

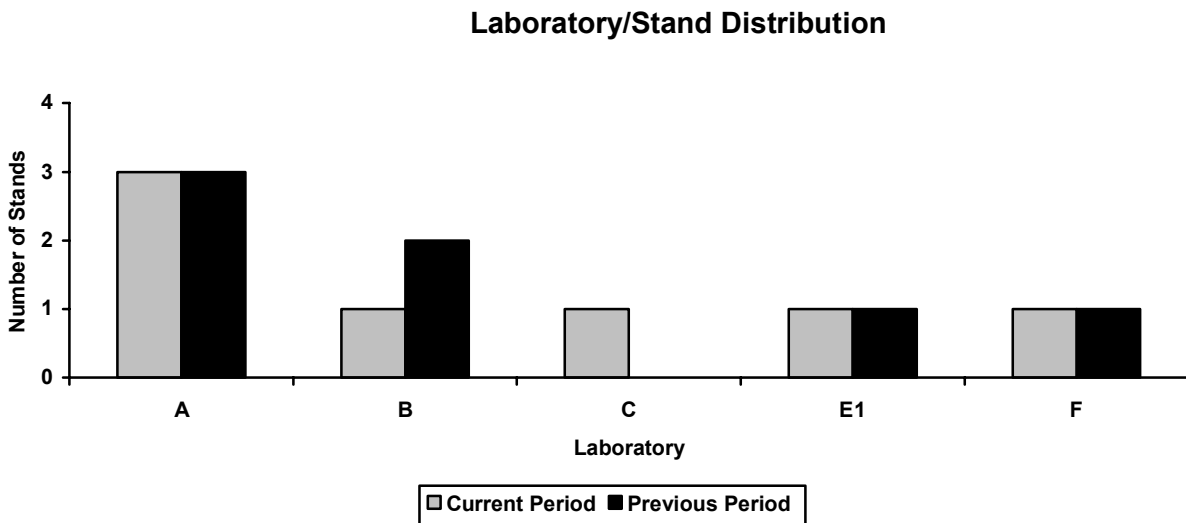
Memorandum: 03-049  
 Date: April 25, 2003  
 To: Bill Buscher, Chairman, Sequence IVA Surveillance Panel  
 From: Michael T. Kasimirsky *Michael T. Kasimirsky*  
 Subject: Sequence IVA Semiannual Report: October 1, 2002 through March 31, 2003

The following is a summary of Sequence IVA reference tests that were reported to the Test Monitoring Center during the period October 1, 2002 through March 31, 2003.

Lab/Stand Distribution

	Reporting Data	Calibrated as of March 31, 2003
Number of Laboratories:	5	4
Number of Test Stands:	7	6

The following chart shows the laboratory/stand distribution:



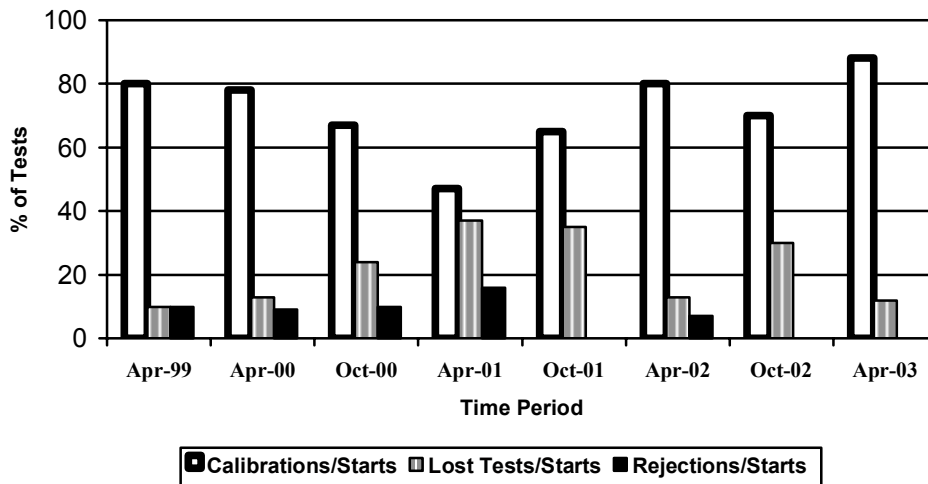
The following summarizes the status of the reference oil tests reported to the TMC:

Calibration Start Outcomes	TMC Validity Codes	No. of Tests
Operationally and Statistically Acceptable	AC	7
Failed Acceptance Criteria	OC	0
Stand Failed Reference Sequence – data pulled	MC	0
Operationally Invalid (Laboratory Judgment)	LC	1
Operationally Invalid (Lab & TMC Judgment)	RC	0
Aborted	XC	0
Total		8

Donated & Industry Support Outcomes	TMC Validity Codes	No. of Tests
Acceptable Donated Tests – Reference Oil 1009	AG	5
Total		5

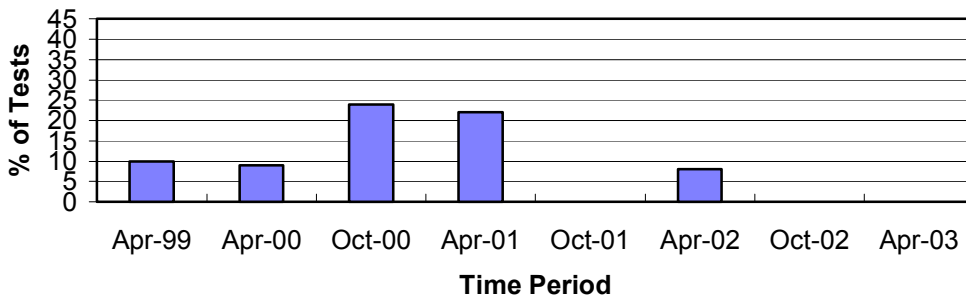
Calibrations per start, lost tests per start and rejection rates are summarized below:

### Calibration Attempt Summary



The calibration per start rate has increased since last period. The lost test rate has decreased since last period. No tests were rejected this period.

### Rejected Test Rate



There were no failed 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.

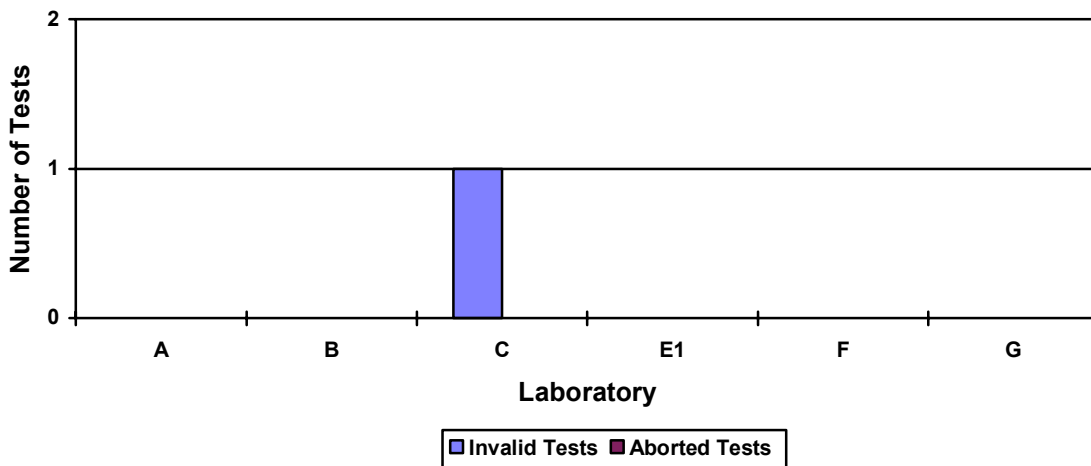
One lab visit was performed this period. No major problems were found.

### Lost Test Summary

One test was lost this period. The cause is summarized in the following chart:

Lab	Reason for Lost Test	Number of Tests	Breakdown of Tests (LC/RC/XC)
C	Loose Thermocouple Wiring	1	1/0/0

### Lost Test Distribution



Information Letters

Sequence IVA Information Letter No. 02-4, Sequence No. 10, dated December 18, 2002, was issued during the period and contained a change to the procedure for lubricating camshafts during installation in the test engine.

Severity and Precision Analysis

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

Industry Severity Summary			
Parameter	Average $\Delta/s$	Pooled standard deviation (degrees of freedom)	Average $\Delta$ , in micrometers
ACW	-0.01	17.45 (df=5)	-0.17

ACW Results, by Laboratory	
Laboratory	Average $\Delta/s$
A	-0.426
B	1.505
C	1.277
E1	-1.289
F	-0.258

The industry has been within limits for severity for the period (see Figure 1). The industry ended the period with a single-point precision alarm but subsequent testing has returned precision within limits. Severity was on target for the period (see Figure 2). Precision has degraded slightly compared to last period but is still comparable to overall historical performance (see Figure 3).

