

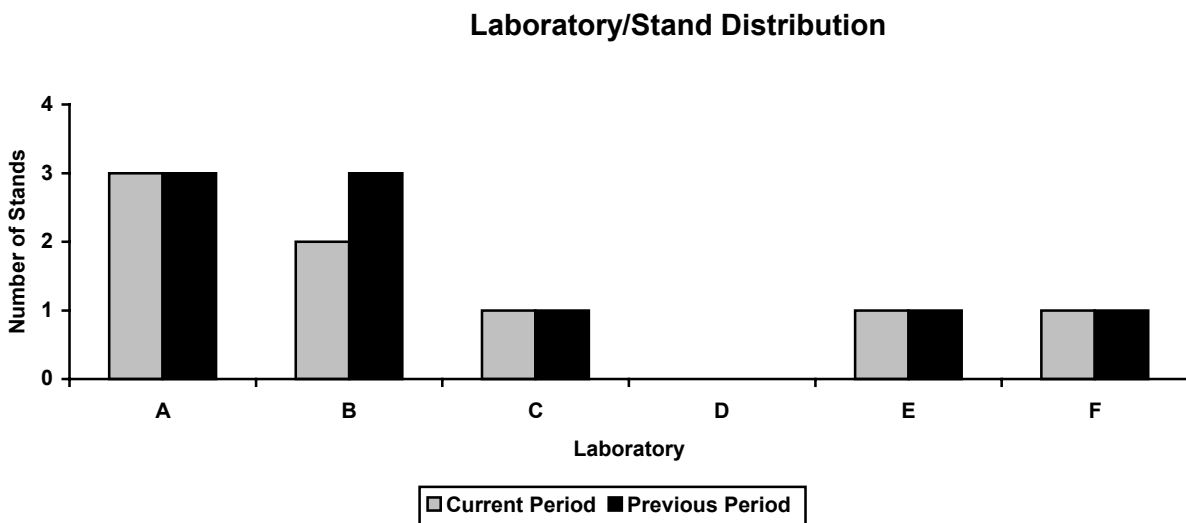
Memorandum: 00-157  
 Date: November 7, 2000  
 To: Larry M. Bendele, Chairman, Sequence IVA Surveillance Panel  
 From: Michael T. Kasimirsky  
 Subject: Sequence IVA Semiannual Report: April 1, 2000 through September 30, 2000

The following is a summary of Sequence IVA reference tests that were reported to the Test Monitoring Center during the period April 1, 2000 through September 30, 2000.

Lab/Stand Distribution

	Reporting Data	Calibrated as of September 30, 2000
Number of Laboratories:	5	4
Number of Test Stands:	8	5

The following chart shows the laboratory/stand distribution:



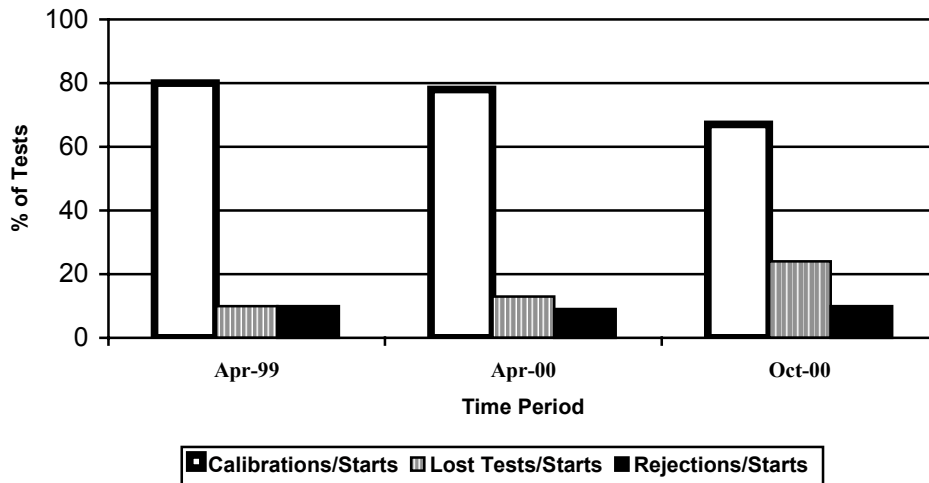
The following summarizes the status of the reference oil tests reported to the TMC:

Calibration Start Outcomes	TMC Validity Codes	No. of Tests
Operationally and Statistically Acceptable	AC	14
Failed Acceptance Criteria	OC	5
Operationally Invalid (Laboratory Judgment)	LC	2
Operationally Invalid (Lab & TMC Judgment)	RC	0
Aborted	XC	0
Total		21

