Test Monitoring Center
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(412) 365-1000

Memorandum: 05-068

Date: October 10, 2005

To: Bill Buscher, Chairman, Sequence IVA Surveillance Panel

From: Richard E. Grundza

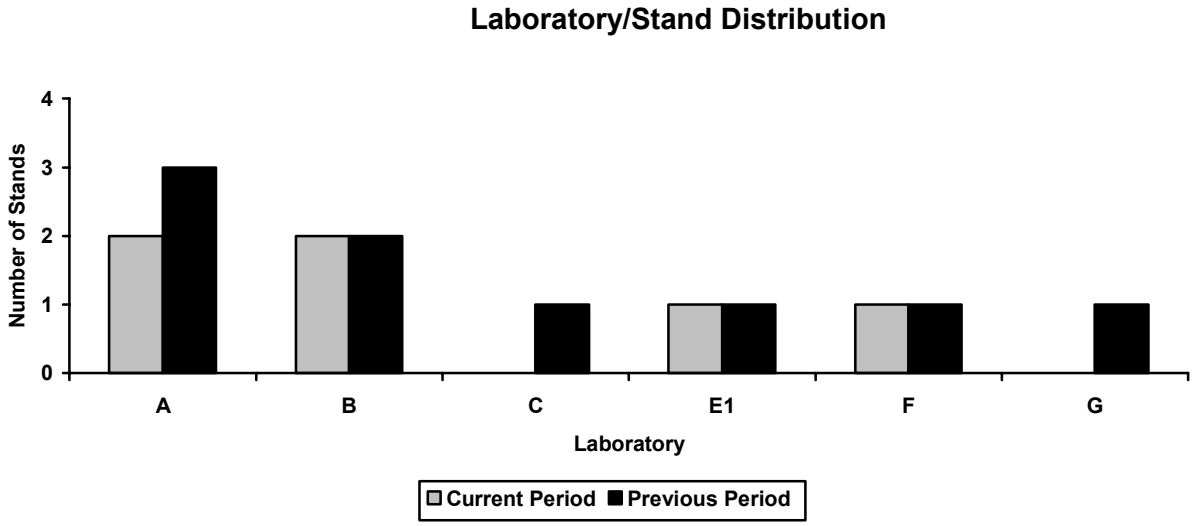
Subject: Sequence IVA Semiannual Report: April 1, 2005 through September 30, 2005

The following is a summary of Sequence IVA reference tests that were reported to the Test Monitoring Center during the period April 1, 2005 through September 30, 2005.

Lab/Stand Distribution

	Reporting Data	Calibrated as of September 30, 2005
Number of Laboratories:	4	3
Number of Test Stands:	6	5

The following chart shows the laboratory/stand distribution:

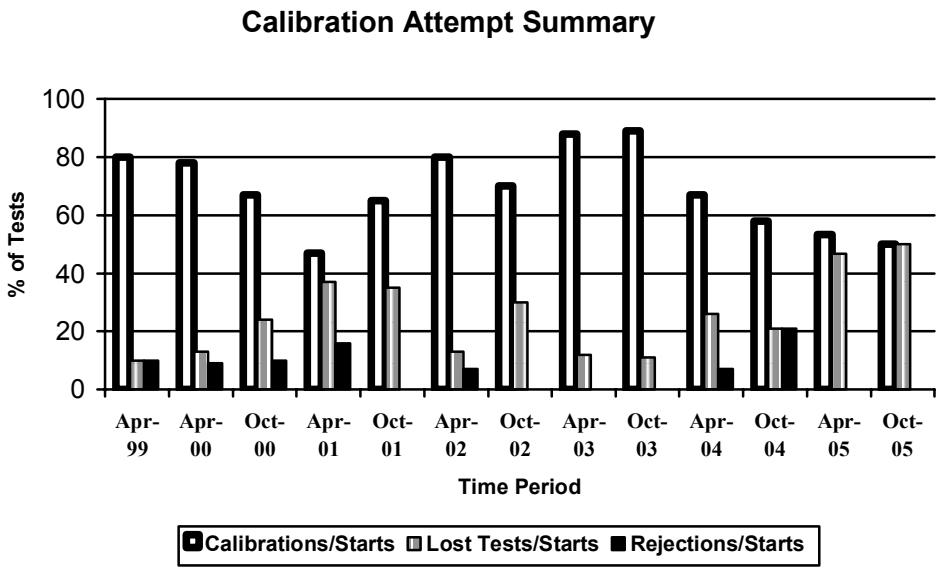


The following summarizes the status of the reference oil tests reported to the TMC:

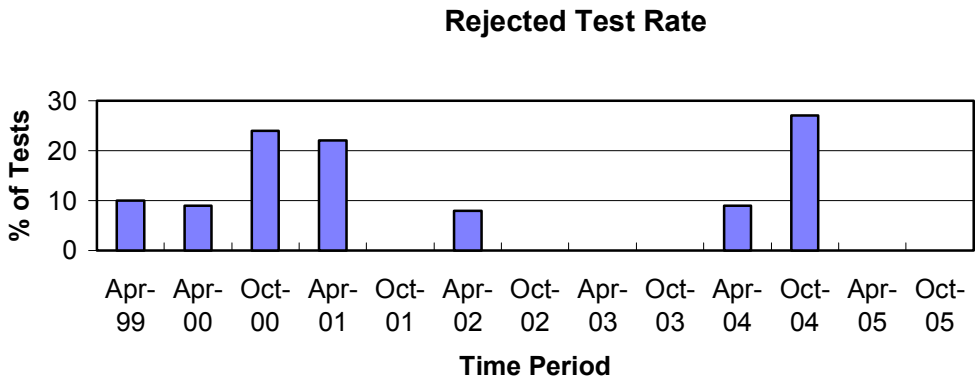
Calibration Start Outcomes	TMC Validity Codes	No. of Tests
Operationally and Statistically Acceptable	AC	5
Aborted	XC	1
Operationally Invalid (Laboratory Judgment)	LC	2
Operationally Invalid (Lab & TMC Judgment)	RC	1
Cam Lot Abandoned	MC	1
Total		10

Donated & Industry Support Outcomes	TMC Validity Codes	No. of Tests
Not for Industry Statistics, Evaluating Potential Stand Changes	NI	1
Total		1

Calibrations per start, lost tests per start and rejection per start rates are summarized below:



The calibration per start rate has decreased since last period. The lost test rate has increased with respect to the last period, and is the highest rate observed in the history of the Sequence IVA test. There were no rejected tests this period.



There were no LTMS Deviations written this period. There has been one deviation from the LTMS since its introduction in 1999.

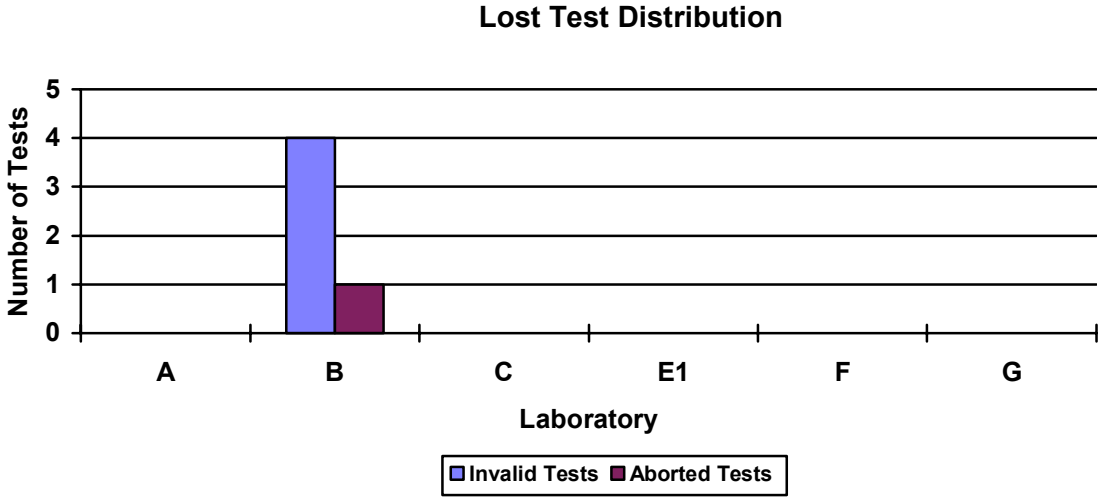
There were no QI Deviations written this period.

