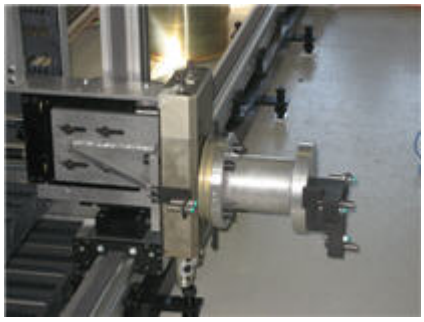
Outbound Technologies

PROJECT SUMMARY

Project Name:	Fuel Blending System
Total Value:	$727,265
Hours:	Over 2,300
Engineers:	One (1) – Electrical design Two (2) – Software Design Two (2) – Commissioning
Market:	Automotive
Manufacturing/Process:	Process Automation
PLC:	Rockwell – ControlLogix
SCADA:	Iconics – WebHMI
Motion:	Rockwell – Kinetics 6000 Servo



Introduction:	The purpose of this job was to perform the conceptual design, PLC and HMI software design, control panel build, mechanical subcontractor management, and commissioning for the fuel blend system at an automotive research facility.
Objectives:	The Fuel Blending System contained two boards of 374 manually actuated valves. Each board (labeled "J" and "K") contained 22 valves across by 17 valves high for a total of 748 valves. The valve boards supplied various fuel types to test cells in the research facility's campus. Due to the types of fuel being used, the operational environment was treated as Class 1 Division 1. The objective was to design and implement a control system to operate and monitor all of the manually actuated valves in this environment, as well as all automated valves in the fuel supply system.
Solution:	OTI conceptualized the entire mechanical and electrical system and subcontracted the mechanical design and build. The valves were actuated by an automated gantry robot which was controlled by a PLC. The valve boards were back-to-back, with each

having its own robot. Safety fencing was constructed around the valve boards to protect personnel and detect intrusion to the area.

The Fuel Blending System PLC controlled the 17 automated ball valves that supplied fuel from the Head Tanks to the fuel blend board, the 44 automated ball valves along the bottom of the blend board that supplied fuel to the test cells, and the 19 hydrogen/helium valves that supplied various test cells.

Controls Overview:
The control system for the robot was broken down into logical segments for the PLC, servos, and software.

PLC Equipment:

- ControlLogix 1756-L63B processor
- 120VAC I/O
- 1756-ENBT Ethernet cards
- 1756-M08SE SERCOS interface card to communicate with the servo system

Servo Drive Equipment:
The servo system was an Allen Bradley Kinetics 6000 servo drive properly matched with a Getty's explosion-proof servo motor with an absolute encoder.

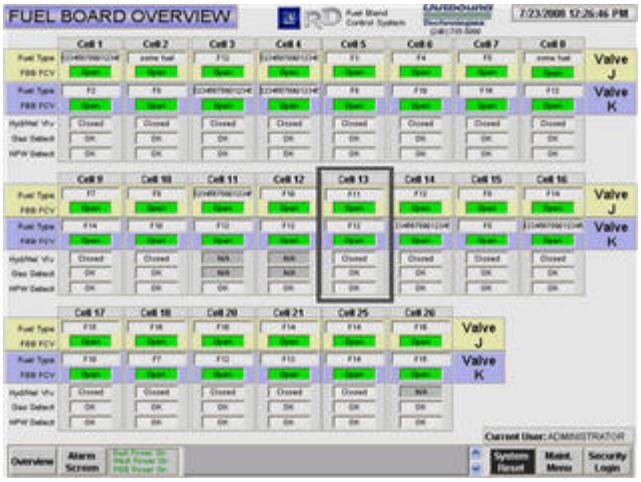
Software:

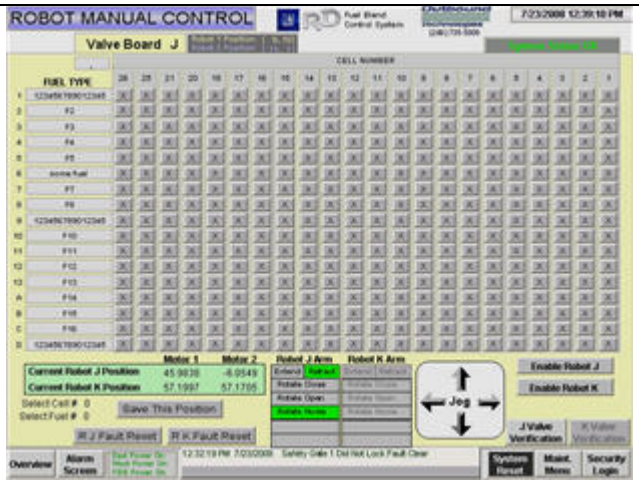
PLC

The PLC software was RSLogix 5000 Version 16.03. All robot functions and facility controls were programmed in this software.

HMI

The HMI software was Iconics WebHMI. All three HMI's used Internet Explorer to connect to this software to allow the operators to interface with the equipment.





Pneumatic Controls:
All motions (except the servo) in regards to the robot were pneumatically operated. The pneumatics were controlled via 120VAC solenoid valves located in the unclassified (safe) area in the tunnel and pilot the control valves located in the junction boxes mounted to the outside of the safety gate. Each motion was supplied with a relieving regulator and flow controls. The motion positions were verified via intrinsically safe proximity sensors that were in accordance with the Class 1 Division 1 specifications.

Mechanical Overview
The mechanical make-up of each robot consisted of the X and Y axis actuator, the servos, the gear boxes, and the Z axis slide assembly.

Robot Assembly:
The robot concept was a four-axis modular actuator system. There were three linear motions (X, Y, and Z) and one rotating axis for the ball valve actuation.

Nook Actuator:
The main actuator for the X and Y axis was the ELZU-80S actuator by Nook Industries. This actuator was driven by one continuous belt for both the X and Y axis. This belt was rated to be static resistant and explosion-proof.

This belt allowed for the use of two rigid mounted high powered explosion proof electric servo motors that controlled the actuator. Rigid mounting allowed the high voltage cables that supplied power to these servo motors to be run in rigid conduit, and eliminated the requirement

	of a flexible high powered cable for the Class 1 Division 1 environment. ***Servo Motor:*** The servo motors were Getty's explosion-proof style**.** ***Gear Boxes:*** The gear boxes were Alpha corrosion resistive model LP070. This model was completely fabricated with aluminum and stainless steel. This was in accordance with Class 1 Division 1 specifications. 
Process Documentation:	The following is a list of documentation provided by Outbound Technologies in order to exceed the required industry standards: • Electrical and Mechanical Drawings • Software (PLC and HMI) • Sequence of Operations / Operations Manual / Training Manual • Vendor Documentation • Check-Out Forms
Industry Standards:	• Class 1 Division 1 • NFPA • NEC
Project Outcome:	All systems controls performed as designed. The customer and end user were satisfied. Warranty work has been minimal, and OTI is contracted exclusively for all system upgrades.