

Should Royal Navy Ships Designed for Optional Crewing Only Enable Humans to Survive, or Also Enable Them to Thrive?

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Synopsis

Humans have crewed ships for thousands of years. Over that time, ship design has evolved to incorporate the requirements that humans need to survive. Whilst many see uncrewed systems as the future, it is likely there will be a period of transition utilising optionally crewed vessels. This provides time for quantitative reliability assessments of autonomous systems to be conducted using real world operating statistics. There is also then the option to alternate between crewed and uncrewed operations - in military applications, optionally crewed vessels pose a significant advantage over crewed vessels: continued operation whilst removing the crew from harm's way may mean the difference between life and death. One benefit of a fully autonomous vessel is the minimal requirement for the vessel to support human habitability, enabling savings on space and cost throughout the design and build phases of the vessel's life, with less systems to maintain in service. However, optionally crewed vessels by definition are required to support human habitability. This presents a critical decision point: does the design of an optionally crewed vessel include basic habitability functions only, or does it incorporate all the functions required for humans to both survive and thrive onboard? For civilian vessels, the intended use case will be specific and therefore go some way to defining this, but for a Royal Navy ship it is likely that the use case will be wide-ranging and varied, and may change during the life of the vessel. This paper will address the question "should Royal Navy ships designed for optional crewing only enable humans to survive, or also enable them to thrive". It will take the commonly recognised requirements for humans to survive and thrive; consider the form their enablers may take when incorporated into a Naval vessel, and reflect on the human advantages and disadvantages of their inclusion or omission, in scenarios where the Royal Navy may utilise optionally crewed vessels. Although the Royal Navy's decision on when optionally crewed vessels are to be crewed or uncrewed cannot be pre-determined, it is expected that any vessel required to support human habitability for more than a short period of time will enable humans to thrive, as well as survive.

Keywords: Optional Crewing; Human Requirements; Survive or Thrive; Naval Ship Design

1. Introduction

In the 5000 years since the Ancient World first purpose-built ships for battle (Reilly, Guilmartin, Friedman, Scheina, & Eller, 2024) there have been numerous advances in technology that have dramatically altered the conduct of naval operations: steam powered and iron clad ships; the advent of aircraft carriers; and the use of nuclear technology for power and deterrence are notable, recent examples. In the 21st Century, that shift centres on the use of autonomous vessels to facilitate and conduct naval operations. The IMO (International Maritime Organization) defines four degrees of autonomy (International Maritime Organisation: Maritime Safety Committee, 2021):

- Degree 1 – Ship with automated processes and decision support.
- Degree 2 – Remotely controlled ship with seafarers on board.
- Degree 3 – Remotely controlled ship without seafarers on board.
- Degree 4 – Fully autonomous ships.

For a ship designed for or with autonomous capabilities, no material or technical changes may be required to go from Degree 2 to Degree 3 or 4, it would be a case of whether there is a crew on board. Where the switch between crewed and autonomous can be so easily achieved, it may be tempting for those designing and procuring naval ships to opt for a ship that supports only the basic habitability functions of a crew who will not be there the whole time, lowering the initial and through life costs. However, humans are designed to do more than survive – they are designed to thrive, and yearn to do so once their basic needs are met. Navies globally are looking towards optionally crewed assets (Eckstein, 2018) (Garman, 2024). This paper aims to explore whether Royal Navy ships designed for optional crewing should enable humans to survive, or to survive and thrive, and for the latter why they should do so when there are measurable benefits to designing for survive only.

Author's Biography

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Despite much debate on the quantifiable aspect of the theory, the most widely recognised analysis of human requirements remains that developed by Maslow, and commonly dubbed Maslow's Hierarchy of Needs. This has been the topic of thousands of scientific papers, and provide the basis for a substantial number of other psychological theories. As such, this paper will use Maslow's Needs as the definition of what humans need to survive or thrive.

2. Method Definitions

2.1 Maslow's Basic Needs

In his original 1943 paper, Abraham Maslow sought to establish a framework from which the factors that motivate humans could be defined and explored. Maslow identified five 'basic needs' that humans work to satisfy (Maslow, 2017). These have been expanded and modified (particularly the esteem and self-actualisation needs) by many psychologists in the years since original publication (Guy-Evans & Mcleod, 2024), but for brevity the original five areas will be considered here. These were split into two distinct sections: deficiency needs (survive) and growth needs (thrive) (Guy-Evans & Mcleod, 2024).

