Wasteline Cleaning with Videoscope Surveillance

Presentation by :

Dipl.Wirts.Ing.

Willy Reinhardt

Focos of this Essay

- Various Airliners statistics have shown an increase of the breakdown of Wastlines due to blockages cause by caliumcarbonate and urinstone as well as debris of all sorts.
- It is the focus of this essay to try and find a workable technical solution to reduce and/or prevent blockages in the vacuum tubes;
- A total of roughly 100 A/C from the two major manufacturers, Airbus and Boeing were under survey for a time span of 2 and half years.

Surveillance System

- In order to define the current status of the wastelines it was inevitable to examine these with a newly develped videoscope surveillance equipment and so create a digital documented „before and after“ scernario per A/C checked and maintenanced.
- Developement of the Surveillance System

Surveillance System // Camera

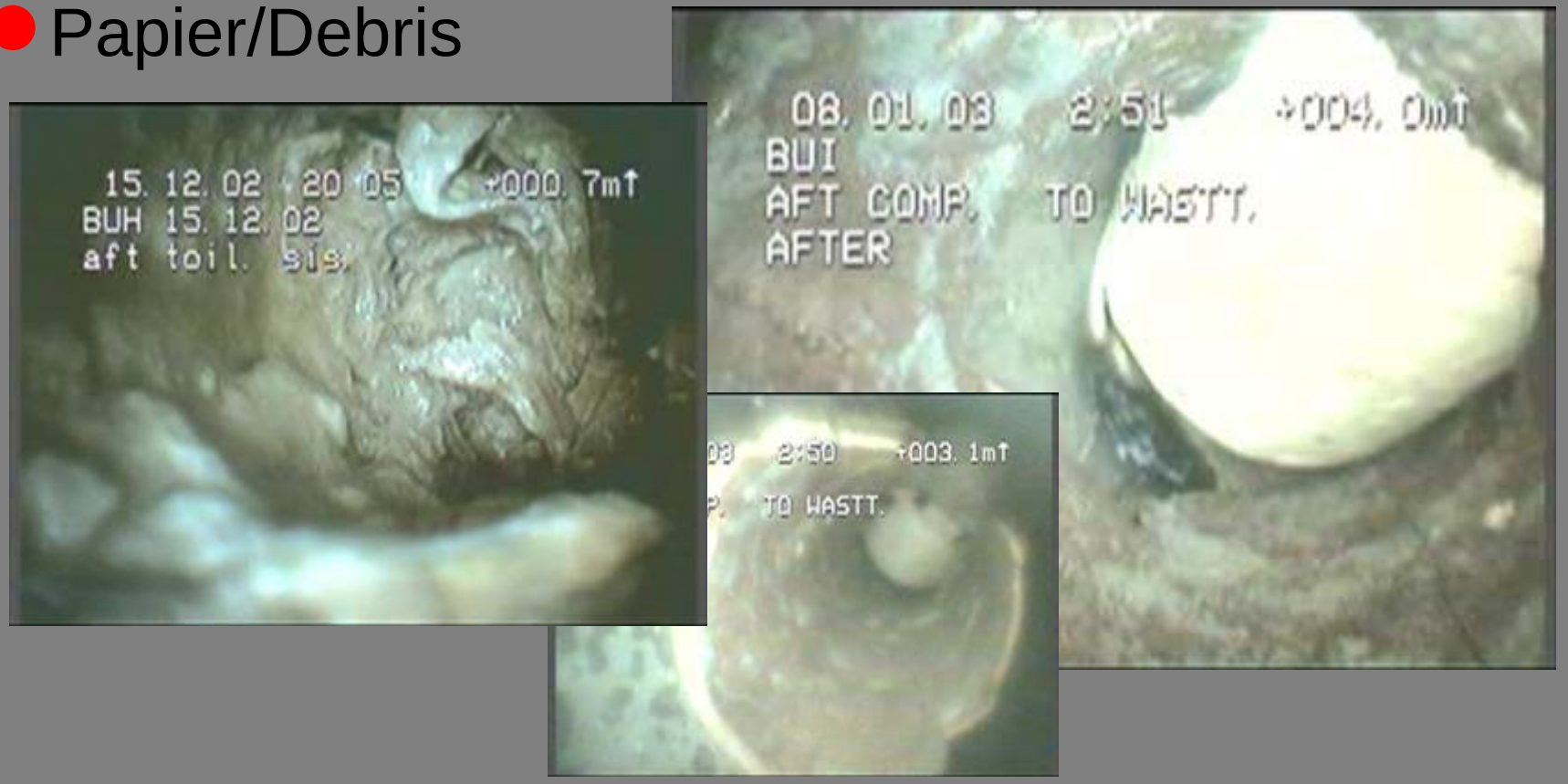
- High Resolution Waterproof Video scope Module with digital regulated light system
- Intergraded Electronic module for direct Video input/output (BNC standard)
- Keyboard for direct input of information on Video screen (plugged) Screen, 7-inch color LTPS at 720x480 pixel
- Direct Data input on Video screen of covered distance in meter; 40m / 4,5mm Dia. Fbrg. cable
- Stabilizing Spring for easy gliding of the Camera
- Powered by build-in lead storage battery
- Rugged steel cable winch

