

COMPUTATION NOTE BOOK



43-648

Made in U.S.A.

Course STS - 2, 3, 4Name W. Thornton701 Cowards Crk Rd.

13 July '81 Mtg. at ILC @ Whitmore, M^cComb et al

Sched. on facing pg. but delivery will be slipped ~ 1 mo. since mtg. is simple procedure.

Whitmore to take T.M. and do following -

tear down

clean

replace, refurbish any worn parts

develop mtl. list

put set screw on throttle

add helicoils

lub. @ approved lubes.

make two additional clamps for each end

ILC

design & mfg interface

" " blunges, cords

M^cComb to supply connectors to studs

It was decided to:

lv. tachometer off.

lv. 2" clearance on door for release of front pins

Need to:

Get Photo's Scheduled

Prepare Cue Cards

Get mtl. for leg dimers.

15 July

Machael mtg.

Orbiter schedule loose

Wt. may be prob.

To Annie Aldrich PRCB vs Deke

Spring rates existing bungees -
 ~ 1st/in no. end travel -

27" ← rest length

40"-38" ← force at 40" NB gives rate of 3rd in

Heights & Wts -
 Engle Truly

Ht

Wt.

Ht, Crest, Iliac

44" (112 cm)

" Trochanter

41" (104 cm)

Girth

K. Butt

Sit. Ht.

STS-3

Gordo

Lausma

Matt

177 (69 3/4)

140

42 1/4

H. Hartsfield

178 (70)

163

42 1/4

81 cm (32)

87 (34 1/2)

50 61 cm (24 in)

58 (22 3/4)

92.5 cm 36 3/8

95.5 (37 5/8)

6

Shoes

Iliac Cr.

43.70

44.5 - 1.3 = 43.2

Ht.

70.75

73.4 - 1.3 = 72.1

Waist

34.00

36.

To Wong
 10 Dec

21 July Bungo -

Exercise too short to be effect. STS-2

No diff. 2 1/2 → 5 day - g tol

Feels I.V.

Compliance

4 baroreceptors

104

STS-1

5

G Load vs H.R.

1/11/80 1300

TD	G	HR
21		21
00:00	0.44	72/76
01:40	0.54	72/75
03:20	0.78	76/79
05:00	1.1	84/83
06:40	1.5	88/89
8:20	1.55	90/91
10:	1.43	99/94
11:40	1.43	96/93
13:20	1.32	110/93
15:00	1.00	99/93
16:00	1.00	100/96
16:40	1.18	
17:00	1.0	107/98
18:00		104/103
19:30	1.0	
19:00		109/97
20:00		111/106
21:00		112/114
24		
17:55		74/83

BL - Cdr P-77

68

2 Hrs

20 m p TD
Crip 20 BPM in
seat

NB - 14 min - PK-P
→ 108

Stand up? 148

75-

66

6up
BP

Pre
61

58

48

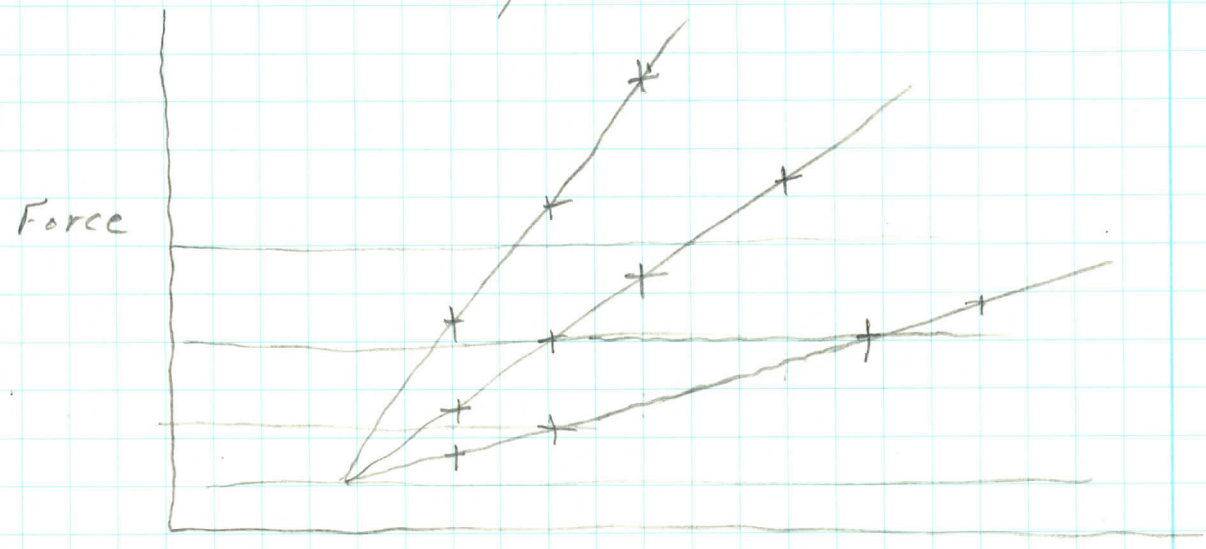
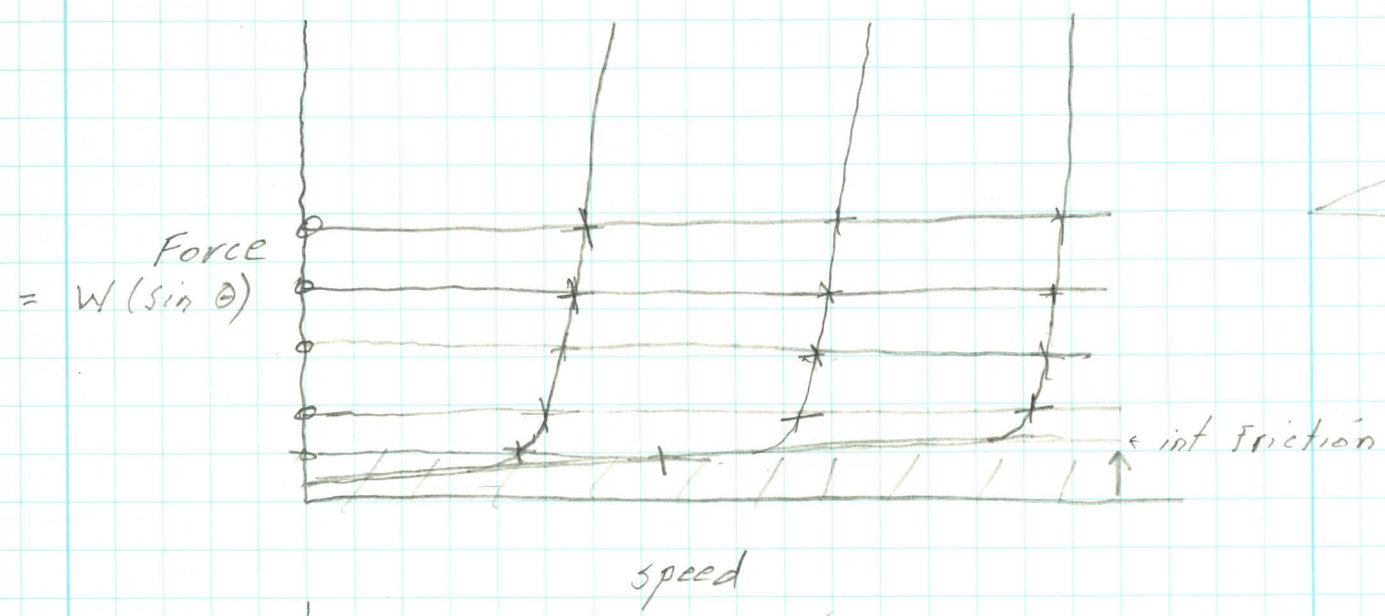
30

6

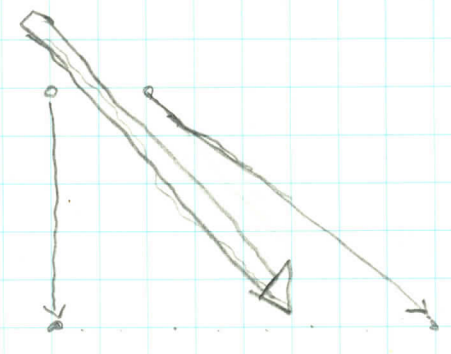
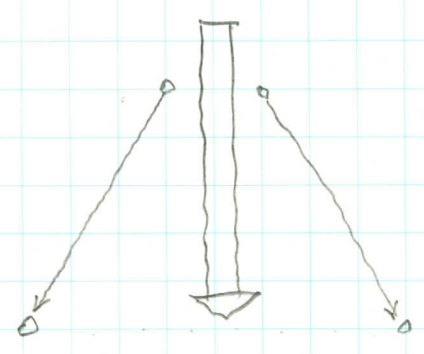
120
40

2 July

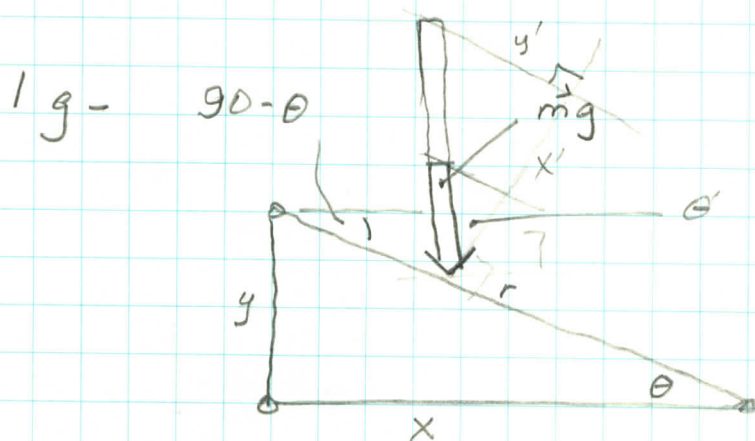
T/M



vel -



Treadmill - 1 g-equivalent forces.



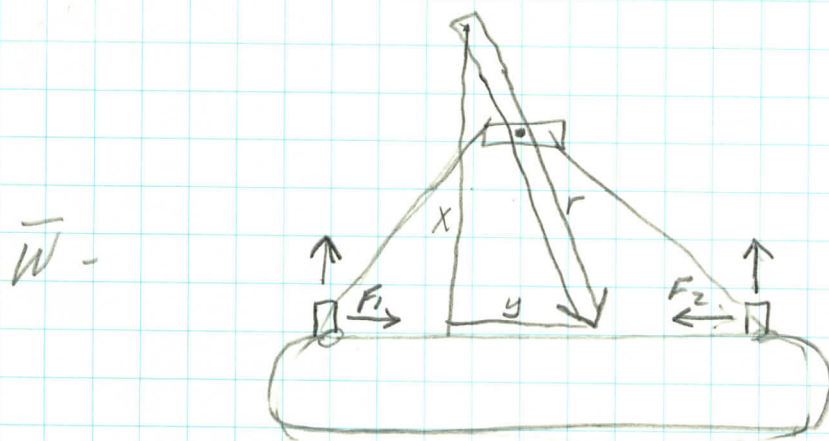
$$\sin \theta' = \frac{y'}{r}$$

$$\& y' = r \sin \theta'$$

$$(W)$$

$$= mg \sin \theta'$$

$$y = W = mg$$



$$F_2 - F_1 = \Delta F$$

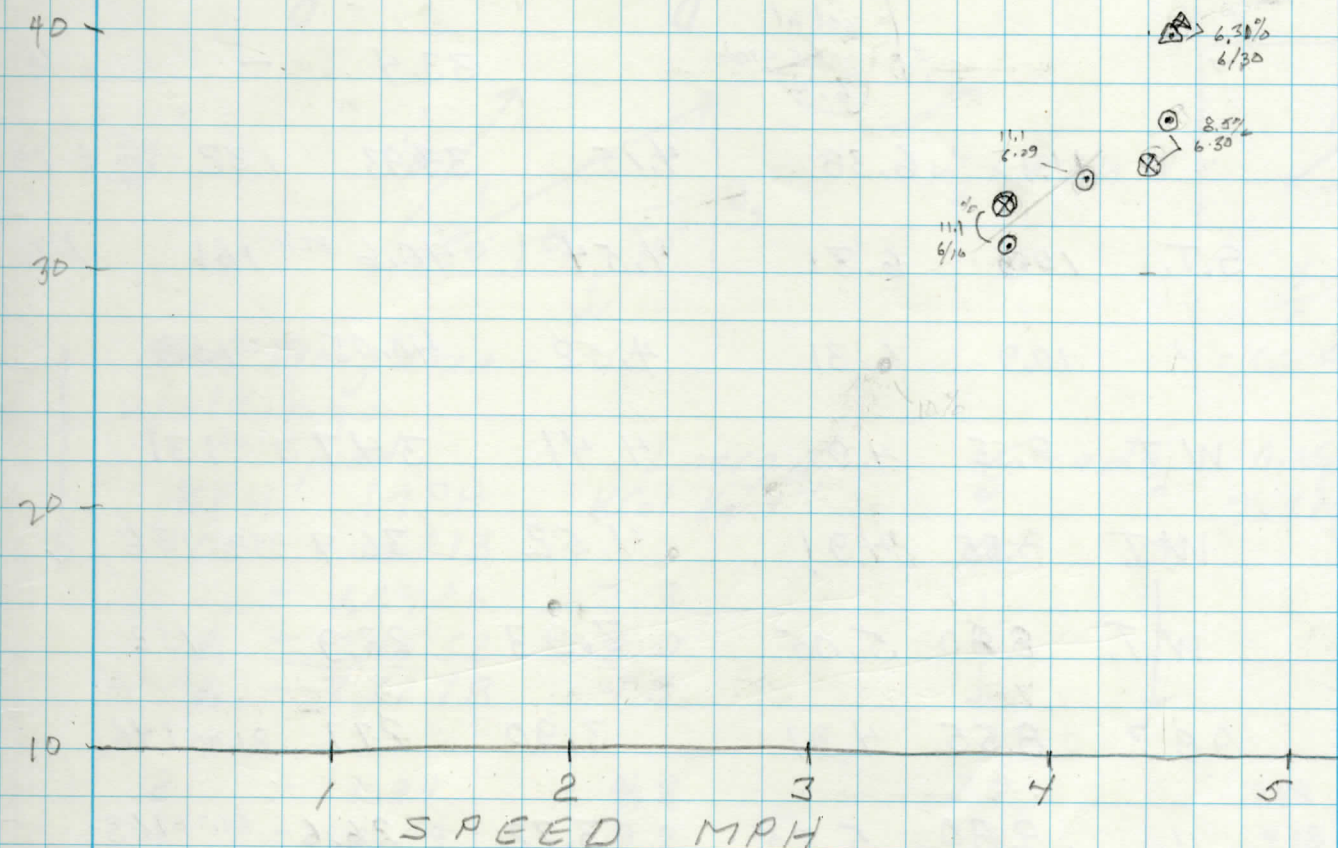
$$\sin \theta = \frac{y}{r} \text{ or } \theta = \sin^{-1} \frac{y}{r}$$

$$y = W = mg \Rightarrow 1g$$

y = component of force on tread

24 July Results From 1976 Tests, Passive Prototype & E-10
1981

Subj. - W.T. ST.
Act. - $\odot$ $\otimes$ Δ
Pass. - $\otimes$ Δ



Results From 1976 Tests Contd

Tread Mill	Subj.	Elev- %	Speed MPH	O ₂ ml/kg Min	HR	Date
E-15	WT ?	11.1	6.4°	3.83	31.1	73.15 6.16.76
TTM	"	? } presumed set at same grade 6.4		3.79	33.1	6.16
TTM	"	? }			33.4	6.16
E-15	"	11.1	6.38	4.15	33.93	132 31.8 APM MPH 6.29
TTM	S.T.	10.9	6.31	4.54	40.6 82.04	161 6.30
E-10	"	10.9	6.31	4.52	40.05	82.20/58
TTM	W.T.	8.55	4.91	4.41	34.7	92.02/31
E-10	W.T.	8.55	4.91	4.52	36.7	94.96 136
TTM	W.T.	8.80	5.05	3.93	23.9	152
E-10	AB ?	8.55	4.91	3.90	27.1	81.00 146
TTM	"	8.80	5.05	3.72	26.6	81.26 163
E-10	"	8.33	4.78	3.73	24.8	80.00 153
TTM	WT	1.50	0.86	4.69	52.0	~140 7.2
"	"	8.80	5.05	4.41	52.8	~140
"	"	10.8	6.19	5.17	41.0	

31 July 1981

Quinton
C.V. Lab JSC

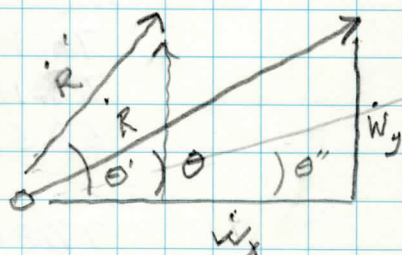
W.T.

8.8 5.05 4.0 MPH 28.82 64.1

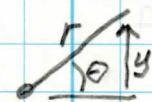
8.8
 5
 44. | 28.20.
 264
 180
 176
 40

Comparison of Treadmill results

Speeds and grades from 1976 tests were in a different ^{speed range} regime from recent studies and cannot be directly compared. If O_2 uptake is a function of external work rate then it may be possible ^{prob.} walking vs running.



$$W_y = R \sin \theta$$



$$\frac{y}{r} \times 100$$

$$= \sin \theta \times 100$$

From Margarita -
Walking -

Speed		Energy KCal Kg ⁻¹ H ⁻¹
KPH	MPH	
1.00	= .6213	
2.	- 1.2426	2.3
4.	- 2.4852	3.0
6.	- 3.7278	4.8

Grade %	
0	0
↓	↓

Gr x Sp. Energy/Grade Sp.
% x MPH /

2.	-	1.24	4.8
4.	-	2.49	9.7
6.	-	3.73	-
2	-	1.24	7.4

20

.248
.498

$\Delta = 2.7$
19.35
19.47
19.89

30

.372

1976 results -

Subj	Vel. x Elev. MPH x %	O_2 / Vel. x Elev. ml/kg/min / MPH x %
WT	4.15 x 11.1 = 46.05	.7368
ST	4.54 x 10.9 = 49.48	.8204
↓	4.62 x 10.9 = 49.27	.8128
WT	4.41 x 8.55 = 37.70	.9203
↓	4.52 x 8.55 = 38.65	.9496
↓	3.93 x 8.80 = 34.44	.6910 ?
AB	3.90 x 8.55 = 33.34	.8127
↓	3.72 x 8.80 = 32.736	.8126
W.T.	3.73 x 8.33 = 31.07	.7982
↓	4.41 x 8.80 = 38.81	.7350
↓	5.17 x 10.8 = 55.83	.7343

Energy Costs, 10° Margarita

KPH	MPH	KCal	5	10	15
1	.62		12.5	16.5	20.5
2	1.24		10	14.3	17.5
3	1.86				
4	2.48		9.5	14-16	
5	3.10				
6	3.72		10.5	15.3	20.5
7	4.34		12.5	17.3	23.5
8	4.96				
9	5.58				
10	6.2				

A = Active
P = Passive

1981 Comparison of TTM & Quinton

Subj. T/M	Slope	Speed =	0.1 / sl. speed	Date	Subj.
WT P	%	MPH (KPH)		19 June	
↓	10	1.95 3.1 = 19.5	.8144		B
	10	2.41 3.9 = 24.1	.7394		
	10	2.81 4.5 = 28.1	.7491		
	10	3.31 5.3 = 33.1	.7915		
			$\Delta = -7.0\%$		
A	10	1.76	76.14	17 Jun	
	12	2.56	63.15		
	14	3.43	58.52		
A	10	1.76	77.84	18	M
	12	2.55	62.74		
	14	3.49	61.60		
A	10	1.75	77.40	19	
	12	2.55	64.70		M
	14	3.45	60.87		
A	11	1.78	76.99	19	
	13	2.57	64.35		
	15	3.49	59.40		G
P	10 (11)	1.68	82.98 (75.43)	17	
	12 (13)	2.28	73.03 (67.41)		
	14 (15)	3.25	70.40 (66.70)		
P	10 (11)	1.69	91.72 (83.77)	18	
	12 (13)	2.47	71.86 (66.33)		
	14 (15)	3.25	68.13 (63.59)		
P					

T = Thornton
M = McNair
G = Gibson

1981 Comparison Contd.

Subj.	T/M	Slope %	Speed MPH	OT/Gr. Sp (V ₄)	Date
B	A	10	1.75	74.85	17
		12	2.55	67.32	
		14	3.48	61.98	

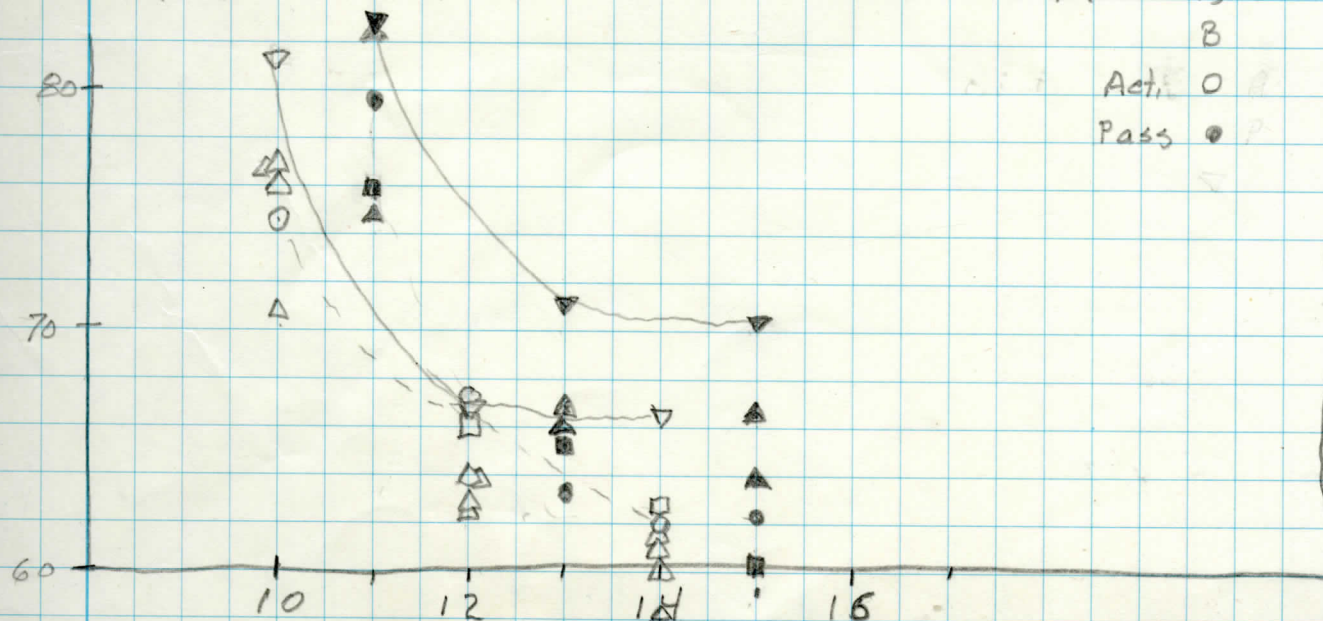
B	P	10(11)	1.70	87.64 (79.67)	17
		12(13)	2.44	68.99 (63.68)	
		14(15)	3.23	66.78 (62.33)	

M	A	10	1.74		
		12	2.56	66.08	17
		14	3.45	62.52	

M	P	10(11)	1.59	84.28 (76.61)	17
		12(13)	2.46	70.29 (65.35)	
		14(15)	3.19	64.26 (59.97)	

G	A	10	1.73	81.5	
		12	2.54	67.58	
		14	3.48	67.32	

P	10(11)	1.69	91.71 (83.37)	
	12(13)	2.46	77.23 (71.29)	
	14(15)	3.27	75.57 (70.54)	



Barry Linder -
Tremor -

Muscles Olive, } Basmajian Pp. 90 Will. & Wilkins, '74
Lippold Sci. Amer. 224, 6F-73, 1971
" , Jour. Physiol. 137, 473-487, 1957

Records -

14 July	-	Filter in place, Σ	, Joseph Prather,	sl. ↑	, 50 mmHg.	Tremor
16 "	"	"	Crystal Granger,	^{LBNP} sl. ↑	,	No " Tremor
17 "	"	"	Carter,	^{LBNP} ?	,	" Tremor
20 "	"	"	B. Linder,	LBNP	,	No Tremor
21 "	"	"	Allen,	No Act.	,	No Tremor
2 "	"	3 Filter, Σ	B.L.	32 mmHg Cuff,	Nothing -	
8 "	"	"	"	"	, W.T.	"
X				Cuff run		
10 "	"	2 Filter, Σ	B.L.	Cuff	No chg.	No tremor -
X				Cuff run	"	"
27 July	"	"	B.L.,	changes LBNP,	Tilt.	
28 "	"	"	LBNP,	3 subs,	No chg-	
29 "	"	"	Saucillo,	LBNP	Positive Changes	
30 "	"	"	B.L.	LBNP -	Tremor -	

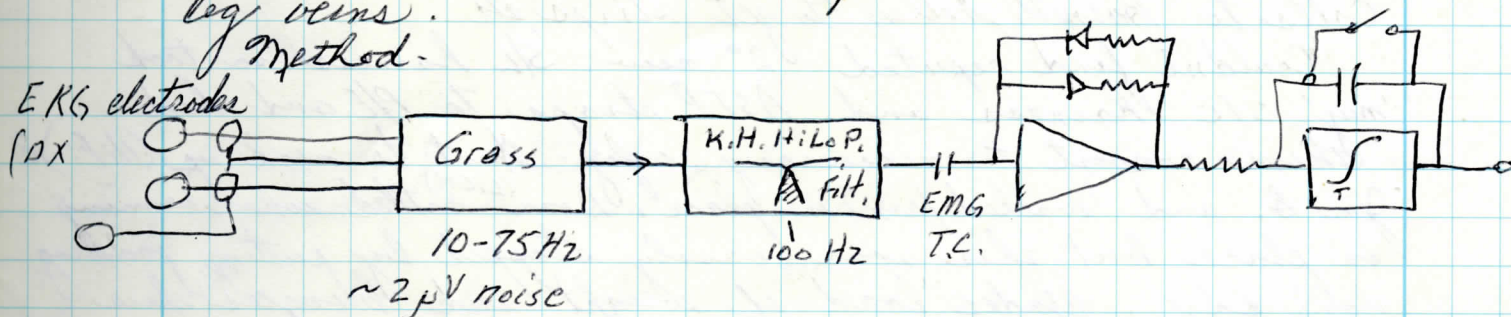
Spent AM reviewing, summarizing & annotating above data & all aspects of the effort. Outline on Japp. pg. Also discussed his presentation to L/S on Wed. and on future work.

Summary - Attempted to relate EMG activity of leg (calf) muscles to stimuli which pool blood and distend superf- leg veins.

Method -

The diagram illustrates the experimental setup. A box labeled 'Human' is connected via a wavy line (representing an EMG signal) to a switch. The switch is then connected to a box labeled 'A.M.P.' (Amplifier).

Method.



Initial effort was use of thigh occlusive cuff - 50 mm Hg press. $\bar{e}$ electrodes on gastroc. on ipsi & contra. lateral legs. Except for bursts of tremor (constant ampl., freq EMG) P-23 little other activity was seen. Next rigged a tilt board

27 July 1981 Summary, STS-2 TM Status

Height has become a real problem for STS-2 and Thomson/Krany deleted TM - Someone(?) decided to replace the SL-4 unit. I tried to follow & appreciable success. Jim Buchli came back today and we decided to re-approach the problem.

My approach is to 'run in place' using same harness & bungees as planned for SL-2. Called Mike Withey & will go by ILC in AM to see harness and flush up flow force bungees.

Probs -

1) Shock/vib to feet & S/C.

soln. pads for feet, if reqd.

Document accel. & vels. - Wren, Rob. B 13-126

Bob Stuckey 3166

2626

2) Vestib. effects

soln. Document accel., vels & examine effects

4) Physiologic efficacy

soln. - EMGs, Force

metabolic -

28 July

Ran EMG on ant & post compartments of calfs thigh walking & jiggling in place - latter looks ok good. I will get VO_2 if possible.

