Sequence IV Surveillance Panel | MINUTES

REVISION DATE: 11/2/2018 10:43:00 AM

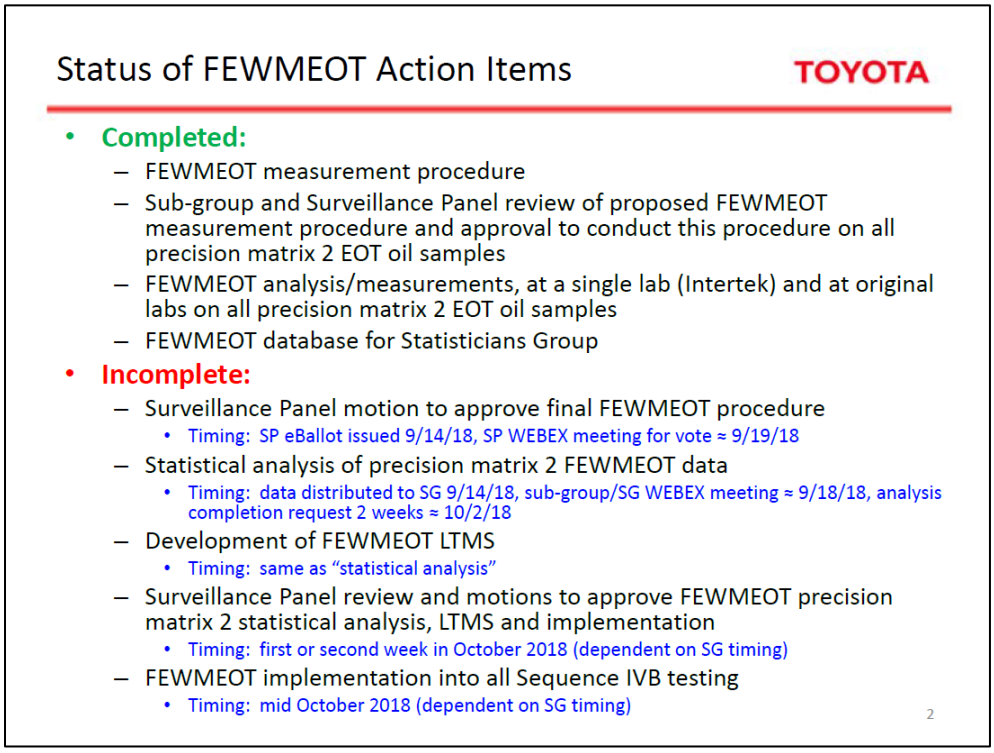
Relevant Test:	Sequence IVA and IVB
Note Taker:	Chris Mileti
Meeting Date:	09-26-2018
Comments:	Surveillance Panel conference call to discuss the finalization of Sequence IVB test.

1. REVIEW OF RECENT AOAP UPDATE (BUSCHER):

1.1. Opening Comments from Chairman:

1.1.1. He recently provided the Industry with an update on Sequence IVB activities.
1.1.1.1. This update was directed to the AOAP, ACC and BOI/VGRA Task Force.
1.1.2. There was a lot to discuss because the three IVB sub-groups have done a lot of work over the summer.

1.2. Slide #2:



1.2.1. The three IVB sub-groups have focused on the following areas:
1.2.1.1. FEWMEOT (end-of-test iron parameter)
1.2.1.2. Camshaft lobe failures
1.2.1.3. Oil consumption as a validity limit
1.2.1.4. Engine life guidelines