Four lab visits were performed this period. No significant discrepancies were observed during these visits.

Lost Test Summary

Five tests were lost this period. The causes are summarized in the following chart:

Lab	Reason for Lost Test	Number of Tests	Breakdown of Tests (LC/MC/RC/XC)
B	Dynamometer Calibration Error	1	1/0/0/0
	Low Oil Pressure, Seal Not Installed	1	0/0/0/1
	Coolant Flow Calibration Error	1	0/0/1/0
	Oil Cylinder Head Thermocouple Damaged, Rocker Cover Flow Problems	1	1/0/0/0
	Cam Lot Abandoned	1	0/1/0/0



Information Letters

Sequence IVA Information Letter No. 05-2, Sequence No. 13, dated June 8, 2005, was issued during the period and contained: Updated precision estimates.

Severity and Precision Analysis

Below is a summary of the average Δ/s, pooled standard deviation, and average Δ in reported units for the tests reported during this report period. Also below is a summary of the average Δ/s value, by parameter, for all laboratories reporting data during this report period.

Industry Severity Summary			
Parameter	Average Δ/s	Pooled standard deviation (degrees of freedom)	Average Δ, in micrometers
ACW	-0.41	0.25 (df=4)	-5.0 µm

ACW Results, by Laboratory	
Laboratory	Average Δ/s
A	-0.90
B	-1.03
C	N/A
E1	N/A
F	1.79
G	N/A

The industry has exceeded severity warning limits twice for the period (see Figure 1). No single stand or lab was responsible for these alarms, though two of the three labs, on average, provided mild results. Industry precision exceeded the warning limits once during the period. The limits were exceeded when a test, -0.93 Δ/s from target was reported after a test, 1.791 Δ/s from target was reported. Results were from different laboratories.

The industry was mild for the period (see Figure 2) with an average Δ/s result of -0.41, which equates to -5.0 µm in reported units. The pooled standard deviation for the period is 0.25 µm, which is much better than the last period and extremely low when compared overall historical performance (see Figure 3). This uncharacteristically low estimate is the result of a small number of data points (5), reported on three oils (1006, 1006-2, and 1009), resulting in an estimate based primarily on one oil, 1009.

Hardware

No hardware changes were made this period.

Reference Oils

Oil	TMC Inventory, in gallons	TMC Inventory, in tests (4gal/test)	Laboratory Inventory, in tests	Estimated life
1006	43	10	7	1 month or less[1]
1006-2	4,697	1,174	8	3+ years[1]
1007[2]	474	118	9	3+ years[1]
1009	834	208	6	3+ years[1]

[1] Multiple test area reference oil; total TMC inventory shown.
[2] Cannot be reblended.

Summary

Calibration per start rate has decreased and the lost test rate has increased with respect to the previous period. There were no rejected tests this period. Calibration per start rate compares with historical rates, while the lost test per start rate is the highest observed in the history of the Sequence IVA test. ACW severity trended mild for the period. Pooled precision estimates show precision has improved when compared with the previous period and compare well with historical estimates. However, the precision estimates maybe unreliable, due to limited number of data points and oils reported during this period.

REG/reg

Attachments

c: F. M. Farber, TMC
Sequence IVA Surveillance Panel
ftp://astmtmc.cmu.edu/docs/gas/sequenceiv/semiannualreports/IVA-10-2005.pdf

Distribution: Electronic Mail

List of Figures

- Figure 1 graphically presents the Industry control charts for ACW and also the CUSUM delta/s plot (by count in completion date order) of average camshaft wear for operationally valid tests.

- Figure 2 graphically presents a historic perspective for ACW mean delta/s by report period.