The Effects of Contamination Build-Up in Wastelines

- The greater the Contamination Build-Up, which can consist of caliumcarbonate and urinstone, the slower the flow in the wasteline.
- The slower the flow; the easier the clogging, and in the worse case the clogging can lead to complete failure, Block-Up´s of the toilets on one or both sides of the aircraft.
- Rough estimation of appr. 2mm Build-Up per month without preventive maintenance

Wasteline Surveillance Equipment WSE

- Examples of blockages
- Papier/Debris



Wasteline Surveillance Equipment WSE

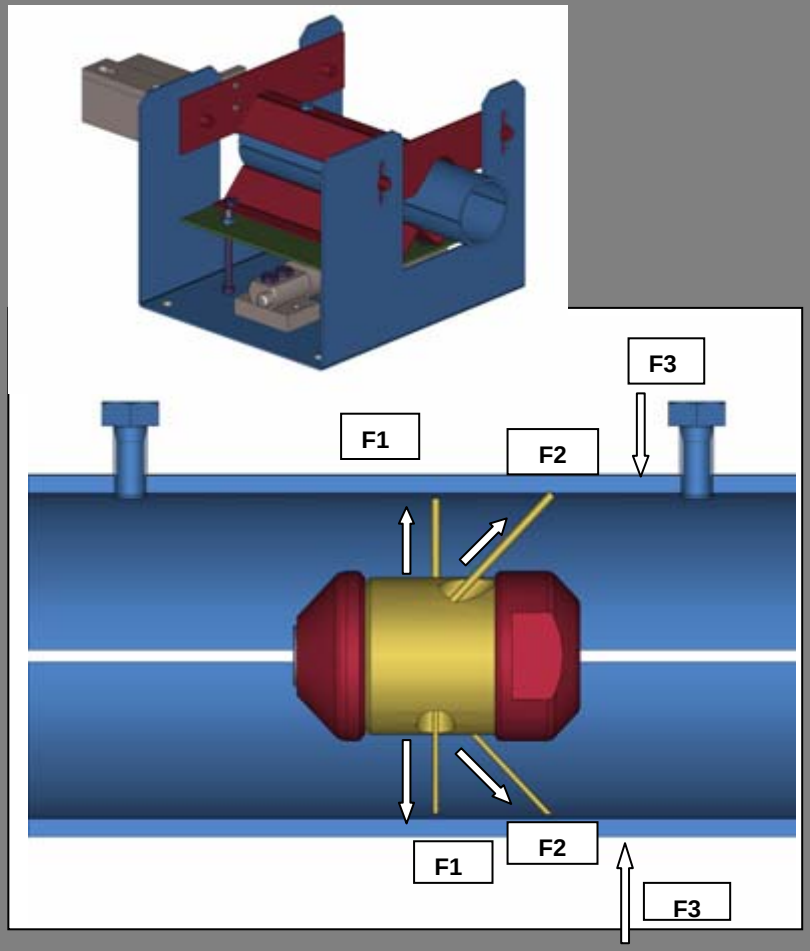
- Examples of Contamination-Build-Up on the inside of the wastelines