1.2.2. Buscher reviewed the work that has been completed along with the work that is still in-progress.

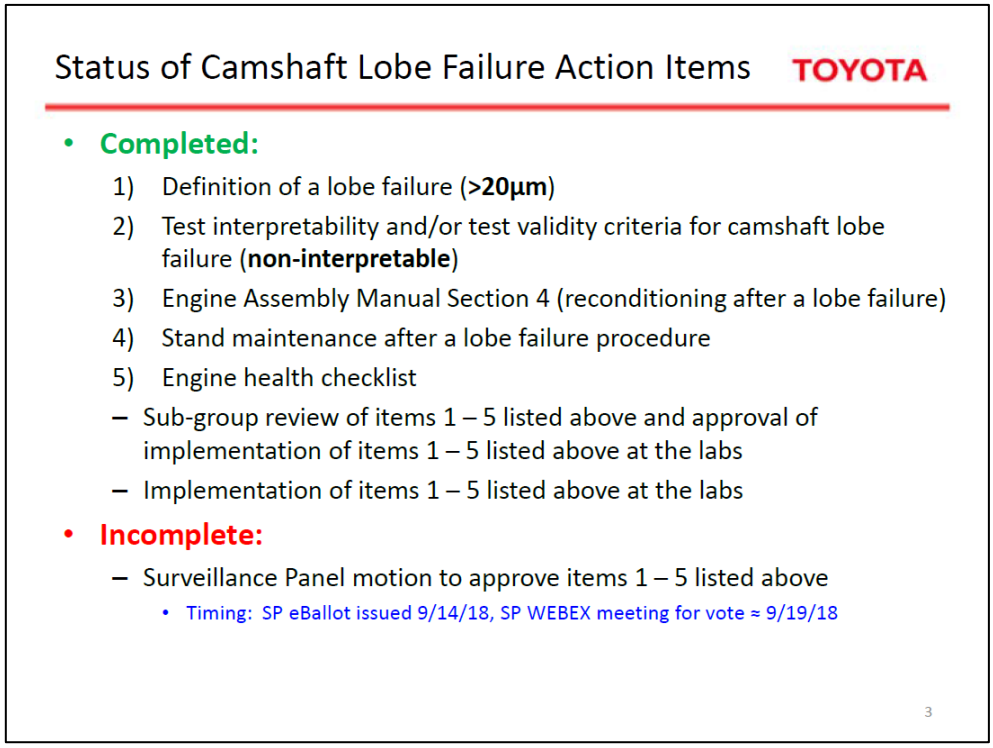
1.2.3. FEWMEOT:

1.2.3.1. The iron measurement procedure has been finalized.

1.2.3.2. The labs have retroactively applied this detergent adjustment to the end-of-test oil samples from the 2nd Precision Matrix.

1.2.3.3. The sub-groups have recently decided to apply this detergent adjustment to all the reference tests run since the Precision Matrix.

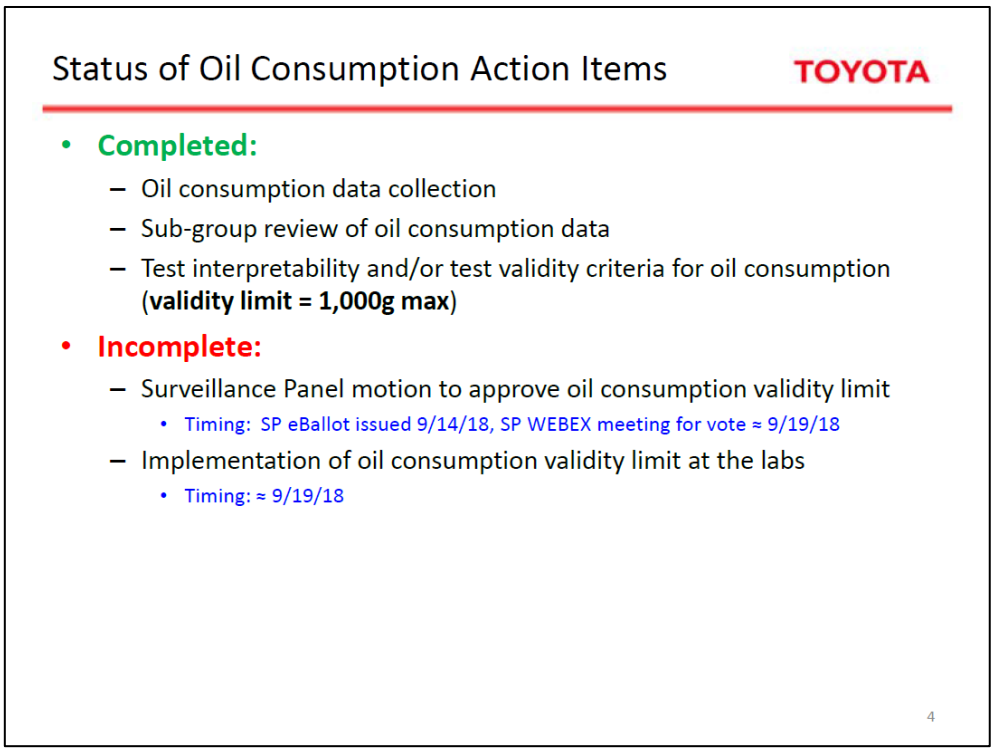
1.3. Slide #3:



