



Test Monitoring Center

6555 Penn Avenue
Pittsburgh, PA 15206-4489
(412) 365-1000

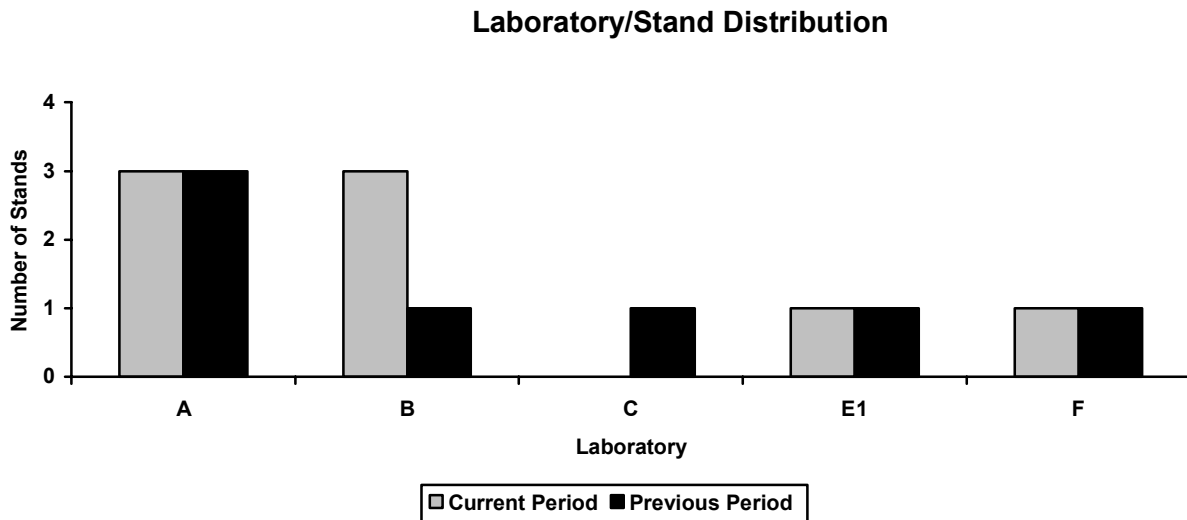
Memorandum: 03-106
Date: October 22, 2003
To: Bill Buscher, Chairman, Sequence IVA Surveillance Panel
From: Michael T. Kasimirsky *Michael T. Kasimirsky*
Subject: Sequence IVA Semiannual Report: April 1, 2003 through September 30, 2003

The following is a summary of Sequence IVA reference tests that were reported to the Test Monitoring Center during the period April 1, 2003 through September 30, 2003.

Lab/Stand Distribution

	Reporting Data	Calibrated as of September 30, 2003
Number of Laboratories:	4	4
Number of Test Stands:	8	8

The following chart shows the laboratory/stand distribution:



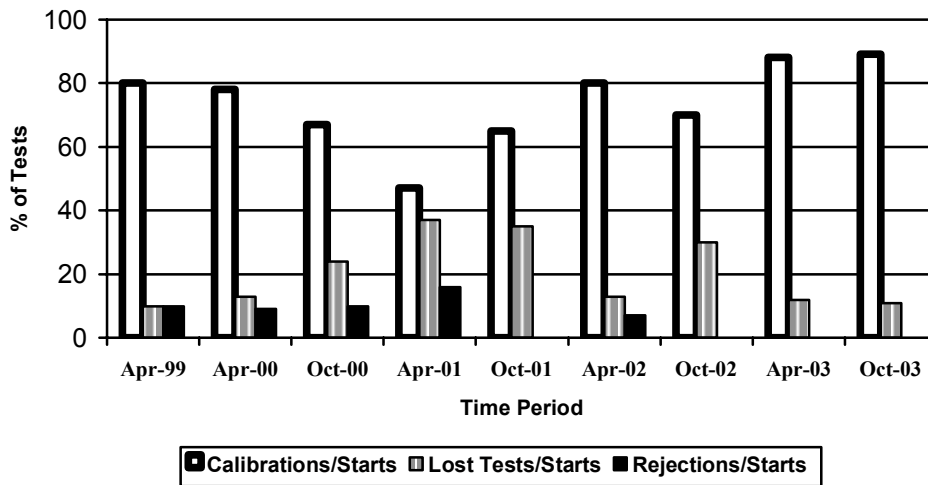
The following summarizes the status of the reference oil tests reported to the TMC:

