P U B L I C A T I O N T R A N S M I T T A L

International Aero Engines

400 MAIN STREET, MAIL STOP 121-10
EAST HARTFORD, CT 06108, USA.
TELEPHONE:- 860 565 5515
FAX:- 860 565 0600

P.O. BOX 31, DERBY
TELEGRAMS - 'ROYCAR' DERBY
TELEX - 37645
TELEPHONE:- 44 (0) 1332 242424
FAX:- 44 (0) 1332 249936

DATE: Dec.14/06

V2500-D5 SERIES PROPUSION SYSTEMS NON-MODIFICATION SERVICE BULLETIN

This document transmits Revision 1 to Service Bulletin EV2500-72-0536

Document History

Service Bulletin Revision Status	Supplement Revision Status
Initial Issue Nov.3/06	

Bulletin Revision 1

Remove	Incorporate	Reason for change
Pages 1 to 15 of the Service Bulletin	Pages 1 to 21 of the Service Bulletin	To bring the engine serial numbers listed in the Effectivity 1.A. in the correct order as the engines should be inspected, to revise the Accomplishment Instruction and to include some minor editorial changes.

V2500-ENG-72-0536

CHECK THAT ALL PREVIOUS TRANSMITTALS HAVE BEEN INCORPORATED
If any have not been received please advise Customer Data Services, Rolls-Royce plc, Derby, England

LIST OF EFFECTIVE PAGES

The effective pages to this Service Bulletin following incorporation of Revision 1 are as follows:

	Page	Revision Number	Revision Date
	Bulletin		
R	1	1	Dec.14/06
R	2	1	Dec.14/06
R	3	1	Dec.14/06
R	4	1	Dec.14/06
R	5	1	Dec.14/06
R	6	1	Dec.14/06
R	7	1	Dec.14/06
R	8	1	Dec.14/06
R	9	1	Dec.14/06
R	10	1	Dec.14/06
R	11	1	Dec.14/06
R	12	1	Dec.14/06
R	13	1	Dec.14/06
R	14	1	Dec.14/06
R	15	1	Dec.14/06
R	16	1	Dec.14/06
R	17	1	Dec.14/06
R	18	1	Dec.14/06
R	19	1	Dec.14/06
R	20	1	Dec.14/06
R	21	1	Dec.14/06

International Aero Engines

SERVICE BULLETIN

ENGINE – HP COMPRESSOR – ONE-OFF BORESCOPE INSPECTION OF STAGES 6 TO 8 BLADES AND STAGES 6 TO 8 VANES – NON-MODIFICATION SERVICE BULLETIN

1. Planning Information

A. Effectivity

(1) Boeing MD90

V2528-D5 engines operated by Saudi Arabian Airlines (SVA).

In-service engines.

For the affected engine serial numbers refer to the table given below:

	Number	Engine Serial Numbers:	Number	Engine Serial Numbers:
R	1	V20251	23	V20176
R	2	V20218	24	V20256
R	3	V20151	25	V20189
R	4	V20150	26	V20273
R	5	V20188	27	V20200
R	6	V20165	28	V20275
R	7	V20228	29	V20232
R	8	V20190	30	V20167
R	9	V20249	31	V20155
R	10	V20242	32	V20278
R	11	V20266	33	V20208
R	12	V20175	34	V20170
R	13	V20201	35	V20262
R	14	V20211	36	V20181
R	15	V20237	37	V20185
R	16	V20206	38	V20146
R	17	V20207	39	V20174
R	18	V20199	40	V20244
R	19	V20197	41	V20264
R	20	V20164	42	V20252
R	21	V20130	43	V20280
R	22	V20180	44	V20274

B. Reason

(1) Reason for issue

R This Non-Modification Service Bulletin introduces an one-off borescope inspection of the stage 6 to 8 rotor blades and stage 6 to 8 vanes for engines which are operated in desert environments.

(2) Problem

R Sand erosion, primarily of the stage 6 vanes and stage 7 vanes, on the SVA
R D5 fleet has led to in-flight shut-down events.

R The inspection of the stage 6 to 8 blade tips will indicate whether the
R blades have suffered from tip erosion which could lead into engine
R performance deterioration and subsequent unscheduled engine removals.