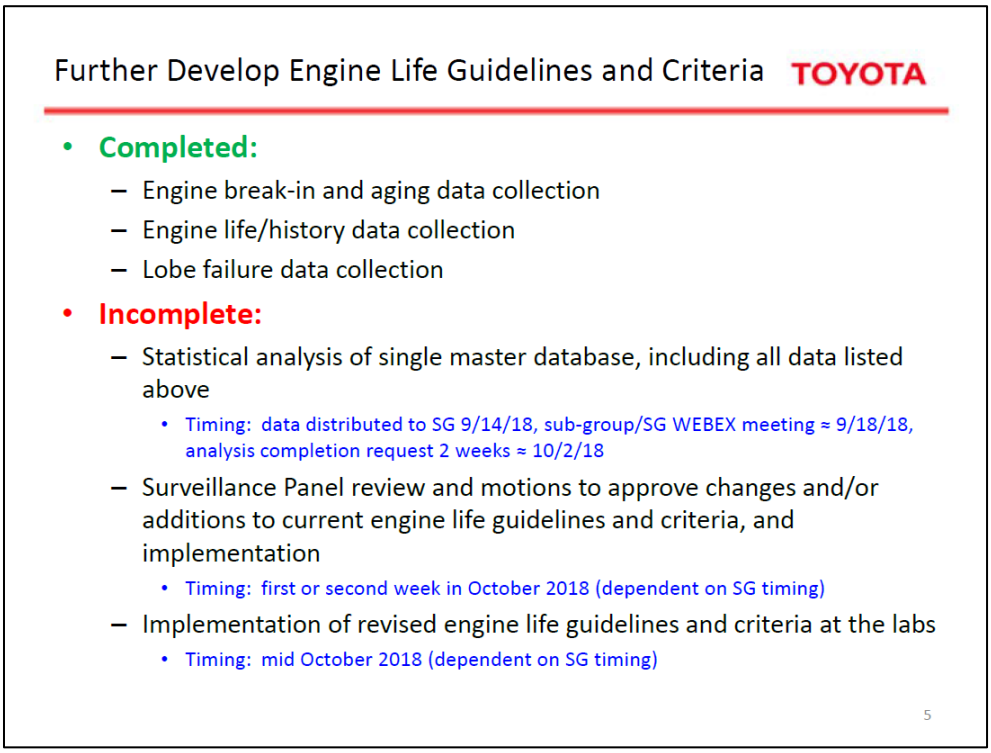
1.3.1. The goal for today's conference call is for the Surveillance Panel to vote on all the supplemental sections that have been created for the procedure.

1.3.2. The approved sections can then be added to the final ASTM draft.

1.4. Slide #4:



1.5. Slide #5:



1.5.1. The sub-groups have created a master database of all the tests conducted since the start of the Precision Matrix.

1.5.1.1. The current revision of this database has been distributed to the Statistics Group.

1.5.2. Additional data will be added as it becomes available.

1.5.3. The Statistics Group will be asked to analyze the final version of the master database.

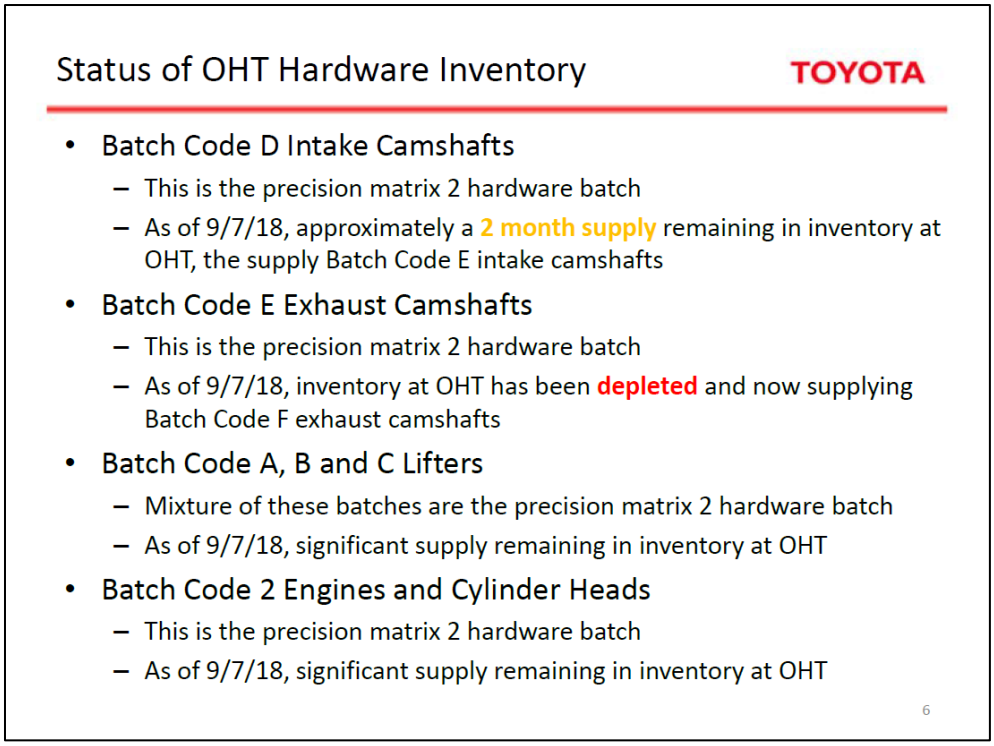
1.5.3.1. The Surveillance Panel can adjust the engine life guidelines based on their findings.

