



Design Considerations To Reduce Mass of Engine Internals.

Robert Evans

Malcolm McDonald

School of Engineering

BEng (Hons) Motorsport Engineering

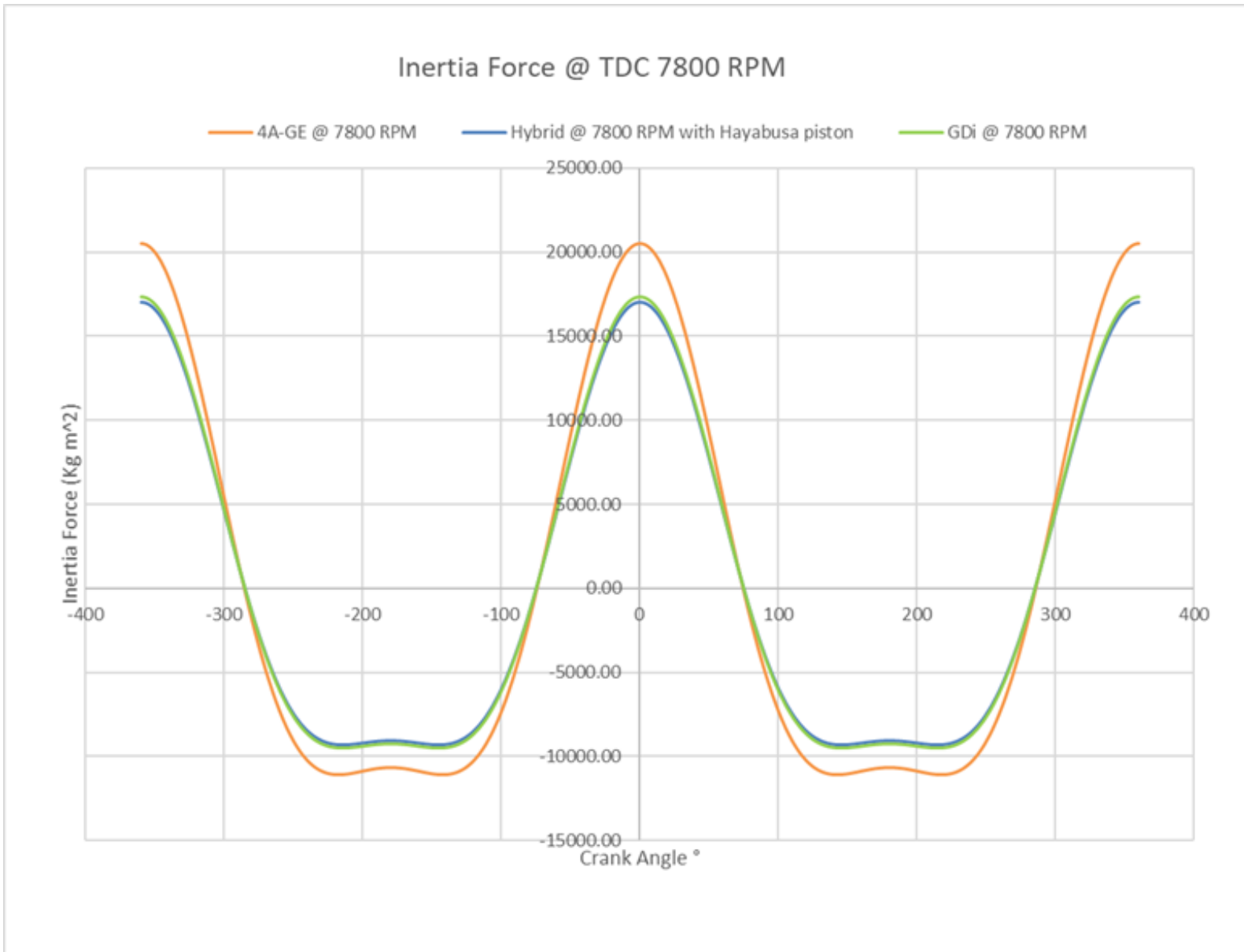


Introduction

The project consisted of comparing two engines from different eras, with the aim of reducing internal engine mass by means of utilizing the lighter components such as crankshaft and conrods. The engines in question?

- An 80's Toyota 1.6l (4A-GE)
- A modern Ford Ecoboost 1.6l

By using the Ecoboost Crank & Conrods and lightened flywheel gives a 35% less internal engine mass.



