

METAL PARTICLE SUMMARY

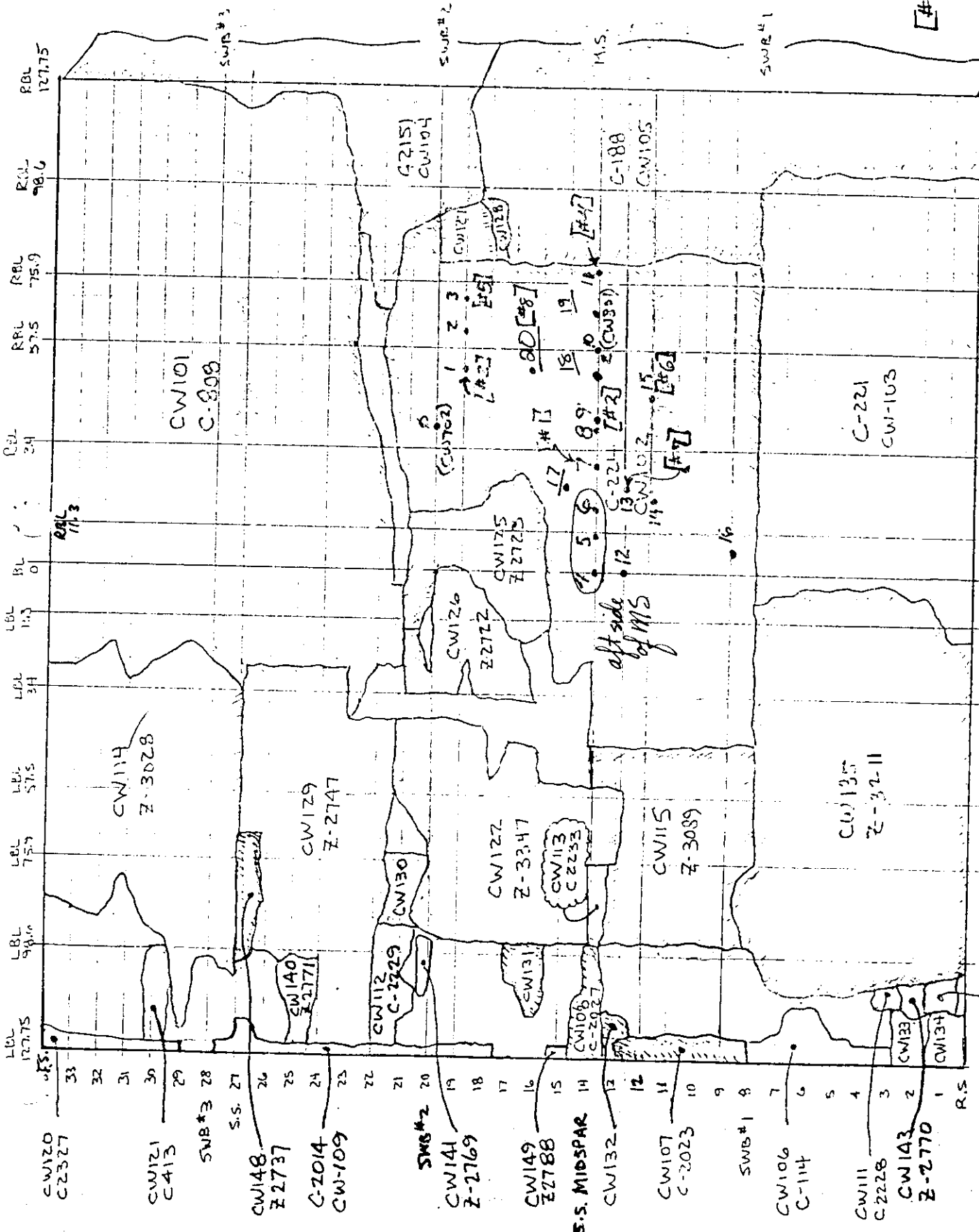
UPPER WING CENTER SECTION
SEW PANEL

W Stewart

CW-102
10/26/96
J. TRICIL

SUMMARY METAL PARTICLE LOCATIONS

[#] - NTSB SAMPLE No.



