



# ADVANCED

## TEST & AUTOMATION

Systems and Software for a Complex World in Motion



# Project Overview



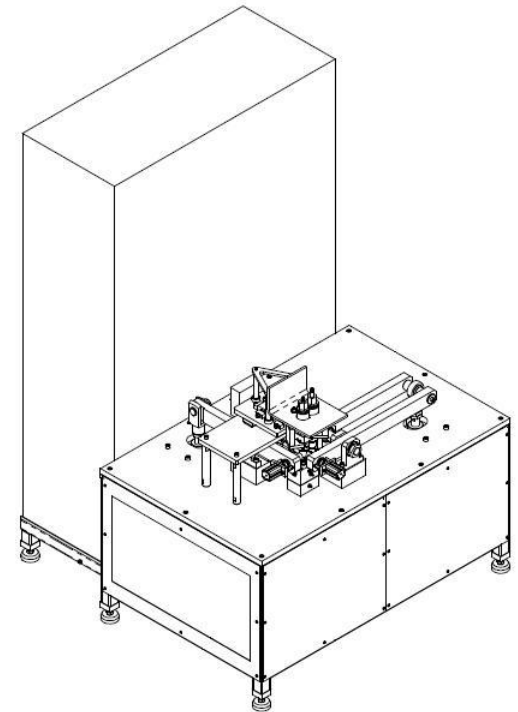
## High-Pressure Direct Injection (HPDI) Fuel Injector

Injector Actuator Tuning Test Stand



# Who We Worked With

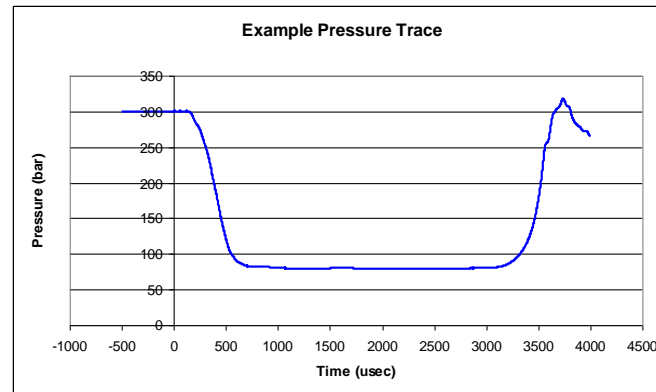
- ATA Inc. was approached by a new client with a need for a tuning device for their high-pressure fuel injector actuator block
- The client was a world leader in development of technologies that operate on clean-burning alternative fuels
- The client had an existing, outdated test system which did not have sufficient accuracy and precision, and was looking to significantly reduce the test cycle time for larger throughput
- A set of custom test limits was provided, so that every production injector actuator needed to be tuned within the envelope of those limits





# Tailored To Specific Needs

- The tuning test stand was to be delivered in conjunction with the end-of-line injector test stand, so that each injector head needed to be tuned before being assembled onto the injector body
- Injector head was to be fired at a specific frequency and pulse-width, and the output pressure trace was monitored

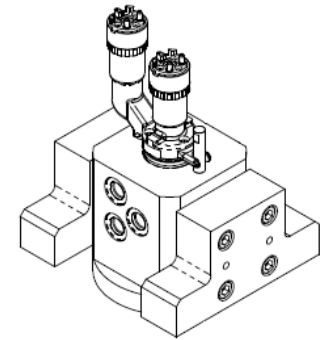


- ATA proposed an architecture for the tuning test stand which allowed real-time monitoring of the output pressure trace and regulation of injector actuator head response to desired parameters



