September 22, 2004

Reply to: Fred Gerhart
Southwest Research Institute
6220 Culebra Road
P.O. Drawer 28510
San Antonio, Texas 78228-0510

Phone: (210) 522-3842
Fax: (210) 684-7523

UNCONFIRMED MINUTES from the SEQUENCE VIB SURVEILLANCE PANEL

Held in San Antonio, TX September 15th, 2004

Welcome

Chairman Charlie Leverett called the meeting to order. The agenda was accepted and is included as Attachment 1.

Secretary Items

- Bill Buscher of SwRI was the Motion and Action Item recorder for this meeting. The motions and action items are included as Attachment 2.
- The membership roster was distributed for review and corrections and is included as Attachment 3.
- Membership Changes or Additions
    a.) Clayton Knight replacing Ron Buck for TEI

Previous meeting minutes approval (CC January 04)

Minutes from the conference call of January 2004 were approved as posted on the TMC web site.

Review/Discussion of GF4CAT Oil 1 & 2 results. (Attachment 4)

1. Do we want to accept either or both oils? Neither oil demonstrated passing GF-4 performance. After discussion the panel choose to not accept either of these oils at this time pending review of additional data from the suppliers of these two oils. **Action Item – Surveillance Panel chairman to request original data test report forms 4, 5 and 6, and more test detail, from the suppliers of the GF-4 CAT-1 and CAT-2 oils.**

2. A 5W30 has been offered up and should be available soon. After discussion, the surveillance panel elected to not pursue any additional 5W30 oils. However, the

surveillance panel would like to pursue a 5W20 oil that performs at the GF4 pass limit for FEI2. Some of the discussion highlights concerning the selection of a 5W20 oil:

- Data from oil 538 suggests many tests are required to prove performance of reference oils because many 538 results meet GF-4 yet several do not.
- GF4CAT Oil 1 has 5 out of 7 results that meet GF-4 limits. This suggests that perhaps GF4 limits were set incorrectly for viscosity grade 5W20.

Motion – Surveillance Panel to report the donated test data, along with the original data from the oil suppliers, from the GF-4 CAT-1 and CAT-2 oils, and the existing reference oil data (oils 538, 539, 1008-1), to the Passenger Car Engine Oil Classification Panel by 9-24-04. (Tom Franklin / Joe Vujica / Passed with one waive

RSI report on VIB activity (Severity and lost tests) – (Attachment 5)

RSI did not have a representative at this meeting but did supply a report in advance to the chairman of this panel. Chairman Leverett presented the highlights of the RSI data. The panel is concerned about the possibility of a shift in severity. The RSI data was grouped in sets by viscosity grades XW-20 and XW-30. Some panel members feel any shift would be hard to detect because of not having the data grouped by individual viscosity grade. The panel requested the following action item to be undertaken by the chair. **Action Item – Surveillance Panel chairman to request XW-20 data from RSI separated into 0W-20 and 5W-20 data sets.**

LTMS Review, presentation from Task Force by Ben Weber. (Attachment 6)

In response to request by the surveillance panel chair, a meeting of the LTMS task force took place on September 14th, 2004 in San Antonio, Texas to review the LTMS requirements for the Sequence VIB test method. Refer to the attachment for details. **Motion – Accept the VIB LTMS Task Force report from the 9-14-04 meeting, which includes the following motions:**

1. **Motion – Start the initial Q_i calculation with the first acceptable reference oil test. Effective 9-21-04.**
2. **Motion – Set Z_0 for stand/engine combinations based on the average Y_i of tests that were obtained after and including the first acceptable reference oil test through the second acceptable reference oil test. All other aspects of the LTMS remain unchanged. Effective 9-21-04. (Guy Stubbs / Rich Grundza / Passed unanimously)**

Discuss Alternate Reference Requirements

VI B Calibration Proposal – Gordon Farnsworth / Ben Weber (Attachment 7)

Currently industry is averaging ~ 2-3 candidate tests per calibration due to tests that are terminated after determination of FE1 causing some laboratories to experience a high ratio of calibration test to candidate tests. Changing to a by test hours requirement will even out the referencing intervals industry wide. **Motion – Modify the test procedure to read: 1st calibration period allows up to 4 full length tests or 600 engine hours, whichever occurs first. 2nd calibration period allows up to 7 full length tests or 1050 engine hours, whichever occurs first. Effective 9-21-04. (Gordon Farnsworth / Guy Stubbs / Passed, 8-0-2)**

TMC Report – included as Attachment 8

- Semi-annual report – Rich stated that the current reporting period has not closed and the semi-annual report would be distributed once the current reporting period completed. The data presented today is an update and will be different once the semi-annual report is released. Calibration status - Seven calibrated labs. With 22 stand engine combinations calibrated as of 9/10/04.
- Summary of Data review (Severity Trend?) - FEI1 is trending slightly severe. FEI2 has been on target for last year and a half (18 months)
- Update on BC-6. Commitment of components and funding needed for blending. Target for blend completion is Jan 2005 with approval by June 2005.
- Review Break-in Ramps - Several transition graphs were presented from the laboratories and are included in attachment 8. All graphs had different trends when compared to each other. The surveillance panel requested a task force to be formed with membership composed of the laboratories to study how to best handle the transitions during break-in.

AER Report – included as Attachment 9

The current inventory of assembled VIB engines is 19.Total engines used for the last 12 months are 46 engines. The chart below gives the details of engine usage by month.

Engine Usage From (Sept 03 - Aug 04) per month	
Month	**Engines Sold**
Sept	3
Oct	3
Nov	3
Dec	4
Jan	7
Feb	2
Mar	7
Apr	0
May	3
June	3
July	1
Aug	10

The current average usage rate is 4 engines per month. The existing inventory could be exhausted within 2 to 4 months. The next available build window is May 2005 and will require a different block, different chain drive parts, and different cylinder heads. The price for additional 4.6L engines using the parts identified in attachment 9 is $4660.61 per engine. After discussion of the AER report, the panel requested the following action items:

- Test laboratories to present quantity of used F1 and F4 Ford 4.6L cylinder heads that they have on hand and available for the Sequence VIB test to the Surveillance Panel chairman.
- Surveillance Panel chairman to work with AER to determine availability of original Ford 4.6L engine block or if a replacement will need to be identified.

Hardware Issues

a.) Discussion on new timing chain - when parts are replaced should a mandatory break-in be conducted before resuming testing? Some laboratories do not conduct any break-in and others run Stage 5 for a short period of time. **Motion – Require test laboratories to run 16 hours of Stage 2 aging conditions following camshaft drive hardware replacement, before conducting the reference test. (Gordon Farnsworth / Jason Bowden / Failed)**

b.) Cylinder Head Replacement - lab experience with valve seal replacement is that most of the time changing just the valve seals does not significantly impact oil consumption. Could the entire cylinder head be changed? The group's consensus was that just changing the cylinder heads and or valve guides would not restore oil consumption.
Action Item – Laboratories to review the reasons for removing engines from service and report information to the Test Monitoring Center. The Test Monitoring Center will report the data to the Surveillance Panel.

New Business

FEI and BC Shift by Build Year - Rich Grundza- (Attachment 8)

Different oil pump was selected for 2003 builds.
Oil Consumption across builds has been stable.

Instrumentation Calibration - David Glaenzer

See attachment 2 item 10 for the full text of the motion. Motion Carried with 4 waives.

Adjourn

This meeting adjourned at 13:20. The next meeting will be at the call of the chair.

Attachment 1

Sequence VI Surveillance Panel Meeting
September 15, 2004
9:00AM – 4:00PM
San Antonio at SwRI in Building 209

Agenda

1.) Introduction
2.) Membership Changes
3.) Previous meeting minutes approval (CC January 04)
4.) LTMS Review, presentation of recommendations from the LTMS Task Force
5.) TMC Report
    a.) Semi annual report
    b.) Summary of Data review (Severity Trend?)
    c.) Update on BC-6
    d.) Review Break-in Ramps
6.) Review/Discussion of GF4CAT Oil 1 & 2 results.
    a.) Data Review
    b.) Do we want to accept either/both oils?
    c.) Used oil analysis from GF4CAT-1
    d.) A 5W 30 has been offered up and should be available soon.
    e.) Volunteers for donated tests on the 5W 30
7.) RSI report on VIB activity (Pass/Fail and Terminated Tests)
8.) Reference Requirements;
    a.) Discuss alternate reference requirements
9.) AER Report
    a.) Current inventory of VIB engines.
    b.) Usage rate last 12 months, please show by month.
    c.) Parts availability for next build, and estimated build date (this is dependent on current inventory and usage rate).
    d.) Quote for additional 4.6L engines.
10.) Hardware Issues
    10.1) Discussion on new timing chain
    a.) Break-in of new parts
    10.2) Cylinder Head Replacement
11.) Old Business
12.) New Business
    a.) Test Length test starts vis engine hours.
    b.) Instrument Calibration Requirements
13.) Adjourn

Attachment 2

Sequence VIB Surveillance Panel
September 15, 2004
9:00AM – 4:00PM
San Antonio, Texas

Motions and Action Items
As Recorded at the Meeting by Bill Buscher

1. Motion – Accept the VIB LTMS Task Force report from the 9-14-04 meeting, which includes the following motions:
   - Motion – Start the initial Q_i calculation with the first acceptable reference oil test. Effective 9-21-04.
   - Motion – Set Z_0 for stand/engine combinations based on the average Y_i of tests that were obtained after and including the first acceptable reference oil test through the second acceptable reference oil test. All other aspects of the LTMS remain unchanged. Effective 9-21-04.

