


Memorandum: 09-006

Date: April 8, 2009

To: Bill Buscher, Chairman, Sequence IVA Surveillance Panel

From: Richard E. Grundza 

Subject: Sequence IVA Semiannual Report: October 1, 2008 through March 31, 2009

The following is a summary of Sequence IVA reference tests that were reported to the Test Monitoring Center during the period October 1, 2008 through March 31, 2009.

Lab/Stand Distribution

	Reporting Data	Calibrated as of March 31, 2009
Number of Laboratories:	4	3
Number of Test Stands:	9	6

The following chart shows the laboratory/stand distribution:

Laboratory/Stand Distribution

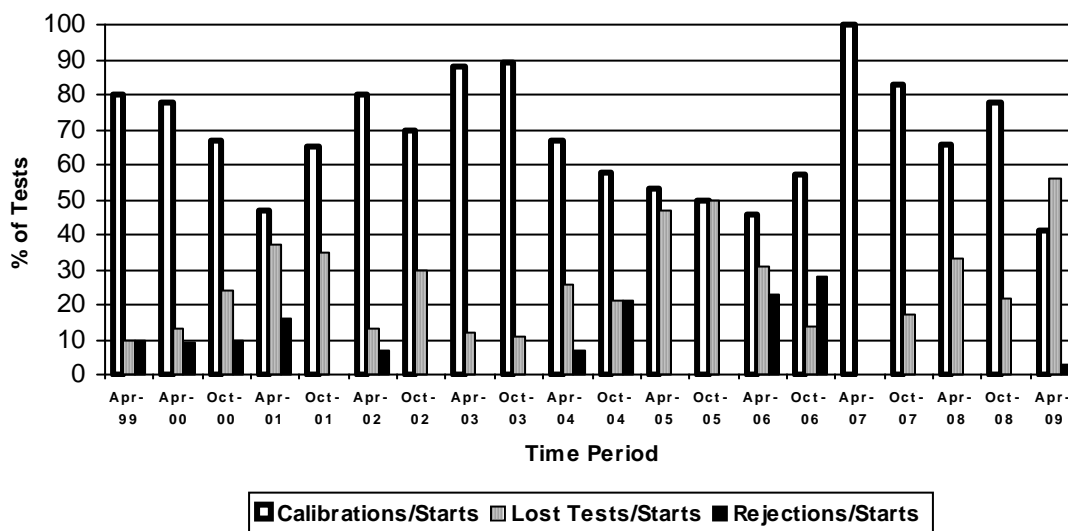


The following summarizes the status of the reference oil tests reported to the TMC:

Calibration Start Outcomes	TMC Validity Codes	No. of Tests
Operationally and Statistically Acceptable	AC	13
Operationally Valid, Statistically Unacceptable	OC	1
Operationally Invalid, Laboratory Judgement	LC	11
Operationally Invalid, Laboratory and TMC Judgement	RC	1
Stand Abandoned	MC	3
Aborted	XC	2
Total		31

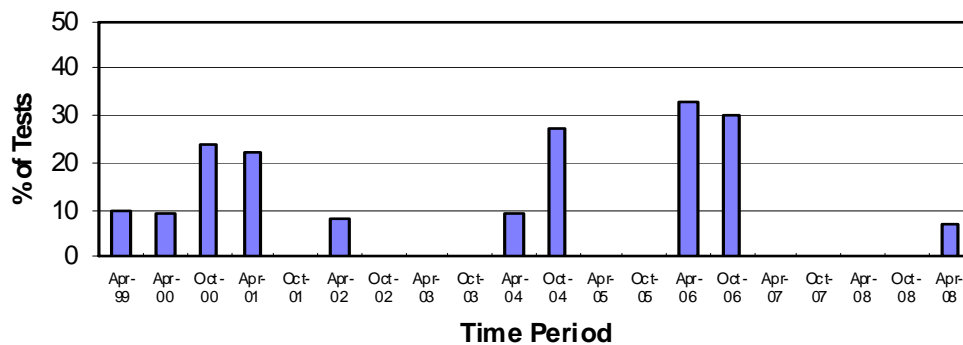
Calibrations per start, lost tests per start and rejection per start rates are summarized below:

Calibration Attempt Summary



The calibration per start rate has decreased since last period. The lost test per start rate has increased since last period. The rejected tests per start rate has increased this period.

Rejected Test Rate for Operationally Valid Tests



One test failed for a stand precision Shewhart alarm.

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

There were two QI Deviations written this period. One QI deviation was issued for speed control generating a QI value below 0.000, while a second was issued for intake air temperature QI value below 0.000.