R The inspection of the stage 6 to 8 vanes will focus on the thickness and
R condition of the trailing edge. Sand erosion causes a thinning of the
R aerofoil near the vane platform. This may lead to a loss of material on
R the trailing edge and cracking of the aerofoil.

C. Description

R This Non-Modification Service Bulletin details the in-service borescope
R inspection of engines which are operated in a desert environment.

R It can be substantiated that damage found on the HPC stage 6 to 8 blades and
R HPC stage 6 to 8 vanes within the limits described in paragraph 3.
R Accomplishment Instructions has negligible effect on the subject blade and vane
R stress levels and the engine performance.

D. Compliance

Category Code 3

Accomplish a one-off, on-wing inspection on the affected engines listed in step 1.A. Effectivity, on receipt of this Non Modification Service Bulletin. The order of the engines to be inspected shall be consistent with the engines listed in step 1.A. Effectivity.

E. Approval

The compliance statement in step D. Compliance and the procedures in Section 3. Accomplishment Instructions of this Non-Modification Service Bulletin comply with the Federal Aviation Regulations and are FAA-approved for the engine model listed.

F. Manpower

Estimated man-hours necessary to embody this Non-Modification Service Bulletin in full:

(1) In Service

Total - 5 hours.

(a) To gain access - 1 hour.

(b) To embody - 3,5 hours.

(c) To close up - 30 minutes.

(2) At overhaul

Not affected.

G. Material Price and Availability

Not applicable.

H. Tooling Price and Availability

(1) 6mm flexible borescope with a tip viewing angle of at least 100 degrees. Borescope length should be at least 2.5m.

(2) Video recording equipment.

I. References

(1) MD90 Aircraft Maintenance Manual (AMM), Chapter 72-00-02, Borescope Inspection of the HPC.

(2) Internal Reference No.

Engineering Change No. 06VR1006.

2. Material Information

None.

3. Accomplishment Instructions

A. Inspection Instructions

CAUTION: IN ORDER TO REDUCE THE POTENTIAL FOR MULTIPLE ENGINE IN-FLIGHT SHUT DOWN, POWER LOSS, OR OTHER ANOMALIES DUE TO MAINTENANCE ERROR, IAE RECOMMENDS THAT OPERATORS AVOID PERFORMING MAINTENANCE ON MULTIPLE ENGINES INSTALLED ON THE SAME AIRCRAFT AT THE SAME TIME. IF IT IS NOT POSSIBLE TO AVOID MAINTENANCE ON MORE THAN ONE ENGINE AT THE SAME TIME, IAE RECOMMENDS THAT ADDITIONAL CONTROLS BE APPLIED IN ORDER TO ENSURE THAT MAINTENANCE TASKS HAVE BEEN COMPLETED AS DEFINED.

(1) General

(a) Obey all the WARNINGS and CAUTIONS in the procedures that are referred to.

(b) Consumable Materials

(i) Refer to the related Manual tasks given in this instruction.

(c) Tools and Equipment

(i) Refer to the table that follows:

REFERENCE	DESIGNATION
No Specific	6mm flexible borescope with a tip viewing angle of at least 100 degrees. (Borescope length should be at least 2.5m)
No Specific	Video recording equipment

(2) Borescope Inspection of Stage 6 Blades

(a) Insert the borescope through access port cover C (AMM reference: Figure 601/72-00-02-990-801).

(b) In addition to the AMM requirements, inspect each blade in turn for tip erosion, according to the limits shown below in step (c).

NOTE: The condition of the stage 6 blades should be recorded on the Inspection Feedback Form (Figure 1).

R (c) Tip Erosion (Refer to Figures 11 to 13)

(i) Re-inspect the engine in 500 cycles if the chordal extend of the erosion is less than 25 percent of the remaining chord.

R (ii) Re-inspect the engine in 125 cycles if the chordal extend of the erosion is greater than 25 percent but less than 50 percent of the remaining chord.

R (iii) Reject the engine within 10 cycles if chordal extend of the erosion is greater than 50 percent of the remaining chord.

