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CONSIDERING ANTI-PIRACY SHIP SECURITY: CITADEL DESIGN AND USE

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Professional paper

Summary

As piracy continues to pose a threat to the shipping industry, a number of measures for protecting ships, cargo and crew will need to be implemented. Along with other steps, such as deploying military rescue teams, securing the crew within a ship's citadel has proved to be a highly effective form of self-protection against hostage-taking by pirates. From a design standpoint, aspects that should be considered include the location and dimensions of the citadel, the maximum time crew can stay within it and the specific requirements for various elements of the ship or citadel equipment. Exploiting data on pirate attacks recently occurring in High Risk Areas, this article analyses the design and use of the citadel as a self-protection measure against piracy. As a conclusion, various requirements for these structures are recommended.

Keywords: piracy; hostage-taking; self-protection; citadel

1. Introduction.

The fact that piracy is threatening the shipping industry makes the news. However, crew safety has always been a major concern in navigation and piracy should not be considered a new phenomenon. It is an activity whose intensity responds to a typical pattern.

Many factors facilitate piracy: the shipping business is thriving, making attacks profitable. Pirates also enjoy easy access to technology and there is a lack of effective protective measures.

If the combined effect of these factors remains below a certain level, anti-piracy measures are not stepped up. It is felt that the consequences of piracy on maritime trade do not justify further action. On the other hand, when these factors reach a certain level and pirate attacks increase, they are then considered a significant threat to shipping and to the safety of seafarers. Protective measures should then be increased in proportion to existing pirate activity. Moreover, this effort must be kept up over time to reach the level of security and confidence necessary for the shipping business.

Stealing a ship's cargo has always been the primary objective of piracy [1], [2]. With an increase in the volume of goods transported by sea over recent decades [3], the instability of riparian countries along maritime routes of communication and the easy access pirates have to technology, this activity has spiralled.

From 2006, some coastal states, especially in the Gulf of Aden and, to a lesser extent, in the Gulf of Guinea, do not monitor maritime zones effectively. As a result, pirates operate in a different way; in turn the world alters how it perceives this phenomenon. Cargo theft is no longer the sole purpose of pirates; a rescue operation is sought instead [3], [2]. Hostages are taken to increase the amount demanded for ransom, as well as the chances of the operation being a success. Protecting the crew now becomes a priority, to prevent pirates from seizing control of the ship as well as to protect the lives of seafarers.

Leaving aside political and economic measures to eradicate poverty and stabilize the countries in which pirate organisations flourish, the international community, along with shipping companies, has implemented a set of measures to avoid attacks or minimize their effects. These include deploying naval forces, finding alternative routes, organising convoys or establishing specific traffic control devices [4]. Self-protection measures must also be carried out on ships. Some are nonlethal, such as carrying out evasive manoeuvres or using citadels as well as fire hoses, sliding paint, acoustic devices, fences and other objects on the flanks of a vessel. Finally the creation of decisions support systems (like SARGOS system), involve the development of an overall protection method, automatic threat detection and identification, risk assessment and management of an appropriate response [5]. Other measures are lethal, with private, armed teams coming on board.

In the area around the Gulf of Aden, a combination of all these measures, with naval forces present and private armed teams coming on board, has proved to be very effective. The number of successful pirate attacks has gone down, but, these measures are not universally embraced. For one thing, they are costly. Ship owners may also be reluctant to have weapons on board; indeed, doing so is prohibited by law in some countries [6], [3], [4]. The number of attacks was expected to be significantly reduced and statistics show this is already the case in the Gulf of Aden. As a result, the most costly or controversial measures have not been deemed as necessary. However, it seems desirable to maintain medium and long -term non-lethal self-protection measures, which are less expensive and free from controversy. Another point is that piracy has indeed accelerated in other regions.

In any case, both in high-risk areas (HRA) and in those in which it has been possible to reduce this risk, adequate self-protection measures should be kept up. Among nonlethal measures, the citadel is the last defence. When other strategies have failed, citadels make it possible to stop pirates from gaining access to the control bridge, propulsion and crew. This article discusses the use, features and equipment that a citadel must have for the dual purpose of protecting the crew and blocking the pirates` access to the vital systems of the ship.

2. Evolution of high risk areas (HRA).

At the beginning of the XXI century, piracy had very low activity levels (Fig. 1), and was therefore met with the indifference by the international community. Only the region of Southeast Asia experienced a high number of attacks, the main objective of these was not hostage – taking.

