

# Cluster EFW Anomaly Report

## Problem with Probe 1 on SC1

Anders Eriksson, Per-Arne Lindqvist, Lennart Åhlén, Mats André

EFW-IRFU-AR-003

May 24, 2002

## Document control

Version	Date	Comments
0.1	2002-01-16	First draft
0.2	2002-01-27	Updated after first comments
1.0	2002-05-24	Wire lengths added, minor updates, released

## Contents

<b>1 Observations during the failure</b>	<b>2</b>
<b>2 Diagnostic experiments</b>	<b>7</b>
<b>3 Failure identification and possible remedy</b>	<b>13</b>
<b>Appendix A: Operations 2002-01-02</b>	<b>14</b>
<b>Appendix B: Command log 2002-01-02</b>	<b>16</b>
<b>Appendix C: EFW Boom Deployment Status</b>	<b>19</b>

## 1 Observations during the failure

Probe 1 (P1) on Cluster SC1 stopped working properly at 2001-12-28 03:02:57 UT. Subsequent resets and power cycling of EFW has not remedied the situation.

Figure 1 shows EFW, WHISPER and STAFF SA data from the time of the failure. At the time, all probes on SC1 were in electric field mode with a bias current set at -35 digital units, corresponding to -137 nA. At 03:02:57, the probe-to-spacecraft potential of P1 (black line in top panel) suddenly falls from around -23 V to -68.57 V, which is the saturation value of the A-to-D converters. At the same time, WHISPER shows much increased narrow spectral line contamination, and STAFF SA notes an increase in broadband noise over all of its frequency range, though most in the lowest frequencies. Spectra of EFW data show similarly increased broad band noise from P12, while the P34 signal stays the same except for a slight increase at the spin frequency harmonics.

In Figure 2, we see a blowup of the 20 seconds around the failure time. The probe potentials (top panel) can be seen to change from about -23 V before the failure to -25 V after an initial overshoot. As P1 now is at maximum negative bias current, it emits more photoelectrons than before, so the spacecraft potential must adjust itself accordingly, which explains the final value. The central panel shows the two spinning E-field components E12 and E34. After some initial excursions, E34 reassumes its sinusoidal pattern with a slightly enhanced amplitude, as was seen in Figure 1 as well. This amplitude change probably is the response of the spurious sunward electric field to the changing spacecraft potential. E12 of courses changes drastically, with the new value of around 0.5 V/m essentially being the difference of the P1 and P2 probe potentials,  $68 - 25 \text{ V} = 43 \text{ V}$ , divided by the 88 m probe separation. The increased level of variation simply is the variation of the spacecraft potential that can be seen in the top panel divided by the 88 m, which we should expect to see as V1 is stuck at -68 V while V2 varies with the satellite potential.

Individual samples can be seen in the one-second plots in Figure 3. The individual probe potentials are sampled at a rate of 5 per second, while E12 and E34 are sampled 25 times per second. All data are low-pass filtered at 10 Hz, so there is a time constant of about 0.1 s associated with the filters. E12 reaches its peak value in about this time, while V1 immediately goes down to -68 V (sample not shown), without signs of any time constant. This can be the case because the V1 data are undersampled (filtered at 10 Hz, sampled at 5 per second).

In addition to these science data, the EFW digital subcom telemetry (DSC, time resolution 32 s) may carry additional information. There is no change in the set bias value on P1; nor is there any change of the value of the bias current measured onboard. The WEC current plotted in Figure 4 does not show any clear signature at the time of the failure.

## Overview of WEC data

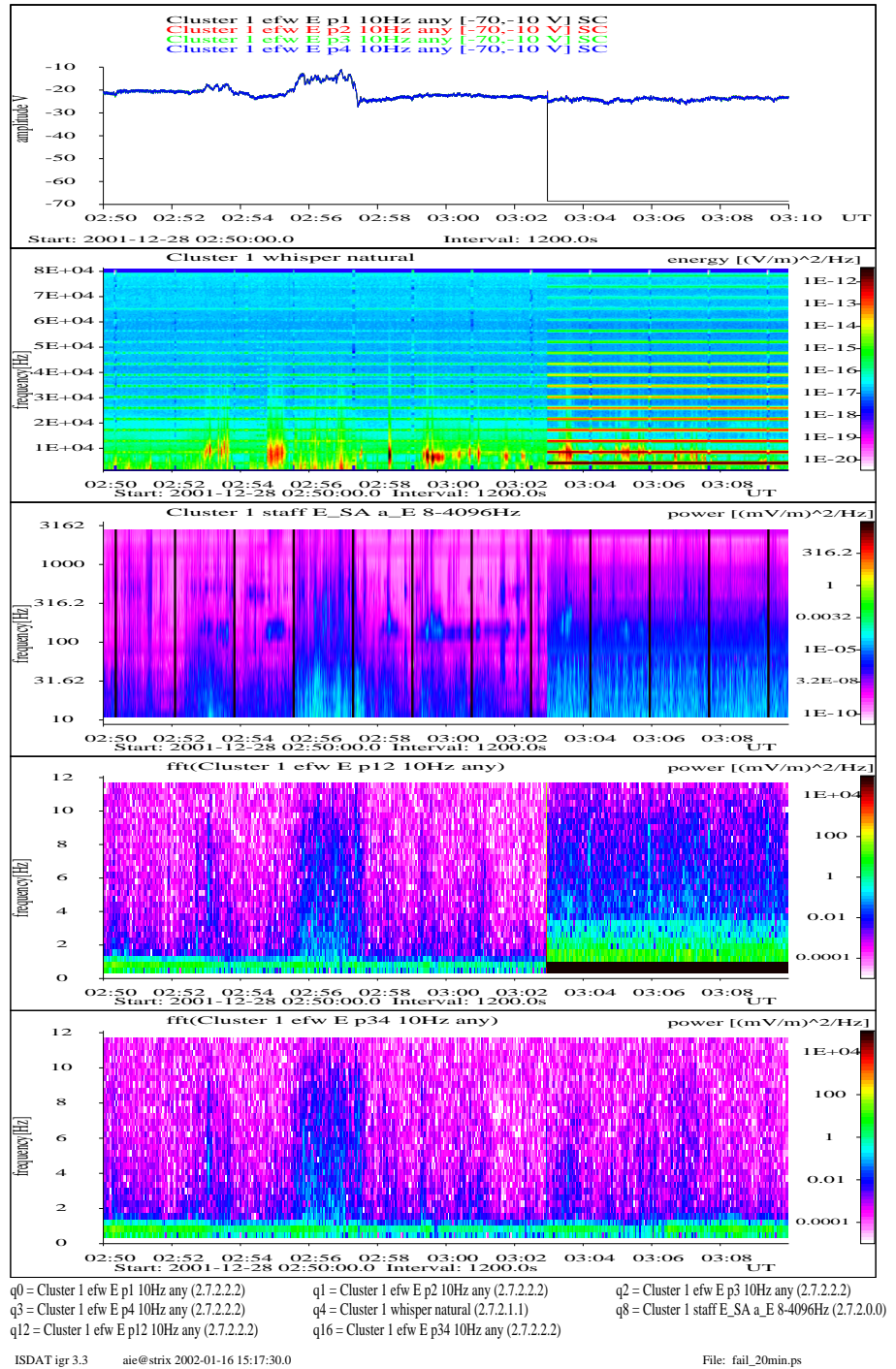


Figure 1: WEC data from SC1 at the time of the P1 failure. From top to bottom: (1) EFW individual probe potentials, in order black-rgb for P1-P4. (2) WHISPER natural mode spectra. (3) STAFF SA electric spectra. (4, 5) Spectra of EFW E12 and E34, respectively.