(3) Borescope Inspection of Stage 6 Vane

R (a) Insert the flexible borescope through access port D between stator 7 and rotor 8 (AMM reference: Figure 601/72-00-02-990-801). Feed the
R flexible borescope between stator 7 and rotor 7 until the trailing edge of the stator 6 is visible. Then feed the flexible borescope towards the trailing edge of stator 6 and then around the circumferential i.e. 360 deg until the entry point is visible. The convex surface of the trailing edge of the stator 6 vane should be visible.

(b) Inspect the trailing edge on the convex surface of the stator 6 vane for nicks or tears, cracks, loss of material and thinning of trailing edge according to the limits shown below in step (d). Upon satisfactory inspection of the first stator 6 vane withdraw the
R flexible borescope circumferentially until the next stator 6 vane trailing edge can be inspected.

(c) Repeat the procedure for the whole set of stator 6 vanes (84 off).

NOTE: Each stator 6 vane will have to be counted in order to ensure that the whole set is inspected.

NOTE: The condition of the stage 6 vanes should be recorded on the Inspection Feedback Form (Figure 2).

(d) Damage from vane platform to 1/3 vane height

R (i) Nicks, tears or dents on individual airfoils (Refer to Figure
R 7)

A	Not more than 0.016 in. (0,4 mm) in radial or axial dimension and not in the area of T/E material loss	Repeat borescope inspection within 500 cycles.
B	More than A, but not more than 0.039 in. (1 mm) in radial or axial dimension	Reject within 10 cycles.
C	More than B	Reject.

R (ii) Cracks

R A	Not more than 0.039 in. (1 mm) in length	Reject within 10 cycles.
R B	More than A	Reject.

R (iii) Loss of material from trailing edge with or without a jagged T/E profile (Refer to Figures 8 and 9)

R A	Not more than 0.006 in. (0,15 mm) in axial depth	Repeat borescope inspection within 500 cycles.
R B	More than A, but not more than 0.016 in. (0,4 mm) in axial depth	Repeat borescope inspection within 250 cycles.
R C	More than B, but not more than 0.035 in. (0,9 mm) in axial depth	Repeat borescope inspection within 125 cycles.
R D	More than C, but not more than 0.079 in. (2 mm) in axial depth	Reject the engine within 10 cycles.
R E	More than D	Reject.

R (iv) Sharp, thin trailing edge that remains straight (Refer to Figure 10) - Place engine on 500 cycle repeat borescope inspection.

(4) Borescope Inspection of Stage 7 Blade

(a) Insert the borescope through access port D (AMM reference: Figure 601/72-00-02-990-801).

(b) Carry out borescope inspection in accordance with AMM TASK 72-00-02-290-801.

NOTE: The condition of the stage 7 blades should be recorded on the Inspection Feedback Form (Figure 3).

(c) In addition to the AMM requirements, inspect each blade in turn for R tip erosion, according to the limits shown below (Refer to Figures 11 R to 13):

(i) Re-inspect the engine in 500 cycles if the chordal extend of the erosion is less than 25 percent of the remaining chord.

R (ii) Re-inspect the engine in 125 cycles if the chordal extend of the erosion is greater than 25 percent but less than 50 percent of the remaining chord.

(iii) Reject the engine if chordal extend of the erosion is greater than 50 percent of the remaining chord.

(5) Borescope Inspection of Stage 7 Vane

R (a) Insert the flexible borescope through access port D until the borescope port is visible again to ensure an inspection of all vanes i.e. 360 deg. until the entry point is visible (AMM reference: Figure 601/72-00-02-990-801).

R (b) Start pulling out the flexible borescope to examine the trailing edge of each vane in turn for nicks or tears, cracks, loss of material and thinning of trailing edge according to the limits shown below in step (c).

NOTE: Each stator 7 vane will have to be counted in order to ensure that the whole set is inspected.

NOTE: The condition of the stage 7 vanes should be recorded on the Inspection Feedback Form (Figure 4).

(c) Damage from vane platform to 1/3 vane height

R (i) Nicks, tears or dents on individual airfoils (Refer to Figure 7)

A	Not more than 0.016 in. (0,4 mm) in radial or axial dimension and not in the area of T/E material loss	Repeat borescope inspection within 500 cycles.
B	More than A, but not more than 0.039 in. (1 mm) in radial or axial dimension	Reject within 10 cycles.
C	More than B	Reject.