ILC has STS-1 harness & connectors & sh. straps. will get SL harness and make light weight conn. (bungees) and set up in mock up for clearance. Called Bob Stuckey of structures to get a force plate.

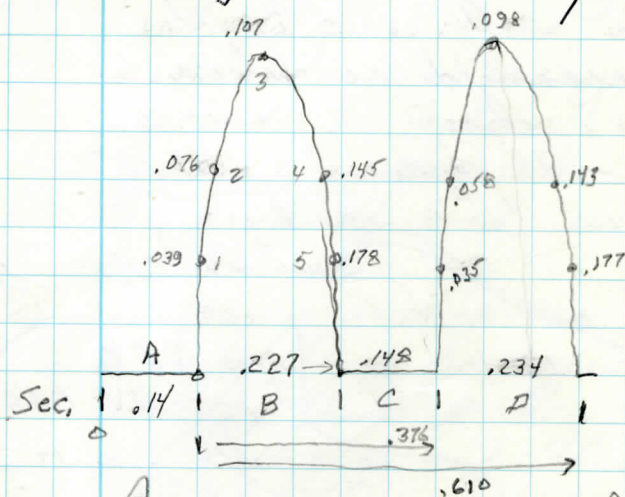
Discussed above w Jim B. and agreed to get addl. EMG etc. assemble & test run data belt/bungees in mock up today or tomorrow & present plan to crew at first of wk. Calls to Barnett/Withey to get straps, etc.

Couldn't find reputed 2° new SL harness so took 'my' SL harness and ASTP straps to P/E and had them convert to necessary config. Went to mock up (H/F) & Jim B. and walked/ran in place. Door ^(L/OH) rattled when running in place but this was easily stopped by putting padding along edge. Under load of weight and bungees there was considerable flexing of floor but much less w only 1 g. loads.

B Aug.

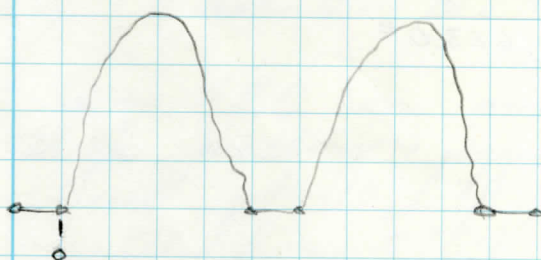
Analysis of force plate data.

'Run' in place max force.



A	B	C	D
1	2	3	4
8	14	42.6	13.5
11	18.5	42.8	17.5
22	36	21.4	33.8
22	36	17.8	33.8
63	104.5	124.6	98.6
5	5	5	5
315	522.5	623	493

D	1	2	3	4	5
.411	.434	.474	.519	.553	
7.6	14.8	19.5	36	13.5	
15.8	22.5	32.3	28	13	
19.5	26.3	32	26	9.5	
21.5	31.5	42.8	16.5	5	
64.4	95.1	124.6	106.5	41	
5	5	5	5	5	
322	475.5	623	532.5	205	



1 Aug - Summary of V-M investig. - contd.

$\bar{c}$ saddle and did one study. on this $\bar{c}$ striking response which was repeated $\bar{c}$ LBNP, then attempted to repeat $\bar{c}$ same plus two additional subjects $\bar{c}$ success. A fourth subject showed a marked increase in activity which appeared to be a function of pressure + which $\bar{c}$ muscle pumping. The 'tremor' was seen in most subjects, always unilateral but in either leg and never before pressure applied, usually abolished by muscle pumping but sometimes present $\bar{p}$ pressure.

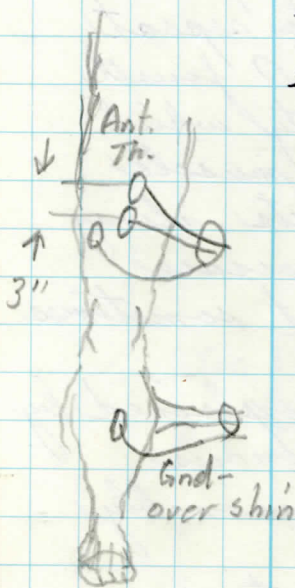
Any EMG activity other than reflex ~~we~~ can be explained by anxiety, etc. however the possibility remains that venous pressure in fact facilitated the tremors. To reasonably conclude this investigation should:

- 1) use a larger more diverse group of subjects.
- 2) " tilt table or higher, 'tapered' LBNP

A more definitive investigation would try to image the superficial and deep vv. echo (scan) or CAT, measure V.P. and measure IM pressure - No opportunity at this time.

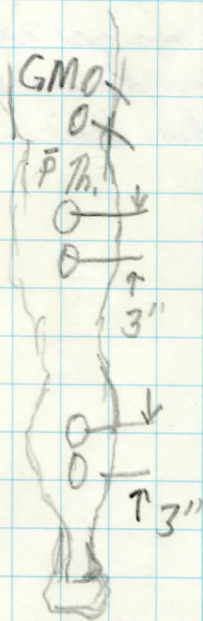
Recorded EMG's from R leg of W.T. as at left
Grass Polygraph, E/EMG amps and integ.
Recorded/integrated from sites shown during following activity:

	cycles R & L leg	min
walk in place		
walk on T.M. 3 MPH	" "	
jog in place		
jog on T/M 8 min mi	cycles "	
max run in place		
run on T/M 6'		



Record Marked: 5 strides

TM - 3 MPH	1.	66
	2	60
	3	60
	4	54
	5	54
	6	48



O_2 Uptake -

<u>Log in</u> <u>Rate</u>	<u>Place</u> <u>H.R.</u>	<u>O₂</u> ml. Kg,	<u>Vol</u> L/Min	<u>Resp</u> Br./Min	<u>Time</u> Min
72min	110	27.1	84.5	47	4
	114	27.6	82.3	44	5
Rest		3.65	12.3	12	4
		3.75	12.65	11	5
Max	136	40.6	152.4	50.	4
90	138	40.0	152.4	52.	5

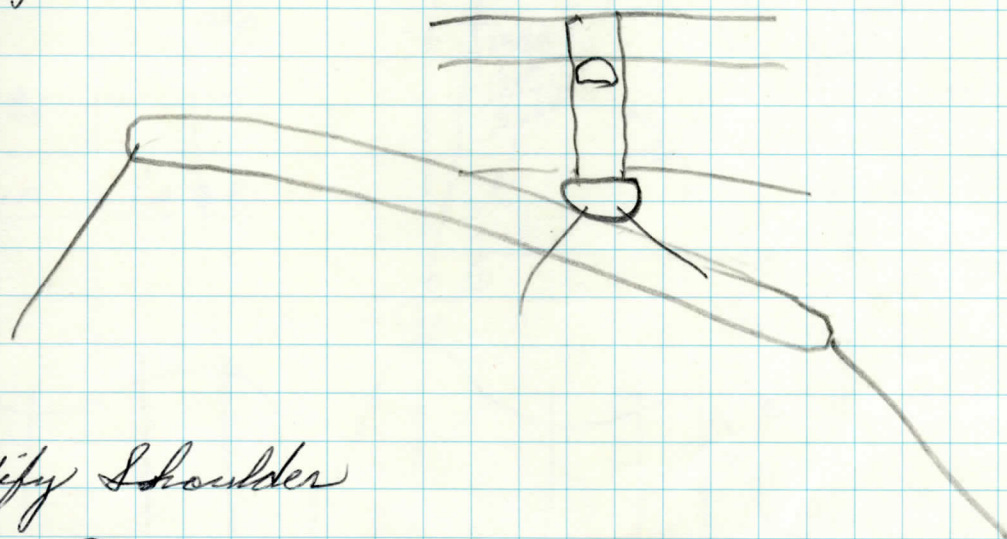
TM 8.8% + 3.5 mph

5 Aug - STS-2 exercise

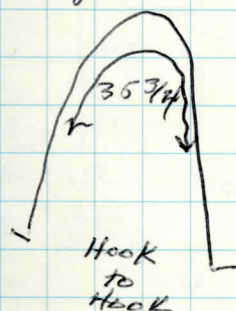
Called Susan Brune^{X278} who is assigned to harness develop.
by ILC and will meet her at 1000 tomorrow. Asked her to ascertain
2nd harness status -

6 Aug. Mtg. E. Withey & Ruth Davison, ILC on
Harness; ie SL-4 belt & shoulder strap

- 1) Increase ant. D ring bungee attach -
- 2) Modify post. " " " "

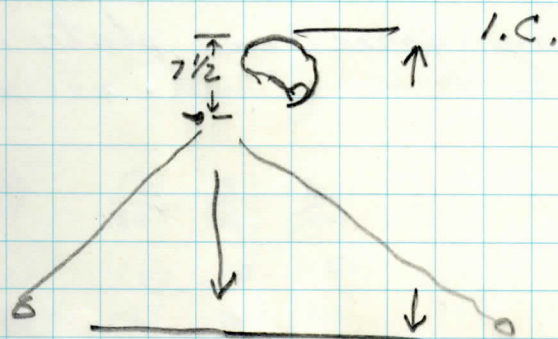


- 3) Modify Shoulder



- decrease lgth.
- improve adjusters
- lighter hooks
- tighten packs

- 4) Bungees



Force Curve - jog in place

Force Pounds

Measured curve

Curve From
Biomechanics
see Opp. pg.

1.0

200

400

2.

3.

600

(R)

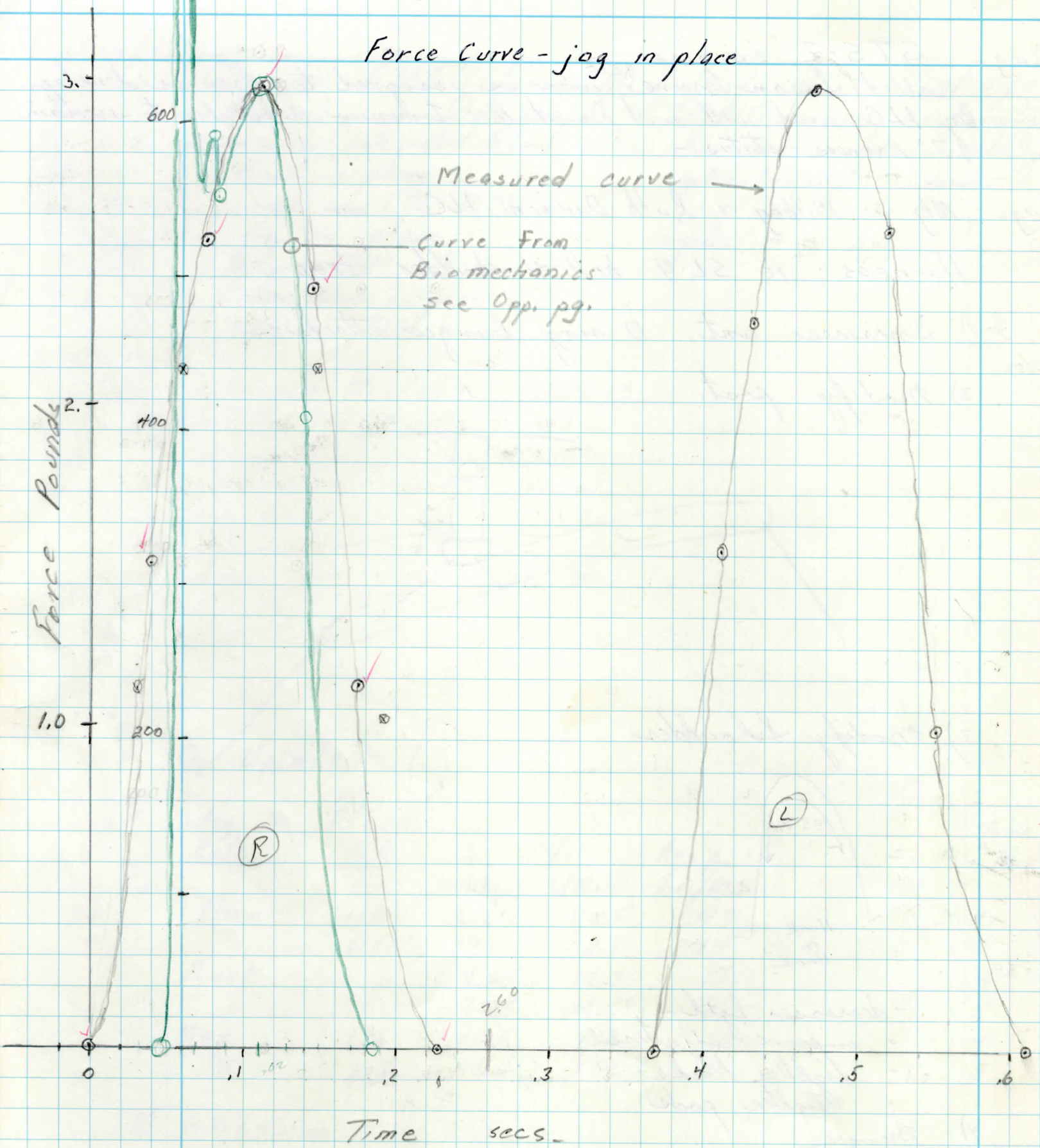
(L)

2.60

Time secs.

Two steps at max force on plate running
in place

1 lb. = .2248 N.



Hand-drawn sketches of three hills with handwritten calculations and notes. The first hill is labeled "Walk in place" and the second and third are labeled "place From Record".

Hill 1 (Walk in place):

- 723.74
- 5.48 BW
- 378.3 / 287
- 360.9 / 2.67
- 62 ms
- 257.7 / 1.95 BW
- 92.4
- 13.9 ms
- 38.4
- 77
- 28.8
- 13.6
- 48
- 348
- 30
- 27
- 30.4
- 77
- 139 ms

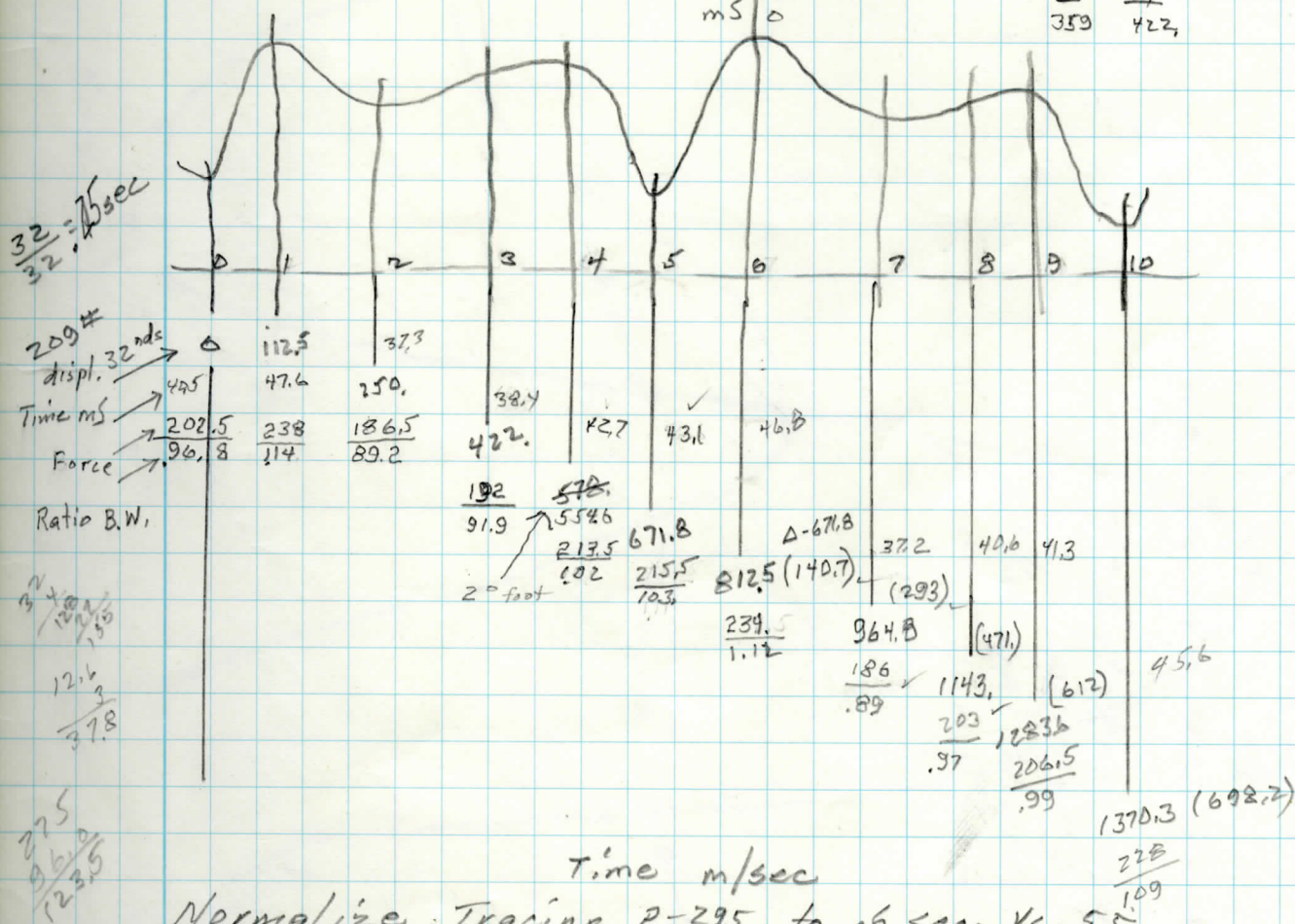
Hill 2 (m/step(?) Margaria p. 108):

- 92.8
- 464
- 2,22
- 156 ms
- 38.4 div
- 192#
- 92 BW
- 61 ms
- 142.5
- 168
- 289 ms
- 46
- 359
- 54
- 422

Hill 3 (place From Record):

- 94.3
- 471.5
- 2.26
- 45.8 div
- 229#
- 1.09
- 48 BW
- 5.47 ms
- 84
- 656 ms
- 38.3
- 191.5
- .92
- 94
- 100
- 734
- 781.3

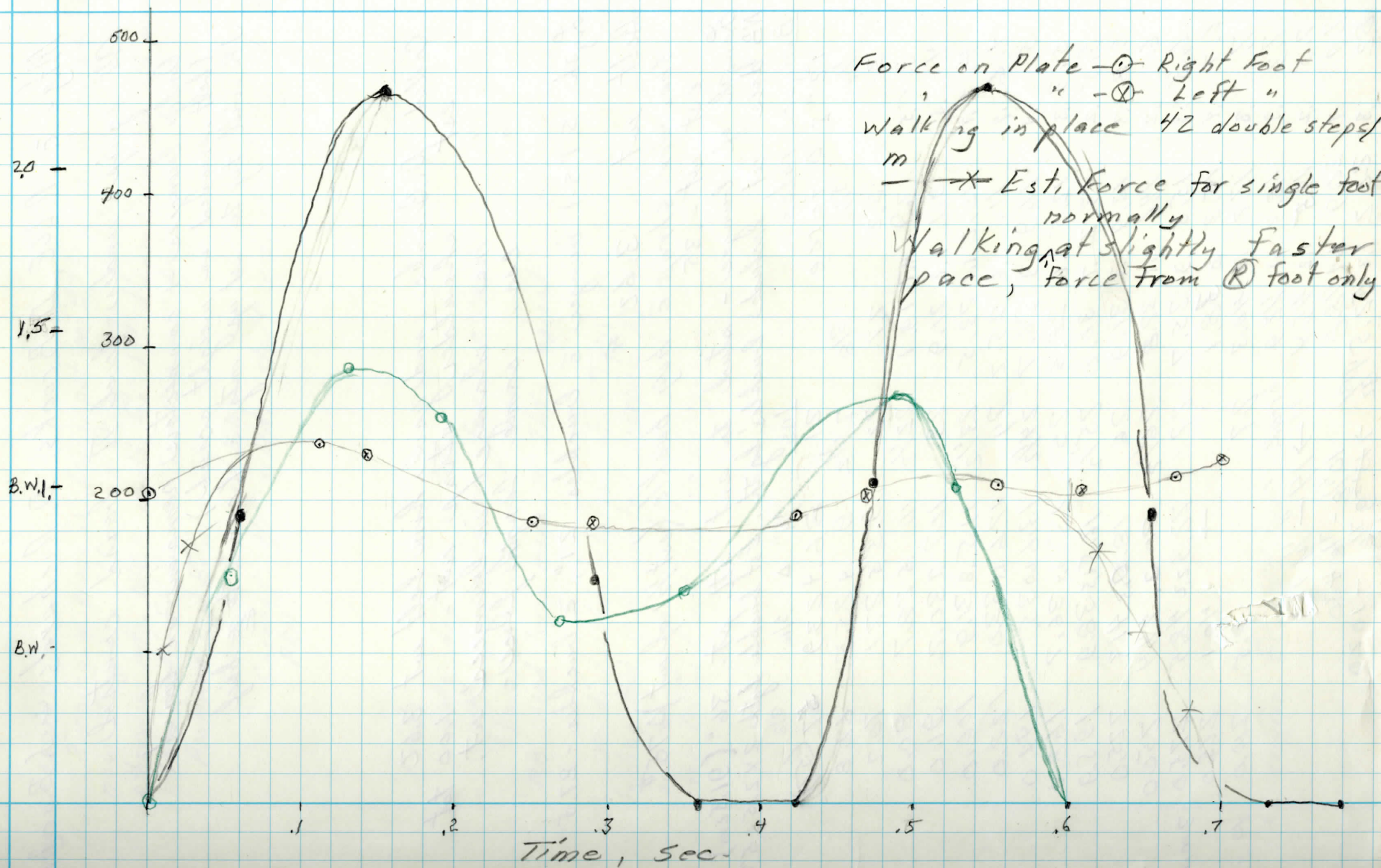
Walk in place



Time m/sec $\frac{2}{1}$
 Normalize Tracing P-295 to 0.6 sec. vs. 0.5 $\frac{1}{1}$

	$1/32''$	$1/16''$	$1/8''$	$3/16''$	$1/4''$	$3/8''$	$1/2''$
(ms) Time	54	134	188	266	347	425	522
Force #							
B.W	75.7	141	133	58	66	134	99
" #	98.7	186.4	175.5	76.7	87.7	164.5	131.6

Ground Force Vs Time, Walking



Mtg. c R. LOE, D. Brooks, D. Richards & J. Buchli 2

Dave 2541

All equip. under level II board control

Only bungees & connectors remain on board
(belt removed in weight scrub)

J.B. will try to set up mtg. c Kranz to ~~be~~ brief

11 Aug Called D. Brooks and gave him belt wt 3.62
est shoulder strap wt. 1.00 tot
" no change in bungees' wt.
" ess. same length force-

Lyth. STS-1 bungee 5 buckles 21", c buckles - 27.5"

5/2 Belt wt. 3.62 #
shoulder strap c hug buckle (est. 1/2 of wt) 0.75 #
est wt - .35

Tread Area -

28 x 12

53 #

-10

From M.W.

I.L.C.

AL Δ.5"

13 .5

13 1/2

14

14 1/2

15

15 1/2

16

16 1/2

17

17 1/2

18

18 1/2

19

19.5

20

8.5 20.5

Length of bungee - stud to ant. att. pt. 36" (91.5cm)

NB does not include buckles' lyth. Est buckle lyth $2 \times 2.5 = 5" \pm .31"$

Bungee rates

	1/4	5/16	3/8	1/2	5/8	3/4	7/8	1
12" 0 force	21	21 1/2	22	22 1/2	23	23 1/2	24	24 1/2
1/4 5/16 3/8	8.6	9.4	9.5	10.5	10.7	11.5	12.6	13.6
3 3.2 2.7	23.9	25.5	27.1	28.7	30.2	31.9	33.0	35.0
3.5 3.5 2.9 4.7 19.1	57 (57)	62.8	70.2	80.0	91.0	106.0	122.0	144.0
4 3 9.1 1.2 21.9								
4.2 7 10.2 1.1 23.5								
4.6 4 11. 8 25.2								
5. 4 11.9 9 26.7								
5.3 3 12.5 6 28.3								
5.5 2 13.2 7 30.0								
5.8 3 13.9 7 31.9								
6 2 14.6 7 32.8								
6.3 3 15.5 9 35.7								
6.7 4 16.3 8 38.1								
7 3 17.2 9 40.3								
7.3 3 18.3 1.1 42.9								
7.5 2 19.5 1.2 45.4								
7.9 4 20.9 1.4 48.8								
8.2 3 22.2 1.3 52.5								

break

4 → 14" 1/4 150

10 5/8 - 7/8 430

7 1/2 - 7/8 - 10 20

3 mins

10 "

1/2 26 Aug. Resume

Running in place is being put on STS-2 i.e. SL Harness & straps + new bungees. ILC is making dwgs., putting ILC labels on & otherwise mtg. NASA reqts. for Flt. documentation. ILC promises to have hdwe. ready for dry run in A.M. & will 'train' crew for 1 hr. in PM

Reviewed J. B. who will:

Schedule trainer (B-9)

Correct I/F sched. start eve. of 3rd day BID 15 min eq.

PRN

I will:

make dry run in AM

set up procedures for cue card

(have) reviewed ILC work

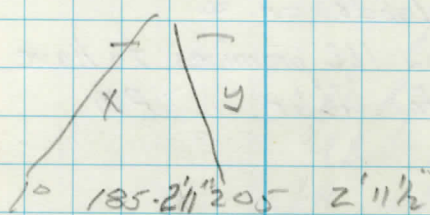
N.B. need force meas + JAYs agreed to get scales - for A.M.

We discussed status of T/M re. STS-3. Repeated Jack L's feeling that 1) he wanted exercise 2) didn't want to force wt. problem. and we agreed to drop for 3 if wt. remains prob. Now sched. for Fri but will try to delay.

* cushion for LIDH door

27 Aug - 1200 B-9A H.F. MockUp Dry Run of STS-2 exercise
Had 4 eq bungees

(2595)



MF 284 Pilots-Clothing Locker

190 3' 2 1/2" 3' 3/8"

1 1/2 scale

Cue Card for exerciser, STS-2

Items are stowed in MF 284, Pilots Clothing Locker

Note - this item to be used at option of crew - It is nominally scheduled to begin _____ but should not be used in presence of "motion sickness", etc.

Set Up - The 4 connectors, A, are plugged into the seat mounting studs on the LiOH door outer

by depressing the side pin and pulling the knurled collar up (toward) the ring

The connectors ^{are} attached to the studs by ~~pl~~ centering them and pushing down on the collar - note; be sure the collar is down and the side pin shows - pull hard to test security -

Attach the bungees, B, to each connector ring ^{the snaps}

" " rear bungees to the large D-ring on the rear of the belt C-1 and the front bungees to the front 'D' ring (on a lanyard) (C-2)

Joel Leonard 2693

33

FR- C NAS 9-14523 30 Dec 77 TLR 741 LSP 7020

Cue Card, Exerciser STS-2

Attach ^{both} shoulder straps, D, to top (small) 'D' ring on rear waist belt with buckle side in front and clip the remaining ends ~~buckles~~ to one of the 4 small buckles on the left and right side of the belt (C-3)

Kneel on the L10H door, wrap the belt around the waist well above the level of the 'hip bones', put arms through the shoulder straps, and cross the ends of the belt ^{in front} such that a pair of holes line up. Insert, from below, the tapered pin (C-2) through this pair of holes and secure it with the captured thru pin C-5 -

Now stand slowly and then adjust the shoulder load to the desired level by the adjustable buckles and if necessary adjust the waist harness by moving the tapered pin to another hole in the belt ends.

Cross belt (-7) may be used to further secure the waist belt by attaching to the small D ring (-8). Note - the majority of the load should be carried on lateral hips - not shoulders.

Warning - large forces and considerable energy are present in stretched bungees - Treat them with caution and insure that they are secured before use - especially the floor connectors - between uses & then slip into it

It should be possible to leave the harness secured in place.

Use - The first day should be used for familiarizing yourself to the 'feel' of the device & for short trials of walking & jogging, or other exercise -

The recommended mode is a fifteen min. jog in place lifting the feet well clear of the floor - Exercise level (and Fatigue) will be determined by rate of jogging and height of foot lift. The level of exercise should be determined by your preference but will also be driven by sweat rates & need to clean up, etc. Do not push yourself. Still & cine photos would be valuable for future use.

