American Chemistry Council
Product Approval Protocol Task Group (PAPTG)

Engine Test Development
Project Management Considerations
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Introduction

Quality engine tests are necessary to appropriately define, measure and discriminate the performance of lubricants. This is a foundational principle of acceptance of an engine test into the ACC Code of Practice. Designing "quality" into an engine test early in the development process has shown improvements in timeliness and industry acceptance. As such, ACC PAPTG provides this set of considerations for applying project management principles to engine test development for those who are developing such tests to follow.

Overview

Developing a new engine test is a complex and difficult task. Engine test development may be required when an existing engine test is no longer available for use or when a new engine oil performance measurement is required

While different activities and criteria may be required, all new engine test developments may benefit from using the principles of project management –

- Well-defined project goals and objectives
- Define your deliverables and what success is at the start
- Clear team roles and responsibilities
- Strategy for initiation and execution
- Careful budgeting and scheduling
- Identify priorities and milestones
- Establish accountability and responsibility
- Create a communication plan; be transparent with stakeholders
- Develop a risk assessment and actively manage risks
- Monitor and measure progress; active decision making

This document provides commentary and recommendations as to how project management principles may be applied to the engine test development process. It is organized into four main sections:

- Pre-Development Considerations
- In-Development Considerations
- Post-Development Considerations
- Communication

Pre-Development Considerations

The engine test development process begins with a stated need, such as "we need to measure a new fluid performance criteria" or "we need to develop a replacement engine test to maintain older API categories". A project "sponsor" must be identified to champion the effort; typically, an OEM or party with specific knowledge of the need and/or expertise in that area. The project "sponsor" may or may not become the engine test development project lead or manager.

Planning for a successful project is the key focus during this stage. Project Sponsor development of a Project Charter that details the project scope (what's in, what's out), goals & objectives, deliverables, timing, metrics and process for stage gate decisions, and vision of success can help provide parameters for the project. The Charter may also include information as to the proposed project team, resourcing requirements, and key risks:

Information Generally Included in New Test Charter

1. What phenomenon will the test try to measure and how?
    a. Name phenomenon and how many parameters you need to measure.
2. Is need supported by field data?
    a. Where possible, provide data on failure modes/rates, and fluids involved.
3. Is need supported by engine development or durability data? (Corollary to previous).
    a. Where possible, provide data from in-house testing, including hardware, oils, test cycle and fuels.
4. Is need due to novel engine development, platform direction or regulatory (emissions, fuel economy) requirement?
    a. Where possible, provide information on development direction and why current lubricants are expected to be deficient.
5. Is the need precipitated by a change in service requirement, e.g., drain interval or legislative requirement?
6. Is the need due to a changing chemistry, i.e., sustainable chemistry, legislative requirements like REACH, bio-sourced and/or re-refined base stocks?

Information Generally Included in Replacement Test Charter

1. What phenomenon will the test try to measure and how?
    a. Name phenomenon and how many parameters you need to measure.
2. What do you expect this test to be backwards compatible with?
    a. What specific performance or specification limits will you target?
    b. Will the new test deliver at least comparable discrimination and precision to its predecessor as measured by its current reference oil slate?
3. What is status of current test and why does it need to be replaced?
    a. Evaluate if the test is still needed.
    b. Is there an alternate, existing test in place that can be adopted?
    c. If replacement is hardware supply related, have all possible solutions to continue supporting existing test been exhausted?
4. How long is existing test expected to be viable?

Additional Information Useful to Include in all Test Development Charters

1. Is the requested test redundant with an existing measurement tool? Could the parameter be evaluated with an existing test or a bench test?
2. What engine platform will be used?
    a. Provide information or data used for selection process. (inter-OEM discussions, intra-OEM platform rationale, etc.)
    b. Will proposed platform hardware (including expected critical parts) be available for next 10 years, minimum?
    c. Is “specialty” hardware required? Included would be non-standard wear or rating components, or any other modified or non-OEM components.
3. How will parts be managed?
4. If a Central Parts Distributor (CPD) is required, have any discussions with CPD’s taken place? Are commitments in place?
    a. If so, explain the current status
5. Has any pre-development work taken place?
    a. If so, provide data and any commentary

Once the Engine Test Development Project Charter has been developed, the OEM Sponsor should communicate and review the Charter with key stakeholders. Key stakeholders are those parties involved in the test development process and intended users of the subject test; these may include individual companies, such as parts suppliers, test laboratories, additive companies, oil marketers, and engine manufacturers who may recommend use of lubricants qualified by the test or trade associations, such as API, ACC, ASTM etc… who may publish the final test procedure as a public standard, accept the test into a lubricant quality monitoring & registration system or into a lubricant performance specification.

Alignment and agreement on the Project Charter by all Stakeholders provide the necessary information for resourcing estimates to be developed and stakeholder funding discussions to begin.

The Test Development Project Team should be selected at this time with the project's objectives and vision of success in mind. Recommendations for the Test Development Project Team are:

- Core Team Members
    A. A Test Sponsor (typically OEM for Engine Test, test developer for bench test)
    B. A Statistician
    C. An Additive Company and/or an Oil Marketer as "Fluids Subject Matter Expert"
    D. A Project Manager
    E. A Test Development Engineer
- Potential Other Team Members
    A. A Base Stock Supplier (ideally supplying various types of Base Stocks)
    B. A Fuel Supplier
    C. A Parts Supplier
    D. Other subject matter experts

In-Development Considerations

While other project management formats and techniques exist, it is recommended that a Stage-Gate process by used during the engine test development project. This process provides for the clear definition of deliverables and milestones in an increment fashion and allows for key stakeholder review and alignment to occur at the end of each stage in a "gate meeting" and prior to the start of the next. Active decision making during the gate meeting can mitigate concerns and risks early in the test development process, leading to faster development times and greater probability of success. At each gate, a decision to go, hold, recycle, or kill is made by the Test Development Project Team.