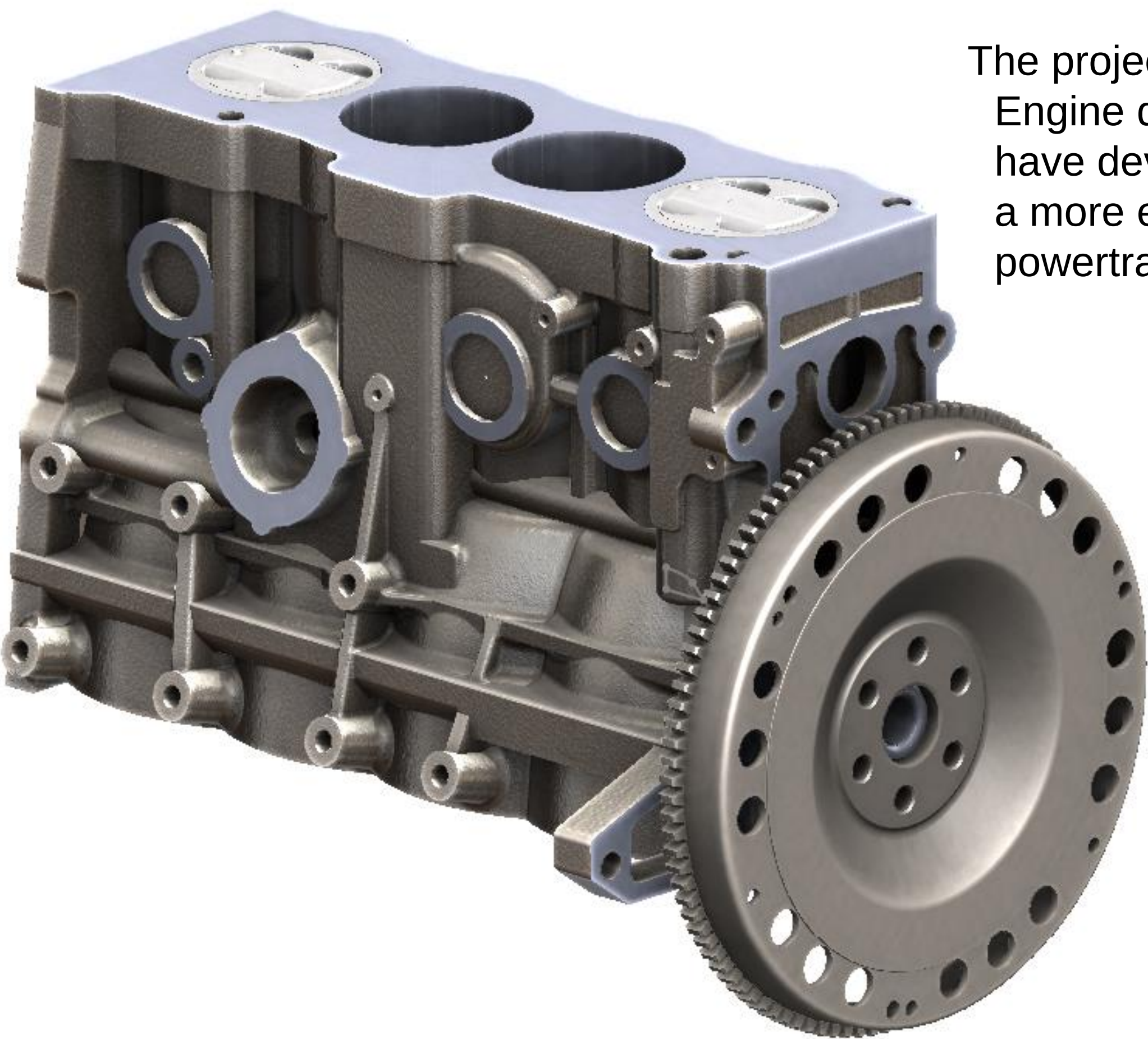
Project Aims

- ☐ Investigate the viability of using the Ecoboost crank & rods
- ☐ Model necessary components to aid with fitment and FEA
- ☐ Give the author a thorough understanding of engine principles and design requirements.

Engine Data	EcoBoost (Kg)	4A-GE (Kg)	4A-ECO(Kg)	Difference	
				Kg	%
Piston Mass	0.25	0.32	0.32	0.00	-1
Piston Ring Mass	0.02	0.02	0.02	0.00	-5
Gudgeon Pin mass	0.08	0.10	0.10	0.02	18
Crank Mass	10.20	12.70	10.20	2.50	20
Con-rod mass	0.27	0.35	0.27	0.09	25
Con-rod cap mass	0.11	0.12	0.11	0.01	11
Crod bolt & nut mass	0.03	0.06	0.03	0.03	45
Big End Shells Mass	0.02	0.03	0.02	0.01	21
Reciprocating Mass	0.49	0.63	0.49	0.14	
Flywheel Mass	11.20	6.80	3.30	4.40	65
TOTAL	22.17	20.50	14.86	7.19	35

Methodology

Using engine data from Ford to initially setup an excel model to compare the both engines, pressure data was used from a sigma engine to provide a pressure log for the 4A-GE. The both engines were measured to find they had similar dimensions. CAD models were produced to prove fitment virtually and modifications carried out in CAD



Conclusion

The project gave a great insight in Engine design and how engines have developed over time to make a more efficient and well packaged powertrain unit.