

# **GE Marine and Stationary 6L250 EPA Tier 3 Development**

## **Task #2 Report**

**for:**

**New Technology Research and Development Program**

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**Submitted by:**

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## **Abstract/Executive Summary**

This project involves the prototype build and engine performance testing of US Environmental Protection Agency (EPA) Tier 3 compliant marine engines. In particular, it is a goal of this project to release a Tier 3 compliant engine ahead of the January 1, 2014, compliance deadline.

This task involved the procurement of components and subsequent upgrade of a GE 6L250 test engine to meet EPA Tier 3 regulations as defined in 40 CFR 1042. The scope of this task included procuring new camshafts, and a new turbocharger. Overall, this task will allow for the engine test and emissions recipe development such that final EPA compliance can be obtained.

## Introduction / Background

The GE family of inline engines has traditionally been US Environmental Protection Agency (EPA) Tier 2 certified engine. This project seeks to modify the current inline engine design such that it is capable of meeting the more stringent EPA Tier 3 guidelines. Given that the EPA guidelines on Tier 3 marine engines only apply to engines with a rated load of less than 2000 kW, the inline engines are the only engines in GE's portfolio that are subject to the Tier 3 regulations.

## Project Objectives / Technical Approach

From the Grant Activities (Scope of Work):

*“1.1. The objectives for this work are:*

*1.1.1. Certify a marine 4-stroke six and eight cylinder engine rebuild kit to American Bureau of Shipping (ABS) class standards and EPA Tier 3 marine emission standards ahead of the 2014 EPA regulatory deadline.”*

This report in particular is in regards to the parts procurement and rebuild of the prototype engine to be used for compliance certification.

## Tasks

### Task 2

#### Procure components

From the Grant Activities (Scope of Work):

*“2.2. Task Statement: The PERFORMING PARTY will procure all components for and rebuild a 6L250 prototype engine.*

*2.2.1. The PERFORMING PARTY will procure all required Tier 3 package components to include but not limited to: turbochargers, cam shafts, and power assembly components (pistons, piston rings, etc).”*

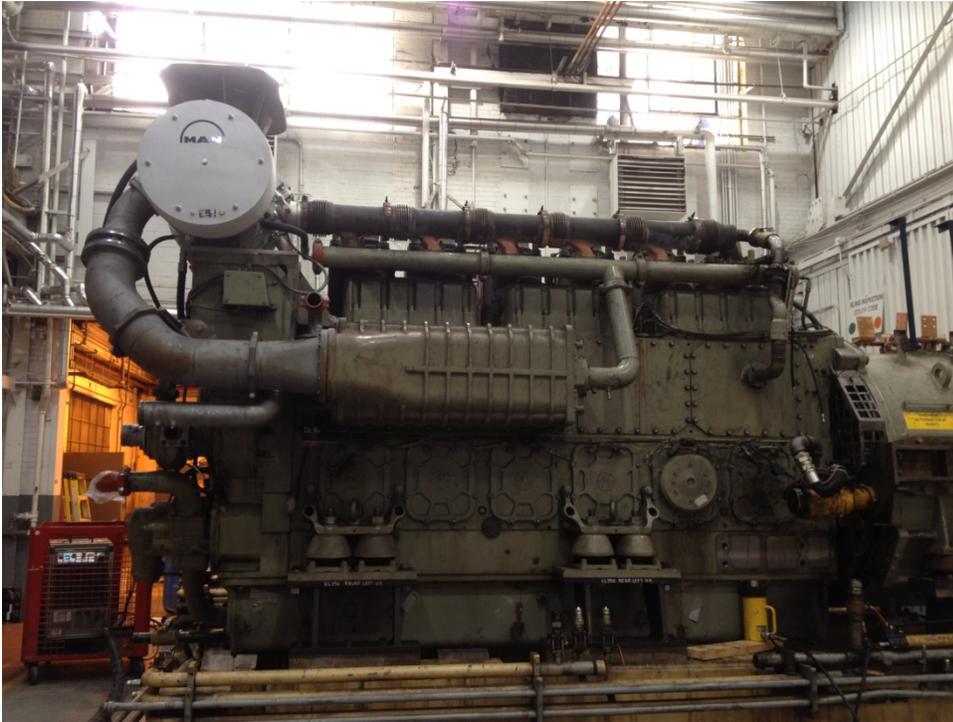
The power assembly components (piston rings, rotating component bearings) in this case were procured through the GE replacement parts team, however the turbocharger is a new component for GE engines, and as such was procured as an engineering prototype component. Similarly, the required engine camshafts were a new design on GE engines, however they are based on the current GE design. Since the final camshafts were a new component, they were also procured as prototype engineering components. All components for this task were received by October 5, 2011, in time to allow for associated engine build steps and requirements.