## EFW Data

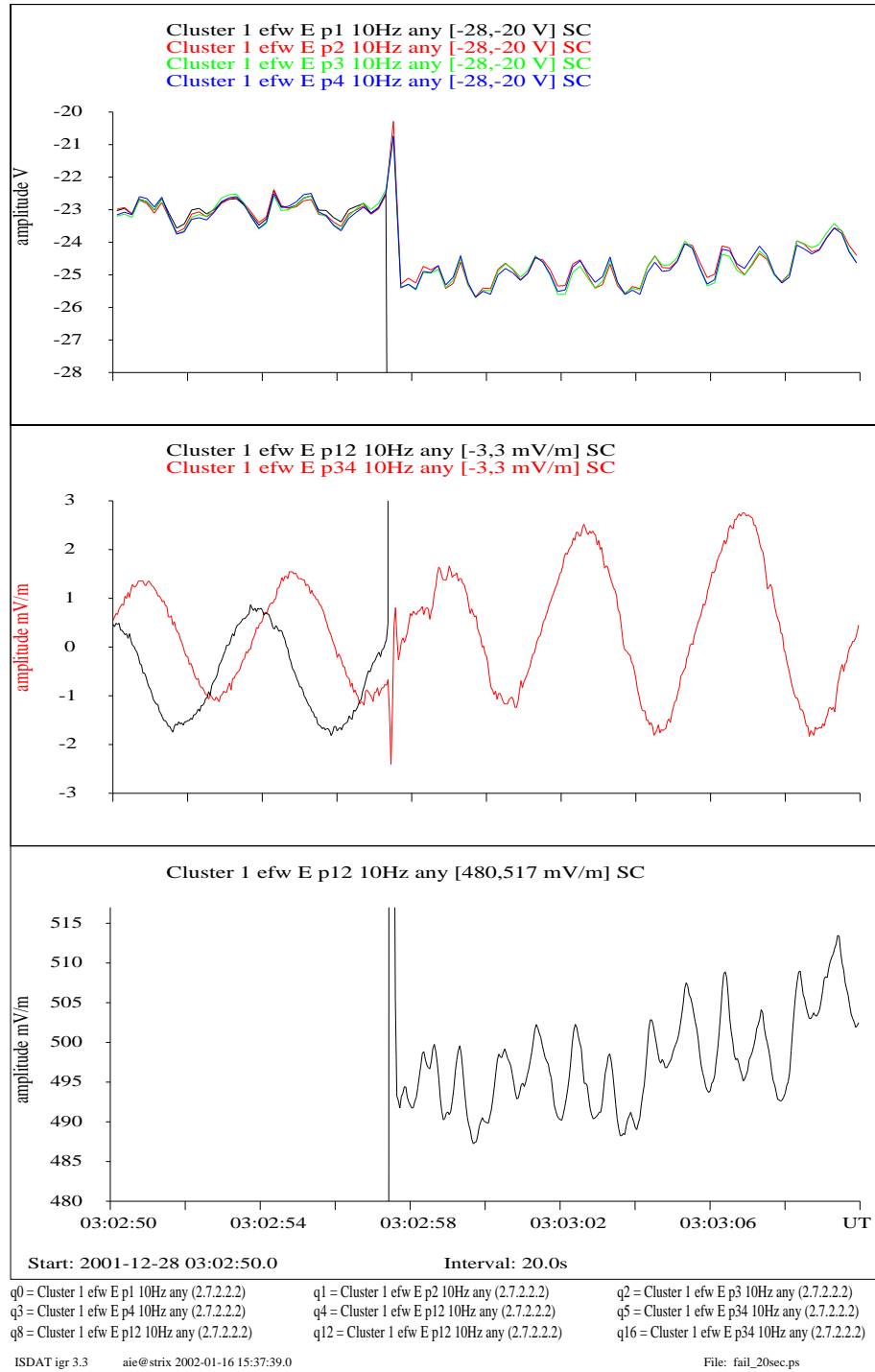
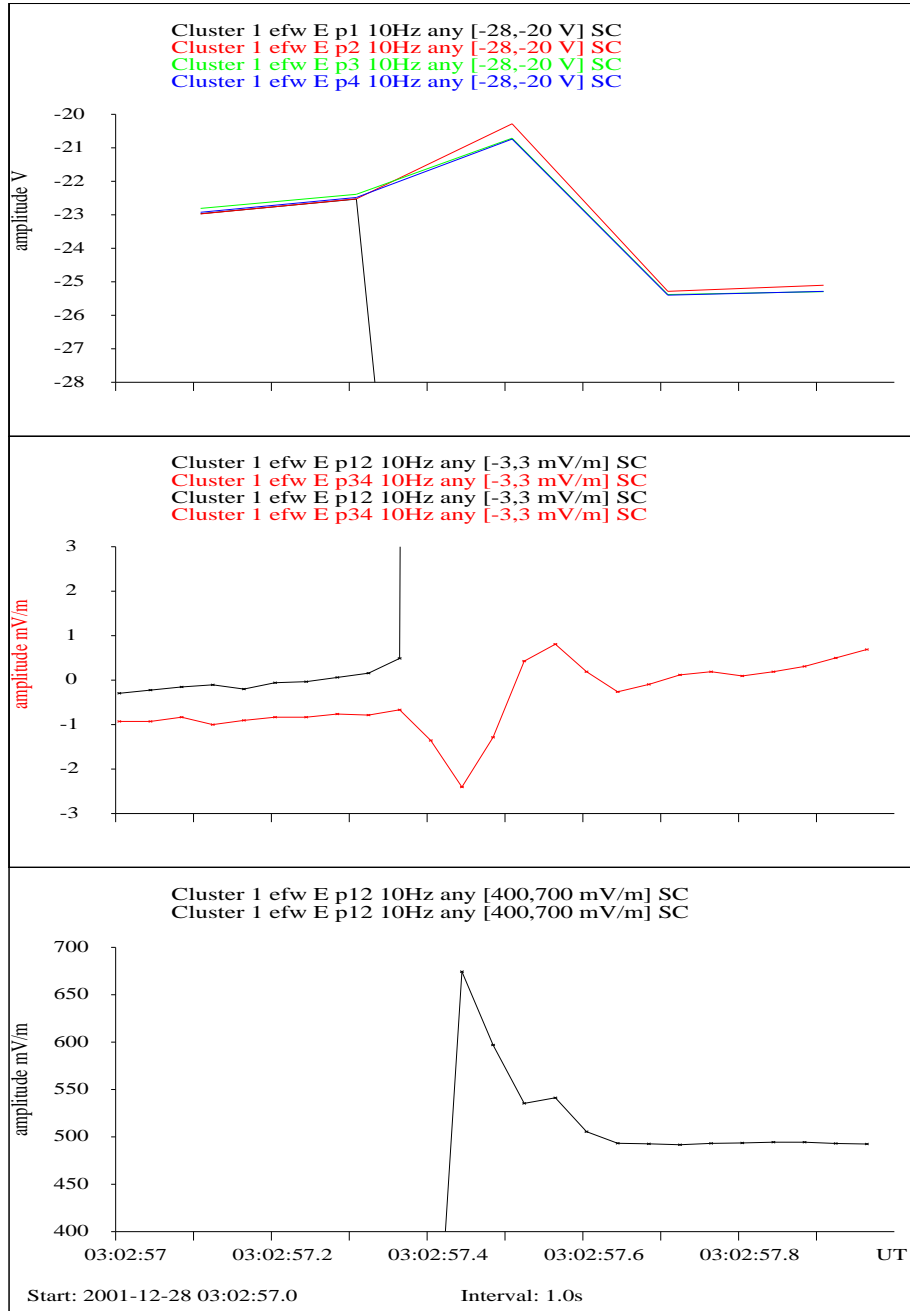


Figure 2: SC1 EFW data at the time of P1 failure. From top to bottom: (1) individual probe potentials, in order black-rgb for P1-P4. (2) E12 and E34. (3) E34 (shifted plot).

### Details of EFW Data



q0 = Cluster 1 efw E p1 10Hz any (2.7.2.2.2)      q1 = Cluster 1 efw E p2 10Hz any (2.7.2.2.2)      q2 = Cluster 1 efw E p3 10Hz any (2.7.2.2.2)  
 q3 = Cluster 1 efw E p4 10Hz any (2.7.2.2.2)      q4 = Cluster 1 efw E p12 10Hz any (2.7.2.2.2)      q5 = Cluster 1 efw E p34 10Hz any (2.7.2.2.2)  
 q6 = Cluster 1 efw E p12 10Hz any (2.7.2.2.2)      q7 = Cluster 1 efw E p34 10Hz any (2.7.2.2.2)      q8 = Cluster 1 efw E p12 10Hz any (2.7.2.2.2)  
 q9 = Cluster 1 efw E p12 10Hz any (2.7.2.2.2)      q12 = Cluster 1 efw E p12 10Hz any (2.7.2.2.2)      q16 = Cluster 1 efw E p34 10Hz any (2.7.2.2.2)

ISDAT igr 3.3      aie@strix 2002-01-16 15:53:19.0      File: fail\_1sec.ps

Figure 3: SC1 detailed EFW data at the time of P1 failure. Format as in Figure 2..

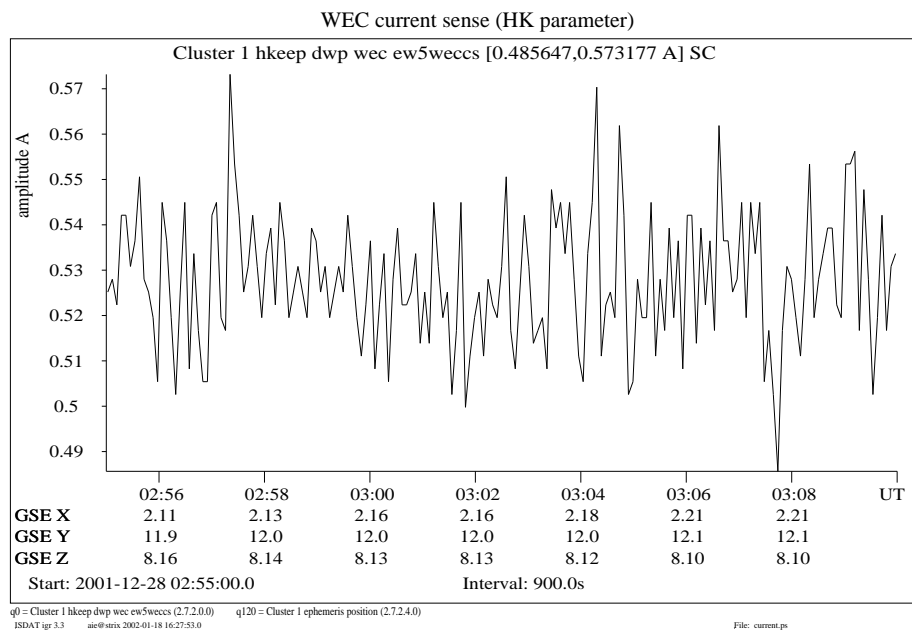


Figure 4: SC1 WEC current at the time of P1 failure.