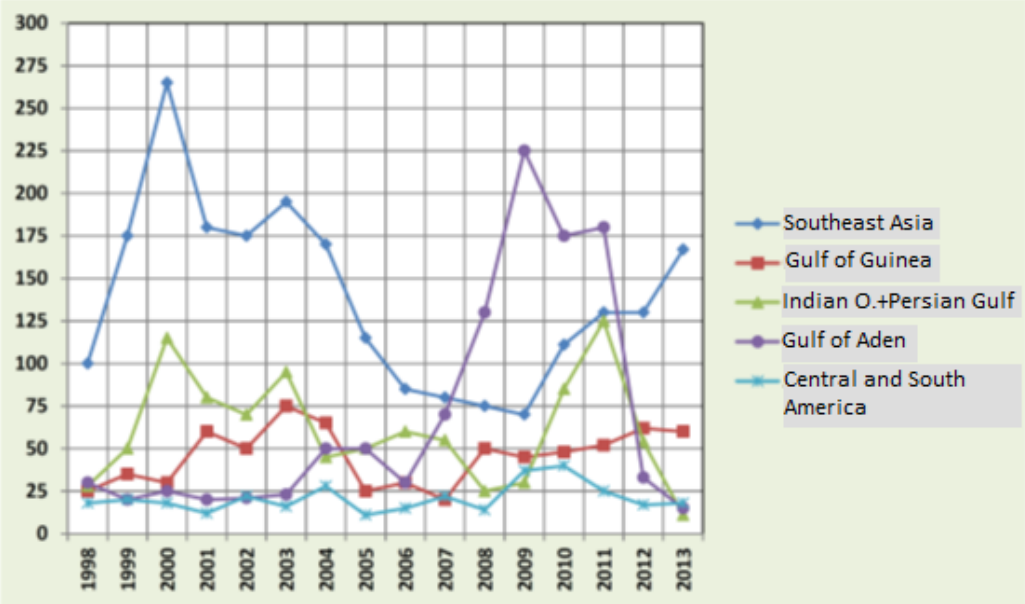

Fig. 1 Evolution of piracy cases in the main HRA from 1998 to 2013. Source: [7]

However, getting a ransom in exchange for the release of a ship, cargo and crew became the main objective of Somali pirates between 2006 and 2011 [6]. Piracy off the coast of Somalia evolved from a disorganized activity into a perfectly planned and developed criminal enterprise. Somali pirates were able to improve their skills, expanding their area of operation to areas well off the coast.

The number of attacks and kidnappings increased significantly, causing notable losses to shipping [8], [3] and raising serious concern among the international community.

Since 2010, however, piracy off Somalia has decreased (Fig. 1) because supranational protective measures were implemented. Proved to be highly effective, these measures included implementing Best Management Practices on ships (BMP) [9] and using an increasingly strong multinational naval presence and a growing number of armed, private security teams on board (PCASP) [2], [10] , [6].

At the same time, an alarming trend in piracy is the way in which HRA has grown in the Gulf of Guinea. In 2003, the number of piracy acts far exceeded the figures for Somalia. While a slight decrease occurred in 2007, since then, there has been a return to previous levels (Fig. 1). Moreover, the pirates in that area have changed their mode of action. Before 2007, attacks mainly took place within territorial waters, where maritime domain could be exercised to some extent. Since that year, attacks have occurred more frequently and in more remote areas off the coast [5].

These pirates have adopted the performance principles of their Somali counterparts, such as kidnapping the crew to get ransom. On the other hand, some of the countries in this area forbid private armed personnel to be shipped out. Within the waters of the coastal countries, they require private security company workers or armed personnel to hold their nationality [11]. This requirement leads to inefficiency and corruption and makes it extremely difficult to apply effective protective measures against piracy [6]. Therefore, the HRA are considered to be in even greater danger [7].

3. Using citadels as a self-protection measure.

In response to piracy off the coast of Somalia, the International Maritime Organisation (IMO) produced the circular MSC.1339 2011 [12] to stress the importance of implementing and updating the Best Management Practice Guidance BMP MSC.324 1989 [13]. INTERTANKO (independent tanker owners and operators of oil and chemical tankers), OCIMF (Oil Companies International Marine Forum), and other industries were represented by the International Chamber of Shipping (ICS), which drafted the document BMP4 (Best Management Practices) [9]. This is a practice guide relevant to ship owners, operators, shipmasters and vessel crews.

The document BMP4 [9] provides the three fundamental pillars in the self-defence of a ship. The first two are administrative measures: previously registering the path - MSCHOA and vessel position - UKMTO. The third pillar is known as ship protection measures – SPM- in which the document states [9], p. 23: "*The Ship Protection Measures described in BMP are the most basic that are likely to be effective. Owners may wish to consider making alterations to the vessel beyond the scope of this booklet, and/or provide additional equipment, and/or manpower as a means of further reducing the risk of piracy attack. If pirates are unable to board a ship they cannot hijack it.*"

This document also mentions the convenience of having a safe meeting place and a citadel as a last layer of security to protect the crew [9], p. 37: "*A Safe Muster Point is a designated area chosen to provide maximum physical protection to the crew, preferably low down within the vessel".* Similarly, the need to accommodate the entire crew is noted [9], p. 38: "*A Citadel is a designated pre-planned area purpose built into the ship where, in the event of imminent boarding by pirates, all crew will seek protection. A Citadel is designed and constructed to resist a determined pirate trying to gain entry for a fixed period of time.*"

The aim of the citadel is to prevent the crew from falling into the hands of aggressors. Two goals are sought: preserving the vessel's integrity and stopping the pirates from operating and steering it themselves [9].