Calibration Start Outcomes	TMC Validity Codes	No. of Tests
Operationally and Statistically Acceptable	AC	8
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		9

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

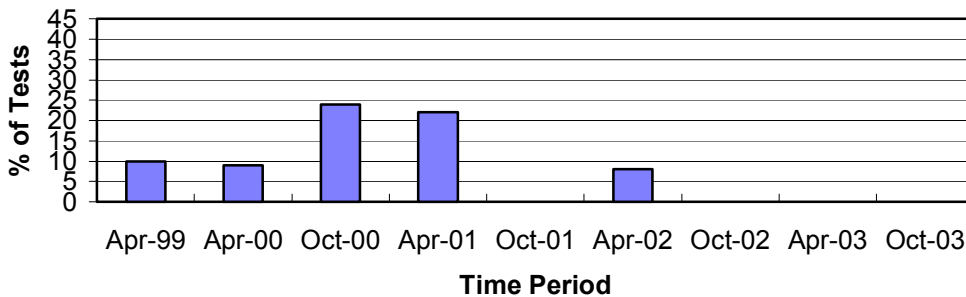
Calibrations per start, lost tests per start and rejection rates are summarized below:

Calibration Attempt Summary



The calibration per start rate has increased slightly since last period. The lost test rate has decreased slightly since last period. No tests were rejected again 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 two QI Deviations written this period. One was written due to speed and torque control problems related to a bad throttle controller. The other was written due to coolant out temperature control problems related to sediment present in the heat exchanger.

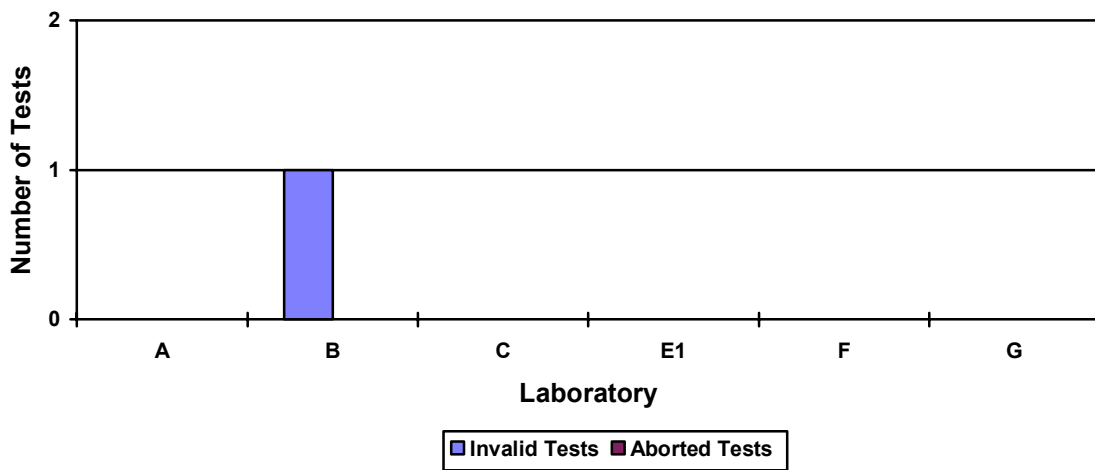
One lab visit was performed this period. No major problems were found.