   Guy Stubbs / Rich Grundza / Passed unanimously

2. Action Item – Surveillance Panel chairman to request original data test report forms 4, 5 and 6, and more test detail, from the suppliers of the GF-4 CAT-1 and CAT-2 oils.

3. Action Item – Surveillance Panel chairman to request XW-20 data from RSI separated into 0W-20 and 5W-20 data sets.

4. Motion – Surveillance Panel to report the donated test data, along with the original data from the oil suppliers, from the GF-4 CAT-1 and CAT-2 oils, and the existing reference oil data (oils 538, 539, 1008-1), to the Passenger Car Engine Oil Classification Panel by 9-24-04.
   Tom Franklin / Joe Vujica / Passed with one waive

5. Action Item – Test laboratories to present quantity of used F1 and F4 Ford 4.6L cylinder heads that they have on hand and available for the Sequence VIB test to the Surveillance Panel chairman.

6. Action Item – Surveillance Panel chairman to work with AER to determine availability of original Ford 4.6L engine block or if a replacement will need to be identified.

7. Motion – Require test laboratories to run 16 hours of Stage 2 aging conditions following camshaft drive hardware replacement, before conducting the reference test.

Gordon Farnsworth / Jason Bowden / Failed

8. Action Item – Laboratories to review the reasons for removing engines from service and report information to the Test Monitoring Center. The Test Monitoring Center will report the data to the Surveillance Panel.

9. Motion – Modify the test procedure to read: 1st calibration period allows up to 4 full length tests or 600 engine hours, whichever occurs first. 2nd calibration period allows up to 7 full length tests or 1050 engine hours, whichever occurs first. Effective 9-21-04.
   Gordon Farnsworth / Guy Stubbs / Passed, 8-0-2

10. Motion – Modify section 10.2 of the test procedure as follows:

10.2 *Instrument Calibration*—Record all instrument calibrations for further reference. Perform a complete test stand instrument calibration ~~prior to conducting the initial reference test in a new engine~~ **every six months**. ~~A previously calibrated (existing) stand/ engine will require that~~ The following is to be calibrated prior to ~~the next~~ **a** reference test **sequence**: ~~(*1*) engine load measurement system;~~ (**1**) fuel ow meter; (**2**) engine speed; (***3***) AFR analysis equipment; and (***4***) exhaust back-pressure equipment.

10.2.1 *Engine Load Measurement System*—Calibration by use of deadweights is required at the start of a test and before each reference oil test. Prior to calibration, start the engine and run for a minimum of 30 min at 1500 r/min, 37 N· m. Shut the engine down, leave dynamometer cooling water on, and start performing the load cell calibration within 3 min after shutdown.

10.2.1.1 Perform the calibration at the 3 designated torques (approximately 26, 37, and 98 N· m). The stand load measurement system shall perform within ±0.3 N· m of the calibration standard.

10.2.2 *Fuel Flow Measurement System*—Use accurate mass scale measurements for calibrating. Perform this calibration at three fuel ow rates (approximately 1.4, 3.2, and 5.4 kg/h). Evaluate each ow rate a minimum of three times to verify repeatability.

10.2.2.1 The test stand owmeter shall perform to within 0.25 % at 5.4 kg/h, 0.32 % at 3.2 kg/h,and 0.54 % at 1.4 kg/h of the calibration standard. For each ow rate, a minimum of three consecutive ow readings shall be within the speci ed tolerance. The calibration standard shall be at least 4 times more accurate than the test stand owmeter at each speci ed ow rate.

10.2.3 *Coolant Flow Measurement System*—Calibrate the ow measuring device a minimum of once every ~~three~~ **six** months.

10.2.4 *Thermocouple and Temperature Measurement System*—The calibration of the test stand temperature measurement system (thermocouple through readout) is checked at the test stand using the existing readout system ~~prior to running a new engine reference or~~ a minimum of once every ~~three~~ **six** months ~~whichever occurs rst~~. For the critical temperatures (see Table 3) the individual temperature sensors shall indicate within ±0.56°C (±1°F) of the laboratory calibration standards. The calibration equipment utilized shall be appropriate for the ±0.56°C (±1°F) accuracy level here speci ed. See 6.9 for additional thermocouple calibration requirements.

10.2.5 *Humidity Measurement System*—Calibrate the primary laboratory measurement system at each stand ~~on a semiannual basis~~ **a minimum of once every six months** using a hygrometer with a minimum dew point accuracy of ±0.55°C at 16°C (±1°F at 60°F). Locate the sample tap on the air supply line to the engine in the intake air cleaner.

10.2.5.1 The calibration consists of a series of paired humidity measurements comparing the laboratory system with the calibration hygrometer. The comparison period lasts from 20 min to 2 h with measurements taken at 1 to 6 min intervals, for a total of twenty paired measurements. The measurement interval shall be appropriate for the time constant of the humidity measuring instruments.

10.2.5.2 Verify that the ow rate is within the equipment manufacturer's speci cation, and that the sample lines are non-hygroscopic. Correct dew point hygrometer measurements to standard conditions (101.12 kPa [29.92 in. Hg]) using the appropriate equation (see 6.8.1). Co mpute the difference between each pair of readings and calculate the mean and standard deviation of the twenty paired readings, using Eq A8.1 and Eq A8.2 in Annex A8. The absolute value of the mean difference shall not exceed 1.43 g/kg (10 grains/lb), and the standard deviation shall not be greater than 0.714 g/kg (5 grains/lb). If these conditions are not met, investigate the cause, make repairs, and recalibrate. Maintain calibration records for two years.

10.2.6 *Other Instrumentation*—As a minimum, calibrate instrumentation for measuring parameters other than those detailed in 10.2-10.2.5 ~~after every 10 non-reference oil tests or every 90 days, whichever occurs rst~~ **every six months**.

Dave Glaenzer / Joe Vujica / Passed with four waives

Attachment 3

ATTENDANCE ASTM SEQUENCE VIA/VIB SURVEILLANCE PANEL VOTING MEMBERSHIP

NAME	ADDRESS	PHONE / FAX / E-MAIL	ATTENDANCE
KNIGHT, CLAYTON	Test Engineering, Inc, 12718 Cimarron Path San Antonio, TX 78249	Phone: (210)690-1958 Fax: (210)690-~~3621~~/959 ~~cknight@testeng.com~~ CKNIGHT@TEI-NET.COM	
BOWDEN, DWIGHT H.	OH Technologies, Inc. P.O. Box 5039 Mentor, OH 44061-5039	Phone: (440)354-7007 Fax: (440)354-7080 DHBOWDEN@OHTECH.COM	
CAUDILL, TIMOTHY	Ashland, Inc. 22nd & Front Streets Ashland, KY 41101	Phone: (606) 329-~~5708~~ 1960 X5708 Fax: (606) 329-~~3009~~ 2044 Tlcaudill@ashland.com	
CLARK, SID	General Motors Corporation Engine Engineering Building Mail Code 483-730-322 823 Joslyn Road Pontiac, MI 48340-2920	Phone:(248) 857-9959 Fax: (248) 857-4425 sidney.l.clark@gm.com	
DUFFY, FRANK R.	Chrysler 800 Chrysler Drive CIMS 482-00-13 Auburn Hills, MI 48326-2757	Phone: (810) 576-7476 Fax: (810) 576-7490 fd13@chrysler.com	
FARNSWORTH, GORDON **Chairman, Ref Oils & Fuels**	Infineum USA L.P. P.O. Box 735 Linden, NJ 07036	Phone: (908) 474-3351 Fax: (908) 474-3637 gordon.farnsworth@infineum.com	
FERNER, MARK	Pennzoil Quaker State P.O. Box 7569 The Woodlands, TX 77387	Phone: (281) 363-8190 Fax: (281) 363-8092 or 8002 markferner@pzlqs.com	
GLAENZER, DAVID	Afton Chemical Corporation 500 Spring St. P.O. Box 2158 Richmond, VA 23218-2158	Phone: (804) 788-5214 Fax: (804) 788-6358 dave.glaenzer@aftonchemical.com	
GRUNDZA, RICH	ASTM TMC 6555 Penn Avenue Pittsburgh, PA 15206-4489	Phone: (412) 365-1031 Fax: (412) 365-1047 reg@tmc.astm.cmri.cmu.edu	
LAI, PATRICK	Imperial Oil Ltd. Of Canada P.O. Box 3022 Sarnia, ONT N7T8C8 CANADA	Phone: (519) 339-5611 Fax: (519) 339-5866 patrick.k.lai@esso.com	
LEVERETT, CHARLIE **Survillance Panel Chair**	Perkin Elmer Automotive Research 5404 Bandera Road San Antonio, TX 78238	Phone: (210) 647-9422 Fax: (210) 523-4607 Charlie_Leverett@PerkinElmer.com	
MOSHER, MARK	ExxonMobil 600 Billingsport Road Paulsboro, NJ 08066	Phone: (856) 224-2132 Fax: (856) 224-3628 mark.r.mosher@exxonmobil.com	