TEST Program Wasteline

- The major OEM´s Airbus and Boeing have defined the maximum loads in the wastelines exposed to high pressure water cleaning:
- Airbus: 1450 psi = 100,0 bar
- Boeing: 2500 psi = 172,0 bar
- Based on the above it was the challenge; a)define the pressure on the inner walls of the vacuum tubes b) stress test the area of the attachement points/tube fittings/clamps

Developement of Wasteline Cleaning System with rotating nozzle

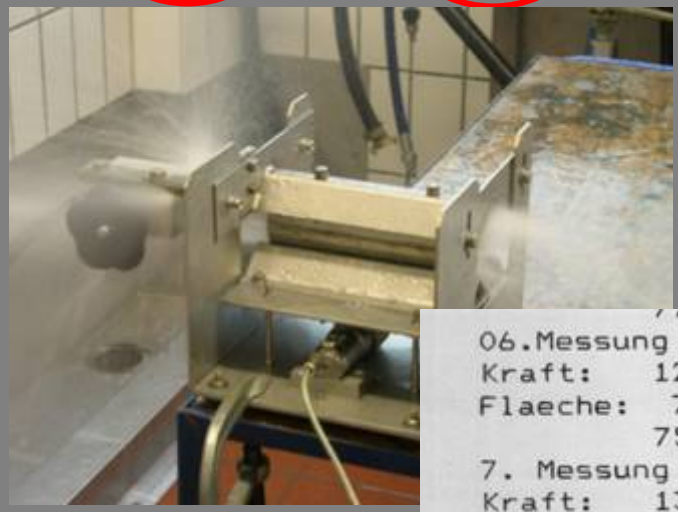
- Developement of Rotating Nozzle
- High pressure cleaning procedures for the Wasteline Cleaning process



TEST Wasteline Expl. Test-Build-Up

- The set up of the measuring system defining the impact of the pressured water consists of 2 half tubes, both in correspondence with the diameter of the originals.

- On the lower side of the bottom tube a pressure transducer is connected which submits the applied water pressure to the inner walls of the tubes to a manometer. The manometer is connected to a data plotter



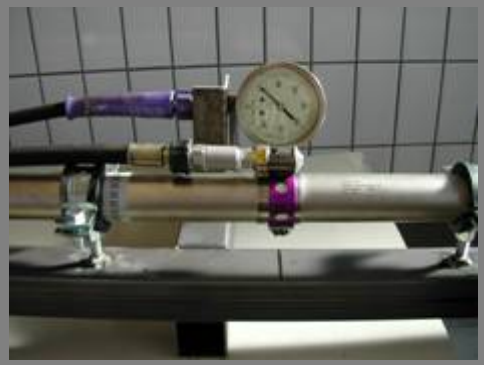
06.Messung 16:35:38
Kraft: 12.80 N
Flaeche: 7.52 N/mm²
75.20 bar
7. Messung 16:35:39
Kraft: 13.67 N
Flaeche: 8.04 N/mm²
80.40 bar
8. Messung 16:35:39
Kraft: 14.13 N
Flaeche: 8.31 N/mm²
83.10 bar
9. Messung 16:35:40
Kraft: 14.08 N
Flaeche: 8.28 N/mm²
82.80 bar
10.Messung 16:35:40
Kraft: 12.65 N
Flaeche: 7.44 N/mm²
74.40 bar

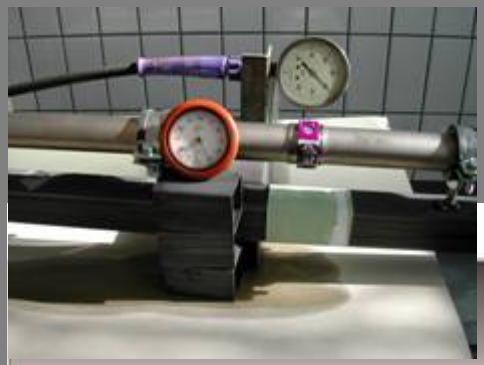
Transmission of measured data

- For the first interval water pressure is applied to the rotating nozzle in the inside of the 2 half tubes of the test module.
- One Interval consisting of 60 sec. carried out, of which 10 Tests are transmitted to the plotter reflecting the average of the Tests completed in the first interval!
- Due to the fact that there is no statical point because the nozzle constantly rotates the definition of the surface pressure is only inadaquately calculable.