R (ii) Cracks

A	Not more than 0.039 in. (1 mm) in length	Reject within 10 cycles.
B	More than B	Reject.

R (iii) Loss of material from trailing edge with or without a jagged T/E profile (Refer to Figures 8 and 9)

A	Not more than 0.006 in. (0,15 mm) in axial depth	Repeat borescope inspection within 500 cycles.
B	More than A, but not more than 0.016 in. (0,4 mm) in axial depth	Repeat borescope inspection within 250 cycles.
C	More than B, but not more than 0.035 in. (0,9 mm) in axial depth	Repeat borescope inspection within 125 cycles.

D	More than C, but not more than 0.079 in. (2 mm) in axial depth	Reject the engine within 10 cycles.
E	More than D	Reject.

(iv) Sharp, thin trailing edge that remains straight (Refer to Figure 10) - Place engine on 500 cycle repeat borescope inspection.

(6) Borescope Inspection of Stage 8 Blade

(a) Insert the flexible borescope through access port cover E (AMM reference: Figure 601/72-00-02-990-801).

(b) Carry out borescope inspection in accordance with AMM TASK 72-00-02-290-801. In addition to the AMM requirements, inspect each blade in turn for tip erosion, according to the limits shown below in step (c).

NOTE: The condition of the stage 8 blades should be recorded on the Inspection Feedback Form (Figure 5).

(c) Tip Erosion

(i) Re-inspect the engine in 500 cycles if the chordal extend of the erosion is less than 25 percent of the remaining chord.

(ii) Re-inspect the engine in 125 cycles if the chordal extend of the erosion is greater than 25 percent but less than 50 percent of the remaining chord.

(iii) Reject the engine if chordal extend of the erosion is greater than 50 percent of the remaining chord.

(7) Borescope Inspection of Stage 8 Vane

(a) Insert the flexible borescope through access port E until the borescope port is visible again to ensure an inspection of all vanes i.e. 360 deg. until the entry point is visible (AMM reference: Figure 601/72-00-02-990-801).

(b) Start pulling out the flexible borescope to examine the trailing edge of each vane in turn for nicks or tears, cracks, loss of material and thinning of trailing edge according to the limits shown below in step (c).

NOTE: Each stator 8 vane will have to be counted in order to ensure that the whole set is inspected.

NOTE: The condition of the stage 8 vanes should be recorded on the Inspection Feedback Form (Figure 6).

(c) Damage from vane platform to 1/3 vane height

R (i) Nicks, tears or dents on individual airfoils (Refer to Figure
R 7)

A	Not more than 0.016 in. (0,4 mm) in radial or axial dimension and not in the area of T/E material loss	Repeat borescope inspection within 500 cycles.
B	More than A, but not more than 0.039 in. (1 mm) in radial or axial dimension	Reject within 10 cycles.
C	More than B	Reject.

R (ii) Cracks

A	Not more than 0.039 in. (1 mm) in length	Reject within 10 cycles.
B	More than A	Reject.

R (iii) Loss of material from trailing edge with or without a jagged
R T/E profile (Refer to Figures 8 and 9)

A	Not more than 0.006 in. (0,15 mm) in axial depth	Repeat borescope inspection within 500 cycles.
B	More than A, but not more than 0.016 in. (0,4 mm) in axial depth	Repeat borescope inspection within 250 cycles.
C	More than B, but not more than 0.035 in. (0,9 mm) in axial depth	Repeat borescope inspection within 125 cycles.
D	More than C, but not more than 0.079 in. (2 mm) in axial depth	Reject the engine within 10 cycles.
E	More than D	Reject.

R (iv) Sharp, thin trailing edge that remains straight (Refer to
R Figure 10) - Place engine on 500 cycle repeat borescope
R inspection.

(8) Digital images or a video

(a) Digital images or a video shall be made for any findings, which lead into a repeat borescope inspection.

B. Recording Instructions

(1) A record of accomplishment is necessary.

(2) Inform the IAE local office that this Non-Modification Service Bulletin
R has been accomplished by sending the feedback form (Pages 12-17 of this Non-Modification Service Bulletin).