Joe Esperson Particle Locations
confirmed Swed ones added 10/19/96
12/18/96

LH 12/16/96

CW110
C-2227

METAL PARTICLE LOCATIONS
[PARTICLES ADHERING TO SEALANT
IN MOST CASES]

CW-102
10/26/96
J. TREIL

- Ø - SWB 2 @ RBL 38 FRAGMENT TRAPPED IN CRACK [CW-752]
- 1 - STGR 5-19 AFT OF SWB 2 @ RBL 55
[NTSB # 3]*
- 2 - STGR 5-19 @ RBL 60
3mm x 3mm
- 3 - STGR 5-19 @ RBL 70
[NTSB # 5]*
- 4 - MIDSPAR E ATTACH
- 5 - MIDSPAR @ RBL 8.94 SHEAR TIE
- 6 - MIDSPAR @ RBL 17.27 SHEAR TIE
- 7 - MIDSPAR @ RBL 31-32 [NTSB # 1]* UPPER CHORD
- 8 - MIDSPAR @ RBL 36 UPPER CHORD
- 9 - MIDSPAR @ RBL 37 UPPER CHORD [NTSB # 2]*
- 10 - MIDSPAR VERT. FLANGE @ RBL 58 TRAPPED FRAGMENT IN CRACK
[CW801]
- 11 - MIDSPAR @ RBL 79 UPPER CHORD [NTSB # 4]*
- 12 - STGR 13 @ RBL 1, 1.5, AND 3 SHEAR TIE
- 13 - STGR 13 @ RBL 22/23 [NTSB # 7]*
- 14 - CW102 @ RBL 18 AFT OF STGR 12 ABOUT 2.25 INCHES
- 15 - STGR 12 @ RBL 41/42 [NTSB # 6]*
- 16 - STGR 9 @ RBL 6/7
- 17-18-19-20 Added JE 12/6/96

* [] REMOVED BY NTSB MS 10-16-96
FOR ANALYSIS

JE 12/12/96
12/17/96

CROSS REFERENCE MAP IS MARKINGS

RE-MARKED HARDWARE ϕ -16

METAL PARTICLE

LOCATIONS

10/27/96

J. TRZIL

CW-102

10/27/96

J. TRZIL

MAP SUMMARY
LOCATION ITEM NO.

- ϕ
- ① NTSB # 3 ^{1/2}
- 2
- ③ NTSB # 5 ^{1/2}
- 4
- 5
- 6
- ⑦ NTSB # 1 ^{1/2}
- 8
- ⑨ NTSB # 2 ^{1/2}
- 10
- ⑪ NTSB # 4 ^{1/2}
- 12
- ⑬ NTSB # 7 ^{1/2}
- 14
- ⑮ NTSB # 6 ^{1/2}
- 16

CWT MARKINGS
SEE NOTES FOLLOWING PAGES



FRAGMENT
SWB2 @
RBL 38

GENERALLY -
WING SKIN
SEALANT LINE
ASSOCIATED
WITH:

- A
 - B
 - C
 - A
 - B
 - C
 - F
 - E
 - D
 - D
 - G
 - E
 - F
 - G
 - H
 - I
- } @ STGR 5-19
 RBL 55, 60, 70
 RESPECTIVELY
- } @ MID SPAR
 ♀, RBL 8.9, 17.2
 RESPECTIVELY
- } @ MID SPAR UPPER CHORD
 RBL 31, 36, 37
 RESPECTIVELY
- } MID SPAR VERT FLANGE
 UPPER CHORD
- MID SPAR RBL 79
- STGR 13 @ RBL 1, 1.5, 3
- STGR 13 @ RBL 22/23
- CW 102 @ RBL 18
- STGR 12 @ RBL 41/42
- STGR 9 @ RBL 6/7