UT	Commanding	Comment
14:25:00	SWECJ015, X'19', X'01'	Set probe 1 to density mode
14:26:00	SWECJ015, X'19', X'00'	Set probe 1 to E-field mode
14:35:00	SWECJ015, X'01', X'00'	Set probe 1 bias to 0 nA
14:36:00	SWECJ015, X'01', X'DD'	Set probe 1 bias to -140 nA
14:45:00	SWECJ015, X'19', X'01'	Set probe 1 to density mode
14:46:00	SWECJ015, X'01', X'7F'	Set probe 1 bias to +40 V
14:47:00	SWECJ015, X'01', X'81'	Set probe 1 bias to -40 V
14:48:00	SWECJ015, X'01', X'DD'	Set probe 1 bias to -10 V
14:49:00	SWECJ015, X'19', X'00'	Set probe 1 to E-field mode
15:05:40		WEC was switched off
15:09:20		WEC was switched on
15:20:00		Switch on each WEC instrument and set up EFW
15:20:30		EFW was switched on
15:45:00	SWECJ015, X'19', X'01'	Set probe 1 to density mode
15:46:00	SWECJ015, X'01', X'00'	Set probe 1 bias to 0 V
15:47:00	SWECJ015, X'09', X'66'	Set probe 1 puck to +1 V
15:48:00	SWECJ015, X'11', X'14'	Set probe 1 guard to +6 V
15:48:30	SWECJ015, X'09', X'9A'	Set probe 1 puck to -1 V
15:49:00	SWECJ015, X'11', X'EC'	Set probe 1 guard to -6 V
15:49:30	SWECJ015, X'01', X'DD'	Set probe 1 bias to -10 V
15:50:00	SWECJ015, X'19', X'00'	Set probe 1 to E-field mode

Table 1: Summary of WEC/EFW commanding during the recovery attempt and diagnostic experiment. Further details are available in Appendices A and B.

## 2 Diagnostic experiments

A recovery attempt and diagnostic experiments was performed on 2002-01-02 14:25 - 15:50 UT. This is summarized in Table 1, with further details in Appendix A (operations report from Per-Arne Linqvist) and Appendix B (excerpt from command log). The recovery attempt was not succesful, while the diagnostic experiment proved useful.

Overviews of the data from the WEC instruments are shown in Figures 5 and 6 (before and after the WEC power cycling, respectively). There are several bow shock crossings at the time, whose effects must not be confused with the effects of the EFW commanding.

The magenta curves in the top plots of Figures 5 and 6 indicates when P1 was in voltage bias (density) mode. It can immediately be seen that there is no significant change in WHISPER and STAFF SA noise levels at these times (beware of the almost simultaneous bow shock crossings). This has also been verified by the WHISPER team (Pierette Decreau, personal communication).

EFW data from the diagnostic experiment are shown in Figure 7. The magenta line indicates the period when P1 is in voltage mode, between 15:45 and 15:50 as indicated in Table 1. Some detailed response to the EFW commands is shown in the 20-second plots in Figures 8 – 11.

## WEC data at first recovery effort

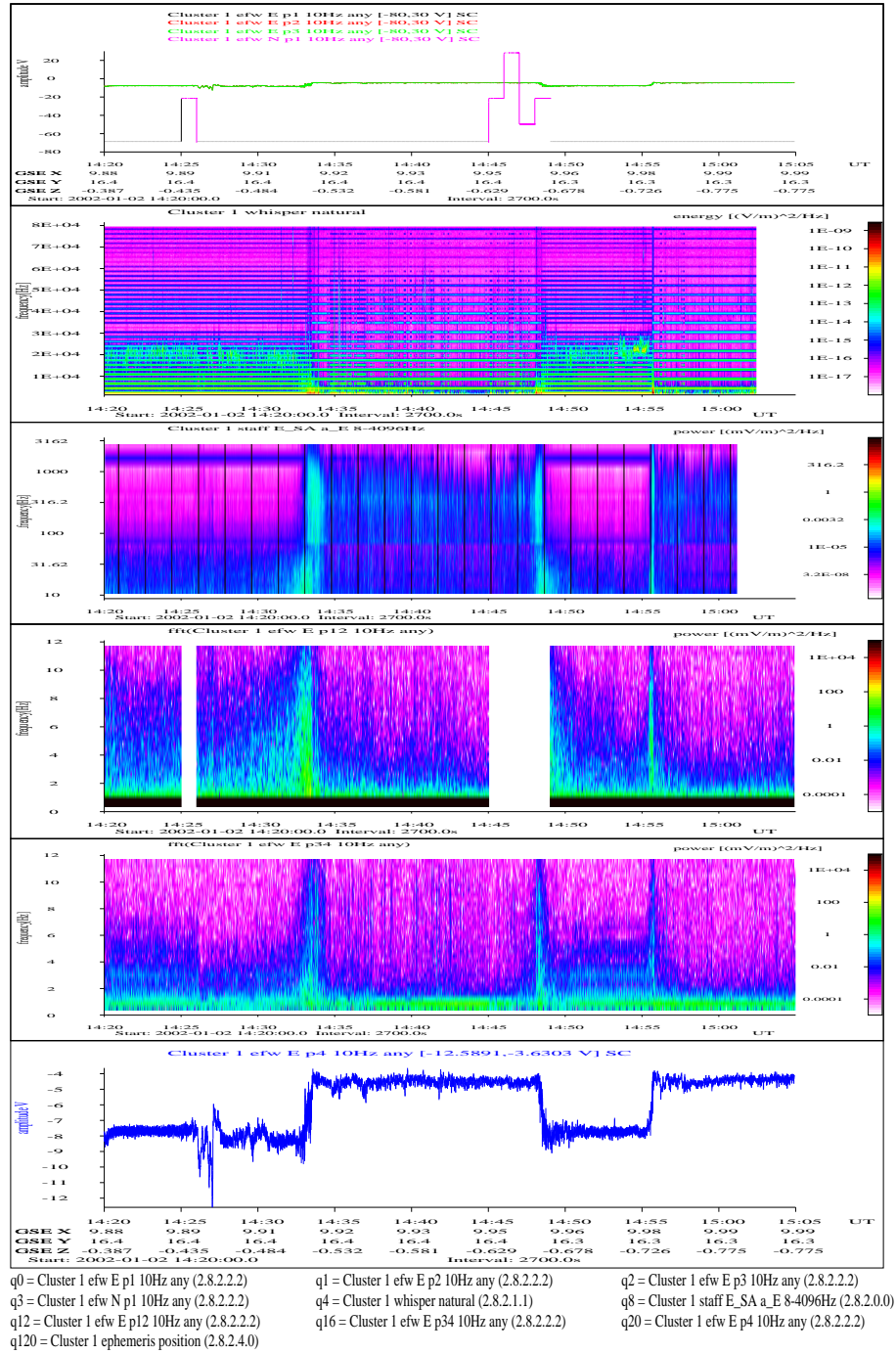
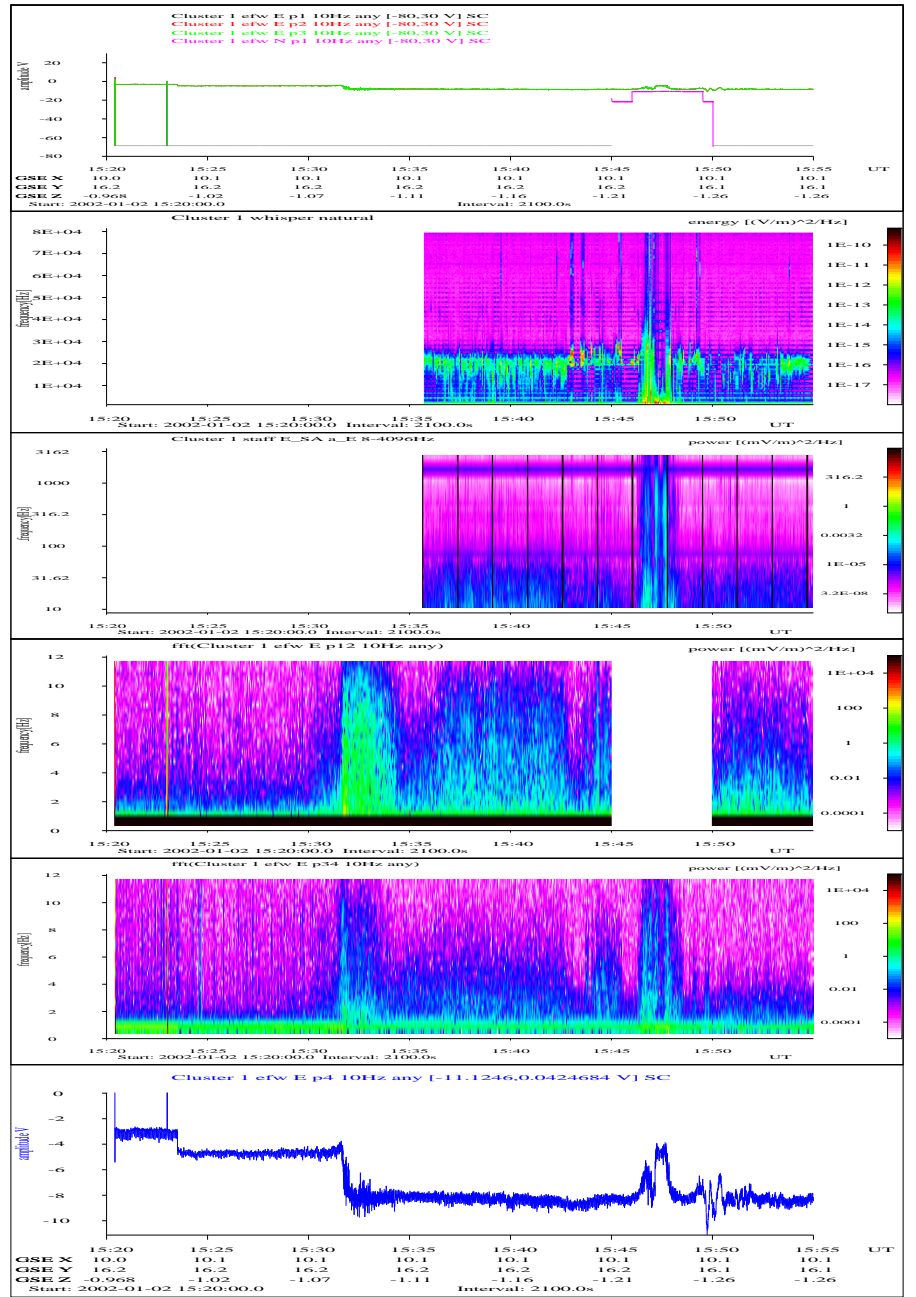


