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MARINA MILITARE-AMERIGO VESPUCCI

Implementation of the digital survey and database for the management of Italian naval excellence

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Abstract. The survey project of the Amerigo Vespucci is part of a research line that DiDA, Department of Architecture of the University of Florence, developed through an experience of collaboration and partnership with the Department of Defense. For more than two years, the Department has been involved in the study of the *Cascine* park, in Florence, analyzing the architectures of historical value, with a particular focus on the *Scuola di Guerra Aerea*. The documentation of the architectural heritage received in recent years an innovative technological boost, which led to the development of new modern methodologies of investigation. It is possible to apply integrated survey methods not only to immovable assets such as historical buildings, which abounds in our country, but also to movable ones, included vessels. By now, the processes of data registration and graphical restitution of the survey, both laser-scanner and photogrammetric, are functioning and consolidated, and can therefore be applied in research projects, if the appropriate considerations on the specific asset typology of the subject of study are taken. The application of specific instruments in support of the survey and architectonic representation enables us to achieve increasingly accurate results, engaging multiple aspects of the structure under study. The project investigating the *Nave Scuola Amerigo Vespucci* allows to expand the current knowledge on the sailboat in order to provide, through survey methods and architectonic representation, the documentation necessary to conduct future renovations and wood restorations. The aim of the present research is to create a digital database that, similarly to those used for buildings of historical value, would facilitate the management of this excellent asset of the Italian Navy.

1. The partnership

The survey project of the Amerigo Vespucci is part of a line of research that Department of Architecture of the University of Florence, developed through an experience of collaboration and partnership with the Italian Navy specifically with the 7th Ships Department of Joint Chiefs.

For some years now the Survey Laboratory has been engaged in collaborations with bodies of the Ministry of Defense and conducts specific research and educational experiments: from 2016 for the Air Force develops a documentation project, aimed at the realization of a 3D navigable model of the entire architectural complex of the Institute of Aeronautical Military Sciences in Florence, better known as the School of Air War of the Cascine of Florence, designed by architect Raffello Fagnoni.

Considering the Department of Architecture's experience in Heritage documentation and DIDA's long-established collaborative activity with different sectors of the armed forces, the report takes great consideration. development of research and experimentation that can integrate with the activities of the Navy. The main objective of this project is the ambitious prospect of creating a model of the Vespucci



Ship, through a targeted enhancement of the methods of integrated survey. The methodological approach involves the use of laser instrumentation for high-resolution scans that also allows the acquisition of high-range images to capture the shape of objects and architectures of particular complexity of which it is composed the ship.

The project aims to create digital texturized models that allow different variations of use, including the possibility of scale reproductions and tactile models and the development of VR or AR explorations for virtual visits. The following contribution is intended to describe the activity of investigation and 3D detection of a world-recognized historical witness, addressed through the use of new technologies in the cultural field. In particular, it deals with the experimentation of these new techniques of object perception, which are crucial for the enhancement and enjoyment of Amerigo Vespucci.



Figure 1. Vespucci ship moored at the port of Livorno

2. Memory of the most beautiful ship in the world

The Amerigo Vespucci is the oldest and most admired ship of the Italian Navy currently in operation. We recall the 1962 meeting in the Mediterranean with the American aircraft carrier USS Independence who asked, "Who are you?" followed by the reply: "Amerigo Vespucci School Ship, Italian Navy", to the reception of these words the aircraft carrier turned off the engines, interrupting his navigation, and he sounded three siren shots in salute, replying, "You are the most beautiful ship in the world."

The history of Amerigo Vespucci began in the second half of the 1920s, when the Italian Navy faced the renewal of the units for the training of the students of the academy: despite the advancement of technological progress, the Navy decided that the best way to teach the love of the sea and the secrets of navigation was by being aboard a sailing ship, where manoeuvres had to be performed strictly by hand.

The project was entrusted to the engineer and lieutenant colonel of the Naval Genius Francesco Rotundi, from 1925 director of the Royal shipyards of Castellammare di Stabia (NA), who between 1930 and 1931 designed and built the Amerigo Vespucci, together with the twin Cristoforo Colombo,

both of which are in the School Ship Division. The engineer Rotundi, in designing the two ships, was inspired by the vessels of the early 1800s and in particular referred to the designs of the sailing ship of the Neapolitan naval engineer Sabatelli, including the one for the flagship of the Royal Navy of the Kingdom of the Two Sicilies: the Monarch. The white bands of the Vespucci represent precisely the two lines of cannons of the vessel.