J.E. 12/6/97
LH 12/6/97

FYI -
BACK UP
ROUGH
NOTES

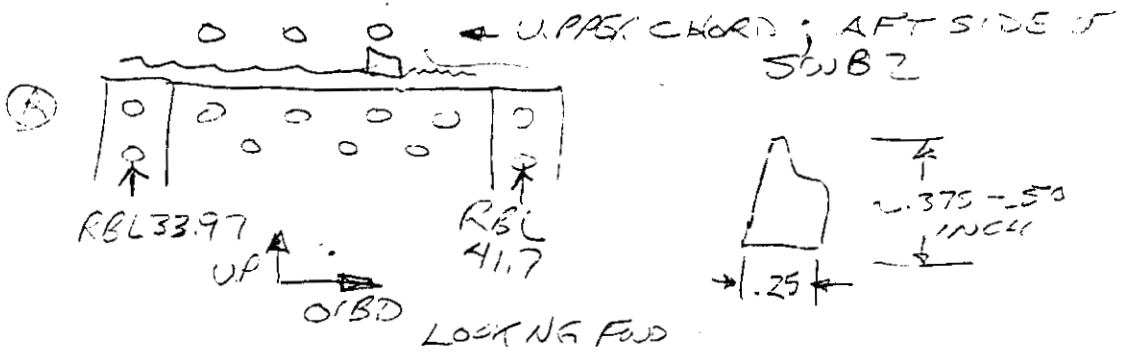
NOT IN
OTHER
BINDERS

LOCATION OF METALLIC
PARTICLES - SWB 2

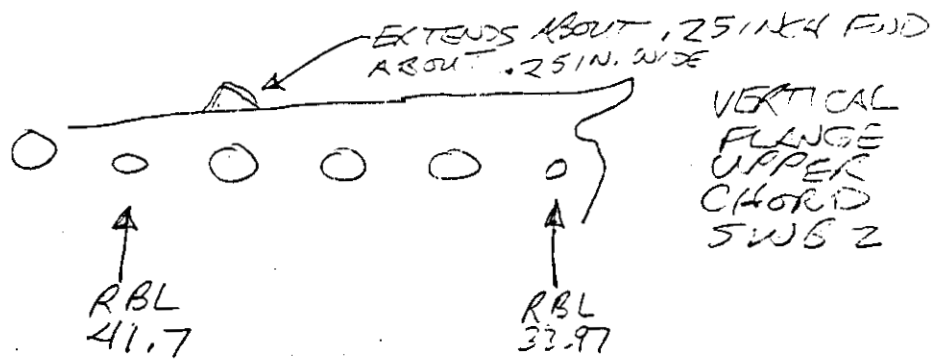
CW-702
10-26-96
J. TRZIL
(0071N4)

BETWEEN RBL 33.97 & 41.7 AT ABOUT
RBL 33 A FRAGMENT OF METAL IS
TRAPPED IN A CRACK IN THE VERTICAL
FLANGE OF SPANWISE BEAM NO. 2 UPPER
CHORD

Aluminum Sheet



(B) LOOKING AFT



JE 10/6/96 (NTSB)
UH 12/12/96
TWA

CENT UPPER SKIN INTERSECTION
WITH FWD MIDSPAR [S-14],
AFT SWBZ AND S-19.

CW-102
10-26-96
J. TREIL

LOCATION OF METALLIC
PARTICLES - UPPER SKIN TO
STRINGER SEALANT LINE

LOOKING
FWD

1 [A] STER S-19 AFT OF SWBZ (S-20)
@ AFT SEALANT LINE WITH UPPER SKIN
@ ~RBL 55

PARTICLE REMOVED FOR ANALYSIS
BY "NTSB/MB 10/16/96 #3"

2 [B] STER S-19 AFT SEALANT LINE
@ ~RBL 60

3MM X 3MM
PARTICLE - IN PLACE
AS OF THIS DATE

3 [C] STER S-19 AS ABOVE EXCEPT
NEAR RBL 70

SMALL LENGTH SINGLE STRAND FINE WIRE
REMOVED BY "NTSB 10/16/96 MB #5"
FOR ANALYSIS

9: [D] MIDSPAR UPPER CHORD (S-14) FWD SEALANT
LINE NEAR RBL 37 - VISUALLY WHITE LINE
RESIDUE REMAINS AT THIS DATE
PARTICLE REMOVED FOR ANALYSIS
"NTSB MB 10/16/96 #2"