1.5.4. New Motion from Toyota:

1.5.4.1. The current engine life guidelines limit the engine block to (12) runs and the cylinder head to (6) runs.

1.5.4.2. Toyota plans to present a motion later in this meeting to revise the maximum number of runs on the engine block and cylinder head.

1.6. Slide #6:



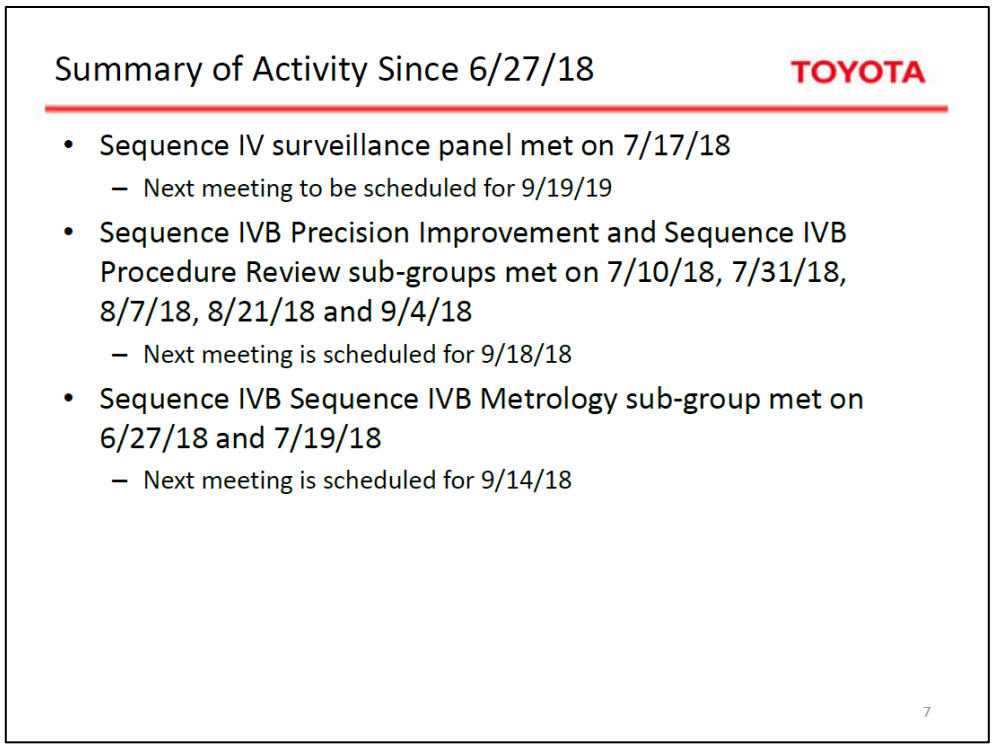
1.6.1. The BOI/VGRA committee asked a lot of question about the current inventory of IVB hardware.

1.6.2. The Industry is in the process of switching from Batch-D intake camshafts to Batch -E intake camshafts.

1.6.3. The Industry is now using Batch-F exhaust camshafts.

1.6.4. There are no major changes to the lifter and engine hardware batches.

1.7. Slide #7:



1.7.1. This slide summarizes all the meetings held by the three IVB sub-groups.
1.7.2. Lubrizol was asked to update the IVB Action Item list and distribute it to the Surveillance Panel.