Attachment 3

ATTENDANCE ASTM SEQUENCE VIA/VIB SURVEILLANCE PANEL VOTING MEMBERSHIP

NAME	ADDRESS	PHONE / FAX / E-MAIL	ATTENDANCE
RILEY, MIKE	Ford Motor Company 21500 Oakwood Blvd POEE Bldg Rm DR 167 MD 44 Dearborn, MI 48121-2053	Phone: (313) 390-3059 Fax: (313) 845-3169 Mriley2@ford.com	MJR
STUBBS, GUY	Southwest Research Institute 6220 Culebra Rd. P.O. Drawer 28510 San Antonio, TX 78228-0510	Phone: (210) 522-5039 Fax: (210) 684-7523 gstubbs@swri.org	GTubbs
SUTHERLAND, MARK	ORONITE Technology Group 4502 Centerview Drive, Suite 210 San Antonio, Texas 78228	Phone: (210) 731-5605 Fax: (210) 731-5621 MSUT@chevron.com	MSut
VUJICA, JOSEPH	Lubrizol Corp. 29400 Lakeland Blvd. Wickliffe, OH 44092	Phone: (440) 347-2058 Fax: (440) 347-4096 jsvu@lubrizol.com	JVujica

Attachment 3

ATTENDANCE ASTM SEQUENCE VIA/VIB SURVEILLANCE PANEL NON VOTING MEMBERSHIP AND GUESTS

NAME	ADDRESS	PHONE / FAX / E-MAIL	ATTENDANCE
BUSCHER JR., WILLIAM A.	Buscher Consulting P.O. Box 112 Hopewell Jct. NY 12533	(914)897-8069 (914)897-8069 BUSCHWA@AOL.COM	
FARBER, FRANK	ASTM TMC 6555 Penn Avenue Pittsburgh, PA 15206-4489	(412) 365-1030 (412) 365-1047 fmf@tmc.astm.cmri.cmu.edu	
FERNANDEZ, FRANK	Oronite Global Technology 4502 Centerview Dr., Suite 210 San Antonio, TX 78228	(210)731-5603 (210)731-5699 ffer@chevron.com	F.F.
GERHART, FRED **Surveillance Panel Secretary** Member, non-voting	Southwest Research Institute 6220 Culebra Rd. P.O. Drawer 28510 San Antonio, TX 78228-0510	Phone: (210)522-3842 Fax: (210)684-7523 fgerhart@swri.org	
HALL, GREG	AER Mfg., Inc. P.O. Box 979 Carrollton, TX 75011-0979		
HAMILTON, LARRY	Lubrizol Corporation 29400 Lakeland Blvd. Wickliffe, OH 44092	(440)347-2326 ldha@lubrizol.com	LDH
HENNELLY, PAUL	AER Mfg., Inc. P.O. Box 979 Carrollton, TX 75011-0979	(917)417-3149 (917)417-3175 Paul_Hennelly@AERmfg.com	
BOSCHERT, TOM	Ethyl Corporation 2000 Town Center, Ste 1750 Southfield, MI 48075-1150	Phone: (248) 350-0640 Fax: (248) 350-0024 Tom_Boschert@ethyl.com	
NANN, NORBERT	Nann Consultants, Inc. 59 Edgehill Drive Wappingers Falls, NY 12590	(914)297-4333 (914)297-4334	
NIELSEN, DENNIS	AER Manufacturing 796 Springfield Drive Northville, MI 48167	(248)349-4114 (248)349-6647	
PATRICK, RICHARD J.	Citgo Petroleum Co. P.O. Box 3758 Tulsa, OK 74102	(918)495-5937 (918)495-5912	
OLIVER, RICK	2805 Beverly Drive Flower Mound, TX 75022	Phone: (972)724-2136 crickoliver@home.com	
RUMFORD, ROBERT H.	Halterman Products P.O. Box 429 1201 South Sheldon Road Channelview, TX 77530-0429	(281)457-2768 (281)457-1469 rhrumford@~~specificdl.com~~ dow.com	

Attachment 3

ATTENDANCE ASTM SEQUENCE VIA/VIB SURVEILLANCE PANEL NON VOTING MEMBERSHIP AND GUESTS

NAME	ADDRESS	PHONE / FAX / E-MAIL	ATTENDANCE
RUTHERFORD, JIM	Oronite/Chevron 100 Chevron Way Richmond, CA 94802	(510)242-3410 (510)242-1930 jaru@chevron.com	
SCHUETTENBERG, ALEX	Phillips Petroleum 148 AL Phillips Research Center Bartlesville, OK 74004	(918)661-3563 (918)661-8060	
SHAUB, DR. HAROLD	Quaker State Corp. 225E John Carpenter Freeway Irving, TX 75062	(972)868-0486 (972)868-0678	
TUCKER, RICHARD	Shell Oil Co. P.O. Box 1380 Houston, TX 77251	(281)544-8354 (281)544-8585 rftucker@shellus.com	
WILLIAMS, LEWIS	Lubrizol 29400 Lakeland Blvd. Wickliffe, OH 44092	(440)347-1111 (440)347-9244 LAWm@Lubrizol.com	
RITCHIE, Andrew	Infineum 1600 E Linden Ave, Linden NJ 07036	908-474-2097 908-474-3637 Andrew.Ritchie@Infineum.com	AR
FRANKLIN, THOMAS	PERKINELMER		TF
BISHOP, ZACK	TEI		ZAB
JOHN W. KNIGHT	TEI	210-690-1958 JKNIGHT@TEI-NET.com	
BUSCHER III, WILLIAM	SWRI	210-522-6802 wbuscher@swri.edu	WAB
Bowden, Jason	OHT	440-354-7007 440-354-7080 jbowden@ohteel.com	
CARLSON, JON	LUBRIZOL	210-391-8838 JOMC@LUBRIZOL.com	
MARTINEZ, JD	ORONITE	310-[illegible]5563 jogm@chevrontexaco.com	

Please add to list.

Attachment 3

ATTENDANCE ASTM SEQUENCE VIA/VIB SURVEILLANCE PANEL NON VOTING MEMBERSHIP AND GUESTS

NAME	ADDRESS	PHONE / FAX / E-MAIL	ATTENDANCE
Craig Springer		210 522-5394	C Springer
Ben Weber		(210) 522-5911	Ben Weber
Keith Pierre-Auguste (AER Manufacturing)		(972) 417-3112	Keith Pierre-Auguste
Jody Kocsis Lubrizol		JAKOC@Lubrizol.com	Jody Kocsis
MARTIN CHADWICK PECKINELMER		MARTIN.CHADWICK @PECKINELMER.COM	MC
KEN OWNBY	HALTERMANN PRODUCTS CHANNELVIEW, TX	jkownby@dow.com	KOwnby

GF4CAT VIB Summary

Lab	Engine #	Engine Hrs. at EOT	BC Batch	Pre-BC	Total Fuel Consumed Post-BC	TO Phase I	TO Phase II	BC Shift	FEI I	FEI II	Corrected FEI I	Corrected FEI II
D	33	1422	4	1.479812	1.483557	1.453727	1.454738	-0.25	1.81	1.92	2	1.83
B	66012	608	5	1.520524	1.515921	1.491580	1.493454	0.3	1.84	1.51	1.86	1.51
G	92	1911	4	1.484510	1.487436	1.459436	1.463501	-0.2	1.73	1.59	1.85	1.6
G	87	3452	4	1.484081	1.486208	1.459210	1.461403	-0.14	1.7	1.65	1.71	1.6
A	69	3460	5	1.485968	1.488833	1.456822	1.458666	-0.19	2	2.01	1.88	1.96
								Average	1.82	1.74	1.86	1.70
								Std. Dev	0.12	0.22	0.10	0.19

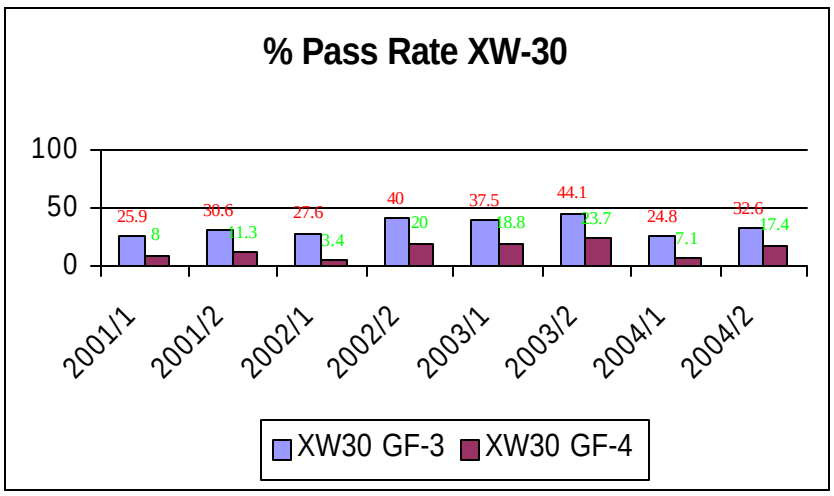
GF4CT2 VIB Summary

Lab	Engine #	Engine Hrs. at EOT	BC Batch	Pre-BC	Total Fuel Consumed Post-BC	TO Phase I	TO Phase II	BC Shift	FEI I	FEI II	Corrected FEI I	Corrected FEI II	
L	40	1323	4	1.487532	1.485773	1.460419	1.461706	0.12	1.8	1.63	1.76	1.64	
C	6	1123	5	1.481952	1.480852	1.451876	1.458764	0.07	2.01	1.5	2.1	1.64	
B	98019	884	5	1.490724	1.489122	1.460849	1.464494	0.11	1.98	1.66	1.97	1.58	
F	15	738.2	4	1.019838	1.010622	0.991511	0.985995	0.9	2.6	2.53	2.69	2.53	****
G	91	1062	4	1.497066	1.494883	1.464932	1.472837	0.15	2.12	1.49	2.09	1.53	
								Average	1.98	1.57	1.98	1.60	
								Std. Dev	0.13	0.09	0.16	0.05	