Some consider self-protection measures like the citadel as only a short-term solution [8]. However, people in industry have a different perception. In this sense, the appendix *"Guidance relating to the construction and use of citadels in waters affected by Somalia Piracy"* [14], p.1 states that "*… although the initial use of the citadel was limited to the Gulf of Aden, which could be a quick response of the naval forces, now its use has spread to other areas outside the Indian Ocean*".

Now that a period of time has passed since the BMP was implemented [9], it would be interesting to analyse how effectively citadels have been designed and used. Table 1, 2, 3 and 4 have been compiled from the 1,690 reports collected from pirate attacks [15], [16], [17], [18], [19]. Only reported incidents have been covered and therefore they only represent a partial number of the total [20].

Using data from the last five years, Table 1 shows that, when ships were attacked by pirates and the crew took refuge in the citadel, in just 5.5% of cases did the pirates take control of the ship. The reason a citadel went unused in the first place may be that only some of the crew could reach it or the citadel was not properly designed in the first place. In both cases the result was the same. The crew could not stay safely in the citadel.

Table 1 Citadel use during acts of piracy and robbery. Data collected by the ICC-IMB, indicating those cases where it failed to protect the crew. Source: author's own information and IMB in [15], [16], [17], [18], [19].

	2010	***2011***	***2012***	***2013***	***2014***	***TOTAL/MEDIA***
CASES IN WHICH CITADEL USED	19	54	25	16	14	**128**
CITADEL USED IN TOTAL NUMBER OF CASES FOR YEAR (%)	4.3 %	12.5%	8.4%	6.1%	5.7%	**7.6%**
CITADEL FAILURE RESULTING IN CREW BEING KIDNAPPED OR HARMED	1	2	1	2	1	**7**
CITADEL FAILURE IN TOTAL NUMBER OF CASES CITADEL USED (%)	5,2%	3.7%	4%	12.5%	7.1%	**5.5%**
TOTAL NUMBER OF ACTS OF PIRACY	445	439	297	264	245	**1690**

If only some of the crew is confined, pirates can take hostages and the effectiveness of the citadel is impaired (Table 1). Once the crew is outside, it is captured by the raiders. It is therefore easy to force the others to leave the place (Cases include: M.v.Gulf Coast - 2010, M.v. UAL transporter - 2012, M.v. Walvis - 2013). From the seven cases in which an undesirable outcome took place in the citadel and, as a result, crewmembers were kidnapped or harmed, only in three cases (42%) did all the crew reach the place. Also, during the period being studied, in 45% of the cases (Table 2), partial confinement of the crew was used along with other self-protection measures. For example, armed teams went on board to repel the attack.

Table 2 Comparing the degree in which crew members could protect themselves: by confining the entire crew in the citadel versus having only some of the crew confined and using other measures adopted by the members who remained outside. Source: The author´s own and IMB in [15], [16], [17], [18], [19].

	2010	***2011***	***2012***	***2013***	***2014***	***Total***
ATTACKS MADE AND CITADEL USED	19	54	25	16	14	**128**
ONLY SOME OF THE STAFF INSIDE; THOSE OUTSIDE IMPLEMENTED OTHER SELF-PROTECTION MEASURES	3	20	15	10	10	**58**
PERCENTAGE OF TOTAL						**45%**
ENTIRE CREW HAD TO TAKE REFUGE	16	34	10	6	4	**70**
PERCENTAGE OF TOTAL						**55%**

There is no doubt that, as time passes, pirates can change their tactics to adapt to citadels in an effort to reach the crew and take them hostage. They could use firearms or more powerful explosives and cutting tools found in the vessel itself or they may intentionally start a flood and fire. The citadels would become more vulnerable [9]. If the citadel is properly designed, and the crew scrupulously follows known and tested protocols, its integrity would remain intact until the rescue team arrived. In any case, the data in Tables 1 and 2 show that,

when coupled with other protective measures, using the citadel is an effective step that contributes to the safety of the ship and crew.

Several factors determine if a citadel should be installed. These include the extent to which a ship is vulnerable, the likelihood that pirates will attack and the existence of other protective measures. Therefore, the following point should be taken into account:

- Freeboard height and ship speed. Less than eight meters of freeboard and a low speed increase the likelihood of a ship being attacked by pirates. There are no cases of piracy on ships whose speed exceed18 knots [9], [20].
- Cruising areas. The use of a citadel is more indicated for vessels that regularly operate from areas with high risk of pirate attack.
- Other measures of protection. Using the citadel has to be coupled with other protective measures to delay the approach long enough for the crew to take refuge. Also necessary are protective devices, like the MSPA (Maritime Security Patrol Areas) with intervention teams that can act in a reasonable time. (Table 3)

Table 3 Use of the citadel within HRA areas, indicating in brackets the number of times armed forces rescuers on helicopter or ship intervened to release the crew. Source: Author's own and IMB in [15], [16], [17], [18], [19].