2.1.1 Survive

Physiological needs form the most basic requirement to sustain human life, and include air, food, water, warmth, and rest – without providing these, a ship would be unable to support human habitation. As such, the physiological needs will not be considered further.

Safety is defined as 'not in danger or at risk', and also as 'protected from danger or harm' (Cambridge University Press and Assessment, 2024). Whilst this is most obviously apparent in physical safety and security, it can also encompass the psychological aspects such as job security and workplace culture. Although safety is a deficiency need, psychological safety is an area often forgotten. Consequently, it will be considered alongside the growth needs here – its ease of being overlooked means that it may not be considered as a key requirement when designing a vessel.

2.1.2 Thrive

The growth need is belongingness and love, which includes relationships, friendships, and human interaction, with belonging defined as 'a feeling of being happy or comfortable as part of a particular group' (Cambridge University Press and Assessment, 2024). Key to this is the link to safety - humans are naturally group creatures, one person alone will struggle to feel like they belong to a group.

Esteem is one's pride in themselves, their team, and their organisation, as well as how they are viewed by others – 'respect for or good opinion of someone' (Cambridge University Press and Assessment, 2024). For someone to feel esteemed there needs to be a sense of purpose and accomplishment to the job or activities being conducted, such as contributing to a greater cause. A secondary consideration of esteem is self-confidence, how an individual feels about themselves directly impacts their pride.

The final tier to be considered is self-actualisation – 'to achieve and be everything they possibly can' (Cambridge University Press and Assessment, 2024). This includes learning, knowing, religious beliefs, and creative activities, and incorporates what many would consider to be pursuits outside of the workplace, but are also things recognised as being vital for our mental health, often incorporating interaction with other people.

2.2 Concepts of Use (CONUSE)

The intended use of a vessel will dictate the percentage of time a crew are likely to be embarked for, which will in turn drive whether the vessel is designed for 'survive' or 'survive and thrive'. There are numerous combinations of local actors, environmental nuances and operational sensitivities that will dictate how and if optionally crewed vessels are utilised in a theatre. For the purposes of this paper, the below concepts of use will be used. The periodicity of the embarkation is based on a monthly aggregate of the weekly night limit for Service personnel to be entitled to Substitute Single Service Accommodation (SSSA), 4 nights each week (Ministry of Defence, 2023).

- CONUSE 1 – A vessel forward deployed, with the crew primarily embarked but are removed when the threat level reaches a given threshold. The time spent embarked is upwards of 16 days out of a month.
- CONUSE 2 – A vessel deployed on defence engagement, initially autonomous (e.g. for transit) and the crew are then embarked to complete specific tasks. The time spent embarked is between 5 and 16 days of a month.

- CONUSE 3 – A vessel deployed on environmental monitoring, with the crew only embarked for periodic maintenance. The time spent embarked is less than 5 days in a month.

3. Survive or Thrive

3.1 Enablers

3.1.1 Safety

When considering physical safety, the ship itself should not introduce risk to personnel. Crewed and autonomous vessels are certificated as appropriate for their class (Lloyds Register, n.d.) (Unknown, 2023), and it would be reasonable to assume that this would be the same for an optionally crewed vessel. As such, the ship itself would not endanger those on board. However, the certification of a Royal Navy vessel also considers its CONUSE, and the theatre in which it will be employed. If a ship is to be considered sacrificial (as in CONUSE 1), the question as to whether it is certificated for crewed operation in a hostile environment needs to be addressed. This will drive the risk appetite for the point of removal of the crew, as well as some fundamental design aspects and the equipment requirements of the vessel.

It is commonly accepted that a Royal Navy vessel may operate in a location where there is a level of danger or risk to the crew from external actors. However, this is dependent on the intended theatre, risk appetite, and whether the vessel is considered sacrificial – whilst it may not be reasonable due to the CONUSE of the vessel to incorporate the same level of threat detection and weapons systems as a crewed platform, a similar level of security could be provided through operation within a task group or another asset that provides detection and defence.

The majority of the psychological safety and security enablers of personnel on a ship are addressed by attitude and culture of both the ship and the organisation. However, there are aspects that can be incorporated to make individuals more comfortable. Soundproofed areas for making phone calls and discussing sensitive topics ensure that individuals have privacy, and can serve both a personal and operational purpose. Providing individuals with their own space to spend time in and personalise, no matter how small, allows that individual to create a sense of home within an alien environment – a place to call home brings an air of psychological safety, as well as somewhere to unwind when the day has been tough, thus facilitating an improved mindset and mental health.