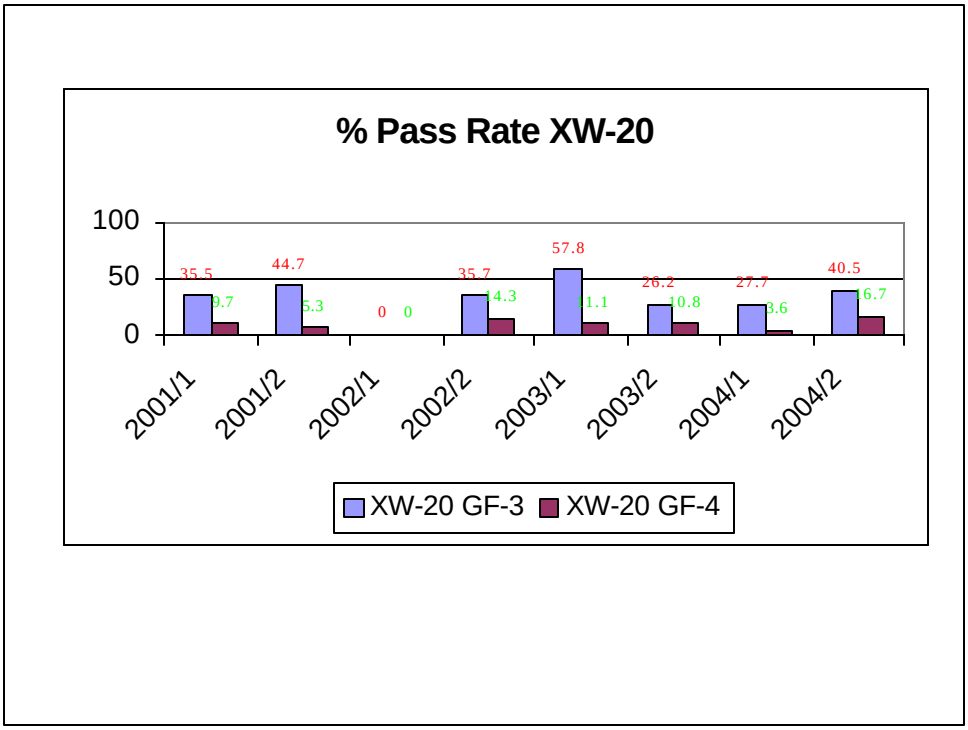
*** Subsequent investigation into fuel flow showed a calibration offset of approximately 40% Test declared invalid by lab. Average and standard deviations for GF4CT2 do not include this data point.

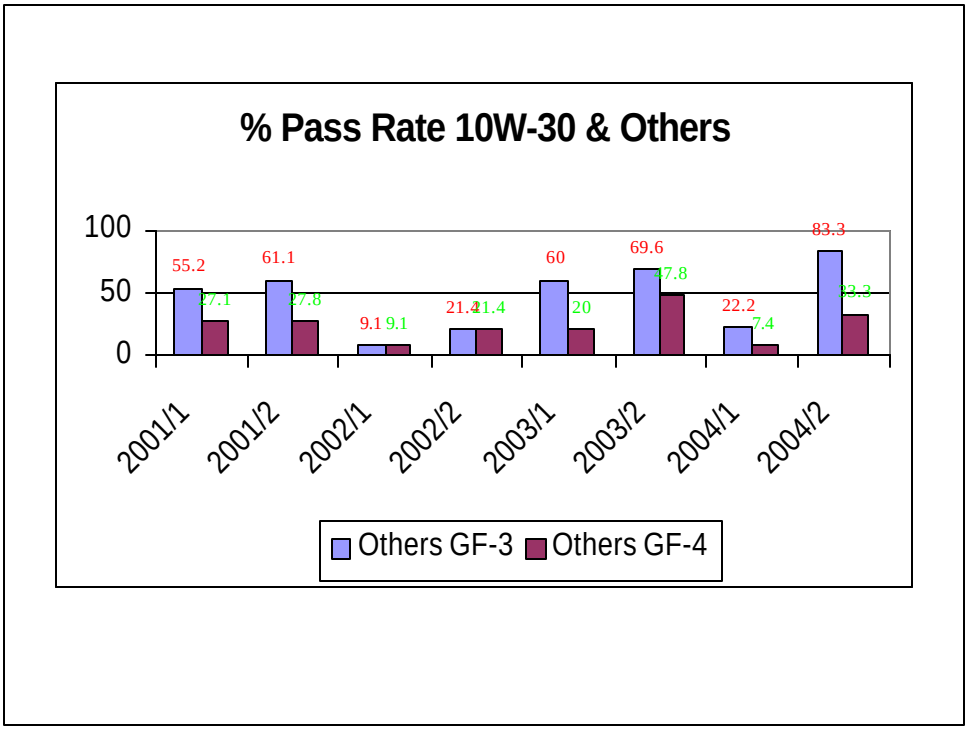
Attachment 5

Period	XW30		XW-20		Others	
	GF-3	GF-4	GF-3	GF-4	GF-3	GF-4
2001/1	25.9	8	35.5	9.7	55.2	27.1
2001/2	30.6	11.3	44.7	5.3	61.1	27.8
2002/1	27.6	3.4	0	0	9.1	9.1
2002/2	40	20	35.7	14.3	21.4	21.4
2003/1	37.5	18.8	57.8	11.1	60	20
2003/2	44.1	23.7	26.2	10.8	69.6	47.8
2004/1	24.8	7.1	27.7	3.6	22.2	7.4
2004/2	32.6	17.4	40.5	16.7	83.3	33.3



Attachment 5





LTMS TF Report 9/15/04

Following 3 items were addresses

1. Determine if an engine should start with a Qi of zero after the first test instead of calculated based on the target
2. The appropriateness of using a lambda value of 0.3 for Zi calculation
3. The rationale for setting the initial Zi for the first reference run

LTMS TF Report 9/15/04

1. Determine if an engine should start with a Qi of zero after the first test instead of calculated based on the target

Motion - Start the initial Q_i calculation with the first acceptable reference oil test. Effective 9-21-04. Passed unanimously.

LTMS TF Report 9/15/04

2. The appropriateness of using a lambda value of 0.3 for Zi calculation

   Left unchanged

3. The rationale for setting the initial Zi for the first reference run

Motion 1. Set Z_0 for stand/engine combinations based on the average Y_i of tests that were obtained after and including the first acceptable reference oil test through the second acceptable reference oil test. All other aspects of the LTMS remain unchanged. Effective 9-21-04. Passed unanimously.

VIB Calibration Proposal

Gordon Farnsworth
Ben Weber

September 15, 2004

Test Hours Versus Run Numbers

- What about using a fixed number of test hours instead of run numbers for the calibrations?
- Currently our industry is averaging ~2-3 candidate tests per calibration
  - Data from TMC website
- Why not use the test hours = to what the SP has already agreed to technically?

Example: 4 Runs = 4 * 150 h = 600h

7 Runs = 7 * 150 h = 1050h

How Would This Work?

For example: SwRI VIB *average* = 75 hours

1st Cal Period *could* = 600 / 75 = 8 tests

2nd Cal Period *could* = 1050 / 75 = 14 tests

Note: These are *averages* for a stand as some would terminate at FEI1 and others at FEI2

- Stand hours are already recorded & reported
- Candidate test could start based on intention to complete a full length test of 150 hours
  - 1st Cal Period: OK to start if stand < 450h (600-150)
  - 2nd Cal Period: OK to start if stand < 900h (1050-150)

Summary

- Let's use engine hours for the VIB calibration frequency
- Let's use the already agreed upon possible calibration length, but in engine hours
- Based on the current VIB averages, this could almost double the number of candidates per calibration

