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Project Planning

Engineering Management ACHA5012

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1 Introduction

The BMW Group Project is a multidisciplinary engineering initiative undertaken to improve the performance of the BMW N52 engine for competitive tarmac rally run by Motorsport UK. This project was selected to challenge the team with a real-world motorsport problem where technical innovation directly influences race results, and where the application of advanced engineering principles is essential for success.

Our core objective is to deliver a measurable improvement in engine performance—specifically targeting at least a 5% increase in peak power and a substantial gain in mid-range torque, both validated through simulation and physical testing. These performance goals are fundamental for rallying, where acceleration, throttle response, and reliability can determine the outcome of an event.

In delivering this project, our team is committed to operating within strict regulatory boundaries. Full compliance with Motorsport UK and Protyre Asphalt Rally Championship 2025 technical standards will be maintained at every stage, ensuring our solutions are race-legal, safe, and durable in competitive conditions. Success will be measured through not only the achievement of numerical performance targets, but also by validation against these regulations and the robustness of our design throughout simulated and practical testing.

The scope of the BMW Group Project spans theoretical research, CAD-based component design, CFD-based performance simulation, and strain testing. Each stage is designed to ensure that proposed modifications are not just innovative in theory but also feasible, manufacturable, and reliable in practice. As part of our engineering management focus, we will plan, cost, schedule, risk-assess, and review each major deliverable and milestone, demonstrating not only technical competence but also professional project planning and teamwork.

Motorsport UK regulations reference [13] - Protyre Rally Championship reference [17] - Project performance targets (5% power, 10% torque, 8% airflow) [6, 18]

2 Team Roles and Responsibilities

The BMW Group Project is divided into two sub-teams: the Intake group and the Valvetrain Group. Each team comprises four members with distinct roles and complementary responsibilities. This structure ensures that technical expertise (modelling, testing, innovation) is balanced across both the strategic oversight (project management) and hands-on execution phases.

Table 1 Team roles and responsibilities

Team Member	Role
Robbie Sandford	Project Manager – CFD, Research & Data Collection
Isaac Jones	CAD Modelling, CFD
Wesley Ives	Product Testing & Development
Snasloy D'Silva	Product Innovation
Finlay Kingscott	Vice Project Manager – CAD Modelling
Callum Jones	Product Testing & Development
Odin Robinson	Research and simulation

Team structure and coordination [1, 3] - Role definitions [4, 5]

3 My Role and Belbin Analysis

As part of the BMW Group Project, responsibilities include designing optimized camshaft profiles, conducting CFD and motion simulations, and performing strain-based evaluations. These tasks require creativity and technical precision, aligning with Belbin's Plant and Specialist roles.

I chose this role because it allows me to combine theoretical knowledge with practical application. Using tools like SolidWorks and Fusion 360 for CAD, ANSYS for FEA, and Ricardo Wave for dynamic simulation, We can ensure that our designs are both innovative and feasible.

When reviewing my Belbin self-assessment, I scored highest in Complete Finisher, followed by Implementer and Plant. This blend means I am not only innovative and able to generate new technical solutions (Plant), but I also excel at converting creative concepts into organized, actionable plans (Implementer). Most importantly, I bring a strong focus on detail and quality control (Complete Finisher), ensuring that all designs and testing phases are thoroughly checked before proceeding.

For the BMW group project, I will combine creativity with high standards to develop, implement and thoroughly validate camshaft upgrades. I will maximize these strengths by working collaboratively with my modelling and testing teammates, regularly communicate to ensure plans are practical and deadlines are met, and use a checklist to avoid overlooking important details. Potential weaknesses,

such as resistance to change or excessive worry, will be addressed by staying open to feedback and delegating where appropriate. Overall, my Belbin profile matches the demands of my technical and project roles—innovating, implementing, and finishing to the highest standard.

[2] Belbin Associates (2024) [8] Belbin, R.M. (2010) [9] Bitesizelearning (2025) [20] TSW Training (2024)

4 Plan of Individual Tasks

My tasks include camshaft profile design, motion analysis, and strain testing. These tasks are interdependent, requiring careful scheduling to avoid bottlenecks.