$\dot{V}O_2$ & HR - Jog in place

HR
120
110
100
90
80
70
60
50
40
30
20
10
0

Treadmill 8.8% - 3.5mph
 Jog in place

90 str/min
steps

40.3 ml kg min⁻¹
3.42

28.82

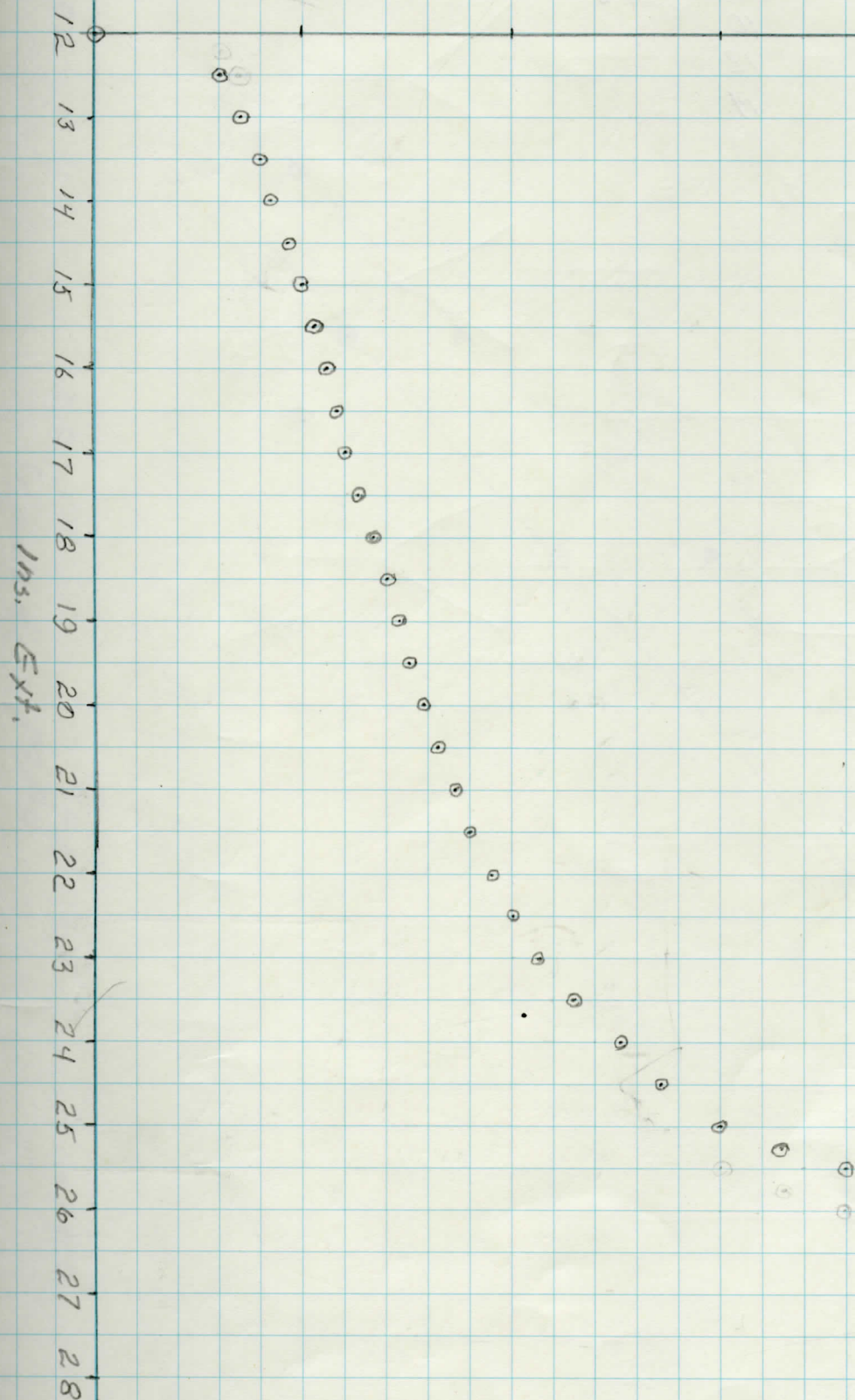
27.35 ← 3.95
4.06 } B.M. (ml kg min⁻¹)

72 strides/min

Rest

Time mins

Bungee Force Curve



37

Plot of O_2 & HR vs Speed on TTM at 11% elev. 19th June

HR
BPM

O_2
lit/min

Δ

140

130

120

110

100

90

80

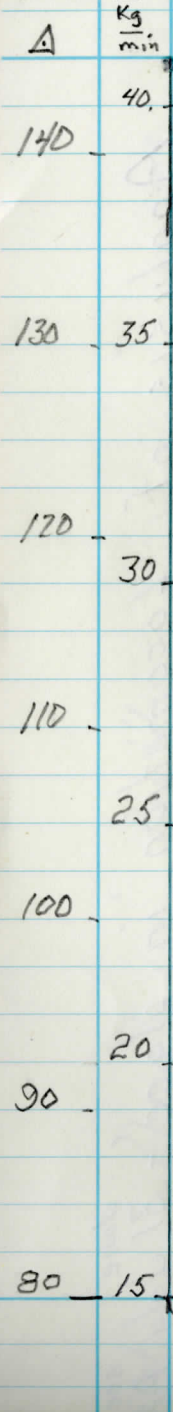
2.0

3.0

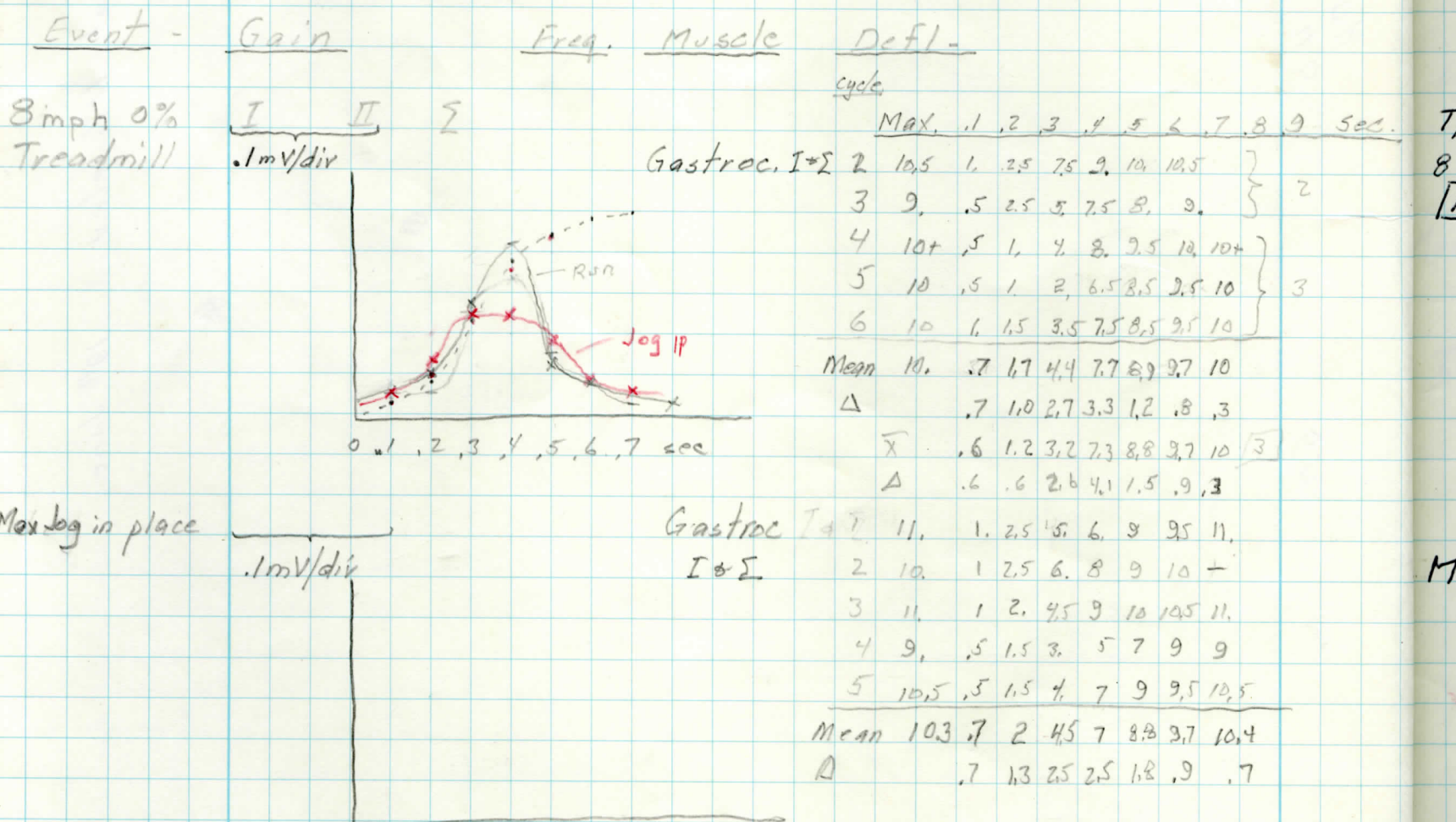
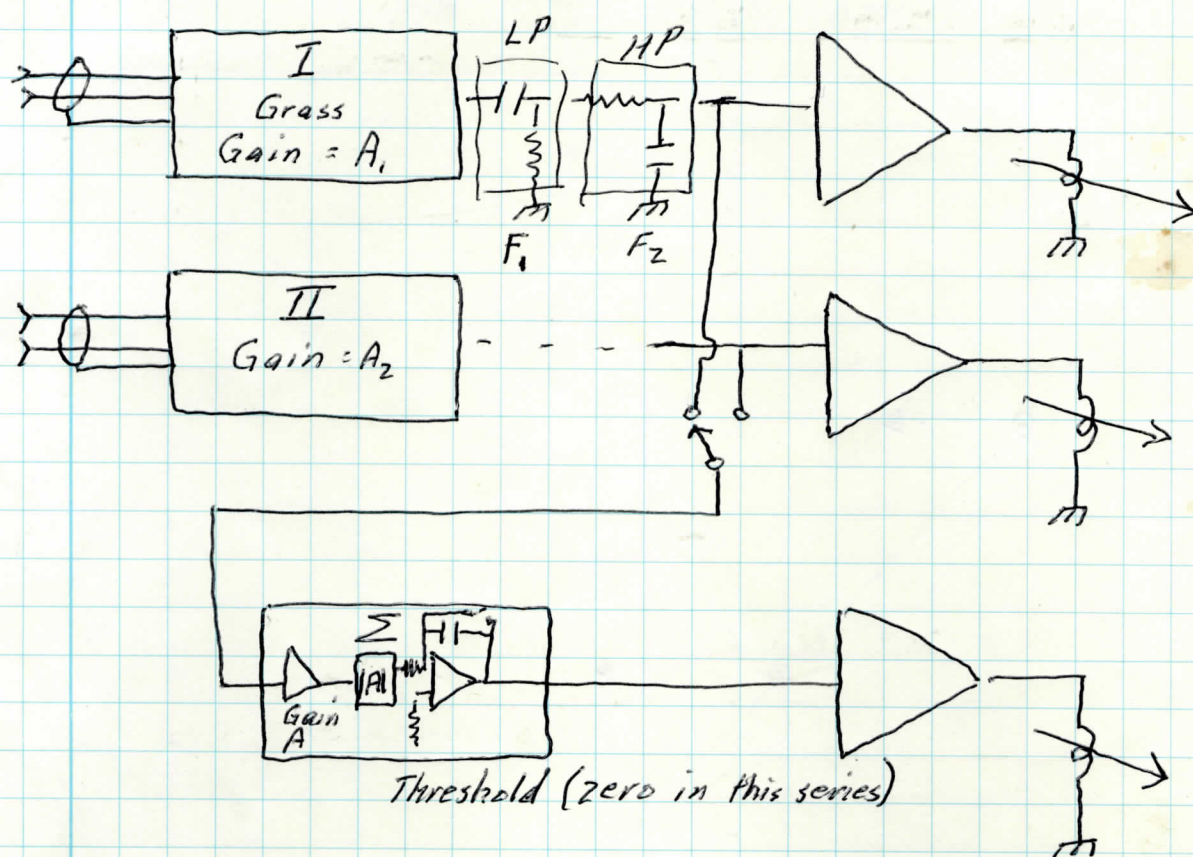
4.0

5.0

Speed MPH



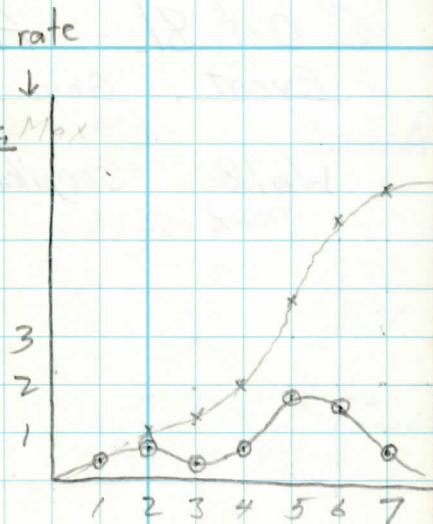
Analysis of Locomotion 'in place' - ^{done} 31 July ^{see} P.24



24 5 Oct.

Analysis Cont'd.

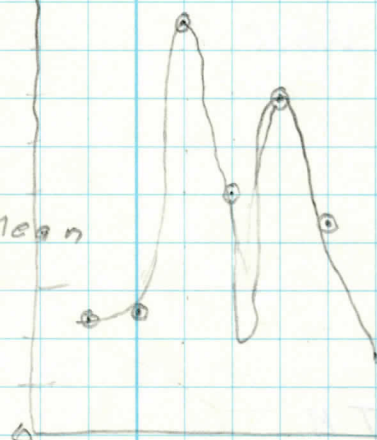
Event	Gain	Freq	Muscle	Cycle	Deflection	rate
Log in place	I II Σ				.1 .2 .3 .4 .5 .6 .7 sec	Max
Max	$\frac{1 \text{ mV}}{\text{div.}}$		Ant. Thigh	1	.5 1. 1. 2.5 4.5 5.5 6.	
				2	.5 1. 1.5 2.0 5. 6. 6.5	
				3	.5 1. 1.5 1.5 3. 4.5 5.5	
				4	0. 1. 1.5 2.0 2.5 5.5 6.0	
				5	.4 1. 1.3 2. 3.8 5.4 6.0	
					.4 .6 .3 .7 1.8 1.6 .6	



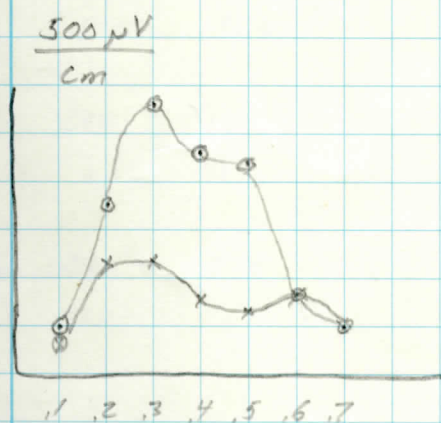
T/M
8 MPH
I II Σ
 $\frac{500 \mu\text{V}}{1 \text{ cm}}$

Ant Thigh	1	1. 4.5 14. 20.5 27. 29.
	2	1.5 3.5 5. 13 16.5 24 30.5
	3	2.3 4.8 13.5 18.5 25.5 29.8
	4	
	5	

Mean

 Δ 2.3 2.5 8.7 5. 7. 4.3

T/M
8 MPH
11.1



Post. Thigh

	1	1 2.5 7. 12 15 18.5 20 20.5
	2	1.3 5.5 8. 12.5 15.5 16.5 18
	3	1 3 8 11.5 14.2 15.5 17
	4	.7 4. 10 12. 17 18 18.5
	5	1.5 3 8.5 12 16 17.5 18.5
		1. 3.6 8.3 12 15.5 17.2 18.2
Δ		1 2.6 4.7 3.7 3.5 1.7 1.

Max Log
10.2

P. Thigh

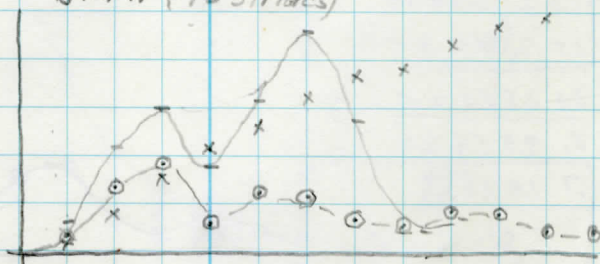
	1	.2 2. 3.6 4.5 6. 7.5 8
	2	.6 2.2 5.3 7 8 10 11 11.5
	3	1. 4 5.5 7 8.5 10 11
	4	
	5	

 $\bar{X}$.8 3.1 5.4 7 8.3 10 11 Δ .8 2.3 2.3 1.6 1.3 1.7 1

5 Oct. 81 Analysis Cont'd

Event	Gain	Muscle	Cycle	Deflection
-------	------	--------	-------	------------

Walk	500 μ /cm	Gastroc		
3 MPH (46 strides)				



	1	2	3	4	5	6	7	8	10	11	12	13	Sec.
1	.8	3	3.5	3.5	6	7	8	8	8.5	9	9.5	10	
2	.5	2.6	3.5	4	4.5	5	6	7	8	8	8.5		
3	0	1	3.3	4	5	7	7.5	8	9	11	11	11.5	
4	.8	1	3.5	4.5	5.5	6.5	7	8	9.5	10.4	11	11.5	
5	0	1	4	5	6	7	8.5	8	8.5	9	9.5	10	
$\bar{X}$	.4	1.7	3.6	4.2	5.1	6.5	7.2	7.8	8.7	9.5	9.9	10.3	
Δ	.4	1.3	1.9	.6	1.2	1.1	.7	.6	.9	.8	.4	.4	

Walk ?

1	.5	3.5	6	7	12	17	18	18.5	19	20
2	1	3.5	6	7.7	11	15.5	17	17.3	19	
3	0	1.5	4.5	6.5	8	12	17	18	19	
4	0	1.5	4.5	7	9.5	13	17	17	18	
5	.3	2.5	6.3	8.5	11.5	17.5	20	21	21	
6										
$\bar{X}$	.4	2.5	5.5	7.3	10.4	15	17.8	18.4	19.2	
Δ	.4	2.1	3	1.8	3.1	4.6	2.8	.6	.8	

TM

5 Oct, 81

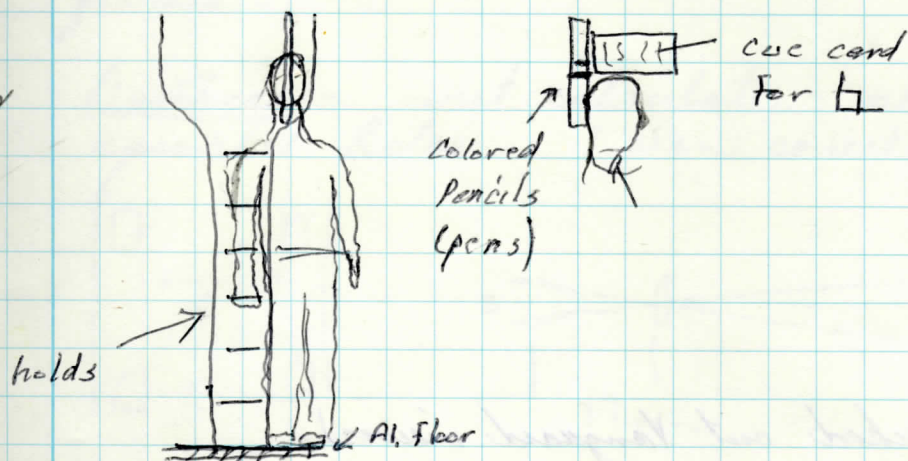
Analysis Contd.

Event	Gain		Σ	Freq Hz	I.D.	strides min.	Musc. channel		Remarks
	I	II					I	II	
3 MPH					1.1	60	A Thigh	P	
T.M.					1.2	60	G.M.	G.	
					1.3	60	G.M.	G.	Σ man reset.
3 MPH	200	500	22	1-75	2.1	54-60	A Thigh	P	Σ man reset.
TM									
Walk 1P	200	500			3.1	54-48	G	G.M.	
Walk 1P	200	500			4.1	54-48			
Walk 1P					5.1	60			
TM?									
TM?					6.1	54			
TM?	500	500			7.1	52			
TM	500	500			8.1	78	A Thigh	P	
5 MPH	500	500			8.2		G	GM	
Jog 1P.	500	500			9.1	78			
	500	500			9.2	78			
	500	500			9.3	78	G	GM	
Max Jog 1P.	500	500			10.1	84	G	GM	
	↓	↓			10.2	84	A Thigh	P	
T.M. 8 min mi	500	500			11.1	90	A Thigh	P	
	500	500			11.2		G	GM	

Oct. 12 - Ht. meas.

Crew approached by C/S_{ys} to get $\bar{w}$ hts. & D.T. proposed putting paper on locker doors but independent fiducial needed - J.E. suggested flipping up steps & stdg. against stairs - Went to 1g trainer & tried it & showed them how to use Cue card -

Jim
Taylor



Desired measurements -

1. Early shifts in fluid volume & pressure
2. Effects of exercise

Looking first at 2.

$\frac{1}{4} = .25$

$\times .025$

Heart rate - pre, during
vs. exercise
time, effort

Fluid shifts during exercise
subjective -

Photos - before & after



Leg bands -

Tissue depression -

14 Oct.

Photo

40 FPS

1 - walk in place

70° Sh-

100 Sec/Film

2 - jog in place

18 mm

3 - run " "

4" ref.

grid-

4x2 walk

5x2 Run

6x2 Jog

21 Oct.

Good film, checked out Vanguard viewer.

STS-2

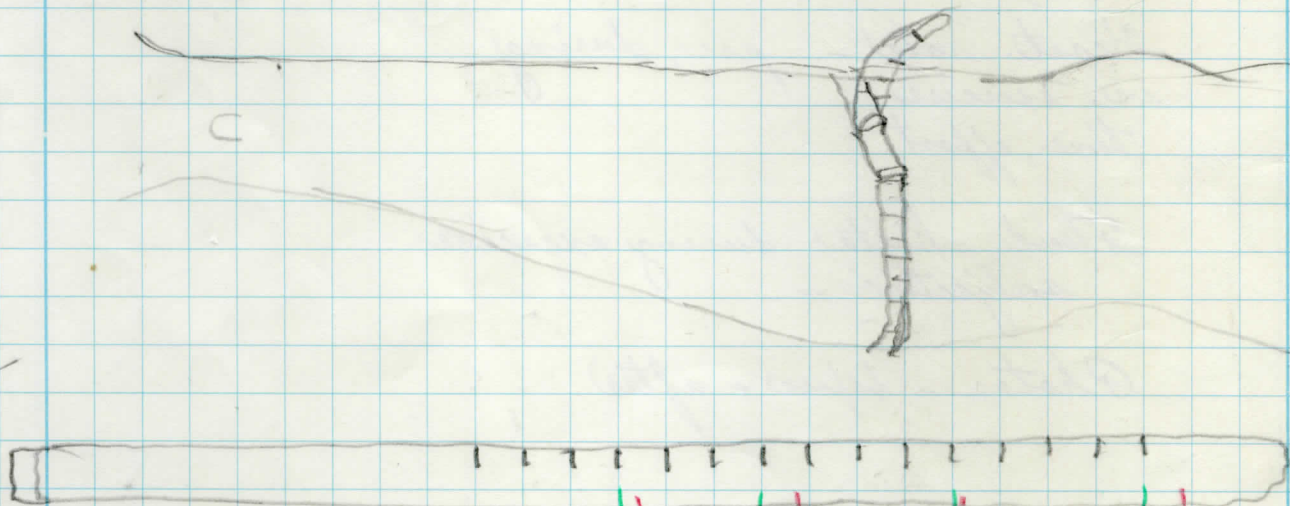
Frank
James

35 mm

10 cassettes film pos - ASA-64

70 - 100 mm

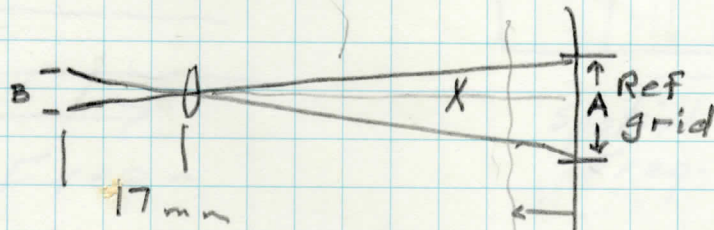
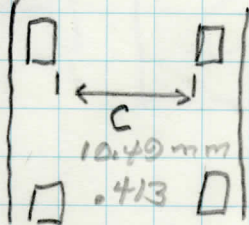
Direct measurement of girth -



21 Oct. Plan for analysis of film.

Time - 1/100 sec. flashes on edge of continuously moving film - nominal frame rate of 40 sec. is 7 of 25 ms or 2.5 flashes/frame - check rate by counting for 4 + 40 frames.

Distance - must calculate - no fiducial mark - use sprocket holes - ? then correct for reduced dist. $\uparrow 7013$



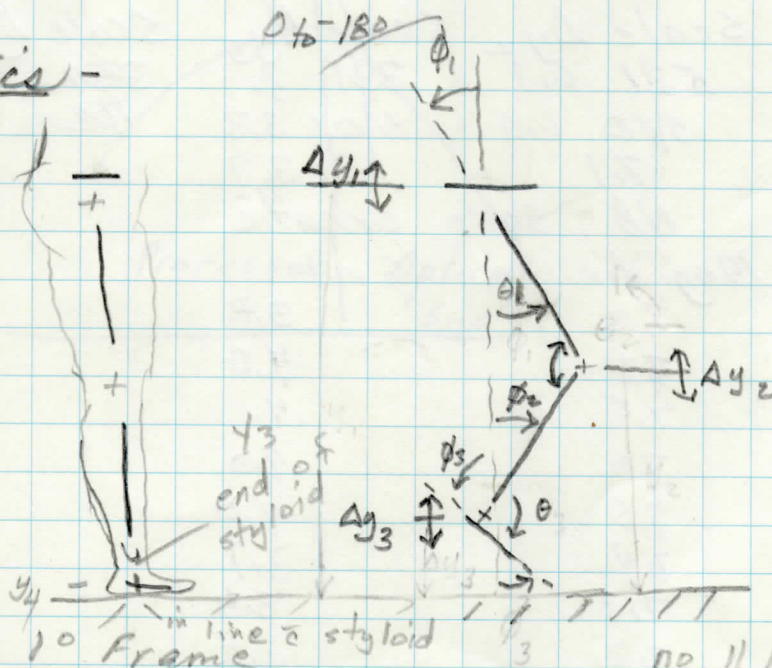
Vg-scale 7913-1265 =

$$\frac{B}{C} \times \text{cin mm}$$

$$\frac{B}{17} = \frac{A}{X} \quad \alpha \quad X = \frac{17A}{B}$$

Grid

Kinetics -



$$\theta_3 = \phi_2 - \phi_3$$

$$\theta_2 = \phi_2 - \phi_1$$

$$\theta_1 = 0 - \phi_1$$

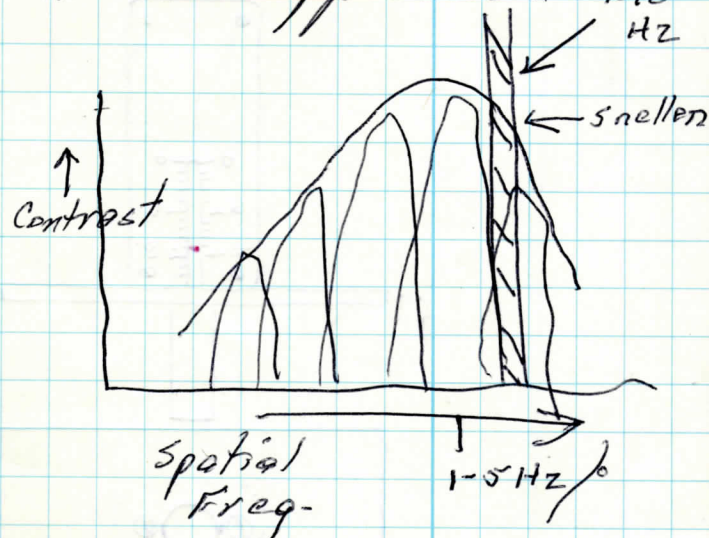
05000 start 10 Frame $\uparrow$ 1 frame prior to heel lift $\downarrow$ no 11 lax

Time (frame)	Scale Δy_1	Scale Δy_2	Scale Δy_3	ϕ_1	ϕ_2	ϕ_3	γ_4
5056	696 11.3	469 5.	1	261	87	104 5	2607
57	696 11.3	460 5	2	293	85	107 8	273
58	697 11.3	473 5.1	3	290	79	112 22	283
59	698 11.3	479 5.2	.6	301	72	115 27	293
60	698 11.3	486 5.3	.8	319	67	120 29	304
61	698 11.3	494 5.6	1.3	337	60	124 30	310
62	698 11.3	504 5.9	1.8	341	58	129 36	337
63	700 11.4	513 6.1	2.1	345	52	133 39	354
64	699 11.4	511 6.4	2.7	384	40	138 38	372

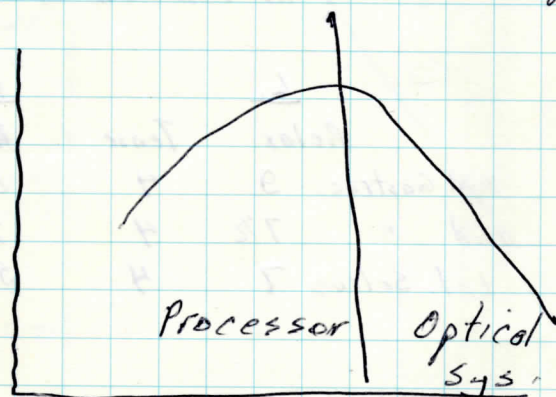
Maj. - Ginsberg - AMRL -

Visual contrast functions - naive approach -

Crt - Snellen at Hillie -



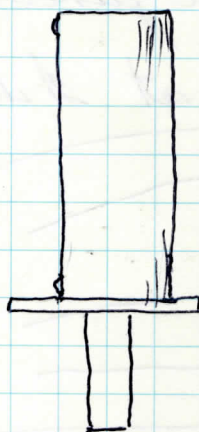
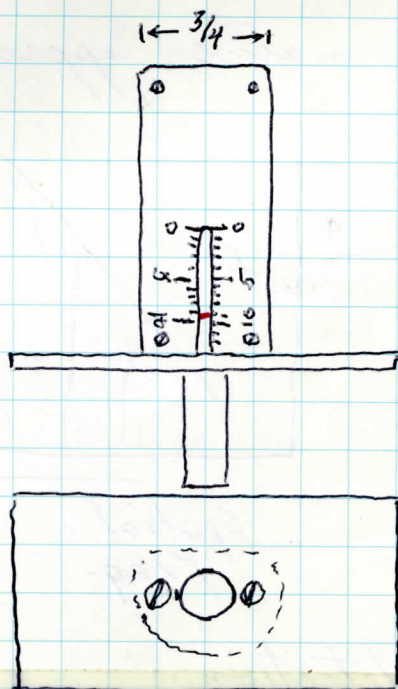
VA not related to tgt. detection



26 Oct.

Tissue Press.

