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Amazing Engineering

How digitalization can help decarbonize heavy industry: the BLOM Formula

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The extensive use of steel makes this one of the most important industries in in our society. According to worldsteel.org, steel production has grown from 189m tonnes in 1950 to 1,951m tonnes in 2021.

The metal has a vital impact on society, employing 96 million people across the industry and its supporting structures, and on the global economy where it generates and facilitates a contribution of US$2.9 trillion [1].

Global environmental policy and ever-increasing limits on CO2 emissions require ongoing improvements in efficiency and safety. This leads BLOM to make constant changes to its production systems, implementing new technologies with more advanced solutions and using 3D design tools such as Leica, AVEVA, Autodesk, or Bentley that offer a more efficient way of designing. 3D spaces allow designers to simulate on-site conditions and work in real-world situations, which helps enhance safety during installation, and saves time and money. However, before 3D technology can be used it is necessary to first create a digital twin of the facility.

Fig.1. Spheric view of a steel mill plant.

This does not simply mean using a point cloud as a three-dimensional digital representation of the object. Rather it means creating a complete information system to manage the data obtained during the scanning process, to design, and to install new systems and, most importantly, to support the team responsible for maintaining and operating the steel mill during continuous production.

We know from experience that scanning is just the beginning of creating an optimal solution and, one might say, represents the tip of the iceberg. However, being the initial stage of the process, BLOM uses state-of-the-art equipment, provided by Leica Geosystems [2].

The same can be said of managing costs during the lifecycle of a plant: where design influences approximately 1% of the cost over the entire lifecycle of the asset, operation and maintenance represent up to 70% [3]. BLOM's approach targets exactly this component:

The quality and completeness of the point cloud is, however, the most important factor affecting the quality of the other elements. In fact, it represents the fundamental starting point for most of our engineering projects.

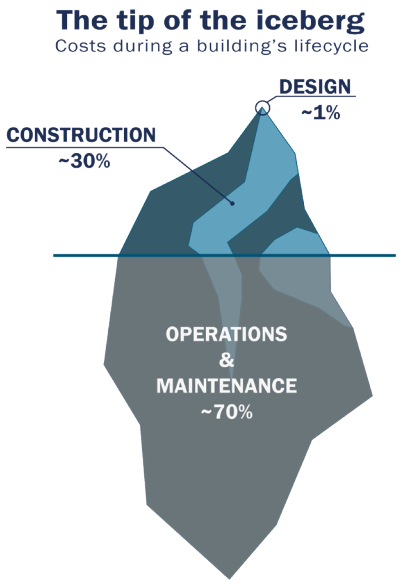

Fig.2. Costs during a building's lifecycle.

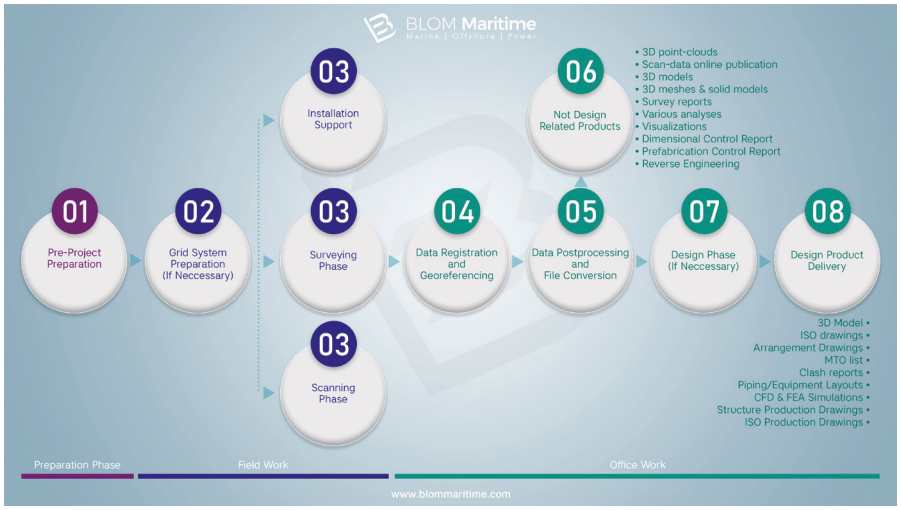

Fig.3. Standard BLOM Maritime workflow.

