Company Overview | JONES ENGINEERING GROUP | joneseng.com

Jones Engineering Group is a leading global, mechanical, electrical, and fire protection contractor operating in 14 countries across Europe and the Middle East. The original company was set up by Harry O'Neil in 1890 and, to this day, it has continued his vision of prioritising education, training, and innovation. Over the last century, Jones Engineering has grown sustainably in both size and reputation, with a turnover of approx. €700m and personnel of over 3,500 people worldwide. Jones Engineering has been applying Lean principles for many years, and recognising the benefits it brings to the firm, our clients and the industry as a whole. This commitment has fostered our dynamic, knowledge-driven, and customer-focused concentration on creating value-add and eliminating waste.

Author

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Overview & Background to the Lean Initiative

In delivering mission-critical projects across Europe and the Middle East over the past decade, we have witnessed three typical project forms, each with a major shift in the approach to building:

- The old school stick build approach.
- The OSM "we tried, we failed, now we're fixing it on-site" approach.
- The collaborative and early engagement approach.

This case study considers the importance of, and opportunities related to, MEP Off-Site Manufacturing (OSM) and Design for Manufacture and Assembly (DFMA) in enabling Lean in construction. A cautionary note is that how a DFMA project is realised could lead to a project having more waste than a typical stick build project.

Lean Initiative Undertaken – Lean Thinking, Tools, Techniques

The Old School Stick Build Approach

There will always be elements of a project that will need to be stick built, at least for the foreseeable future. However, all too often we witness systems still being installed with the stick build approach. This is primarily due to the project teams not understanding the overall project benefits that emanate from a successful OSM and Lean approach, including, for example:

- 7%-30% reduction in cost.
- 20%-60% reduction in construction programme time.
- 70% reduction in on-site labour.
- 20% reduction in pollution and site congestion.
- 90% reduction in on-site waste using volumetric construction.
- Increased Quality achieved in factory environment.
- Reduced on-site commissioning duration post-functional module testing off-site (if strategy realised and incorporated at schematic design stage).

The OSM "we tried, we failed, now we're fixing it on-site" Approach

There are numerous reasons for an OSM approach to fail. A successful OSM project is down to the project team's understanding of a few key design and working practices. Without a clear understanding of these enablers, a retrospective stick build approach is usually adopted during construction, which creates more waste than any other project.

To create a program framework (LOD100) which can work towards a typical 80% OSM target from the Basis of Design (BOD) development, the following are required:

- A complete design taking a nuts and bolts approach to stage 4 design.
- Clear understanding of the end-user requirements during BOD to eliminate retrospective change as much as possible.
- A collaborative approach with all project parties.
- A clear understanding of all interfaces to achieve OSM targets.
- Each project party understands the drop dead dates to facilitate OSM from both design and procurement viewpoints.

Figure 1. DFMA Benefits (Source: KPMG 2018-2020)

The Collaborative & Early Engagement Approach

The most successful projects are down to the project team completely understanding the benefits of OSM as well as the enablers to achieve a collective OSM goal, and taking an integrated project delivery (IPD) and early engagement approach.

The early engagement of the design and construction partners provides benefits in terms of close collaboration as early as the BOD stage. This collaborative approach ensures that the design under development is based on sound construction methodology and that time is allocated to consider, identify, and advise on the best construction route based on the developing design, price, and quality.

When early engagement, and ideally an IPD structure, are implemented, the project and team approach towards OSM will directly influence the development of potential project gains and Lean efficiency per Figure 2.

Taking such an approach to early engagement, Jones Engineering was enabled to engage with all of the project stakeholders, design teams, and vendors. This case study details the M&E systems, capital plant, and supporting infrastructure that we were able to maximise via the OSM approach and benefit the project gains – a key objective to achieve from the outset.

Figure 2. Early Collaboration & Capabilities

Containerised Generator Sets

(Location: Northern Holland; Project: Confidential Data Centre.) During the development of the containerised generators, early engagement enabled us to successfully and fully detail and manufacture the following elements of a contemporary generator set up, which are typically site stick built:

- Cable entry box installed with cable gland plates installed and pre-drilled ready for cable termination.
- All FLS services within the generator container installed and FAT tested through early coordination between the Fire Alarm Contractor and Generator Manufacturer.
- BMS interfaces and network switches installed and configured.