Figure 5: SC1 WEC data during the first half of the recovery attempt and diagnostic test. Format as in Figure 1, except for the new magenta line in the top panel, which is the voltage of P1 when put in bias voltage mode, and the added bottom plot, to which which the P4 voltage have been moved from the top plot in order to show the naturally occurring variations in the plasma.



## WEC data at second recovery effort



q0 = Cluster 1 efw E p1 10Hz any (2.8.2.2.2)      q1 = Cluster 1 efw E p2 10Hz any (2.8.2.2.2)      q2 = Cluster 1 efw E p3 10Hz any (2.8.2.2.2)  
 q3 = Cluster 1 efw N p1 10Hz any (2.8.2.2.2)      q4 = Cluster 1 whisper natural (2.8.2.1.1)      q8 = Cluster 1 staff\_E\_SA\_a\_E 8-4096Hz (2.8.2.0.0)  
 q12 = Cluster 1 efw E p12 10Hz any (2.8.2.2.2)      q16 = Cluster 1 efw E p34 10Hz any (2.8.2.2.2)      q20 = Cluster 1 efw E p4 10Hz any (2.8.2.2.2)  
 q120 = Cluster 1 ephemeris position (2.8.2.4.0)

ISDAT igr 3.3 <fail\_1.igr>

aie@strix 2002-01-18 15:13:51.0

File: recov\_2.ps

Figure 6: SC1 WEC data during the second half of the recovery attempt and diagnostic test. Format as in Figure 5.

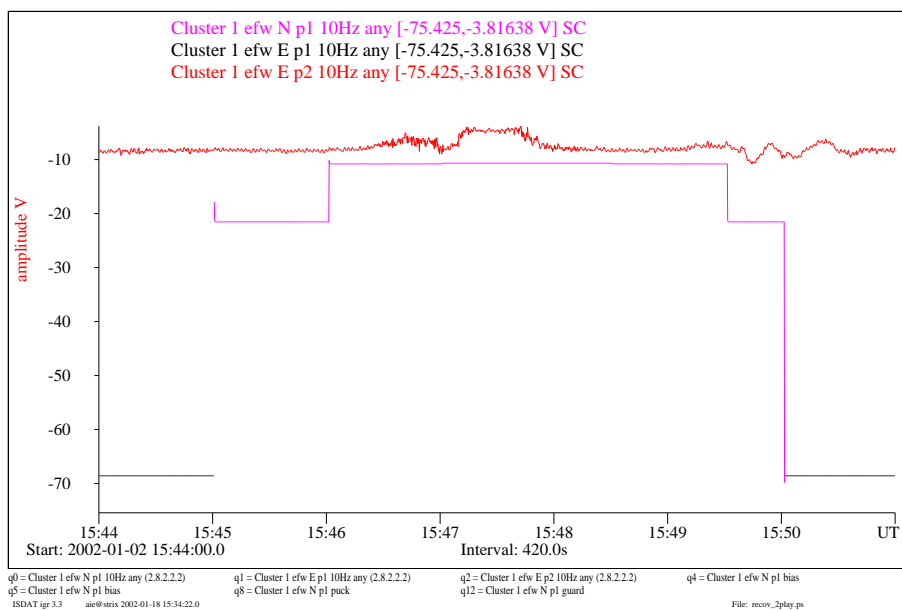


Figure 7: SC1 EFW P1 (black/magenta) and P2 (red) data during the diagnostic test. Black is P1 data when in current bias (E-field) mode, magenta when in voltage bias (density) mode.

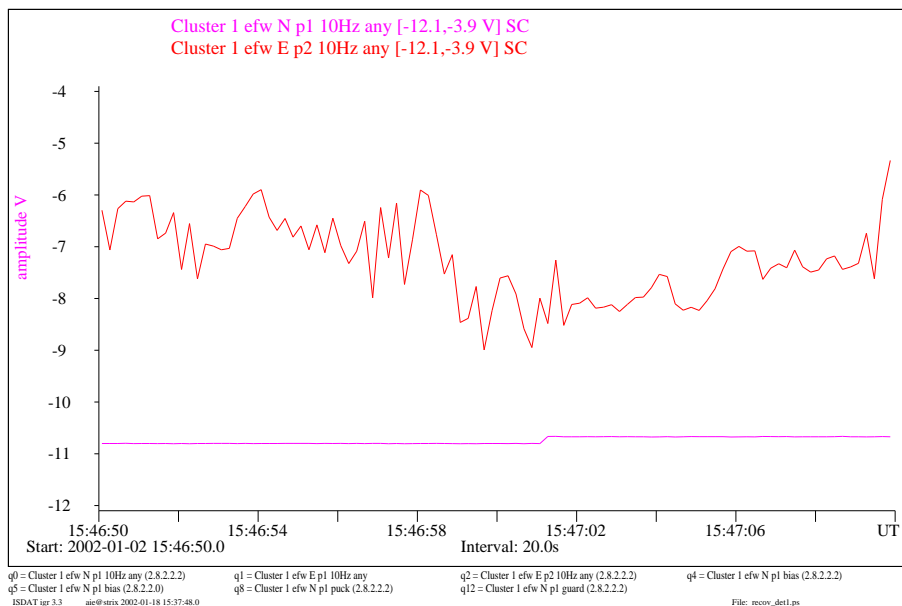


Figure 8: SC1 EFW P1 and P2 data, format as in Figure 7. A small variation in probe voltage can be seen when the puck potential changes at 15:47:00.

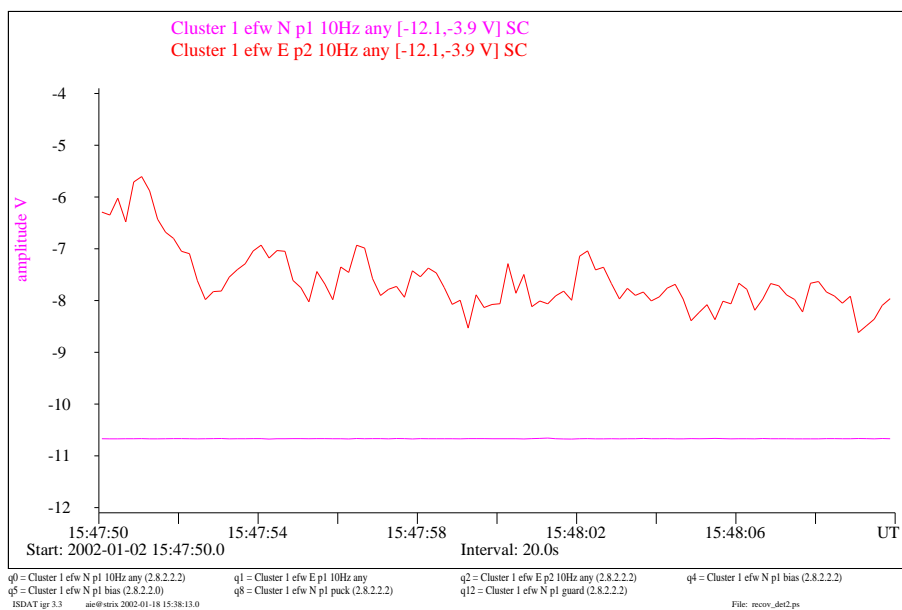


Figure 9: SC1 EFW P1 and P2 data, format as in Figure 7. No significant signal can be seen at the guard potential change at 15:48:00.