Attachment 8

Sequence VIB Surveillance Panel Meeting

San Antonio, Texas

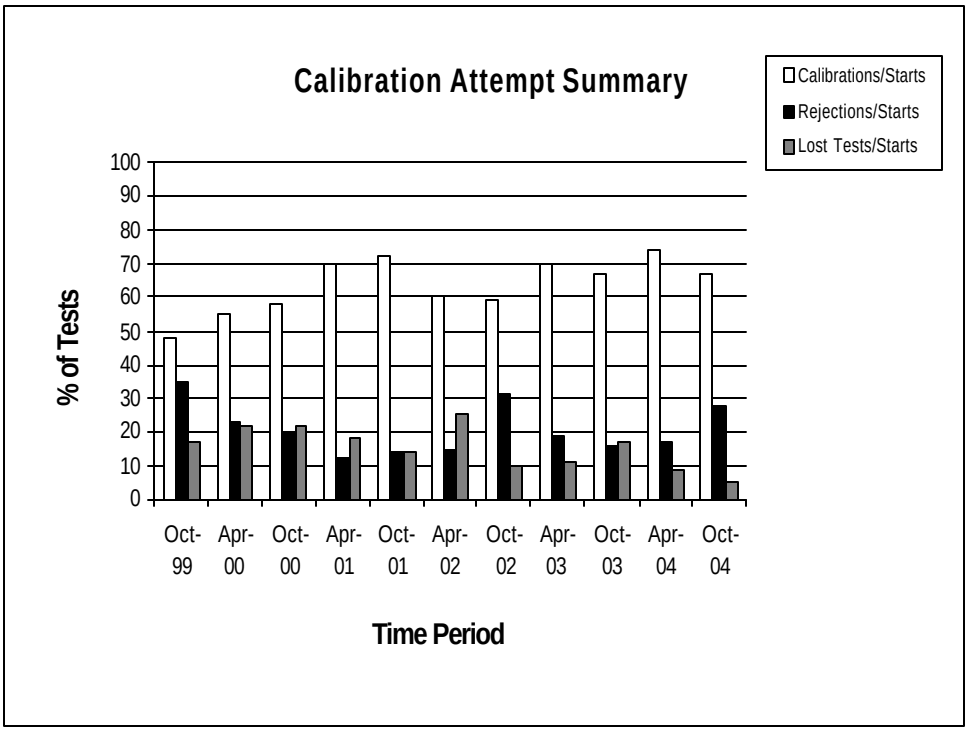
September 15, 2004

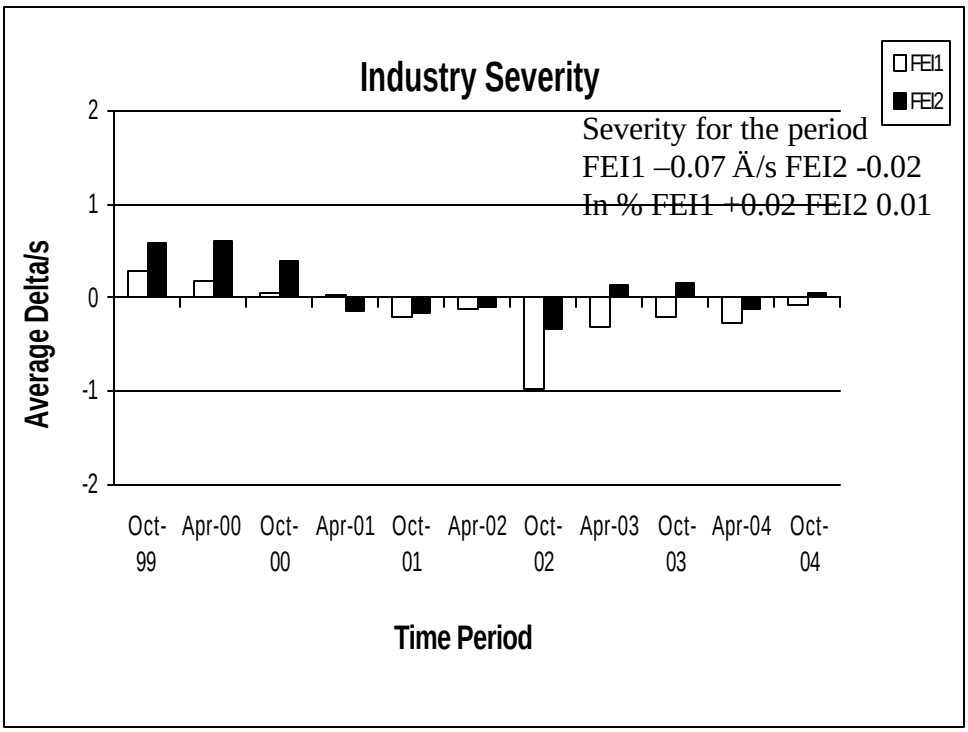
Lab and Stand Summary

	Reported Data During Period	Calibrated as of 09/10/2004
Laboratories	7	7
Stand/Engine Combinations	39	22

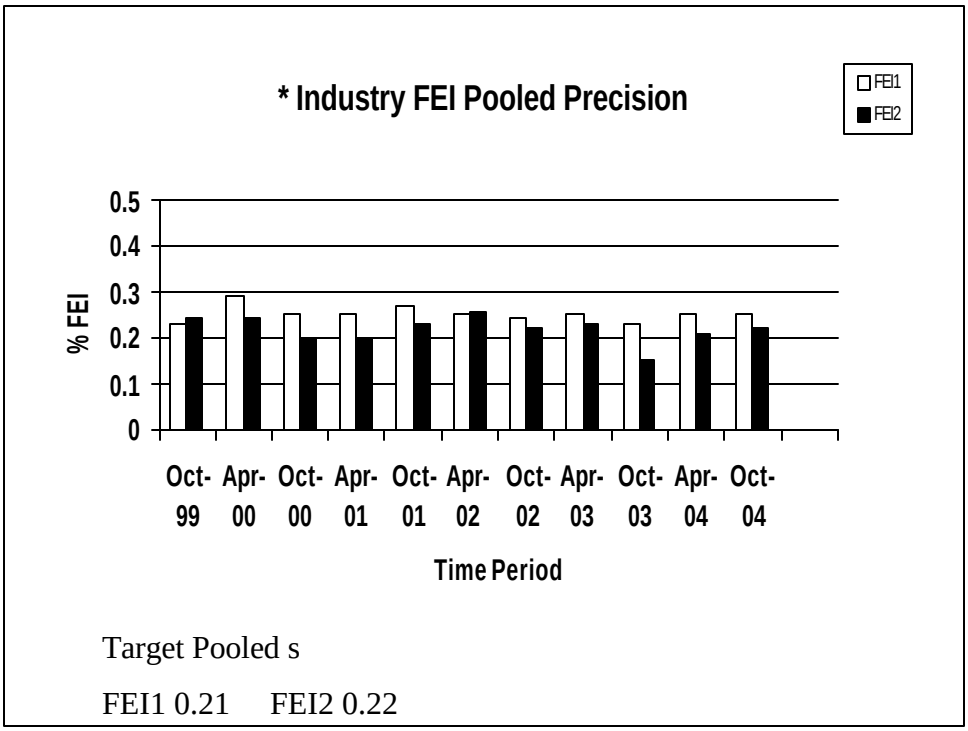
	TMC Validity Codes	No. of Tests
Operationally and Statistically Acceptable	AC	80
Failed Acceptance Criteria	OC	33
Operationally Invalid (Laboratory Judgement)	LC	6
Donated	AG	10
Total		129