Ongoing collaboration in the metallurgical sector

BLOM collaborates openly with several major players in heavy industry. One of its partners is Mostostal Zabrze Biprohut. This company describes the project as follows:

"In 'design and build' projects on existing structures, knowledge of the actual condition of the facility is invaluable. The more information designers have about an object, the better they can adapt the design to the existing conditions and avoid potential problems during project implementation. A 3D design makes it possible to visualize existing conditions, to dimension objects that are difficult to access, and to perform a spatial analysis of potential clashes between newly designed objects and existing ones. 3D scanning has therefore become an indispensable tool for the designers at Mostostal Zabrze Biprohut.

"The structure scan that BLOM Maritime produced for us was an invaluable source of information for the design work associated with the recently completed renovation. Due to the size and complexity of the facility, the scan saved hundreds of designer hours that would otherwise have had to be spent on inventorying key elements. Furthermore, the ability to implement the scanning directly in the Biprohut design environment accelerated the entire design process by allowing newly designed process plants and steel structures to be created from scratch by building on their existing state. This significantly shortened the process of design verification and analysis before the design was released for implementation. The scan also helped the investor and other project stakeholders to visualize the newly designed solutions during discussions."

Other projects in European facilities

In other measurements for its partners, BLOM's engineers have performed more than 3,000 scans of different parts of facilities using LeicaRTC360 scanners. The point clouds were delivered in colour with the most important aspect of each measurement procedure being to define the clients' required elements very precisely. Despite the extent of every project, BLOM also took detailed measurements of specific critical elements, upon which 3D models were then created.

In order to achieve the objectives of decarbonization and the optimization of steel mills and furnaces, BLOM and its clients have jointly resolved to discontinue production of these system components. In one case, the plan is to build a new mini mill using two EAF (electric arc furnace) 9s to achieve the decarbonization milestones.

In this context, some materials such as scrap will be removed by trains and trucks. Other materials will be transported from

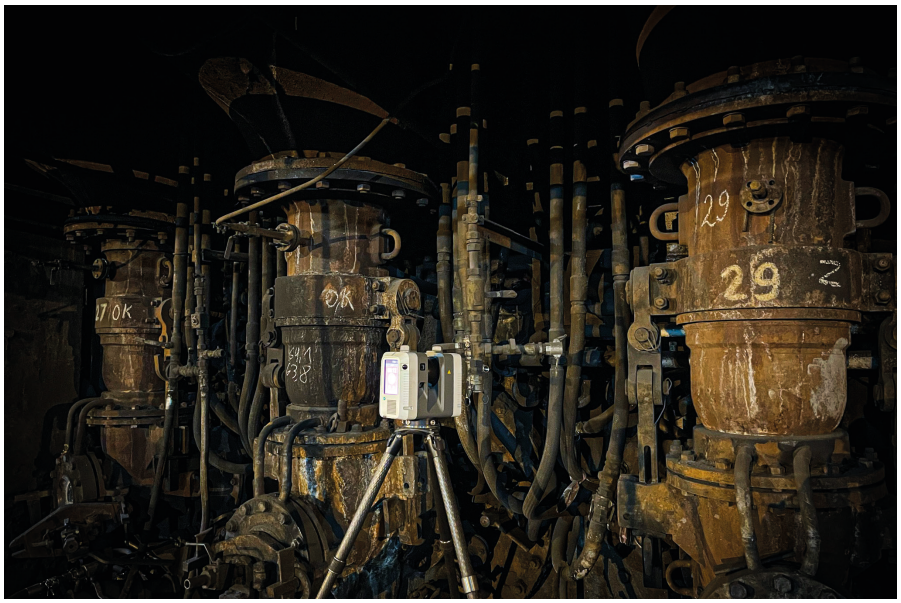

Fig.4. Scanning of the facility.

Fig.5. Survey engineer at the Brazilian Steel Mill

the storage areas to the new mini mill by conveyor. Specifically, HBI (hot briquetted iron), lime and dole, and alloys are planned to be transported to the EAFs via conveyors. To design these conveyors, BLOM's client requested complete scanning documentation of all the areas of interest including the landform, existing equipment, and roads.

To develop the required engineering, the client required:

- The details of the state of the scanned area.
- The ability to identify the possible collisions and non-ergonomic solutions.
- Highly accurate measurements of the distances (the scanner's permissible deviation in accuracy could not exceed ±3 mm for a range of 70 metres).

The Brazilian Steel Mill project in numbers.

