



An Introduction to Fabrum Ltd.

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FABRUM



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Introduction

- Fabrum Ltd. is a start up company based primarily around the skills and experience of its directors
- Independent engineering consultants
 - IC Engine Specialists
- Directors
 - All ex. Chief Engineer's at Cosworth Technology Ltd. Responsible for
 - Design
 - Analysis
 - Development
 - Research
 - Test
 - Control System Calibration
- Over 50 years combined automotive experience



Areas of Expertise

- Engine technology / concept development
 - Clean sheet or incremental
- R&D programs
 - Concept to production
 - Definition, implementation and delivery
 - Knowledge of key technology, resources and suppliers
- Technical approach
 - Design and Development process including validation requirements
 - Production Calibration and Validation
 - Certification
 - Experimental design for efficient testing
 - Data processing and analysis
 - Application of modelling (FE, cycle simulation, CFD, Offline calibration, etc)
- Problem resolution
- Project Management



Engine Technology

- Whole engine experience
 - System based approach
 - Design verification plan driven
- Spark Ignition Performance
 - Road / race & Non automotive performance
 - 1D performance prediction
- Fuel economy and Emissions
 - Downsizing, variable compression ratio, cylinder deactivation, combined starter generator, GDI
 - High performance EUIV, LEV and ULEV systems
- Mechanical
 - Base engine specialism
 - Valvetrain, OHC, pushrod, variable valve timing
 - Intake system, multi stage variable geometry
 - Exhaust, highly tuned emissions compliant systems



Engineering support

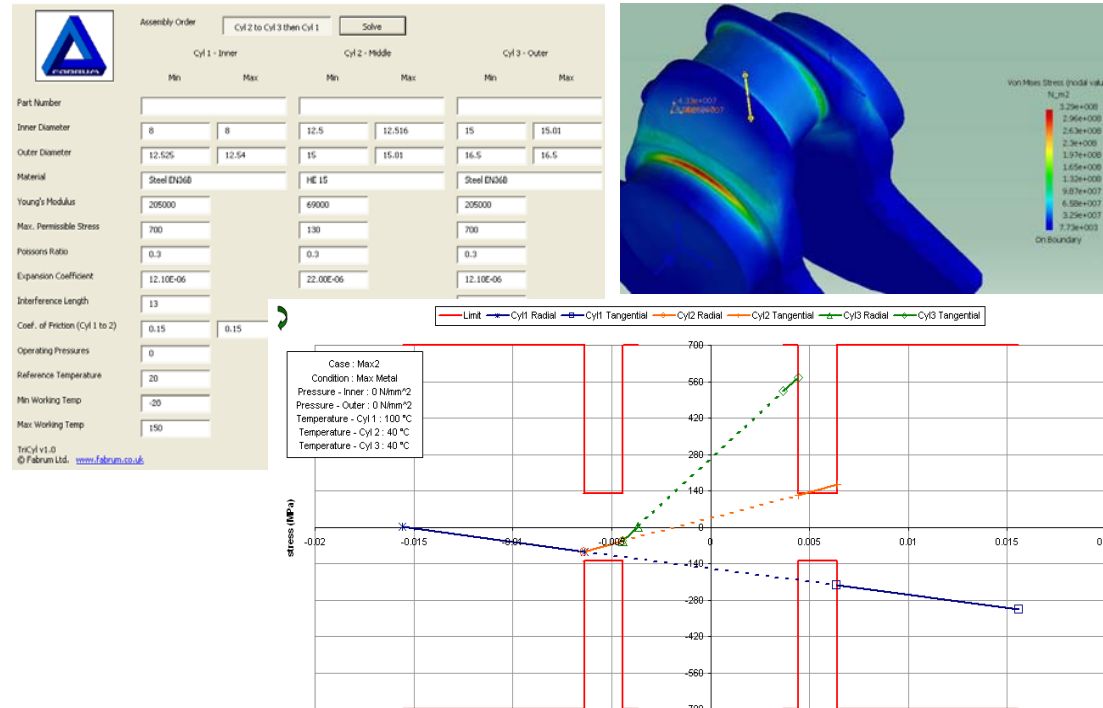
- Example activities:
 - Power unit development
 - Power unit installation specification + issue resolution
 - Product validation
 - Emissions and EMS development
 - Certification and homologation
 - Problem solving
 - Analytical tool development
 - Component Design + manufacture
 - Supplier engineering support