	2010	***2011***	***2012***	***2013***	***2014***	***total***	***%***
CITADEL USED DURING ATTACK	19	54	25	16	14	**128**	***100***
SOMALIA	5 (2)	39 (13)	10 (3)	2 (2)	4	**60**	***46.9***
GULF OF ADEN/RED SEA	2 (1)	15 (3)	4 (0)	5 (4)	4	**30**	***23.4***
OTHER AREAS OF AFRICA	12 (4)	-	11 (4)	9 (2)	5	**37**	***28.9***
OTHERS	0	0	0	0	1	**1**	***0.8***

4. Citadel design.

When designing a citadel, factors have to be taken into account. These include its location or dimensions and the maximum time it is necessary for the crew to be confined. One should also consider other specific requirements related to different elements of the ship, like doors, hatches, bulkheads and decks. A further consideration is related to the materials and equipment needed to service the citadel, including the remote control system platform, power generation, ventilation, communications equipment, water and food.

4.1 Location

Considering the different types of ships, each one with its corresponding distribution of spaces, it is difficult to identify a location that is valid for all types of vessel. However, it is possible to identify some general criteria that should be taken into account as far as possible:

a) The citadel should be difficult for pirates to locate. Access to the citadel should be camouflaged and close to the safe assembly point *(muster safe point*). It seems reasonable to have a dual path to reach and leave the citadel, that is, access to two different passageways.

b) The citadel should be on a middle deck, if possible within the hull. Superstructure areas should be avoided. Because of the lower sheet thickness used there, it can be easily pierced by small calibre ammunition.

c) The citadel should not be in direct contact with the ship's side or outside decks. Nor should it be vulnerable to an attack with grenade type weapons of greater calibre.

d) As far as possible, one should avoid having any type of openings to the outside or to other easily accessible compartments that are difficult to protect.

e) The citadel should be located close to a supply area and exhaust ducts with independent, forced ventilation. This area has to be difficult to sabotage.

4.2. Length of time confined in the citadel

With the design of the citadel, it should be possible for the crew to be confined for at least the time it takes the rescue team to intervene. Since 2010, in cases in which the entire crew was enclosed, the average time in hiding has been 12.5 hours. The maximum registered time was 19 hours in 2010 (Table 4). If citadel use extends to other areas where the MSPA runs less efficiently [14], p. 3, the design may have to be altered so that the crew can stay for up to 48 hours.

Table 4 Average time period spent inside the citadel in cases where the entire crew was secured. Source: Author´s own and IMB in [15], [16], [17], [18], [19].

	2010	***2011***	***2012***	***2013***	***2014***	***Total***
CASES CITADEL USED WITH ENTIRE CREW SECURED	16	34	10	6	4	**70**
				Average		
AVERAGE TIME SPENT THERE (HOURS)	19	14	5	SHORT	SHORT	**12.5**

4.3. Dimensions

The citadel capacity must be capable of accommodating the entire crew [11]. When it comes to building *community*, *safe rooms* on onshore facilities, the USA - Federal Emergency Management Agency [21] determines that the area ranges from 6 to 12 m^2 per person, depending on how long they are to stay there. On the other hand, warships are clearly limited in terms of space. The area for common use is reduced to 5 and 7 m^2 [22]; ILO Convention 92 [23] concerning accommodation recommends a lever value, 2. 78 m^2 (Table 5).

Therefore, considering the limited space on board and the length of stay required (48 hours), it seems reasonable for the citadel to have an area of about 3 m^2 per person.

Table 5. Estimating the citadel area required for confined spaces for people in case of inclement weather outside [21] (FEMAP), necessary living space aboard warships [22] (NATO) and minimum space for cabins [23] (ILO). Source: Author´s own

	FEMAP, [21]		**NATO,** [22]		**ILO Convention 92,** [23]	
Category	Without distinction		Officers	Seamen	Officers	Seamen
Time inside (days)	1-7	> 7	Undefined	Undefined	Undefined	Undefined
Area per person (m^2)	6	12	5-7	2-2.5	2.78	1.85

4.4 Specific requirements for the ship

4.4.1 Doors and hatches

Installing metal safety doors and hatches in certain areas will make it more difficult for pirates to gain access to essential equipment and systems. Thus they cannot gain control of the ship in terms of the bridge, motors, generators and steering gear. Nor can they reach existing cutting tools on board and use them in their assault of the citadel [9].

Lashings should be independent, possibly with a common drive system to make manoeuvring easier. The same is true of fittings and hinges along the inside surface. Here the aim is to stop the pirates from taking them apart on the outside. Moreover, the elements are better integrated and camouflaged along the bulkhead [14].

4.4.2 Bulkheads and decks

Bulkheads and decks should be made of welded steel to achieve a degree of gas tightness, and then they should undergo pneumatic testing.