- 3,000 colour scans
- 78,000m^2 covered
- 4-week scanning process
- 7 survey engineers involved
- 3TB of data delivered

Steel mill scanning in South America

In a recent project at a steel mill in Brazil, BLOM performed the scan during a technical shutdown in order to access zones where there was a danger of gas leakage. While this created considerable challenges due to the high levels of staff activity, it did not stop our inspectors from completing the task.

Fig.6. Scanning survey of a steel mill.

A further challenge was coordinating the job with the various stages involved in overhauling the blast furnace which required some of its essential equipment to be dismantled. As a result, our engineers had to demonstrate great flexibility and availability in order to make optimal use of their time at the facility. The local visa requirements and customs duties added even more complexity to the project, underlining the fact that planning and logistics are key to success. Nevertheless, the successful outcome proved that everything is doable for BLOM.

The South America steel mill project in numbers

- 885 colour scans
- 12,000m^2 covered
- 2-week scanning process
- 2 survey engineers involved
- 5TB of data delivered

Fig.7. Coloured 3D scan of the inside of the facility.

Fig.8. BIM model of the same area.

Digital twin of an aluminium plant in Norway

In the case of the Speira-Holmestrand aluminium plant in Norway, the measurement study involved the entire plant area including the office buildings. It required the creation of a survey grid together with GPS measurements. Work on site was performed at night when human traffic was reduced to minimize the danger to our engineers.

More than 6,000 scans were taken during the study to generate the point cloud from which the Building Information Modelling (BIM) was created in Autodesk Revit software. The model included all buildings with structures as well as the road infrastructure, all of which were executed in the LOD300 standard.
Figs. 7 and 8 compare the results of a 3D colour scan of an area and the BIM model of the same area created in Revit.

The Norwegian project in numbers

- 6,000 colour scans
- 165,000m^2 covered

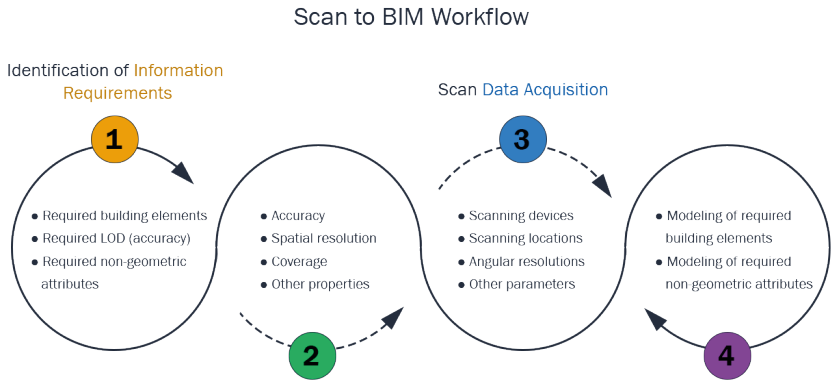

Fig.9. Scan to BIM Workflow Framework [4].

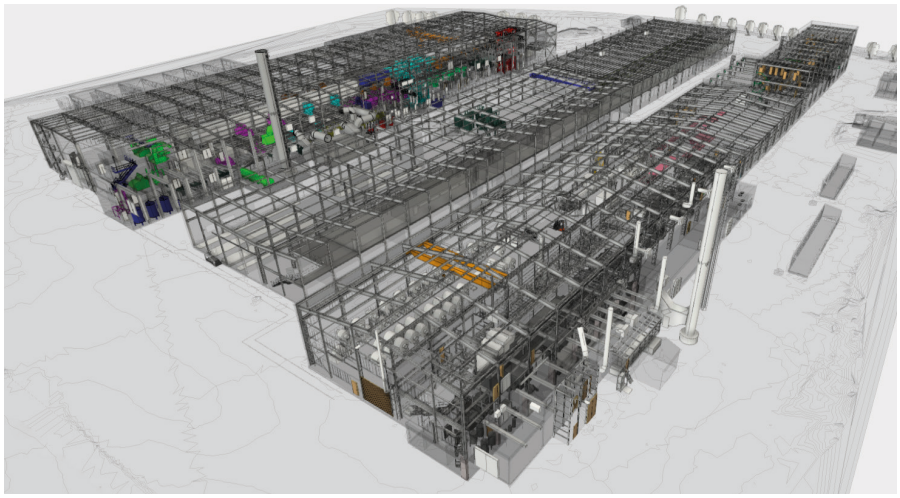

Fig.10. Steelmaking plant developed with a BIM approach.