2. REVIEW OF RECENT SUB-GROUP ACTIVITIES:

2.1. Procedure and Precision Sub-Groups (Buscher):

2.1.1. These two sub-groups have been working since May of this year.
2.1.2. They have accomplished a lot.
2.1.3. There is a massive data collection effort underway.
2.1.3.1. This data is being inputted into a master database that should be finalized today or tomorrow.
2.1.4. A conference call was held with the Statistics Group last week.
2.1.4.1. The purpose of this conference call was to discuss the objectives of their upcoming analysis of the master database.

2.2. Metrology Sub-Group (Lubrizol):

2.2.1. The Metrology Sub-Group has focused on two main objectives.
2.2.2. Objective #1 – Keyence Round-Robin:
2.2.2.1. The original three IVB labs have previously conducted round-robin trials.
2.2.2.2. However, this is the first round-robin to include the Keyence units from all five laboratories.
2.2.2.3. A single set of lifters will undergo pre-test and post-test measurements at all five labs.
2.2.2.4. The data will then be given to the Statistics Group for analysis.
2.2.2.5. Intertek used these lifters for a REO300-1 Industry information run.
2.2.2.6. The pre-test measurements are complete, and the post-test measurements are underway.
2.2.2.7. The round-robin may not be complete until November.

2.2.3. Objective #2 – Use Keyence to Pre-Screen Lifter Profiles:

2.2.3.1. The IVB procedure previously specified that the PDI profilometer be used to screen lifters for an acceptable crown.

2.2.3.1.1. This process was very time-consuming.

2.2.3.2. The Metrology Sub-Group agreed upon a procedure to use the Keyence to screen lifters for profile acceptability.

2.2.3.3. The Keyence is quicker and more accurate.

2.3. Camshaft Batches:

2.3.1. One of the conference call attendees asked if camshaft batches are listed in the IVB test report.

2.3.2. Comments from Buscher:

2.3.2.1. Yes, the camshaft batch is included in the test report in Form 11.

2.3.2.2. The batches are included in the serial number fields.

2.3.2.3. The serial number suffix identifies the batch.

2.4. FEWMEOT Data from Reference Tests:

2.4.1. The five Sequence IVB laboratories previously decided to repeat the start-of-test and end-of-test ICP measurements for their recent reference tests.

2.4.1.1. The repeat measurements will be used to calculate a calcium-adjusted end-of-test iron.

2.4.2. Intertek's repeat measurements will be done today.

2.4.3. Lubrizol's repeat measurements are done.

2.4.4. Southwest's repeat measurements are done.

2.4.5. Lubrizol confirmed that the three consecutive reference tests that it completed as part of an internal engine life study are in the master database.

3. MOTIONS:

3.1. Motion #1:

3.1.1. ***Motion:*** *"Sequence IV surveillance panel approves the addition of the "IVB FEWMEOT measurement procedure R.1" to the Sequence IVB ASTM draft procedure. The Sequence IVB test report forms and data dictionary will be updated accordingly. Effective for all Sequence IVB candidate and reference oil tests started on or after 10/9/18.*"

3.1.2. This motion will require an update to the IVB report form and data dictionary.

3.1.3. The implementation date will give the laboratories two weeks to implement the necessary changes.

3.1.4. The laboratories will need to update their analytical procedures.

3.1.5. This motion only involves the implementation of the detergent-adjustment measurement procedure.

3.1.6. Comments from TMC:

3.1.6.1. The detergent-adjustment measurement procedure is based on the procedure used for the Sequence IIIHB.

3.1.6.1.1. Coincidentally, the procedure for the IIIHB was recently changed (Revision R.1).

3.1.6.1.2. Section 11.4.6.1 was modified to adjust the sample dilutions.

3.1.6.1.3. The IIIHB change is reflected in the IVB procedure.

3.1.7. Toyota made the motion and Intertek seconded the motion.

3.1.8. The motion passed with a final vote of 17 approves, 0 negatives and 1 waive (TMC).

3.2. Motion #2:

3.2.1. ***Motion:*** *"Sequence IV surveillance panel approves establishing an oil consumption limit of 1,000 grams maximum for the Sequence IVB test. Any candidate or reference oil test exceeding oil consumption of 1,000 grams will be reported as Invalid "I" and "has not" on Form 1 and with "No" checked for declaration No. 1, with "No" checked for part 1 of declaration No. 2 and with either "Yes" or "No" checked for part 2 of declaration No. 2, as per the test engineer's discretion, on Form 14 of the Sequence IVB test report. The Sequence IVB ASTM draft procedure will be updated accordingly. Effective for all Sequence IVB candidate and reference oil tests started on or after 9/26/18."*

