

University of Hull

Smart Delivery Board

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Honours Stage Project

Project Definition Document

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Contents

**No table of contents entries found.**

# Project background & purpose

## Introduction

The production of wind turbine blades at Siemens Gamesa Factory in Hull is a complex process that involves multiple phases and teams. Tracking the progress of each blade as it moves through production is crucial for meeting delivery deadlines and maintaining quality standards. Currently the factory relies on manual data entry across multiple sources to track production progress. This can often result in reduced transparency, leading to miscommunications between teams and delays in responding to issues.

The project proposes the development of a smart delivery dashboard which relies on a manufacturing execution system (MES) as a single source of truth for the production status of blades in real-time. By presenting key milestones on a more granular level and reducing time spent on manual data entry tasks, the system will support teams and management in improving both efficiency and coordination.

## Objectives

### Primary objective – Design and implement backend data integration for the smart delivery dashboard

**SPECIFIC**

Create a centralised system that collates the current production phase and status of all blades at Siemens Gamesa Hull Blade Factory by retrieving data directly from the factory’s MES

**MEASURABLE**

The system must capture the entire production cycle of each blade and update the current phase automatically as frequently as the MES can supply data.

**ACHIEVABLE**

While the MES will only become available part way through the project the scope is still achievable by initially using test data. The system will be designed as to ensure compatibility with the MES once the system is live and the API endpoints become available.

**RELEVANT**

The system addresses the need to reduce multiple data inputs across different systems by integrating directly with the MES. This will minimise manual data entry, lowering the risk of errors and free up man hours for production related tasks.

**TIME BOUND**

Deliver a fully operational software system that is integrated with the factory’s MES by 30th of April 2026.

### primary objective - Develop a USER-FRIENDLY smart delivery dashboard interface

**SPECIFIC**

Design and implement a front-end interface that visualises the collated data from the MES. The interface must present each production phase or a blade in a way that is easy to interpret by both shop floor operatives and management.

**MEASURABLE**

The dashboard must display at least 3 production metrics for each blade. For active phases, it must show the phase name, elapsed time, and estimated completion time. For completed phases it must show the phase name and the total phase duration.

**ACHIEVABLE**

Simulated data can be used for the initial development of the front-end ensuring that the interface is functional once the live MES data becomes accessible.

**RELEVANT**

The system addresses the need for improved visibility of blade production, supporting decision making, reducing production related delays, and ensuring stakeholders remain aligned with expected delivery times.

**TIME BOUND**

Deliver a fully operational front-end interface that is integrated with the factory’s MES by 30th of April 2026.

### Primary objective – Enable Data Storage and reporting

**SPECIFIC**

Transform and store data from the MES in a structured SQL database using Entity Framework. The database will be used in conjunction with Power BI to generate blade reports, KPI scorecards and dashboards.

**MEASURABLE**

The system must record a unique blade identifier to track each blade. For every production phase the system must capture the phase name, start time, end time, and duration. Additionally, it must record any delays that occur within a phase, including the reason for the delay and the time lost due to the delay. As multiple delays may occur on a single phase the system must be capable of storing multiple records per phase.

**ACHIEVABLE**

Data storage can be implemented by creating class models and using entity framework to persist data inputs to the system. Power BI can be used to connect to the SQL database to then visualise the stored data.

**RELEVANT**

Reporting on production data gives stakeholders the ability to improve efficiency of blade production based on historical insights. Allowing them to make more informed decisions moving forward.

**TIME BOUND**

Deliver a fully functional data storage and reporting workflow by 30th of April 2026.

### SEcondary objective - enable timely detection of delays

**SPECIFIC**

Implement functionality to highlight when a blade has surpassed the expected production time for specific phases based on the phase duration thresholds provided.

**MEASURABLE**

The system must generate a visual alert once a production phase has incurred a delay of at least 15 minutes.

**ACHIEVABLE**

The system logic to compare phase durations against pre-defined phase thresholds can be easily implemented with simulated data. This ensures that the alert feature can be developed and easily integrated with live data once available.

**RELEVANT**

Early indication of delays is critical for reducing downtime and meeting delivery schedules.

**TIME BOUND**

Deliver a fully operational delay detection and alert feature that is integrated with the factory’s MES by 30th of April 2026.

## Scope

### IN Scope

The project will deliver a smart delivery dashboard that integrates with the factory’s MES to capture and store production data in a SQL database. The system will display live and historical production data, surrounding phase processes, for all blades within the factory. The production life cycle of each blade will be visible phase by phase to the highest level of granularity permitted by the MES. It will include functionality to detect delays as they occur and integrate with existing systems to gather and display recorded delays. The dashboard will run as a web application providing a tailored user interface suitable for staff at an operational and supervisory level. Finally, to support with analysis the stored SQL data will be utilised to create a semantic model forming the foundation for an initial Power BI report and dashboard.

### Out of scope

The system will be designed to consume data form the MES and will not involve any modification of the MES itself. Advanced predictive analytics or forecasting capabilities based off historical data will not be implemented nor will the project implement the use of any AI technologies. The system will be delivered as a desktop web application and will not accommodate cross platform or mobile deployment Finally; the finished product will be developed for compatibility with the Hull blade factory only and will not facilitate multi-site deployment across the other blade factories within the organisation.

## Deliverables

## Constraints

## Assumptions