- 3-week scanning process
- 6 survey engineers involved
- 2TB of data delivered

The BLOM Maritime approach

BLOM's main objective is to offer clients different solutions based on the Scope of Work provided. The company's approach is then defined by constant improvement and efficient use of data already in hand using the tools in each organization. In many cases, BLOM's team needs to think "outside the box" to simplify things, or to show opportunities that the client's users already have. Our flexible, cross-cutting technology which works with dedicated software accompanied by adequate planning as early as the measurement phase and the application of appropriate procedures delivers a rich set of results that exploits diverse possibilities for delivering the final product, such as data format, and the form of presentation. All these projects precisely follow BLOM's standard approach (see Fig. 9).

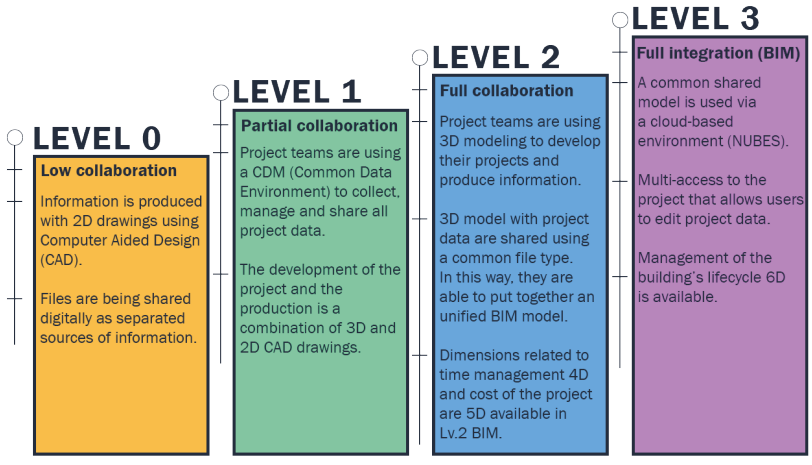

Fig.11. BIM maturity level.

The Speira facility was a perfect example of the execution of this workflow: 3D scanning of the entire structure and the development of a BIM model with Revit. This approach gives BLOM a substantial number of possibilities to include precise information (BIM) about each 3D element from the paint colour and manufacturer, all the way to the assembly timeline (4D) stage and the cost of the modelled item (5D), unlocking so-called Level 2 BIM [5].

The key to success of the project is to provide "tailor-made" delivery taking into consideration the client's workflow and the hardware and software in use. We resolved this for Speira as follows:

- The point cloud provided the input data which was processed and prepared in Recap format, and oriented with global coordinates to facilitate interaction with Revit.
- The initial modelling stages. Accuracy, level of detail, and level of development were adjusted to the client's expectations and requirements. In most cases, the LOD300 standard is widely accepted. This approach provides a ready basis for updating, so that the client can decide what relevant information to store later.

As a result, this project has a level 1-2 maturity level: there is a common data environment, and the system is ready to develop to level 2 and, later, to level 3 [5] (see Fig. 11).

All BLOM's experiences with steel mill projects have had a common denominator: the enormous quantity of data involved. A project of 1,000 scans fills up to 70GB in Navis Works software. Computers with elevated computing performance, powerful graphics cards, and large, fast internal drives can be essential for working with laser scan data.

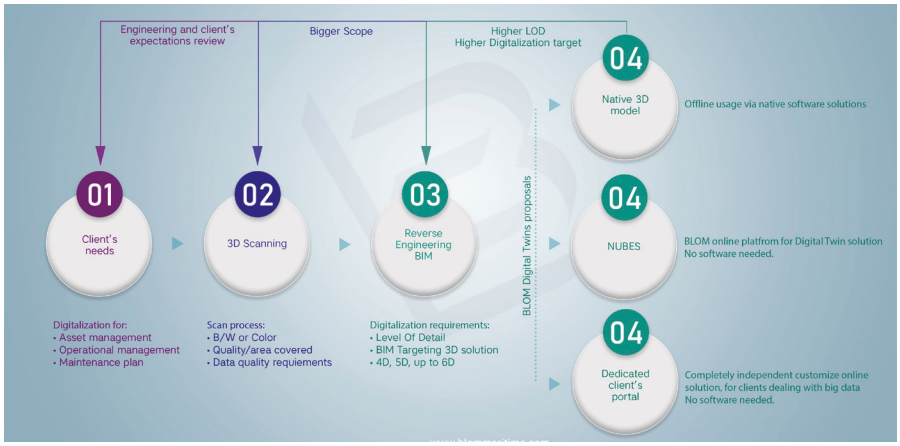

Fig.12. BLOM Digital Solution levels: native, NUBES or dedicated portal.