3.1.2 Belongingness and Love

For those deployed on a vessel away from home, the primary enabler for belongingness and love is the ability to connect and communicate with those at home. There are several methods by which this can be achieved: post, voice calling, and internet connectivity (video calls and emails). The ability to receive post can be arranged without impacting the design of the vessel, and as such will not be considered further here. For voice calling, including phones with the ability to ‘dial out’ in all accommodation spaces would give personnel much greater ability to contact home, as well as providing the vessel with the ability to restrict those communications if required by the operating environment.

Having the ability to be able to video call loved ones is becoming the norm for anyone working away from home, but relies on internet connectivity with sufficient capacity. Access to the internet would also grant the use of online learning and resources for self-actualisation, and access to wider assistance for fault rectification from an operational viewpoint. There are numerous providers of systems that will work globally and in remote locations, though it is acknowledged that providing connectivity through a third party brings security challenges.

Another facet of belongingness is human interaction in the workplace – being able to speak with someone at a deeper technical, tactical, or strategic level than someone at home or outside the immediate scenario is reassuring and fulfilling, satisfying both the psychological safety and self-actualisation aspects of the hierarchy. Humans are naturally herd creatures and do not like being alone – our instincts tell us that it is safer to be in a group, even if that group is small. Ensuring there are multiple people on board the vessel satisfies this: the Royal Navy should not be considering optionally crewed vessels with only one person on board. A crew of multiple personnel also drives the culture of a Ship’s Company, working together to achieve tasks and outputs, and socialising when away from work – belonging.

3.1.3 Esteem

Esteem, much like the psychological safety, is primarily driven by the attitudes and cultures of the organisation, and other’s opinions of one another. The Royal Navy must ensure that the crew of an optionally crewed vessel still feel valued and are serving a purpose by being there. Whilst attitude, culture and opinion

cannot be built into a vessel directly, building in aspects that make personnel feel valued and considered will significantly improve their esteem – these aspects are the thrive elements of the hierarchy.

Additionally, the Royal Navy should ensure that the ability to optionally crew the vessel does not render the crew under-employed when embarked. Having facilities on board that cannot be accomplished by a machine, for example a galley, decision making or approval, and maintenance activity, ensure that the crew feel a purpose for being there, and a sense of accomplishment and professional satisfaction when a task is completed.

3.1.4 Self-Actualisation

Crewed vessels naturally accumulate some of the enablers for self-actualisation over time, regardless of whether the design incorporated them, as the crew are permanent residents. This includes designated spaces to practise religious beliefs, small libraries, collections of musical instruments, and gym equipment and exercise spaces. The inclusion of these enablers post build on crewed vessels is a strong indicator that humans want access to these facilities whilst on board, and designing spaces in from the start will ensure they are in suitable locations.

Esteem and self-actualisation can be both found through career and professional development, which whilst not things that can be directly built into a vessel, are enabled by access to material to learn or study from, or by the ability to attend conferences and courses. This also incorporates self-learning, such as studying part time for a degree.

Considering the physical aspects of the enablers listed above only, they are themselves enabled primarily through designated, appropriate spaces or internet connectivity. Both can be incorporated during the design of the vessel. Although not necessarily a design feature, the Royal Navy could provide an allocation of money towards the vessel during its initial concept and build, to ensure that the spaces, resources and equipment to facilitate self-actualisation are furnished and ready to use as soon as there is a crew on board, as opposed to the crew accumulating them over time, or purchasing them through ship's funds and other sources once in service.

As mentioned in belongingness and love, there are additional security considerations surrounding internet access. However, a system that has been procured and approved through a recognised route; incorporates the 'Secure by Design' philosophy (gov.uk, 2024), and can have access controlled by the chain of command for operationally sensitive theatres or scenarios is feasible for ship-wide incorporation. Alongside the design and electronic safeguards, a good security culture is key to facilitating widespread use of internet connectivity on board. It is noted that there are some areas of the Royal Navy where the option for internet connectivity whilst deployed will never be within the risk appetite due to the security implications.