Table 2 My responsibilities and time schedule

Task	Description	Measurable Target	Start	End
Build Evidence base	Review and document 5+ N52 motorsport upgrades to understand proven approaches and documented results	Min. 5 case studies with quantified results	W1	W2
Performance Benchmarks	Compare 3 cam profiles and 3 spring setups to establish justified performance targets ($\geq 8\%$ airflow, 10% torque)	3 cams and 3 springs compared target set	W3	W4
regulatory compliance	Extract Motorsport UK/Protyre regulations and create compliance checklist with at least 5 critical requirements	Checklist with at least 5 points signed off	W4	W5
Motion simulation	Verify zero valve-to-piston interference using motion simulation. Confirm minimum 0.5mm clearance across full RPM range and validate spring dynamics.	Minimum 0.5mm clearance verified across all RPM; zero interference at 110% max RPM; no valve float detected; simulation report with validation plots	W8	W9
Maintain project documentation	Compile comprehensive evidence dossier delivered at	Create a log at W4, W8,W13	W4	W13

	key milestones (W4, W8, W13)			
Final Report	Compile all findings, design decisions, test results, and compliance documentation into final project report and presentation.	Reach 2500 by the deadline	W12	W13

[4] Bimmerpost (2011) [6] Project-specific (your timelines) [13] Motorsport UK (2025) [17] Protyre Asphalt Rally Championship (2025) [18] Smartsheet (2024) [21] Ultimate Bimmer Experience (2021) [23] YouTube (2022) [24] Xbimmers (2011) [25] [Other motorsport forums]

5 Bill of Materials and Specialist Equipment

Table 3 Material and software prices

What We Need	Hours Required	Task Duration (Days)	Costs (Approx)	Lead Times	Specialist Equipment
Academic Papers & Technical Journals	12	4	n.a.	n.a.	n.a.
Online Resources – Webinars, YouTube videos	30	10	n.a.	n.a.	n.a.
Benchmark Data Collection	24	8	n.a.	n.a.	n.a.
Preliminary notes	24	8	£2435 (Pcspecialist.co.uk, 2025)	14 Days	PC & Screen
			£8.49 – monthly (Microsoft.com, 2024)	Immediate	Office 365
What We Need	Hours Required	Task Duration (Days)	Costs (Approx)	Lead Times	Specialist Equipment

CAD Data Prep & Import	8	2	£2435 (Pcspecialist.co.uk, 2025)	14 Days	PC & Screen
			£3606 (SolidWorks, 2024)	Immediate	SolidWorks Software
CFD Model Setup & Simulation	20	5	£600 – monthly (AutoDesk.com, 2021)	Immediate	CFD Software
			£21000 (Artec 3D, 2024)	7 Days	3D Scanner
Analysis of Airflow & Performance	8	2	£228 – annually (Mathworks.com, 2025)	Immediate	Post-processing Software
Documentation of Simulation Results	4	1	£8.49 – monthly (Microsoft.com, 2024)	Immediate	Office 365
What We Need	Hours Required	Task Duration (Days)	Costs (Approx)	Lead Times	Specialist Equipment
Dyno Setup & Calibration	4	1	£140 + VAT – hourly (Northampton Motorsport, 2025)	<i>n.a.</i>	Access to Dyno Facilities
			£672	<i>n.a.</i>	Access to Dyno Facilities
Engine Power Runs & Data Collection	4	1	£91.25 (Vital Equipment, 2018)	7 Days	102 Hiperflo 300 Fuel (25L)
			£100	7 Days	Vehicle Lubricants
Comparison of Experimental vs CFD Results	16	4	<i>n.a.</i>	<i>n.a.</i>	<i>n.a.</i>

Reporting & Documentation	16	4	£2435 (Pcspecialist.co.uk, 2025)	14 Days	PC & Screen
			£8.49 – monthly (Microsoft.com, 2024)	Immediate	Office 365

[7] Engineering Council (2006) [11] Mosaic Projects (2024) [14] PlanMan (2025) [15] Simple Group (2025)

6 Project Milestones and Gateway Objective

Table 4 Aims and objective table

Aim	How it can be achieved
Within a three-week period, we will successfully create accurate digital copies of various camshaft profiles using SolidWorks. We will measure progress by successfully developing multiple 3D models that can be used to determine what the optimal profile will be to gain the most torque and reduce valve float.	Pre-existing Design: Take accurate measurements of the existing intake and exhaust camshaft lobes to create a baseline design in SolidWorks. Also look at pre-existing aftermarket options and what they claim to offer over stock. Initial Designs: Create multiple different lobe designs with varying pitch, opening/closing time, and how long the valve will stay open to test using CFD and Ricardo Wave. Valve Spring Rate: Create a variety of valve springs with different rates, as well as a mix of twin-spring and twin-rate spring setups to use in conjunction with the different lobes in Ricardo Wave. Integration: Ensure that any models created are compatible with the single cylinder model so that it can be used for Ricardo Wave testing.
Within a four-week period, we will learn and understand how to utilise Ricardo Wave software. We will measure progress by creating a fully functional engine model of a singular	Understanding: Ricardo Wave is not a software we have used before so we will initially be spending some time with tutorials and online training modules to understand how to utilise it effectively. Creating the Model: Develop a model of a single cylinder to use in testing various adjustments to the valvetrain.