3.2.2. The Precision Sub-Group discussed the proposed oil consumption limit.

3.2.3. The Sub-Group debated whether it should be a validity limit or an interpretability limit.

3.2.3.1. It was decided to make it a validity limit.

3.2.4. The maximum allowable oil consumption will be 1000g at the end of the test.

3.2.5. Previous testing has shown that oil pump starvation becomes a problem when oil consumption exceeds 1200g.

3.2.5.1. Only a few tests in the master database have oil consumptions this high.

3.2.6. The ACC previously told the Surveillance Panel that they would like to see an oil consumption limit for this test.

3.2.6.1. This motion should help address that.

3.2.7. Comments from Afton:

3.2.7.1. This test has a significant amount of water and fuel dilution.

3.2.7.2. *Should this be considered during the oil consumption calculation?*

3.2.8. Comments from Intertek:

3.2.8.1. The purpose of the oil consumption limit is to prevent aeration, so the volume of fluid in the sump is all that matters.

3.2.8.2. Intertek also confirmed that the oil consumption calculation is adjusted for the 25HR oil samples.

3.2.8.3. Oil viscosity and engine hours can affect oil consumption.

3.2.8.4. In general, the oil consumption ranges between 100g-850g by the end of the test.

3.2.8.5. Oil consumption above 850g is generally considered to be an anomaly.

3.2.8.6. It is not uncommon for a lab to have a negative oil consumption.

3.2.9. Comments from Valvoline:

3.2.9.1. Other test types have a "cushion" in their oil consumption limit.

3.2.9.2. Does 1000g give the Sequence IVB a "cushion"?

3.2.9.3. Intertek believes that there is enough "cushion" with the current limit.

3.2.9.3.1. The oil gallery pressure does not start to degrade until well above 1000g of oil consumption.

3.2.10. Dipstick vs. Oil Mass:

3.2.10.1. Intertek confirmed for Afton that the oil consumption limit was based on oil drain mass measurements and not dipstick measurements.

3.2.10.1.1. The 1000g limit was the result of trials run with a sight glass in the oil pan to observe aeration.

3.2.10.1.2. Other trials were run that confirmed oil mass measurements are more consistent than dipstick measurements.

3.2.10.2. Lubrizol believes that the installation angles of the engine make dipstick measurements too inconsistent.

3.2.10.2.1. Even small variations in the side-to-side installation angle can have a big impact on the dipstick reading.

3.2.11. Lubrizol made the motion and Toyota seconded the motion.

3.2.12. The motion passed with a final vote of 18 approves, 0 negatives and 0 waives.

3.3. Motion #3:

3.3.1. There was discussion within the Panel about introducing a motion to limit the allowable number of tests on an engine block.

3.3.2. The test guidelines allow for (12) runs on an engine block and (6) runs on a cylinder head.

3.3.2.1. The draft procedure contains an "X" for the allowable number of runs on the engine and cylinder head.

3.3.3. Comments from Intertek:

3.3.3.1. The longevity of an engine depends on factors such as oil viscosity, oil performance and camshaft lobe failures.

3.3.3.2. Most engine blocks can be used for 5-6 tests without issue.

3.3.3.3. In rare cases, an engine block will last for 9-10 tests.

3.3.3.4. In the future, the Industry may be able to get more runs out of a block as chemistry evolves.

3.3.3.5. Toyota is recommending that the test be temporarily modified to limit both the engine block and cylinder head to (6) runs.

3.3.3.5.1. This means that cylinder head replacements will no longer be routine.

3.3.3.6. These limits can be reevaluated after the Statistics Group has time to review the IVB master database and the Surveillance Panel gains more experience with this test.

3.3.3.7. Toyota did review this proposal with the central parts distributor.

3.3.4. Comments from Infineum:

3.3.4.1. *Should the statisticians discard data from tests with more than six runs on an engine block when conducting their analysis?*

3.3.4.1.1. Intertek does not feel that the statisticians should discard any data at this point.

3.3.4.1.2. The data will help the Surveillance Panel make changes in the future.

3.3.4.2. *Should a motion to limit the number of runs on an engine be "tabled" until the statisticians can review the master database?*

3.3.4.2.1. Afton agreed that this is appropriate.

3.3.4.2.2. This issue can be revisited during the October 4th meeting after the Statistics Group has time to review the database.