- Figure 3 graphically presents a historic perspective for ACW pooled standard deviations by report period.

- Figure 4 is the Sequence IVA Timeline, created to track changes in test hardware and operations.

Figure 1

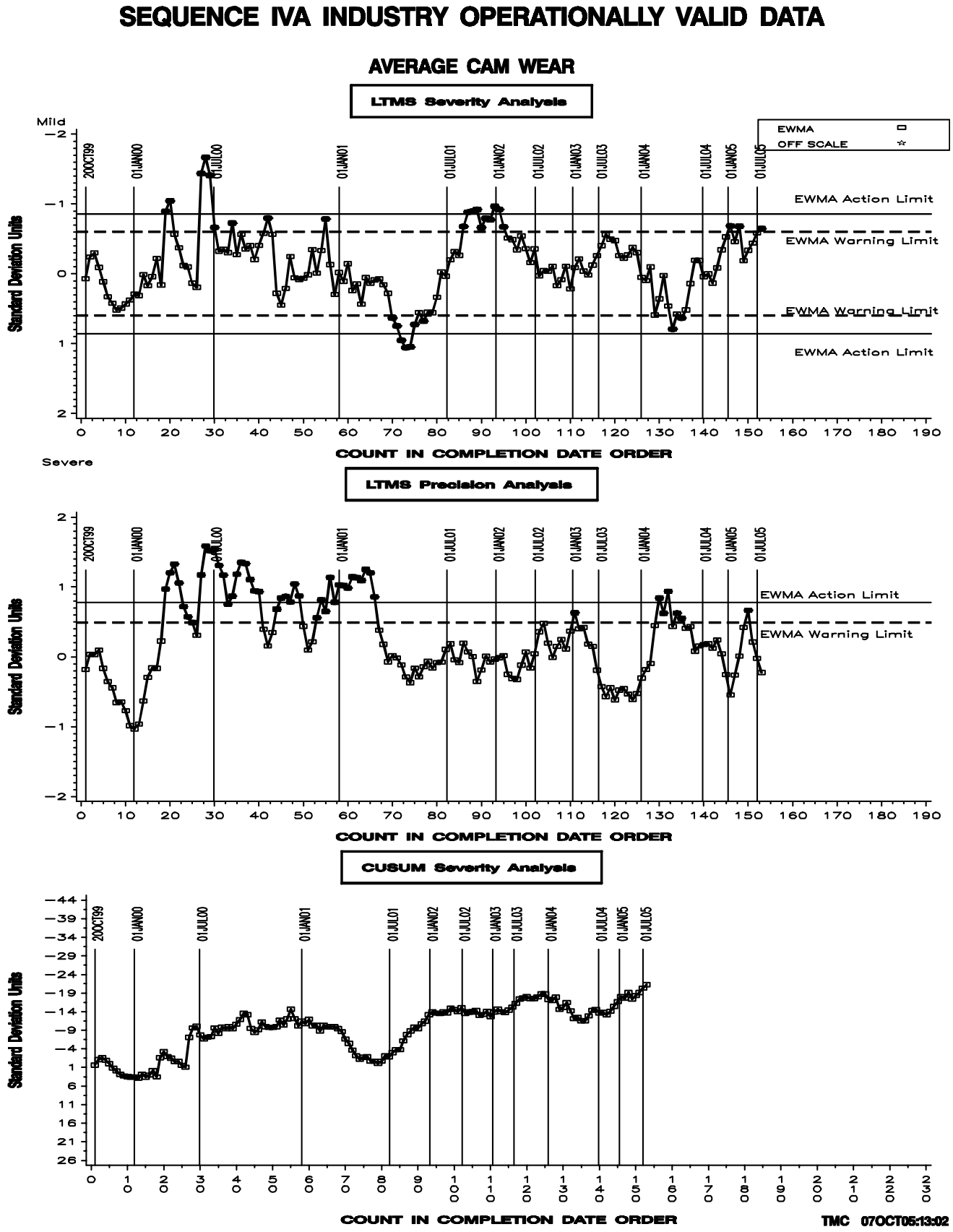

SEQUENCE IVA INDUSTRY OPERATIONALLY VALID DATA
AVERAGE CAM WEAR
LTMS Severity Analysis
Mild
Standard Deviation Units
EWMA
OFF SCALE
EWMA Action Limit
EWMA Warning Limit
EWMA Warning Limit
EWMA Action Limit
COUNT IN COMPLETION DATE ORDER
LTMS Precision Analysis
Severe
Standard Deviation Units
EWMA Action Limit
EWMA Warning Limit
COUNT IN COMPLETION DATE ORDER
CUSUM Severity Analysis
Standard Deviation Units
COUNT IN COMPLETION DATE ORDER
TMC 07OCT05:13:02