Fittings/Clamp Tests

- Test consisted of 60 min./ rotating nozzle with high water pressure directly to the fitting / O-Ring section



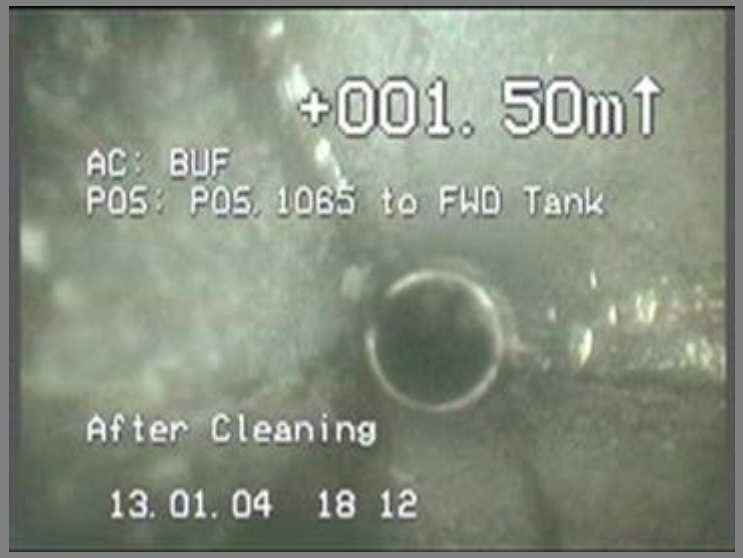


Results of the transferred and measured data

- Kompressor: 400 bar – 450 bar
- 35-40 ltr./min volume water flow rate
- Nozzle: equipped with 4 bored adjustable exits, two which „jet-stream“ the water in an angle to the inner wall of the tube enabling a propulsive thrust and 2 bored exits for intensive cleaning.
- Obtained maximum pressure to inner walls of the tube was 86,50 bar

High pressure cleaning with rotating nozzle

- Location of wastline blockages with VSE
- Removal of existing sediments in the tubes
- Methods for prevention of further accumulation of Contamination Build Up



Preventive Cleaning of Wastlines

- **Conclusion**

- Per A/C Wasteline Cleaning - 2 X´s per Year prevents not only contamination build-up but also removes the thin and soft layers of sedimentation on the walls of the pipes. Guarantee´s free flow normal condition of waste vacuum lines
- Rough estimation of appr. 2mm per month without preventive maintenance

Preventive Cleaning of Wastelines

Cleaning of Vacuum Waste Lines

25.09.2002	D-ABUF	1. Clean.	4 MA	13:00	06:00	17 STD	41566	7653
26.09.2002	D-ABOE	1. Clean.	5 MA	15:00	23.00	8 STD	10686	4629
27.09.2002	D-ABOC	1. Clean.	4 MA	18:00	00:00	6 STD	10460	4164
07.10.2002	D-ABOH	1. Clean.	4 MA	15:00	21:00	6 STD	10706	4093
10.10.2002	D-ABOG	1. Clean.	4 MA	18:00	23:00	5 STD	10915	4230
24.10.2002	FE-RBG		4 MA	14:00	17:00	3 STD		
04.11.2002	D-ABUZ	1. Clean.	4 MA	09:00	16:00	6 STD	49901	9212
	D-ABUH		2 MA	16:00	20:00	4 STD		Video Aufnahnen