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)
B	Oil Cylinder Head Thermocouple Installed Incorrectly	1	1/0/0

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

Industry Severity Summary			
Parameter	Average Δ/s	Pooled standard deviation (degrees of freedom)	Average Δ , in micrometers
ACW	-0.47	5.46 (df=4)	-2.6 μm

ACW Results, by Laboratory	
Laboratory	Average Δ/s
A	0.03
B	-0.72
C	-
E1	-0.96
F	-0.70

The industry has been within limits for severity for the period (see Figure 1). Severity was mild for the period (see Figure 2) with an average Δ/s result of -0.47 , which equates to $-2.6 \mu\text{m}$ in reported units. Precision has improved significantly compared to last period and is at its lowest levels compared to overall historical performance (see Figure 3). However, this precision estimate is probably artificially low because only reference oil 1007 and 1009 data was used in the pooled standard deviation calculation (due to insufficient reference oil 1006 and 1006-2 data) for the period. As you know, the target for reference oil 1009 is very low, compared to the other reference oils used in the LTMS, and it has very little spread in the data, giving very precise results.

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	11	1 month or less ¹
1006-2	4,967	1,241	14	3+ years ¹
1007 ²	482	120	15	3+ years ¹
1009	958	239	4	3+ years ¹

¹ Multiple test area reference oil; total TMC inventory shown

² Cannot be reblended

Memo 03-106
Page 5

MTK/mtk

Attachments

c: F. M. Farber, TMC
Sequence IVA Surveillance Panel
<ftp://astmtmc.cmu.edu/docs/gas/sequenceiv/semiannualreports/IVA-10-2003.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