## Rebuild 6L250 Engines

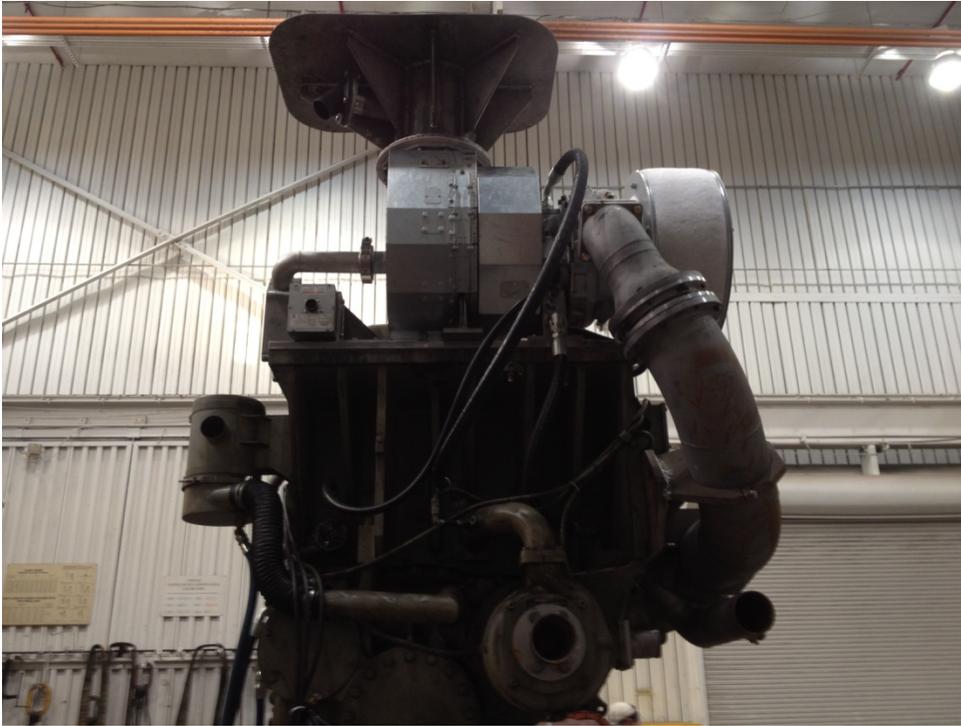
From the Grant Activities (Scope of Work):

*“2.2.2. The PERFORMING PARTY will rebuild one existing 6L250 prototype engine with the chosen Tier 3 engine configuration.”*

This work has been completed on the 6L250 engine. Figures 1, 2, and 3 below display the engine as configured with the components noted above, and ready to begin performance testing.



**Figure 1: Left side view of prototype 6L250 engine configured for performance testing**



**Figure 2: Front view of prototype 6L250 engine configured for performance testing**



**Figure 3: View of new turbocharger installed on the prototype 6L250 engine**

## **Discussion/Observations**

### ***Objectives vs. Results***

All desired objectives have been met for this portion of the grant objectives. All prototype components have been procured and mounted on the engine. Any necessary prototype mounting components have also been fabricated and are in place on the engine as shown in the above figures.

### ***Critical issues***

The only issue of note for this section of work is the extended lead times experienced for the prototype turbocharger components. For future engine development, this item must be considered and included in the planning for the later parts of that grant activity.

### ***Technical and commercial viability of the proposed approach***

All aspects of this project to date are deemed achievable and technically viable. Some activity is still to be undertaken to develop a serial production ready version of the hardware, however this task can be viewed as a modification of the prototype component designs.

### ***Scope for future work***

Future work is to involve the performance testing and compliance certification of the engine with the applicable governing bodies. As noted in the grant scope of work, the work on the 6L250 engine will be mirrored in the 8L250 development work to follow.

## **Intellectual Properties/Publications/Presentations**

No issues.

## **Summary/Conclusions**

This task as part of the grant activity allowed for the preparation of a 6L250 engine to be used for engine performance testing. Following activities as noted in the grant scope of work will finalize the compliance review and release of this engine to the governing bodies.