Preventive Cleaning of Wastlines

25.11.2002	D-ABUA	1. Clean.	3 MA	09:00	19:00	10 STD	49611	8674
01.12.2002	D-ABOL		3 MA					Beanstandung 3 Lav. Inop
08.12.2002	D-ABUH	1. Clean.	4 MA	12:00	19:00	7STD	40884	7060
10.12.2002	D-ABOK	1. Clean.	4 MA	08:00	14:00	6 STD	8096	3047
15.12.2002	D-ABUH		4MA	16:00	22:00	28 STD		Beanstandung 2 Lav. Inop
23.12.2002	D-ABOJ	1. Clean.	4MA	18:00	22:00	4 STD	8316	3074
25.12.2002	D-ABUE	1. Clean.	4MA	06:30	22:00	15:30 STD	46047	7815
30.12.2002	D-ABOL	1. Clean.	4MA	08:00	14:00	6 STD	7773	2998
04.01.2003	D-ABUH	2. Clean.	3 MA	08:00	14:45	7 STD	41233	7104
12.01.2003	D-ABUB	1. Clean.	4 MA	14:00	04:30	14,3	49854	8694
14.01.2003	D-ABUC	1. Clean.	4 MA	13:00	01:45	12:45	58048	8117
25.01.2003	D-ABUD	1. Clean.	4 MA	12:00	03:00	15:00	49200	8780
03.03.2003	D-ABUF	2. Clean.	4 MA	08:00	22:00	14:00	43781	7973
06.03.2003	D-ABOI	1. Clean.	4MA	08:00	13:00	5 STD	8182	3200
12.03.2003	D-ABON	1. Clean.	4 MA	13:00	19:00	6 STD	8026	3018
27.03.2003	D-ABOM	1. Clean.	4 MA	13:00	19:00	6 STD	8034	2897
02.04.2003	D-ABUZ	2. Clean.	4 MA	08:30	16:00	07:30	52113	9487

Preventive Cleaning of Wastlines

10.04.2003	A6-SIR				**VIP**			
11.04.2003	VP-BUZ		4 MA	10:00	23:00	13 STD		
23.04.2003	D-ABUH	3. Clean.	4/ 5 MA	18:00	08:00	14 STD	42702	7294
29.04.2003	D-ABUV	1. Clean.	4 MA	14:00	21:00	7 STD	18746	2956
15.05.2003	D-ABUE	2. Clean.	4MA	08:00	16:00	8 STD	48005	8126
30.05.2003	D-ABUW	1. Clean.	4 MA	11:00	22:45	11:45 STD	16663	2631
25.06.2003	D-ABUD	2. Clean.	4 MA	19:00	06:45	11:45 STD	51410	9055
01.07.2003	D-ABUI	1. Clean.	4 MA	14:00	01:00	11 STD	42039	7212
30.07.2003	V8-ALI		3 MA			**VIP**		
07.08.2003	D-AIBH		3 MA					
13.08.2003	D-ABOB	1. Clean.	4 MA	08:00	14:00	6	12507	4904
19.08.2003	D-ABUF	3. Clean.	3 MA	08:00	16:00	7,15	46048	8305
02.09.2003	D-ABUZ	3. Clean.	3 MA	07:00	20:00	13:00	54211	9804
02.09.2003	D-ABUZ	3. Clean.	3 MA	22:30	01:00	02:30	54211	9804
10.09.2003	D-ABOE	2. Clean.	3 MA	15:00	22:00	06:15	13194	5591
23.09.2003	D-ABOC	2. Clean.	4MA	10:00	18:30	08:30	13026	5118
06.10.2003	D-ABUH	4. Clean.	3MA	08:00	19:45	11:45	45020	7695