S.T.S. - 2,3



W.M.T. Impromptu Meas 5 Apr. ~ 1 hr p
1 hr run on T/M

Bill —
(finally!!)

MET = 1/21:40:00

right leg
only

relaxed tensed

upper
thigh

7

7

calf

2

6

inside
ankle

12

15

fulhard
(space doc)

	<u>L.</u>		<u>R.</u>	
	Relax	Tense	Relaxed	Tense
Mid Gastroc.	9	4	8+	4
Med "	7½	4	7½	3½
Lat. Soleus	7	4	5½	3½

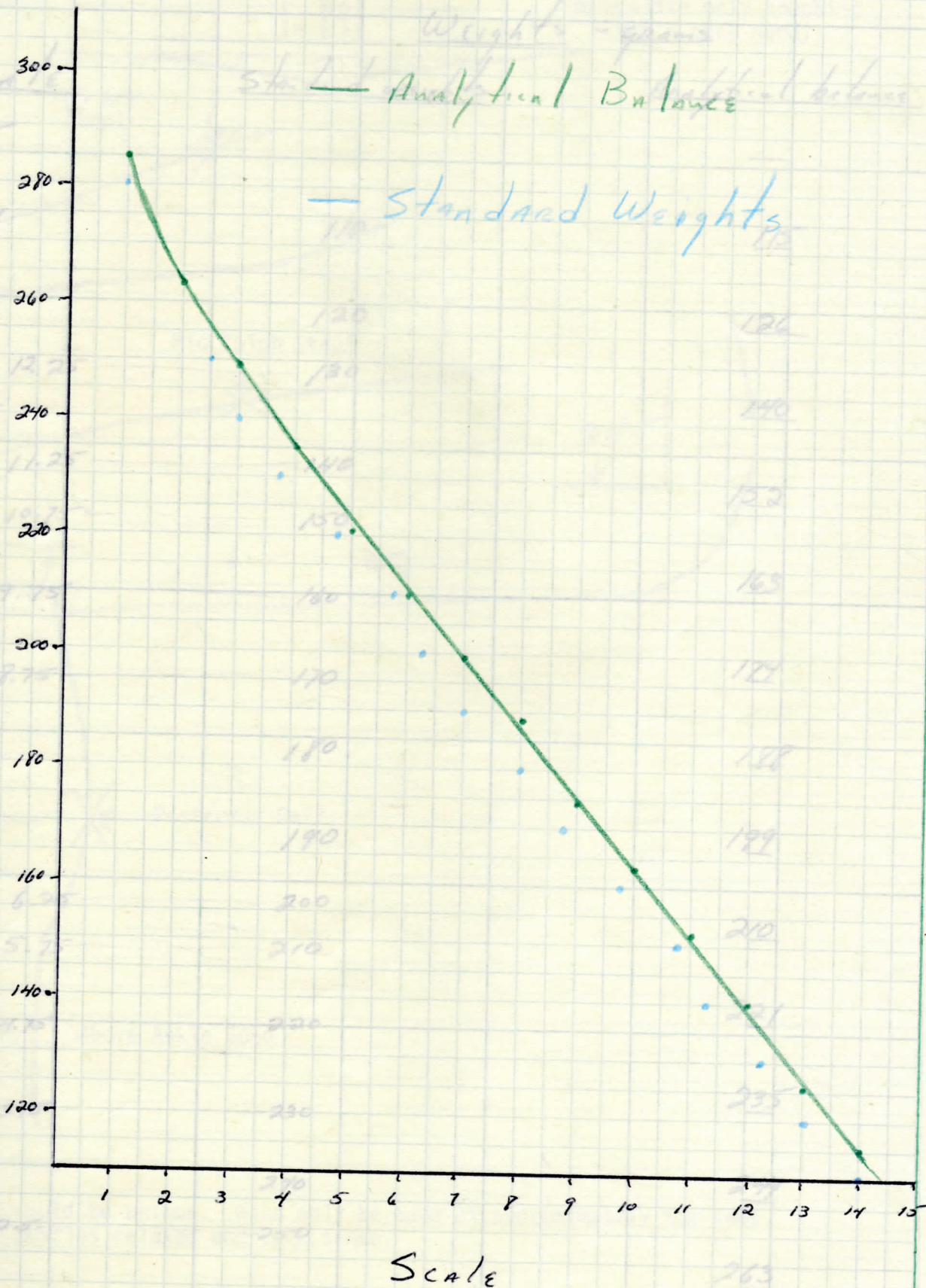
Torimeter Calibration

Weights - grams

— Analytical Balance

— Standard Weights

Weight - gms



T. pressure

Tonemeter Calibration

Lead red line to nearest mm.

Weights - grams
(base plate only touching
push hard)ScaleStandard weightsAnalytical balance

15

14

110

115

13

120

126

12.25

12

130

140

11.25

11

140

152

10.75

10

150

9.75

160

163

9

8.75

170

174

8

180

188

7

190

199

6

6.25

200

5.75

210

210

5

4.75

220

221

4

3.75

230

235

3

240

249

2

2.5

250

263

1

280

285

Any or all should be unique. Need only be made at approximately the same point w/ muscles relaxed and tense.

T pressure

Read red line to nearest mm.

base plate only touching
(don't push hard)Mid Arm
(top)

Mid Thigh (top)

90°

90°

Posterior Calf

Above Ankle Bone

Any or all would be unique. Need only be made at approximately the same point with muscles relaxed and then tense.

Oct 31st

T

E

	HR	b	after	before	after
		68	132	74	112
Up-Th	1	$22\frac{1}{2}$	$22\frac{1}{2}$	$23\frac{3}{8}$	$23\frac{1}{8}$
Mid T	2	$20\frac{1}{2}$	$20\frac{1}{2}$	$20\frac{5}{8}$	21
knee Above	3	$14\frac{3}{4}$	$14\frac{7}{8}$	$15\frac{1}{8}$	$15\frac{1}{4}$
Below	4	$12\frac{3}{4}$	$12\frac{7}{8}$	$12\frac{5}{8}$	$12\frac{7}{8}$
Calf	5	$13\frac{3}{4}$	$14\frac{1}{16}$	$12\frac{3}{4}$	$12\frac{3}{4}+$
Ankle	6	$8\frac{1}{2}$	$8\frac{5}{8}$	$7\frac{3}{8}$	$7\frac{1}{2}$

4½ mins

Bill, for your info this is
measurement data Joe and I
took at the gym on Oct 31st.

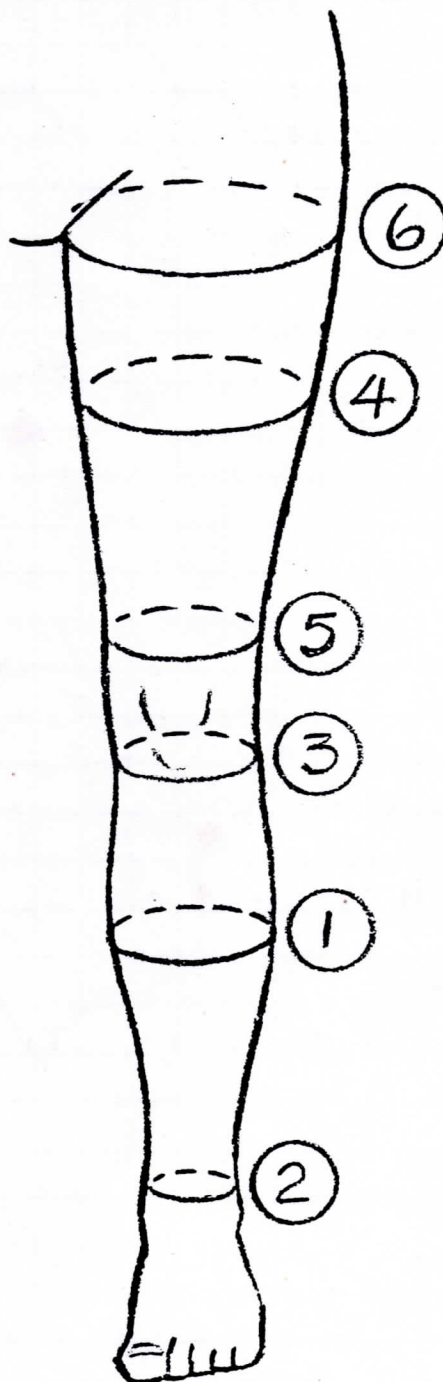
Fuhard

(numbers start at upper thigh, continue
on down to above ankle bone)

Leg Girths

The following girths are listed in order of desirability. N.B.--even one site is more than we have now and each additional site or measurement is that much more.

In flight the leg should be relaxed and straight. On earth the measurement should be made lying flat on back (by second person) and relaxed. The locations are not critical so long as they are repeatable.



14 Nov. '81 Summary S T S - 2

Initial flight day delayed by computer, fuel cell & APU probs. Launched 12 Nov. and then lost fuel cell & return at 1522 today for hectic 2 day flt. Hts. were marked in crew gtrs. & data on opp. pg. recorded as shown. Should be amazed if anything had been recorded in flt. Maybe 3.

18 Nov. '81 They managed to get a height at 6 hrs. which did not increase after that time, use the bungees, and do some indentation meas.

On the 2nd day J.B. rigged the force restraints and started to run in place when he found he was being 'pulled over' backward but by leaning forward was able to jog in place however he was concerned over 'motion sickness' which began had been present on day 1. Also feet had to be kept close together.

19 Nov.

D.T. - confirmed above and said that the calf was so lax that a near max. reading was obtained. D.T. has unit and will get readings which were recorded by J.E. Comments on flight:

Fluid
Shift

Noted head fullness immediately but not stuffy nose. By next A.M. when they first looked at mirror faces were puffy. Nose was "stopped up". Upon awakening ~~next~~ first morning the feeling of head down fullness had abated. I would interpret the full feeling as being 2nd to ↑ venous pressure which had probably been reduced by the 1st 12 hours or conceivably the sensory receptors had adapted (doubt the latter).

Height

Height. They put baseline heights on bathroom wall in crew gtrs. at KSC and repeated marks on ~~ladder~~ ^{ladder} at in the S/C. Earliest measurement was at 6 hrs. and no changes were seen subsequently. No difficulty noted in donning soft suit.

Anthro

Tried to sleep in seat but thigh/struck angle prevented this and belt was uncomfortable when pulled down so released and 'floated' in seat area. Second night went to mid-deck and floated free for a period but was awakened by ending up in corner. Went to flight

19 Nov In Flt. contd.

STS-3 } each where he slept in cp seat for 2:49:- Had only 3-4 hrs. sleep
 Photos } each night & frequent awakenings from alarms, etc. Also took
 T.P. } free floating pix.
 ENT } Heart rate: He noted rates as low as 44 BPM, just prior to sleep.
 Photos } Typical rate was 50 & max. noted as 56. In 1 g. horiz.
 Pre-Post } rate is usually 60 which is what it was $\bar{p}$ flt. & 100 stdg.
 Heights } Fluids - D.T. was not hungry/thirsty but ate usual diet on run
 on 2^o day - Lost 2#. J.E. ate & drank v. little & vomited(?)
 1^o day! Lost 8#.

Vestib. D.T. moved v. slowly for first period and gradually
 incr. activity until he was unrestricted at 3-4 hours and never had
 any sp. SE. was apparently sick first day & few sx. second.
 All wore the "patch".

Other - D.T. noted sensation of heaviness & onset of g. &
 great apparent weight of Hasselblad camera he picked up to photo.
 Calif. coast line. I

24 Nov GWA forbade me to go to med. debriefing. Apparently E was
 v. dehydrated

19 Nov.

Height- STS-2, 3

From crew quarters - measured by KSC P.C. measure in mock up. (JSC)Truly $5' 7 \frac{3}{4}"$ Engle $6' \frac{1}{4}"$

13116" Mac Cr. head

Spinal Lgt.

E. $72.25 - 44" - 10" = 22.25$

$$5' 11 \frac{3}{4}" + 3 \frac{1}{4}" = 6' \frac{1}{4}"$$

$$5' 7 \frac{1}{2}" + 3 \frac{1}{4}" = 5' 8 \frac{1}{4}"$$

$$\Delta = 4 \frac{1}{4}" \text{ for Engle}$$

Nygren had marks on ladder meas. but ladder was removed from bird and must wait til it is repl. at Cape.

21 Mar.

In flt. marks; two marks marked T lower one marked $6 + 0 \frac{2}{3}$, upper was measured from floor at $69 \frac{1}{4}$ couldn't find upper - 2° mark was cut $\frac{1}{4}"$ greater at T:distance from mounting bolt was $1 \frac{3}{4}"$ + to bottom of first step was $13 \frac{3}{4}"$ Trueuly was $69 \frac{1}{4}$ this represents Δ of $69.25 - 67.75 = 1.5"$ for Engle $69 \frac{1}{4} + 4 \frac{1}{4} = 73 \frac{1}{2} - 72 \frac{1}{4} = 1 \frac{1}{4}"$

(see below)

26 Nov

TP probe - returned - haven't gotten data in flt. yet
In Gym there was no detectable difference in pressures at 4 points on calf + thigh be and $\bar{p}$ running 1 mi. (nr. max.)
Will try pressures $p + \bar{p}$ sleep -

STS-3

Girth Mac Ht.

Statue

J. Lousma

Gordo, F.

34 est.

Height changes, cont'd.

21 Mar
cont'd.If correct level above floor of bolt hole is $1 \frac{3}{4}"$ then:Nygren's measure
of ladder "

$$\begin{array}{lcl} \text{Engle} & 5' 11 \frac{3}{4}" + 1 \frac{3}{4}" & = 6' 1 \frac{1}{2}" \text{ (chs.)} \\ \text{Truly} & 5' 7 \frac{1}{2}" + 1 \frac{3}{4}" & = 5' 9 \frac{1}{4}" \text{ (chs.)} \end{array} \left. \vphantom{\begin{array}{l} \text{Engle} \\ \text{Truly} \end{array}} \right\} \text{both meas. agree.}$$

$$\Delta \text{ in } \bar{W} - \text{Engle} = 1 \frac{1}{4}"$$

$$\text{Truly} = 1 \frac{1}{2}"$$

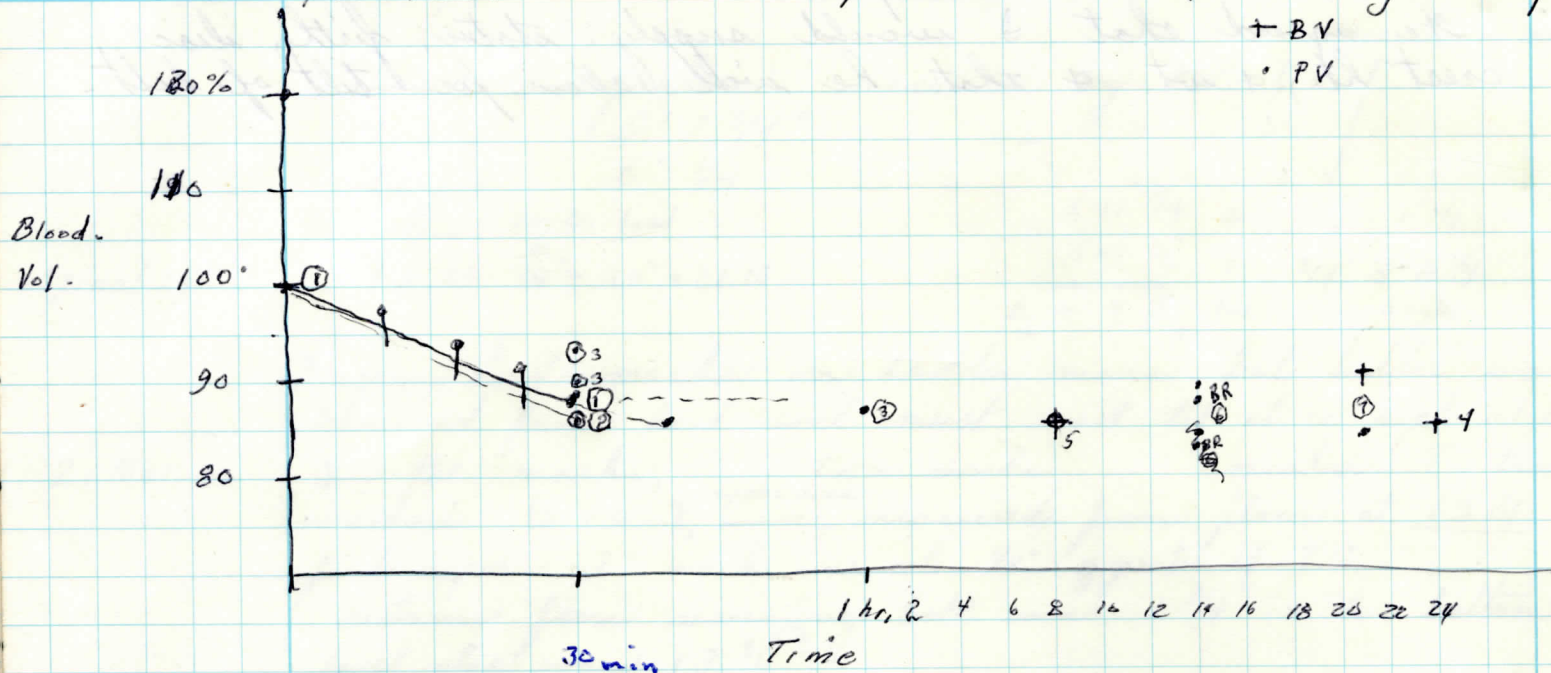
Clinical

In flt.
D-5 8 Δ

		72.5	73.75	74.25	73.5	
Jack L.	30 Mar.	72.5	73.75	74.25	73.5	1.25 + 1.0
Fullerton	" "	70.25	71.88	72.0		1.75

 $1 \frac{1}{4}"$ $1 \frac{3}{4}"$

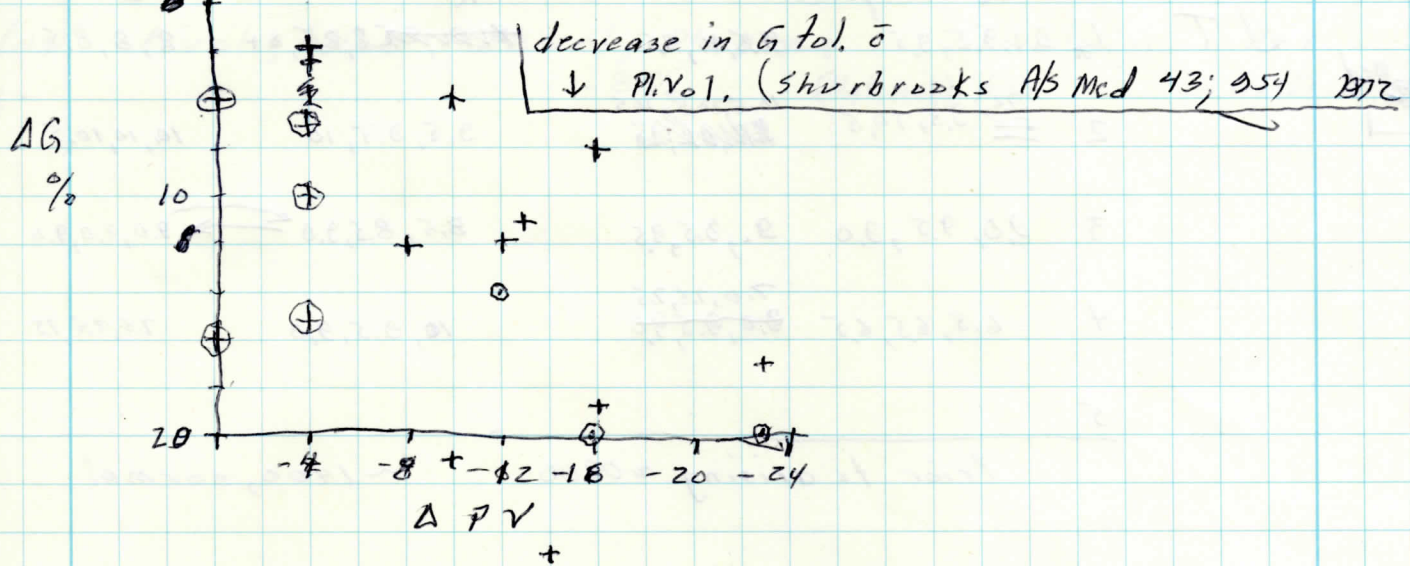
25 Nov Meet. 2 ILC rep. on STS-3 bungees
He agreed that I would supply: stature, girth, iliac
crest ht., & wt & that he will allow for tilt of belt.

Review of Blood/Fluid Shifts ($\bar{c}$ changes in pos.)

- ① Thompson² & Dailey J.C.I. 5; 573 1928 dye, rpt. in; ~~rept. in~~
- ② Waterfield, J. Physiol. 72; 110 CO
- Krogh, JCI 1932 11; 63
- Youmans JCI 1934 13; 447
- Landis Physiol. Rev. 30; 1 1950
- ③ Epstein, Δ Hgb, Hct
- ④ Nixon JAP(?)
- ⑤ Gauer
- ⑥ Greenleaf, Aerosp. Med. July 1973 BR [2 wks] Δ P.V., dye
NB lost 6.8 & 6.5% P.V. in 3 cf. runs $\bar{p}$ BR vs 4.1% normal runs
- ⑦ Taylor Am Jr. Physiol 144; 227, 1945 BR 3 wks, dye

$$\frac{.85}{.390} \text{ or } \Delta = -600 \text{ ml.}$$

Review cont'd.



27 Nov T/P

JT	R supine L		R L	
1	9.2, 9.2, 9.5	9.5, 10, 9.5	8.5, 8.5, 8.5	8, 8, 8.5
2	9.2 9.5, 10.5	10.5, 10.5, 10.5	9.5, 9.5, 10	10, 10, 10.5
3	9.0, 9.5, 9.0	9., 9.5, 9.5	8.5, 8.5, 9.0	9.0, 9.0, 9.0
4	6.5, 6.5, 6.5	7.0, 7.5, 7.5	10, 9.5, 9.0	7.5, 7.5, 7.5

5

Prior to arising ~0800

~1400, normal

James

1	6.0, 6.0, 6.5	7., 7., 7
2	5., 5., 4.5	6.0, 6.0, 6.0
3	7.0, 7.5, 7.5	7., 7., 6.5

Subj supine & leg straight & supported at heel

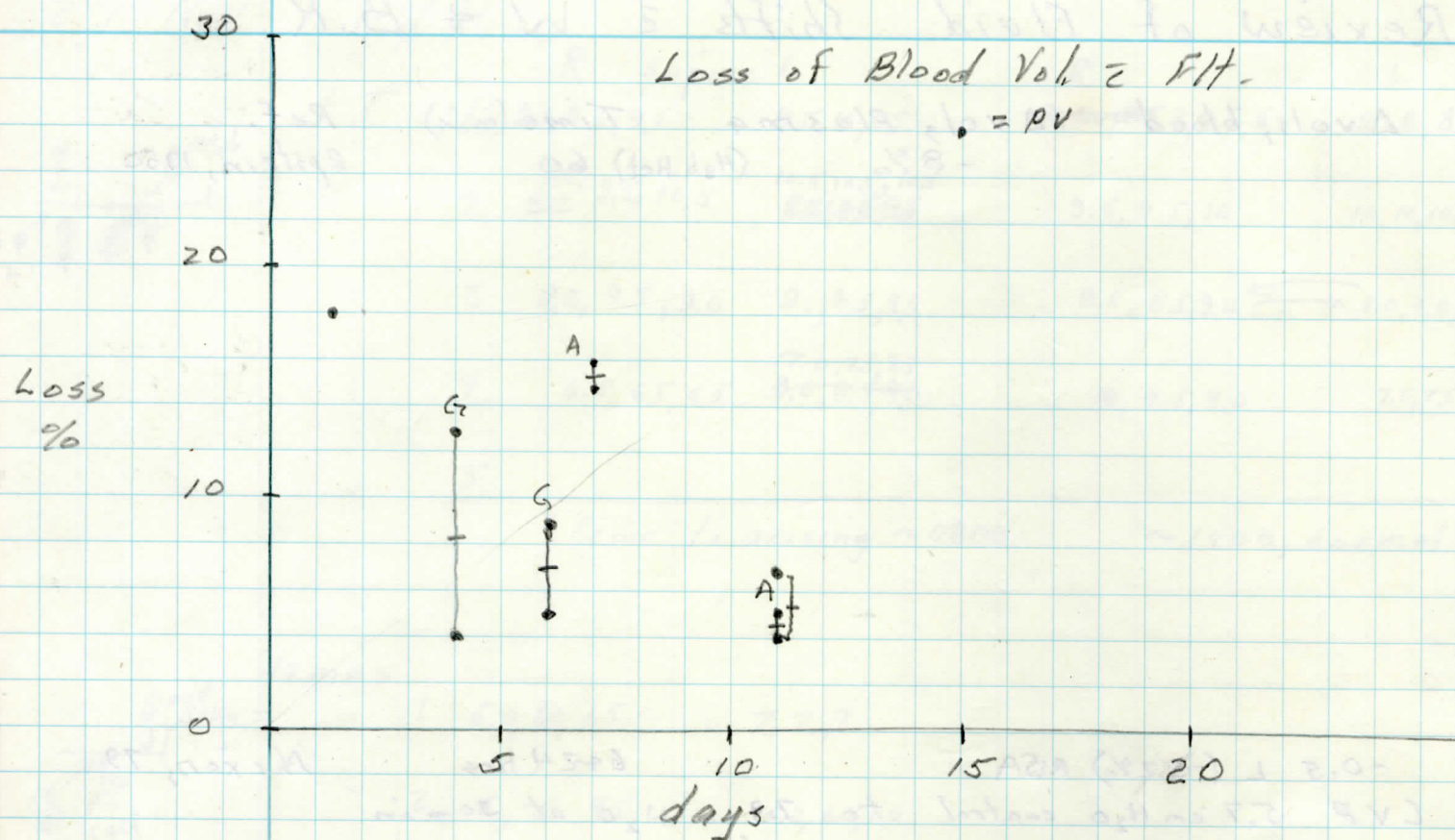
- ① post calf between bellies of gastroc., Foot plate across bellies
- ② medid(al) calf
- ③ lat. thigh
- ④ Ant. "

posns.
marked
pen

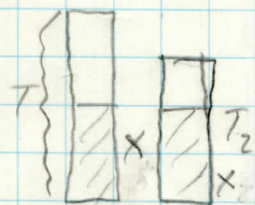
Review of Fluid Shifts in W & B.R.