Attachment 8



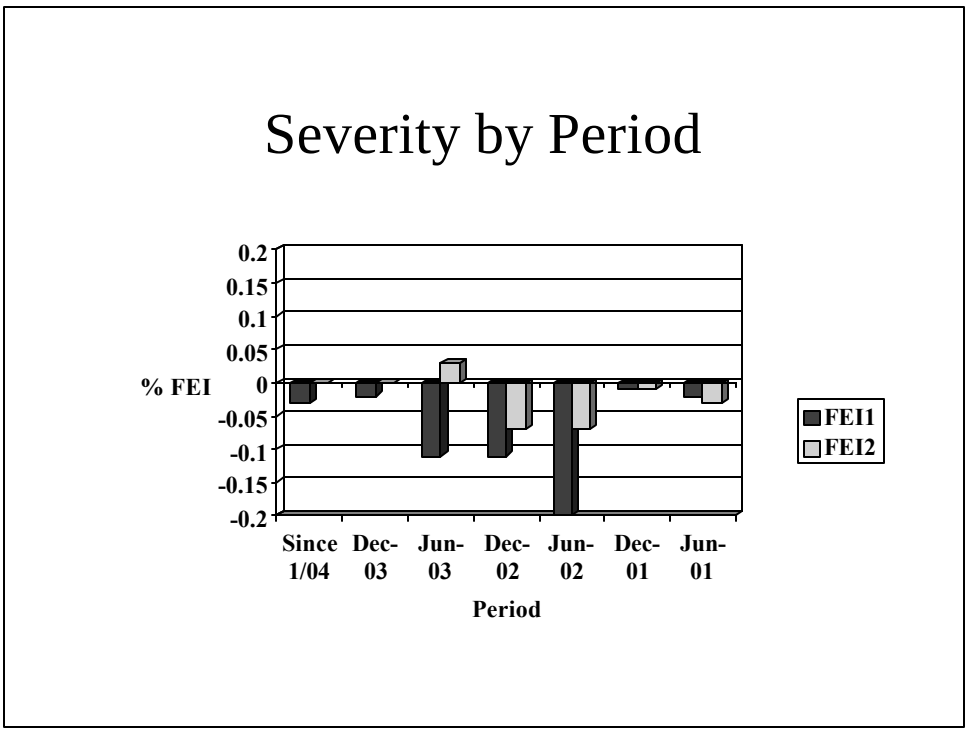


Attachment 8



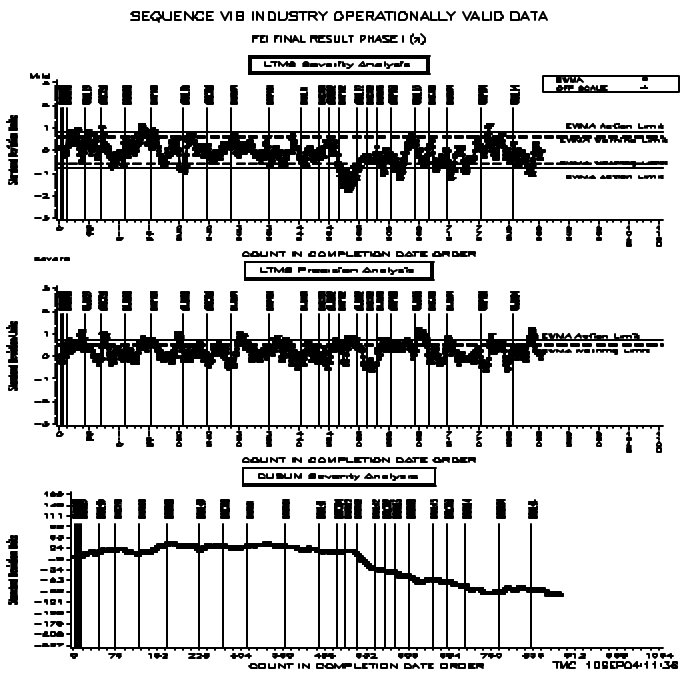
Target Pooled s

FEI1 0.21 FEI2 0.22

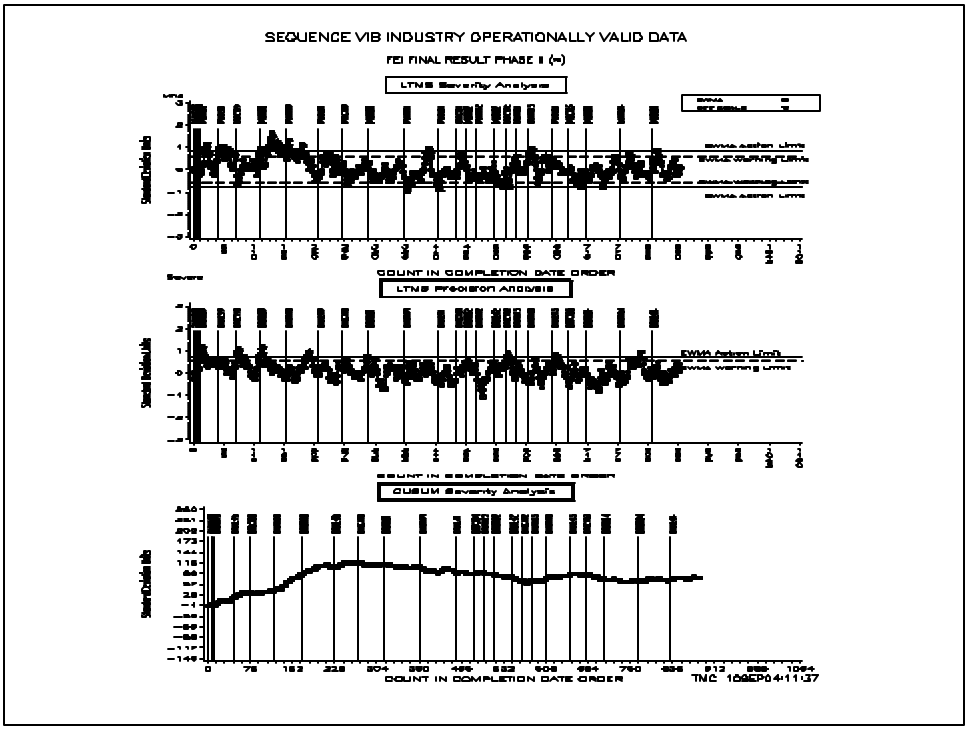


Lost Tests

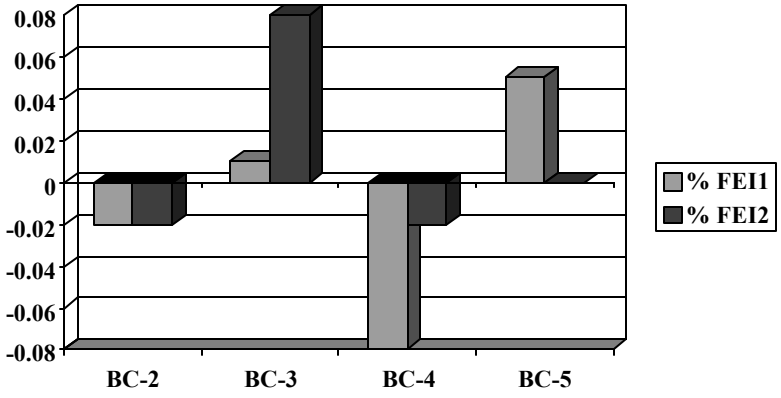
- Six Lost Tests since 4/1/04, all declared operationally invalid by lab.
- Invalid for:
- Fuel Consumption Measurement 1
- Load Control Out of Spec 1
- Exceeded Downtime 1
- Load Cell Calibration Problems 1
- Ran an Additional Hour of Aging 1
- Tensioner Failure 1



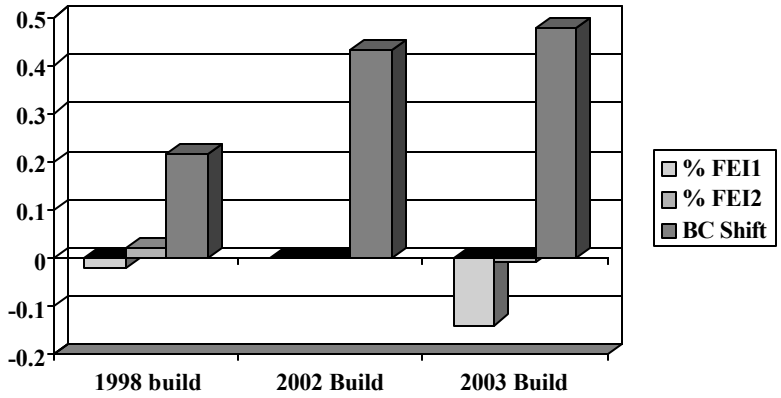
Attachment 8



Severity by Baseline Calibration Oil Batch



FEI and BC Shift by Build Year

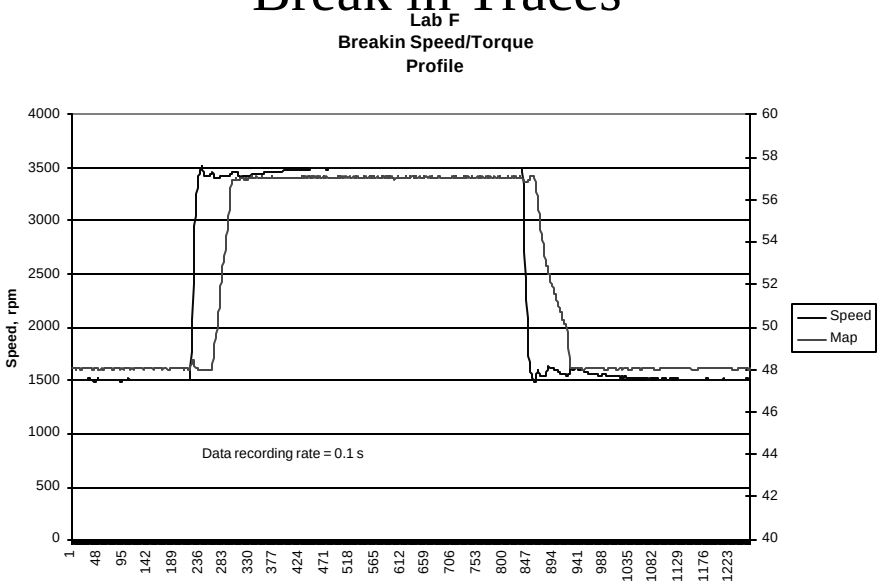


BC-6 Blend Status

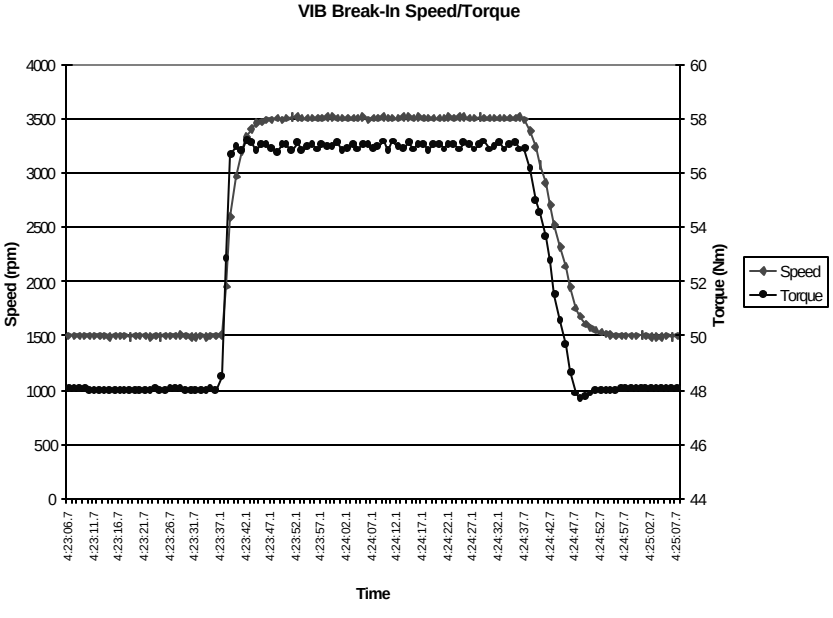
- Parties contacted, pricing obtained
- Purchase orders sent to labs to obtain funding in advance
- Checks from three parties received, awaiting remaining monies to move forward and purchase components and start blend
- Time Frame Unknown depends on funding