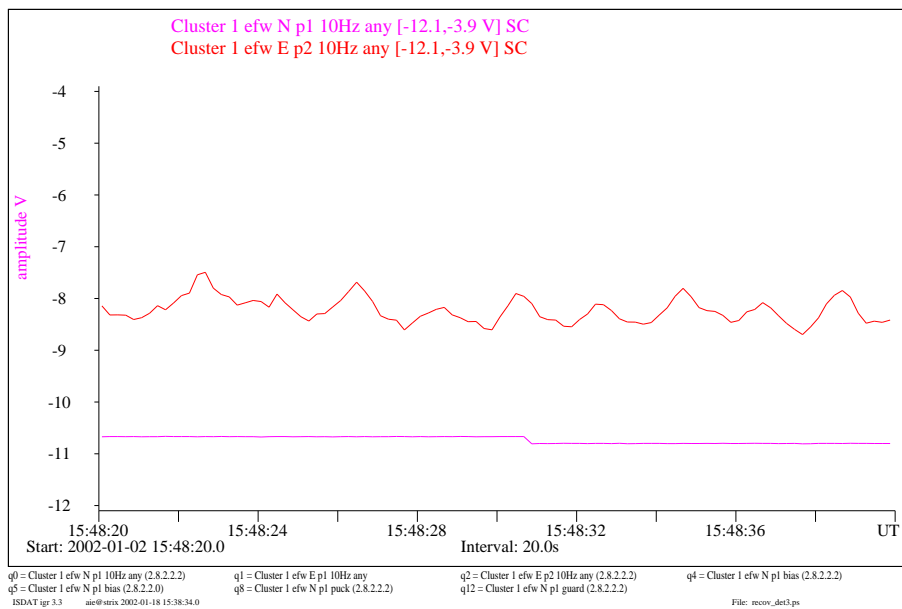


Figure 10: SC1 EFW P1 and P2 data, format as in Figure 7. A small variation in probe voltage can be seen when the puck potential changes at 15:48:30.

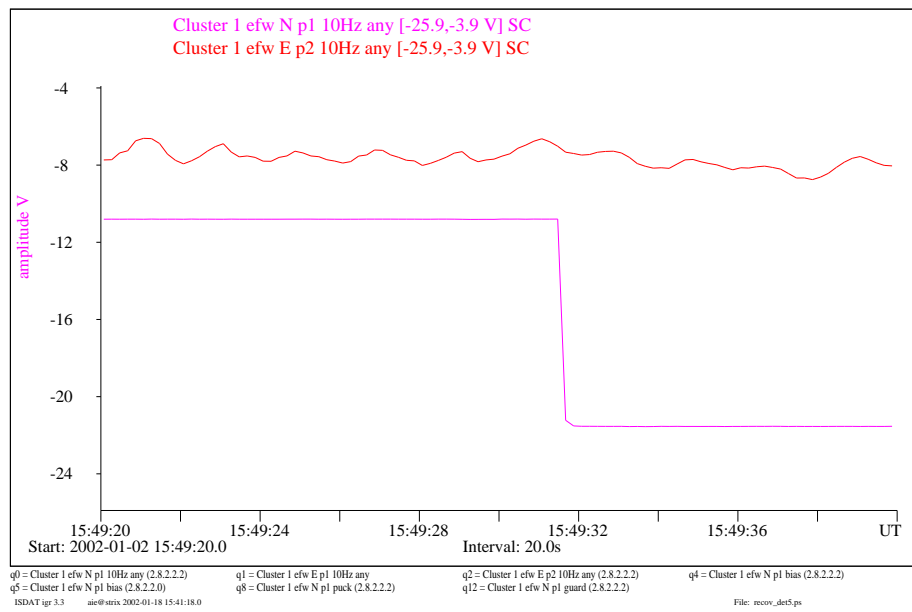


Figure 11: SC1 EFW P1 and P2 data, format as in Figure 7. Probe response to the bias voltage change at 15:49:30.

### 3 Failure identification and possible remedy

The data above can be summarized as follows:

- When in E-field mode (current bias), the voltage returned from the probe shows maximum negative value.
- When in E-field mode, the probe really is at maximum negative bias, as the s/c potential is seen to adjust itself accordingly at the time of the failure.
- When in Langmuir mode, the probe returns a voltage 12 V lower than the bias set.

These result points to a failure of the 12 V power to the preamplifier in the puck. Such a failure would have immediate impact on the feedback to the bias circuitry, so that the probe gets stuck at maximum negative bias as is observed, and also give the observed difference between set and measured potential when in Langmuir mode. The small cross-talk observed when changing the puck potential is also consistent with this interpretation.

A power failure on the 12 V line could occur for a variety of reasons, from component breakdown to micrometeoroid impact on the wire boom. Most of the possible failure scenarios give no hope of recovery, with the exception of the possibility of a loose connection. If this is the explanation, then the problem may possibly be cured by deploying the boom a little more, say a few decimeters. The vibrations in the boom when running the motor could possibly rectify the situation. If the location of the bad connection should be one of the slip-springs/brushes mounted at both ends of the cable spool, a further deployment would be very likely to fix the problem.

We do not think there is any risk associated with running the motor once more: the worst-case scenario is that the probe gets even worse, which does not matter as it is useless already. A possible re-deployment scenario could be to run the deployment by EFW commanding, set to deploy two clicks. This should take about 20 seconds, so by letting the spacecraft power off the motor after say 40 seconds one has additional safety. There is at least 2.5 meters of cable left to deploy (Appendix C – note that the suggestion in the appendicized report was indeed implemented), so we run no risk of reaching end of wire.

The operation can be run by ESOC with EFW standing by remote: as the total time of the operation is shorter than the full turn-around time for data reaching ESOC, any local EFW representative checking and reacting on the data, and ESOC staff issuing a new command, there is little point for EFW to be at ESOC. We have very good experience of covering EFW operations from home institutions.

## Appendix A

### Operations report 2002-01-02

From: "Per-Arne Lindqvist, KTH Stockholm" <lindqvist@plasma.kth.se>  
To: <Micha.Schmidt@esa.int>; <Silvano.Manganelli@esa.int>; <Philippe.Escoubet@esa.int>  
Subject: Problem on SC1 EFW probe 1 remains  
Date: 2 January 2002 17:53

Dear All,

This is to summarize today's attempts to solve a problem with EFW probe 1 on SC1. This probe has been stuck at -68 V since 2001-12-28 around 03 UT. Unfortunately the attempts today to fix it were unsuccessful, and the probe is still saturated at -68 V. The present idea is that the +12 V floating supply voltage to probe 1 has malfunctioned, either within the electronics onboard or by a possible break in the wire out to the probe.

I summarize below the timeline of what was done today, 2002-01-02:

1. Switch probe to density mode and back to E-field mode

14:25:00 SWECJ015, X'19', X'01' ! Set probe 1 to density mode  
14:26:00 SWECJ015, X'19', X'00' ! Set probe 1 to E-field mode

This did not help.

2. Switch bias current to zero and back to -140 nA

14:35:00 SWECJ015, X'01', X'00' ! Set probe 1 bias to 0 nA  
14:36:00 SWECJ015, X'01', X'DD' ! Set probe 1 bias to -140 nA

This did not help.

3. Switch probe to density mode and play with voltage

14:45:00 SWECJ015, X'19', X'01' ! Set probe 1 to density mode  
14:46:00 SWECJ015, X'01', X'7F' ! Set probe 1 bias to +40 V  
14:47:00 SWECJ015, X'01', X'81' ! Set probe 1 bias to -40 V  
14:48:00 SWECJ015, X'01', X'DD' ! Set probe 1 bias to -10 V  
14:49:00 SWECJ015, X'19', X'00' ! Set probe 1 to E-field mode

This did not help. The measured value of the probe voltage differed from the commanded value by about -12 V, suggesting that there might be a problem with the +12 V supply voltage.

4. Switch EFW off and on again

FCP\_WEC\_M002 ! Switch of each WEC instrument, and WEC LCL  
(15:05:40 WEC was switched off)

FCP\_WEC\_M001 ! Switch on the WEC LCL  
(15:09:20 WEC was switched on)

15:20:00 FCP\_WEC\_M902 ! Switch on each WEC instrument and set up EFW  
(15:20:30 EFW was switched on)

Sequences to setup WEC:

15:35:00 SWECJ266 with parameters X'42', X'ad', X'25', X'50', X'74'

15:35:12 SWECJ267 with parameters X'4c',X'ca',X'00',X'58'  
15:35:24 SWECJ013 with parameter X'0f'  
15:35:36 SWECJ004 with parameter X'02'

This did not help.

#### 5. Additional EFW tests

15:45:00 SWECJ015, X'19', X'01' ! Set probe 1 to density mode  
15:46:00 SWECJ015, X'01', X'00' ! Set probe 1 bias to 0 V  
15:47:00 SWECJ015, X'09', X'66' ! Set probe 1 puck to +1 V  
15:48:00 SWECJ015, X'11', X'14' ! Set probe 1 guard to +6 V  
15:48:30 SWECJ015, X'09', X'9A' ! Set probe 1 puck to -1 V  
15:49:00 SWECJ015, X'11', X'EC' ! Set probe 1 guard to -6 V  
15:49:30 SWECJ015, X'01', X'DD' ! Set probe 1 bias to -10 V  
15:50:00 SWECJ015, X'19', X'00' ! Set probe 1 to E-field mode

This was done to determine if there was any crosstalk between the bias, puck and guard voltages. A small change in the probe voltage (0.13 V) was detected when switching the puck voltage between +1 V and -1 V. I do not yet know the significance of this, if any. There was no influence of changing the guard voltage.

The instrument was left in the same state after the tests as before the tests.