External Sprinkler & Water Meter Buildings

(Location: Northern Holland; Project: Confidential Data Centre.) During the development of the external sprinkler buildings and water meter buildings, early engagement enables us to successfully fully detail and manufacture the following M&E systems:

- Internal containment and supports for M&E services completed and QAQC checked.
- Internal LV & ELV standalone systems installed and factory tested to L3 and QAQC vetted.
- FLS systems installed and tested.
- All mechanical pipework and pump work installed and factory tested.
- External cable entry points installed with cable seals prior to site delivery.
- All ELV wiring and BMS monitoring points installed, tested, and configured prior to site delivery.
- Drainage lines pre-installed.

Main Primary LV & MV Primary Trestles

(Location: Northern Holland; Project: Confidential Data Centre.) During the early stage 3 & 4 development, early engagement with the steel manufacturer enabled Jones Engineering to install all of its containment into the primary steel infrastructure to be delivered in 13 meter sections. The benefits of using this approach were:

- Higher quality of installation of the containment modules doing high-level work at low level in the steel manufacturing facility.
- All MV and ELV primary containment installation time greatly reduced.
- Mechanical supports in place ready for pipework installation and cladding.
- H&S risks limiting working at height durations.
- Drastic improvements on programme installation time.
- Reduced labour costs as a factory assembly attitude was adopted in the steel manufacturing facility, and as the containment install became part of the precision process.
- All earthing and bonding completed and QAQC checked.
- Enabled cable pulling to be mitigated and starting earlier on the programme.
- Reduction in access plant hire.

Figure 3. Off-Site Manufactured Primary Steel Gantry with M&E Services

CHAC – Cold & Hot Aisle Supporting Structure Modules

(Location: Northern Holland; Project: Confidential Data Centre.) Once the end-user requirements were known for the data hall white space, the team was collectively and successfully able to develop M&E modules in 13 meter sections complete with systems pre-installed. The key element to achieving this OSM element is taking a nuts and bolts approach with confidence in the stage 4 design to enable a design freeze, whilst meeting all of the client/end-user requirements:

- Lighting, emergency lighting, lighting controls, and fittings only.
- All LV & ELV containment systems.
- Fire Alarm/Vesda.
- Sprinkler system hangers and supports.
- Distribution boards and headers localised to primary routes.

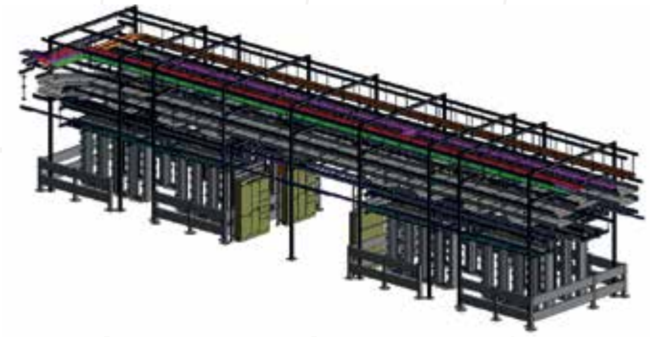

Figure 4. OSM White Space M&E Module Example

Containerised Electrical Plant Rooms

(Location: Northern Holland; Project: Confidential Data Centre.) The main objective specific to the project brief for the electrical capital plant was to maximise the OSM approach and design external electrical containerised plant rooms mounted on an external gantry.

Taking this approach greatly increases the amount of commissioning that can be achieved off-site, and all of the projects savings noted above were all achieved from reduction of off-site labour to minimising QAQC issues usually found on-site during Level 3 commissioning.

Figure 5. Containerised Electrical Plant Room Typical Example

Lean Initiative Improvements & Impact

The Jones Engineering Way

The major contributing factor in how Jones Engineering successfully delivers its OSM and DFMA approach, again and again, is down to our global in-house OSM & DFMA facilities which have an extensive DFMA portfolio listed below, being championed by Ian Davy the Jones Engineering Manufacturing General Manager & Group QA Manager.