R (3) Send the feedback forms (Pages 12-17 of this Non-Modification Service Bulletin) to IAE Technical Services to the following fax number: +49 (0) 33708 6 3313.

DATE: _____ INSPECTED BY: _____

ENGINE DETAILS

ENGINE NUMBER: _____ AIRCRAFT AND POSITION: _____

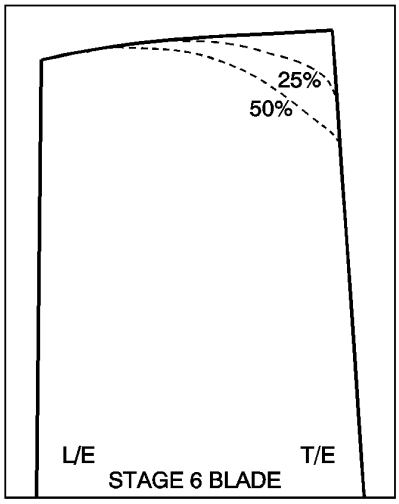
HOURS: _____ CYCLES: _____

INSPECTION DETAILS

EROSION ON WORST BLADE

(INDICATE EXTENT OF EROSION ON THE OUTLINE.)

COMMENTS:



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Stage 6 Blade Inspection Feed Back Form
Figure 1

DATE: _____ INSPECTED BY: _____

SIGNATURE: _____

ENGINE DETAILS

ENGINE NUMBER: _____ AIRCRAFT AND POSITION: _____

HOURS: _____ CYCLES: _____

INSPECTION DETAILS

VANE NO.	PASS	REPEAT AT 'X' CYCLES	VANE NO.	PASS	REPEAT AT 'X' CYCLES	VANE NO.	PASS	REPEAT AT 'X' CYCLES
1			29			57		
2			30			58		
3			31			59		
4			32			60		
5			33			61		
6			34			62		
7			35			63		
8			36			64		
9			37			65		
10			38			66		
11			39			67		
12			40			68		
13			41			69		
14			42			70		
15			43			71		
16			44			72		
17			45			73		
18			46			74		
19			47			75		
20			48			76		
21			49			77		
22			50			78		
23			51			79		
24			52			80		
25			53			81		
26			54			82		
27			55			83		
28			56			84		

bmi0000123

Stage 6 Vane Inspection Feed Back Form
Figure 2

DATE: _____ INSPECTED BY: _____

ENGINE DETAILS

ENGINE NUMBER: _____ AIRCRAFT AND POSITION: _____

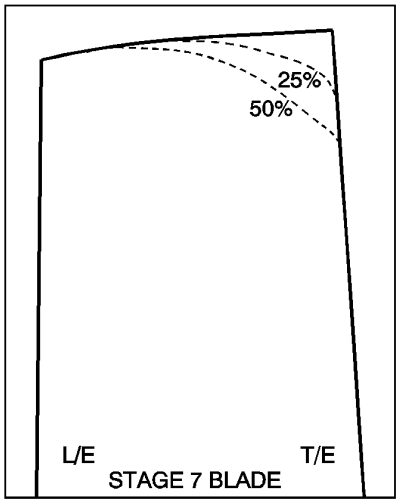
HOURS: _____ CYCLES: _____

INSPECTION DETAILS

EROSION ON WORST BLADE

(INDICATE EXTENT OF EROSION ON THE OUTLINE.)

COMMENTS:



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Stage 7 Blade Inspection Feed Back Form
Figure 3

DATE: _____ INSPECTED BY: _____

SIGNATURE: _____

ENGINE DETAILS

ENGINE NUMBER: _____ AIRCRAFT AND POSITION: _____

HOURS: _____ CYCLES: _____

INSPECTION DETAILS

VANE NO.	PASS	REPEAT AT 'X' CYCLES	VANE NO.	PASS	REPEAT AT 'X' CYCLES	VANE NO.	PASS	REPEAT AT 'X' CYCLES
1			31			61		
2			32			62		
3			33			63		
4			34			64		
5			35			65		
6			36			66		
7			37			67		
8			38			68		
9			39			69		
10			40			70		
11			41			71		
12			42			72		
13			43			73		
14			44			74		
15			45			75		
16			46			76		
17			47			77		
18			48			78		
19			49			79		
20			50			80		
21			51			81		
22			52			82		
23			53			83		
24			54			84		
25			55			85		
26			56			86		
27			57			87		
28			58			88		
29			59					
30			60					