Stimulus stdg.	Δ vol., blood	Δ vol., Plasma -8% (Hgb Hct) 60	Time (min)	Ref. Epstein, 1950
-------------------	----------------------	--	------------	-----------------------

ORT, 74 - 5°	-0.5 L (-10.2%) RISA		6 & 24 hrs	Nixon, 79
	CVP 5.7 cm H ₂ O control to 7.9 cm H ₂ O at 30 min			
	Leg Vol. total = -0.9 L (			



Hot Calc-



$$X + T = X_2 + T_2$$

$$\frac{X}{T} = Hct_1$$

$$\frac{X_2}{T_2} = Hct_2$$

$$Hct_1 T = Hct_2 T_2$$

$$\frac{Hct_1 T}{Hct_2} = T_2$$

$$\frac{43}{49} \cdot 100 = 88\%$$

Orthostasis - History of early flts.

Gemini Mid
Prog Conf
SP-121, Berry
p-235

Hypograv. &
Hypodynam
Environ;
NASA SP-289
Dietlein p1

MA-9
Cooper
Ch 18?
Catterson
Duration 0840-1825+24 Δ wt. 147-139 1/4#
NB - had H₂O probs.
HR ↑ 188 BPM → 92 BPM on egress, p syncopal

Tilts - 1, 3, 6.5, 19 hrs p fth - 70° e stakes litter

Hct 3 hr p - 49 vs 43 pft or 88% BV+

Age Max hr. 185 Normal p fth. HR
(stdg?) 72

	HR BPM	p tilt	Mean	Δ	
p fth. 1		66	82	16	
2		66	90	24	-
					%
p fth.	Hrs p fth.				
1	1	85	120	35	
2	3	88	140	52	
3	6.5	80	110	30	
4	19.	55	80	25	

Kinesimetry

16 Mar. Jim Lewis, Perner, Wofford

Sel Spot - p mission - move to larger qtrs.
 Jim Stramer - Northrop - PhD - near physiol. psych.
 Mann - MIT
 Goniometry - Static -
 '660 300 Hz - Video Recdr.
 SW & H.P. -
 Original Video sys - 'damaged'

I.R. sys -

Summary: Have heard nothing from Lewis for 6 mos. or more. They have funded SWRI for an 'improved' kinesimeter & video tape recording, are going forward & requests for large funds \$3-7 x 10⁶ for in flight work, and used goniometer to make study of STS suit. In latter SWRI was given sole credit for development. Last wk. Wofford called for film made at SWRI for NASA HQ presentation. On morning of 16 discussed my complaints & Perner incl.: being shut out of program I developed & anyone left & knowledge of problem eg. Lewis removed Jackson & has avoided me while using only computer people & SWRI

1. SWRI is claiming abilities & accomplishments they don't have while charging w. large sums
2. Large amts. of money are being spent on Adv. & organizations & little in way of results
3. There is now an interest & need for facilities for STS-5 & other

Stramer called the day following & the above & what sounded as business as usual & delays from SWRI, etc. It ill have to look at alternatives. Discussed briefly & Lenoir. See next page.

23 Mar

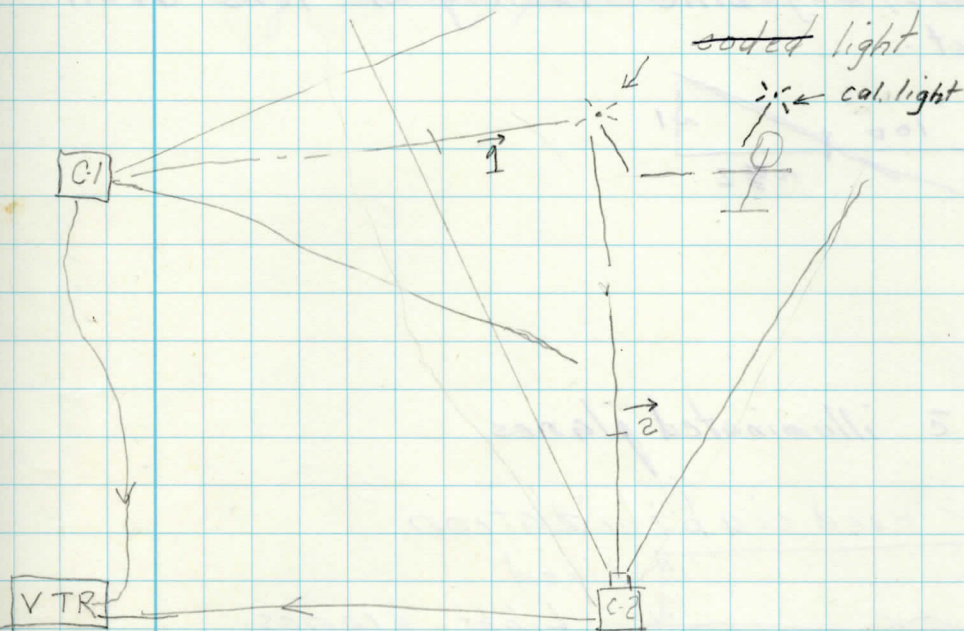
Called Lewis expressing my concern over above attitude and intent to press on. He promised results. In meantime I am looking at all possibilities. See opp. pg.

Range of motion studies -

General plan:

Study kinesiology features (ROM, strength, etc.) on gnd, in WIF and in orbit.

Strength will be difficult (money, size, wt., etc) but try the two following for ROM.



1.1. Use 2 cameras in PLB
~~with a coded light or~~
 continuous light

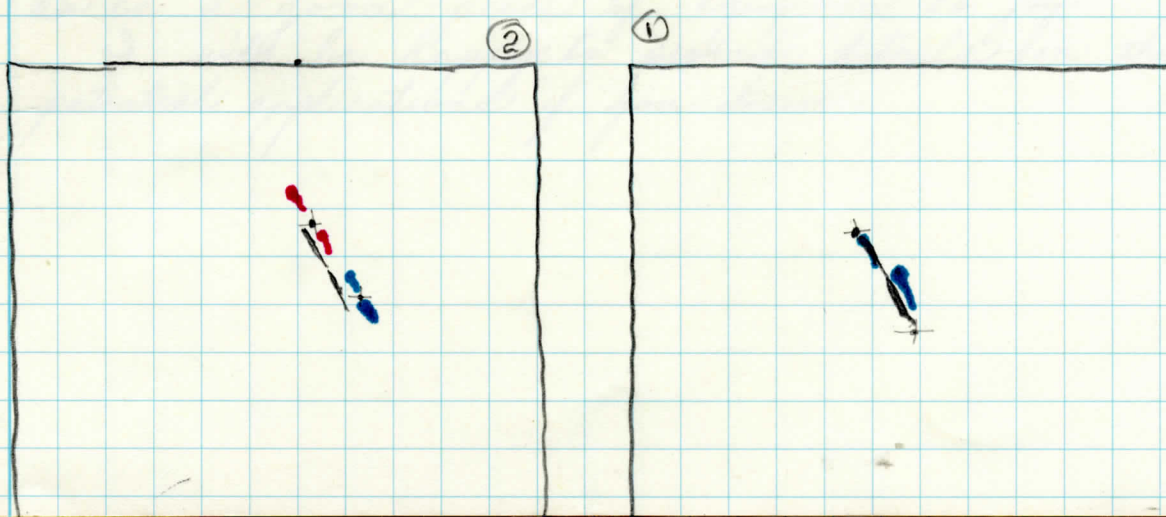
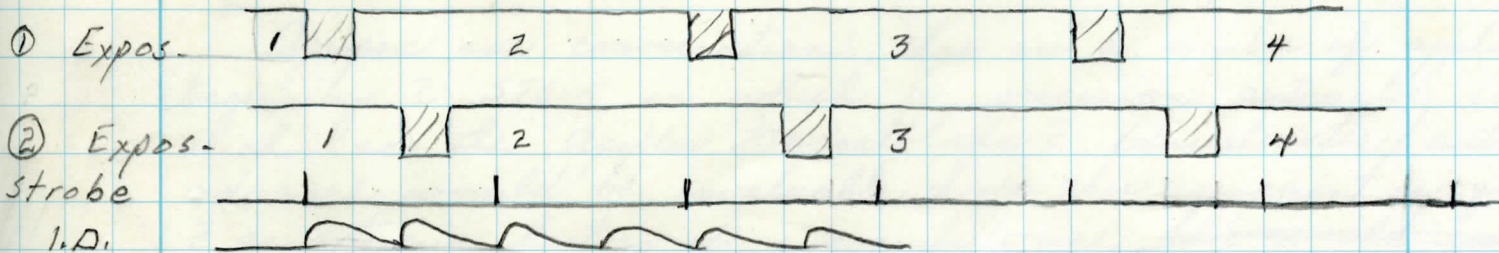
1.2. Record on VTR

1.3. Auto analyze results

1. Video tracking.

2. Stereo Cameras with same setup but with coded light

1. leave shutters open for appreciable time + synch with light
2. auto advance film NB. Hasselbl. has 200/mag.

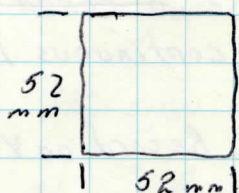


24 Mar.

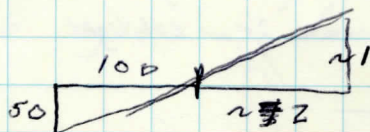
Kinesiology, Cont'd.

Jim Ragan } 3173 Hasselblad experts -
 Jeff Bremer *

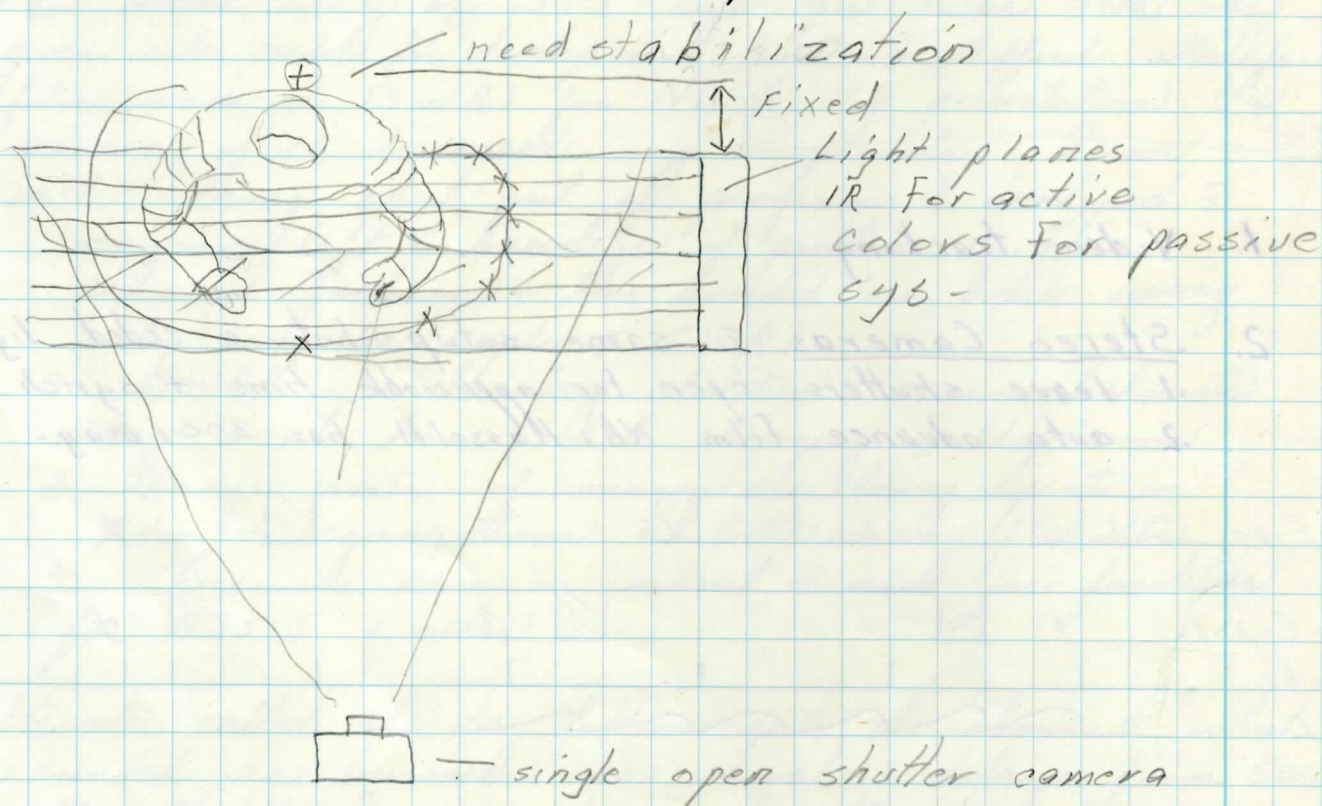
Has qualified cameras & auto advance & intervalometer
 to be qual. for 5:3. surplus & fiducial marks
 Can get 192 exps. / magazine - variety of lens avail.
 100 mm is best.



70 mm format



3. Single camera & illuminated planes



30 Mar 1982 Visit to JPL, Dr. Blankenhorn,
 Discussed various needs, possibilities for photography/processing
 on current Shuttle flights and agreed on the following:
 1. All try to get test film of leg & body by fixing camera
 2. w/ size calib. on the subject and turning body. A second
 3. is ~~is~~ photography of face, body for vessels. B- suggested
 4. 'ching' crewman permission etc to look at body locations.

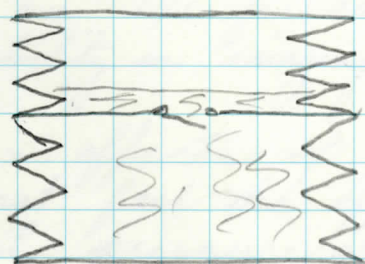
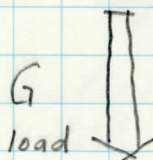
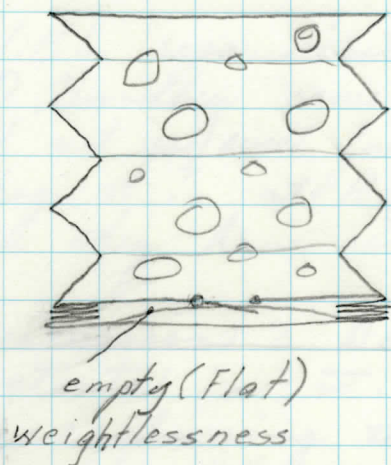
To: Jerry Ross
 5 Apr. Subj: - EVA cameras

Apropos our conversation, there are a number of applications,
 beginning w/ STS-5, in which a precision, automatic camera
 such as the Apollo Hasselblad's w/ intervalometer/automatic
 advance would be invaluable. Since this equipment is qualified
 w/ an extensive history of successful use, ~~this would seem as~~
 and since a number of cameras ^{are} in stock, this would seem
 to be a good piece of equipment to fly.

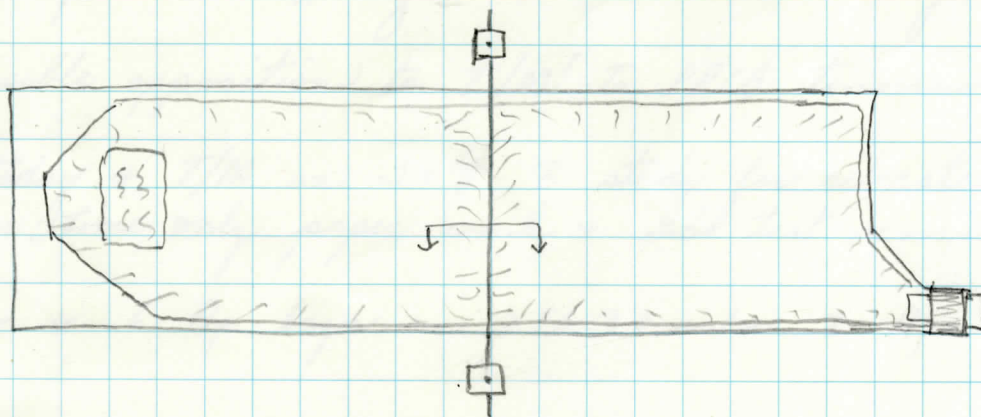
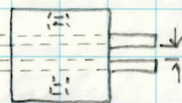
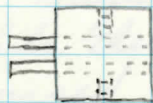
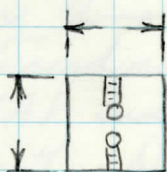
I will be happy to provide details on this equipment &
 potential applications if you desire.

12 Jan H_2O /gas separator

The fuel cell still produces large quantities of gas in the drinking H_2O which can't be separated. After discussion c J.R. I placed a contract c J.R. Enterpr. for a physical separator. (Nov. 81) The initial concept was a two compartment device c a one way internal valve.

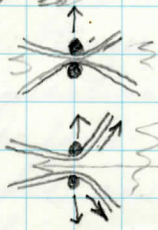


After initial attempts an external clip/valve was proposed, and after failure of a flat spring the arrangement below was made and c only two or three swings around one's shoulder at arm's length, the fluid is completely separated.



A polyethylene bag was fabricated for test and worked very well separating the air: H_2O to $\geq 1-2:100$ in 3-4 complete swings - The flat Apollo beverage packs also fit nicely - see next pg -

valve action



G load

Water-gas separator - contd.

The device was demonstrated to a number of people in the ofc. including S.K. who seemed enthusiastic. Showed it to Rita R. who in turn supplied me c Apollo flat beo. bags which c the container for the mouthpiece clipped off, works well. Told S. I would prepare a brief report and am in process. Took photos today and started sketches. Also demonstrated to S.L. who seemed enthusiastic. Will coordinate c the medics.

12 Jan. S.P.L. repts. visit;

O Hardley came by c a physiologist and a computer type. Did not go well for they are in bed c Pool & Bush & Nicos. H. ? at H.Q. working on U/S for cardiac use. Shame, for they have obvious capability in imaging, etc.

13 Jan Discussion c De Meester on effects of gas in abdom. contents in w. He did not feel the effects of gas cushioning the normal pressure of stomach walls would explain stasis but offered an explanation of esophageal sphincter action which

19 Jan H_2O/H_2 sep. Showed D.K. & Crip. the unit & Crip. directed Ortiz to proceed c stowage. Demonstrated to Ortiz who borrowed equip., bag & valve, for demo. to ? Report almost finished.

Readmill - Briefed D.K. on it and he encouraged us to get it in ASAP and while there was little chance on 3 he felt confident of 4. Discussed c Crip who in turn talked to Loc. Apparently a local prob. c Hwang & Loc was directed to get word from K.

20 Jan No visible opposition to T/M! To PRCB tomorrow(?) per Rod Lowe.

25 Jan PRCB today & T/M on 3 & 4 c study for relocate on 5 & subs. At this time only paper work & vib. test remain.

29 Jan T/valve & 6 Ap. bags on STS-3 & subs. c Ap. H_2O gun (integ. filter).

4 Feb. Recd. 2 ea new T/W valves from W for STS-3 (#200) and flew them both on NASA 955 in Geo G parabolas today. W had twisted valve 75-80° to increase tension at mid-point. I restored one valve to original 'straight' configuration and used two Apollo bags supplied by Rita R. c red food coloring in one bag. Flew multiple parabolas during two flights in which both bags were swung in a small arc i.e. their own length + 3-4 ins. & They were (over)

H₂O sep. cont'd.

swung with a tether cord tied to a corner of a bag (hole in first flight & metal grommet in hole in second). Separation was complete but it is important to have the valve 'below' the fluid level. Photos were taken & Hasselblad + my Canon + turned in for processing.

4231-Dan Ferris Piccard VTR - Charlie Hall & Ulrich 5212

6 Apr. 1982

Film Review STS-3

H/H₂O sep. 582-28914[✓] & STS-3-21-087[✓]
Head W. Gordo 28908[✓]

"	"	"	09 [✓]
"	"	"	14A ¹⁵ - 26
Face	Jack	17A	"
"	"	18A	"
"	Gordo	STS-3	19-037 [✓]

16 mm

Mag - 138

good translation

Int 39

Exer - Gordo

C-297 roll #

45 #?

Jack Exer.

44

" horsing & "

VTR

Reel 10055

18:13:57

26:55

15:48:26

10616

15:51:44

16 Feb T/M in 1 G Trainer

TV - Fred

Koons

3841

Bogart

2541

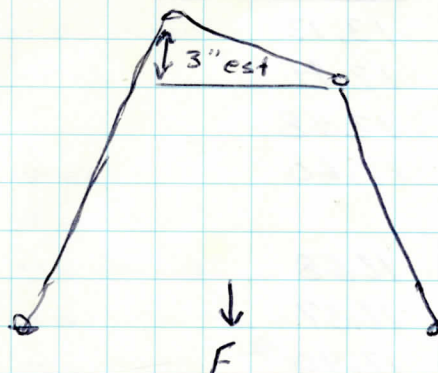
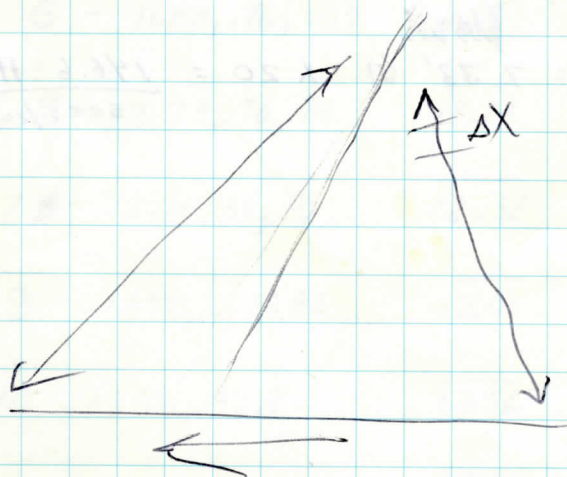
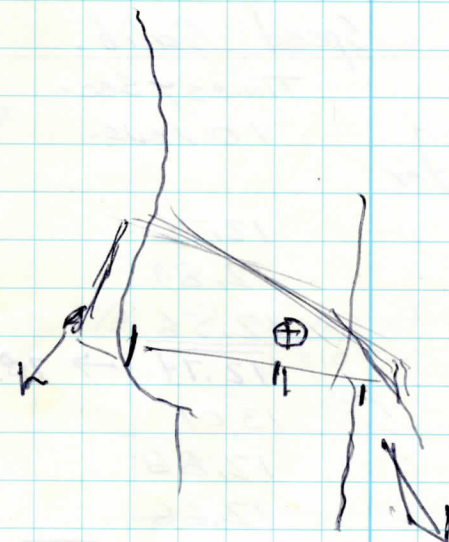
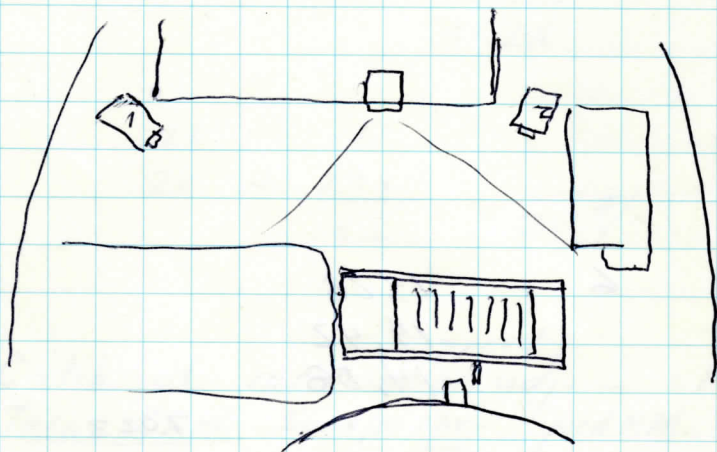
Ramos

2541

T/M has been shaken/shocked and plan is to run it in for 30-45 min. At the same time we have questions of clearance for Jack L. and need to interface all the items for support eg. belt, bungees, etc.

1g. trainer sched. 11-1200 - 12C late + 3 small bungees i.e. low rate bungees for use in 1g. Immediately obvious that post. loads are too large just as Joe B. described. Overall force is acceptable i.e. $\sim 200\#$. Current speed control vernier is limited in range.

T.V. (for pub. consumption?) wants set up with lateral shots.



	Extenders		
	None	1 rear	2 rear 1 front
	438	430	385
Subj. Wt	270	220	220
	218	210	165

$$\Delta X = 45\#$$

17

Tays, Withey, Wong at ILC.

Discussed post. torque prob. as note by J.E. on 2 + by me yesterday and probs. of adding adjustment at this time. Also advantages of adding adjustment; single bungee length, exact adjustment in space, elimination of loops.

Speed Calib.

Turns on
micrometer

Times + Sec.
10 revs.

Wrong Way

3	12.76 12.89 <u>12.56</u> 12.74 → 7.03 mph
5	13.01 12.86 12.66 <u>12.66</u> <u>12.73</u>
0	13.12 12.44 12.48 12.60
0	12.68 12.57 12.40
2	13.68 13.24 <u>13.84</u>
4	13.70 13.78 13.50

6 14.28
14.42
14.08

7.023

~~MARK~~
TTM = 7.33' (1) × 20 = $\frac{146.6 \text{ ft (2)}}{\text{secs./20 rev.}} \div \frac{1.47 \text{ ft}}{\text{sec.}}$

- eliminate 'C' & mark zero
- Add ~ 9" adj. front & rear $\bar{c}$ 1/2 calib.
- Use 4/6 rate cords rear: front

WT to give Larry W. JA. meas - I.C. 40 H-66
WT 132

spring rate 5/16" Cord x 1

15 17# - 18" 10# 4"

27.5# - 22" 2.5# 11"

12.5# 4 3.1# 11"

$\Delta F / \Delta X$

22" - 27.1

20" - 20.9

6.2

3.1# 11"

27

Calib. of micrometer, ^{speed} adj. - 1LC

Turns C.C.W. Secs/10 rev. Speed MPH

18 Feb. 0 - 10.67, 70, 40 10.59 $\uparrow$ 8.45

4.71

6 - 11.88, 76, 54 11.73 4.25

8 - 12.73, 76, 70 12.73 3.92

7 - 12.11, 34, 50 12.32 4.05

9 - 13.02, 2, 12.82 13.01 3.83

10 - 13.58, 4, 7 13.56 3.68

11 - 13.98, 14.42, 12 14.17 3.52

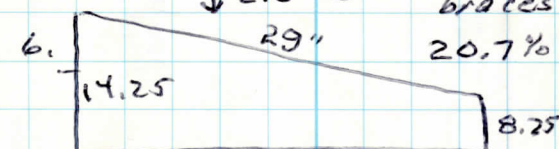
12 - 14.57, 90, 70 14.72 3.39

13 - 14.8, 84, 49 14.71

14 - 15.92, 43, 63 15.66 3.18

18 - 19.01, 18.84, 99 18.95 2.63

T/M mtd. on top of jig-held
braces



ft

sec/10

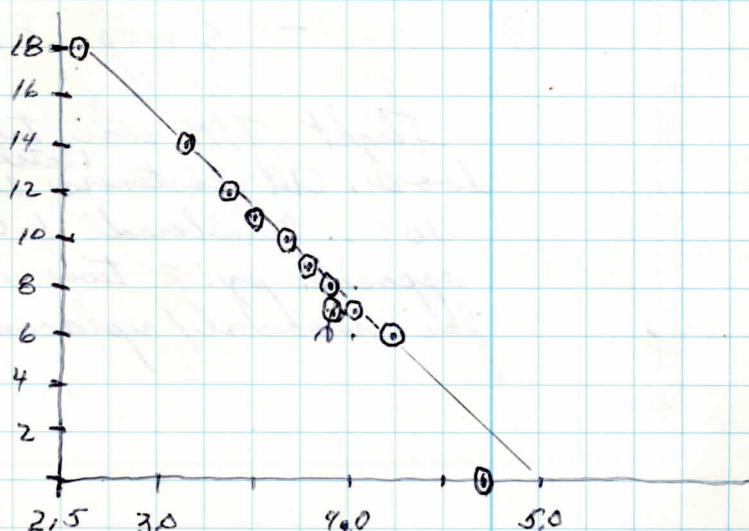
10 x 7.33

= 73.3

1.47 = Sec.