4.4.3 Ballistic protection

The ballistic protection of certain elements on the ship is considered crucial in citadel design; it directly affects the safety of the area against armed attack. Thus, installing suitable steel doors, bulkheads and decks or reinforcing existing ones will provide appropriate ballistic protection (Table 6).

Table 6 Resistance of bulkheads and doors with ballistic protection and blast resistance [24], [25], [26], [27]. Source: Author´s own

Citadel	**Ballistic Resistance**		**Blast Resistance**	
	Bulkhead and decks			
	Opaque zone	**Glazing**	**Opaque zone**	**Glazing**
	Ballistic resistance classification EN 1522 (1998)	Securing glazing resistance EN 1603 (2000)	Standards EN 13123/124-1 (2001) Related to windows, doors and enclosures. Specification on and classification of tests performed with shock tube	Standards EN 13123/124-2 (2004) Relating to windows, doors and enclosures. Specification on and classification of outdoor tests
	Ballistic Resistance		**Blast Resistance**	
	Doors and frames			
	Impacts Calibre 7.62 x 51 a 10 m.			
	Opaque zone	**Glazing**	**Opaque zone**	**Glazing**
	FB6 or FB7 *	BR6 or BR7	EXR4 (S/NS) or EXR5 (S/NS)	EPR3 (S/NS) or EPR4 (S/NS)

* Equivalent to an AK 47 rifle type

4.4.4 Fire extinguisher Systems

Given that pirates could start a fire to make, the crew evacuate the citadel, local systems should have active and passive fire prevention. An example of this is A60 type fire retardant insulation in [28], Cap.II.2, part A, rule 3, in bulkheads and decks, as well as along the inside of doors. The fixed fire-fighting system has to be water mist. When faced with a fire recently started inside the premises, it should be enough to have one or two fire extinguishers, preferably water ones.

On the other hand, two other ideas would be useful for the remote control system of the platform. It should receive information from the fire detection system [14]. Moreover, there should be remote control for local extinguishing systems, such as in the engine room or cabins (Fig. 3).

4.5 Equipment

4.5.1 Platform remote control system

Pirate will have difficulty gaining control of the ship if equipment and systems can be operated remotely from the citadel. Another useful device would be a remote locking system for doors and hatches providing access to this equipment. The citadel would control this equipment as long as possible. From the platform, this would include essential ship systems, such as steering, propulsion and power generation, were controlled from the citadel. Crew would also be able to switch off bridge consoles and camera controls. Figure 2 shows the arrangement for the control of these systems. Similarly it would be desirable to receive information from and control of the fire detection system, as well as the ventilation.

4.5.2 Autonomous power generation system

Ventilation and fire control are crucial to the crew's survival in the citadel. Communication equipment must also function. The corresponding electrical balance will help calculate the power, which determines the characteristics of an enclosed autonomous generator system. For reliability and adaptability to the environment, the most suitable system is a generator with electric starter and battery power. Should the generator fail, this battery would feed emergency lighting. The exhaust would be located outside and the main way of cooling the engine would be with air.

4.5.3 Ventilation

On occasion, pirates have used various methods to force the crew to leave the site. One of them is to start a fire outside so that smoke enters the premises through the vents [14]. Therefore, vents are the main point of weakness within the citadel.