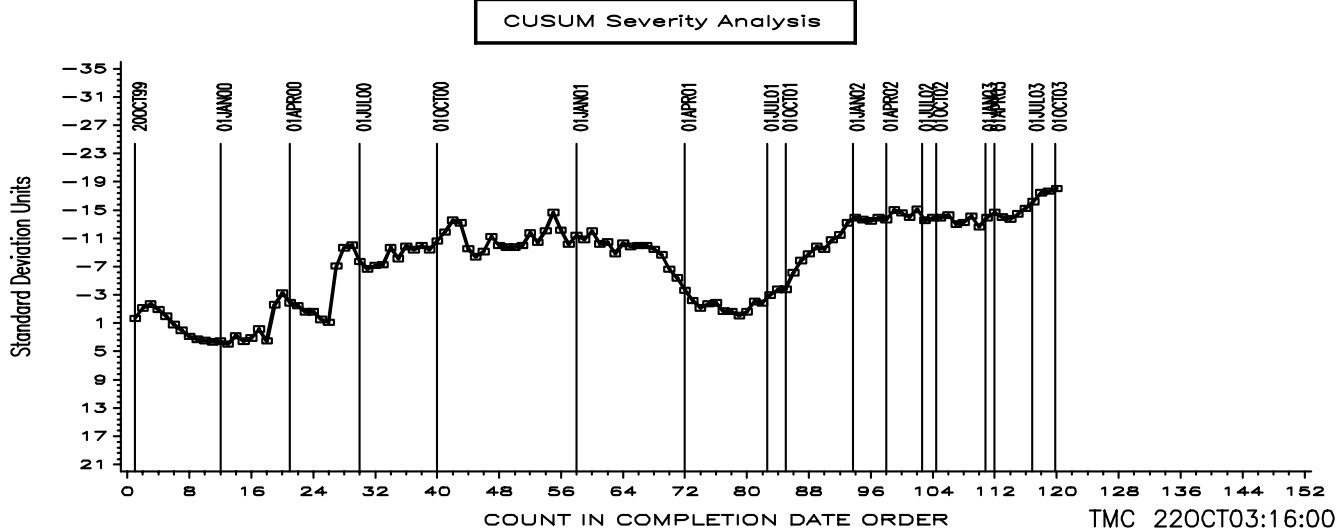
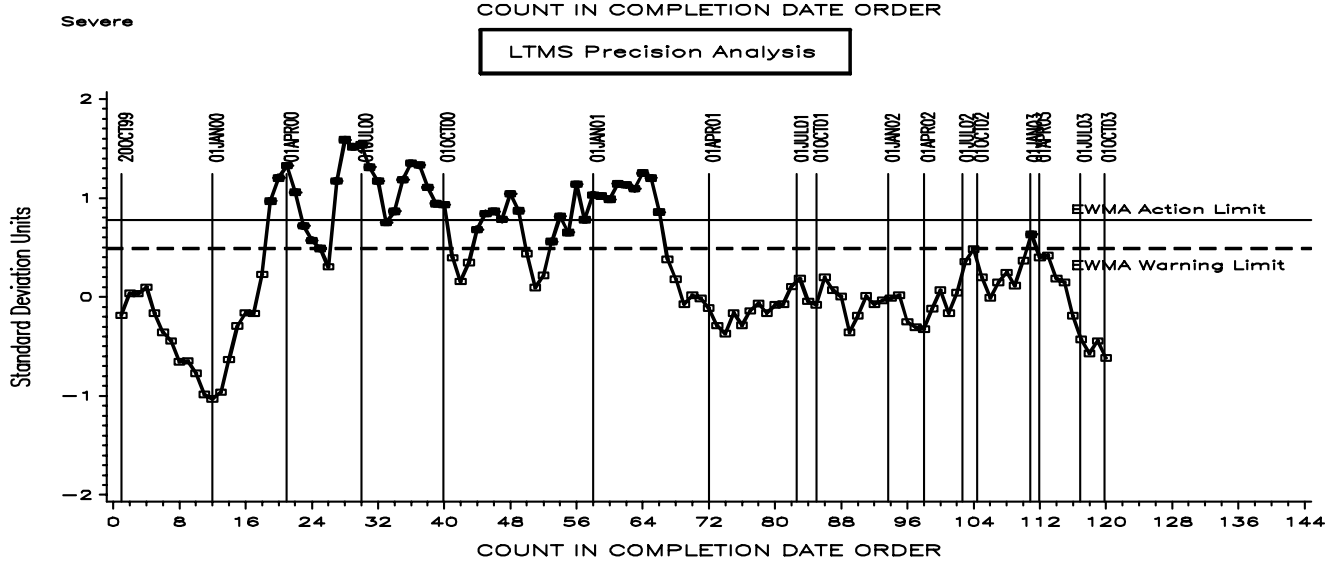