Figure 2 - Sequence IVA Reference Oil Data
Average Camshaft Wear

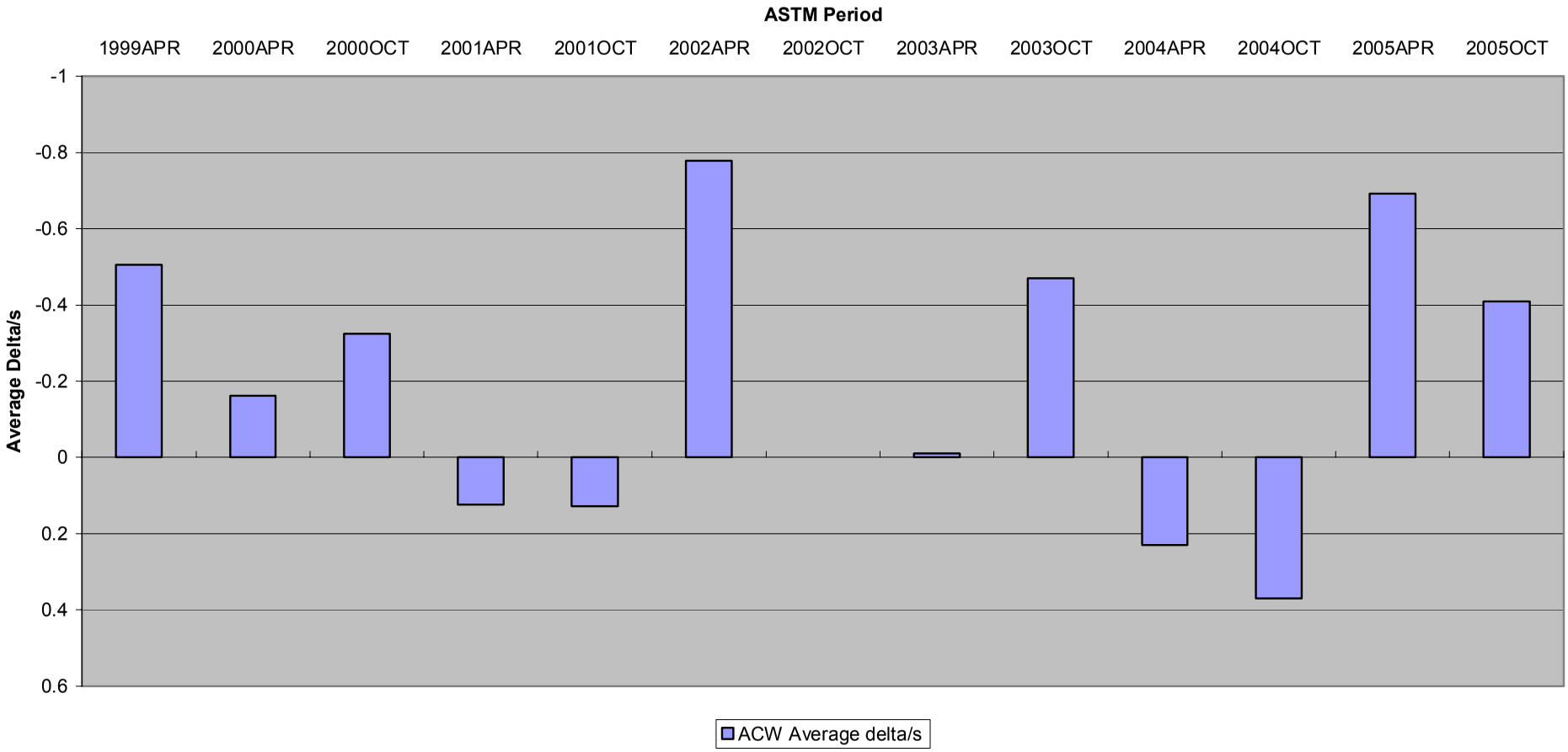


Figure 3 - Sequence IVA Reference Oil Data
Average Camshaft Wear

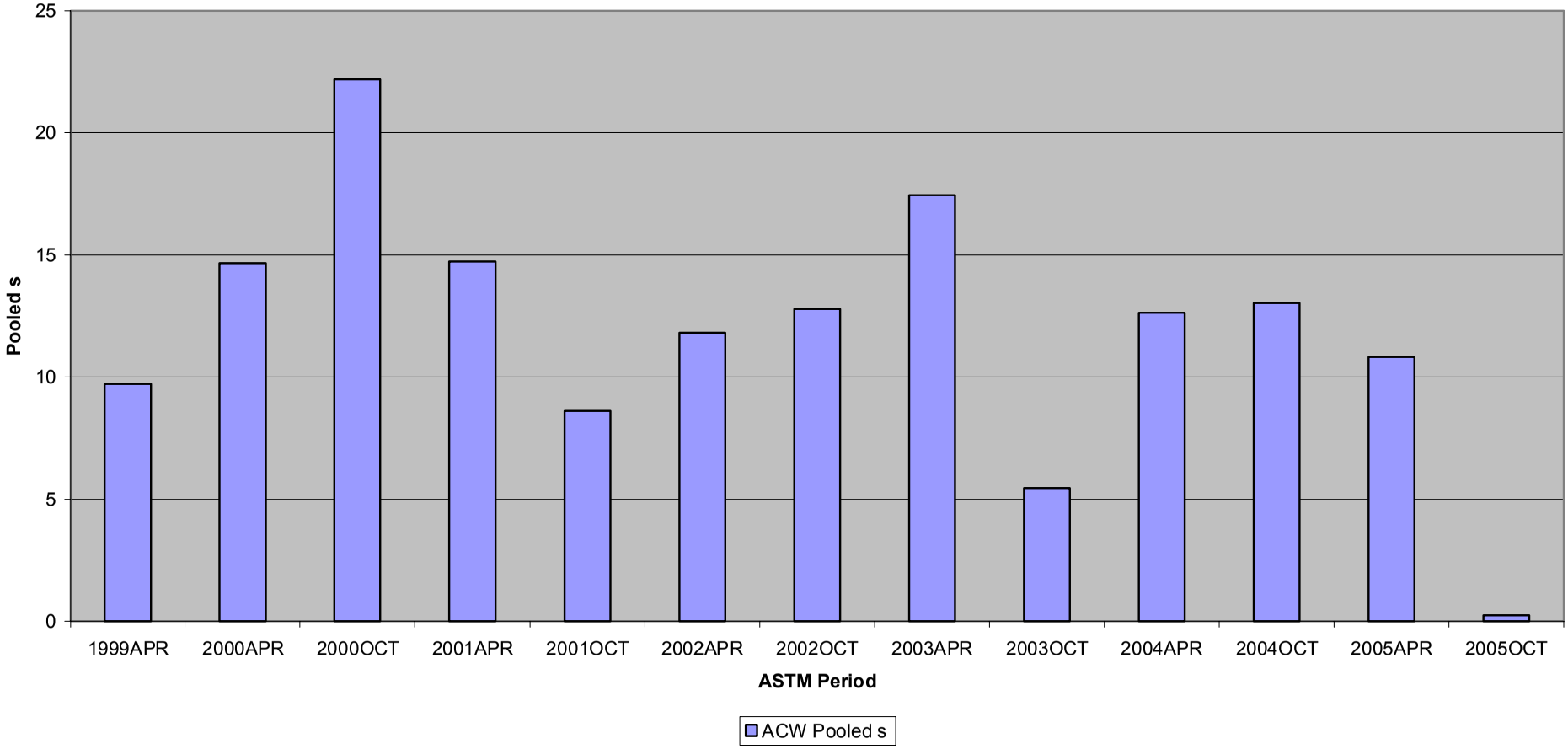


Figure 4 - Sequence IVA Timeline		
Date	**Topic**	**Information Letter**
2/10/1999	SEQUENCE IVA TEST LTMS ESTABLISHED BY SURVEILLANCE PANEL	
11/17/1999	CALIBRATION STATUS RESUMED	
2/16/2000	DRAFT 4 OF TEST PROCEDURE ISSUED. INCORPORATED JACKETED ROCKER COVER, CONTROLLED FLOW OF FRESH AIR TO ROCKER COVER, AND OIL CYLINDER HEAD AS OIL TEMPERATURE CONTROL POINT.	00-1
8/1/2000	REVISED DATA DICTIONARY AND REPORT FORM SET (VERSION 20000126) GOES INTO EFFECT.	00-2
6/12/2000	REVISED DOUBLE-FLUSH COOLANT CONTROL REQUIREMENTS EFFECTIVE	00-3
6/12/2000	REVISED ENGINE STARTING PROCEDURE EFFECTIVE	00-3
