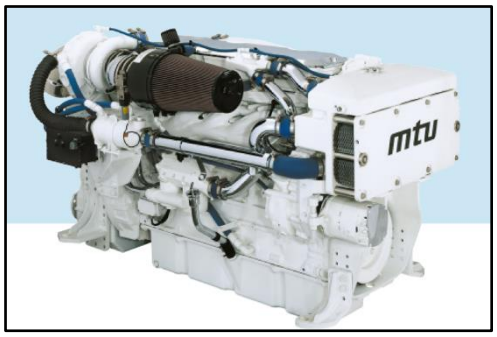
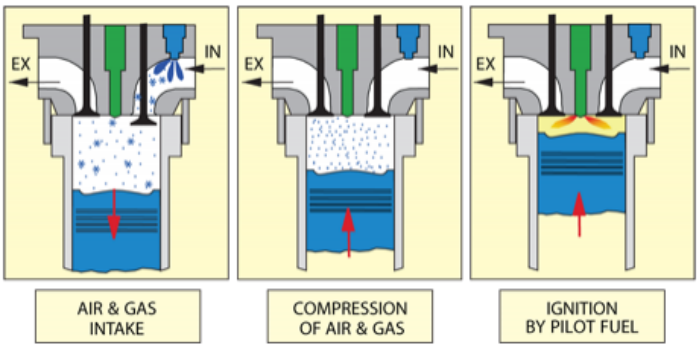
THE VIABILITY OF COMPRESSED NATURAL GAS AS FUEL: THE INSTALLATION OF A DUAL-FUEL SYSTEM FOR AN ELECTRONICALLY-TIMED, HIGH-SPEED DIESEL

by
Sean Healy & Luke Herbermann

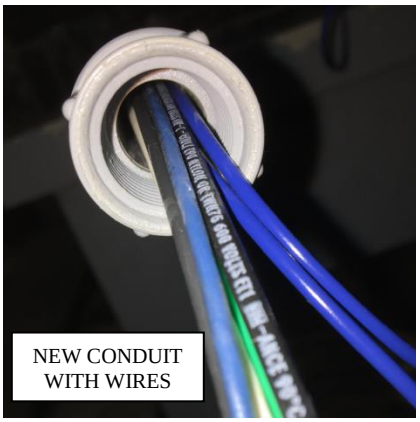
Abstract: In recent years, strict emissions regulations have created a challenge for the shipping industry. One of the ways to help ships meet these regulations is to convert an existing engine to run on dual fuel. Running on dual fuel in our case means running on a mixture of about 30% diesel and 70% natural gas. This thesis is a continuation of several previous Webb Institute theses. The objective was to finish the dual-fuel conversion of an existing Detroit Diesel Series 60 engine, shown on the right, in Webb's Haeberle Laboratory.



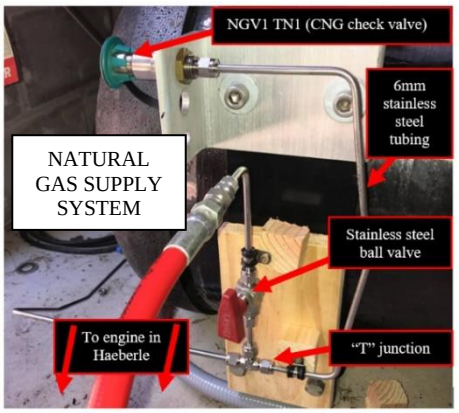


The Dual-Fuel Solution: For this thesis, the type of dual-fuel system is considered a low-pressure system in which the natural gas is injected with the intake air. When the piston reaches top dead center, a small amount of diesel fuel is injected and ignited from the pressure and temperature in the combustion chamber. The process is shown in the diagram on the left. The blue nozzle with blue fuel is the natural gas.

The Conversion Process: When this thesis was taken up, there was still a lot of work to do to complete the conversion. In previous theses, students had finished installing the continental controls natural gas injection system and started to work on the gas detection and alarm system. We designed, installed, and tested the gas detection and alarm system as well as a more functional version of the natural gas supply system. The project involved many hours laying electrical conduit, testing gas fittings, and double checking our work.


NEW CONDUIT WITH WIRES

GD-12 GAS DETECTOR



Recommendations for Future Work: The spark for this thesis was primarily the ever-tightening emissions regulations. With most dual-fuel conversions, the biggest drawback is the potential for methane-slip or the unintentional release of natural gas into the atmosphere. Natural gas (made up of 95% methane) is an extremely potent greenhouse gas and can make a conversion to dual-fuel more harmful than helpful to the environment. The greatest recommendation for future work is to characterize the engine after the conversion by testing its emissions, efficiency, and other performance indicators. Such testing would shed light on the positive and negative impacts of a dual-fuel conversion.