

## Methods and Tools for Biological Risk Assessment of Naval Vessels

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The COVID-19 epidemic highlighted the weaknesses of civil and naval vessels to overcome the propagation of infectious diseases on board, which impacts the availability of forces. The French Aircraft Carrier Charles de Gaulle is an example, where corrective measures were implemented to limit the spread of the COVID-19 virus. The spread of pathogens can harm the entire crew at the same time, thus is considered failure by common mode. The consequences of such spread of pathogens on board can be considerable like the inability of naval vessels to carry out their missions. This suggests that it is essential to implement preventive and protective solutions that limit the presence and spread of pathogens on board. Those solutions, technical, architectural, or organizational, can be integrated within the conception of vessels and safety measures against communicable diseases on vessels. However, the definition of such solutions requires a sufficient understanding of pathogens, their modes of transmission and propagation within a vessel to identify the conditions to limit their effects [1]. That's why, it is necessary to define well-fitted propagation and infection indicators to assess the impact of the future solutions on vessels' levels of biological resilience thanks to calculations and simulations. The selected indicators evaluate the mode of transmission of the pathogen, its infectivity, and its impact on the crew health and capability. The calculations and simulations provide the way the epidemic spreads through the crew according to their habits on board and the architecture of the vessels. This poster aims to present preliminary work led in Naval Group through the thesis "Methods and Tools for Biological Risk Assessment of Naval Vessels" and opens up to a draft roadmap for discussion and suggestions.

[1]. R. Ghemraoui, C. Beghin, C. Roger, A. Duclos, B. Roussine, L. Celli, C. Yams, *Study for epidemic safety assessment of military vessels*, ATMA n°2791, 2023