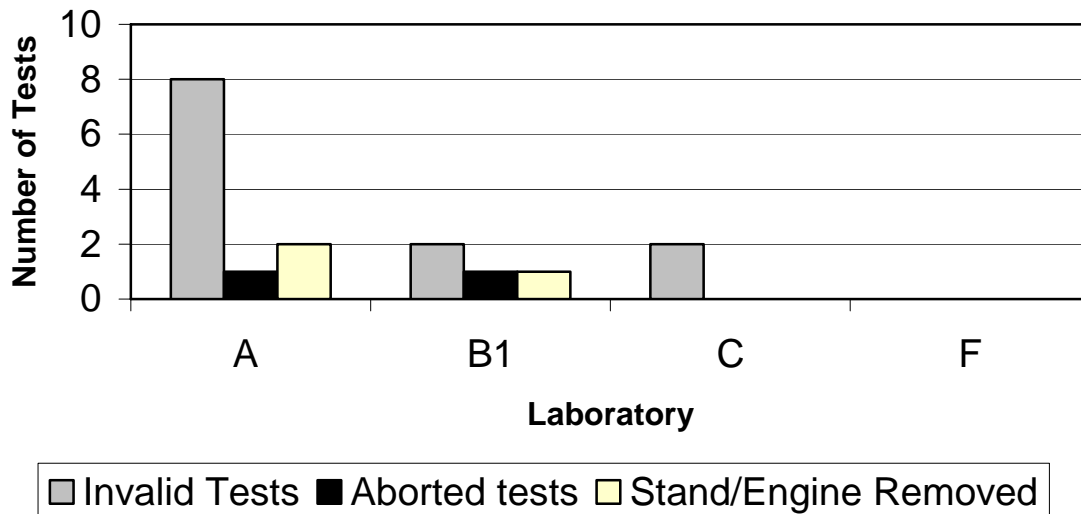
Lost Test Summary

Five tests were lost this period. The reasons for the lost tests are tabulated below:

Reasons for Lost Test(s)	Number
Stand abandoned	3
Dyno failure	1
Intake air pressure calibration error	1
Low compression, intake valve leak	1
Cylinder head thermocouple insertion depth	1
Wrong fuel	1
Oil temperature QI, control valve installed backwards	1
Incorrect oil temperature control valve trim installed	1
Throttle control, speed QI	1
Exhaust leak	1
Incorrect speed and load ramp	1
Camshaft gear failed	1
Incorrect front cover configuration, wrong PCV system	1
Cylinder head oil temperature QI	1
Intake air humidity QI	1

Aborts and operationally invalid tests, reported by laboratory, are summarized in the following chart:

Lost Test Distribution



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 laboratory.

Industry Severity Summary			
Parameter	Average Δ/s	Pooled standard deviation (degrees of freedom)	Average Δ , in micrometers
ACW	0.336	14.30 (df=13)	4.80 μm

ACW Results, by Laboratory	
Laboratory	Average Δ/s
A	0.352
B1	0.039
C	N/A
F	1.378

The industry control chart for severity began the period in control, but sounded two warning alarms at the end of the period. With the exception of three warning alarms midway through the period, precision was in control for the period. (see Figure 1).

The industry was severe for the period (see Figure 2) with an average Δ/s result of 0.336 which equates to 4.80 μm in reported units. The pooled standard deviation for the period is 14.30 μm , which has degraded when compared to the last period, but compares well with overall historical performance (see Figure 3).

Hardware

No hardware changes were made this period.

No lab visits were conducted this period.

Information Letters

Information Letter 08-1 was issued this period. The subject of this information letter can be found in the Industry Timeline, Figure 4.

Reference Oils

Oil	TMC Inventory, in gallons	TMC Inventory, in tests (4gal/test)	Laboratory Inventory, in tests	Estimated life
1006	41	10	7	1 month or less ¹
1006-2	4,281	1040	4	3+ years ¹
1007 ²	303	75	5	3+ years ¹
1009	585	146	3	3+ years ¹

¹ Multiple test area reference oil; total TMC inventory shown.

² Cannot be reblended.

Summary

Calibration per start rate has decreased with respect to the previous period. The lost test per start rate and rejected test per start rate have increased with respect to the previous period. ACW severity trended severe for the period. Pooled precision estimates show precision has degraded when compared with the previous period, but compares well with historical estimates.