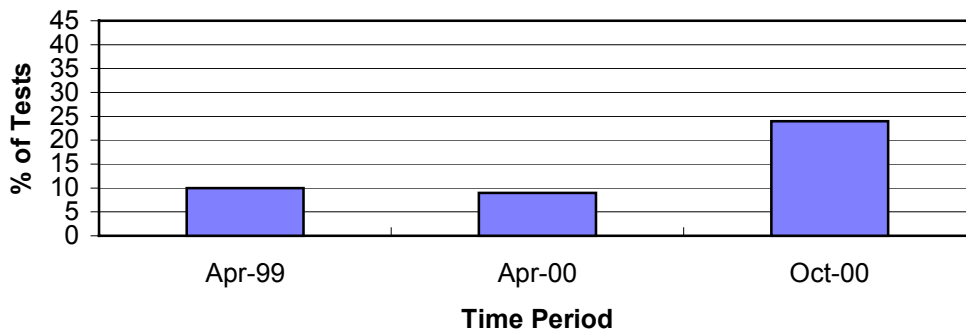
Donated & Industry Support Outcomes	TMC Validity Codes	No. of Tests
Acceptable Reference Oil 1007 Run	AG	5
Unacceptable Reference Oil 1007 Run	OG	2
Invalid Reference Oil 1007 Run	LG	2
Total		9

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

### Calibration Attempt Summary



### Rejected Test Rate



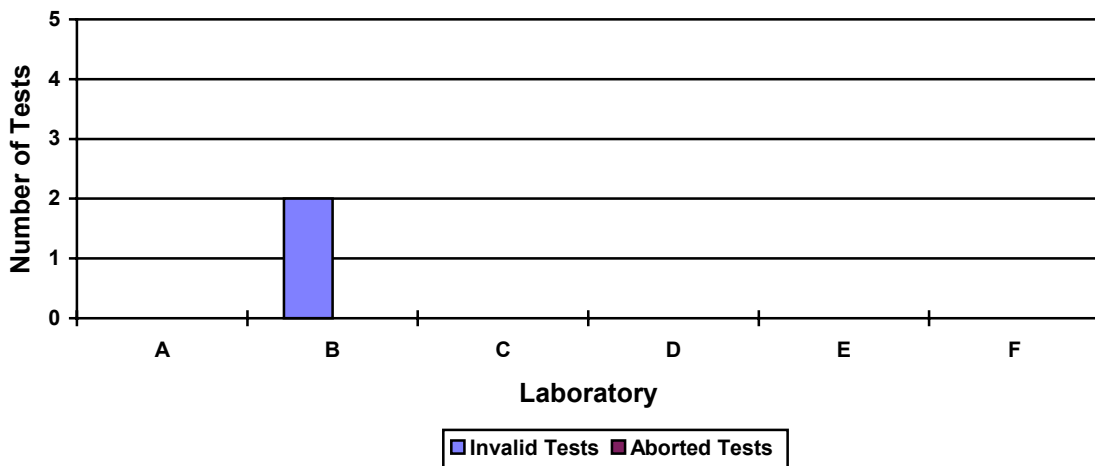
There were five failing tests for the period; four failed due to Shewhart Severity alarms on ACW. Three were in the mild direction and one in the severe direction. The remaining test failed due to EWMA Precision Alarms at both the lab and stand level.

There was one LTMS Deviation this period. There has been one deviation from the LTMS since its introduction in 1999.

### Lost Test Summary

Two tests were lost this period. One was lost due to throttle body problems and the other was lost due to a faulty throttle position sensor.

### Lost Test Distribution



### Information Letters

Sequence IVA Information Letter No. 00-2, dated June 15, 2000, was issued during the period and contained a revised Data Dictionary and Report Form Set.

Sequence IVA Information Letter No. 00-3, dated August 25, 2000, was issued during the period and contained the following items: revised Double-Flush Coolant Control Requirements, a revised Engine Starting Procedure, revised Transient Ramping Requirements, a revised Oil Sampling Procedure, revised Double Flush Oil Drain Time Requirements, revised Compression Test Requirements, and new Camshaft Cleaning Requirements.