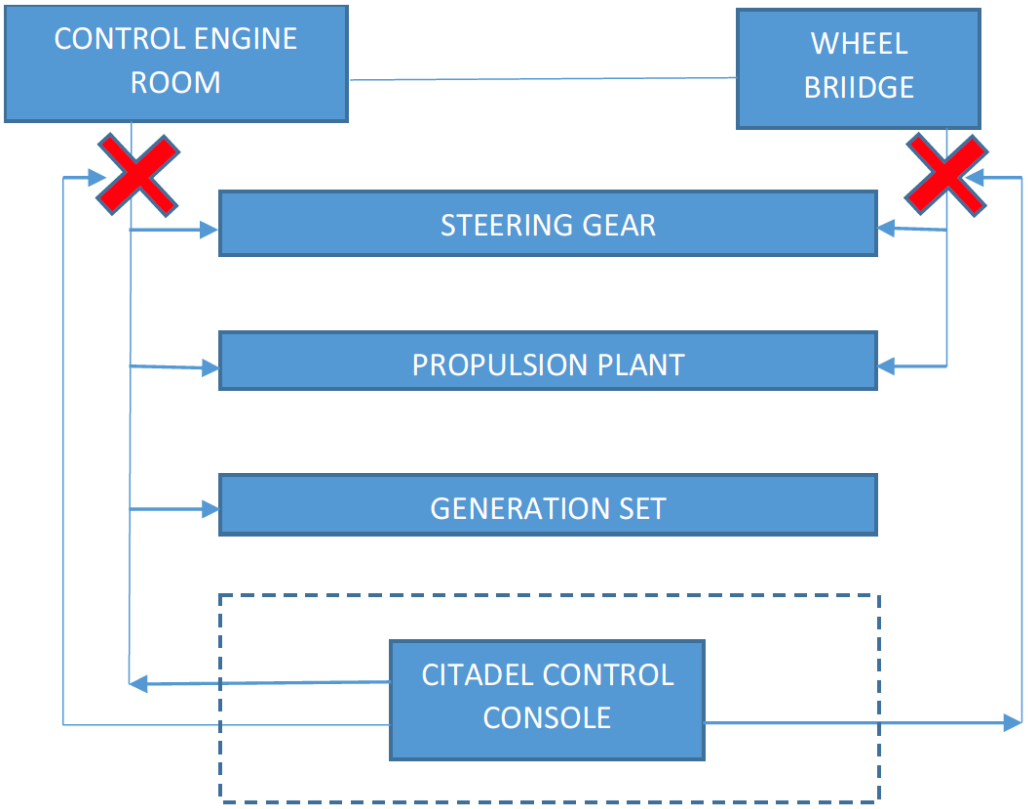

Fig. 2 Control of propulsion and steering of the ship from the citadel, with the possibility of disabling the machine control console and navigation console so that crew can take control of the propulsion and power generation plant, as well as steering, from the secure space. Source: Author´s own

To prevent smoke from making its way in, the room's ventilation should be autonomous, working independently from the ship's ventilation systems and general electricity generation. It is advisable to have two selectable points of air admission that are sufficiently spaced. Both the exterior intake and exhaust grille openings should be easily accessible, and not easily recognizable.

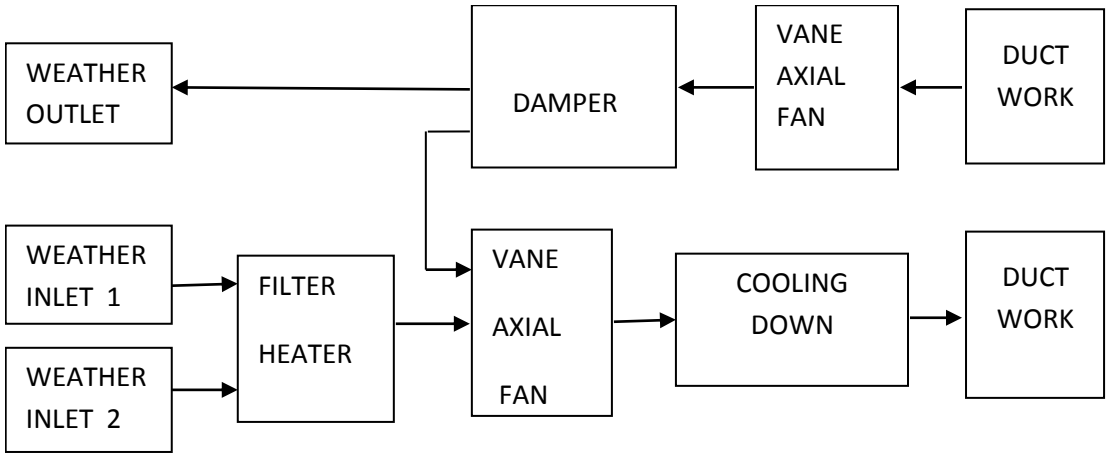

Fig. 3 Functional scheme of autonomous ventilation for the citadel, according to strict design specifications: Double capacity of selectable intake and discharge by a centrifugal axial-type fan, with in-house heating, air filtration and distribution. There is an axial extractor fan with discharge to the outside and possibility of air recirculation with a minimum replacement rate over a limited time. Source: Author´s own

Table 7 Calculation of ventilation needed in siege conditions. Source [29]

Volume	10 renovations/hour
Discharge	mechanical
Extraction	mechanical
Design temperature	18 – 26.7 ºC
Relative humidity	55%
Minimum renewal for recirculation	8.5 – 17 m^3/hour-crewmember

The system should be capable of renewing the room's air every six min., re-circulating and cooling it for short periods of time. This factor may be the way to counter any attempt made by the assailants to introduce smoke through the main air intake. The air is re-circulated, so that a minimum of air is drawn from the outside and comes from a different weather inlet. The flowchart in Fig. 3 charts this process; its technical specifications are contained in Table 7, while the ventilation control is represented in the flowchart for Fig. 4.