= 49.86

sec



19 Feb.

Mtg. on T/M I.F.

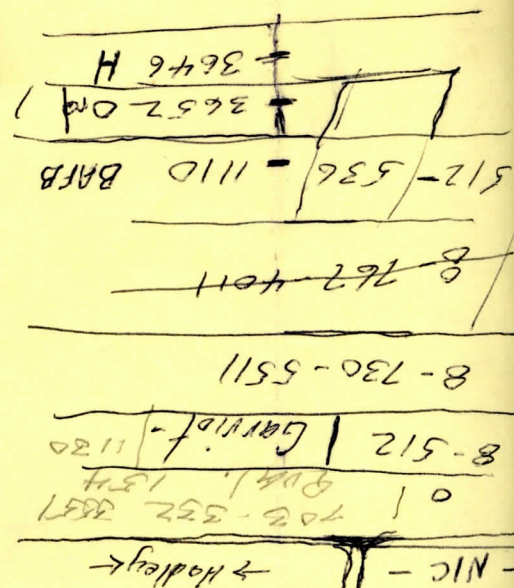
Drexel - not concerned about discern.

Q+A concerns -

Rockwell concerned

Jo MS Mann
Neg. Press. Reg.
Barnett

- Add procedure to cue card

Gil Perez
3591

22 Feb.

Fit CK on 1 G Trn-

M. Cohen 2541, Wong, W.

Stowage

Jim George
2541

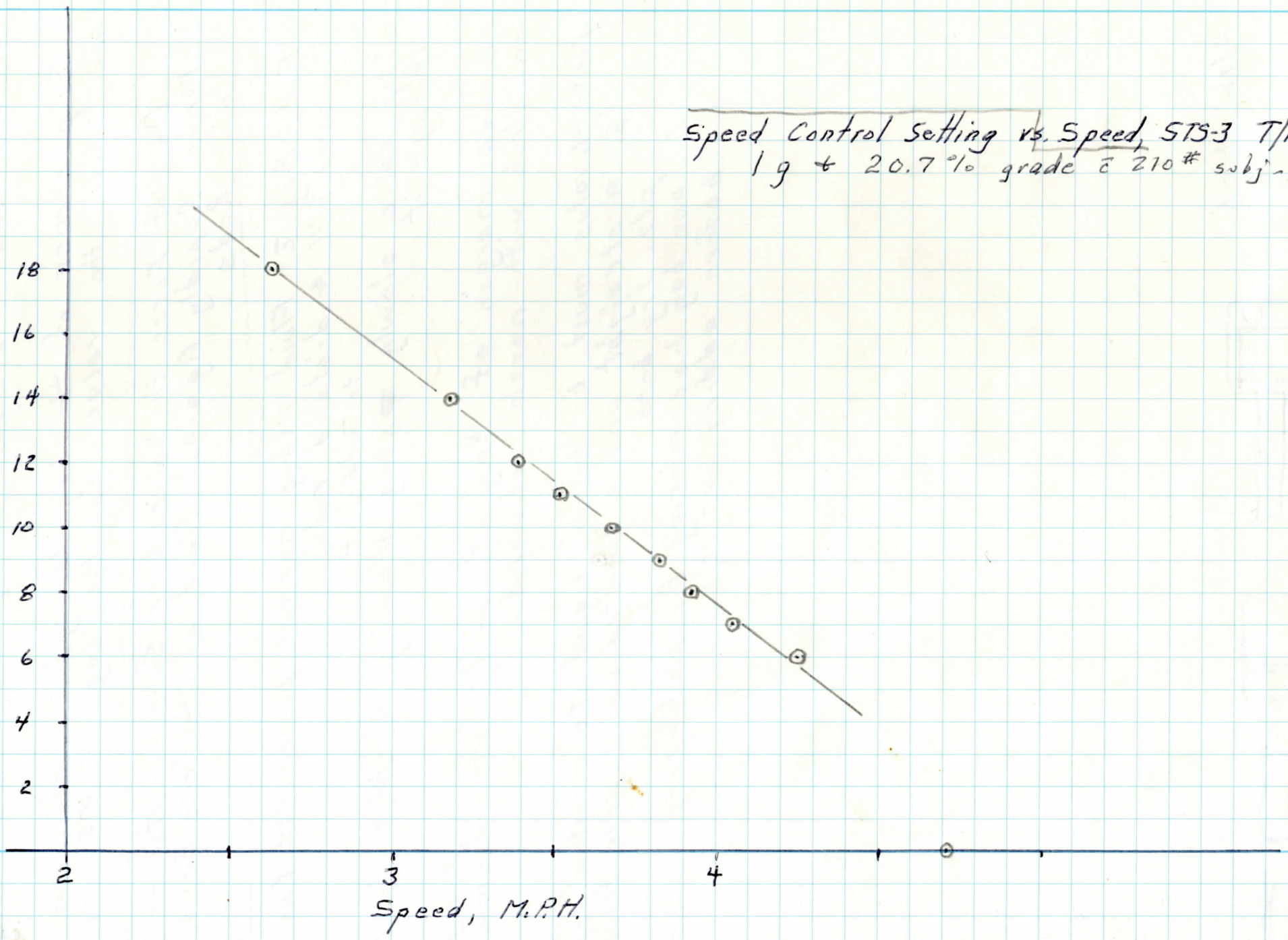
- Only 1st row can be easily removed { 3 moving }
2nd " removed = difficulty T/M
- With all racks on Bottom
1st 2 rows ^{FORE-AFT} can be easily removed
3rd " Aft " " removed = difficulty -

1st day - Fresh LiOH to Filter2nd " - " " " " " 1 vq. 1st filter in3rd " - Swap Fresh for 1st day Filter -

Slight T/M was taken to 1g. trn. & placed on the LiOH door. All fasteners ^(latches) could be opened and the door opened ~ 30°. Numbered LiOH canisters are placed in racks as on the opposite pg. & two vertical racks on the 5th d. side. Schedule for removal/replacement is on opp. pg.

22 Feb.

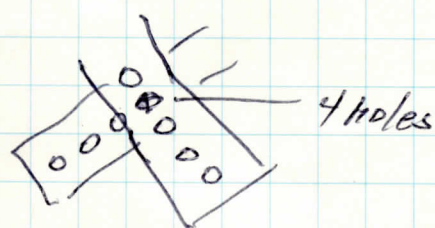
Turns, C.C.W.



22 Feb Check of revised Harness

1430

Photos
made



0-Front } 210# $\bar{c}$ $\sim 1\frac{1}{2}$ " scales
10-Back }

5 ~~Front~~ } 165#
17 ~~Back~~ }

" "

N.B. X shoulder strap in future

Clamps work $\checkmark$ well -

25 Feb. Bench Cks. $\bar{c}$ prime today & B/U yesterday -

Crew wants direction ^{arrow} on T/M (agree)

Also will cut off Pontube & inspect bags for flight

Robertson Ing. for prime now set for 4 Mar $\bar{c}$ shipment to Cape on 5th -

1 Mar. Reviewed & 'trained' STS-3 prime crew in 1g trainer for 30 min.
Crew warned about various aspects including:

Don't attempt if vestib. sx. are present

Start slowly $\bar{c}$ slow speed and reduced loads

Be sure hand holds are available and used - watch feet and don't slip

N.B. cue cards were compromised to pt. of inadequacy

Also reviewed H₂O separator - Rita R. removed Pontubes & changed out the strawberry drink bag which was delaminating - Warned crew about age & fragility of bags.

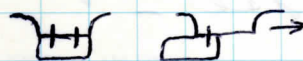
10 Mar Discussed v. briefly rationale of T/M $\bar{c}$ J.L. who agreed to try to get any ancillary data possible -

Items requested were:

- Heart rate ~~was~~ before & immediately after T/M runs.
N.B. pulse counting is not possible on T/M so must be done in first 10-15 sec. $\bar{p}$ stopping.
- T/M speed - count 10 passages of tread mark & time
- Record Force strap settings
- Measure leg size pre/post T.M. runs

11 Mar STS-3 Fit Check

~ 3/4" interference c H₂O tank cover - ample clearance on off end.



12 Mar - slipped T/M to next screw location i.e. use a single screw c stiffening clip on one end. Fit chd. in Shuttle today by K. Sullivan.

15 Mar - This was accepted by PRCB today. Plan to be at ~~area~~ Cape at inst-F-22.

16 Mar STS-3 T bag

Leg size -
Heart rate -
Tissue tension -
Height

Any of the following would be most valuable for future missions:

Comments ^{on} & documentation of treadmill use -

Total time used & when

Speed, estimate - if ~~time allows~~ possible the stopwatch time for 10 revolutions i.e. ~~start watch on time by~~ red marks

Force on bungees - i.e. length of force belt between buckle & harness count pulse at rest for 30 sec.,

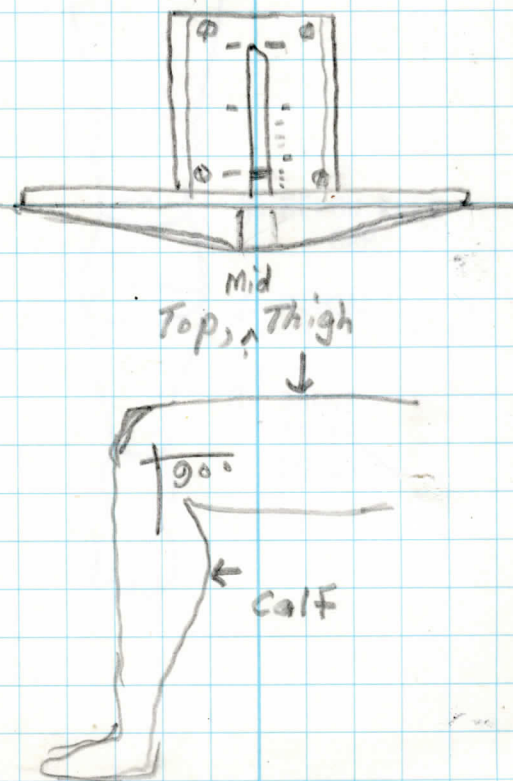
Heart rate - after ~~see~~ walking/jogging for several minutes at a given rate stop and immediately count pulse for 15 sec. -

Change in leg tone - before & immediately after exercise

Push the plunger against the muscle of the ~~c~~ until both sides of the foot plate just touch the skin red line on the

Read/record the scale shown; ~~a couple~~ of repeat readings are desirable

^{measure} Before and after a treadmill ^{run} or other exercise choose a points on the leg as shown, and measure as above at the before & after exercise



STS-3 T bag contd.

Leg girths before and immediately after ~~HAA~~ use
exercise -

With the leg straight, measure &
record the girths shown -
numbers are priority - mark &
use some landmark to insure same point

3

ANY OF THE FOLLOWING WOULD BE VALUABLE FOR FUTURE MISSIONS:

COMMENTS ON AND DOCUMENTATION OF TREADMILL USE

TOTAL TIME USED AND WHEN

SPEED, ESTIMATE - IF POSSIBLE THE STOPWATCH TIME FOR 10 REVOLUTIONS BY RED MARKS

FORCE ON BUNGEEs, i.e., LENGTH OF FORCE BELT BETWEEN BUCKLE AND HARNESS

HEART RATE - COUNT PULSE AT REST FOR 30 sec AFTER WALKING/JOGGING FOR SEVERAL MINUTES AT A GIVEN RATE STOP AND IMMEDIATELY COUNT PULSE FOR 15 secs

CHANGE IN LEG TONE - BEFORE AND IMMEDIATELY AFTER EXERCISE

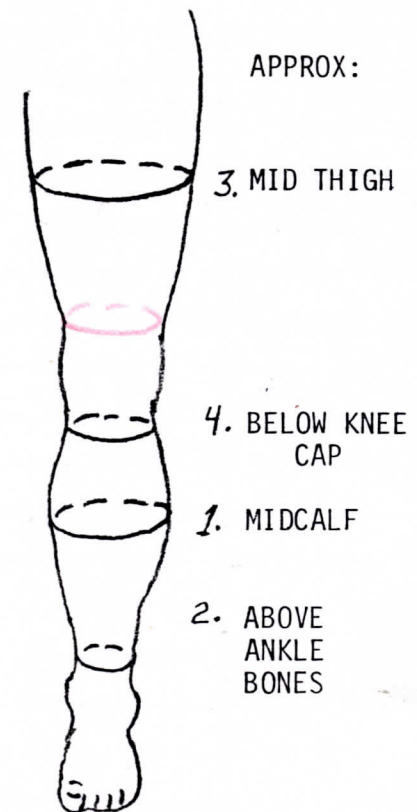
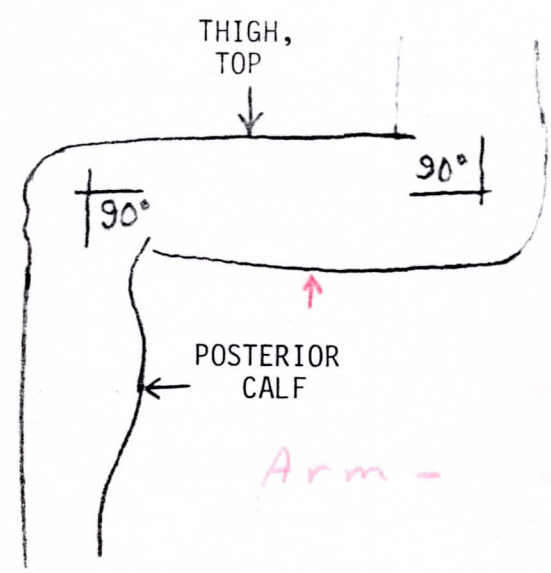
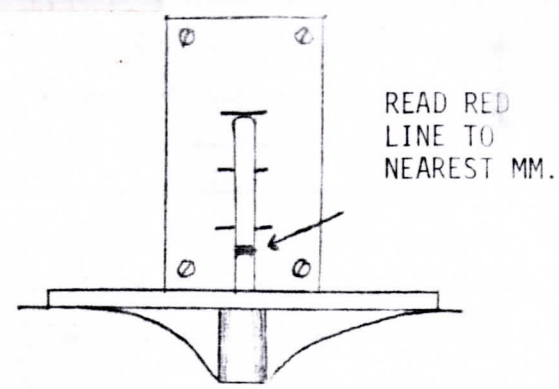
PUSH THE PLUNGER AGAINST THE MUSCLE UNTIL BOTH SIDES OF THE FOOT PLATE JUST TOUCH THE SKIN

READ/RECORD THE RED LINE ON THE SCALE; REPEAT READINGS ARE DESIRABLE

MEASURE POINTS ON THE LEG AS SHOWN

LEG GIRTHS BEFORE AND IMMEDIATELY AFTER EXERCISE

WITH THE LEG STRAIGHT, MEASURE AND RECORD THE GIRTHS SHOWN - NUMBERS ARE PRIORITY - USE SOME LANDMARK TO INSURE SAME POINT



Height -
4's for 4

Osc. ————

21 Mar 1983 Summary

Put T/M on 3 at 0400 today & difficulty p. chg. it in clean room. Stiffner in place, governor operates well and unlatched & difficulty. Also meas. lengths of ladder in place. See STS-2 for data

22 Mar. Nominal launch $\approx$ 1 APB shut down for $\uparrow$ temp. No apparent difficulty $\bar{c}$ T/M on L.O.H. door.

23 Mar.
Summary
1830

Light has been nominal but Jack noted vestib. sx. at 0 M5 burn, was quiet & sx. for 3-4 hrs. then developed sx. $\bar{c}$ vomiting at suit daffing & retired to quiet tasks $\bar{c}$ Gordo doing active ones. He has apparently worked & difficulty although T/M was cplx. as was a suit exercise. Late today a port aft bulkhead latch jammed during a closure test (after $\uparrow$ temp. exposure?) A number of tiles on the upper nose ^{tile} are missing - $\bar{c}$ latch flap, which will require EVA & return if not cleared, there will be no T/M.

Comments on Jack's vestib. prob. He is particularly resistant to motion sickness in 1 g, but susceptible to 0.G. flts. and was quite sick for 3 days on SL-3. He 'conditioned' himself vigorously preflight by flying sets of 5 rolls $\bar{c}$ head rotated 90°, rolled level and back faced forward. He was doing 100 (!) sets of these p. flt. They planned to use Scope. dex. & apparently did.

24 Mar.

Gordo apparently has significant low back pain. Recommended cautious T/M trial but neither used it at scheduled time today & only Jack is scheduled for this P.M.

1905

No word on T/M. J. Logan feels they elected not to use it today because of vestib. prob. & will push for its use tomorrow.

25 Mar.

Day 4's sched. was substituted for yesterday's day 3 sched. but the T/M was not used ($\bar{c}$ to vestib. upset?). Day 3's sched. is being used today $\bar{c}$ only one exercise period. This leaves a ^{max.} total of 05 x 15 min. periods, one of which is set up and one for PAO.

Discussed $\bar{c}$ Crip. who is concerned about lack of meals, etc. and assures me he is trying to keep time available for exercise but that it is ultimately a crew option to use.

Mar 26

STS-3 Treadmill

PAO did not reinstitute the T/M shots but a crew were queried about use and said they had not previously felt up to it but would use it & apparently tried it in A.M. with difficulty - Crew called down good msg. on H_2O separator. Apparently up to 10% gas was present in earlier beverage H_2O containers. NB Why wasn't it used? Wanted to use drinks? Called Whitmore & discussed a pon tube valve for complete elimination from present/planned containers.

27/8 Both crewmen gave T/M a solid trial yesterday²⁷ and reported:

1. Jack shook the cockpit using it
2. It worked well
3. One can work up a sweat
4. It can be used 'hands off'

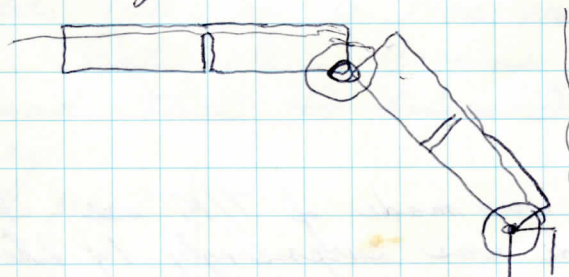
It is only scheduled 1° today for Jack.

Why wasn't it used on a regular basis?

29. Future Mods.

1. Need to reduce height & increase length + width (desirable to mount flush)
2. Reduce shock to S/craft
3. Modify speed control curves
4. Add instrumentation
5. Reduce noise

1. Height is function of belt flexibility. This implies smaller transverse links. A combination of transverse steps and connecting belt might be considered. N.B. This will also absorb some impact loads.



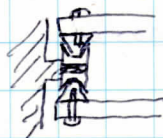
current layout



Another possible arrangement is the Woodward scheme.



'V' belt



Ideal -

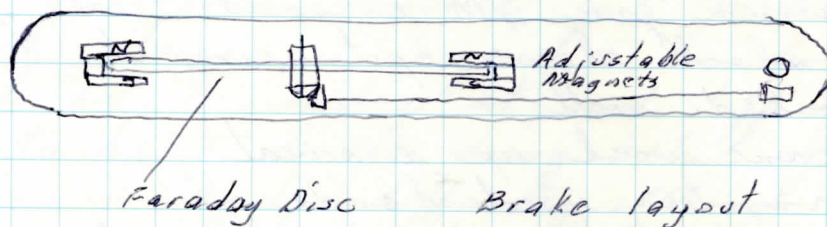
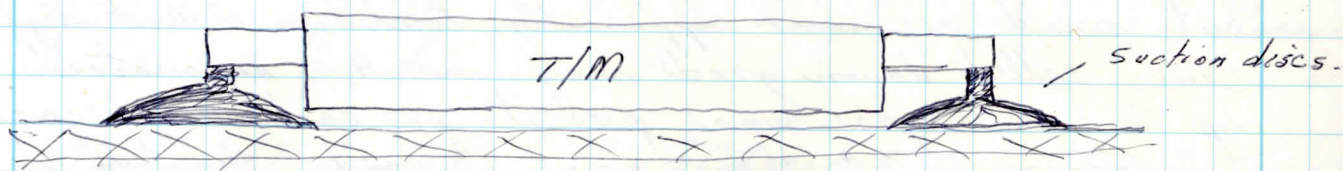


Floor, wall, ceiling, etc

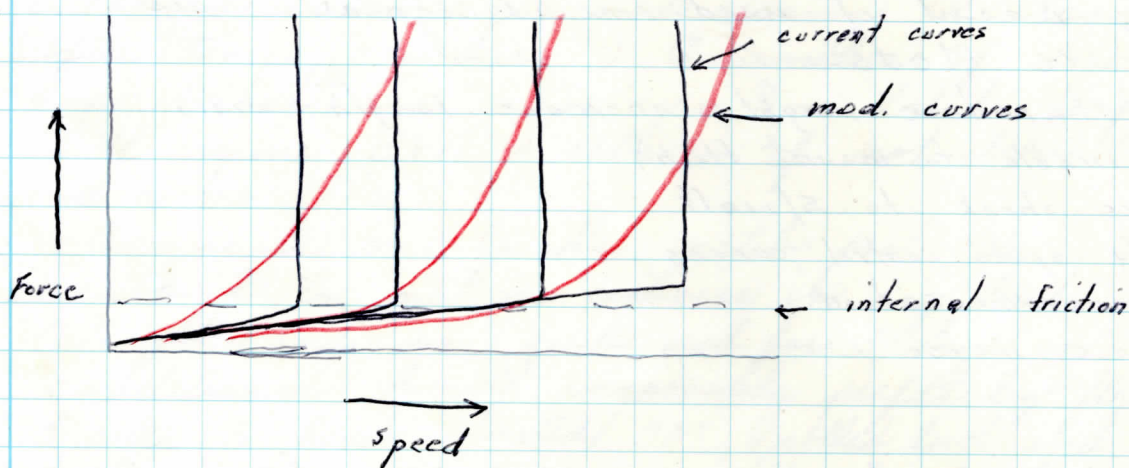
Stock Mountings

contd.

29 Mar. T/M Improvements cont'd.
Alternative
1, 2



3.



6 Apr. 82
T.M. Use

Apparently only 16 mm. & VTR? were made of T/M use. Although steps were short ~~stride~~ stride was surprisingly 1g like complete $\bar{c}$ arm swings. Ant. bungees were too close and only $\sim 1/2$ of tread was used. Starting transient was obvious $\bar{c}$ crew leaning forward to start. Photo arrangement was poor.

1 Apr. STS-3 crew condition -

S.P. felt were in good condition equiv. to STS-1

Wt.	Cdr.	Pt.	$\bar{p}$ Flt	B.P.
Pre -	204 1/2	164		
Post -	200 1/4*	157 1/4		
$\Delta\#/\%$	4 1/4 (2.1%)	6 3/4 (4.1%)		
* this was after 1qt H ₂ O ~ 1 L = 2.2#				
or Δ	6.45 (3.2%)			
			Lie	120/90
				120/80
				140/82
				118/84
				110/82
			Stand	120/100
				120/76
				110/68
				104/72
				102/68
				104/70

1 min.
2
3
4
5

C.B. says crew is sore (joints) and has some instability (vertigo, neuro. muse.?)
J.K. talked to Gordo, noted rail dependency in climbing steps, who used T/M twice, 10 min. ea. and felt it was operationally satisfactory

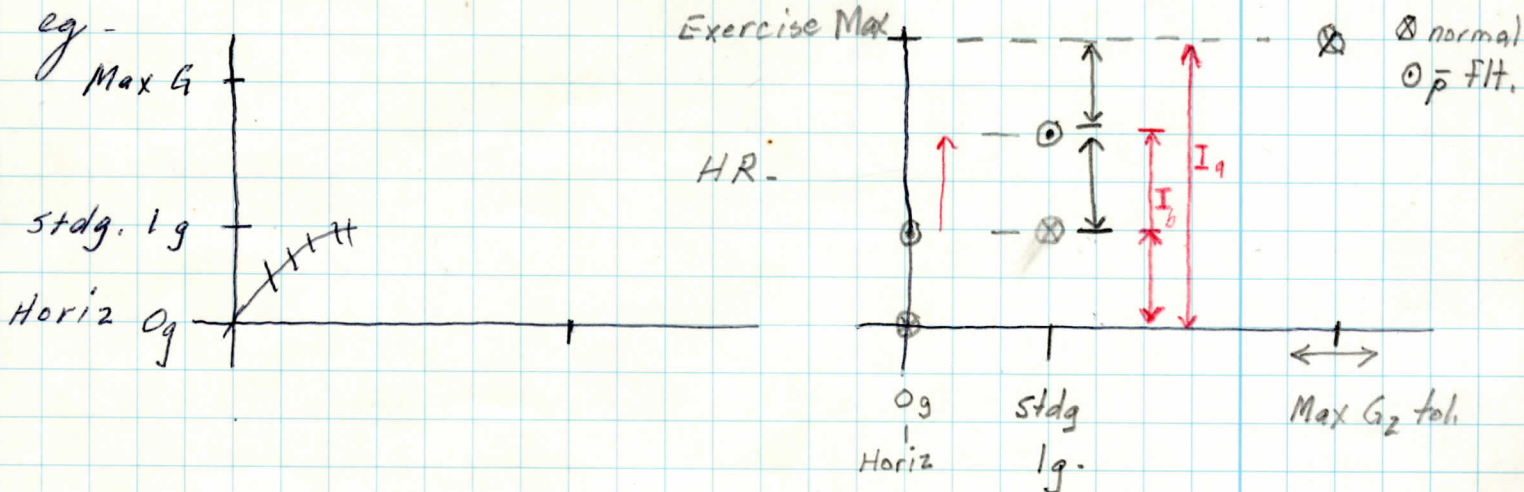
B.F. said crew felt very bad on reentry in spite of inflating G suit through out entry.

Jack R. said suit was 'loose'

Mike B. - Crew inflated suit 6 mins. prior to entry I.F.
Jack ingested 1 qt. fluids prior to exam and Gordo, an unknown Jack's suit was press. to 1.5# and Gordo's higher.

Std. - H.R. as G load indicator.

Rationale - Assume exercise H.R. max. is true max. and that $G_{tolerance}^{H.R.}$ is related to max. G load.



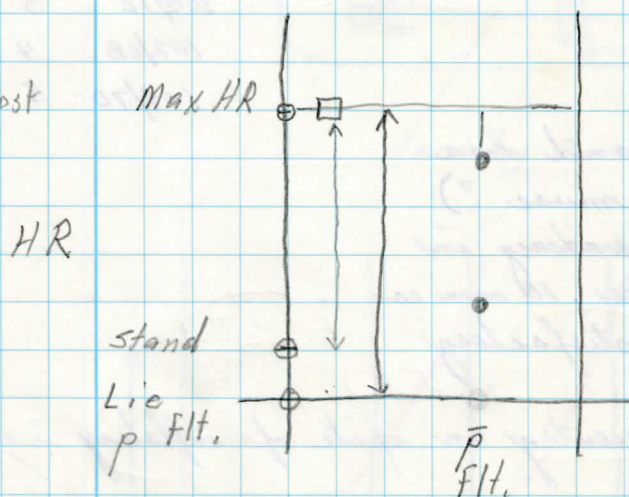
11 Apr.