Attachment 8

Break in Traces

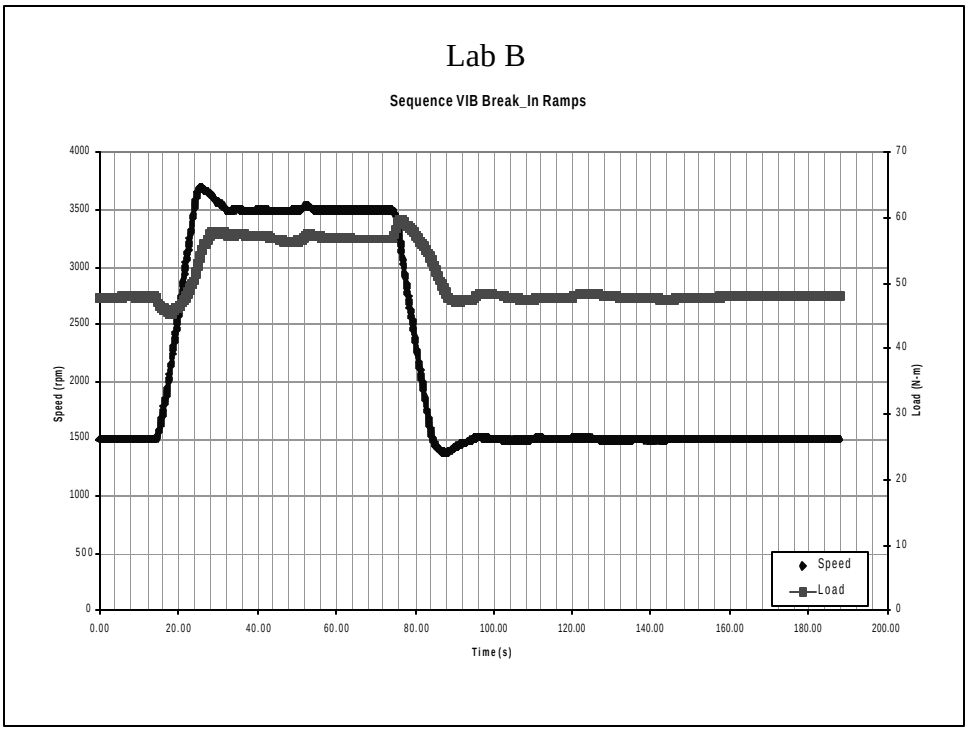


Lab D

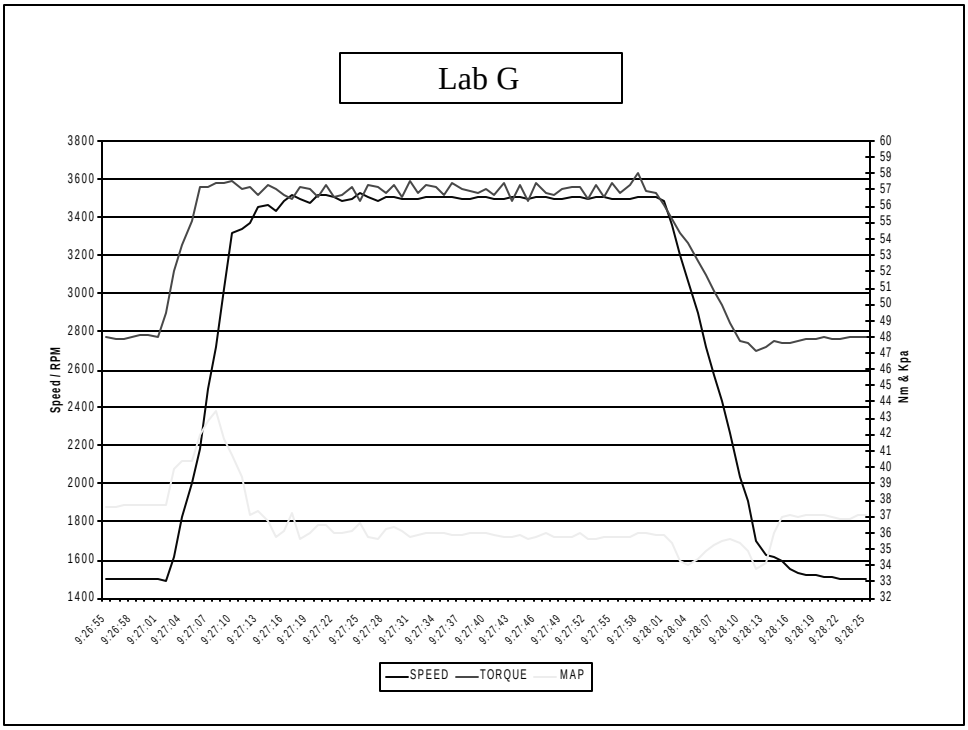


Attachment 8

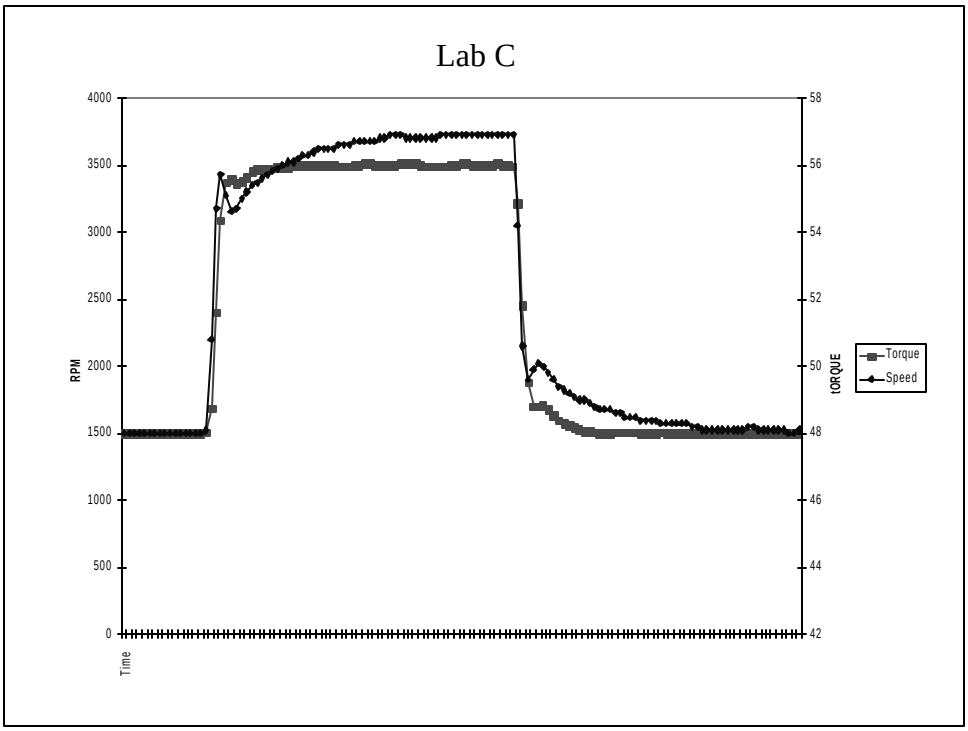
Lab B

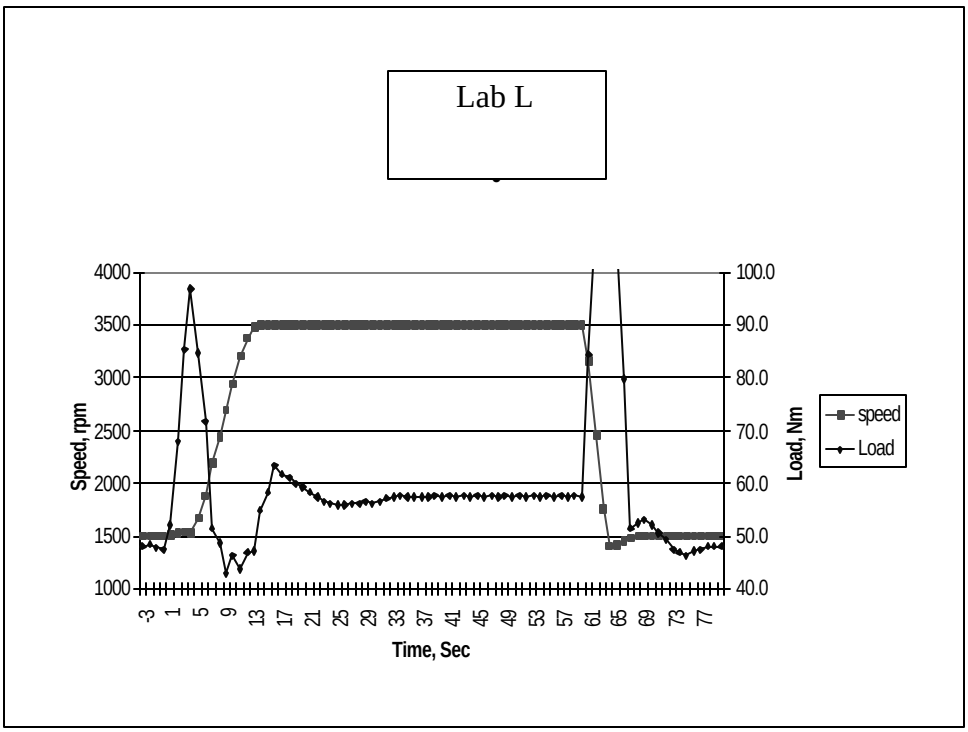


Lab G



Attachment 8





Attachment 8

Lab A

Summary of 538 Results

Lab	FEI1	SA	Corrected FEI1	FEI2	SA	Corrected FEI2	New Engine
A	2.07	0	2.07	1.78	0.07	1.85	No
B	1.84	0	1.84	1.64	0.02	1.66	Yes
C	1.68	0.18	1.86	0.85	0.16	1.01	Yes
D	1.85	0.13	1.98	1.51	0.04	1.55	Yes
F	2.1	0.07	2.17	1.40	0.10	1.50	No
L	2.11	0.05	2.16	1.63	0.09	1.72	No
G	2.40	-0.04	2.36	1.97	-0.07	1.90	No
Mean	2.06		2.00	1.54		1.60	
S	0.24		0.19	0.36		0.30	