REG/reg

Attachments

c: F. M. Farber, TMC
Sequence IVA Surveillance Panel
<ftp://astmtmc.cmu.edu/docs/gas/sequenceiv/semiannualreports/IVA-04-2009.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

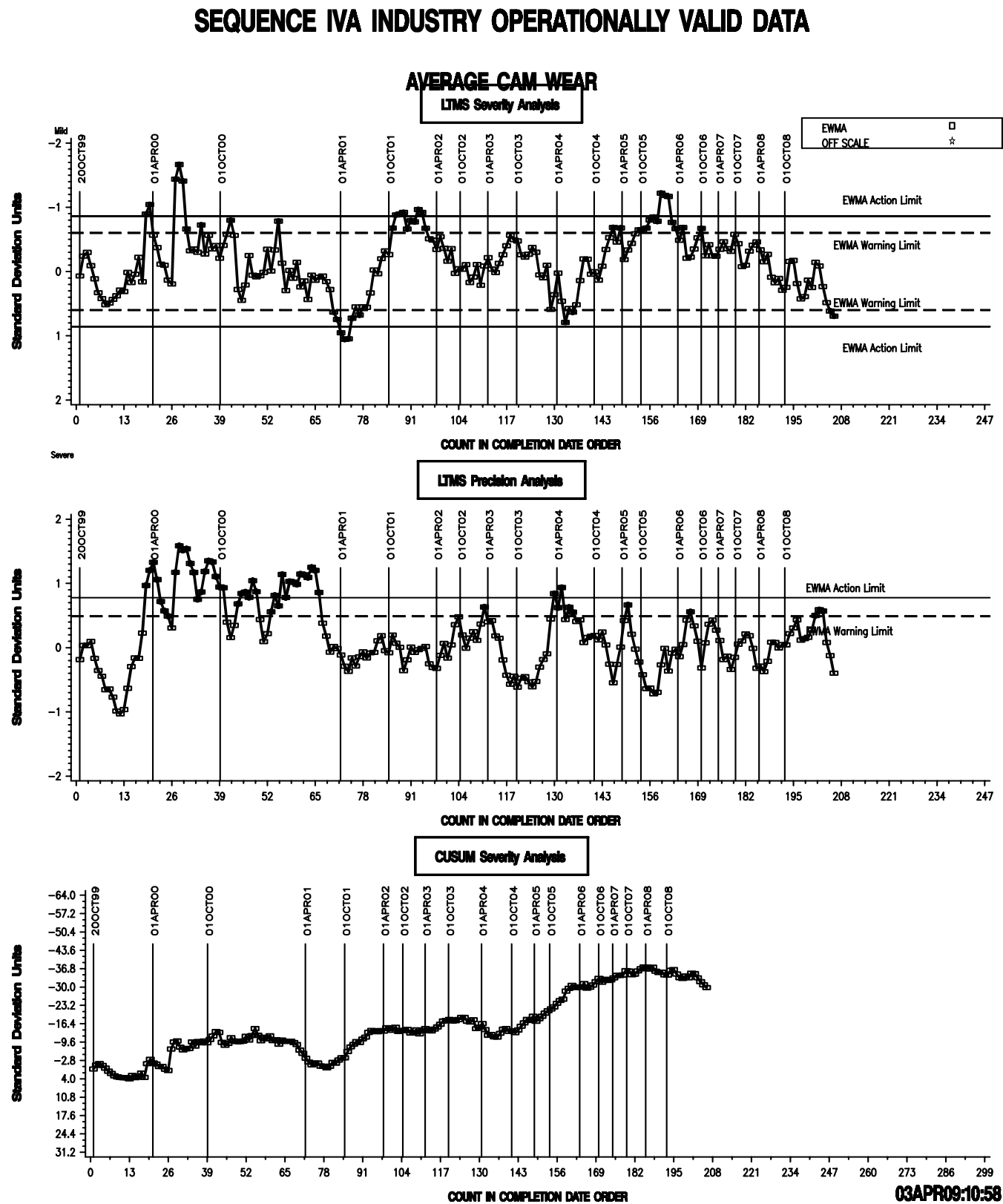


Figure 2 - Sequence IVA Reference Oil Data
Average Camshaft Wear

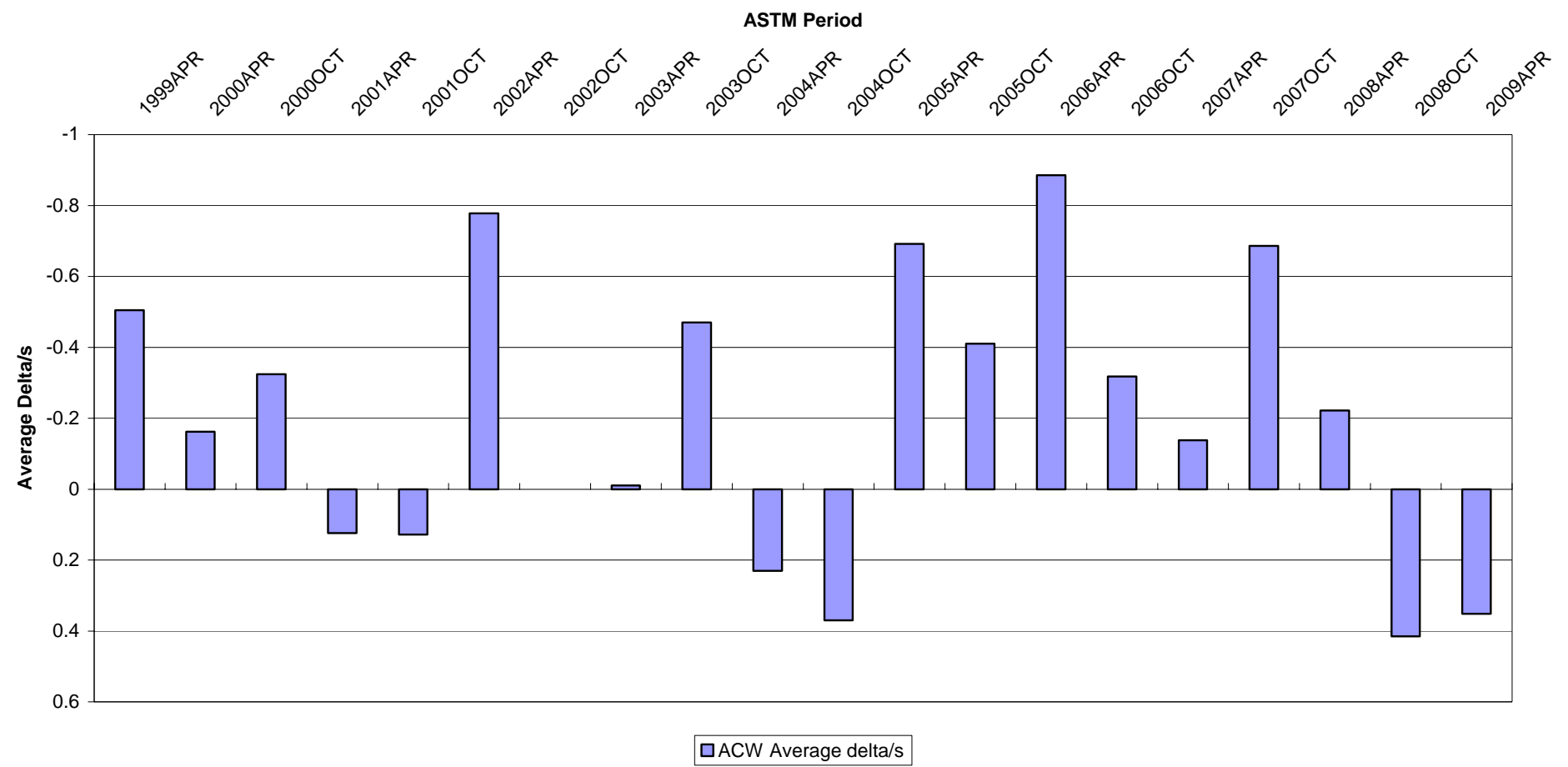


Figure 3 - Sequence IVA Reference Oil Data
Average Camshaft Wear

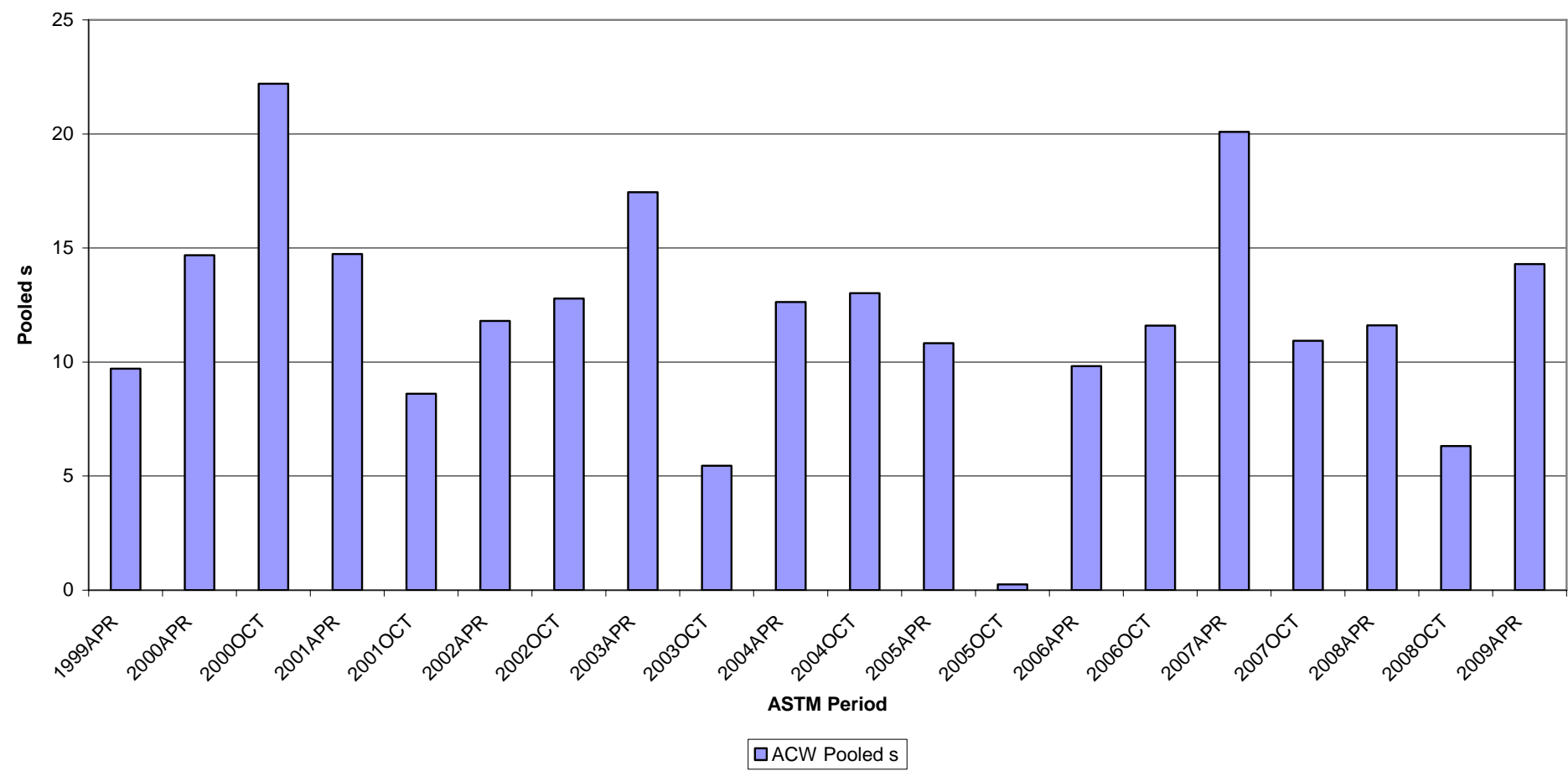


Figure 4 - Sequence IVA Timeline		
Date	Topic	Information Letter