# Key Design Elements

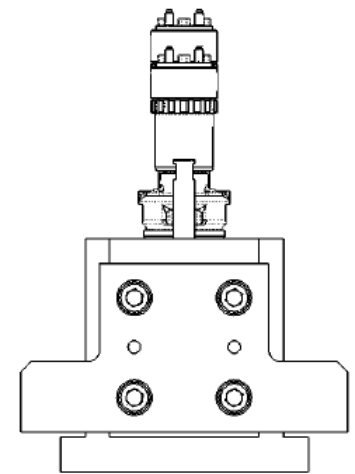
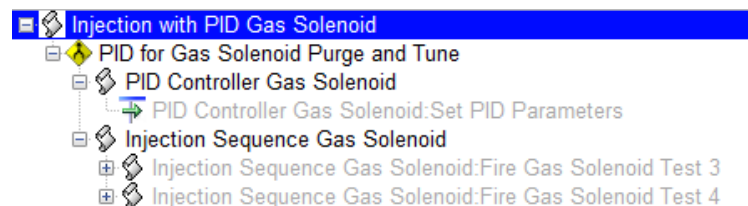
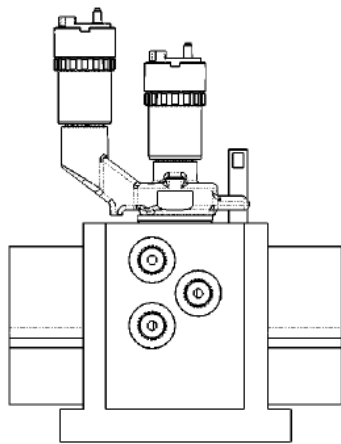
- The initial step of the design process included sizing major test bench components to suit client's product requirements, such as:
  - integration of an innovative main pressure source via a low-flow, high-pressure, air operated hydraulic pump
  - selection of an upstream pressure control valve based on an appropriate Flow Coefficient ( $C_v$ )
  - careful selection and integration of high frequency response pressure sensors for detection of the output pressure trace
- Design of a unique test fixture and component clamping mechanism for quick test part interchanges
- For technical info regarding the test bench, see [Datasheet PDF](#)



# Productivity & Expandability

- Test scripts automatically set up the desired test conditions, and then transfer the system to “tuning mode”, where the operator uses custom tools to adjust the firing response of each actuator head
- Part clamping and unclamping is done automatically via pressurized air cylinders, as well as actuation and coupling of all electrical connections via sliding electrical probes

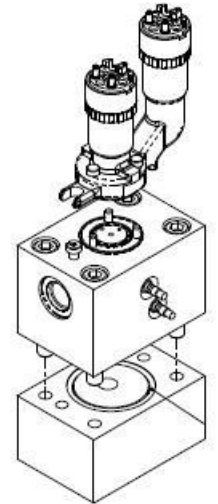
- Manual control screen lets the operator control the state of every test stand component individually, setting up custom test conditions or executing development type tests on different injector models





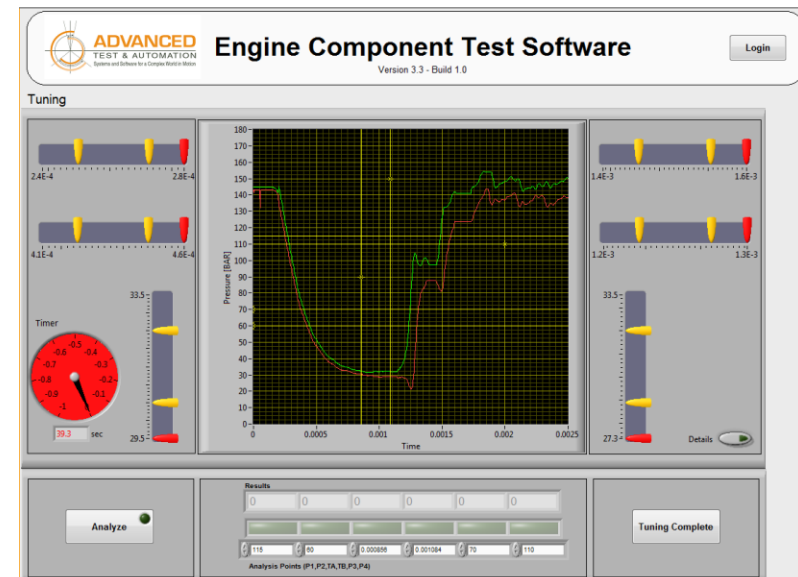
# Superior Efficiency

- Easily configurable test limits allowed the client to modify the tuning criteria, as more information was gathered about the optimal tuning parameters for each injector head model, in turn resulting in further optimized actuator performance
- Advanced software features provided automatic test start when temperature targets are reached, waiting for supply pressure stabilization within specified tolerances, and automatic frequency and pulse-width adjustment for each actuator
- Quick component under test changeover times due to automated clamping and engagement systems, short test cycle time, and quick results feedback reporting