G Loads & H.R.'s

6

Assumed
 Abs. Max. (EX.)
 Stand
 Lie
 Pre Post

If one simply takes ^{individual} max. H.R. as determined by max stress test and assumes that this is also max which can be reached $\bar{p}$ flt. (this will break down at 10-12 days - i.e. max. rate will not be reached before sx. or syncope) and assumes G tol. is inversely related some indication of reserve tolerance may be obtained. The exact relation of orthostatic stress is unknown.



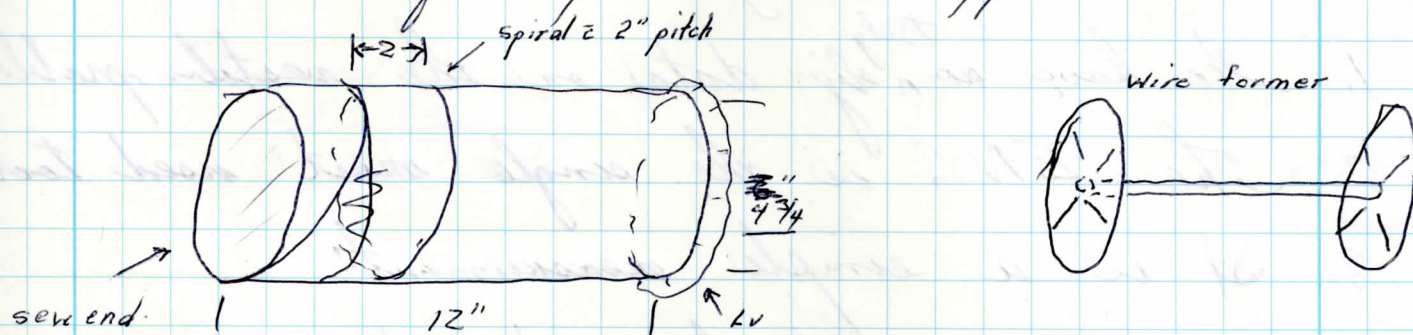
STS-3

CDR

PLT

Time

6 Apr. '82 Test sect. for improved LBNP apparatus



Carried ~ 1 yd. of suit mtl. to La Marque Fabric shop and we agreed to above

STS-4 -

Ony. says sp. is avail. for a number of ~~exp~~ pieces of hdwe.
mtg. today $\approx$ + J. Day -

At this point the two most pressing areas are:

1. Fluid shifts; magnitude, distribution + location, countermeas.
2. Vestibular; identification of mechanism + any obj. data

Fluid shift;

Magnitude -

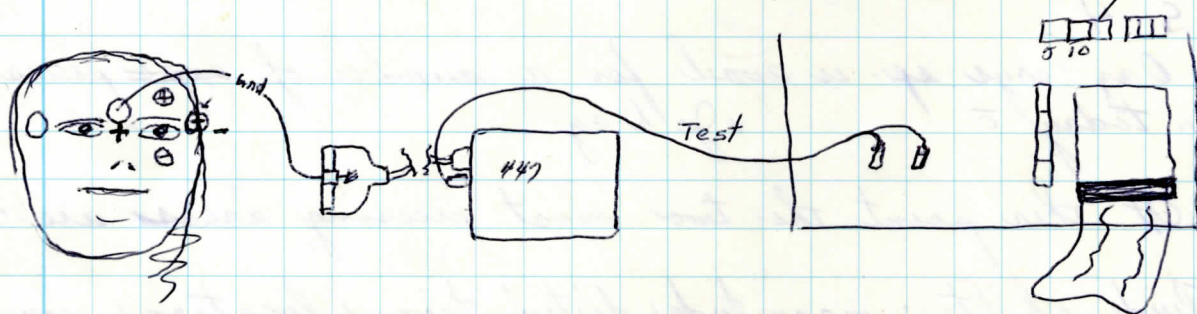
10 Apr. Vestibular thoughts -

1. We have no ^{truly} obj. data on the vestib. problem
2. The ENG is the single most used tool
3. It is a simple measurement
4. An EKG recorder has adequate response? gain
5. Use onboard EKG, & pre amp if necessary

12 Apr.

Feasibility test of EKG for ENG

A DMA 447 & 660 A recorder were set up as below.



The following demonstrations were made:

A single bitemporal lead was arranged and recordings made as eyes deviated stepwise and as eye blinks.

Both the eyes were next connected.

As expected the 2nd channel was noisy -



Horizontal & vertical leads were connected as above and a variety of maneuvers were made including ~~left~~ motion up & down, R & L, reading etc.

9 Apr.

Looman,

La Benta Pool ?

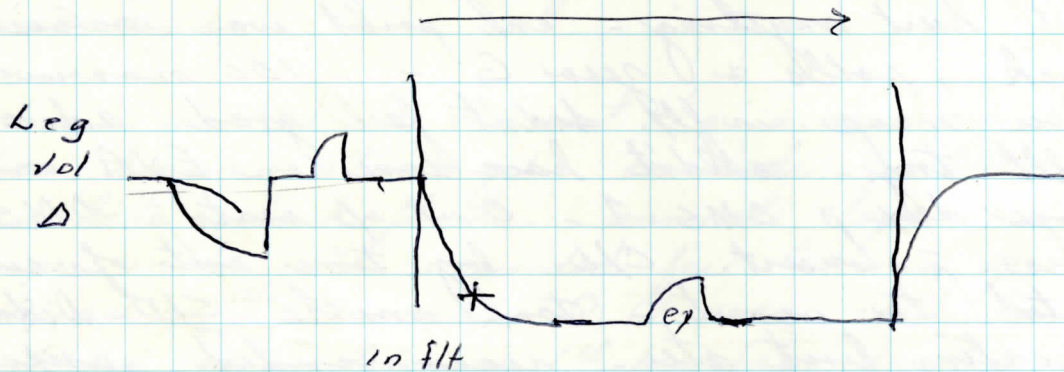
Exercise / T/M -

Veh - integr.

Instrumentation

• 243's
manp. & money

Documentation:



Discussed all plans w him including; exercise update eq. T/M revision, carry on experiments in fluid shift, etc. and exps. in leg pressure & LBNP.

5 TS-3 Debriefing 12 Apr. '82

'Sit up reentries are not bugaboos that medics said - 54
'Crew were in better shape than Crip & I'.

Jack L. Upbeat, "no sweat". Gordo - M.S. concept is correct.

" " Cut off DTO's early Official FOF didn't keep up.
Gordo - Caught bad cold in middle of quarantine -
used contam. headsets, etc.

G. T-38 vestib. 9 OD 3 hrs P/L aileron rolls,
9 in row, reverse, inv. flt. great variation in tol.
can't hurt anything - end point was malaise -
Jack, rolls & zero G - 100 maneuvers & quit.
Never incapac. in flt. didn't feel good - advocates
preflt. trng. - couldn't have done on EVA on 2
Scope dex p OMS 1 - Out of seat p OMS-2
3 hrs. p insert. C/L by time out of suit
wanted to vomit - took another S/D. Didn't feel
like eating but ate - recommended soups & broths.
Able to finish 2^o day - but didn't move head
3^o day 1 S/D & began to eat - Should have
forced EVA on 4th day - 3 S/D. on day 2 -
S/D may have helped but took 2 hrs.

Gordo - Did not want to move head rapidly - never had
clammy or sweaty stomach awareness - took S/D. p
OMS 1 & 9 4 Hr. No appetite, drank liquids - 1 night
no sleep, 1 warm then cool, couldn't locate head -
felt rotten on 2^o day took S/D., no food 'shot'
afternoon day 2 - back pain - coryza - ops. failures
caused depressions - wedged head in corner & toes
feet in holes - 4/5 hrs. Jack slept loosely -

J. did not have sweat, clammy or vomiting was sudden

G - back pain, unusual bed in crew quarters - felt
he strained back on theodolite - 'GI tract quit'
day 3 ate lots of food - momentous events defecation
lots of gas
J. had gas also

Ascent - Something struck windshield - APU shut down -

P/L ops. Accidentally bumped plant growth exp. switch. Exp. procedures
are not common in mini. computers

G - 1 ECM + 1 insect were not properly briefed

Moths - flutter randomly

Bees - bees were ant control

Flies - walked

cage was a mess

H.P. was useful on waveoff, want a world map & AOS/LOS inadequate tools - G used CASIO digital watch

Shutless inken mandatory batta < day

Amb. noise 'not bad' but diverting at night, need more foot restraints

R.M.S. 6 outside cameras + 3 failures, T.V. monitoring is time consuming -

Habitability - doors worked in w, not 1g & r.v. on last flight
two hours storage - commode failure, slings failed -
never had a back flush. manual ops - urinal clogged -
tissues inadequate - crowded for 5 man ops -

EM/ - even on GC 1-2 scgs. Q 14 scgs could have been on wireless
< 10% gas in H₂O on 1st few bag. direct voice is not pract.
comm -

G - never used window shades glasses ~~to~~ to avoid glare

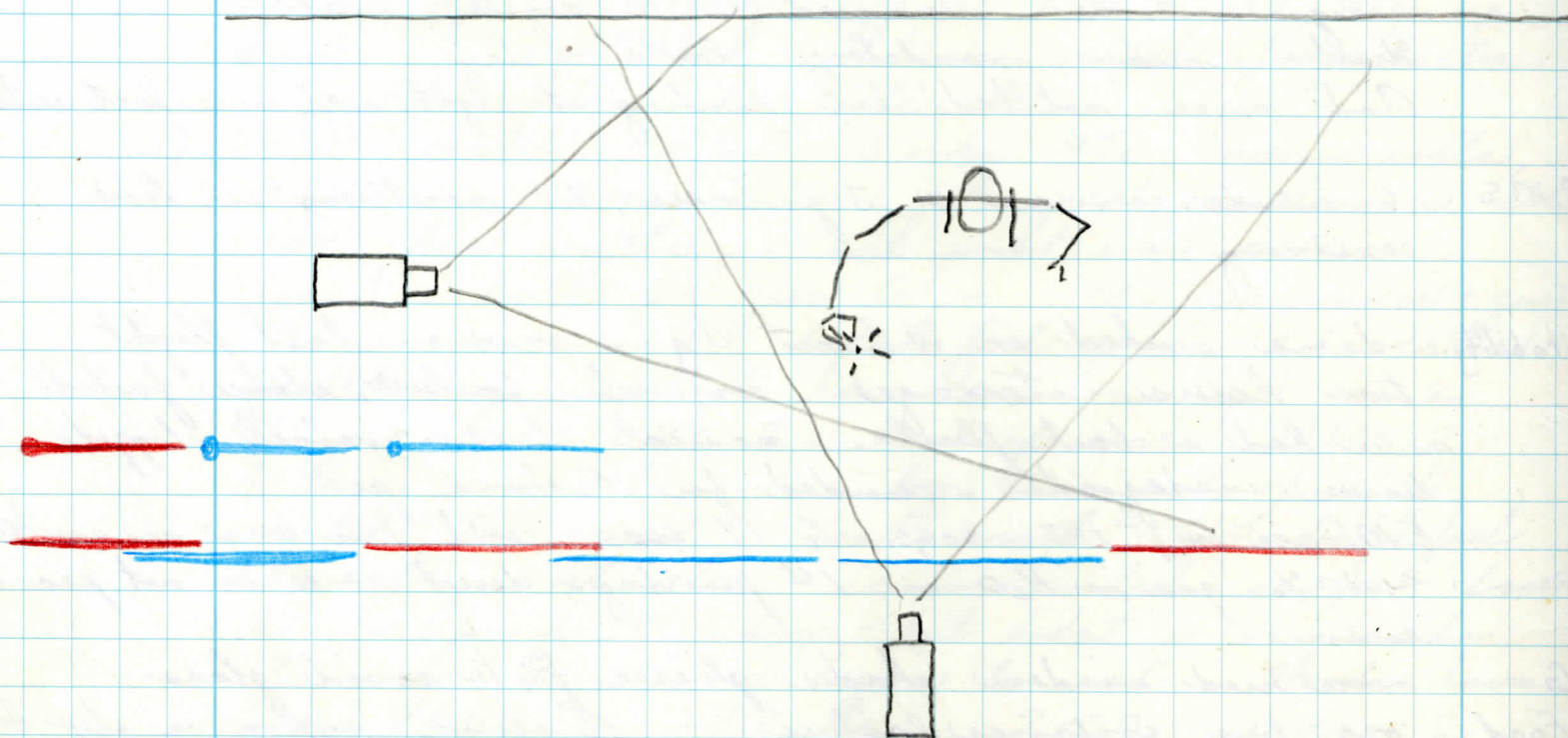
Food - occ. bev. containers failure - new system is step back

Reentry deorbit prep. - 6 hr. saw amorphous glow thru windows
pink → orange → white during dark - M-3 produced noise/
J. vib. from control surface (?) buffet at M.R. → 0.7

Both used g suit 2+ # G + 1.5 # for J. didn't notice -
1 g. felt like 1g - during flt. G felt heavy & unstrapping
stood up felt heavy - lack of equil. 2 days - J. sore back
tired few days - G stiff & sore

12 Apr. '82

After freq. discussions w Dolan & the following scheme is proposed as a test.



For range of motion a pair of cameras at rt. angles may be used, w some loss of coverage, if synchronization is present. In this case the synchronization is provided by a coded light. This code could take several forms but will be discussed in detail as required. In addition to the above calibration & reference will be required eg. a known distance calib., a reference and fiducial marks.

31 May -

A prelim test is set for 1 May. and I am to supply the lights. After cursory exam. of a variety of 'codes' will use or examine a simple scheme of a recurrent strobe w another color every synched at a slower rate. eg.

Shutters will be open 2-3 secs. and will try a rate of 5 Hz. for strobe and $\div 4$ for slow lamp.

Do not have needed components and stores are closed. Initially tried neon bulb relaxation osc. but characteristics are too unstable & 90% bath. may not be avail.

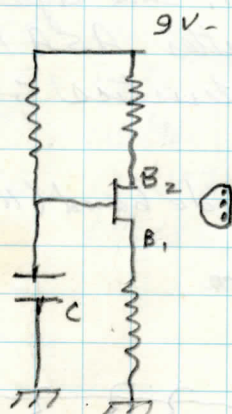
31 May Coordination light, contd.

miniature relays and incandescent bulbs are possible but don't have bulbs or characteristics.

Only have 2 ea red + green LED's and will set up a relaxation or monostable osc.

R/S had ⁵¹⁰ flasher LED. Slow poor output. Obtained some "flat" LED's.

MOT
MU 4891
RS-
276-2029

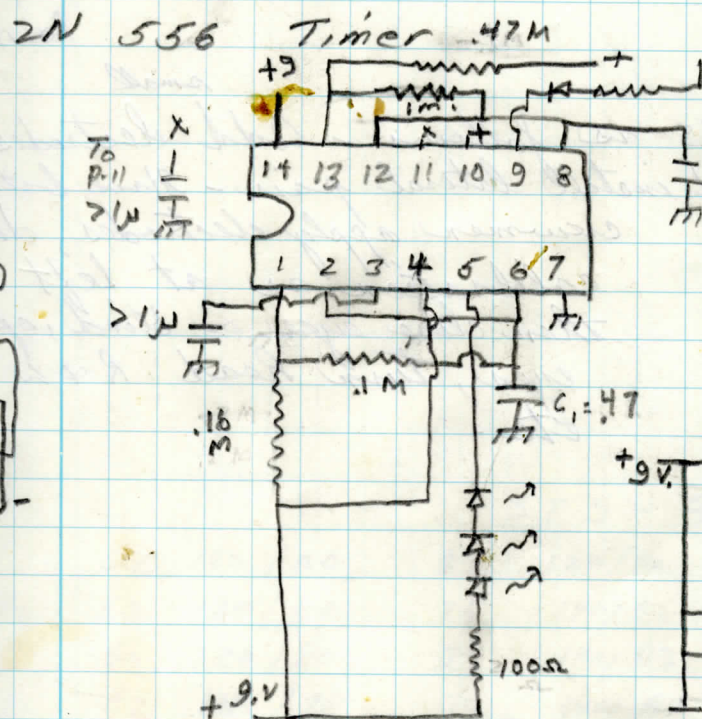


Discharge is very fast.
would have to stretch.

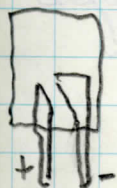
By adding cap. to C, flash
was stretched but still short

$$t_g \approx 20\mu \times 10^2 \Omega (\text{est}) = 2.2 \times 2 \times 10^{-4} \times 10^2 = 4.4 \times 10^{-2} = 44 \text{ m sec}$$

510/9.00

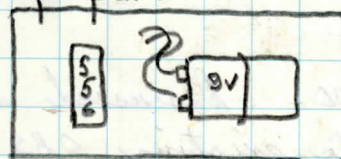


LED

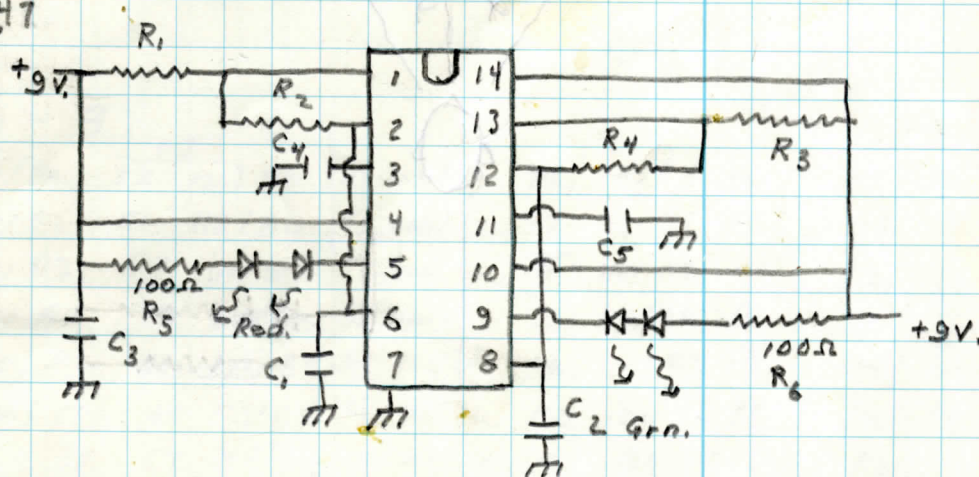


10.3/1 sec
10.10-3/106
10-2

Const'd. on P.C. Bd.
Red. Grn.



Final Configuration



Free
Running

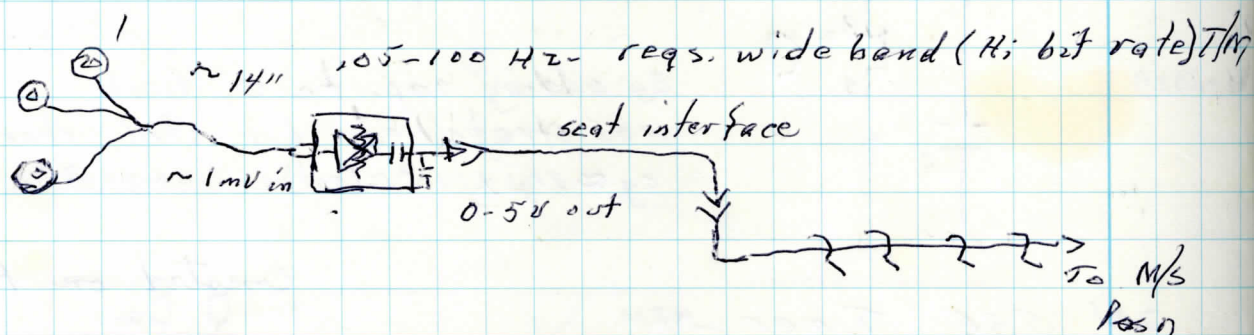
This is intended as a first run test of concept. May have to use more sophisticated light or code.

142 Jun Spent 2 sessions c B. Wolford &

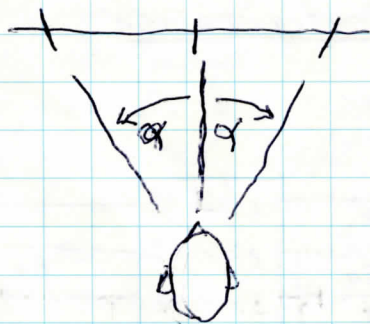
on making 1A sys operational

14 Apr.

Mtg. c Pool, Buogo
 Buogo 0800 - Exchanged data on STS-3 flt.
 Pool - ~~Ex~~ Gave him T-43 on personal monitor and
 on improving T/M, discussed simple procedures &
 my ideas on vestib. sys. is. use of existing OBS for EOG
 EOG SP. recommends that I continue unofficially - data
 collection as possible and that we will share data. He was
 enamored of two ideas, the leg vol. stocking and use
 of the OBS (EKG) to meas. EOG. He agreed to return
 at 1500 to discuss implement. of latter ASAP
 Current OBS has following characteristics:



1500 - Discussed use of OBS as follows - Add ^{small} electrodes
 to existing OBS kit and install lateral pair - Have both
 crewmen apply electrodes, do
 calibration as at left
 then close eyes or blind, open
 eyes, turn head R & L
 etc.



14 Apr. HR/ BP Data STS.

STS-1 - Stand

Cdr

Pit

Time	Pre F-12		Post		Pre		Post	
	HR	BP	HR	BP	HR	BP	HR	BP
F- 1	57	137/86			56	144/89	5	
2	49	133/86			53	150/89		
3	47	137/87			53	140/89		
4	51	127/88	81		56	140/69		
5	55	136/86	81	120/80	58	140/69		
1	65	119/96	104	110/80	60	140/69		
2	71	119/96	118	120/90	68	130/86		
3	69	131/107	116	110/80	67	140/89		
4	69	145/92	116	110/80	68	150/89		
5	73		119	110/80	71	160/89		

STS-3

				+3								
1	52	120/80	82	120/90	52	120/80	51	100/70	79	118/84	52	100/70
2	52	120/80	75	140/82	50	118/84	51	100/70	77	118/84	58	107/80
3	50	120/80	77	140/83	52	110/84	52	100/70	75	110/82	55	112/70
4	52	118/78	76	140/82	49	110/84	53	100/70	76	118/80	58	112/70
5	51	118/78	77	140/82	51	113/84	53	100/70	76	116/82	58	106/70
4	60	100/80	91	120/100	63	113/84	67	95/72	100	120/76	73	116/90
2	66	105/80	109	119/88	67	98/88	65	100/70	125	100/68	72	116/70
3	68	105/80	119	119/88	69	110/90	67	95/70	131	114/71	72	120/70
4	70	105/78	123	119/88	110/90	60	100/72	137	112/68	74	118/70	
5	70	105/80		120/100	129/100	53	110/72	137	114/70	78	114/70	
									111/76			

Max HR 178
87Max HR 180
Sep 80

Cdr. STS-3
F-22 Rec

PLT

Need
G loads
Max H.R.
John, Crip,
Joe, Gordo

	1	120/78		120/90		
	2	76 " / 74	115	118 / 77	55	79
Lie	3	75 " / 77	108	116 / 75	52	78
	4	79 118 / 79	103	112 / 77	54	79
	5	81 " / 81	103	114 / 74	54	79
	6	77 " / 77	95	118 / 76	57	81
	1	86 121 86	106	120 / 72	60	-
	2	80 120 85	105	123 / 73	60	-
Sit	3	79 124 84	105	124 / 76	63	86
	4	81 122 81	110	116 / 77	64	90
	5	86 122 86	112	118 / 73	66	89
	1	92 118 92	118	90 / 71	67	85
	2	101 101	126	112 / 62	73	112
Stand	3	102 102	122	113 / 76	71	115
	4	101 101	90	- / 72	70	111
	5	105 105	83	- / 72	71	111

dizzy, pallor
Liedown

Time	HR	G	T	HR	G		
- 38	120	0	-19	119		0	1.0
37	120	0	18	119	1.0	+ 1	
36	116	0	17	119	-	2	
35	126		16	121	1.34	3	
34	132	0	15		-	4	
33	130	-	14		1.6	5	
32	121	0	13			6	162
31	125	-	12		1.42	7	174
30	143	.06	11			8	
29	134	-	10	165			
28	124	.24	9				
27	118	-	8		1.2		
26	115	.3	7				
25	115	-	6				
24	118	.4	5				
23	114	-	4				
22	114	.47	3				
21	118	-	2	158	1.3		
20	119	.8	1				

15 July - PRCB for 5 T/M

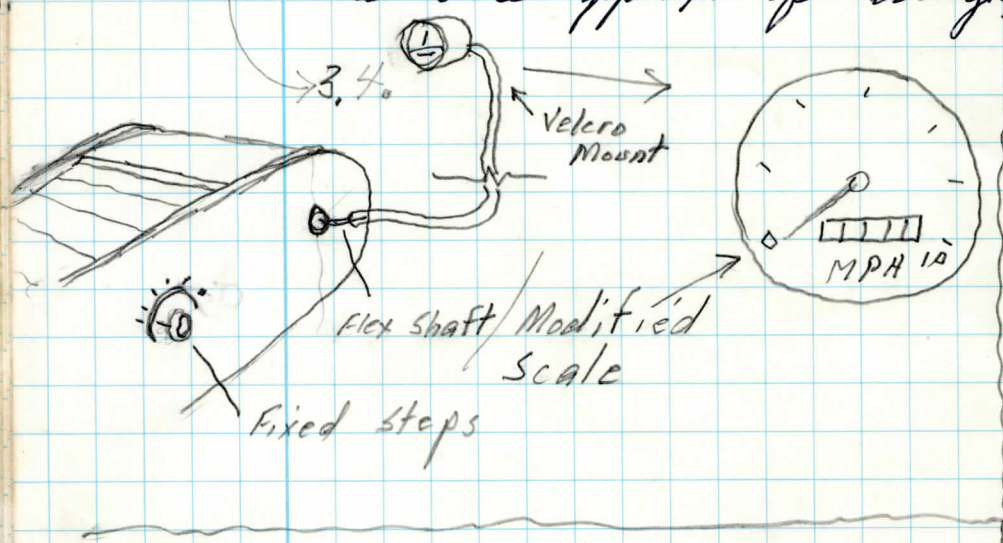
Supported strongly by FOD and others, except L/S & program ofc.
Directed to put on by Aldrich unless weight or other factors
intervene when it can then be removed.

13 Apr. T/M changes suggested -
Gordo: (Noisy)

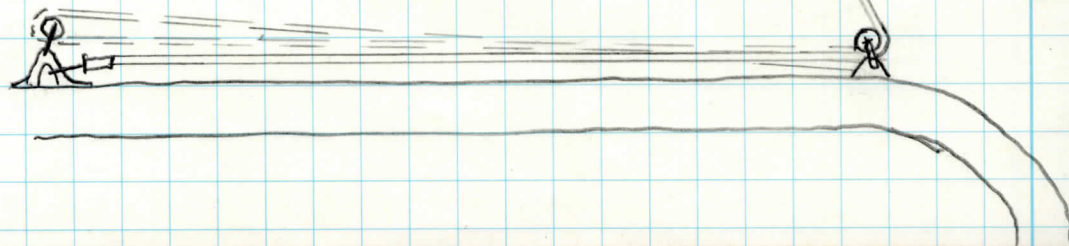
1. Add rough surface to treads
2. Give more room on ant. bungs (see note below)
3. Simplify speed control
4. Add speedometer, odometer, clinometer
5. Reduce change in rate of bungs eg.
6. Indicator for weight
7. Sl. harness ^{mod} 8. Pulse meter

Solns. comments -

1. obvious
2. ILC has plans to add ant. outriggers. A larger force (F_2 , left) would require a smaller angle α
3. Make a simple step device
4. Put a bicycle odometer in shaft & calibrate it
- 5, 6 A longer bungee will be used and this will allow a close approx. of 'weight'



This will provide a
2+ decrease in Δ rate.
A 3+ decrease can be
obtained by folding
the cord again.



STS-4 T bag

1. Water-gas separator - better photos - cine

2. Treadmill

Operational use - X 2 day, 25 min.

Documentation - T.V., 35 mm - , Lat. T.V.

Speed, time, mileage, H.R.