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	45	11	12	1 month or less <sup>1</sup>
1006-2	5,070	1,267	16	3+ years <sup>1</sup>
1007 <sup>2</sup>	478	119	19	3+ years <sup>1</sup>
1009	988	247	9	3+ years <sup>1</sup>

<sup>1</sup> Multiple test area reference oil; total TMC inventory shown

<sup>2</sup> Cannot be reblended

During the period the targets for reference oil 1007 were updated based upon 21 data points. The updated targets are shown in the following table:

<b>Parameter</b>	<b>Mean</b>	<b>Standard Deviation</b>
ACW	86.94	16.22

These targets are effective for all tests completed on or after January 1, 2003.

At the November 19, 2002 meeting of the Sequence IVA Surveillance Panel, the panel approved a motion to introduce reference oil 1009 into the LTMS, at a 10% usage rate, using targets generated from the five donated tests approved at the May 14, 2002 meeting. The initial test targets for this oil are shown below:

<b>Parameter</b>	<b>Mean</b>	<b>Standard Deviation</b>
ACW	21.03	6.23

These targets are effective for all tests completed on or after December 18, 2002.

MTK/mtk

Attachments

c: F. M. Farber, TMC  
Sequence IVA Surveillance Panel  
<ftp://ftp.astmtmc.cmu.edu/docs/gas/sequenceiv/semiannualreports/IVA-04-2003.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

