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Engine test development for evolving specifications

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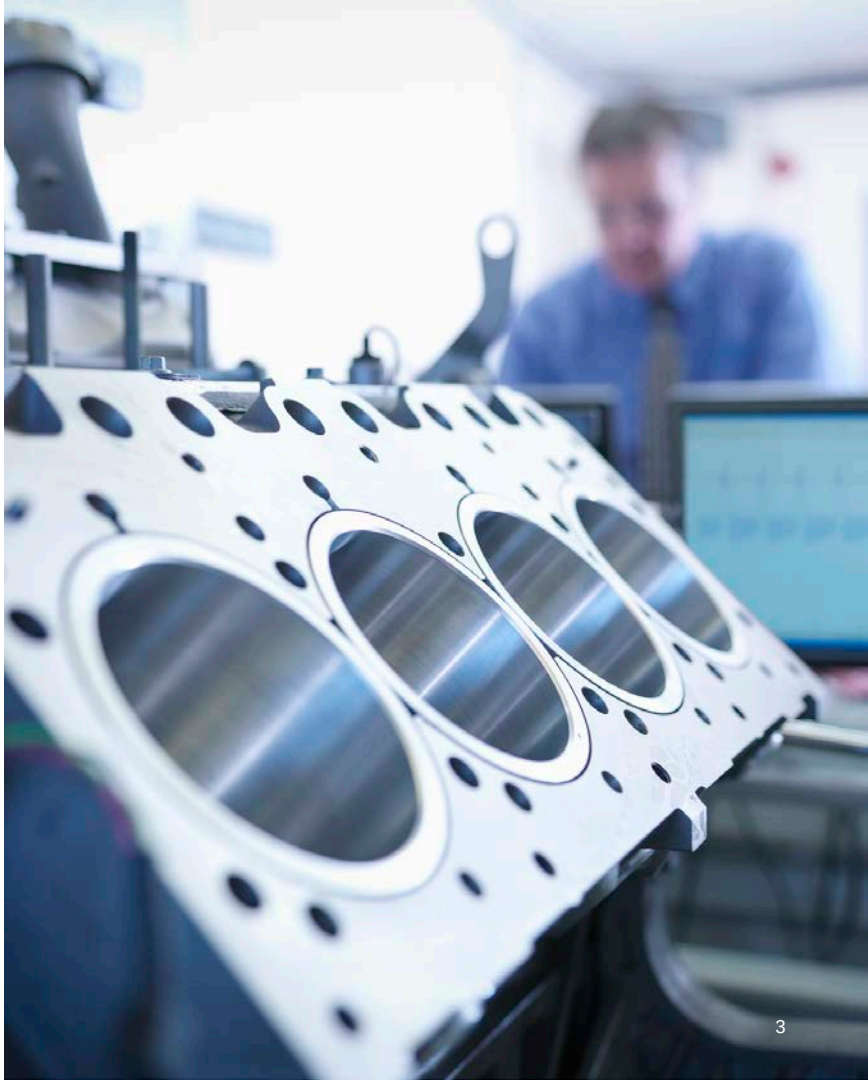
Engine test development

What we'll discuss today:

- Industry challenges
- Current best practices
- Options for a more efficient approach



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As technology advances, complexity increases

Thermal Management

Cooled EGR

Injection Rate Shaping

Drive by Wire

Variable Valve Lift

Altitude Compensation

Turbo Compounding

Variable Geometry Turbocharger

Displacement on Demand

Cylinder Deactivation

Variable Compression Ratio

Variable Valve and Cam Timing

Engine testing increasingly complex and costly

- Critical component for industry / OEM categories for engine oils
- Test development challenges:
  - Complexity of modern engines
  - Resource limitations

Current systems

Approaches vary by region with some common features

- ASTM procedures used to define tests for API standards
- CEC procedures used to define tests for ACEA standards

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Test Development Flow

- Current ASTM and CEC practices have similar flow
- There are key differences in some specific areas – funding and transparency
- Elements from both systems should be incorporated into an optimized approach

	ASTM	CEC
Identify Need	New tests associated with new categories; replacement tests as needed	New tests associated with new/updated categories; replacement tests as needed
Initial Test Selection	Typically proposed by an individual OEM	Proposed by an OEM or CEC Special Projects Group
Initial Test Validation	Done by OEM with selected partners	CEC Test Development Group at lead lab
Finalize Test Conditions	Task Force formed; expand testing beyond initial labs	Additional labs engaged
Test Acceptance	ASTM / ACC procedures after precision work. Formal vote	CEC Management Board approves test. Consensus discussion
Long-Term Monitoring	ASTM Test Monitoring Center coordinates	CEC Statistical Development Group
Long-Term Test Maintenance	Managed by ASTM Surveillance Panels	Test Surveillance Group

- ASTM principles and procedures for an open process
- Establishing standard test methods
- Long-term monitoring of tests
- Specifications effectively protect consumers

- Inconsistent preparation during early stages of test development
- Roles and responsibilities not always clear
- Insufficient preliminary discrimination and precision validation
- Limited resources (funding and test capacity) lead to significant delays

Impacts on lubricant specification timing and long-term viability

No standard global practice for engine test development

- Delays defining updated specs for new engines
- Difficulty establishing replacement tests for current specs

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Implications of test delays

- OEM concerns with increased warranty exposure
  - Lubricant categories not keeping pace with engine changes
- Limited ability for lubricants industry to plan effectively
- Consumers not getting the optimal lubricant technology on a timely basis

A new approach is needed

Global evergreen test development and maintenance

Retain positive aspects of current systems

Gated process to guide test development

Industry sponsored funding and program management

Evergreen test development and maintenance

- Test development managed by independent organization
- Ongoing activities to define new and replacement tests
- Improved planning for test life cycle

Retain positive aspects of current systems

- Transparency / open process
- Establishing and communicating standard test procedures
- Statistical monitoring of tests
- Continue to develop tests to protect consumers

Gated process to guide test development

- Clearly defines roles and responsibilities
- Early focus to validate test relevance
- Confirms tests are fit for purpose
- Includes plan to exclude a test or define an alternate in a specification
- Enhances ability to anticipate issues related to broad test use

Industry sponsored funding and program management

- Consistent budgeting and oversight to overcome resource limitations
- Improved industry capability to monitor and adjust tests in use
- Preliminary $4-6M/yr budget estimate to fund ongoing test developments

Key takeaways

- Once developed, engine tests and specifications provide adequate consumer protection, but timeliness and cost must be improved
- Improving test development efficiency will benefit all stakeholders
  - Decrease OEM warranty concerns
  - Allow the lubricants industry to plan effectively
  - Ensure that consumers will have access to optimal lubricants for their vehicles
  - Provide a formalized structure that will bring cost savings to the broad industry

Looking ahead

- Areas to improve test development should be explored
  - Clarification of roles and responsibilities
  - Consistency and transparency of the development process
  - Funding/ resourcing
- API initiated Lubricant Standard Development Review group
  - Test development to be a major focus area; learnings can be applied globally
- ExxonMobil will be the first to support an increase in fees to fund this effort


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