in accordance with Contract and this Technical Specification.

a. Check hardware and network environments.

b. Basic commissioning: after checking the physical environment of the products, check whether, the basic information such as software system, license, and system time is correct, ensuring that the system is running properly.

c. After checking physical environments, check basic information for accuracy. The basic information includes the software system, licenses, and system time. This ensures that the local equipment works properly and suits interconnection commissioning.

d. Device check: Check devices to ensure that the device status meet deployment requirements and prepare for access commissioning and basic service commissioning.

14.3 PETROBRAS shall realize a visual inspection to check the presence of all items listed on the detailed design and fill in the configurations and handbooks:

a. Equipment configurations;
b. Antennas systems;
c. Antennas cables;
d. Lightning protection;
e. Masts, towers (stays, painting, lightning, …);
f. Wiring, security devices, frames, panels, racks, receivers, energy, software implantation;
g. Handbooks;
h. Marking (Equipment Homologation and Operation Certificate);
i. Technical and legal documentation.

15. LEGALIZATION REQUIREMENTS

15.1 All equipment shall be homologated by ANATEL (Brazilian Government Authority) for SMA operation as per Resolution n° 715/2019 - Aprova o Regulamento de Avaliação da Conformidade e de Homologação de Produtos para Telecomunicações.

15.2 CONTRACTOR shall provide to PETROBRAS all documents and forms required to legalize the system to be installed in the PETROBRAS FPSO Unit, subject of this technical specification, including the payment of the ART (technical responsibility term) to CREA.

15.3 CONTRACTOR shall be responsible to issue all documents required by Brazilian Air Force department in order to issue the DCI (Declaração de Conformidade Inicial/Declaration of Initial Conformity).

15.4 PETROBRAS shall receive the documents mentioned above at least, 200 days before the unit leaves the shipyard.

15.5 CONTRACTOR shall provide the requested signed report of ANATEL resolution number 700 about Evaluation of Human Exposure to Electric, Magnetic and Electromagnetic Fields Associated with the Operation of Radiocommunication Transmitting Stations.

15.6 CONTRACTOR shall be responsible to obtain the certificate issued by the Brazilian army, necessary for the installation and use of IR cameras.

16. SHUTDOWN TELECOMMUNICATIONS SYSTEM

16.1 To meet the requirements of IEC 60079-0 and CENELEC CLC / TR 50427, CONTRACTOR shall provide a shutdown telecommunication system to avoid ignition risks when flammable gases leak is detected in the antenna deck/top roof.

16.2 The radar shall be turned off when fire and gas panel detects flammable gases in the antenna deck/top roof.

16.3 This automation can be done in the electrical panel or inside the radio operation console.