Supplier Results MTAC'ed to FEI1 of 2.15 & FEI2 of 1.71

3 results, one discarded because of oil consumption.

Attachment 8

Summary of 539 Results

Lab	FEI1	SA	Corrected FEI1	FEI2	SA	Corrected FEI2	New Engine
A	0.86	0.02	0.88	0.54	0.22	0.76	No
B	0.07	-0.08	-0.01	0.11	-0.03	0.08	Yes
C	1.15	0.04	1.19	0.41	0.14	0.55	No
D	0.92	0.07	0.99	0.38	0.02	0.40	Yes
F	0.88	0.18	1.06	0.37	-0.15	0.22	No
L	0.59	0.21	0.80	0.23	0.04	0.27	No
G	1.09	0.14	1.23	0.11	-0.06	0.05	No
Mean	0.79		0.88	0.31		0.33	
S	0.37		0.42	0.16		0.26	

Supplier Results FEI1 1.4 FEI2 0.70

Summary of GF4CAT Results

Lab	FEI1	SA	Corrected FEI1	FEI2	SA	Corrected FEI2	New Engine
A	2	-0.12	1.88	2.01	-0.05	1.96	No
B	1.84	0.02	1.86	1.51	0.0	1.51	Yes
D	1.81	0.19	2	1.92	-0.09	1.83	No
G	1.73	0.12	1.85	1.59	0.01	1.60	Yes
G	1.70	0.01	1.71	1.65	-0.05	1.6	No
Mean	1.82		1.86	1.74		1.70	
S	0.12		0.10	0.22		0.	

Supplier Results FEI1 2.50 FEI2 2.35

Summary of GF4CT2 Results

Lab	FEI1	SA	Corrected FEI1	FEI2	SA	Corrected FEI2	New Engine
L	1.8	-0.04	1.76	1.63	0.01	1.64	Yes
B	1.98	0.01	1.97	1.66	0.08	1.58	Yes
C	2.01	0.09	2.10	1.5	0.14	1.64	No
G	2.12	-0.03	2.09	1.49	0.04	1.53	Yes
***F	2.6	0.09	2.69	2.53	0.00	2.53	Yes
Mean	1.98		1.98	1.57		1.60	
S	0.11		0.09	0.16		0.05	

Supplier Results FEI1 2.33 FEI2 1.95

*** Result found to have fuel flow cal error, removed from average

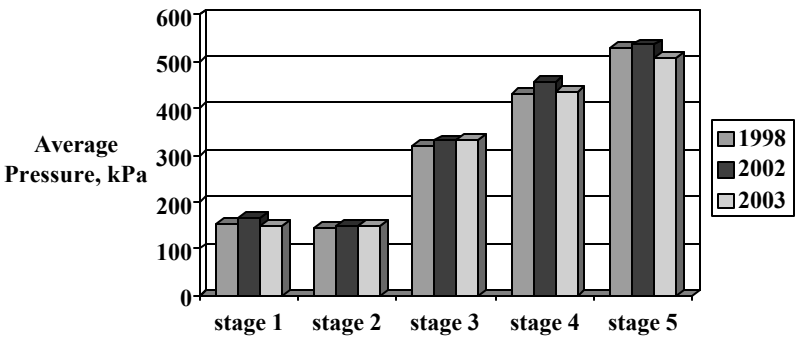
Engine Summary

- 24 stand engine combinations referenced/referencing
- 6 are from 2003 build (2 labs)
- 9 are from 2002 build (4 Labs)
- 3 labs have exclusively 1998 builds (6 stands total)
- Appear to be significant differences in average baseline shift between 1998 and 2002 builds and between 2003 and 1998

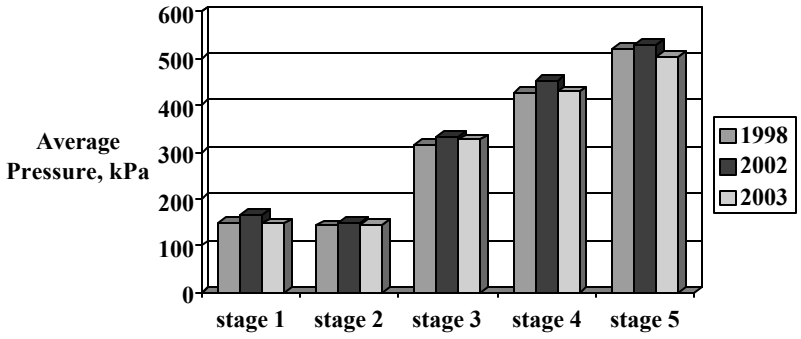
Engine Summary (continued)

- Builds. Differences between 2003 and 2002 builds are not significant.
- Severity shows significant difference between 2003 and other engine builds for FEI1. Small data set, mostly new engines.

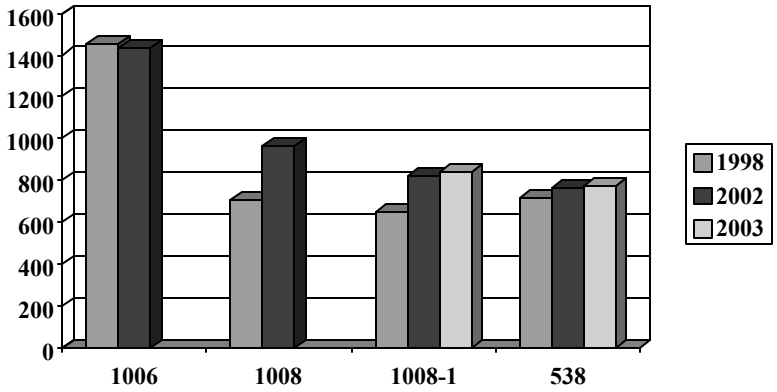
Average Engine Oil Pressure BC Before, Stages 1 - 5



Average Engine Oil Pressure BC After, Stages 1 - 5



Oil Consumption By Build Year



Other Engine Items

- No 2003 Builds rejected
- All build data in TMC data base
- Some Pump Pressure differences
- Pressure @ 4000 rpm 95-100 previous builds, 85 – 90 2003 Build
- Pump relief valve @ 4000 rpm 130 – 140 previous builds, 115 – 125 2003 build.

Attachment 9

Sequence Parts (old vs new)

Old Chain Drive Parts List

Description	Part Number	Qty
Timing Chain	F3AZ-6268-A	2
Crankshaft Sprocket	F1AZ-6306-A	2
Camshaft Sprocket (RH)	F3AE-6256-BA	1
Camshaft Sprocket (LH)	F3AE-6256-C	1
Tensioner Arm (RH)	F3AE-6L253-BA	1
Tensioner Arm (LH)	F3AE-6L253-AA	1
Chain Guide (RH)	F3AE-6K297-BA	1
Chain Guide (LH)	F3AE-6K297-AA	1

New Chain Drive Parts List

Description	Part Number	Qty
Timing Chain	F5AE-6268-AA	2
Crankshaft Sprocket	XL3Z-6306-BA	1
Camshaft Sprocket (RH)	F8AZ-6256-AA	1
Camshaft Sprocket (LH)	F8AZ-6256-BA	1
Tensioner Arm (RH)	1L2Z-6L253-BA	1
Tensioner Arm (LH)	1L2Z-6L2536-AA	1
Chain Guide (RH)	F3AZ-6K297A	1
Chain Guide (LH)	F3AZ-6K297B	1

Newer Model Sequence Engines will utilize:
- Current model block (XW7E-6015-AA)
- Current model cylinder heads w/ cam bearings (1L2E-6090)
- Cast Iron Tensioners (F81E)

Engine Usage From (Sept 03 - Aug 04) per month

Month	Engines Sold		
Sept	3		
Oct	3		
Nov	3		
Dec	4		
Jan	7		
Feb	2		
Mar	7		
Apr	0		
May	3		
June	3		
July	1		
Aug	10	**Total per year**	46

Engine Cost: $4660.71
Note: price excludes TEI fee