A six stage Stage-Gate process is recommended:

- Stage 1: Proof of Concept
- Stage 2: Test Procedure Standardization
- Stage 3: Industry Prove Out
- Stage 4: Industry Precision Matrix
- Stage 5: Test Monitoring & Control
- Stage 6: Test Acceptance for Use

Stage 1: Proof of Concept activities focus on answering the questions – Is the proposed test capable of measuring the fluid performance criteria and show differentiation between "good and bad" oils in one lab/one stand and Are the results repeatable in a second lab/stand?

Specific activities within Stage 1 may include:

1. Identify the development oils and rationale. These should be commonly available, fully formulated fluids and not "boutique". For new test development, the fluids should be of current technology and performance.

2. If preliminary development work has happened, specify whether a development lab has been identified or contacted?
    a. If so, explain who, why, and level of current involvement.

3. Has a specific stand design been identified?
    a. If so, explain rationale and special requirements.

4. Are Design of Experiment (DoE) approaches being considered to identify potential severity "levers"? These levers could be hardware, fuel or operational related. If so, explain.

5. Identify development plan, including test cycle and hardware proposals, number of expected runs per fluid, DoE's planned, etc.

6. What metrics will be in place to ensure initial development needs are met?
    a. (parameters, Coefficient of Variance, Quality Indices or other measure, etc.)

7. Will the development work provide deliverables meeting industry templates, such as ACC CoP Appendix K and Tab 6?

Stage 2: Test Procedure Standardization activities include developing, finalizing & distributing (at least in draft form) the test procedure, identify critical parts, and selecting labs for participation in precision matrix (ideally 3 labs). Stage 2 should focus on answering the question – Is the test sufficiently defined (test procedure, hardware, EOT measurements, etc…)

and are any of these considerations likely to change before, during or after the start of the Precision Matrix?

Stage 3: Industry Prove-Out focuses on answering the question – Are all labs, who wish to run the test, capable of installing the test, using the defined test procedure, and producing test results with precision and discrimination similar to Stage 1 data? Stage 3 may include Test Development team visits and audits of each laboratory's installation and set-up, coordinated reference oil runs by the laboratories, and other procedural alignment activities.

Stage 4 Industry Precision Matrix focuses on answering the question – What is the repeatability and reproducibility of the test procedure and laboratories when running a broad selection of fluids anticipated to use the test procedure to measure fluid performance? Stage 4 activities include developing a statistical precision matrix design, selecting the precision matrix fluids, considerations for collecting additional information such as BOI/VGRA data, running the matrix and statistical analysis of the results after matrix completion, comparing the outcome of the statistical analysis to the original definition of success for Stage 4, and if not consistent, instigating the mitigation plan.

Stage 5: Test Monitoring & Control focuses on answering the questions – Is a system in place to identify if the test is changing over time using defined reference fluids and is a system in place to determine why this is occurring and take action to return the test to historical performance levels through procedural modifications and/or severity adjustments. Stage 5 may include formation of a test Surveillance Panel or assignment of the test to an existing Surveillance Panel, establishment of an LTMS or similar test monitoring system, and selection of appropriate reference fluids.

Stage 6: Test Acceptance for Use focuses on a final review of these questions – Has the test met the Project Goals, Objectives and Vision of Success and Is the Test Acceptable for Use in a fluid performance specification[1]? Stage 6 activities may include inclusion of the test into the ACC Code of Practice and test registration, ASTM review and acceptance of the test procedure by the appropriate committees, API, or other stakeholder acceptance for inclusion of the test in a fluid performance specification.

Post-Development Considerations / Test Maintenance

Post-Development considerations include the active monitoring and management of Stage 5: Test Monitoring & Control activities along with a higher-level view of factors that may impact the test, such as test use rates vs. projections, parts availability and batch to batch qualification, reference oil availability, fuel batch qualification, etc.

It is recommended that the Project Sponsor, Test Development Project Manager, and the Surveillance Panel Chair review these criteria on, at least, a semi-annual basis.

[1] These questions are appropriate to review at each gate decision meeting at each Stage.

Communication & Engagement with Industry Stakeholders

The importance of communication cannot be overemphasized in Project Management. Ensuring all stakeholders are aligned on expectations, obligations, and vision of success throughout the test development process is critical to delivering a meaningful and quality engine test.

Report outs to stakeholders using standardized formats such as a Test Readiness template, the ACC CoP Appendix K and Tab 6 checklist, or other recommended to ensure consistency of message and focus on the milestones and deliverables which result in a successful engine test development project. Report outs should take place whenever there is a meeting where the stakeholders are gathered such as, but not limited to, ASTM D.02.B Class Panels, API Oil Advisory Panels and the like. A feed back mechanism to the Test Development Project Team should be a part of the report out.

Summary

Developing a new engine test is difficult and complex task. The principles of project management can greatly benefit this process. Deliberate consideration within each stage followed by a “gate” review prior to entering the next stage will keep the project on track to meet the original intent and goals of the project. This document describes those questions which should be considered during each stage and gate of the process to obtain a quality engine test.