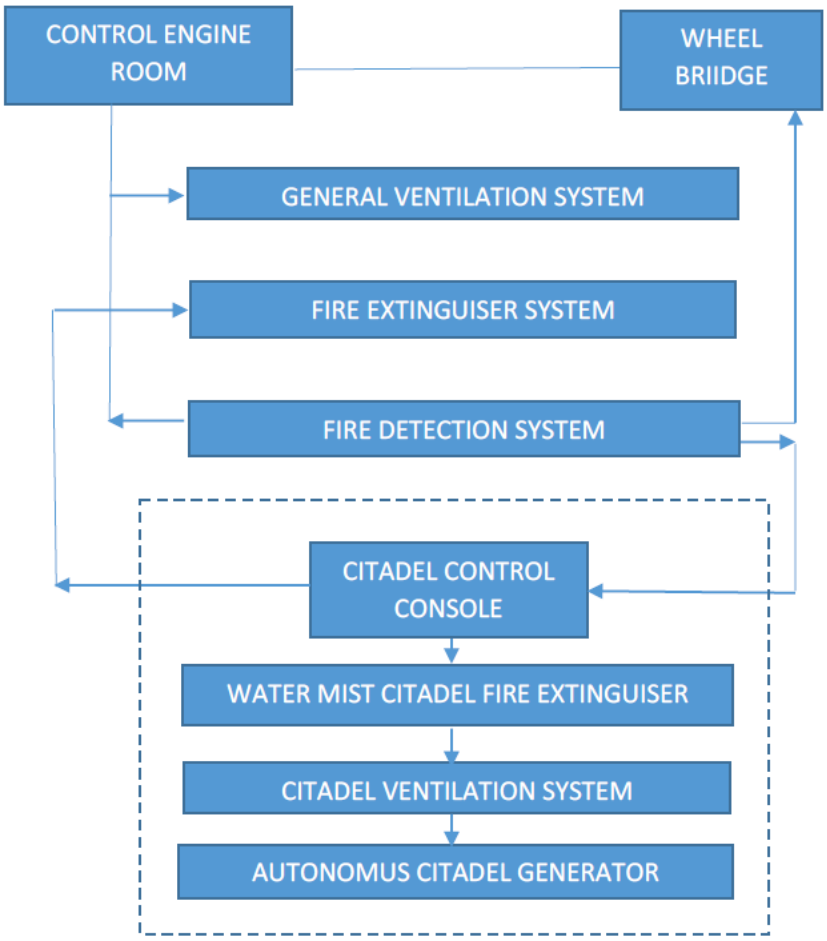

Fig. 4 Ship Control Platform. The ventilation and firefighting systems for the citadel operate by means of an autonomous generator. At the same time, information from the fire detection system is received at the citadel console and the fixed firefighting systems can be activated. Source: Author´s own

4.5.4 Communications Equipment

It is vital to have a link with the military units that will be involved in the rescue of the ship. These units need to be informed of the crew's situation in general and confirm that all of its members have been secured. In the absence of this information, the rescue team will refuse to intervene.

The ICS [14] recommends an autonomous communication system, with a discrete wire antenna, to stop the pirates from doing damage. This equipment should run autonomously for at least three days, relying on the autonomous power system from the citadel. (Fig. 5).

4.5.5 Closed circuit television (CCTV)

A television circuit should be installed on board. Ideally it would be possible to monitor the cameras from the citadel. This system would therefore allow the confined crew to know the movements of the assailants and to inform military units about the situation while the intruders are on board.

4.5.6 General equipment: Food and water, first aid, housing and documentation

Food and the water supplies should reflect the number of crew members and be sufficient for the maximum stay of two days mentioned in paragraph 4.3.

It is also necessary to calculate the space needed for collecting the waste that is generated, as well as for chemical toilets. Again, crew size has to be considered, with one toilet for every ten members (Table 8).

A reinforced standard first aid kit should be enough to meet requirements and provide initial treatment of gunshot wounds or burns. It is important that the kit also includes specific medicines usually required by some crew, such as insulin or allergy relief.

As for documentation, the citadel should include a nominal list of the crew to verify those who are present. There should also be an updated list of contacts to be maintained with control agencies. Other items are recommended to make confinement as comfortable as possible without unduly taking up space. These include sleeping bags, mats or mattresses and torches.