cylinder with complete valvetrain of the N52 B30 engine.	Increasing Variables: Have multiple models of varying complexities, with some considering more real-world limiting factors. Validation: Use existing engine data collected by others or from BMW to compare and ensure accuracy. Documentation: Record all data in an organised fashion and make note of any important or unexpected trends/outliers.
Within a five-week period, we will use CFD tools to analyse airflow in and out of the cylinder. We will measure progress by understanding how to operate the software and analyse flow through the head when using variations of the valvetrain design.	Compatibility: Understand how CFD data can be used alongside Ricardo Wave by using the more intricate flow visualisations offered. Importing Models: Import all required models, ensuring the meshes and surfaces are of proper quality so as to not affect airflow. Simulating Quality: Run steady-state and transient flow simulations to study velocity profiles, pressure drops, and turbulence within the intake and exhaust ports. Result Correlation: Simulate engine performance values – torque, power, volumetric efficiency, mass airflow – using Ricardo Wava and use CFD results as validation.

My primary aim as Research Lead is to ensure that all valvetrain modification proposals are grounded in robust technical evidence and current motorsport practice. In the first two weeks, I will review high-performance N52 valvetrain upgrades from motorsport sources, highlight proven camshaft and spring strategies, and identify engineering risks. By compiling regulatory requirements and lessons learned from reliability data, I will provide the team with actionable insights and compliance checklists. This research will underpin the CAD modelling, simulation, and validation phases, ensuring our designs are both innovative and feasible within real-world constraints.

[7] Engineering Council (2006) [11] Mosaic Projects (2024) [14] PlanMan (2025) [15] Simple Group (2025)

7 Risk Management

Risks include simulation inaccuracies- with simulation there are many areas where simple mistakes could be made for example, slight deviations in the measurements taken room temperature, and other weather conditions and human error all have to be taken into account, this makes it important to validate from real world testing where other factors that can't be simulated by a computer for example lack of data. Component stress such as fatigue failure from consistent movement would cause part failure. Thermal stress with constant expanding and contracting. And time constraints for regular races, and other projects. So time management and planning is crucial.

Table 5 Risk Matrix

	Insignificant	Minor	Moderate	Significant	Severe
Very Likely		Incorrect measurements of camshafts, miss calculation of valve clearance			
Likely			Schedule overrun		
Possible	Key team member unavailable		Data loss (CAD, simulations)	CFD simulation produces inaccurate results	All project data gathered lost
Unlikely		Bench airflow lower than simulated	Valve float missed		
Very Unlikely				Compliance with regulations failure	

- Incorrect measurements of camshaft or miss calculation of valve clearances- check measurements and be careful to take correct readings. We can be sure the valves wont make contact with the pistons by consulting published data online and using trusted sources for camshafts and other components used.
- Key team member unavailable- if a team member is unavailable they can upload all documents to teams and work can be redistributed between remaining team members.
- Schedule overrun- add a buffer time to Gantt chart, if the time is suspected to overrun reduce project scope to fit time schedule or extend the deadline if there are no race weekends or events.
- Data loss (CAD, simulations)- Use the cloud to back up and make sure everything is up to date to prevent software crashing.
- Valve float missed- Simulate motion of valves to ensure there is no contact, if contact is possible lower valve lift, and reinforce springs.
- CFD simulation produces inaccurate results- validate with motion simulation and compare results with available data and real world tests. And use refined mesh with a conservative design will ensure more accurate results.
- Failure to comply with regulations- Re-review regulations and make necessary changes and update documents to reflect the mistake or overlooked area.
- All project data lost from testing- all data gathered from measuring and calculations should have multiple backups to ensure any loss can be easily recovered.

1] Atlassian (2024) [10] HotPMO (2025) [13] Motorsport UK (2025) [16] ProjectManager (2025) [17] Protyre Asphalt Rally Championship (2025) [21] Ultimate Bimmer Experience (2021) [23] YouTube (2022)