6/12/2000	ELIMINATE THE REQUIREMENT FOR LINEAR RAMPING OF TRANSIENT PARAMETERS	00-3
6/12/2000	REVISED OIL SAMPLING PROCEDURE	00-3
6/12/2000	REVISED DOUBLE-FLUSH OIL DRAIN REQUIREMENT	00-3
6/12/2000	REVISED COMPRESSION TEST REQUIREMENTS	00-3
6/12/2000	NEW CAMSHAFT CLEANING REQUIREMENTS	00-3
1/24/2001	CAMSHAFT LOT RESTRICTIONS	00-4
7/22/2001	ROCKER COVER COOLANT FLOW MEASUREMENT & REPORTING	01-1
5/24/2001	REVISED CYLINDER HEAD AND TEST ENGINE REPLACEMENT REQUIREMENTS	01-2
5/25/2001	REVISED TEST NUMBERING REQUIREMENTS	01-2
2/12/2002	REVISED ENGINE BREAK-IN SPECIFICATIONS	02-1
2/12/2002	UPDATED DRAFT STANDARD OF SEQUENCE IVA TEST PROCEDURE RELEASED	02-1
4/5/2002	REVISED CAMSHAFT MEASUREMENT PROCEDURES	02-2
5/14/2002	STAND CALIBRATION REQUIREMENT REVISIONS	02-3