#### 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	-0.324	22.20 (df=18)	-7.19

ACW Results, by Laboratory	
Laboratory	Average $\Delta/s$
A	0.734
B	0.981
C	1.337
D	-
E	-2.540
F	0.004

The industry began the period in a precision alarm due to a single reference oil test which was significantly mild of target (-5.11  $\Delta/s$ ). The severity chart had just returned within limits after an alarm due to this result. This precision alarm continued for the entire period, with the exception of returning within limits for one point. The industry experienced a severity alarm of four points during the period, related to a single reference oil test which generated significantly mild test results (-7.96  $\Delta/s$ ). This test also triggered an industry precision alarm. The follow-up test on this stand also generated mild results (-2.59  $\Delta/s$ ). No cause for these mild results has been found. The two remaining tests that generated Shewhart Severity alarms on ACW, one severe and one mild (2.32  $\Delta/s$  and -2.42  $\Delta/s$  respectively) continued the industry precision alarm.

There is currently an investigation underway to determine if these problems are hardware-related. No conclusions have been reached at this point.

#### Hardware

No hardware changes were made this period.

Reference Oils

Oil	TMC Inventory, in gallons	TMC Inventory, in tests	Laboratory Inventory, in tests	Estimated life
1006	1,552	388	6	3+ years <sup>1</sup>
1007	660	165	5	3+ years <sup>1</sup>

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

MTK/mtk

Attachments

c: F. M. Farber, TMC  
Sequence IVA Surveillance Panel  
<ftp://tmc.astm.cmri.cmu.edu/docs/gas/sequenceiv/semiannualreports/IVA-10-2000.pdf>