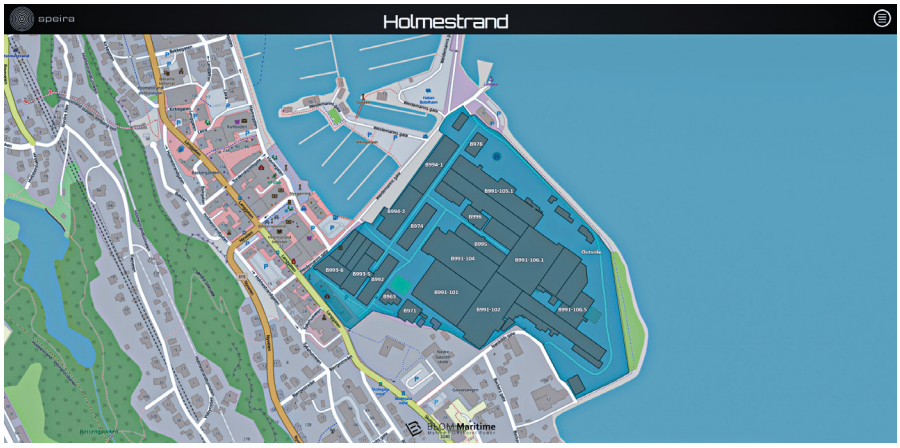

Fig.13. Online portal dedicated to Speira, map of a selection of buildings viewed from above.

NUBES: Visualization and Digital Twin

BLOM's answer to these high expectations is NUBES, the company's in-house online platform that offers the full range of possibilities in a single space, allowing multi-station point cloud work. NUBES is a complete solution that enables BLOM's customers to archive and view their point clouds and provides clients with full access to their data via the Internet from anywhere in the world. NUBES models are fully compatible with AVEVA software, so that clients can extract technical drawings, create annotations, and edit the point cloud and model.

BLOM also uses NUBES to train new employers or visitors. The detailed view of the site means that the company can conduct guided tours, and show risk areas and escape routes, etc. BLOM's crew will therefore be familiar with a site before they even enter it. NUBES also enables virtual reality (VR) experiences. Lastly, it does not require customers to make additional investments in software and hardware.

The latest addition to BLOM's suite of digital solutions is its dedicated client portal: where NUBES provides access to specific projects, this new dedicated portal allows BLOM to offer a completely independent customized online solution to clients dealing with big data and a high-level of discretization. The "Speira" portal, for BLOM's Norwegian client is an example of such a solution.

BLOM Maritime is proud to of its many years of experience working with companies such as Biprohut–Mostostal Zabrze, Speira, and many others. Our deep understanding of the prevailing conditions in steelworks and our long-term collaborations on extensive modifications to blast furnaces gives us the experience and ability to support our clients.

All our experience has led us to one conclusion: investing in the latest 3D technologies that optimally use the digital twin will determine the ability to develop, modify, and improve the efficiency of these complex industrial plants in the future. Our NUBES solution enables us to support steel makers in managing the large amounts of data obtained during design, installation and everyday operations. The ability to quickly and easily manage documents, easily access 3D documentation, visualize and share point-clouds, and most importantly, the continuous updating of collected data allows subsequent modifications to be effectively planned. Such complex systems require this type of holistic approach to optimize their lifecycle management.

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About BLOM Maritime

BLOM Maritime is a leading global provider of 3D digital data acquisition and engineering solutions for the marine, offshore and power sectors. We specialize in capturing and optimizing data 'as-is' for better engineering and project execution. We provide a full-cycle service ensuring that cost-effective solutions are continuously implemented before, during, and after projects. We are part of the TECO Maritime Group. Our subsidiary offices, together with business partners, are strategically positioned around the globe to ensure rapid response and reliable service. The entire network of subsidiaries and strategic business partners employs more than 170 people worldwide. To date, we have completed more than 3,000 projects, across the various industries we serve.