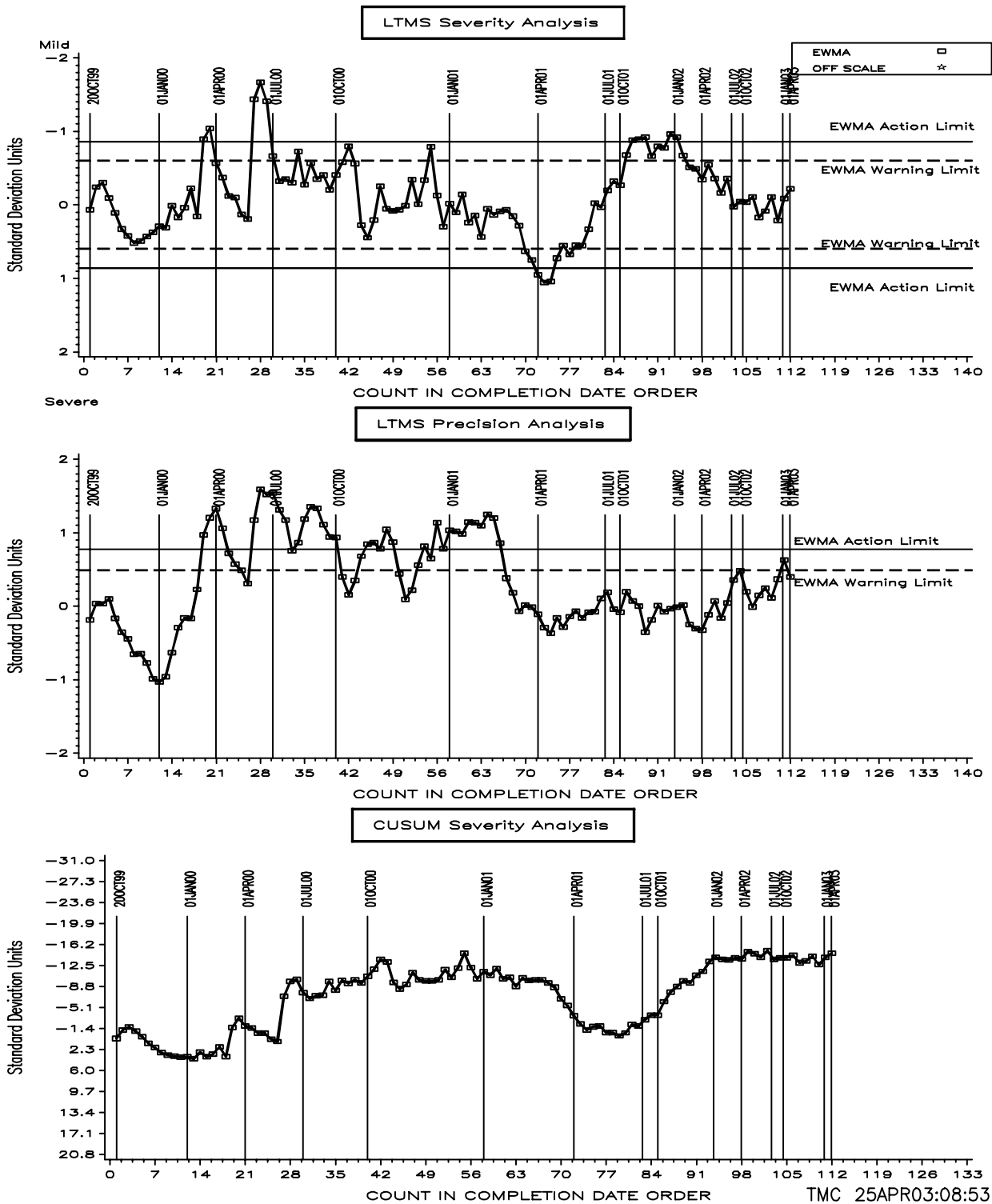
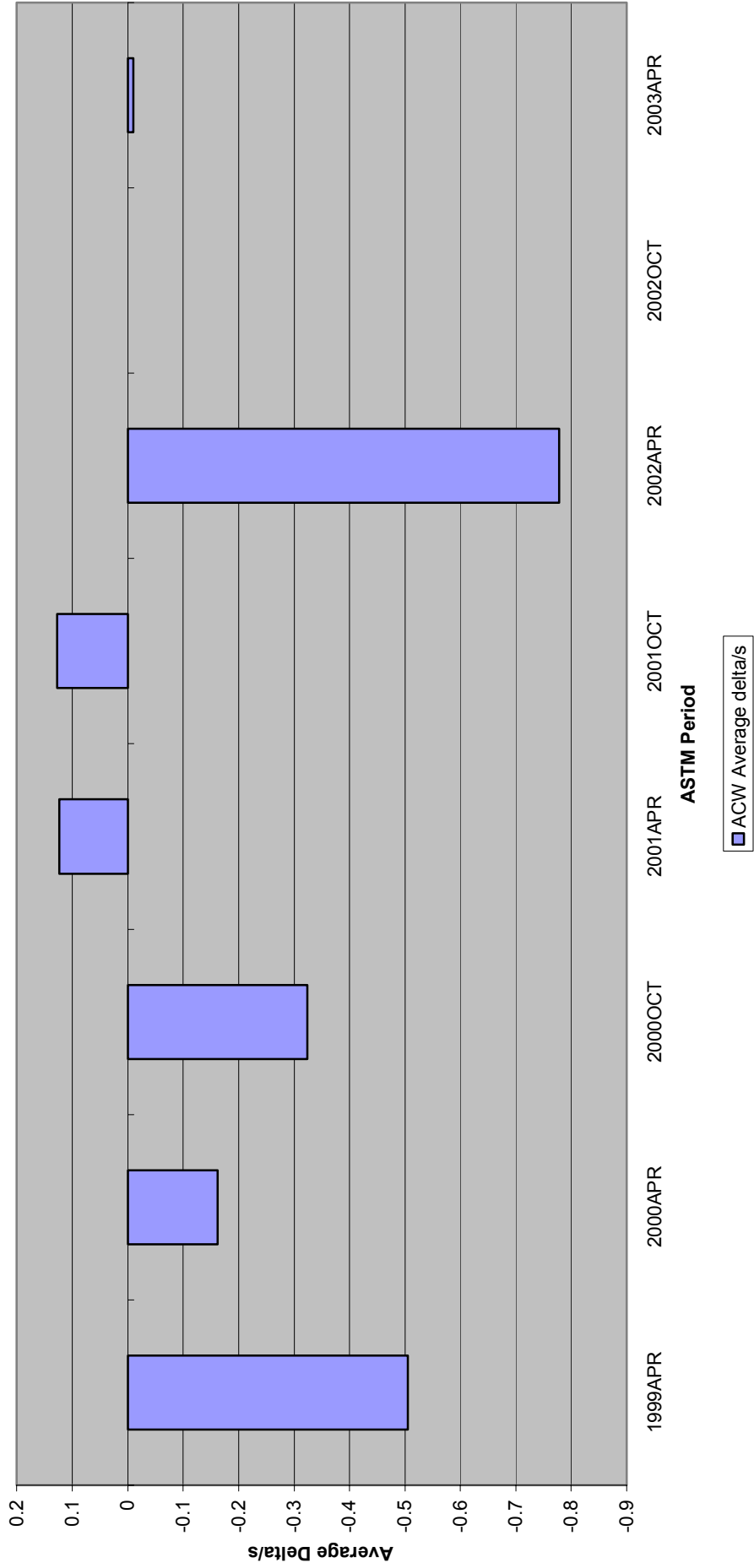
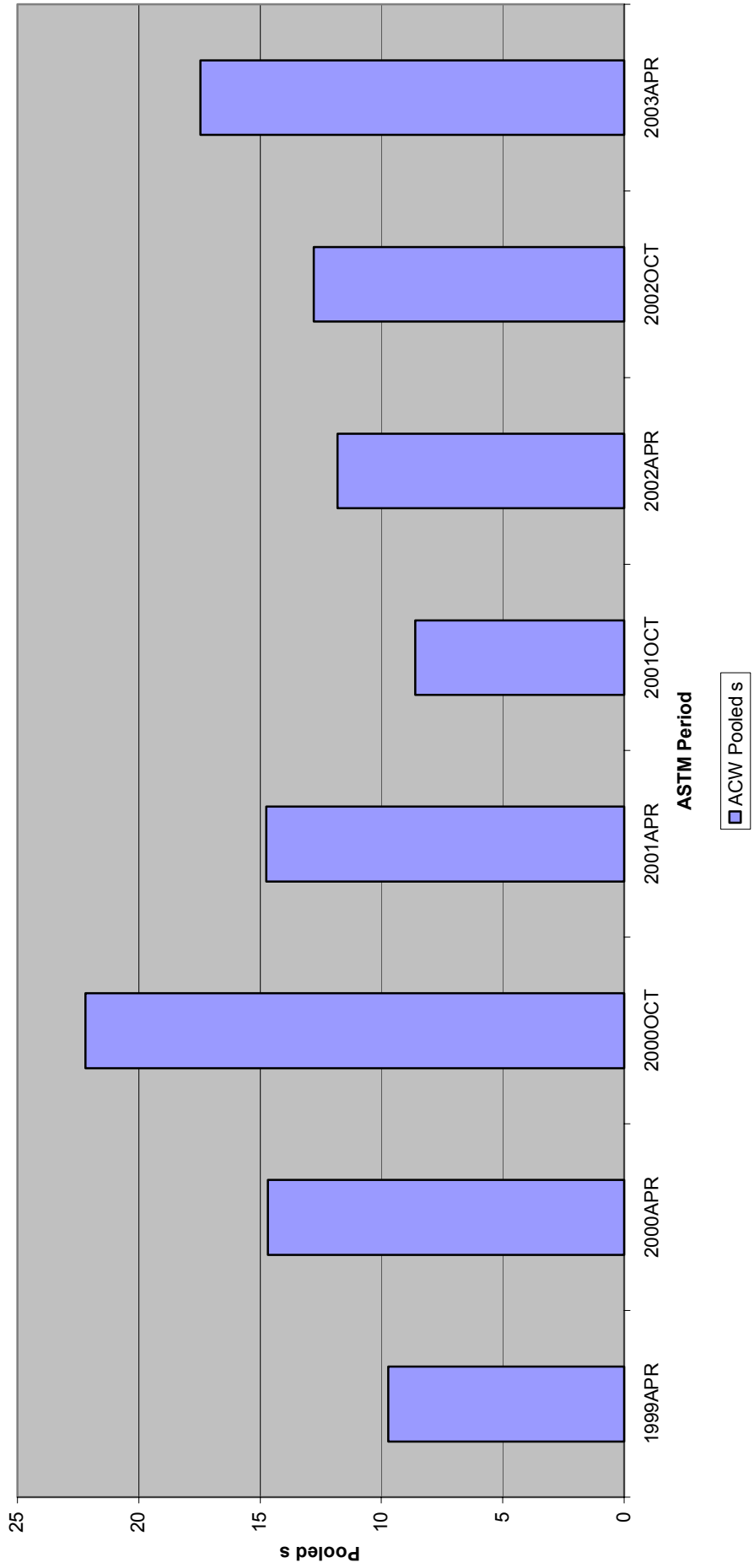


Figure 2 - Sequence IVA Reference Oil Data  
Average Camshaft Wear





**Figure 3 - Sequence IVA Reference Oil Data  
Average Camshaft Wear**



<b>Figure 4 - Sequence IVA Timeline</b>		
<b>Date</b>	<b>Topic</b>	<b>Information Letter</b>
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