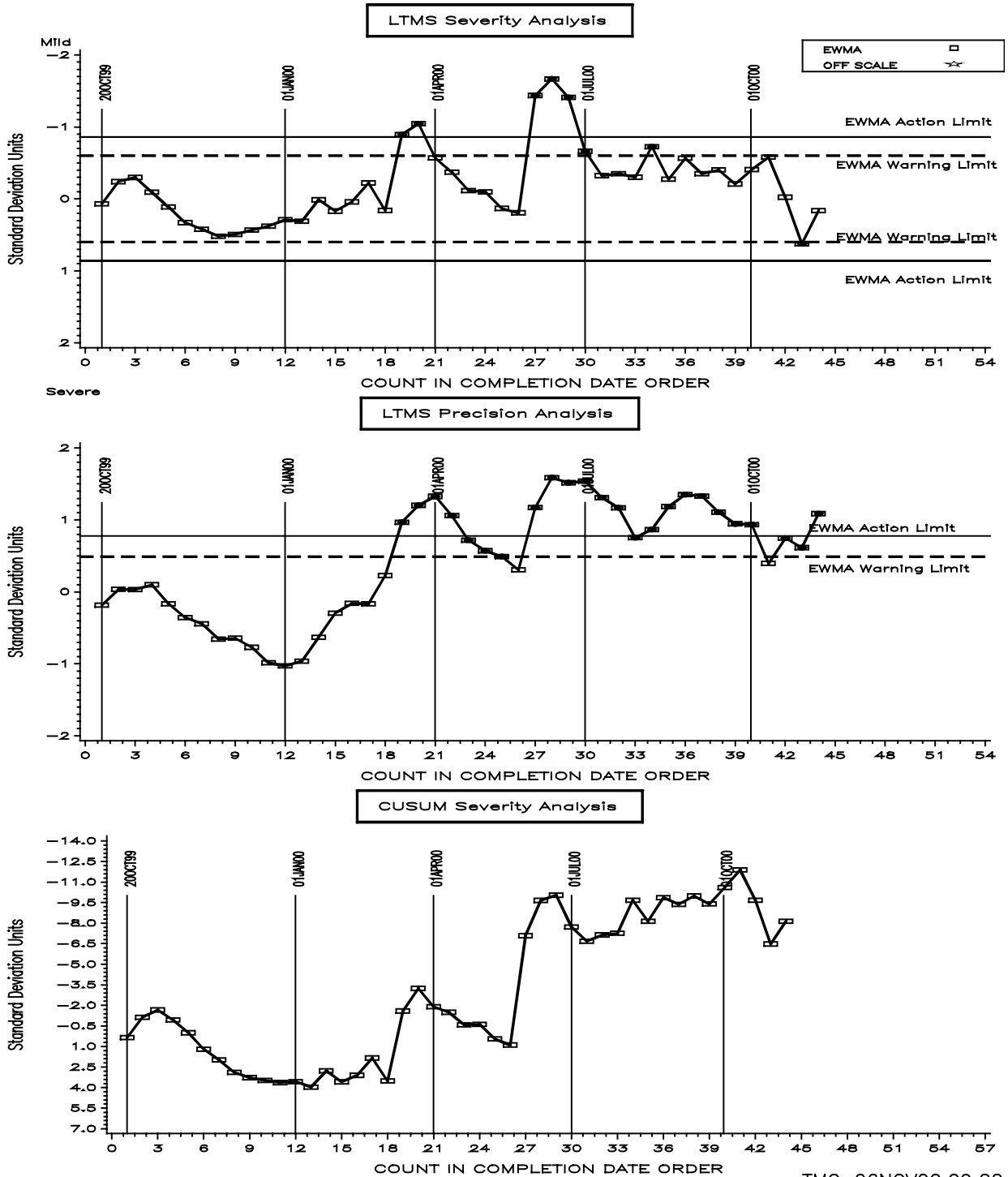
List of Figures

- 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, current through November 6, 2000.