Engineering support – Tools and Analysis

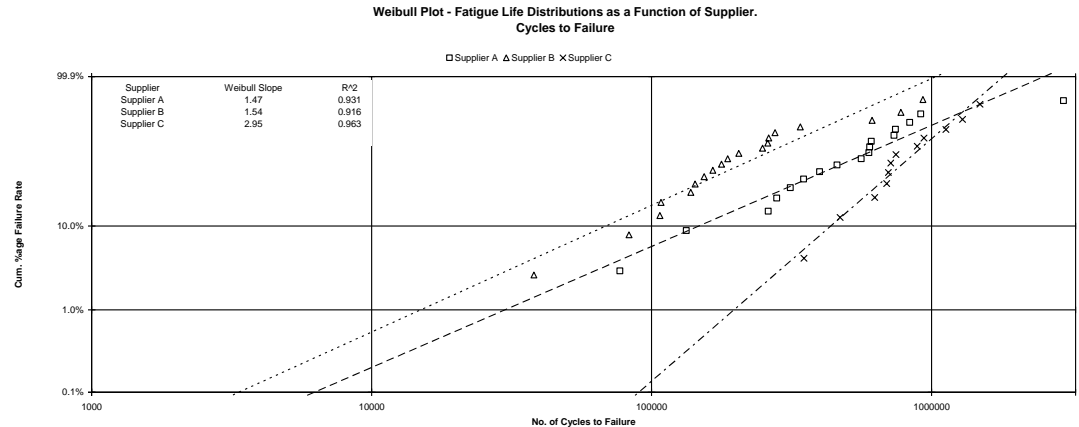
• Software

- Engineering Utilities e.g. TriCyl, Holzer model, etc
- Fabrum utilities – Excel add-in
- FMEA
- Web based Databasing e.g CRM
- Websites



• Data Analysis

- OBD
- SPC
- Failure rate / reliability



– Design

- Novel Engines
- Auxillary power unit
- Industrial Engine benchmarking and Design
- Diesel Engine Analysis, Design and Validation
- V4 & V6 Marine engine
- High Performance Gasoline & Diesel
- Design Critique / Technology review

– Analysis

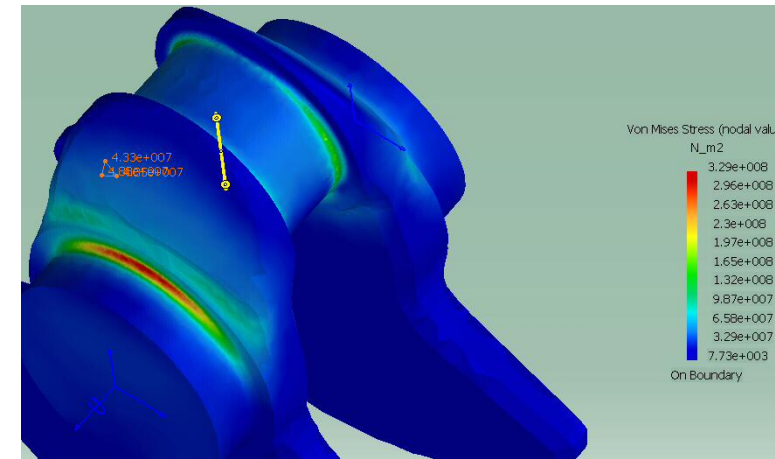
Numerous Predictive and Reactive examples