Best regards,  
Per-Arne

# Appendix B

## Excerpt from command log 2002-01-02

```
2002-01-02T14:25:00.000Z 2002-01-02T14:22:17.933Z 1XEFW3201 1SWECU015 T M V1 2 SET EFW COM MSB 01 PARAMETER,'X'19',None;
2002-01-02T14:25:01.000Z 2002-01-02T14:22:18.033Z 1XEFW3202 1SWECU015 T M V1 2 SET EFW COM LSBT 01 PARAMETER,'X'01',None;
2002-01-02T14:26:01.000Z 2002-01-02T14:22:18.093Z 1XEFW3201 1SWECU015 T M V1 2 SET EFW COM MSB 01 PARAMETER,'X'19',None;
2002-01-02T14:26:01.000Z 2002-01-02T14:22:18.143Z 1XEFW3202 1SWECU015 T M V1 2 SET EFW COM LSBT 01 PARAMETER,'X'01',None;
2002-01-02T14:35:00.000Z 2002-01-02T14:31:38.106Z 1XEFW3201 1SWECU015 T M V1 2 SET EFW COM MSB 01 PARAMETER,'X'01',None;
2002-01-02T14:35:01.000Z 2002-01-02T14:31:38.106Z 1XEFW3202 1SWECU015 T M V1 2 SET EFW COM LSBT 01 PARAMETER,'X'01',None;
2002-01-02T14:36:00.000Z 2002-01-02T14:31:38.166Z 1XEFW3201 1SWECU015 T M V1 2 SET EFW COM MSB 01 PARAMETER,'X'01',None;
2002-01-02T14:36:01.000Z 2002-01-02T14:31:38.336Z 1XEFW3202 1SWECU015 T M V1 2 SET EFW COM LSBT 01 PARAMETER,'X'DD',None;
2002-01-02T14:45:00.000Z 2002-01-02T14:41:13.049Z 1XEFW3201 1SWECU015 T M V1 2 SET EFW COM MSB 01 PARAMETER,'X'19',None;
2002-01-02T14:45:01.000Z 2002-01-02T14:41:13.149Z 1XEFW3202 1SWECU015 T M V1 2 SET EFW COM LSBT 01 PARAMETER,'X'01',None;
2002-01-02T14:46:00.000Z 2002-01-02T14:41:13.199Z 1XEFW3201 1SWECU015 T M V1 2 SET EFW COM MSB 01 PARAMETER,'X'01',None;
2002-01-02T14:46:01.000Z 2002-01-02T14:41:13.269Z 1XEFW3202 1SWECU015 T M V1 2 SET EFW COM LSBT 01 PARAMETER,'X'7B',None;
2002-01-02T14:47:00.000Z 2002-01-02T14:41:13.469Z 1XEFW3201 1SWECU015 T M V1 2 SET EFW COM MSB 01 PARAMETER,'X'01',None;
2002-01-02T14:47:01.000Z 2002-01-02T14:41:13.519Z 1XEFW3202 1SWECU015 T M V1 2 SET EFW COM LSBT 01 PARAMETER,'X'81',None;
2002-01-02T14:48:00.000Z 2002-01-02T14:41:13.569Z 1XEFW3201 1SWECU015 T M V1 2 SET EFW COM MSB 01 PARAMETER,'X'01',None;
2002-01-02T14:48:01.000Z 2002-01-02T14:41:13.629Z 1XEFW3202 1SWECU015 T M V1 2 SET EFW COM LSBT 01 PARAMETER,'X'DD',None;
2002-01-02T14:49:00.000Z 2002-01-02T14:41:13.729Z 1XEFW3201 1SWECU015 T M V1 2 SET EFW COM MSB 01 PARAMETER,'X'19',None;
2002-01-02T14:49:01.000Z 2002-01-02T14:41:13.729Z 1XEFW3202 1SWECU015 T M V1 2 SET EFW COM LSBT 01 PARAMETER,'X'0',None;
2002-01-02T15:00:51.276Z 2002-01-02T15:00:51.276Z 1XOBD4083 1SWECM002 D M V1 2 MON GRP ENA/DIS 02 MON_GRP_ENA_DIS_DISABLED, None;MON_GRP_IDENTIF, 63, None;
2002-01-02T15:01:09.614Z 2002-01-02T15:01:09.614Z 1XDPW3113 1SWECM002 D M V1 2 SET MACRO OPS 01 MACRO_OPERATIONS,'X'0080',None;
2002-01-02T15:03:10.200Z 2002-01-02T15:03:10.200Z 1XDPW3102 1SWECM002 D M V1 2 SET INSTR POWER 01 POW_CTRL_FUN_SEL,'X'05',None;
2002-01-02T15:03:31.127Z 2002-01-02T15:03:31.127Z 1XDPW3102 1SWECM002 D M V1 2 SET INSTR POWER 01 POW_CTRL_FUN_SEL,'X'04',None;
2002-01-02T15:03:52.315Z 2002-01-02T15:03:52.315Z 1XDPW3102 1SWECM002 D M V1 2 SET INSTR POWER 01 POW_CTRL_FUN_SEL,'X'03',None;
2002-01-02T15:04:13.292Z 2002-01-02T15:04:13.292Z 1XDPW3102 1SWECM002 D M V1 2 SET INSTR POWER 01 POW_CTRL_FUN_SEL,'X'02',None;
2002-01-02T15:04:34.130Z 2002-01-02T15:04:34.130Z 1XDPW3102 1SWECM002 D M V1 2 SET INSTR POWER 01 POW_CTRL_FUN_SEL,'X'01',None;
2002-01-02T15:04:55.267Z 2002-01-02T15:04:55.267Z 1XDPW3102 1SWECM002 D M V1 2 SET INSTR POWER 01 POW_CTRL_FUN_SEL,'X'00',None;
2002-01-02T15:05:40.882Z 2002-01-02T15:05:40.882Z 1XP0W8050 1SWECM002 D M V1 1 WEC LCL A/B OFF 00
2002-01-02T15:05:46.991Z 2002-01-02T15:05:46.991Z 1XP0W3560 1SOBEMAC1 D X ** 2 WEC LCL A OFF M 00
2002-01-02T15:05:46.992Z 2002-01-02T15:05:46.992Z 1XP0W3900 1SOBEMAC1 D X ** 2 PDU ML EXECUTE M 00
2002-01-02T15:05:46.993Z 2002-01-02T15:05:46.993Z 1XP0W6560 1SOBEMAC1 D X ** 2 WEC LCL A OFF R 00
2002-01-02T15:05:46.994Z 2002-01-02T15:05:46.994Z 1XP0W6900 1SOBEMAC1 D X ** 2 PDU ML EXECUTE R 00
2002-01-02T15:05:46.995Z 2002-01-02T15:05:46.995Z 1XP0W3562 1SOBEMAC1 D X ** 2 WEC LCL B OFF M 00
2002-01-02T15:05:46.996Z 2002-01-02T15:05:46.996Z 1XP0W3900 1SOBEMAC1 D X ** 2 PDU ML EXECUTE M 00
2002-01-02T15:05:46.997Z 2002-01-02T15:05:46.997Z 1XP0W6562 1SOBEMAC1 D X ** 2 WEC LCL B OFF R 00
2002-01-02T15:05:46.998Z 2002-01-02T15:05:46.998Z 1XP0W6900 1SOBEMAC1 D X ** 2 PDU ML EXECUTE R 00
2002-01-02T15:09:11.117Z 2002-01-02T15:09:11.117Z 1XP0W8049 1SWECM001 D M V1 1 WEC LCL A ON 00
2002-01-02T15:09:18.246Z 2002-01-02T15:09:18.246Z 1XP0W3561 1SOBEMAC2 D X ** 2 WEC LCL A ON M 00
2002-01-02T15:09:18.247Z 2002-01-02T15:09:18.247Z 1XP0W3900 1SOBEMAC2 D X ** 2 PDU ML EXECUTE M 00
2002-01-02T15:09:18.248Z 2002-01-02T15:09:18.248Z 1XP0W6561 1SOBEMAC2 D X ** 2 WEC LCL A ON R 00
2002-01-02T15:09:18.249Z 2002-01-02T15:09:18.249Z 1XP0W6900 1SOBEMAC2 D X ** 2 PDU ML EXECUTE R 00
2002-01-02T15:09:22.396Z 2002-01-02T15:09:22.396Z 1XDPW3113 1SWECM001 D M V1 2 SET MACRO OPS 01 MACRO_OPERATIONS,'X'0080',None;
2002-01-02T15:10:16.529Z 2002-01-02T15:10:16.529Z 1XOBD4083 1SWECM001 D M V1 2 MON GRP ENA/DIS 02 MON_GRP_ENA_DIS_ENABLED, None;MON_GRP_IDENTIF, 63, None;
2002-01-02T15:19:58.320Z 2002-01-02T15:19:58.320Z 1XTTC3206 00 D M V1 1 TRSP 1 RNG OFF 00
2002-01-02T15:20:00.000Z 2002-01-02T15:15:23.736Z 1XOBD0002 1SWECM902 T M V1 2 DUMMY LP COMMAND 00
2002-01-02T15:20:00.000Z 2002-01-02T15:15:23.786Z 1XDPW3113 1SWECJ130 T M V1 2 SET MACRO OPS 01 MACRO_OPERATIONS,'X'80',None;
2002-01-02T15:20:01.000Z 2002-01-02T15:15:23.846Z 1XDPW3113 1SWECJ130 T M V1 2 SET MACRO OPS 01 MACRO_OPERATIONS,'X'5F',None;
2002-01-02T15:20:02.000Z 2002-01-02T15:15:23.906Z 1XDPW3113 1SWECJ130 T M V1 2 SET MACRO OPS 01 MACRO_OPERATIONS,'X'0C',None;
2002-01-02T15:20:03.000Z 2002-01-02T15:15:23.966Z 1XDPW3113 1SWECJ130 T M V1 2 SET MACRO OPS 01 MACRO_OPERATIONS,'X'80',None;
2002-01-02T15:20:09.000Z 2002-01-02T15:15:24.016Z 1XDPW3500 1SWECJ130 T M V1 2 DWP CONFIG 02 KERNEL_ALLOCAT,'X'3',None;DWP_CONFIG,'X'40',None;
2002-01-02T15:20:11.000Z 2002-01-02T15:15:24.066Z 1XDPW3500 1SWECJ130 T M V1 1 DWP CONFIG 02 KERNEL_ALLOCAT,'X'3',None;DWP_CONFIG,'X'31',None;
2002-01-02T15:20:18.000Z 2002-01-02T15:15:24.116Z 1XDPW3113 1SWECJ130 T M V1 2 SET MACRO OPS 01 MACRO_OPERATIONS,'X'5F',None;