3.2 Concepts of Use

3.2.1 CONUSE 1

This is the closest CONUSE to the current Royal Navy operating model with crewed vessels, and there are distinct similarities between a permanently crewed vessel, and one whereby the crew are onboard for a considerable proportion of their time. Humans want to thrive, as indicated by the accumulation and addition of enablers for self-actualisation, and belongingness and love, over the life cycle of a crewed vessel. From a human requirements viewpoint, provision should be made for an optionally crewed vessel as detailed in CONUSE 1, for the crew to thrive.

However, an advantage of an optionally crewed vessel is the ability to operate it autonomously; in CONUSE 1 the crew are removed at a certain risk level, implying that the vessel is sacrificial. Whilst the risk to life far outweighs the equipment risk, the Royal Navy must address the psychological safety of the crew if judging a ship to be sacrificial. When someone spends the majority of their life on the vessel, they have personal effects on board, a routine, and a schedule or plan of when to return home. Knowing that all could be destroyed with minimal notice because the ship is deemed sacrificial does not make a person feel safe or secure in the environment.

Additionally, can those making the decision to evacuate the crew guarantee the correct moment to do so? If the chosen point is too late on a vessel designed to be sacrificial, there will undoubtedly be fatalities. To ensure all personnel remain safe, the Royal Navy would need to have unquestionable faith in the intelligence used to determine that evacuation point, a metric by which to determine its validity, and a margin of safety to guarantee that the evacuation point meant survival. If the crew doubted the integrity of the data driving the decision that kept them alive, they would not be in a psychologically safe or secure state.

In this scenario, the vessel could enable the crew to thrive, without ever enabling them to truly survive.

3.2.2 CONUSE 2

This CONUSE draws comparison with personnel who stay at their place of work for a couple of nights a week, such as those in the military who commute. A military base has some enablers of thrive, such as a gym and internet connectivity, but the transient nature means many individuals do not personalise their space. Although it is not as psychologically comfortable, it is a pragmatic balance of survive and thrive. A vessel whereby the crew are on board for an extended period, but not necessarily on a permanent basis, should enable personnel to thrive, though it would be acceptable for there to be a reduction in the level of facilities and enablers compared to CONUSE 1 due to the shorter time periods of embarkation.

When considering which facilities should be drawn down on in the compromise of survive or thrive, consideration should be given to retaining the communal spaces such as the gyms and recreational spaces within accommodation areas – these encourage team ethos, which directly contributes to esteem and belongingness and love.

3.2.3 CONUSE 3

Akin to visiting a location for a short course, when the crew are onboard for a minimal number of days there is little requirement for the vessel to enable them to thrive. The crew are transient, and the vessel is little more than a staging facility for them to be able to carry out their task. As the vessel in this CONUSE would primarily be designed to be operated autonomously, there would be greater utilisation of the space and weight margins to provide redundancy in the systems than in the facilities for the crew to thrive.

It should be considered though, that where facilities are provided aspects of the task or operation, such as internet connectivity for fault diagnosis by maintainers when on board, whether these facilities could be easily modified to enable some aspects of thrive.

3.2.4 Tasking Consideration

Current Royal Navy vessels are exceptionally flexible in terms of their tasking, demonstrating repeatedly over their lifespan their versatility in being able to alter between counter-piracy, humanitarian aid, task group support and defence engagement. Whilst having a vessel that can be adapted relatively easily to meet a new task has its advantages, there is a cost associated with this, both financially and in the size of the vessel. These changes often do not affect the thrive enablers on the vessel, and the impact to the crew is on a programmatic front rather than a facilities one.

When designing an optionally crewed vessel, it is apparent that whether the vessel enables its crew to survive or to survive and thrive is dependent on the length of time spent on board, which in turn is driven by the CONUSE of the vessel. It is therefore critical that optionally crewed vessels are designed for a specific CONUSE, with a review of the facilities on board the vessel conducted if the CONUSE changes. Whilst the base vessel will be less flexible in terms of the tasking that can be achieved, there are savings to be made by not having equipment competing for space on the same platform to provide it the ability to conduct multiple tasks without refit, and may also allow for a more targeted employment of personnel on those vessels.

Navies are considering the use of modular vessels, payloads and equipment for a more cost effective but still quick change of use (Unknown, 2021) (Unknown, n.d.) (Smidt & Junge, 2014), an idea which is supported by industry concepts (Thomas, 2023) (DAMEN Naval, n.d.). Modularity can also be incorporated into optionally crewed vessels, provided the time spent on board by the crew was common across the CONUSE of the different modules.