– Development

- Diesel systems testing
- Niche volume EU4 engine programme
- Race engine

– Application / Calibration

- OBD applications
- Certification
- Multiple systems experience

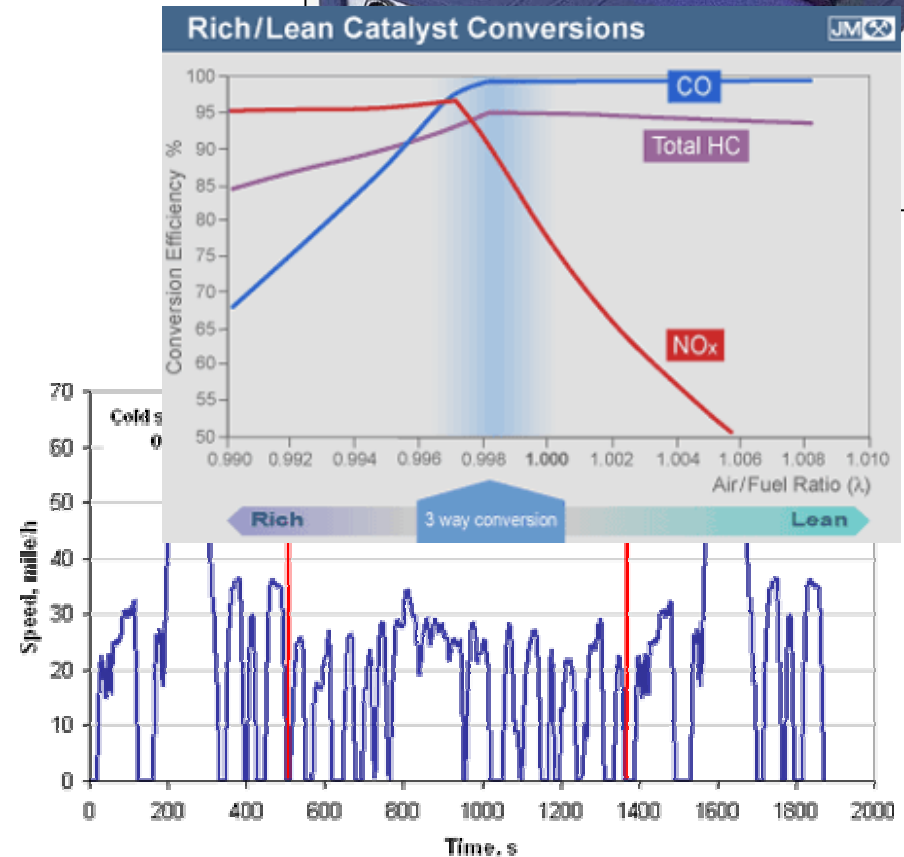
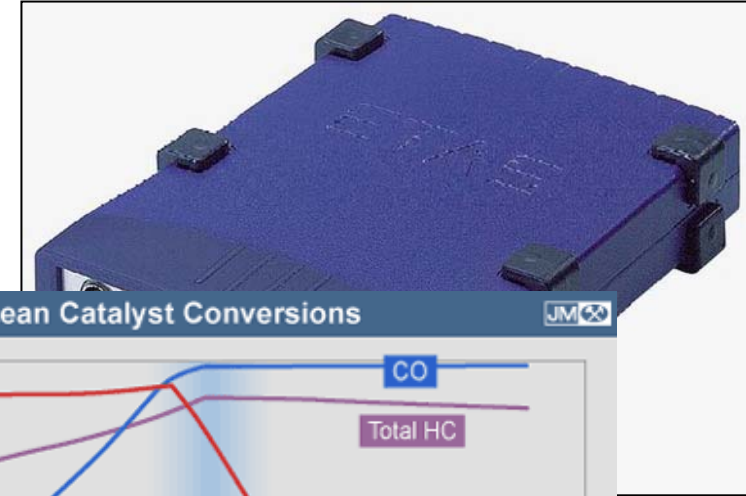




Engineering support – Past project experience

Calibration

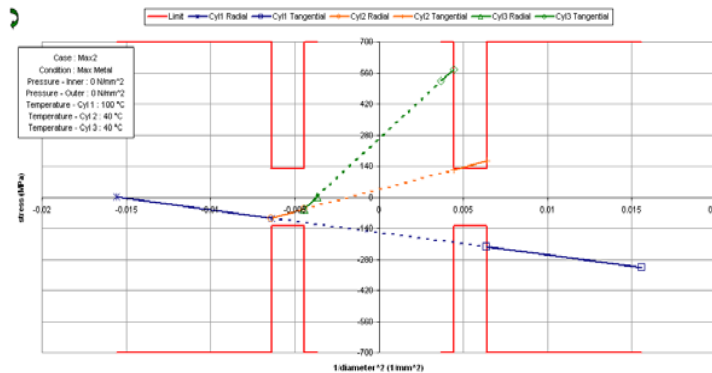
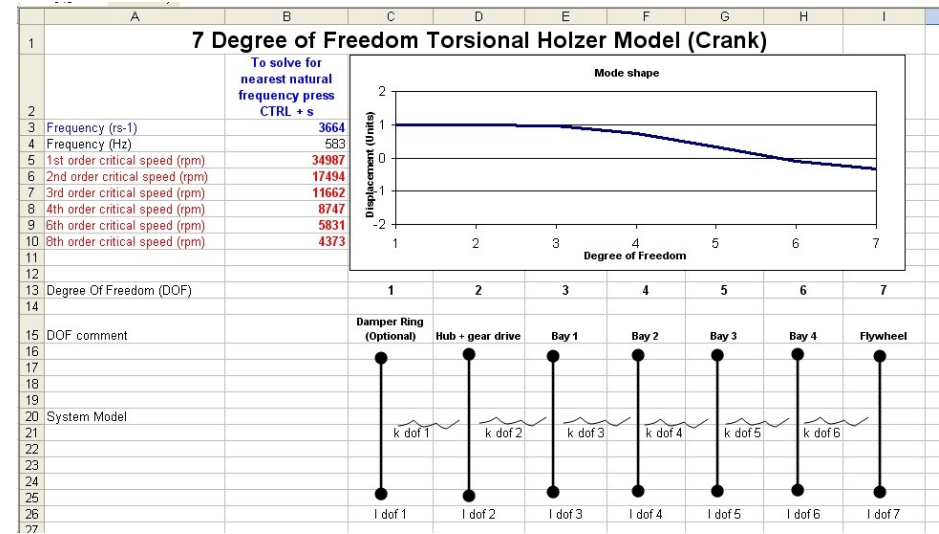
- Experience of Multiple Systems
- Project Management
- Technical Support
- MoS Definition / Sign Off
- OBD review & Validation
- Data analysis
 - Post Processing
 - Off Line Analysis / Simulation
- Certification support
- Niche Market + Volume
- EU4 + ULEVII