# Making Sense Of The Data

- During the tuning of both the diesel and natural gas actuators to their own specific parameters, a real-time update graph is showing the pressure response of the actuator head, as well as:
  - color coded sliding limits at 6 strategically located points to indicate the actuator has been tuned properly
  - numeric indicators for pressure trace values at various points
  - an analysis feature allowing the operator to capture current trace readings and save to a file if desired
- Opportunity to develop a reference system for all tuned injectors based on their serial numbers, providing proof to their customers that each injector actuator has been tuned to optimal parameters before being deployed for field usage



# Project Milestones

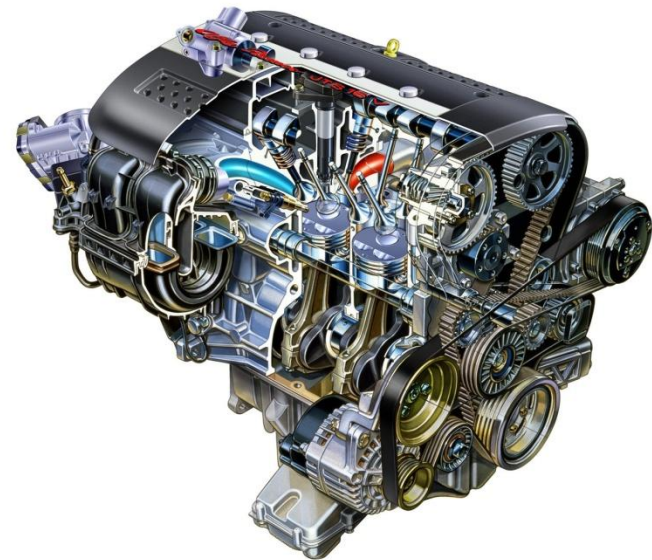
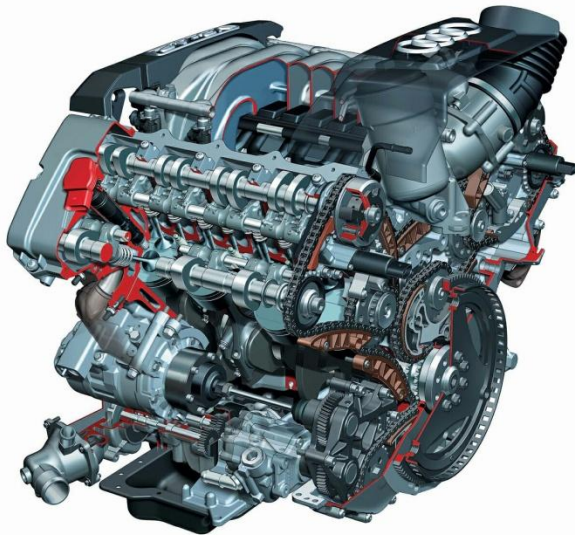
- The full scope of the project was delivered on-time and on-budget, along with the end-of-line injector test stand, in addition to ATA continuing to support the client during test stand operation, test script modification, or results analysis
- Upon project completion, all documentation needed for service and maintenance of the test stand was released to the client:
  - electrical, hydraulic and pneumatic drawings
  - mechanical drawings of custom fixtures and spare parts
  - comprehensive test stand and software manuals
- Proposal to full design time: 1 month
- Design to approval time: 2 weeks
- Software install to on-site setup time: 2 months
- On-site setup to test results time: 2 days





# Facts About ATA Inc.

- Certified Engineering Firm
- Specialized in Complex Rotating Components
- Formalized Project Management & Delivery Process
- Internal Design, Integration and Commissioning Team



# ATA Inc.

*Your Partner in Test*

For further information please contact:

Anthony Khoraych, P.Eng.  
**Advanced Test & Automation Inc.**

641 Main Street East  
MILTON ON L9T 3J2  
Canada

Tel: +1 (647) 477-6247, Ext. 32

Fax: +1 (647) 477-2180

[Anthony.Khoraych@advancedta.com](mailto:Anthony.Khoraych@advancedta.com)

“ Systems and Software for a Complex World in Motion”

[www.advancedta.com](http://www.advancedta.com)