bmi0000125

Printed in Great Britain

R Stage 7 Vane Inspection Feed Back Form
R Figure 4

DATE: _____ INSPECTED BY: _____

ENGINE DETAILS

ENGINE NUMBER: _____ AIRCRAFT AND POSITION: _____

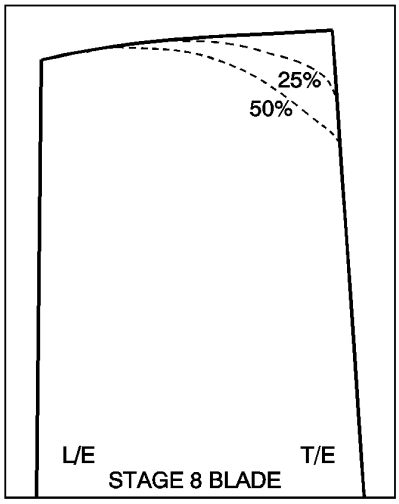
HOURS: _____ CYCLES: _____

INSPECTION DETAILS

EROSION ON WORST BLADE

(INDICATE EXTENT OF EROSION ON THE OUTLINE.)

COMMENTS:



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Stage 8 Blade Inspection Feed Back Form
Figure 5

DATE: _____ INSPECTED BY: _____

SIGNATURE: _____

ENGINE DETAILS

ENGINE NUMBER: _____ AIRCRAFT AND POSITION: _____

HOURS: _____ CYCLES: _____

INSPECTION DETAILS

VANE NO.	PASS	REPEAT AT 'X' CYCLES	VANE NO.	PASS	REPEAT AT 'X' CYCLES	VANE NO.	PASS	REPEAT AT 'X' CYCLES
1			32			63		
2			33			64		
3			34			65		
4			35			66		
5			36			67		
6			37			68		
7			38			69		
8			39			70		
9			40			71		
10			41			72		
11			42			73		
12			43			74		
13			44			75		
14			45			76		
15			46			77		
16			47			78		
17			48			79		
18			49			80		
19			50			81		
20			51			82		
21			52			83		
22			53			84		
23			54			85		
24			55			86		
25			56			87		
26			57			88		
27			58			89		
28			59			90		
29			60			91		
30			61			92		
31			62					

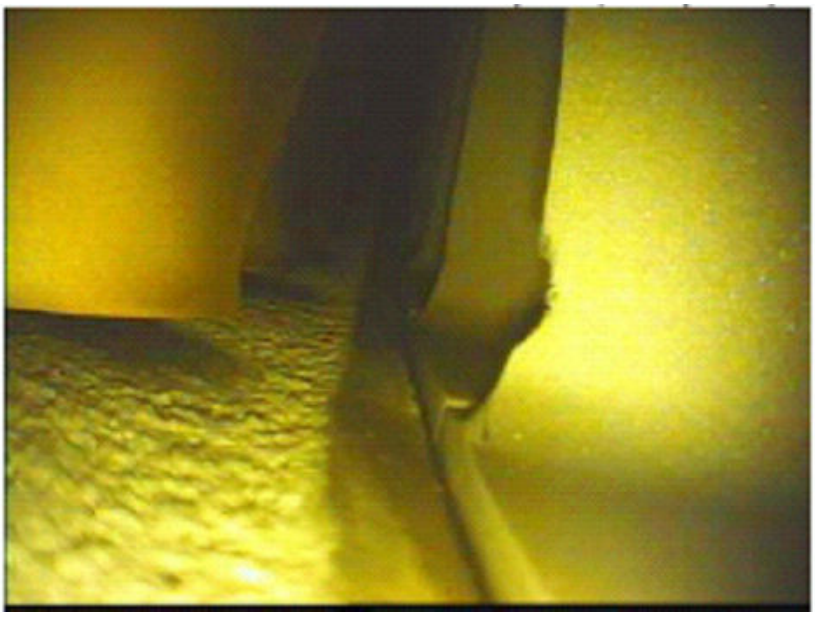
bmi0000127

Stage 8 Vane Inspection Feed Back Form
Figure 6

R Example of borescope pictures

R HPC stage 6 vane with nick at the T/E, dimension of the nick
R 0.014 in. (0,36 mm), no material removal allowed
R Figure 7

