150 Competition: INVESTING IN A SAFER TOMORROW

"Using WIRELESS Signalling for Emergency Alarms Activation During UMS Period"

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INTRODUCTION

Today, safety is one of the most important factors that affect all elements of maritime industry. Whether it is related to safety of life of crew or passengers, safety of ship and her cargo or safety of environment.

Present day maritime industry has a number of codes, conventions and guidelines etc. that set the boundaries of safety in various areas. Consequently, as per demand to build safer ships and to promote safety culture onboard ships, new technologies are emerging day by day. Despite that breakthrough in technology and various safety related work procedures, a ship's engine room or machinery space is still a relatively dangerous place to work.

Here, through this paper I'll try to express my idea to enhance safety in ship's machinery space during UMS (Unmanned Machinery Space) period. The technology, on which my idea is based is already well developed but I believe still not utilized in ship's machinery space. I'll discuss how this technology can be used to enhance safety and reducing losses in ship's machinery space, few design aspects, installation consideration, feasibility and how it is better than conventional present day system which is currently installed on ships.

ABOUT THE SYSTEM/CONCEPT

This system is to be utilized mainly for personnel entering machinery space during UMS periods.

As we are all familiar with “Dead Man Alarm System” which is installed in ship’s machinery spaces. Let me give a brief description about the system, why it is fitted and problem or inconvenience associated with it because of which it is ignored or not used practically when it must be used.

“Dead Man Alarm System” is installed to monitor the ability of the duty engineer in machinery spaces during UMS period. Just before entering the machinery spaces or engine room, the engineer on duty should start the system which triggers a preset countdown timer (10~12 mins) for his own safety. During his stay in engine room the system must be reset every time by pressing any one of the reset switches before that pre-defined interval. In case no reset has been triggered during the preset time the DMA system will start an alarm escalation sequence. That is, first alarm is sounded in engine room for few minutes (3-5mins) then if again no reset is pressed, the system will trigger engineer’s call alarm.

As per my experience as a marine engineer, although this system is designed for our own safety, this system is rarely used by ship’s engineers. Reason for this is- it requires manual reset every time before that pre-defined interval.

Problem arises when, if due to some reason, engineer fails to press reset or fails to switch off the system before leaving engine room, further alarm is activated disturbing all off duty crew. This is very common specially when he comes to accept UMS alarm in middle of the night and often forgets to switch it off. Hence, to avoid this kind of situation, he choose to ignore or by-pass the system.

As we observed "Dead Man Alarm System" is a kind of 'PASSIVE' system, which means alarm is activated when Reset switch is NOT pressed even if there is no any emergency situation. Hence, it gives a possibility of false alarms.
My idea is to make this system 'ACTIVE', which means alarm is activated only when switch is pressed. Hence, no false alarm.

This can be achieved by designing a WIRELESS system in which there'll be a wireless transmitter linked with a receiver. The transmitter will be our hand held remote device which will have few switches such as- **Engineer's call alarm, Fire alarm and General Emergency alarm**. The receiver is connected with ship's alarm system which upon reception of signals from transmitter triggers the appropriate alarm.

Whenever duty engineer enters in machinery space during UMS period, he just has to carry that remote in his pocket. In case, he happened to encounter any emergency situation such as personnel injury, machinery related abnormalities, fire etc. which requires immediate response of fellow mates, he can press appropriate call button on his remote device, alarm will be triggered, help will arrive and action can be taken without delay.

Unlike "Dead Man Alarm System" this doesn't require to press Reset switch every few minutes and no false alarms.

WHERE IT CAN BE INSTALLED?

This system can be used primarily in ship's machinery spaces. On a ship, machinery spaces are generally consisting of engine room and pump room (in case of tanker vessel).

As we know machinery spaces have very noisy environment. Loud noise originating from various running machineries makes verbal communication an arduous and challenging task. Same challenge is faced while we try to communicate through VHF radio or walkie-talkie. So, as per my understanding keeping a VHF radio with us during stay in machinery spaces to be in regular contact with duty officer on W/H is of no use as there is no clear communication. Hence, the only way to contact other fellow mates is by using ship's telephone or by an alarm. As alarm is most appropriate method to alert others in emergency situations, hence this system can be installed in ship's engine room and in pump room spaces.

For engine room system we can have 3 alarm switches on our remote device such as:

- *Engineer's call*
- *Fire alarm*
- *General emergency alarm*

For pump room spaces we can have alarms such as:

- *Fire alarm*
- *General emergency alarm*
- *Call CCR (Cargo Control Room)*

Wheelhouse will get alert in each of the above cases.

HOW IT CAN ENHANCE SAFETY AT SEA?