The Vespucci was launched on 22 February 1931 in Castellammare di Stabia. On 2 July 1931, he received the battle flag in the hands of his first commander, Augustus Radicati of Marmorito. Since then, his task, together with Colombo, has always been the training activity.

The twin ships had different fates: after the war, in accordance with the peace treaty signed in Paris, Christopher Columbus was ceded to the Soviet Union and then destroyed in a tragic fire in 1963, while the Amerigo Vespucci began to build the history of crossing the seas from the Atlantic Ocean to the Baltic Sea.



Figure 2. 1962 Mediterranean Sea, Image of the historic meeting between the US aircraft carrier USS Independence and the Vespucci Ship.

3. Reverse Engineering, first technical trials and applications on the Amerigo Vespucci Ship

Research, finalized at the generation of a three-dimensional digital model, is a complex path to develop, which is always starting with the preliminary study of the object. The Amerigo Vespucci has a steel hull (spiked sheets) 82 m long with three defined decks of deck, battery and corridor with castle and chests respectively at the bow and stern. Its stern to bowpress length reaches 101 m, the hull is 15.56 m wide and has a veil of 2650 square meters on 24 square sails and of oloncanvas straglio (natural fiber). The tree is composed of 3 trees and bowsprit, mast (54 meters), foremato (50 meters) and mezzana (43 meters) - bottom of the low steel flagpoles.

The sailing datasheet highlights the operational complexity of developing a scientific documentation project for the vessel. In order to support field action in the most effective way, the problems related to the extended size, geometric complexities and operation of the ship were considered in the first place. The latter in particular highlights two consequent difficulties: the concurrence of major operations with

the activities of the Navy and the fact that the ship is brought to the dock for maintenance not every year. A first experimental campaign, carried out in Livorno, saw the Amerigo Vespucci moored along one of the docks of the Medici port. The challenge, during the scanning activities, was therefore to minimize the registration error due to the slight roll of the buoyancy. The tool used for digital documentation is a laser scanner Z-F IMAGER® 5016, equipped with an integrated positioning system, which allows automatic registration in the field, with or without targets. The scanner is equipped with a built-in HDR camera, which allows the user to quickly capture color information about the survey object.

Three-dimensional capture allows you to switch between from a physical object to its digital representation. In particular, through 3D scanning, each shot (range map) can be imagined as a digital photo in which, at each pixel, spatial coordinates of points of the object correspond. By matching each laser scan with a photo shoot, you can also match its RGB value at each point. The next merging of multiple individual shots into a single polygonal model (mesh) allows you to create a digital model that, within the chosen tolerance value, will be true to the physical artifact.