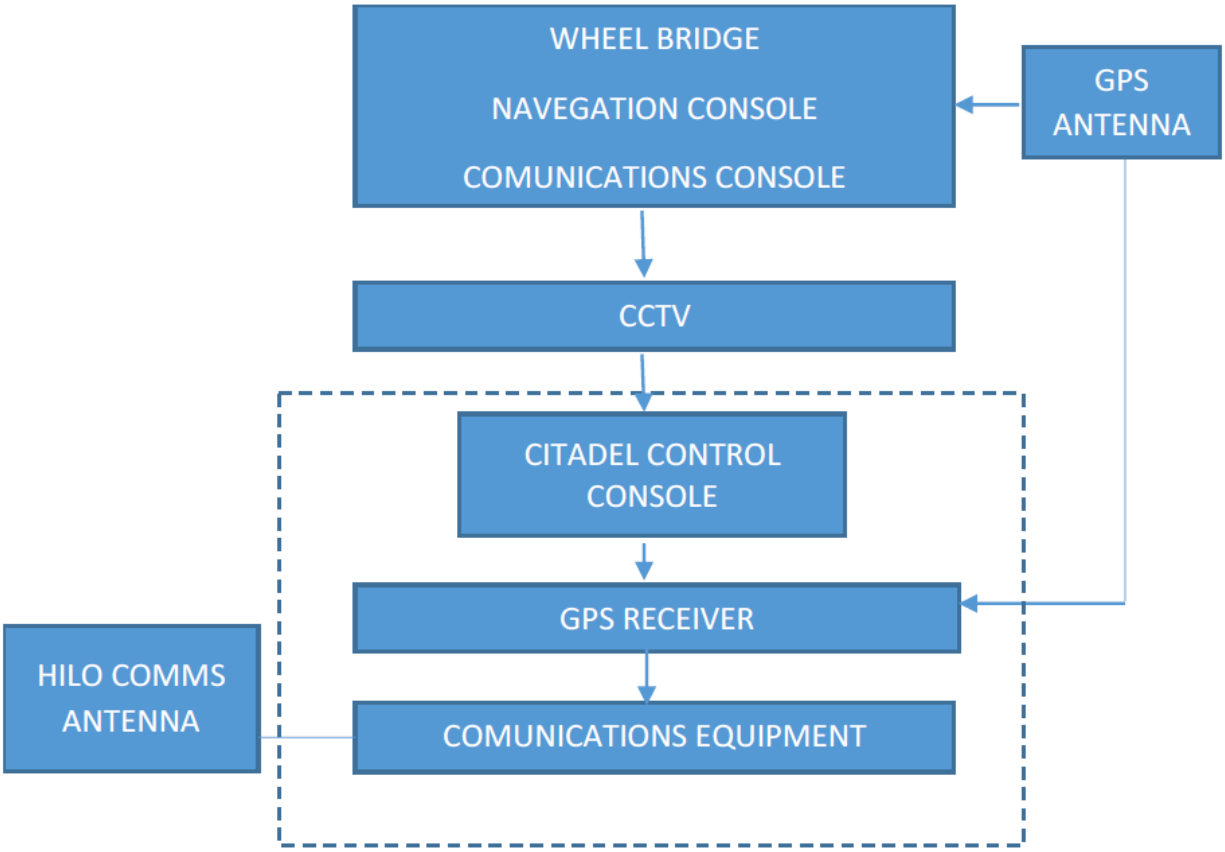

Fig. 5 Communications and navigation systems built into the console of the citadel, receiving GPS and CCTV signals and using a wire communications antenna. Source: Author´s own

Table 8 Number of crew per toilet [22], [23] recommended number of toilets. Source: Author´s own

Category	**NATO** [22]		**ILO** [22]	**Recommendation for citadel**
	Toilets	**Urinals**	**Toilets**	**Toilets**
Officers	8-15 persons per toilet	15-30 persons per urinal	8	10 persons per chemical toilet
Intermediate staff	10-15	20-30		
Sailors	13-15	20-30		

Table 9 Recommendations for the location, length of time in confinement, dimensions, specific elements and equipment in the citadel. Source: Author´s own

LOCATION AND DESIGN OF THE CITADEL - RECOMMENDATIONS		
LOCATION	**Deck**	**Separation at the sides**
	Intermediate	> 2 metres
LENGTH OF TIME IN CONFINEMENT	48 hours	
SURFACE	3 m^2 per member of the crew	
SPECIFIC ELEMENTS		
Doors / hatches and bulkheads / decks (citadel, wheelhouse, engine room, servo place, locker for cutting tools)	Ballistic protection: EN1522 (1998) / EN1603(2000) [24], [25]	
Firefighting system	- Water mist - 1 / 2 water extinguishers	
EQUIPMENT		
Remote control system of the platform	-Steering -Propulsion -Power generation -Navigation - CCTV	
Power generator	- Battery start-up - Air -cooled	
Communications equipment	- Discrete wire antenna	
Ventilation system	- Inlet and exhaust - Two separate points of admission - Discrete and inaccessible exterior grilles -> 8.5 m3 per hour and member of the crew - Renewal every 6 min. - Recycling and renovation for short periods of time	
Food, water and first aid kit	- For 3 days	
Chemical toilets	- 1 toilet per every 10 members of the crew	

5. Conclusions.

With citadels, the main objective is to prevent pirates from taking hostages. They have proved to be an effective self-protection measure, contributing to the safety of the ship and crew. This is especially the case when they are linked to other protection measures, such as deploying military forces as rescue teams. In 2010-2014 the failure rate of the citadel was 5.5 %, or 7 out of 128 cases.

As for the citadel's design, various factors come into play, including location, size, maximum confinement time, the specific requirements for different elements of the ship and the equipment and materials needed to service the citadel (Table 9).

Ballistic protection and the existence of certain independent and autonomous systems are critical aspects of the citadel's design. They directly affect the room's integrity and the crew's resistance to an armed attack. Among these systems, power generation equipment stands out. This equipment makes it possible to feed, among other items, the communication equipment needed to link with the military authorities responsible for the rescue operation. It also runs the ventilation. This crucial system must have two selectable points of admission with discrete and inaccessible grids, with the option of re-circulating the air for short periods of time.

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