As I've discussed, 'Dead Man Alarm System' is a kind of passive system, which means alarm is activated when Reset switch is NOT pressed. Thus, there are possibilities of false alarm by this system. As this system is used in UMS hours which is generally in night, duty engineer who comes for attending UMS alarm often forgets to press Reset or switch off the system before leaving the engine room which results in buzzer buzzing around everywhere. And this is quite common situation. Because of this kind of situation other fellow engineers usually underestimate the seriousness of such calls and don't give proper response assuming as false alarm, or they act after considerable amount of time.

"Just imagine the situation when alarm is real and no help arrives on time"

Also if 'Dead Man Alarm System' system is not used prior entry to machinery spaces (which happens in most of the cases because of the inconvenience associated) and some accident happens with the engineer and he is unable to move to nearest telephone. *He'll not be discovered until next morning.* Hence, the purpose of fitting 'Dead Man Alarm System' is not solved or justified if it is not used.

If we talk about this WIRELESS concept, purpose of this system is same as 'Dead Man Alarm System' but in new/ novel way and with additional benefits. Being a kind of *Active* system, gives no false alarm as the alarm is triggered only when switch is deliberately pressed on Remote device. When alarm is activated, all other fellow engineers and other crew members will give proper response to the alarm and act accordingly. As this gives alarm without any time delay, action can be taken as fast as possible, thus, minimising losses. In addition there is no inconvenience associated with this system.

As we know in emergency situations every second counts. In 'Dead Man Alarm System' alarm is activated after delay of few minutes that too only in case of

‘inability’ of personnel entering machinery space. There is no provision for alarm for other emergency situations.

Let us consider few emergency situations which can arise in ship’s machinery space where this system can be beneficial.

Sometimes duty engineer get stuck in such a situation from where he cannot move and needs immediate assistance. Situations such as personnel injury, holding some heavy object or holding some leakage etc., situations are enormous and can arise anytime and we have to keep ourselves prepared for it all the time. During such situations he can activate ‘Engineer’s Call’ alarm from his pocket and get help from fellow engineers without any delay.

In other case, if he notices some fire in machinery space, he can activate ‘Fire Alarm’ from the remote immediately. By the time help arrives he can take control measures to prevent spread of fire.

In one of the extreme cases such as flooding because of rupture of any sea water pipelines which cannot be controlled or isolated immediately, duty engineer can activate ‘General Emergency’ alarm. All crew will get alerted and necessary action can be taken as per situation without wasting any time.

“Who knows if it may save any life one day?”

APPLICATION

The technology which can be used in this concept is RF technology or Radio-Frequency technology. This technology is already well developed and has widespread applications in various fields. Most of the wireless applications which we use in our everyday life make use of radio waves. Wi-Fi, GPRS, GPS, Bluetooth etc. all utilizes radio waves of different frequencies to transmit signals. Put simply radio wave is electromagnetic wave. It can propagate through vacuum, air, liquid or even solid objects. Which means it doesn't require line of sight between transmitter and receiver. These radio waves carry data. To receive the transmitted data, a radio receiver needs to tune itself to the same frequency as the transmitter. The receiver examines the amplitude or the frequency of the received electromagnetic wave in order to get the transmitted data.

In this concept we will use a simple radio transmitter which will act as our hand held remote device and this transmitter will be tuned with a wireless radio receiver. This receiver will be connected to our ship's alarm system.

This system is similar to wireless car key which locks and unlocks car door. The difference is car keys circuit is quite complicated as security feature comes into play. But here in our system we are not concerned about security feature as we are not using this to lock/unlock any device. This is just used for activating alarm buzzer. This makes our system much simple.

Generally, RF transmitters-receivers are available in 3 different frequencies: 315MHz, 330MHz and 433MHz. Depending upon range and design, any of the above frequency can be used for the pair.

