



# Test Monitoring Center

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Memorandum: 04-035  
Date: April 22, 2004  
To: Bill Buscher, Chairman, Sequence IVA Surveillance Panel  
From: Michael T. Kasimirsky *Michael T. Kasimirsky*  
Subject: Sequence IVA Semiannual Report: October 1, 2003 through March 31, 2004

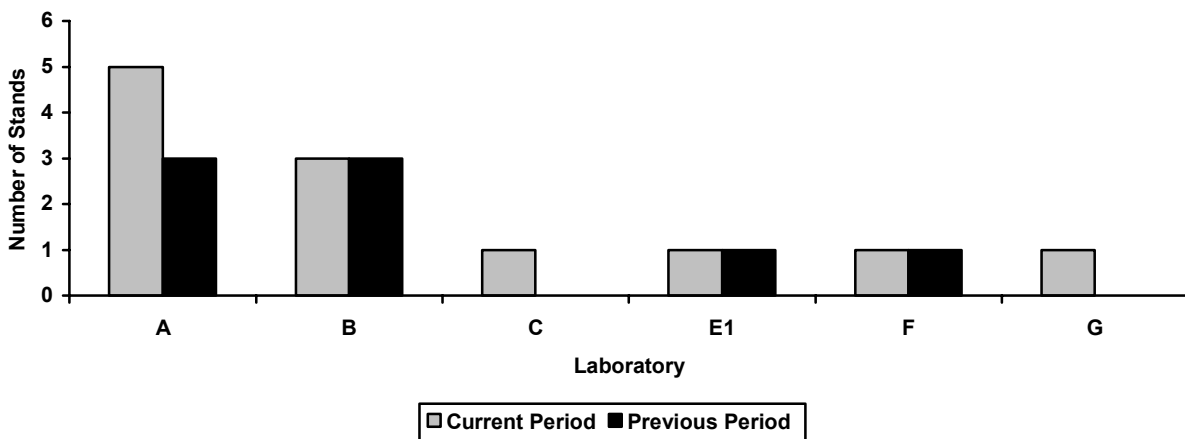
The following is a summary of Sequence IVA reference tests that were reported to the Test Monitoring Center during the period October 1, 2003 through March 31, 2004.

## Lab/Stand Distribution

	Reporting Data	Calibrated as of March 31, 2004
Number of Laboratories:	6	4
Number of Test Stands:	12	9

The following chart shows the laboratory/stand distribution:

### Laboratory/Stand Distribution



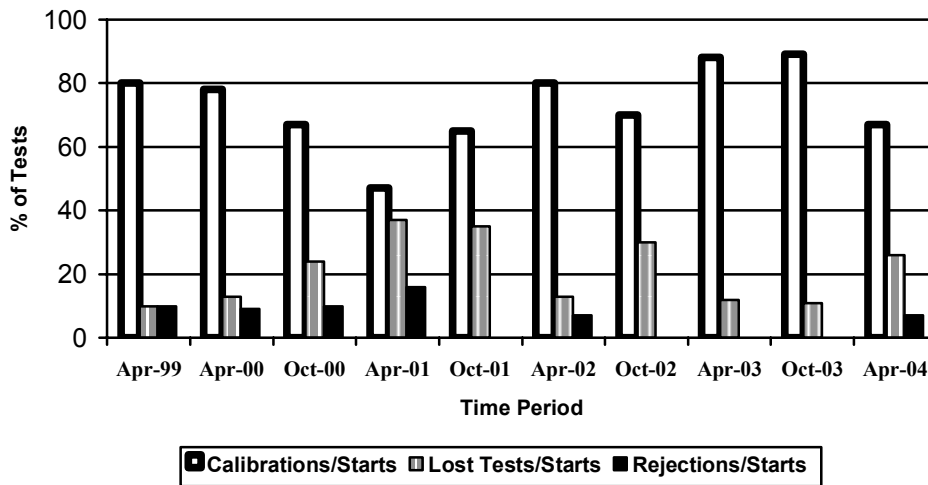
The following summarizes the status of the reference oil tests reported to the TMC:

Calibration Start Outcomes	TMC Validity Codes	No. of Tests
Operationally and Statistically Acceptable	AC	10
Failed Acceptance Criteria	OC	1
Stand Failed Reference Sequence – data pulled	MC	0
Operationally Invalid (Laboratory Judgment)	LC	2
Operationally Invalid (Lab & TMC Judgment)	RC	1
Aborted	XC	1
Total		15

Donated & Industry Support Outcomes	TMC Validity Codes	No. of Tests
Donated Tests	AG	0
Total		0

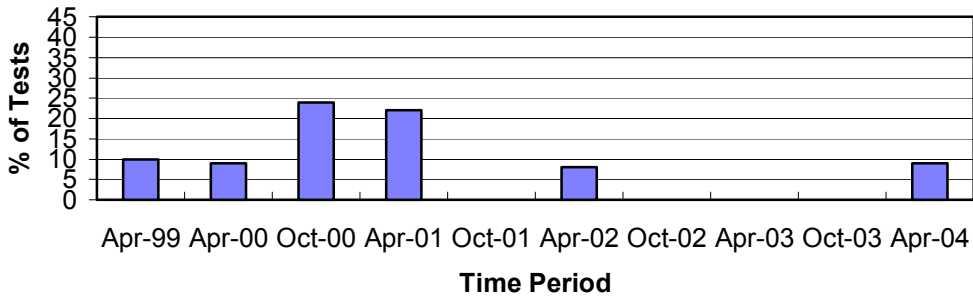
Calibrations per start, lost tests per start and rejection rates are summarized below:

### Calibration Attempt Summary



The calibration per start rate has decreased since last period. The lost test rate has increased since last period. The rejected test rate was above zero for the first time in three periods.

### Rejected Test Rate



There was one failed test this period.

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

There was one QI Deviation written this period. It was written due to coolant out temperature control problems early in the test.

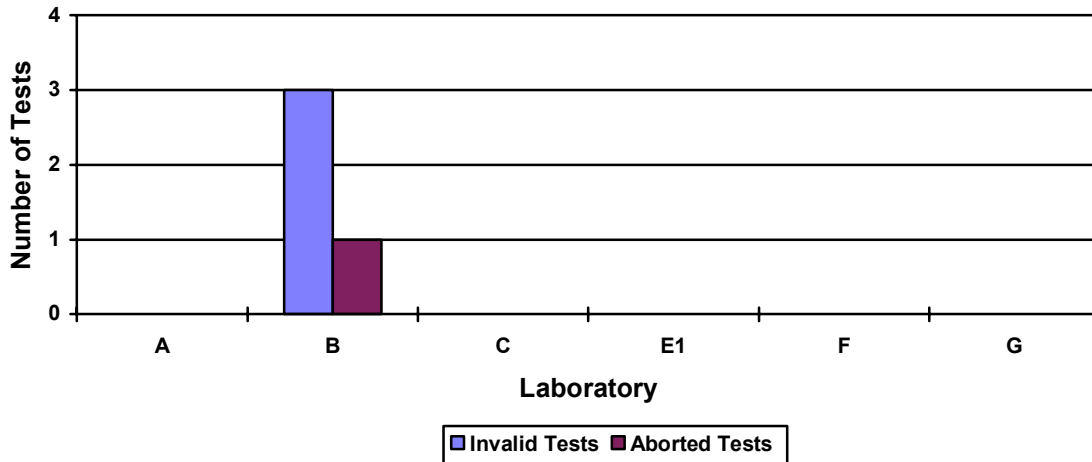
Two lab visits were performed this period. No major problems were found.

#### Lost Test Summary

Four 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/RC/XC)
B	Air-To-Fuel Ratio Control Problems	1	2/1/1
	Blowby Valve Left Open During Test	1	
	Improper Camshaft Installation	1	
	Oil Cylinder Head Thermocouple Installed Incorrectly	1	

**Lost Test Distribution**



Information Letters

No Sequence IVA Information Letters were issued this period.