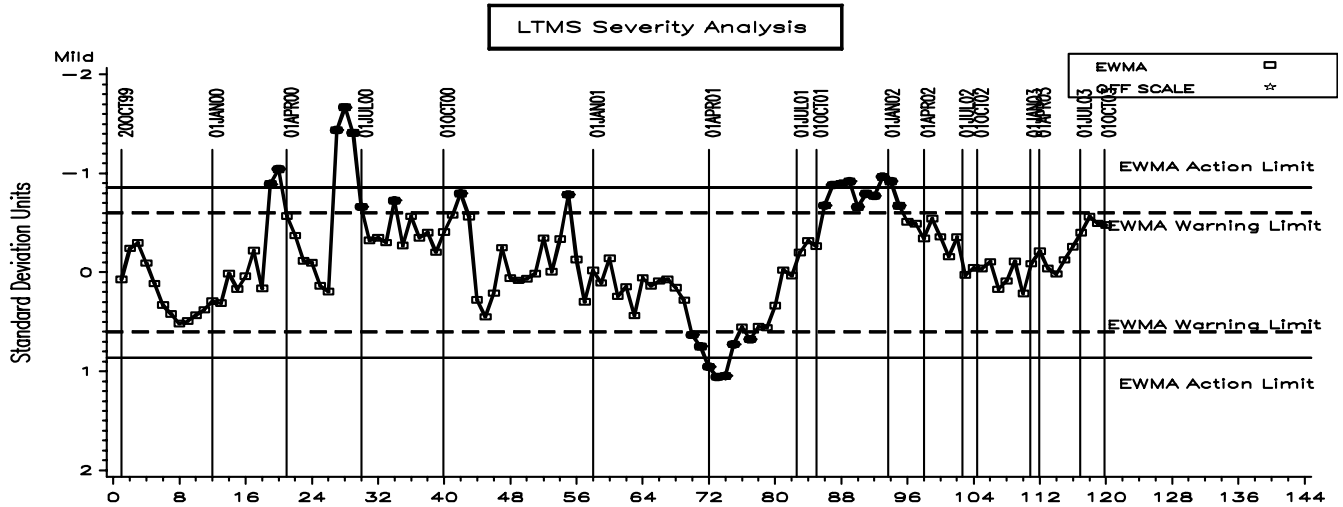
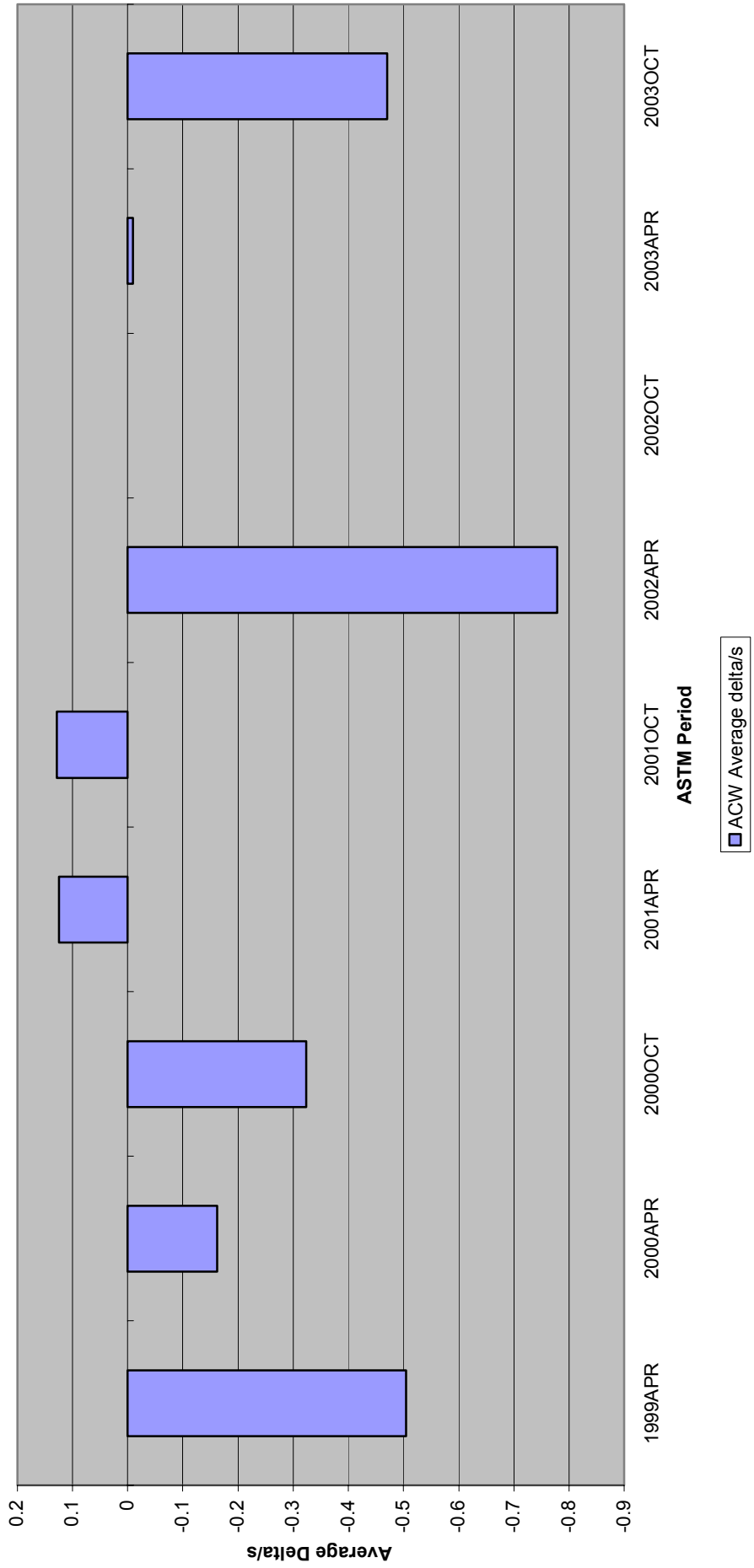