LOOKING
AFT

8 [E] SIMILAR TO [D] EXCEPT NEAR RBL 36
VISUALLY WHITE RESIDUE REMAINS AT
THIS DATE

7 [F] AS [D] AND [E] EXCEPT NEAR RBL 31-32
REMOVED FOR ANALYSIS BY
"NTSB MB 10/16/96 #1"

11 [G] AS [D] EXCEPT NEAR RBL 79
REMOVED FOR ANALYSIS BY
"NTSB/MB 10/16/96 #4"

[CW-102] CWT UNDERSIDE OF UPPER SKIN AND AFT MIDSPAR/STGR 13/STGR 12 [CW-801]

CW-102
10/26/96
J. TRZIL

- 4 $\text{\textcircled{D}}$ MIDSPAR @ ATTACH LOOKING LEFT/END AT UPPER $\text{\textcircled{E}}$ SKIN UNDERSIDE VARIOUS PARTICLES INDICATED THIS AREA BY WHITE CORRECTION FLUORESCENT
- 5 $\text{\textcircled{D}}$ RBL 8,94 SHEAR TIE SEALANT LINE WITH UGTER U.S. RIGHT SIDE OF SHEAR TIE VARIOUS [3 OR MORE] PARTICLES

LOOKING END AT AFT SIDE OF MIDSPAR UPPER CHORD W.S. UPPER CHORD W.S.

NOTE: SOME PARTICLES ALSO ALONG SEALANT LINE BETWEEN $\text{\textcircled{D}}$ AND RBL 8,94 AFT MIDSPAR UPPER CHORD TO UPPER SKIN

- 6 $\text{\textcircled{D}}$ RBL 17,27 SHEAR TIE SEALANT WITH UPPER STIFFENER [RIGHT O'BD CORNER LOOKING END] Small sliver of ~~skin~~ - removed 12/5/96 for safe keeping

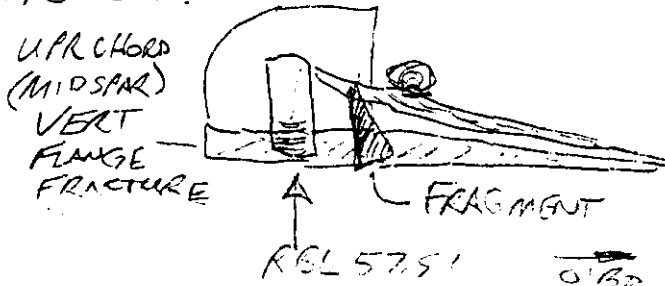
- 10 $\text{\textcircled{D}}$ METAL FRAGMENT TRAPPED IN CRACK SEPARATION OF MIDSPAR VERTICAL FLANGE. FRAGMENT IS ABOUT 1 IN LONG (PROTRUDING AFT & DOWNWARDS AT ABOUT 45 DEGREES) AND ABOUT .25 INCH WIDE

Fragment matches profile of adjacent missing area of Aft flange of upper chord at crack line.

Removed for safe keeping 12/5/96

Joe Epperson NTEB

CRACK PROGRESSION WAS FROM O'BD TO INBD ENDING AT SHEAR TIE LOCATION FOR RBL 57,51 STIFFENER



ABOUT 1 INCH FROM BOLT TO FRAGMENT

- 12 $\text{\textcircled{D}}$ THREE PARTICLES JUST O'BD OF SHEAR TIE @ $\text{\textcircled{E}}$ FOR STGR 13 AT ABOUT 1, 1.5, AND 2 INCHES O'BD ON UNDERSIDE OF UPPER CWT SKIN ADHERING TO SEALANT.