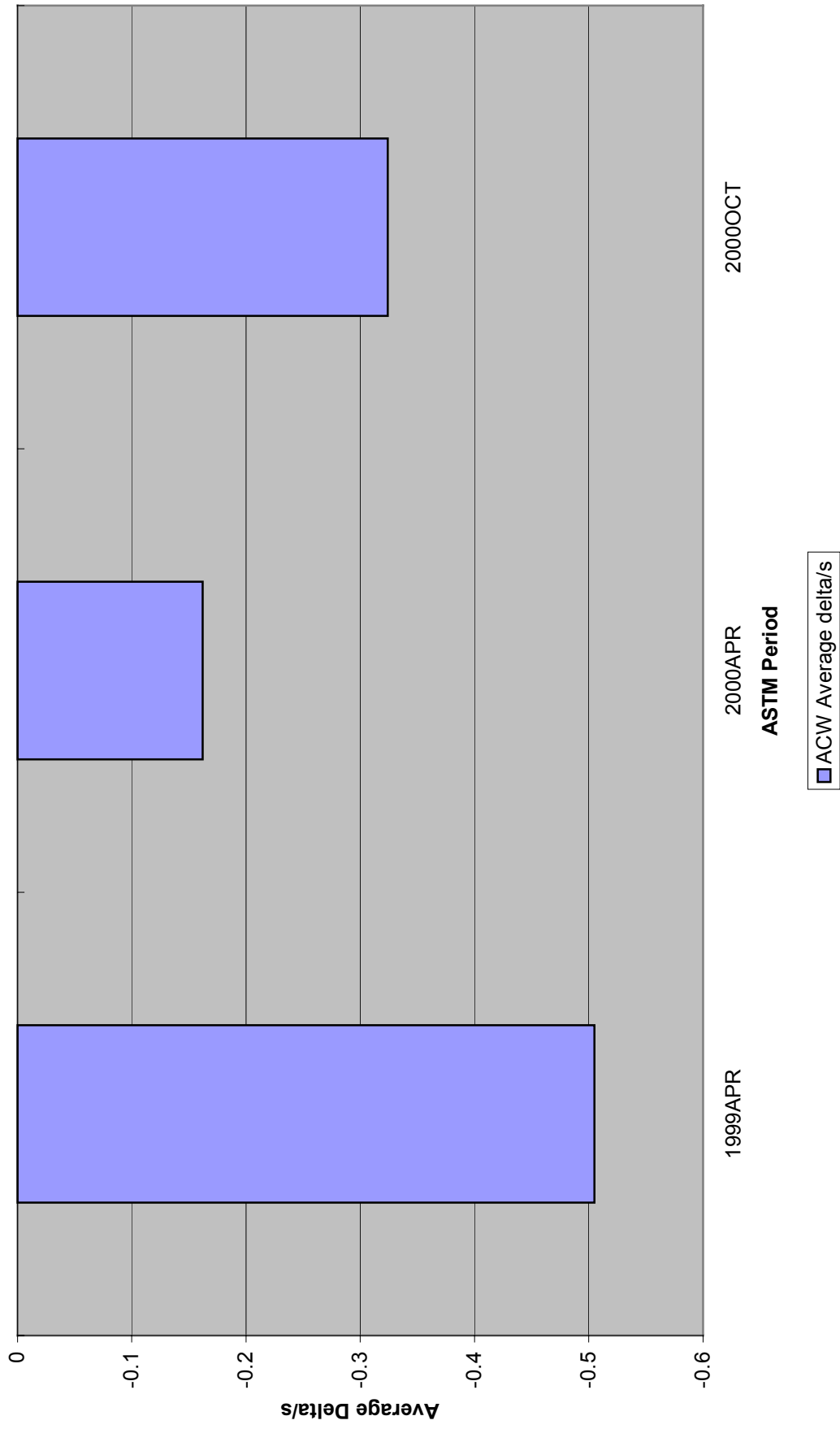
# SEQUENCE IVA INDUSTRY OPERATIONALLY VALID DATA

## AVERAGE CAM WEAR

Figure 1

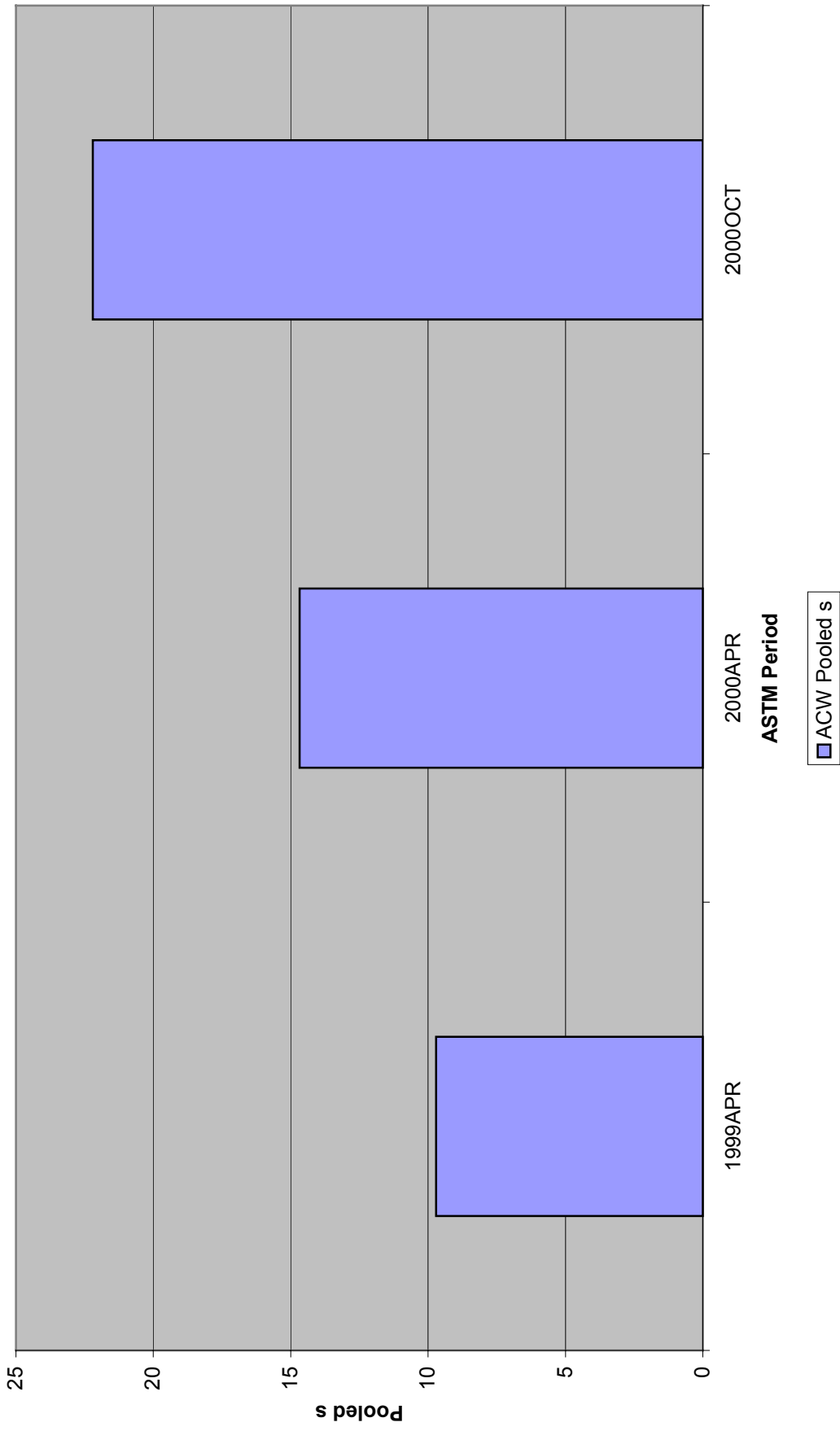


**Figure 2 - Sequence IVA Reference Oil Data  
Average Camshaft Wear**





**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	00-3
6/12/2000	REVISED ENGINE STARTING PROCEDURE	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