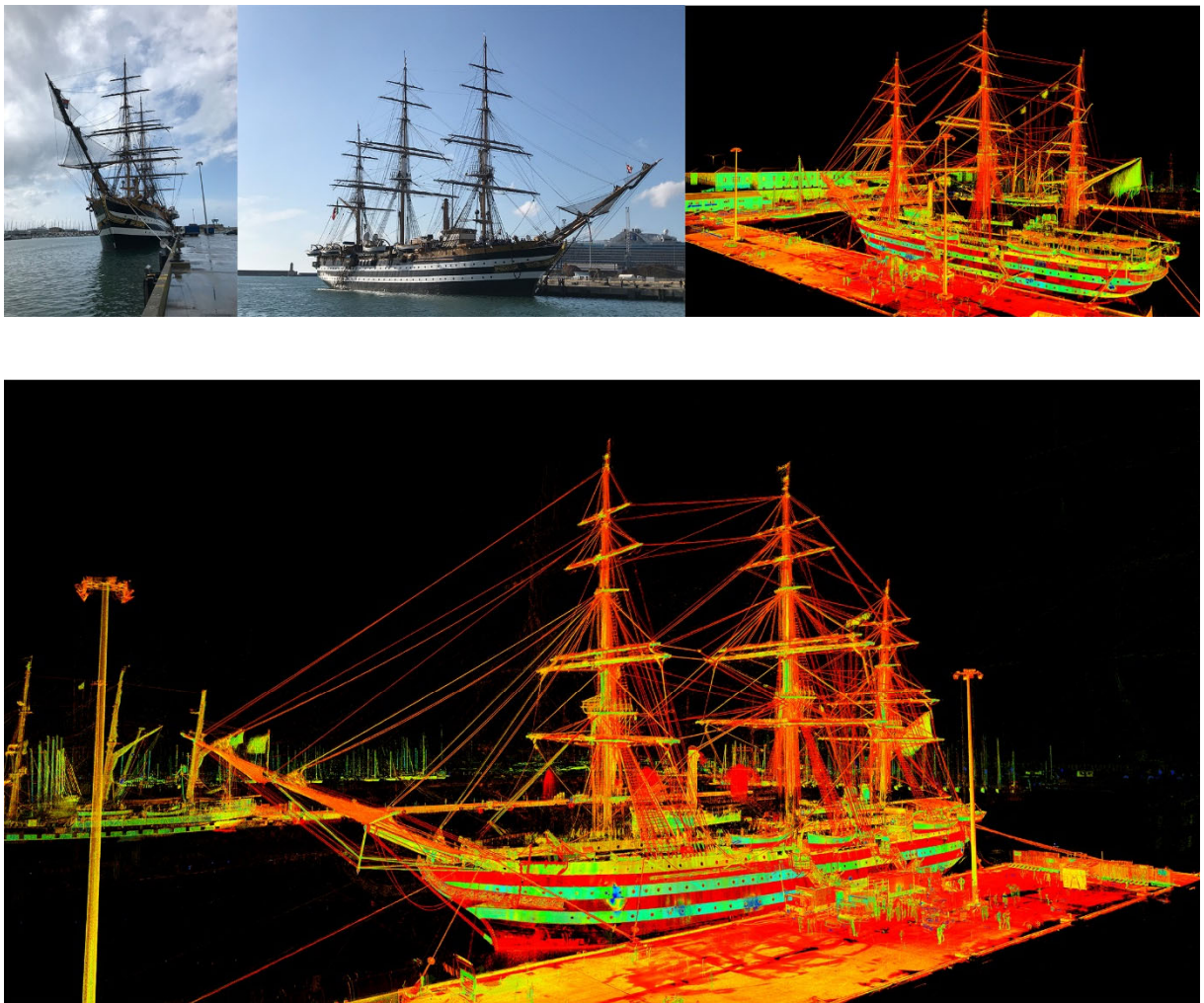


Figure 3. The image documents the difficulty of the relief conducted by the dock of the Livorno port.

4. Disclosure of interactive systems and cultural content

The project follows a defined path on three fundamental aspects: research, knowledge and communication.

The research is aimed at experimenting with modern digital survey methodologies through the use of laser scanners and photogrammetry, experimenting with a working methodology, largely consolidated on architectural Cultural Heritage, to document a historic floating vessel. A survey path characterized by particular difficulties caused also by the presence of elements subject to continuous displacements, such as the rope for the manoeuvrability of the sails. The representation of the Vespucci Ship, in its peculiar dimensional and compositional aspects, allows to know and understand the different areas of which the ship is composed. The first phase of the search allowed the detailed analysis of the Officers area, located at the stern of the Ship, carrying out the relief of the boardroom and part of the official area. The documentation of the representative area of the boat, made through colour scans, is an interesting starting point to create a product aimed at defining the third and final aspect: communication. The three-dimensional return of data allows to develop a subsequent operational phase aimed at the digital museumization of the Amerigo Vespucci, directing attention to the current and captivating offers of use of cultural heritage.

The preparation of an evocative and engaging visiting experience, sustainable through the use of Augmented Reality, opens the possibility to the creation of an information product on the history of the Ship, capable of reaching a renewed and wider increase technical knowledge about Vespucci. Through video reconstructions and timed projections, emotional and immersive experiences will be guaranteed to the visitor that can convey and communicate optimally the multiple scientific information.