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	0.23	12.63 (df=7)	2.9 $\mu\text{m}$

ACW Results, by Laboratory	
Laboratory	Average $\Delta/s$
A	0.24
B	-0.48
C	-0.56
E1	0.28
F	-0.80
G	3.34

The industry has been within limits for severity for the period (see Figure 1). Severity was severe for the period (see Figure 2) with an average  $\Delta/s$  result of 0.23, which equates to 2.9  $\mu\text{m}$  in reported units. The industry is currently experiencing a precision alarm on ACW (see Figure 1). This alarm was caused by two severe results from a single laboratory attempting to calibrate a new test stand.

The precision estimate has degraded significantly 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	44	11	10	1 month or less <sup>1</sup>
1006-2	4,886	1,221	12	3+ years <sup>1</sup>
1007 <sup>2</sup>	494	121	16	3+ years <sup>1</sup>
1009	891	222	5	3+ years <sup>1</sup>

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

<sup>2</sup> Cannot be reblended

MTK/mtk

Attachments

c: F. M. Farber, TMC

Sequence IVA Surveillance Panel

<ftp://ftp.astmtmc.cmu.edu/docs/gas/sequenceiv/semiannualreports/IVA-04-2004.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

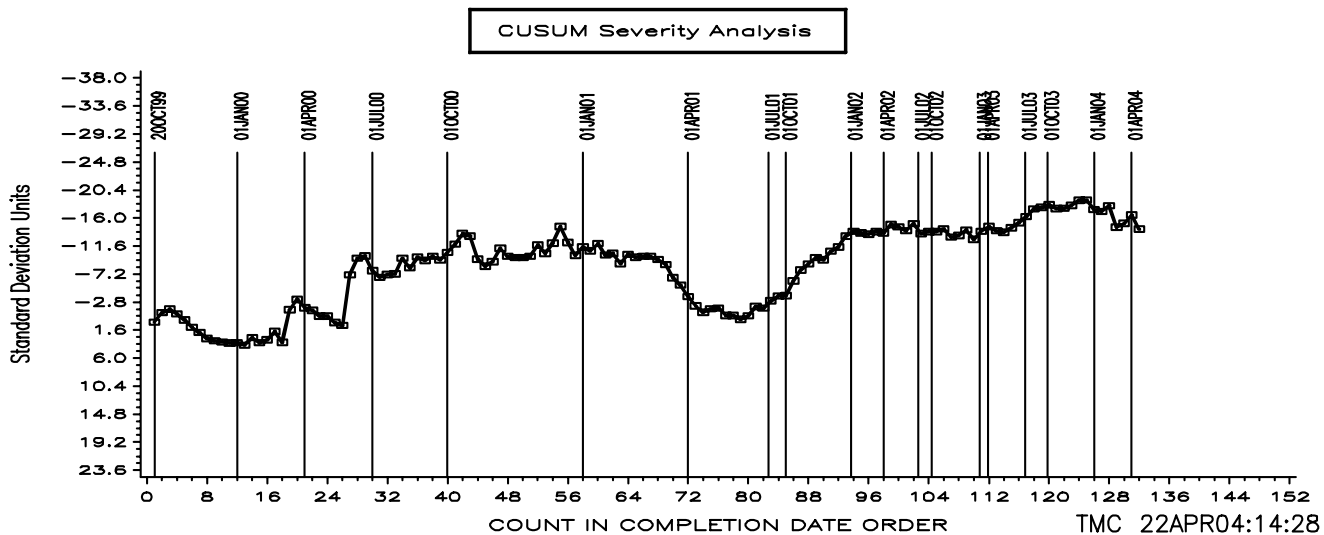
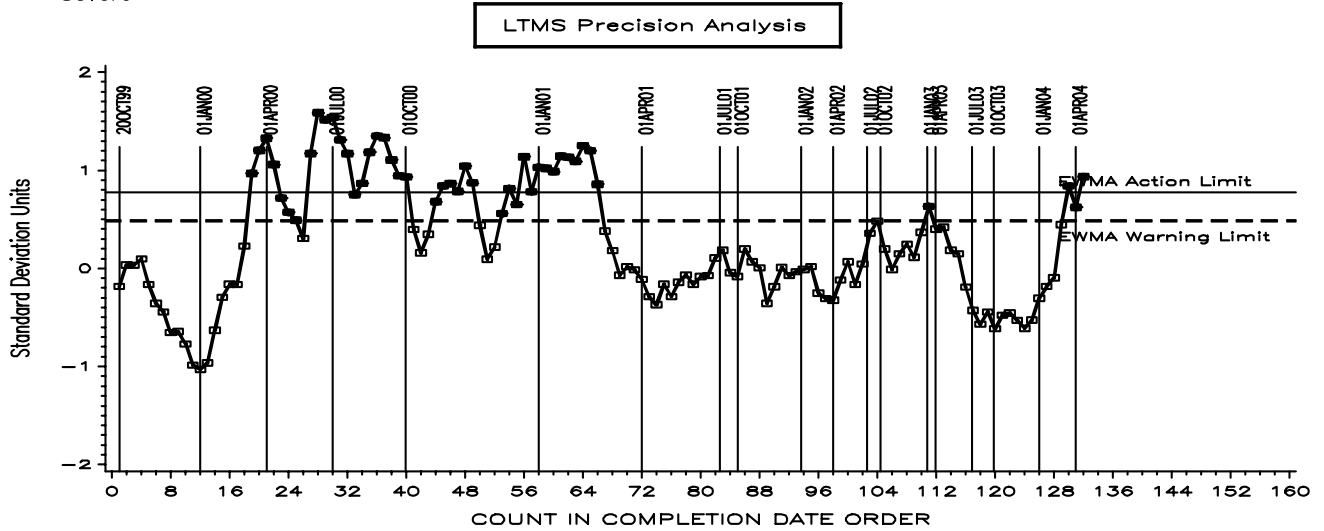
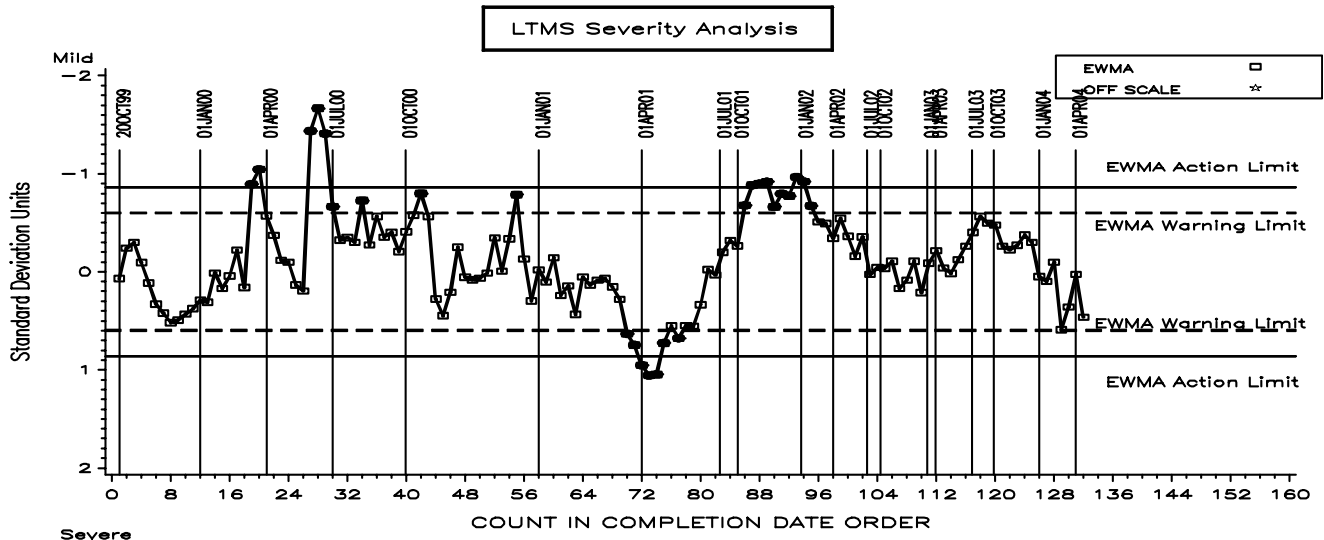
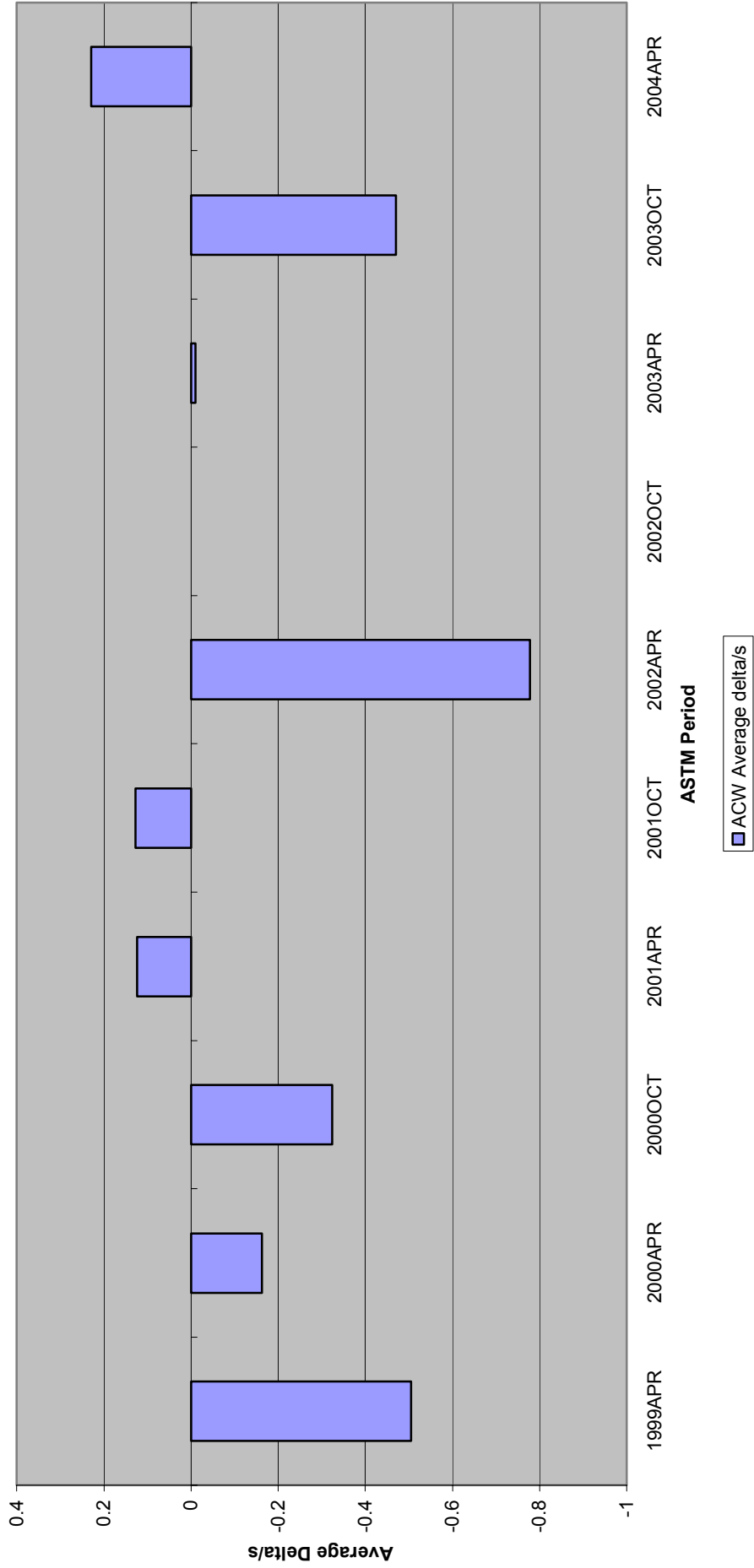
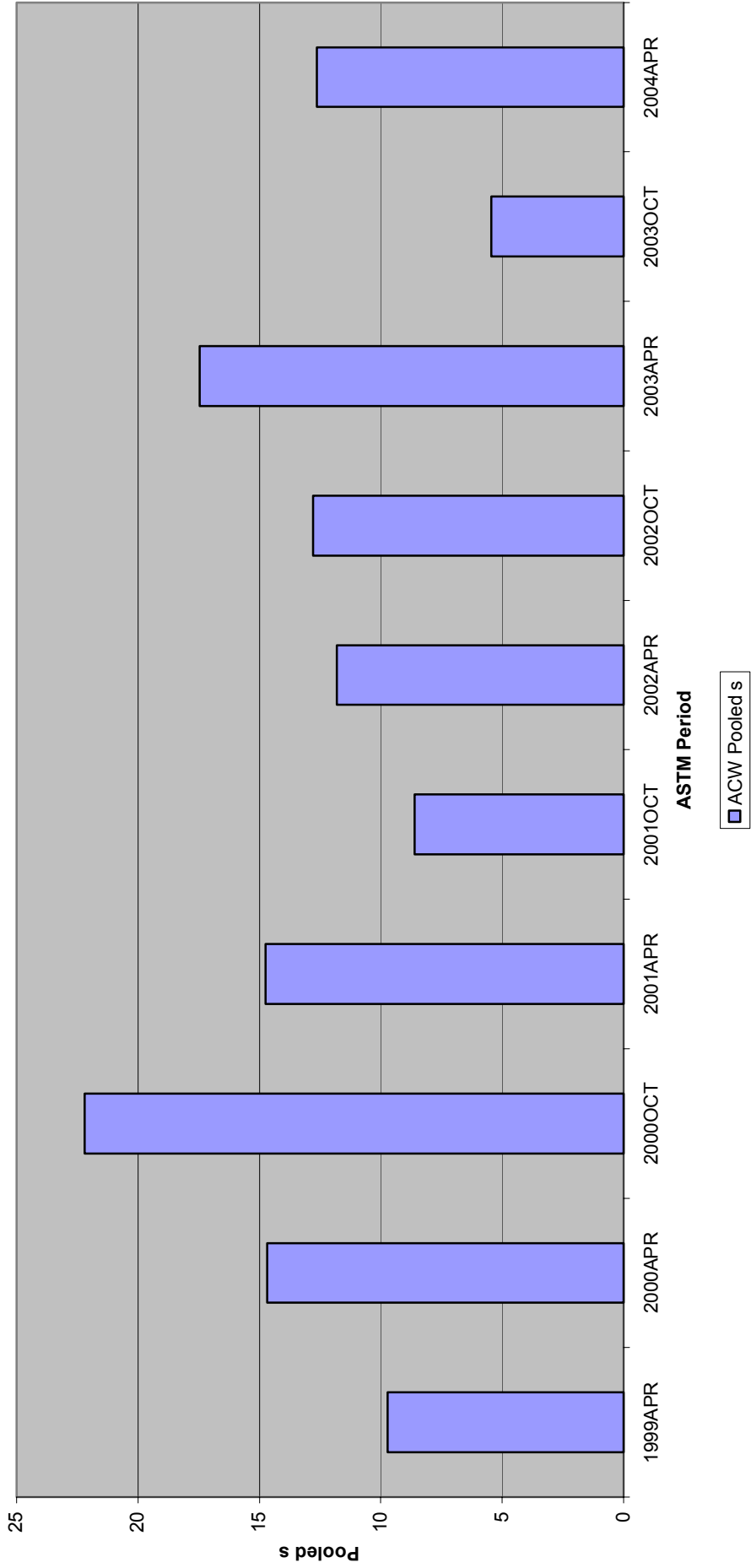


Figure 2 - Sequence IVA Reference Oil Data  
Average Camshaft Wear





**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