5/14/2002	STAND INSTRUMENTATION CALIBRATION REQUIREMENT REVISIONS	02-3
6/1/2002	REVISED OIL SAMPLE TAP LOCATION	02-3
12/16/2002	LUBRICATION OF CAMSHAFT DURING INSTALLATION	02-4
5/11/2004	CAMSHAFT BEARING BORE MEASUREMENTS ELIMINATED EXCEPT FOR INITIAL ENGINE BUILD	04-1
6/2/2004	NEW SOLVENT SPECIFICATIONS	04-1
7/19/2004	REVISED PRECISION DEFINITIONS	04-1
11/19/2004	REVISED REPLACEMENT CRITERIA FOR CYLINDER HEADS AND ENGINES	05-1
11/19/2004	CLARIFIED SOLVENT SPECIFICATION REQUIREMENTS	05-1
11/19/2004	REVISED QI U&L VALUES FOR COOLANT OUTLET TEMPERATURE	05-1
11/192004	REVISED CALIBRATION FREQUENCY FOR INSTRUMENTATION CHANNELS	05-1
11/19/2004	ADDED SECTIONS AND ANNEX TO DEFINE ROLE OF TMC AND EXTEND CALIBRATION PERIODS FOR DONATED TEST PROGRAMS	05-1
6/8/2005	Updated Precision Estimate	05-2