2002-01-02T15:20:19.000Z 2002-01-02T15:15:24.176Z 1XDPW3102 1SWECJ130 T M V1 2 SET INSTR POWER 01 POW_CTRL_FUN_SEL,'X'05',None;
2002-01-02T15:20:20.000Z 2002-01-02T15:15:24.236Z 1XDPW3113 1SWECJ130 T M V1 2 SET MACRO OPS 01 MACRO_OPERATIONS,'X'80',None;
2002-01-02T15:20:24.000Z 2002-01-02T15:15:24.296Z 1XDPW3102 1SWECJ130 T M V1 2 SET INSTR POWER 01 POW_CTRL_FUN_SEL,'X'04',None;
2002-01-02T15:20:30.000Z 2002-01-02T15:15:24.476Z 1XDPW3102 1SWECJ130 T M V1 2 SET INSTR POWER 01 POW_CTRL_FUN_SEL,'X'42',None;
2002-01-02T15:20:36.000Z 2002-01-02T15:15:24.526Z 1XDPW3102 1SWECJ130 T M V1 2 SET INSTR POWER 01 POW_CTRL_FUN_SEL,'X'41',None;
2002-01-02T15:20:42.000Z 2002-01-02T15:15:24.576Z 1XDPW3102 1SWECJ130 T M V1 2 SET INSTR POWER 01 POW_CTRL_FUN_SEL,'X'43',None;
2002-01-02T15:20:48.000Z 2002-01-02T15:15:24.646Z 1XDPW3102 1SWECJ130 T M V1 2 SET INSTR POWER 01 POW_CTRL_FUN_SEL,'X'45',None;
2002-01-02T15:20:54.000Z 2002-01-02T15:15:24.696Z 1XDPW3102 1SWECJ130 T M V1 2 SET INSTR POWER 01 POW_CTRL_FUN_SEL,'X'44',None;
2002-01-02T15:20:55.000Z 2002-01-02T15:15:24.746Z 1XDPW3113 1SWECJ130 T M V1 2 SET MACRO OPS 01 MACRO_OPERATIONS,'X'1C',None;
2002-01-02T15:22:00.000Z 2002-01-02T15:15:24.796Z 1XDPW3113 1SWECJ265 T M V1 2 SET MACRO OPS 01 MACRO_OPERATIONS,'X'57',None;
2002-01-02T15:22:00.000Z 2002-01-02T15:15:24.856Z 1XDPW3110 1SWECJ265 T M V1 1 SET WBD DATA PRO 01 WBD_DATA_PROC,'X'00',None;
2002-01-02T15:22:00.000Z 2002-01-02T15:15:24.906Z 1XDPW3200 1SWECJ265 T M V1 2 DWP COMMON CMD 01 COMMON,'X'0D',None;
2002-01-02T15:22:00.000Z 2002-01-02T15:15:25.026Z 1XDPW3203 1SWECJ265 T M V1 2 SET DWP MEM WRIT 01 PARAMETER,'X'09',None;
2002-01-02T15:22:00.000Z 2002-01-02T15:15:25.176Z 1XDPW3204 1SWECJ265 T M V1 2 DWP COMMON CMD 01 COMMON,'X'00',None;
2002-01-02T15:22:00.000Z 2002-01-02T15:15:25.176Z 1XDPW3204 1SWECJ265 T M V1 2 LOAD KERNEL MEM 01 PARAMETER,'X'18',None;
2002-01-02T15:22:00.000Z 2002-01-02T15:15:25.226Z 1XDPW3000 1SWECJ265 T M V1 2 DWP DUMMY CMD 01 DUMMY,'X'4A61',None;
2002-01-02T15:22:00.000Z 2002-01-02T15:15:25.286Z 1XDPW3000 1SWECJ265 T M V1 2 DWP DUMMY CMD 01 DUMMY,'X'2130',None;
2002-01-02T15:22:00.000Z 2002-01-02T15:15:25.336Z 1XDPW3000 1SWECJ265 T M V1 2 DWP DUMMY CMD 01 DUMMY,'X'24AD',None;
2002-01-02T15:22:00.000Z 2002-01-02T15:15:25.386Z 1XDPW3000 1SWECJ265 T M V1 2 DWP DUMMY CMD 01 DUMMY,'X'3075',None;
2002-01-02T15:22:00.000Z 2002-01-02T15:15:25.436Z 1XDPW3000 1SWECJ265 T M V1 2 DWP DUMMY CMD 01 DUMMY,'X'7524',None;
2002-01-02T15:22:00.000Z 2002-01-02T15:15:25.496Z 1XDPW3000 1SWECJ265 T M V1 2 DWP DUMMY CMD 01 DUMMY,'X'F231',None;
2002-01-02T15:22:00.000Z 2002-01-02T15:15:25.546Z 1XDPW3000 1SWECJ265 T M V1 2 DWP DUMMY CMD 01 DUMMY,'X'7224',None;
2002-01-02T15:22:00.000Z 2002-01-02T15:15:46.571Z 1XDPW3000 1SWECJ265 T M V1 2 DWP DUMMY CMD 01 DUMMY,'X'24F2',None;
2002-01-02T15:22:06.000Z 2002-01-02T15:15:46.631Z 1XDPW3000 1SWECJ265 T M V1 2 DWP DUMMY CMD 01 DUMMY,'X'24F2',None;
2002-01-02T15:22:06.000Z 2002-01-02T15:15:46.681Z 1XDPW3000 1SWECJ265 T M V1 2 DWP DUMMY CMD 01 DUMMY,'X'8475',None;
2002-01-02T15:22:06.000Z 2002-01-02T15:15:46.731Z 1XDPW3000 1SWECJ265 T M V1 2 DWP DUMMY CMD 01 DUMMY,'X'D524',None;
2002-01-02T15:22:06.000Z 2002-01-02T15:15:46.781Z 1XDPW3000 1SWECJ265 T M V1 2 DWP DUMMY CMD 01 DUMMY,'X'7524',None;
2002-01-02T15:22:06.000Z 2002-01-02T15:15:46.831Z 1XDPW3000 1SWECJ265 T M V1 2 DWP DUMMY CMD 01 DUMMY,'X'212D',None;
2002-01-02T15:22:06.000Z 2002-01-02T15:15:46.881Z 1XDPW3000 1SWECJ265 T M V1 2 DWP DUMMY CMD 01 DUMMY,'X'C22D',None;
2002-01-02T15:22:06.000Z 2002-01-02T15:15:47.011Z 1XDPW3000 1SWECJ265 T M V1 2 DWP DUMMY CMD 01 DUMMY,'X'24AE',None;
2002-01-02T15:22:06.000Z 2002-01-02T15:15:47.161Z 1XDPW3001 1SWECJ265 T M V1 2 DWP ESCAPE 01 DATA,'X'A2',None;
2002-01-02T15:22:06.000Z 2002-01-02T15:15:47.221Z 1XDPW3001 1SWECJ265 T M V1 2 DWP ESCAPE 01 DATA,'X'72',None;
2002-01-02T15:22:06.000Z 2002-01-02T15:15:47.271Z 1XDPW3000 1SWECJ265 T M V1 2 DWP DUMMY CMD 01 DUMMY,'X'F021',None;
2002-01-02T15:22:06.000Z 2002-01-02T15:15:47.331Z 1XDPW3000 1SWECJ265 T M V1 2 DWP DUMMY CMD 01 DUMMY,'X'2928',None;
2002-01-02T15:22:06.000Z 2002-01-02T15:15:47.391Z 1XDPW3000 1SWECJ265 T M V1 2 DWP DUMMY CMD 01 DUMMY,'X'242B',None;
2002-01-02T15:22:06.000Z 2002-01-02T15:15:47.441Z 1XDPW3000 1SWECJ265 T M V1 2 DWP DUMMY CMD 01 DUMMY,'X'D524',None;
2002-01-02T15:22:06.000Z 2002-01-02T15:15:47.501Z 1XDPW3000 1SWECJ265 T M V1 2 DWP DUMMY CMD 01 DUMMY,'X'212D',None;
2002-01-02T15:22:06.000Z 2002-01-02T15:15:47.561Z 1XDPW3000 1SWECJ265 T M V1 2 DWP DUMMY CMD 01 DUMMY,'X'212D',None;
2002-01-02T15:22:06.000Z 2002-01-02T15:15:47.611Z 1XDPW3000 1SWECJ265 T M V1 2 DWP DUMMY CMD 01 DUMMY,'X'022C',None;
2002-01-02T15:22:12.000Z 2002-01-02T15:15:47.671Z 1XDPW3000 1SWECJ265 T M V1 2 DWP DUMMY CMD 01 DUMMY,'X'19CF',None;
2002-01-02T15:22:12.000Z 2002-01-02T15:15:47.721Z 1XDPW3200 1SWECJ265 T M V1 2 DWP COMMON CMD 01 COMMON,'X'0A',None;
2002-01-02T15:22:12.000Z 2002-01-02T15:15:47.781Z 1XDPW3203 1SWECJ265 T M V1 2 SET DWP MEM WRIT 01 PARAMETER,'X'37',None;
2002-01-02T15:22:12.000Z 2002-01-02T15:15:47.841Z 1XDPW3200 1SWECJ265 T M V1 2 DWP COMMON CMD 01 COMMON,'X'00',None;
2002-01-02T15:22:12.000Z 2002-01-02T15:15:47.891Z 1XDPW3204 1SWECJ265 T M V1 2 LOAD KERNEL MEM 01 PARAMETER,'X'01',None;
2002-01-02T15:22:12.000Z 2002-01-02T15:15:47.951Z 1XDPW3000 1SWECJ265 T M V1 2 DWP DUMMY CMD 01 DUMMY,'X'27D3',None;
2002-01-02T15:22:12.000Z 2002-01-02T15:15:48.001Z 1XDPW3112 1SWECJ265 T M V1 2 MACRO WAIT LOOP 01 MACRO_WAIT,'X'02',None;
2002-01-02T15:22:12.000Z 2002-01-02T15:15:48.061Z 1XDPW3110 1SWECJ265 T M V1 1 SET WBD DATA PRO 01 WBD_DATA_PROC,'X'1',None;
2002-01-02T15:22:12.000Z 2002-01-02T15:15:48.261Z 1XDPW3113 1SWECJ265 T M V1 2 SET MACRO OPS 01 MACRO_OPERATIONS,'X'0C',None;
2002-01-02T15:22:12.000Z 2002-01-02T15:15:48.321Z 1XDPW3113 1SWECJ265 T M V1 2 SET MACRO OPS 01 MACRO_OPERATIONS,'X'80',None;
2002-01-02T15:22:30.000Z 2002-01-02T15:15:48.381Z 1XDPW3113 1SWECJ004 T M V1 2 SET MACRO OPS 01 MACRO_OPERATIONS,'X'17',None;
```