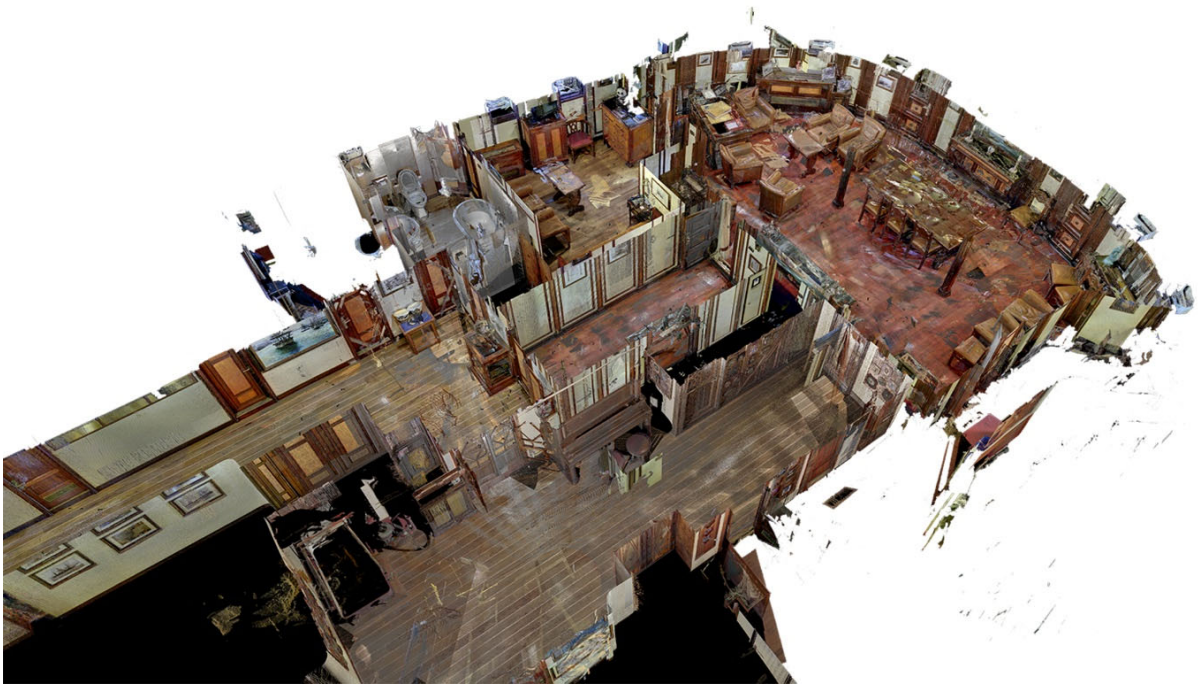


Figure 4. Point cloud of the official area where an AR project will be produced.

5. Conclusions

The research project experiments usual digital survey techniques by applying them to a complex and unusual challenge. In order to correctly define the three objectives, research, knowledge and communication, it is necessary to carry out a multi-level survey, which takes into account the different conditions being detected in the field.

The return of the digital model of the Vespucci Officers area, carried out by a moored boat, reflects the difficulties of acquisition in the post-production phase of the data. The detection operations of the Commando area, for which a communicative product with the use of A/R technology will be developed, did not encounter any particular operational difficulties, as the ship was in the dock at the Arsenal of La Spezia. The development of the 3D digital model of this portion for remote - and/or Augmented Reality - is intended to achieve an effective communicative expression to encourage knowledge and revive the memory of a naval architecture that represents us in the world.

References

- [1] Carpani, P. (2008). *La più bella del mondo. Nave scuola Amerigo Vespucci*. Centro Stampa Offset, Imperia.
- [2] Lorusso, E. (2019). *Nave Vespucci. Diario di bordo (radiofonico) dalla signora dei mari*. Ugo Mursia Editore, Milano.
- [3] Russo Kraus, G. (1998) *Geometria dei galleggianti*, Livorno, 1998
- [4] <https://www.bonculture.it/vintage/lamerigo-vespucci-la-nave-piu-bella-del-mondo-progettata-da-un-ingegnere-che-si-innamoro-di-manfredonia>.
- [5] Girace, C. (2006) Università Degli Studi Di Napoli “Federico II” Facoltà Di Ingegneria Dipartimento Di Ingegneria Navale Tesi di Dottorato di Ricerca in Ingegneria Aerospaziale, Navale e della Qualità XVIII CICLO. *Rilievo di carene navali mediante tecniche di reverse engineering: laserscanner3d_fotogrammetria*.
file:///C:/Users/marco/Desktop/Girace_Ingegneria_Aerospaziale_Navale_e_della_Qualita.pdf
- [6] Pandolfini, E. (2012). *Architettura e spazio urbano. In Realtà aumentate. Esperienze, strategie e contenuti per l'Augmented Reality*. (pp 65---108). I Apogeo, Milano.
- [7] Ruggiero, M.E. (2007) *Note sull'evoluzione del disegno nel progetto navale*, Rapallo, 2007.
- [8] M.E. Ruggiero, M.E. (2017). *Point of view*, Genova, 2017
- [9] Brown, T. (2009) *Change by Design: How Design Thinking Can Transform Organizations and Inspire Innovation*. World Book Company, Chicago.
- [10] Bollini, L., Greco, M. (2008). *Organizzare presentazioni efficaci*. Hoepli, Milano