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The inside story of COVID-19 pandemic on The Diamond Princess as the prime mover of present and future ship design studies

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“..But this coronavirus has forced us into a new framework, within which we move without any ease: everything has new ways, everything appears as never seen, it’s like finding yourself in an uncharted territory..” (G. Arma, 2020)

With these words Gennaro Arma, Captain of the Diamond Princess cruise ship, describes the very first moments following the detection of what would become the first recorded outbreak of Covid-19 outside of China. It occurred during a roundtrip cruise which departed from Yokohama port, in Japan, on 20 January 2020. Among the 3,700 people on board, more than 700 tested positive for the virus, 14 of whom died during hospitalization. A situation which was faced without the support of emergency protocols that contemplated a *modus operandi* to follow.

The ship constituted a confined control volume which allowed to analyze the main routes of virus propagation that mainly occur through direct contact between individuals, indirect one via contaminated objects and surfaces (also referred to as fomites) and airborne transmission. This has greatly affected the overall design paradigm, especially concerning the safety levels to be assured on board. The paper is going to analyze these focal points, starting from a possible implementation of HVAC system. It comes after an extensive study of the air flow circulation, as well as the application of filtering and purifications solutions, considering ship age and ventilation type, assessing the possibility of isolating those sectors of the plant acting on some areas dedicated to the management of emergency situations. Synoptically, there will be an extensive analysis related to the different surface types present on board and possible design interventions (i.e., *smart materials*).

The Diamond Princess experience represents the *prime mover* aimed at the world of scientific research at the formulation of design guidelines applicable to the world of cruise ships and, consequently, in the civil architecture field. The outcome results have helped to build a transversal, holistic know-how, thanks to which it will be possible to control the occurrence of future pandemic episodes.

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