- 13 $\text{\textcircled{D}}$ PARTICLE NEAR RBL 22/23 AT SEALANT LINE BETWEEN STGR 13 AND CWT UPPER SKIN

REMOVED FOR ANALYSIS BY NTSB/MSB

10/16/96 (#7) 2 OF 3

JE 12/7/96

CWT UPPER SKIN AND
AFT MIDSEAM / STER 13 / STER 12
(CONTINUED)

CW-102
10/26/96
J. TRZIL

14
No longer
Present
12/5/96 JE

METALLIC PARTICLE ADHERING TO
BOTTOM OF CWT UPPER SKIN NEAR
RBL 13 (NOTE: NOT AT SEALANT LINE)
AFT OF STER 12 ABOUT 2.25 INCHES
AND MEASURING ABOUT 2mm X 3mm.

15
PARTICLE NEAR RBL 41/42 AT STER 12
AFT SEALANT LINE WITH CWT UPPER SKIN
REMOVED FOR ANALYSIS BY "NTSB MB 10/16/96" #6

16
AI -
sliver
STER 9 AFT SEALANT LINE WITH CWT
UPPER SKIN NEAR RBL 6/7 - METALLIC PARTICLE
ABOUT 3mm X 5mm
Removed 12/5 for safe keeping.

17 - RBL 17 Red Rusty Particle - aft sealant line
1st stinger FWD of MS top skin CWT

18 RBL 44 Red Rusty discoloration in ^{aft} sealant line
of shear tie to CWT upper skin

19 RBL 67 Red Rusty spot aft sealant line
of MS upper chord

20 RBL 50 Red Rusty particle ~~made on~~ CWT
top skin under former location of 3rd stinger
FWD of MS Removed 12/5/96 JE
[NTSB #8]

JE 12/7/96

Met book
12/7/96
Joe EPPERSON
NTSB

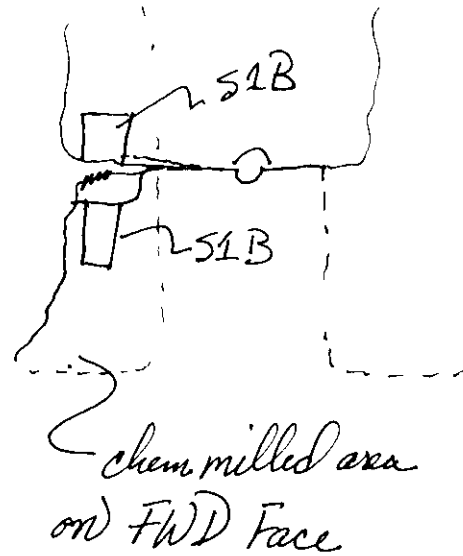
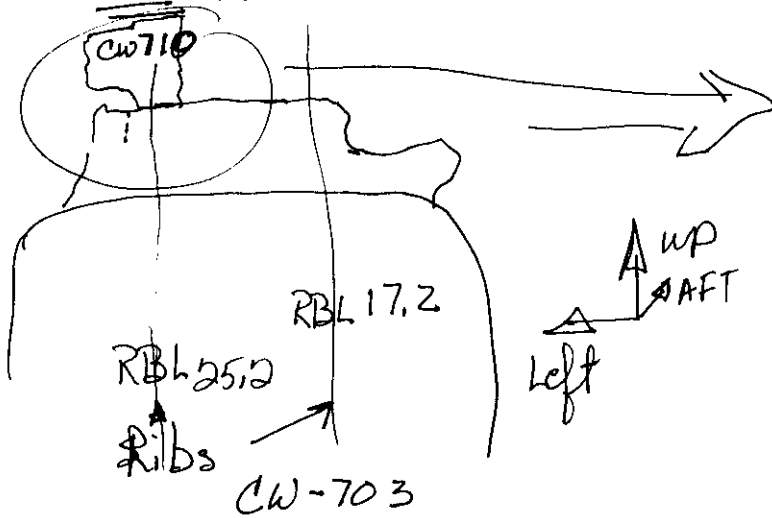
Spanwise Beam #3 Sample (Sections)

S1T } Upper and Lower side of web above
S1B } Manufacture Door (CW-703)

Top section S1T in heated area

Bottom section S1B in non heated area

Fractures at sample locations
do not match.