Figure 2 - Sequence IVA Reference Oil Data
Average Camshaft Wear



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

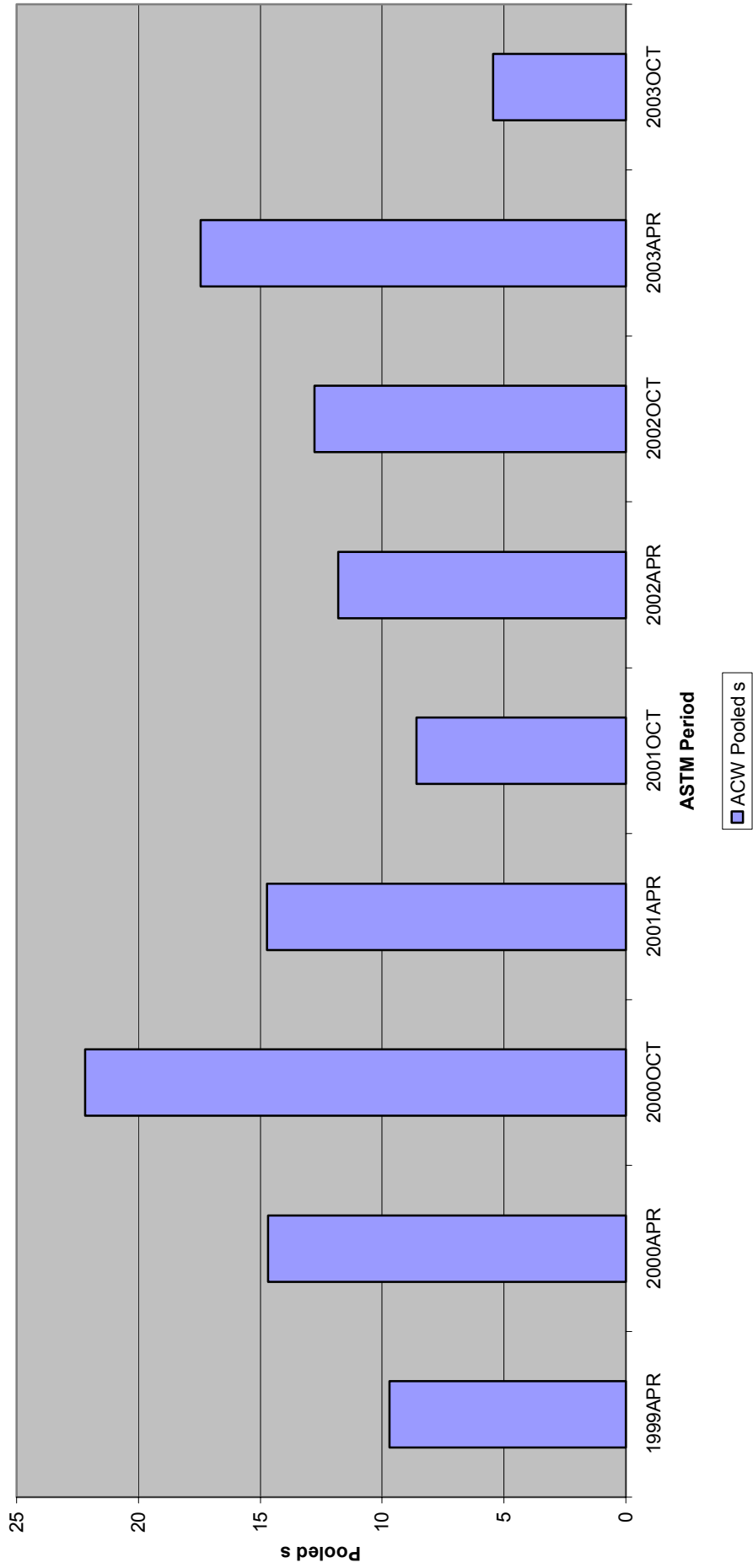


Figure 4 - Sequence IVA Timeline		
Date	Topic	Information Letter
2/10/1999	SEQUENCE IVA TEST LTMS ESTABLISHED BY SURVEILLANCE PANEL	
11/17/1999	CALIBRATION STATUS RESUMED	
2/16/2000	DRAFT 4 OF TEST PROCEDURE ISSUED. INCORPORATED JACKETED ROCKER COVER, CONTROLLED FLOW OF FRESH AIR TO ROCKER COVER, AND 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