3.3.5. Feedback from Statistics Group:

3.3.5.1. The statisticians do not have the final version of the master database.

3.3.5.2. There are only a few business days between this meeting and the October 4th meeting (especially considering travel days).

3.3.5.3. The current revision of the master database does not have a lot of tests with engines that have more than four runs.

3.3.5.4. The Surveillance Panel will need to manage its expectations regarding this analysis.

3.3.6. Comments from Toyota:

3.3.6.1. The current situation is like what happened with the Sequence IVA test.

3.3.6.2. The longevity guidelines for the Nissan engine were loosened over time.

3.3.6.3. They feel that (6) runs on an engine block and cylinder head is a good starting point.

3.3.6.4. The Surveillance Panel cannot wait forever for an adequate amount of data in the master database for a statistical analysis.

3.3.6.5. The Panel will need to make an engineering decision if the Statistics Group does not have enough data for a recommendation.

3.3.7. Comments from Intertek:

3.3.7.1. The Sequence IVA test started as a JASO procedure.

3.3.7.2. The North American version was developed between Southwest and Nissan.

3.3.7.2.1. This development took place between 1996-1998.

3.3.7.3. Nissan originally chose to limit the engine life to (12) runs on the block and (6) runs on the cylinder head.

3.3.7.4. These limits were reevaluated approximately (6) times over 20-years.

3.3.7.5. The current IVA procedure allows for (48) runs on an engine block and (24) runs on a cylinder head.

3.3.7.6. In fact, one of the independent labs continued running an engine block for over 60-tests.

3.3.7.6.1. These tests were unregistered.

3.3.8. Additional Feedback from Statistics Group:

3.3.8.1. The statisticians will focus on a loss of oil discrimination when making a recommendation regarding engine life.

3.3.8.2. What parameters should they look at?

3.3.8.3. *Reply from Intertek:*

3.3.8.3.1. The parameters should include cumulative oil consumption, unadjusted end-of-test iron, cumulative iron and oil pressure degradation.

3.3.8.3.2. There is even candidate data for some of these parameters in the master database.

3.3.9. Comments from Toyota:

3.3.9.1. The main concern regarding engine life is that a test will get severe as the engine ages.

3.3.9.2. Up to a certain point, an engine can tolerate wear and still control oil consumption.

3.3.9.3. Intertek noted that a drastic increase in blowby was used to determine excessive engine age with the Sequence IVA.

3.3.10. The Panel agreed to postpone a vote regarding this motion.

3.3.10.1. It will be up to the discretion of each lab to determine if they want to replace hardware before the current guidelines.

3.4. Motion #4:

3.4.1. ***Motion:*** *"Sequence IV surveillance panel approves the definition of a camshaft lobe failure, as any camshaft lobe experiencing heel to toe wear greater than 20 µm. The Sequence IVB ASTM draft procedure will be updated accordingly. Effective for all Sequence IVB candidate and reference oil tests started on or after 9/26/18."*

3.4.2. The Precision Sub-Group previously decided on a 20µm limit.

3.4.2.1. This may seem like a small amount of wear, but typical IVB tests generate around 1-7µm of lobe wear.

3.4.3. Comments from Lubrizol:

3.4.3.1. Camshaft wear for this test is very binary.

3.4.3.2. There is no "middle ground".

3.4.3.3. The camshaft either has less than 10µm of wear, or the camshaft experiences a lobe failure.

3.4.4. Camshaft lobe failures are currently a rate-and-report parameter.

3.4.5. Comments from Total:

3.4.5.1. Can a range of lobe wear be expected on a test that is experiencing a lobe failure?

3.4.5.2. *Reply from Intertek:*

3.4.5.2.1. A camshaft lobe can exhibit 100-150µm of wear during the early stages of a lobe failure.

3.4.5.2.2. A camshaft can exhibit 3200µm of wear when the lobe gets worn to its base circle.

3.4.5.2.3. The amount of lobe wear is determined by how quickly the lab can identify that there is a problem.
3.4.5.2.4. The ECU identifies when a cylinder starts misfiring due to a lobe problem.
3.4.5.2.5. The ECU will then alter the performance of the engine during the Stage 1→2 transition.
3.4.5.2.6. In other words, the engine will no longer be able to achieve the necessary ramp time.
3.4.5.2.7. There may also be a step-change in the oil pressure.
3.4.5.2.8. It is possible for a test to reach 200HRS with a camshaft lobe failure.
3.4.5.2.9. However, the test will still be classified as non-interpretable if the lobe wear exceeds 20µm.