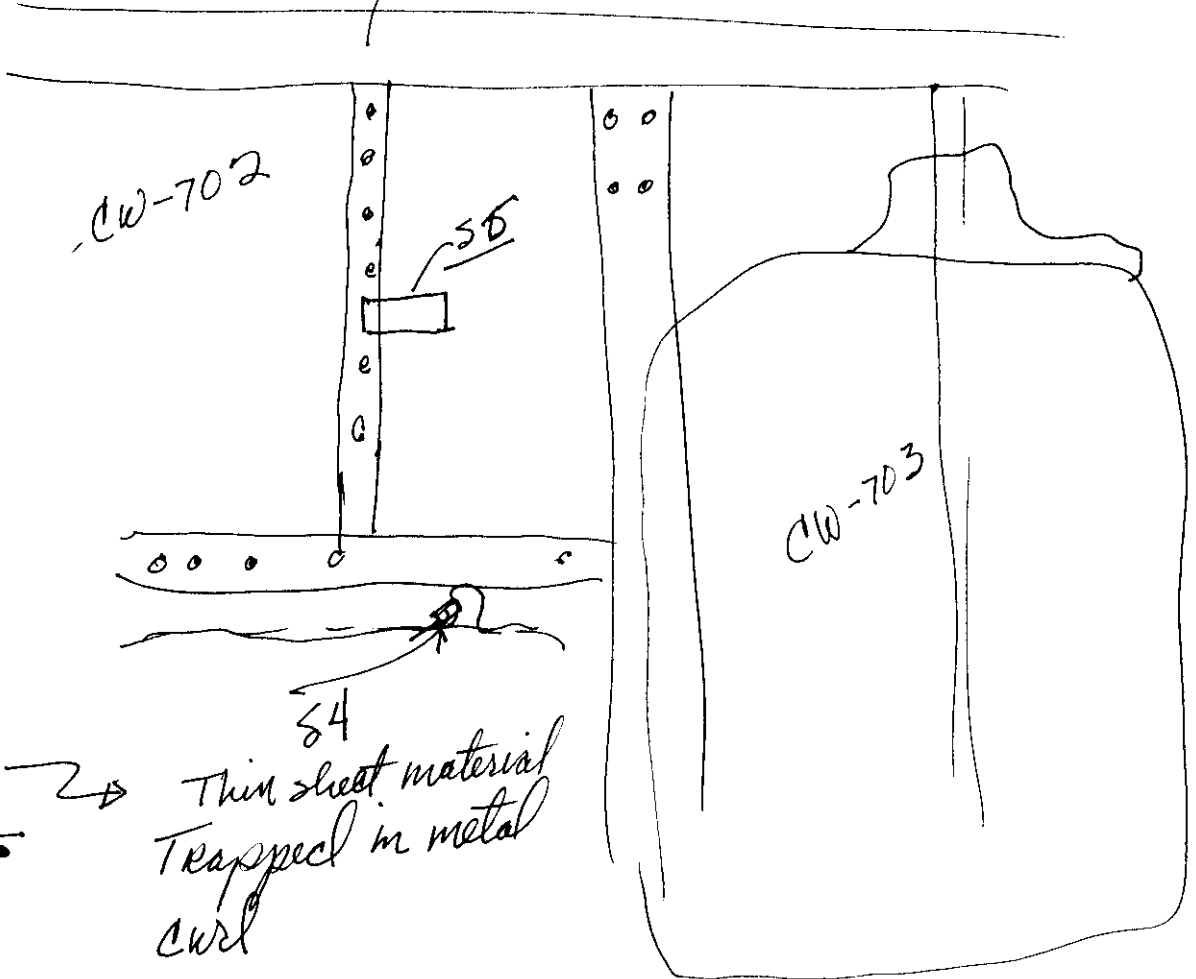
Met Book
12/7/96
Joe Epperson
NTSB

S5 → heated area horizontally across
thick area at Rib (RBL 41.7) into
thin chem milled area to left.

SWB #3

top bow

RBL 702



S4 → Thin sheet material
Trapped in metal
curl

NET Book
12/7/96
Joe Epperson
NTSB

S2 } double curled pieces
S3 } from web right of RBL 83.2 Rib
S2 midway between upper/lower chord
S3 ~~at~~ 25% up from lower chord

Markings on front face of web