Preventive Cleaning of Wastlines

07.10.2003	D-ABOG	2. Clean.	3MA	08:30	17:30	09:30	13946	5247
30.09.2003	D-ABUV	2. Clean.	4MA	11:00	20:15	09:00	20866	3207
13.10.2003	D-ABUE	3. Clean.	4MA	08:00	19,15	11,15	10222	3891
12.11.2003	D-ABOL	2. Clean.	3 MA	08:00	15:30	07:30	10222	3891
17.11.2003	D-ABUD	3. Clean.	3 MA	08:00	15:00	07:00	53016	9323
25.11.2003	D-ABUI	2. Clean.	4 MA	07:30	18:00	10:30	44159	7555
01.12.2003	D-ABOF	1. Clean.	3 MA	07:30	16:00	08:30	13985	5014
02.12.2003	D-ABUB	2. Clean.	4 MA	07:30	18:00	10:30	54147	9283
09.12.2003	D-ABOK	2. Clean.	3 MA	07:30	16:00	08:30	11096	4127
11.12.2003	D-ABOJ	2. Clean.	3 MA	07:30	14:00	06:30	11337	4166
25.02.2004	D-ABOM	2. Clean.	3 MA	08:00	15:30	07:30	10441	3991
11.03.2004	D-ABOI	2. Clean.	3 MA	08:00	15:00	07:00	10869	4201
19.03.2004	D-ASIM		3 MA					
25.03.2004	D-ASID		3 MA					
26.03.2004	D-ASBF		3 MA					

Preventive Cleaning of Wastlines

31.03.2004	D-ABON	2. Clean.	3 MA	08:00	16:00	08:00	11502	4177
05.04.2004	D-ABUH	5. Clean.	4 MA	07:30	15:30	08:00	47725	8057
06.04.2004	D-ABUD	4. Clean.	4 MA	06:00	13:30	07:30	55143	9595
23.04.2004	D-ABUC	2. Clean.	3 MA	17:00	01:15	07:30	58339	8980
26.04.2004	D-ABUB	3. Clean.	3 MA	10:00	19:00	08:15		
01.06.2004	D-ABUI	3. Clean.	3 MA	12:00	19:15	06:45	48842	7890
14.06.2004	D-ABUZ	4. Clean.	3 MA	14:00	00:00	10:00	57896	10284
19.07.2004	D-ABNO	Beanstand.	2 MA	18:00	22:00	08:00	12611	4555
28.07.2004	D-ABOB	2. Clean.	3 MA	15:00	21:30			
17.08.2004	D-ABUE	5. Clean.	3 ma	16:00	23:45	07:00		
18.08.2004	D-ABOA	1. Clean.	3 MA	16:00	00:15	07:30		
24.08.2004	D-ABUA	2. Clean.	3 MA	14:00	21:30			
27.08.2004	D-ABOF	2. Clean.	3 MA	11:00	21:00	09:15	15968	5835
08.09.2004	D-ABOH	2. Clean.	3 MA	16:30	23:15	06:00		
14.09.2004	D-ABUD	2. Clean.	3 MA	14:15	23:15	08:15	57342	9962

Preventive Cleaning of Wastlines

01.10.2004	D-ABUH	6. Clean.	3 MA	07:00	16:45	09:00	50001	8426
05.10.2004	D-ABOG	3. Clean.	3 MA	16:00	00:15	07:30	16994	6320
12.10.2004	D-ABUB	4. Clean.	3 MA	16:00	01:20			
19.10.2004	D-ABUC	3. Clean.	4 MA	15:00	00:00			
27.10.2004	D-ABOL	3. Clean.	4 MA	15:00	23:40			
03.11.2004	D-AIGI		3 MA	12:30	21:30			
04.11.2004	D-ABOK	3. Clean.	3 MA	07:00	15:30			
08.11.2004	D-ABUZ	5. Clean.	4 MA	07:00	17:45		59885	10649
26.11.2004	D-ABOJ	3. Clean.	3 MA	07:00	15:30			
21.12.2004	D-ABUF	4. Clean.	4 MA	08:00	18:00		53209	9247
11.01.2005	D-ABUE	5. Clean.	4 MA	10:00	17:15		56248	9336
13.01.2005	D-ABOM	3. Clean.	3 MA				13391	5050
01.02.2005	D-ABUA	3. Clean.	4 MA				60577	10186
11.02.2005	D-ABOI	3. Clean.	3 MA				13928	5314
15.02.2005	D-ABUD	5. Clean.	4 MA				59544	10274
17.02.2005	D-ABON	3. Clean.	3 MA				14635	5262