3.4.6. Intertek made the motion and the motion was seconded by Toyota.
3.4.7. The motion passed with a final vote of 17 approves, 0 negatives and 1 waive (Total).

3.5. Motion #5:

3.5.1. ***Motion:*** *"Sequence IV surveillance panel approves reporting any Sequence IVB candidate or reference oil test experiencing one or more camshaft lobe failures as non-interpretable. Any candidate or reference oil test experiencing one or more camshaft lobe failures will be reported as "N" and "has" if conducted full duration (200 hours), or "has not" if terminated early, on Form 1 and with "No" checked for declaration No. 1, with "Yes" or "No" checked for part 1 of declaration No. 2, depending on whether or not the test was conducted full duration, and with either "Yes" or "No" checked for part 2 of declaration No. 2, as per the test engineer's discretion, on Form 14 of the Sequence IVB test report. The Sequence IVB ASTM draft procedure will be updated accordingly. Effective for all Sequence IVB candidate and reference oil tests started on or after 9/26/18."*

3.5.2. ACC Presentation:

3.5.2.1. Afton confirmed that the ACC distributed a presentation to the Surveillance Panel this morning.
3.5.2.2. This two-page presentation lists their opinions and concerns about the IVB test.
3.5.2.3. Several attendees recommend that the Panel discuss the ACC presentation before the October 4th meeting.
3.5.2.4. *Comments from General Motors:*
3.5.2.4.1. The Surveillance Panel should focus on the motions first, and then review the ACC presentation after the voting is complete.
3.5.2.4.2. A 2nd meeting or conference call can be scheduled to discuss the ACC issue if needed.

3.5.3. Comments from Afton:

3.5.3.1. They do not remember the Surveillance Panel deciding that a lobe failure will be classified as uninterpretable.
3.5.3.2. A lobe failure should be classified as invalid.
3.5.3.3. Lubrizol confirmed that Afton is correct, the Precision Sub-Group never decided whether a lobe failure should be classified as uninterpretable or invalid.
3.5.3.4. Toyota stressed that camshaft lobe failures are strongly affected by oil formulations.
3.5.3.5. Afton countered that there is also a hardware dependency.
3.5.3.6. Ultimately, this issue comes down to test cost (that is why "non-interpretability" keeps coming up).

3.5.4. Question from Infineum:

3.5.4.1. *Is there a database of repeat testing on oils that have experienced a camshaft lobe failure?*

3.5.4.2. Afton noted that they recently repeated a test that had a lobe failure, and the repeat test completed without issue.
3.5.4.3. Intertek has repeated several tests that originally had lobe failures.
3.5.4.3.1. The repeat tests complete without issue about 50% of the time.
3.5.4.3.2. Only about half of their customers have chosen to repeat tests that were aborted for lobe failures.
3.5.4.4. Exxon has had a similar experience as Afton.
3.5.4.4.1. Their repeat tests have completed without issue.

3.5.5. Comments from Southwest:

3.5.5.1. A camshaft lobe failure should be classified as non-interpretable if the lab follows the procedure.
3.5.5.1.1. Anomalies can still occur that are out of the lab's control.
3.5.5.2. The issue of non-interpretability really does not have anything to do with whether the lobe failure is due to chemistry or hardware.
3.5.5.3. It simply means that the lab did not do anything wrong.

3.5.6. Oil Consumption:

3.5.6.1. Afton asked why camshaft lobe failures are considered non-interpretable while high oil consumption is considered invalid.
3.5.6.2. *Reply from Intertek:*
3.5.6.2.1. Engine age is one of the main factors in oil consumption.
3.5.6.2.2. The lab decides whether to keep running an engine.

3.5.7. Intertek made the motion and Toyota seconded the motion.
3.5.8. The motion passed with a final vote of 6 approves, 1 negative (Afton) and 1 waives.

Action Items	Person responsible	Completion Date

Follow-up Notes/Updates	Initials	Date Added

Attendees	Organization	Contact Information