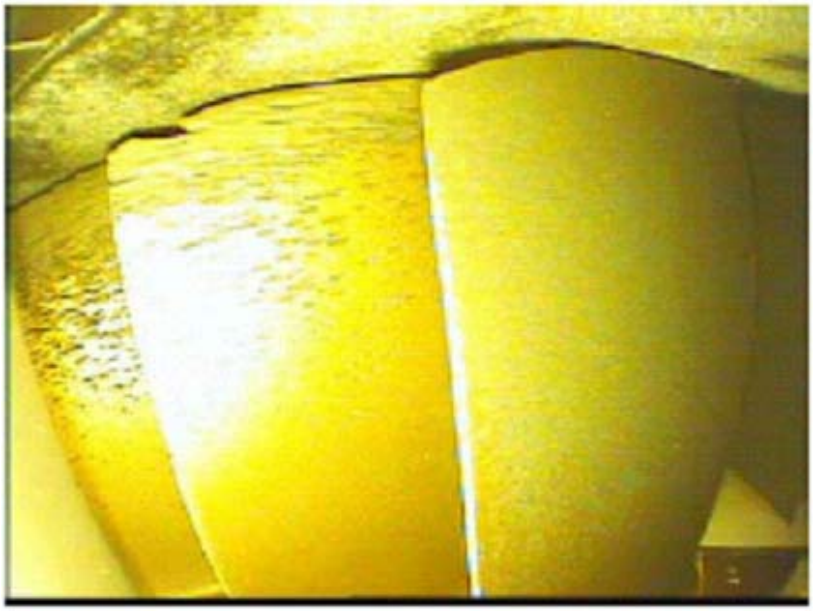
R HPC stage 6 vane; smooth loss of material without a jagged T/E
R Figure 8



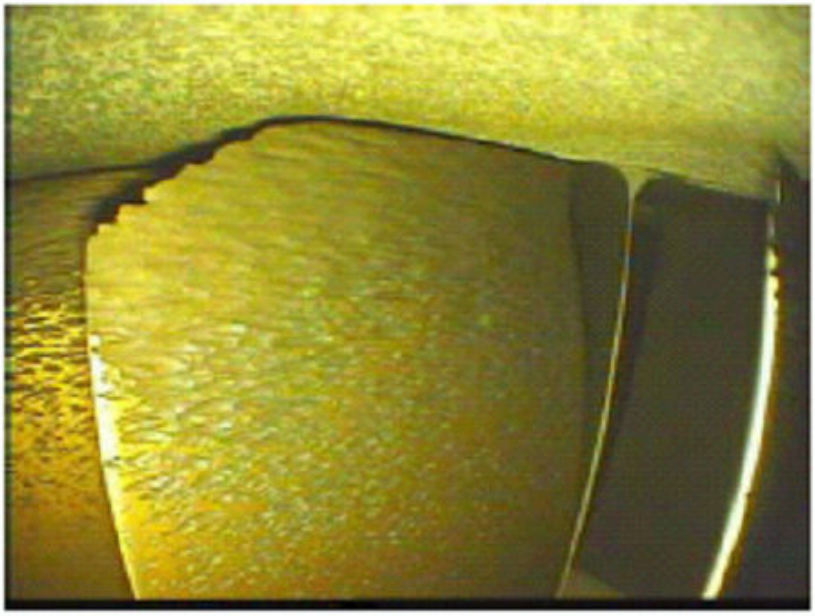
R HPC stage 6 vane; loss of material with a jagged T/E profile
R Figure 9

R HPC stage 6 vane with a thin T/E which remeins straight
R Figure 10

R HPC stage 6 blade without blade tip erosion
R Figure 11



R HPC stage 7 blade with tip erosion not more than 25 percent
R Figure 12



R HPC stage 7 blade with blade tip erosion with more than 25 percent
R but not more than 50 percent
R Figure 13