Laboratory/Clean Rooms	Battery Charging Facilities
Chemical Treatment Building	Water Treatment Building
Acid Storage Building	AHU M&E Modules
Packaged Generators	Battery Tripping Units
Utility Corridor Modules	Fuel Oil Plant Room
Tower Makeup Pump-House	Cold & Hot Aisle Containment
PCW Side Stream Filter	Data/IT Rooms
Low Temperature Hot Water Skid	Modular Colling Units
Chilled Water Skid	Gas Purification Skids
Trestles – Mechanical & Electrical	Air-Cooled Plant Rooms
Sprinkler Pump-House	Heating/Cooling Plant Rooms
Fire & Gas Detection Systems	Central Utility Buildings
Packaged Switch Rooms	Single/Multiple Storey Plant Rooms

Table 1. Jones Engineering DFMA Portfolio

In summary, Jones Engineering recognises the responsibility to advise on best practice, efficient and economic proposals, and alternative options, as well as cost saving and value engineering suggestions during the Early Engagement Process.

We believe that both the design and construction route benefit from close collaboration as early as the BOD stage by all Project partners. This collaborative early engagement approach ensures that the design under development is based on sound construction methodology and that time is allocated to consider, identify, and advise on the best construction route based on the developing design, price, and quality.

Jones Engineering work with a number of clients in the Life Science, Data Centre, and Microelectronic sectors wherein the timescale between BOD to Facility Ready (FR) is under increasing pressure to reduce, thus increasing the need and essential requirement to maximise the utilisation of OSM and DFMA.

To accompany a global reach with state-of-the-art DFMA facilities, the real strength lies with our people and our teams. With our approach, our experience, our in-house working practices and in-house early collaboration to ensure all project DFMA goals are realised, and with our real-world belief that OSM and DFMA implementation can only benefit our projects on multiple fronts.

The unison and the inter-working relationships, collaboration, and understanding of the project benefits of DFMA between both the Jones Engineering Manufacturing Teams and the wider Jones Engineering Mechanical & Electrical delivery teams across all working sectors, is the true power house to our DFMA journey and success. We adopt the early engagement approach in-house within Jones Engineering Group, and identify our collective clients' requirements and project-specific DFMA targets. We then maximise our client targets with internal Jones Engineering Group collaboration between Jones Engineering Manufacturing Facilities and the wider Jones Engineering Technical Sectors, along with external early collaboration with all project partners, to realise the shared project goals.

To finish with a personal note and observation, I have been involved in the hyperscale data centre industry for 15 years and have seen "the good, the bad, and the ugly" across a large geographical footprint. With recent market trends, with delivery programmes becoming ever-more aggressive, with financial budgets forever tightening, and with an ever-growing emphasis and responsibility to reduce our project-specific carbon footprint and enable long-term sustainability, the need for DFMA is only going to increase. Having recently been a leading figure within Jones Engineering Group on the successful delivery of the quickest ever 64MW hyperscale data centre build, we embodied The Jones Engineering Way, and that made all the difference.

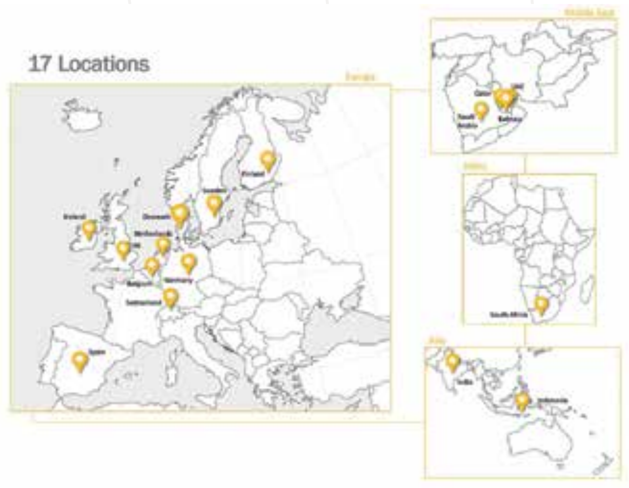

Figure 6. Jones Engineering Manufacturing Geographical Footprint

Jones Engineering