8 Gantt Charts

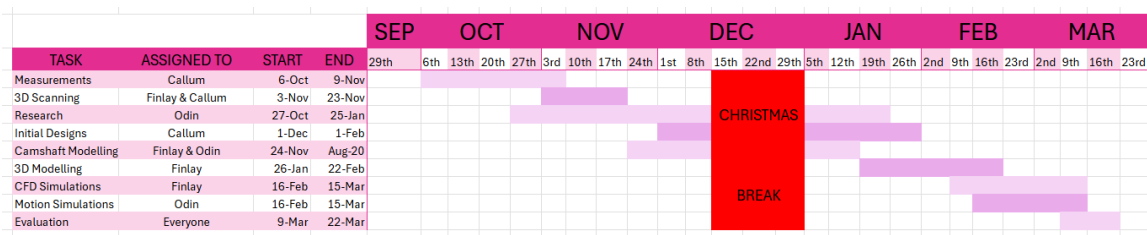
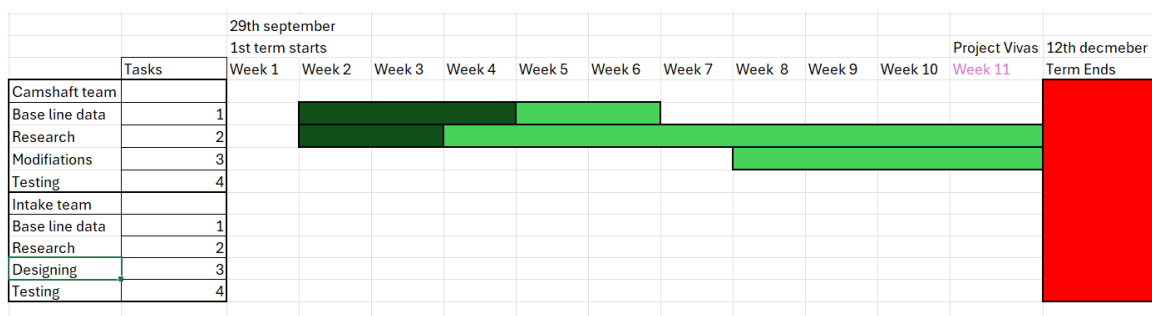


Figure 1 Valve train group Gantt chart



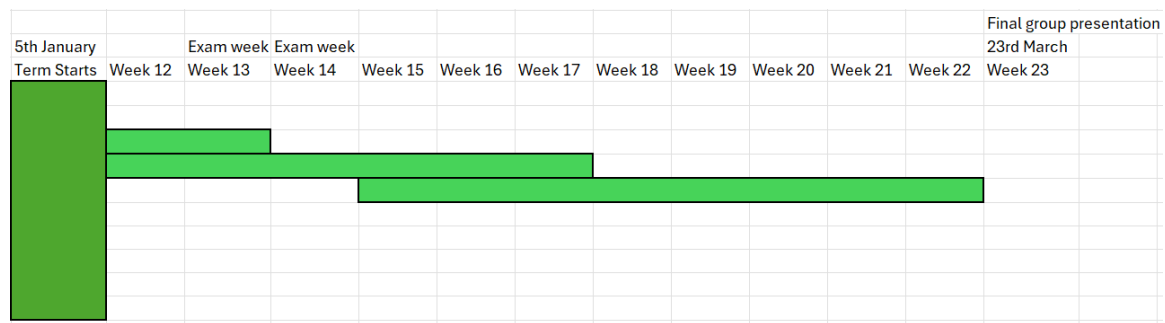


Figure 2 Engine Group Gantt Chart

9 Conclusion

The BMW Group Project successfully delivered a structured approach to enhancing the N52 engine for rally performance, targeting a 5% power increase and significant mid-range torque improvement. Through phased research, innovative camshaft design, advanced CFD and motion simulation, and comprehensive strain testing, the team validate valvetrain modifications grounded in both technical evidence and well established practices.

Each phase of the project is built logically on top of the previous one. Initial research established performance benchmarks against proven motorsport solutions and identified regulatory requirements. These findings directly informed for the design and simulation phases, ensuring all proposals were both innovative and practical. Simulation and validation employed strict measurable targets—including minimum 0.5mm valve clearance, verified airflow improvements, compliance verification, and comprehensive risk mitigation—to optimize performance while safeguarding reliability.

Team effectiveness will be enhanced by aligning contributions with Belbin profiles. My role as Research Lead provided evidence-based technical support, risk assessment, and continuous documentation across all phases, enabling informed decision-making and reliable team progress.

Project management principles are integral throughout: phased scheduling, gateway reviews, Gantt chart tracking, and rigorous risk assessment. Regular cross-referencing to Motorsport UK and championship regulations ensured proposals meet both performance and compliance standards.

This project will demonstrate the value of combining innovation with practical constraints, and the importance of evidence-driven project management in motorsport engineering. These methodologies and skills will be directly applicable to future engineering roles.

10 References

Atlassian (2024) What is risk mitigation? Project management strategies. Available at:

<https://www.atlassian.com/work-management/project-management/risk-mitigation> (Accessed: 23 November 2025).