2002-01-02T15:35:00.000Z 2002-01-02T15:33:04.989Z LXWHI3301 LSWEQJ266 T M V1 2 SET WHIS COM 1 01 PARAMETER,X'25',None;  
 2002-01-02T15:35:00.000Z 2002-01-02T15:33:05.069Z LXWHI3302 LSWEQJ266 T M V1 2 SET WHIS COM 2 01 PARAMETER,X'50',None;  
 2002-01-02T15:35:00.000Z 2002-01-02T15:33:05.129Z LXWHI3307 LSWEQJ266 T M V1 2 SET WHIS COM 3TX 01 PARAMETER,X'74',None;  
 2002-01-02T15:35:00.000Z 2002-01-02T15:33:05.189Z LXDWP3113 LSWEQJ266 T M V1 2 SET MACRO OPS 01 MACRO\_OPERATIONS,X'80',None;  
 2002-01-02T15:35:12.000Z 2002-01-02T15:33:05.249Z LXDWP3200 LSWEQJ267 T M V1 2 DWP COMMON CMD 01 COMMON,X'00',None;  
 2002-01-02T15:35:12.000Z 2002-01-02T15:33:05.309Z LXDWP3201 LSWEQJ267 T M V1 2 LOAD MACRO 01 MACRO\_PAR,X'83',None;  
 2002-01-02T15:35:12.000Z 2002-01-02T15:33:05.499Z LXDWP3109 LSWEQJ267 T M V1 2 SET WHD DATA PRO 01 WHISP\_BIT\_RATE,X'4C',None;  
 2002-01-02T15:35:12.000Z 2002-01-02T15:33:05.549Z LXWHI3300 LSWEQJ267 T M V1 2 SET WHIS COM 0 01 PARAMETER,X'CA',None;  
 2002-01-02T15:35:12.000Z 2002-01-02T15:33:05.619Z LXWHI3301 LSWEQJ267 T M V1 2 SET WHIS COM 1 01 PARAMETER,X'00',None;  
 2002-01-02T15:35:12.000Z 2002-01-02T15:33:05.679Z LXWHI3306 LSWEQJ267 T M V1 2 SET WHIS COM 2TX 01 PARAMETER,X'58',None;  
 2002-01-02T15:35:12.000Z 2002-01-02T15:33:05.739Z LXDWP3113 LSWEQJ267 T M V1 2 SET MACRO OPS 01 MACRO\_OPERATIONS,X'80',None;  
 2002-01-02T15:35:24.000Z 2002-01-02T15:33:05.799Z LXDWP3111 LSWEQJ013 T M V1 2 SET CORR DATA PR 01 PEACRO\_AUTO\_CORR,X'0F',None;  
 2002-01-02T15:35:36.000Z 2002-01-02T15:33:05.849Z LXDWP3113 LSWEQJ004 T M V1 2 SET MACRO OPS 01 MACRO\_OPERATIONS,X'02',None;  
 2002-01-02T15:36:00.000Z 2002-01-02T15:20:57.003Z LXTTC3206 T M V1 1 TRSP 1 RNG OFF 00  
 2002-01-02T15:45:00.000Z 2002-01-02T15:43:46.301Z LXEPW3201 LSWEQJ015 T M V1 2 SET EPW COM MSB 01 PARAMETER,X'19',None;  
 2002-01-02T15:45:01.000Z 2002-01-02T15:43:46.531Z LXEPW3202 LSWEQJ015 T M V1 2 SET EPW COM LSBT 01 PARAMETER,X'01',None;  
 2002-01-02T15:46:00.000Z 2002-01-02T15:43:46.591Z LXEPW3201 LSWEQJ015 T M V1 2 SET EPW COM MSB 01 PARAMETER,X'01',None;  
 2002-01-02T15:46:01.000Z 2002-01-02T15:43:46.641Z LXEPW3202 LSWEQJ015 T M V1 2 SET EPW COM LSBT 01 PARAMETER,X'00',None;  
 2002-01-02T15:47:00.000Z 2002-01-02T15:43:46.701Z LXEPW3201 LSWEQJ015 T M V1 2 SET EPW COM MSB 01 PARAMETER,X'09',None;  
 2002-01-02T15:47:01.000Z 2002-01-02T15:43:46.751Z LXEPW3202 LSWEQJ015 T M V1 2 SET EPW COM LSBT 01 PARAMETER,X'66',None;  
 2002-01-02T15:48:00.000Z 2002-01-02T15:43:46.801Z LXEPW3201 LSWEQJ015 T M V1 2 SET EPW COM MSB 01 PARAMETER,X'11',None;  
 2002-01-02T15:48:01.000Z 2002-01-02T15:43:46.851Z LXEPW3202 LSWEQJ015 T M V1 2 SET EPW COM LSBT 01 PARAMETER,X'14',None;  
 2002-01-02T15:48:30.000Z 2002-01-02T15:43:46.911Z LXEPW3201 LSWEQJ015 T M V1 2 SET EPW COM MSB 01 PARAMETER,X'09',None;  
 2002-01-02T15:48:31.000Z 2002-01-02T15:43:46.961Z LXEPW3202 LSWEQJ015 T M V1 2 SET EPW COM LSBT 01 PARAMETER,X'9A',None;  
 2002-01-02T15:49:00.000Z 2002-01-02T15:43:47.011Z LXEPW3201 LSWEQJ015 T M V1 2 SET EPW COM MSB 01 PARAMETER,X'11',None;  
 2002-01-02T15:49:01.000Z 2002-01-02T15:43:47.061Z LXEPW3202 LSWEQJ015 T M V1 2 SET EPW COM LSBT 01 PARAMETER,X'EC',None;  
 2002-01-02T15:49:30.000Z 2002-01-02T15:43:47.121Z LXEPW3201 LSWEQJ015 T M V1 2 SET EPW COM MSB 01 PARAMETER,X'01',None;  
 2002-01-02T15:49:31.000Z 2002-01-02T15:43:47.171Z LXEPW3202 LSWEQJ015 T M V1 2 SET EPW COM LSBT 01 PARAMETER,X'DD',None;  
 2002-01-02T15:50:00.000Z 2002-01-02T15:43:47.221Z LXEPW3201 LSWEQJ015 T M V1 2 SET EPW COM MSB 01 PARAMETER,X'19',None;  
 2002-01-02T15:50:01.000Z 2002-01-02T15:43:47.271Z LXEPW3202 LSWEQJ015 T M V1 2 SET EPW COM LSBT 01 PARAMETER,X'00',None;

**Appendix C**  
**EFW Boom Deployment Status Report**  
**Per-Arne Lindqvist, September 18, 2000**

Appended on the following pages.