2/10/1999	SEQUENCE IVA TEST LTMS ESTABLISHED BY SURVEILLANCE PANEL	
11/17/1999	CALIBRATION STATUS RESUMED	
2/16/2000	DRAFT 4 OF TEST PROCEDURE ISSUED. INCORPORATED JACKETED ROCKER COVER, CONTROLLED FLOW OF FRESH AIR TO ROCKER COVER, AND 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
11/19/2004	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
12/13/2005	ADDED TOLERANCES TO MEASUREMENT DEVICE LOCATIONS	05-3
12/13/2005	INCREASED NUMBER OF RUNS ALLOWED ON BLOCK AND HEADS	05-3
12/13/2005	ADDED/REVISED SCHEDULE FOR OIL COOLER, PCV VALVE AND COOLANT SYSTEM CLEANING/REPLACEMENT	05-3
12/13/2005	ADDED LIMITS ON LOST OPERATIONAL DATA	05-3
12/13/2005	REVISED FUEL TEMPERATURE CONTROL LIMITS	05-3
12/13/2005	REVISED TORQUE CONTROL STRATEGY	05-3
02/16/2006	REVISED WEAR MEASUREMENT TECHNIQUES	06-1
02/16/2006	ADDRESSED EDITORIAL CHANGES	06-1
2007/11/16	UPDATED REFERENCE OIL TARGETS (N = 29) REFERENCE OIL 1009	
2008/11/20	CLARIFIED CALCULATIONS FOR QI WHEN MISSING OR BAD QUALITY DATA ARE ENCOUNTERED	08-1
2008/11/20	CORRECTED TYPOGRAPHICAL ERROR	08-1