3.3 Should Thrive Be Enabled?

There are disadvantages to including the enablers listed above into the design of optionally crewed vessels. By incorporating dedicated thrive enablers on board the vessel, there may be less space available for systems and payloads, or the vessel may be required to be larger to accommodate the additional requirements.

There is a cost increase with regards to personnel too – having more systems, facilities and designated spaces on the vessels will likely require an increase in, and potentially more specialist, personnel. An uplift in crew size to facilitate this will cost more in both wages and training overheads, and spirals into needing more facilities on board the vessel to ensure there is sufficient supply. There are also the security considerations with regards to internet connectivity, as discussed within self-actualisation.

However, the advantages to enabling the crew of an optionally crewed vessel to thrive far outweigh the disadvantages. This is reflective of other areas of industry – there have been significant numbers of papers written on the motivation of employees.

All the enablers lead to a more satisfied individual. Such individuals are likely to be more motivated, therefore perform better in the workplace and have a more positive attitude towards work. This positive

attitude and sense of accomplishment from performing well set the culture required for esteem and psychological safety. Personnel who are both comfortable with their surroundings and performing at their peak will provide a greater output or quality of output, thus the Royal Navy will get a better service from them.

The crew will feel valued if the organisation enables their satisfaction and considers it from the start, as opposed to including it as an afterthought, which will encourage people to work for the aims and goals of the organisation – this again provides the Royal Navy with a better service. Additionally, these people will experience a higher job satisfaction, encouraging them to remain in the Royal Navy rather than looking at civilian jobs.

Retention of skilled, experienced personnel reduces the training burden on the organisation, alongside providing a natural training and supervisory capacity. By retaining more personnel, there is greater capacity in the system for personnel to explore and take advantages of the other opportunities available within the Royal Navy, such as adventurous training, Service sport, and part time education – this all feeds into self-actualisation. A workforce of motivated employees who enjoy their job will also reap rewards in recruitment – it is much more pleasant proposition to be recruited into an organisation with a satisfied workforce who are keen to see the goals of the organisation met than the opposite. In an ever competitive employment market, and with skilled personnel being more in demand, harder to recruit and more costly to train (Unknown, 2024), can the Royal Navy justify not investing in giving its personnel the opportunity to thrive when the benefits are clear and self-sustaining?

4. Conclusion

From the CONUSEs considered within this paper, it is apparent that there is no one answer to whether Royal Navy ships designed for optional crewing should only enable humans to survive, or also enable them to thrive. The length and percentage of time personnel are embarked for is the primary factor, which is wholly dependent on the planned use of the vessel.

Where the crew spends most of its time embarked, there is no doubt that the advantages of allowing them to thrive outweigh the disadvantages. If the crew are onboard for a minimal amount of time, including the enablers for them to thrive is unlikely to merit the associated reduction in redundancy or increase in size of the vessel. For the CONUSEs between, there is a balance to strike, but when a crew that is thriving leads to a more motivated, satisfied and organisationally focussed workforce, to tip that balance towards thrive is unlikely to yield negative results.

Additionally, it is likely that some of the systems required to operate optionally crewed vessels when the crew are disembarked will themselves provide opportunity to incorporate enablers. Many aspects of the design, function and regulation of vessels operated autonomously rely on continuous communications and data feeds, which may not be so heavily relied upon when the crew are embarked. When the systems have capacity, they could be utilised to enable the crew to thrive.

It is also clear that optionally crewed vessels will need to be used more exclusively than their crewed counterparts. Although this may seem negative as a reduction in flexibility, when applied correctly this can be a positive – a ship designed for a specific area of work will carry less ancillary equipment, so may be of a smaller and more cost-effective design. It may open a broader ship building market, increasing competition in the sector, whilst also providing more targeted employment of personnel who develop deeper specialisms, benefitting the Royal Navy and the ship building and design industries.

The biggest challenge for the Royal Navy with optional crewing lies within attitude and culture – when a vessel can be operated autonomously, how do they make the crew feel valued and purposeful? This becomes even more vital than on a crewed vessel; enabling them to thrive goes a long way to making personnel feel valued, but further research is required into the most appropriate theatres and uses of optionally crewed vessels to ensure Royal Navy personnel continue to feel purposeful.

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Glossary of Terms

CONUSE	Concept of Use
IMO	International Maritime Organization
RN	Royal Navy
SSSA	Substitute Single Service Accommodation