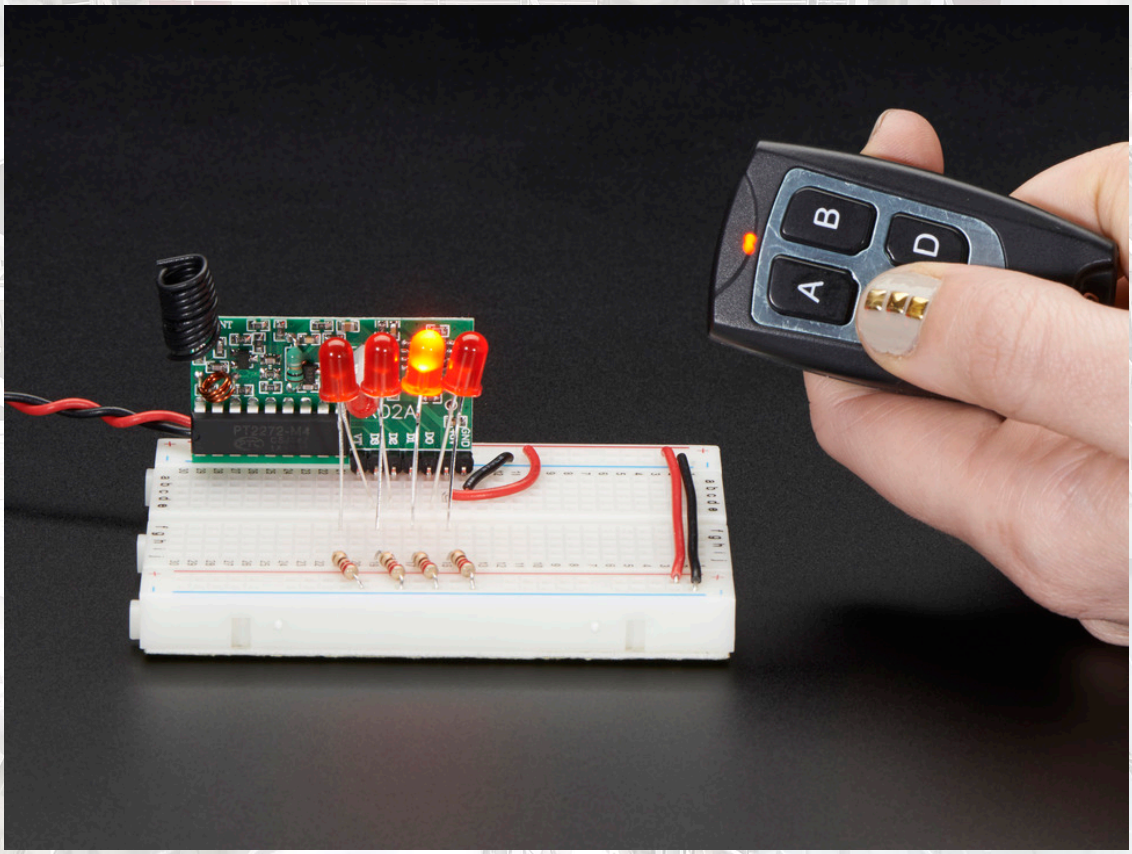
As we understand, switch signal (ON-OFF) is a binary signal and RF signal is an analogue signal and again switching alarm is binary signal. So we need to convert this binary signal to analogue signal in transmitter and again this analogue signal to binary signal in receiver. This is achieved by Encoder and Decoder ICs (Integrated Chips). For our system a 4-bit encoder/decoder IC is

sufficient as we have only 3 data outputs. Examples of these ICs are - *Encoder*: HT12E, PT 2262 etc. For *Decoder*: HT12D, PT 2272 etc.

Output of receiver will be led to activation of various alarm system.

No programming, configuring or addressing required. Simply power the transmitter and receiver with ~5V DC and press the button on paired RF remote. There is no microcontroller required, it's just one-to-one link.

Since there is no addressing required, if we have multiple receivers in a room they'll all work at the same time with a single remote which will be a great advantage for us.



(Representative image only)

DESIGN ASPECTS

There are several aspects which are required to be considered while designing this system. Few of them are:

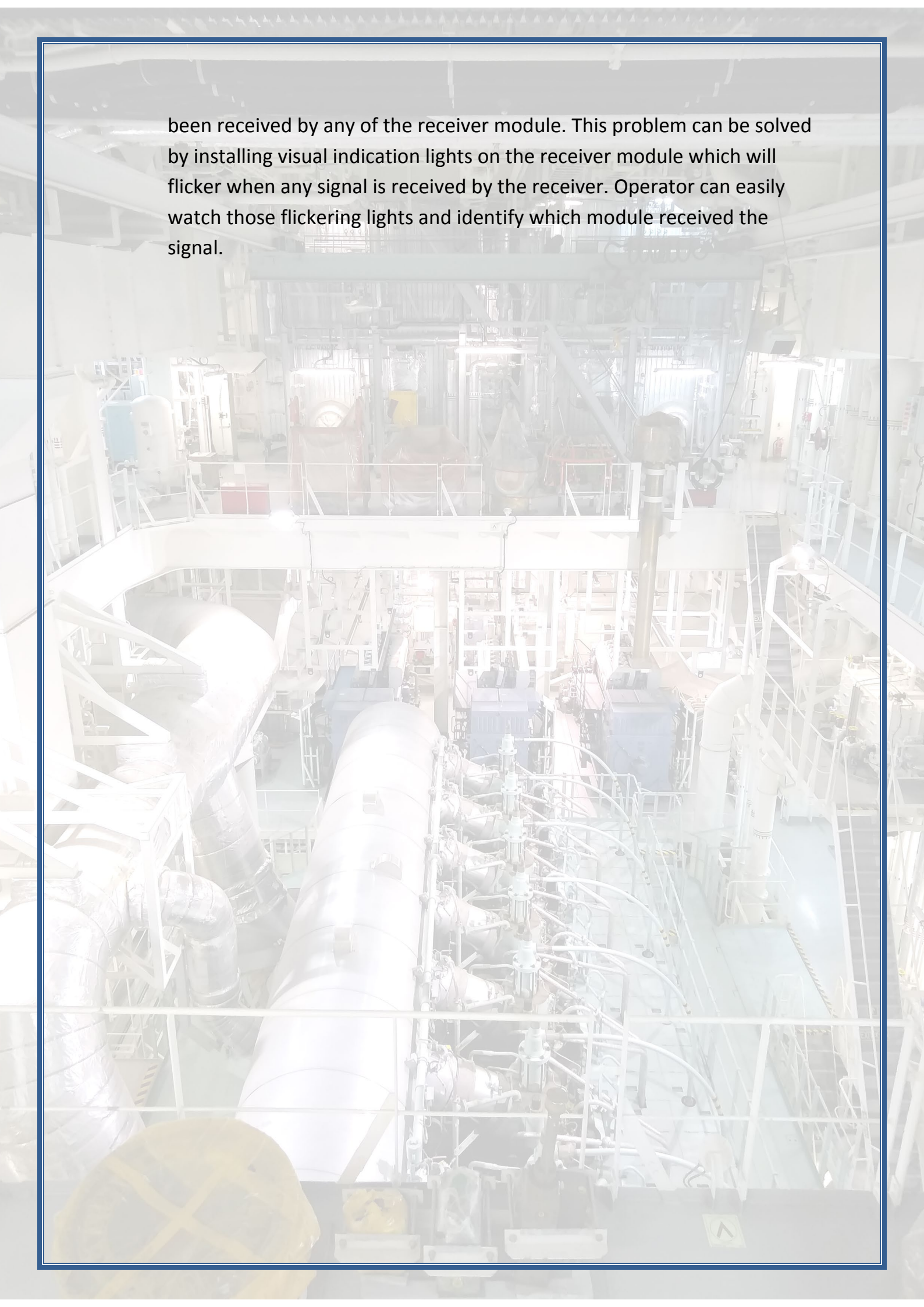
1. **Reliability:** The system and all its components must be designed in such a way that it can withstand harsh marine environment. The system should be reliable and fail-safe to be used in emergency situation. In addition we must consider some backup or redundancy in case of any failure.

2. **Blind Spots:** As we know ship's machinery space whether it is engine room or pump room is a very large space by volume consisting of several platforms within. Hence installing only one receiver for such a large volume will not be enough. As there could be many blind spots or dead zones from where receiver module cannot catch signal properly. (E.g. Engine room casing, below bottom floor plates, steering gear room etc.). All these blind spots must be identified in well advance by conducting an initial survey of the space. Number of receivers and there location should be such that whole volume of the space gets covered and no blind spots are left. All these receivers should be exactly same and must be tuned to same frequency as that of transmitter.

3. **Power source:** As we already discussed, power source required for both transmitter and receiver is ~5V DC. For transmitter we can install a small battery inside the enclosure which can be of rechargeable type. For receiver modules we can get power from ESB 220V supply by a step-down transformer and a rectifier circuit.

4. **Indicators:** Since there is no error checking or bi-directional link, which means remote doesn't know if module received the signal or not. That means there is no indication on remote which indicates that signal has

been received by any of the receiver module. This problem can be solved by installing visual indication lights on the receiver module which will flicker when any signal is received by the receiver. Operator can easily watch those flickering lights and identify which module received the signal.



INSTALLATION CONSIDERATIONS

For installing this system in ship's machinery space, whether it is engine room or pump room some basic safety principles required to be followed.

1. The remote device and the receiver module must be intrinsically safe and inside explosion proof enclosure. The system must be suitable for use in hazardous environment.

2. The receiver module must be mounted at a place where exist low vibrations, low impact, low moisture and low dust environment. Also the receiver should cover maximum volume of the space without leaving any blind spots or dead zones.

3. Use of explosion proof product cable gland to keep air tight which is satisfied with explosion proof regulations must be considered. If line entry is not kept air tight and installed outdoor, this can cause product damage by moisture and dust. Ingress protection must be considered.

4. And last but not the least, complete system must be approved and certified by class.

FEASIBILITY

- ✓ RF transmission technology is well developed and is being used in various applications across the globe.
- ✓ As this concept is without any security feature which makes this less complicated, hence design is very simple.
- ✓ No expensive components required in the design which makes it very cheap and cost effective.
- ✓ The system can be installed on ship anytime during her operating life. No need for vessel to go for drydock or repair yard for installation.
- ✓ No line of sight is required to communicate.


"SAFETY IS NOT A GADGET
BUT A STATE OF MIND"
-Eleanor Everet