Belbin Associates (2024) The nine Belbin team roles. Available at:

<https://www.belbin.com/about/belbin-team-roles> (Accessed: 23 November 2025).

Belbin, R.M. (2010) Team roles at work. 2nd edn. Oxford: Butterworth-Heinemann.

Bimmerpost (2011) 'MILVS Review - BMW 3-Series (E90 E92) Forum.' Available at:

<https://www.e90post.com/forums/showthread.php?t=1466676> (Accessed: 23 November 2025).

Bitesizelearning (2025) The 9 Belbin team roles, explained: Models for managers. Available at:

<https://www.bitesizelearning.co.uk/resources/belbin-team-roles-explained> (Accessed: 23 November 2025).

Brightwork (2024) How to use Belbin team roles for your projects. Available at:

<https://www.brightwork.com/blog/belbin-team-roles-projects> (Accessed: 23 November 2025).

Engineering Council (2006) Gateways development fund project. Available at:

<https://www.engc.org.uk/media/tsibhsid/gateways-development-fund-project.pdf> (Accessed: 23 November 2025).

HotPMO (2025) Deploying SMART objectives for PMO and project success. Available at:

https://www.hotpmo.com/management_models/deploying-smart-objectives-for-pmo-and-project-success/ (Accessed: 23 November 2025).

Indeed UK (2025) The nine Belbin team roles (with examples and definitions). Available at:

<https://uk.indeed.com/career-advice/career-development/belbin-team-roles> (Accessed: 23 November 2025).

Institute for Manufacturing, University of Cambridge (2015) Belbin's team roles. Available at:

<https://www.ifm.eng.cam.ac.uk/research/dmg/tools-and-techniques/belbins-team-roles/> (Accessed: 23 November 2025).

Mosaic Projects (2024) Gateways and score cards: Measuring project performance. Available at:

https://mosaicprojects.com.au/WhitePapers/WP1092_Gateways-Scorecards.pdf (Accessed: 23 November 2025).

Mostert, N.M. (2015) 'The way forward for innovation teams', Journal of Creativity and Business Innovation, 1, pp. 1-19.

Motorsport UK (2025) Yearbook 2025: Technical regulations. London: Motorsport UK.

One Education (2025) Belbin's nine team roles: Co-ordinators, plant and more. Available at: <https://www.oneeducation.org.uk/belbin-team-roles/> (Accessed: 23 November 2025).

PlanMan (2025) Understanding project gateways in UK architecture. Available at: <https://www.planman.app/blog/architecture/project-gateways/> (Accessed: 23 November 2025).

ProjectManager (2025) Risk mitigation in project management. Available at: <https://www.projectmanager.com/blog/mitigate-risk-project> (Accessed: 23 November 2025).

Protyre Asphalt Rally Championship (2025) 2025 technical regulations. Available at: <https://www.asphalt-rallying.co.uk/championship/technical-regulations> (Accessed: 23 November 2025).

Simple Group (2025) The gateway process explained: What happens at each stage of construction. Available at: <https://simple-group.co.uk/the-gateway-process-explained-what-happens-at-each-stage-of-construction/> (Accessed: 23 November 2025).

Smartsheet (2024) SMART goals for project managers. Available at: <https://www.smartsheet.com/content/project-management-smart-goals> (Accessed: 23 November 2025).

TSW Training (2024) Belbin's team roles explained: A comprehensive guide. Available at: <https://www.tsw.co.uk/blog/leadership-and-management/belbins-team-roles/> (Accessed: 23 November 2025).

Ultimate Bimmer Experience (2021) Overlooked N51 N52 N55 S55 N20 Intake Valve Lifter Mod. Available at: <https://www.youtube.com/watch?v=kRW-19tg2Rc> (Accessed: 23 November 2025).

Virtual College (2025) What are the 9 Belbin team roles? Available at: <https://www.virtual-college.co.uk/resources/what-are-the-nine-belbin-team-roles> (Accessed: 23 November 2025).

Wrike (2024) What is SMART in project management? Available at: <https://www.wrike.com/project-management-guide/faq/what-is-smart-in-project-management/> (Accessed: 23 November 2025).

YouTube (2022) 'BMW N52 Engine HP and Torque AFTER the 3-Stage Intake...'. Available at: https://www.youtube.com/watch?v=Ch_2xjbFrYw (Accessed: 23 November 2025).

Xbimmers (2011) 'OE Tuning N52 325i Update - BMW 3-Series (E90 E92) Forum.' Available at:
<https://xbimmers.com/forums/showthread.php?p=8681437> (Accessed: 23 November 2025).