Engineering support – Recent/current Fabrum experience

- Niche volume EU4 engine application project management
- Race Engine Design & Development
- 1D Performance Analysis
- Test bed Problem Resolution
- Engine Management System Application Support – High Volume Production Vehicles for Major EMS Supplier
- Analytical Tools for Designers
- Supplier support – applications
- Engineering Production Problem Solving
- Engineering recruitment



Assembly Order: Cyl 2 to Cyl 3 then Cyl 1

	Cyl 1 - Inner		Cyl 2 - Middle		Cyl 3 - Outer	
	Min	Max	Min	Max	Min	Max
Part Number						
Inner Diameter	8	8	12.5	12.516	15	15.01
Outer Diameter	12.525	12.54	15	15.01	16.5	16.5
Material	Steel EN36B		HE 15		Steel EN36B	
Young's Modulus	205000		69000		205000	
Max. Permissible Stress	700		130		700	
Poissons Ratio	0.3		0.3		0.3	
Expansion Coefficient	12.10E-06		22.00E-06		12.10E-06	
Interference Length	13				11	
Coef. of Friction (Cyl 1 to 2)	0.15	0.15			(Cyl 2 to 3)	0.15 0.15
Operating Pressures	0					10
Reference Temperature	20			Temp. of Cyl 2 during assy. to Cyl 3		80
Min Working Temp	-20			Temp. of Cyl 3 during assy. to Cyl 2		21
Max Working Temp	150			Temp. of 283 during assy. to Cyl 1		40
				Temp. of Cyl 1 when assembled to 283		100

TriCyl v1.0
 © Fabrum Ltd. www.fabrum.co.uk



Example Project Experience

- High performance, mass-volume derivative
 - Base-engine emission compliant upgrade programs, NA and Turbo
- Engine installation and integration
 - Large engine, small car
- Industrial, marine and aerospace application
- Clean sheet engine design, prototype to production
- Value engineering
- Full powertrain calibration
- Diagnostic calibration, overchecking and validation for production calibrations
- Calibration validation
- Certification (US and EU)



Problem Solving

- Experienced in wide range of engine and engineering problem resolution:
 - Durability failures
 - Performance issues
 - Emissions problems
 - NVH
 - Cooling, lubrication and thermal management
 - Fuel systems
 - Vehicle systems
 - Instrumentation and measurement
- Analytical & scientific approach



Services & Working Arrangements

- Technical consultancy
- Problem solving
- Concept definition
- Program/project management
- Program plan/proposals
 - Preparation
 - Scope/resource definition
 - Review
 - Presentation
 - Support
- Open approach
 - Professional and confidential
 - Transparent methodology
 - Informal training and technology transfer provided
 - Team development including recruitment support



Services & working arrangements

- Flexible
- Based in Midlands
- Work at client's site if required
- Individual assignment or team based
- Reactive consultation – requirement driven
- Planned/regular support
- Visible or invisible to your customer
- Additional support can be provided through our industry contacts
- Fixed scope or Time and Materials performed



Mike Fry

- PhD in spark ignition charge formation
- Chartered Engineer
- 12 years Postgraduate experience in engine technology Research & Development at Lotus, Cosworth and Ngenious Ltd.
- Specialisms: Performance, concept definition, Engine development and validation.
- Project Management experience delivering highly technical projects
- Chief Engineer – R&D for Cosworth Technology
- Principal Consultant – Ngenious Ltd.
 - independent IC engine consultant





Graham West

- BEng in Mechanical Engineering
- 19 years experience at Jaguar and Cosworth Technology
- Extensive Calibration experience
 - Full production calibrations
 - Concept demonstrator calibrations
 - Emission, climatic and diagnostic calibration on transient test bench
 - Lucas, Denso, Visteon and Bosch, MBE systems
- Development of off-line calibration techniques
- Development of Diagnostic validation techniques
- Development of Statistical Data Analysis techniques
- Low Volume Certification to US
- Chief Engineer – Calibration at Cosworth Technology





Carl White

- Cranfield MSc. in Automotive Product Engineering
- 20 years experience at Rover, Jaguar & Cosworth
- Concept to Production
- Design and Analysis capability
- Base Engine responsibility for Jaguar.
- Significant experience cylinder block, cranktrain and cylinder head design
- Project Management experience delivering Production Programmes on time and to budget
- Advanced Product Quality Planning experience
- Design for Manufacture and Assembly
- Chief Engineer – Design and Analysis at Cosworth Technology





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Summary

- Flexible
- Straightforward, direct and open
- Professional and confidential
- Few but loyal customers preferred
- Here to help