Leg size, tone

3. Anthropometric

Legs, biplanes

Body, "

Height - initially, post TM and pre-entry

4. Anatomic

Percussion, photo

5. Dynamic

Eyes - cine

Acceleration

ROM

6. Explor.

Mtg. c. 5 days, Kathy + on T/M chgs.

DMA

1 ch-

5 3/8 x 2 3/4

x 1 3/8

They have done study on extending bungees and a 3 cord model has a % variation over ins. Agreed to a nominal "int." of 150# and to a modest extension of cord attach points at ant. end. The water tank has been moved so we can reverse the T.M. for documentation.

Final-

Part 67

Av. Med. Std.

67-9

Fed Apr 15

EFF May 17

ILC purchased two Sears pulse meters; one a combine tachometer-odometer. Both used a heavy car pick up and as expected were sensitive to jogging eg. apparent rate was ~144 jogging uphill (~4.1 MPH) but dropped to ~133 when walking at same rate. Impossible to accurately count pulses on T/M at other than slow walk so will have to do EKG's.

Tachometer fluctuates eg 1.7 MPH 1.6 → 1.8 = wider fluctuation at ↑ speed.

May 17

67-9

13, 15, 17

C. Baaher

30 mg

50 mg

6 May - Mtg. c. Crew, Pinky, Coats.

40 min - day 3-7 -

M AP

3. Com H. Dis

req R

Symptomatic

Lo. Cue Card as is

Stow | Bungees
on T/M | Harness

Archer

Paul

Presented plans for exercise on 5/4 and it was agreed to use schedule above vs. 2x/day which interferes c. ops. Support crew directed to maintain schedule. No record will be made of use except informal, personal record for me. I need HR, speed & distance. Discussed use of Sears tachometer 564.2917 and Ken will use it if it can be launched in place or stowed but wants to save stowage. He is working EOG & will try to use onboard system.

19 Sun. (Personal time) Pulse Rate Monitor

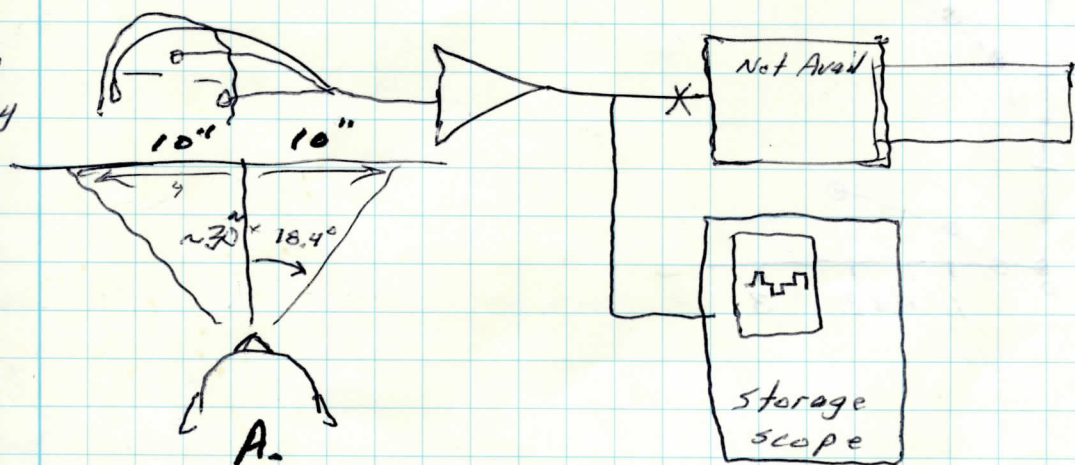
Pulse Input Limits 50-200 B/M

EKG - level .5 - 5 mV

QRS Component - Hz



6 May
@ J. Day



Tek
5403

45 V div - ckr 0.4 VPP input -

Ampl. of A. 0.45 V $\overline{I}$

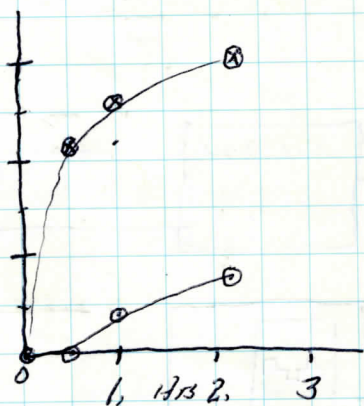
20 May - Briefed Tk. and D.T. on above and D.T. talked to G.A. → S.P.
All agreed to do but S.P. wants to add something of his own.
Will write brief description to D.T. and have mtg. @ S.P. at 0930
tomorrow. This must be a demo, only i.e. as simple as
possible -

(contd. P-120)

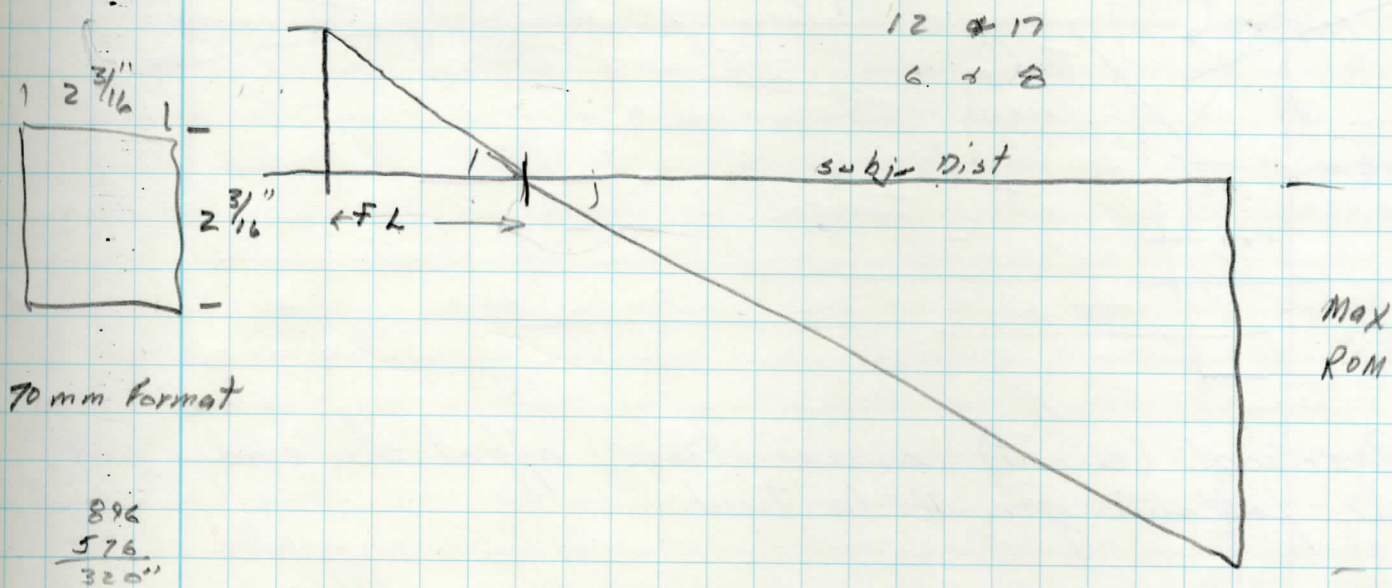
6 May - Lk. out of respirator[®]

Set up and wound smallest band around calf X2 & read consistent $\Delta \bar{c}$ pumping, stdy, etc. put 3 turns on ankle & noisy, drifts back to calf -

Time	Cond.	Mtr	Stability ch -
30:30	st, ret.		loosely wrapped
31	"	0, 0	two sm. adult
32	"	- .14	sensors around
33	✓	- .50 imm - 2.00 $\Delta = 2$	a towel phy. & guard.
34	"	- 2.50 slow.	R+B. Abd.
35	✓	- .58	2102 -.02 .05
37	"	- .58	2132 +0.01 +1.10
37:30	✓	- 2.52	2203 +0.22 +1.34
38	"	- 2.76	2315 +0.41 +1.55
38:30	"	- 2.68	* 2320 -1.36 -.54
39	"	- 2.52	** " .47 1.87
40	"	- 2.70	
40:10	✓	- 2.27	
40:30	"	- 1.53	
41	"	- .80	
41:30	"	- .55	
42:00	"	- .50	
43	"	- .45	
44	"	- .44	
44:30	" 10 max constr.	- 1.24	
45	"	- .70	
		- .68	
47	std, 3 wt.	- .60	
48	" " "	.00	
48:30	↑	+ .30	* reversed xducers
48:40	pump 10	- 1.05	** original
49:30		+ .80	
49	pump 10	- 1.36	
50:30		+ 1.05	
51		+ 1.12	
	4/5 s pump 10	+ 1.74	
	st	- .64	
52:30		+ 1.5	
53		+ 2.00	
	✓	1.72	
	✓	+ 2.0	

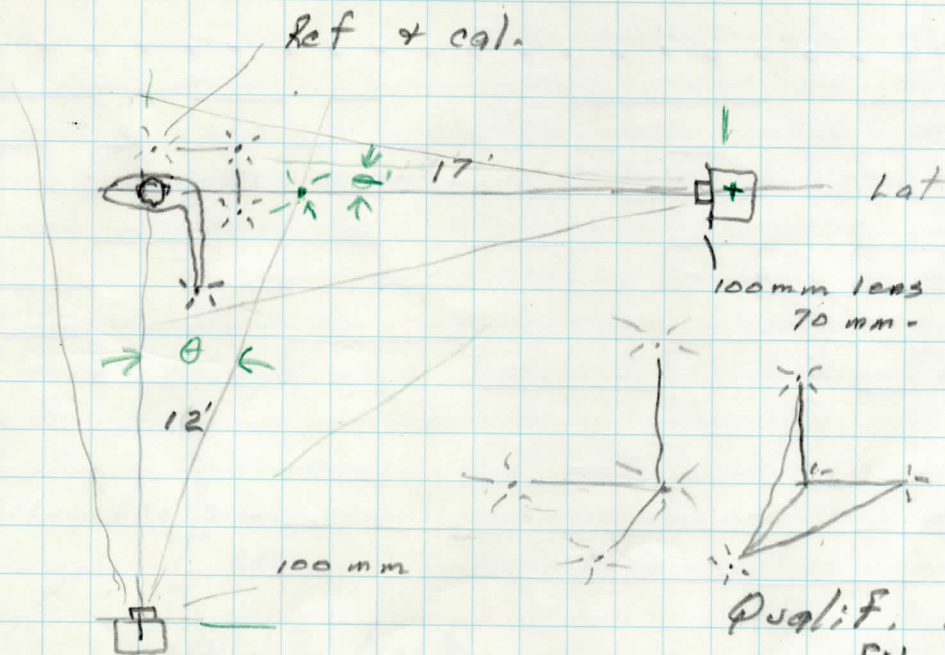


20 Apr. STS-5 Feasibility Tests -



896
576
320"

5 $\frac{3}{16}$
1" $\approx$ 62"



Vanguard

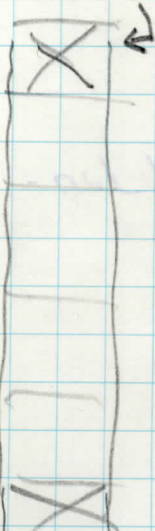
Intervalometer - & manual release

2-10 sec. exposures

Exps. 1.
2.

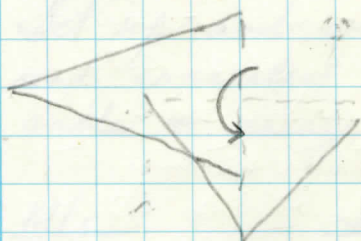
Find analysis unit -

Data Board

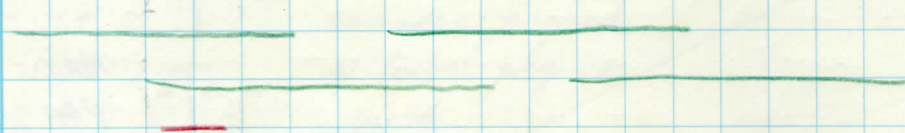


23 May Code light for Photo-synch

1. exposures are unsynch



t/c
...



Practical (circuit) considerations affect the code and the following will be tried.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

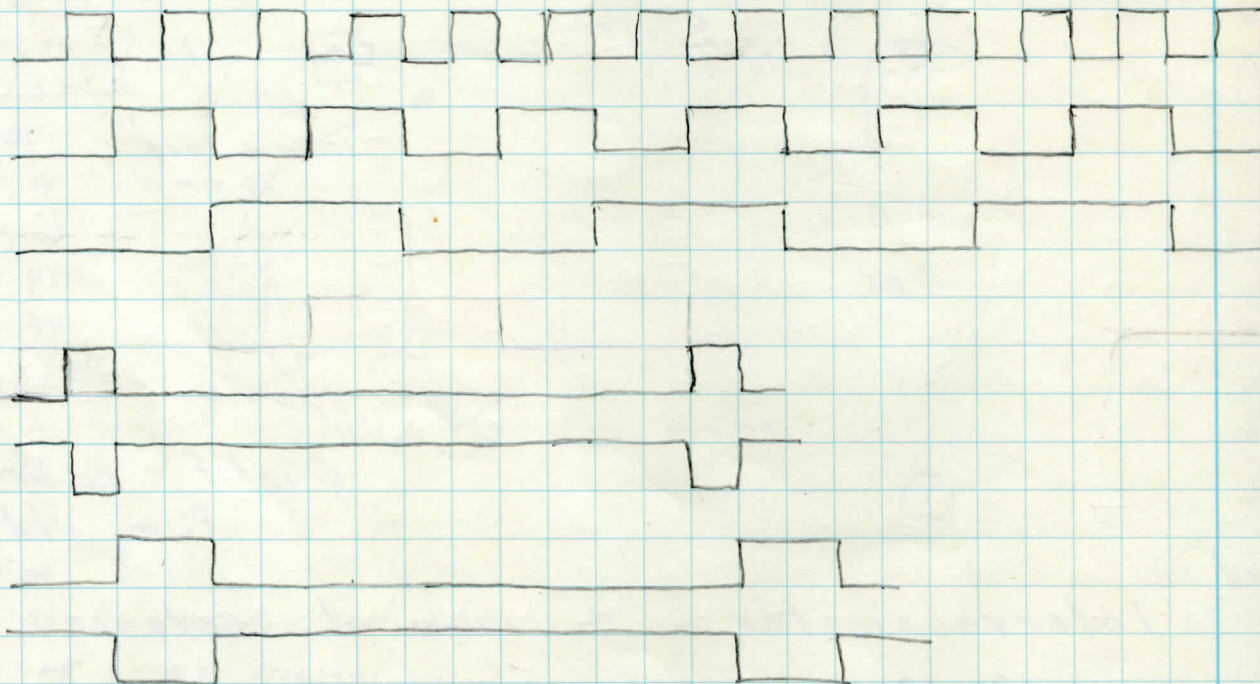
.....

.....

.....

.....

Usual Flip Flop



1 Jun -

See P-100,1
Photo lab tests of 1st Code Light, exposures -

11
22
3
4
5
6
7
8
9
0
1
2
3
4

13 July 82 TKM - STS-4

Reentry - during transition from night to daybreak - after sky was illuminated and 1st onset of g load overriding sensation of pitching up - went back to instruments - did not feel increase in G load from .2 to 1.8 G during maneuvers - agreed that he would fly HAC give to Hank, then to AUTO & back - flew perfect HAC entry turned to look at Hank and became completely disoriented - went back to instruments - near flare all ~~mo~~ pitch & roll motions were grossly exaggerated in perception (couldn't say whether somatosensory or central/vestib.) Had sensation of time compression and having to mentally squint. flew known attitudes / rates on instruments during final, only correcting laterally (these lateral corrections were perceived as exaggerated) - on rollout couldn't apply prescribed braking pressure (system or perception?).

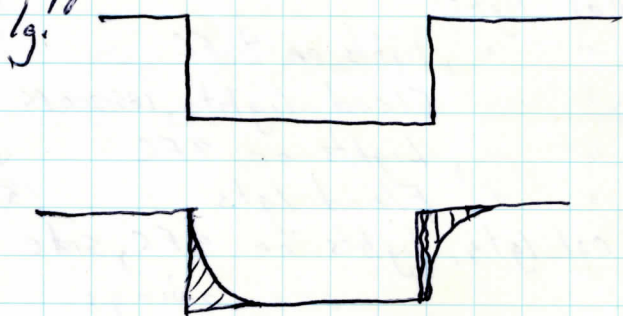
now did
Hank

Could not rise from seat 2 times was afraid to lean out of seat laterally - made a conscious max. effort and got out of seat - did every wt. was perceived as grossly heavy - did variety of exercises but still reqd. care descending steps - overcorrected on salute.

NB - Vdepl's
Kamberg,
past pointing
were normal.

Had difficulty when turning corner - reqd. ~ 2 days to adjust - NB. On orbit his senses were sufficient to detect thruster accelerations - did not have difficulty 1/2 bungees on TM - TK convinced that his g sensors became increasingly sensitive during flight & 'saturated' during reentry.

This places new light on problem - reentry probs. are now a case of senses adjusting to changing conditions & this is first evidence for reciprocal effects.



Is obviously a multi-faceted problem. (and vestibular) is only one element -

20 Mar.

✓

Memo to Terry outlining ops. procedures
 Call to Biggers & discussed proposed scheme. He had several suggestions which weren't possible under in or in STS eg. body rotation & caloric stim. and agreed that simple calibration, head rotation, eyes open-closed are the most that can be done.
 21 Mar. Talked to Sam Pool who agreed this would be a demo only i.e. would not complicate.

21 Mar

Fendell/

Rm 2022
Schmitt

Plugs in Panel-A15[✓] J-7[✓] or Cdr. PS Bio Med
 " -A11 ~~A~~-J-10 PIT. MS Bio Med
 mid deck

MO62M - 3 plugs J-2, J-1, J-3

Control R-10 S-13, 14 selects

Only Hi data Rate

Only 2 5 Biomed 162, 163

LOS on tape dumped - site if possible

Real Time - Surgeon - Hahn on Record
Recorded -

Dump

Recorded 2 speeds - 5:1 8:1
 Data request -

Dwg - P-1710 - Biomed,

Sys - H.B.

Config. High/Low Data Rate

129 HDR

161 HDR

164 HDR

FCS Firing 162 None LDR

GPC Mem. Dump 163 None LDR

165 HDR

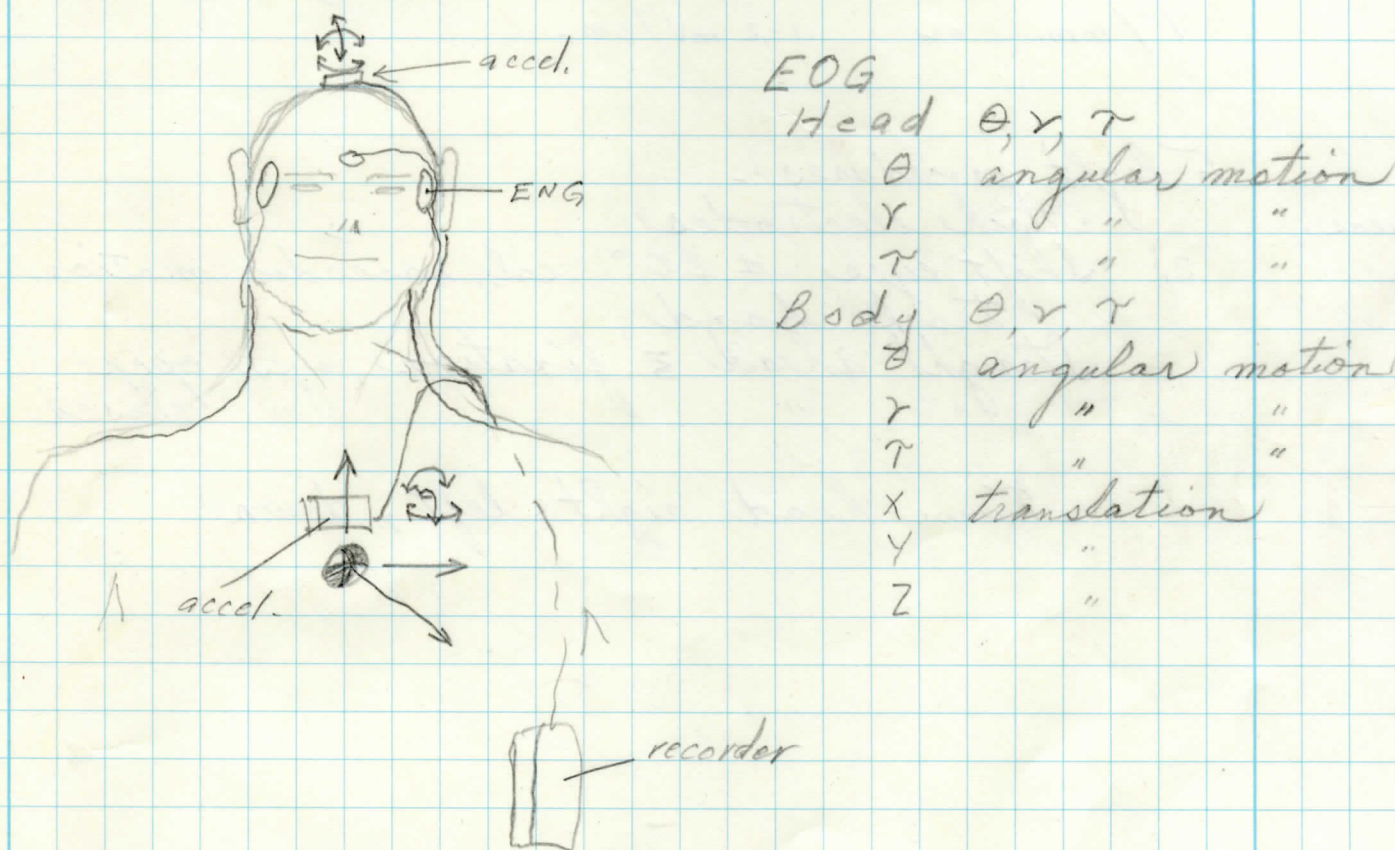
168 HDR

Terry Neal-

22 Mar ✓ contd.

D.T. called S.P. (per G.A.) and he was agreeable ("happy") to plans which he characterizes as a hardware demonstration and wants to keep it low key. I am concerned that the selected vestib. experts such as Young MIT may consider this poaching and will review his work as planned in T. England in this in view.

N.B. A simple Holter (or Oxford recorder) could be used to get ENG and motion data as below.



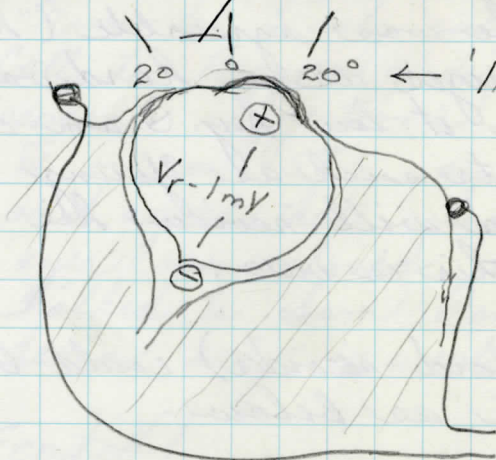
By subtracting angles, head motions could be studied as well as body motions (rotatory). Trunk translations are also measd. - NB this could be markedly simplified.

In view of the Russian contention that vestibular upset continues or rather recurs post flight a simple accelerometer on the head during a Romberg would be most useful.

ENG procedures -

Ref.;
Eng.
Toglia, Thomas
1976

Man. of ENG.
Barber,
2° 1980
Mosby



1°/mm. or .1-.2 mV/cm -

N.B. V_r changes $\approx$
light level etc. $\sim$ 16 min.
response time to light
change may be %

Right & Up produce 'up' defls.

10 mm/s is nom. recording speed -
Fast phase give direction
nominal 10 to 20 μ V/1° & cal. at

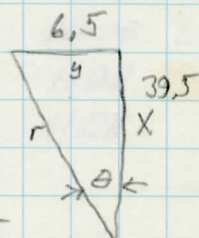
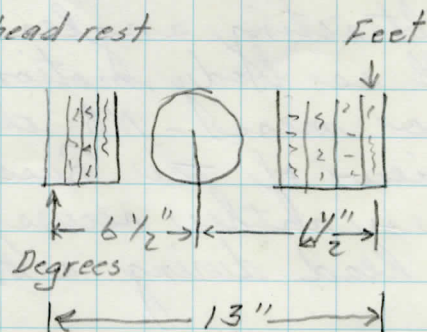
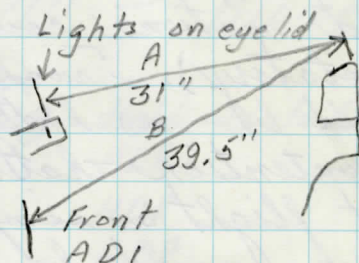
5 light procedures -

Get meas.
on

1. Attach electrodes
2. Shift eyes $\pm 20^\circ$ cal., saccadic motion
track hand,
Straight ahead $\pm$ fixation, eyes open
" " " closed

Turn head right, left, down

Measurements in 1g. trainer - both seats



$$\tan \theta = \frac{y}{x} = \frac{6.5}{39.5}$$

$$\theta = 9.47^\circ$$

Actual eye location will be
 ~ 30 ins & angle θ is 12.2°

9 Jun. Summary -

T/M was avail at 1600 yesterday - config'd. as dugs on P. (spring training cords). which increased 'wt' ~ 30# ran cal. 'curves' on new speed control and Sears tach. Then walked for ~ 2 mi. on unit. No obvious problems except wt. on back seemed excessive -

Speed Set. Time, Sec, 10 revs.

Tach, MPH-

1

2

3

4

5

6

7

7

12.78

3.8 - 3.9

In Mock 12.92

Up - 'pushing'

7

11.82

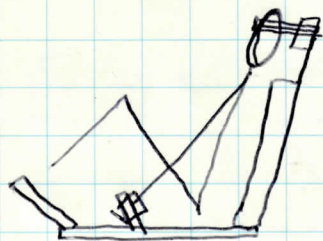
At ILC .65

4.1 - 4.4

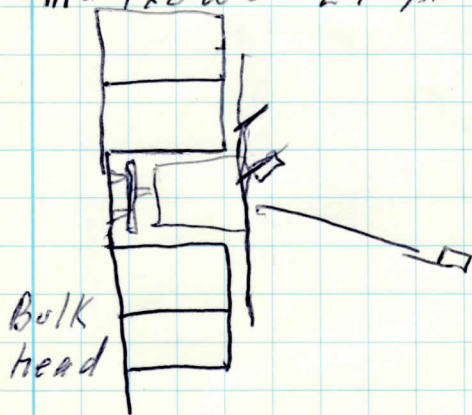
5" elev. .60

to Tng. Harness.

STS Rotating Chair



M-120W-27 1/4" - 5-10 x 2 x 10³



Bulk
head

max
slope

Controls

new
velocity

USAF - '73rd data
5-95% -

ϕ 1 has no random, sine
RPM
2 - 60 2%

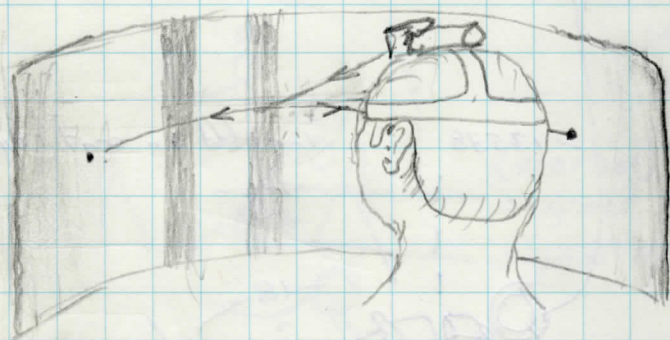
5 June Vestib. Mini Lab.

1. Extend OBS harness cables & use two for Horiz + Vert. - or add an accelerometer to 1 channel.

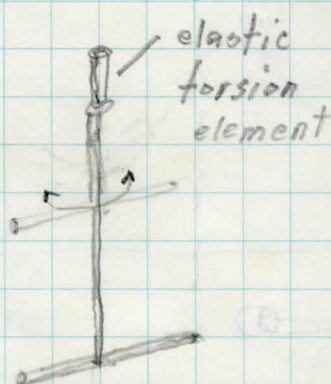
2. Calib.

LED which can be alternated

NB - may be



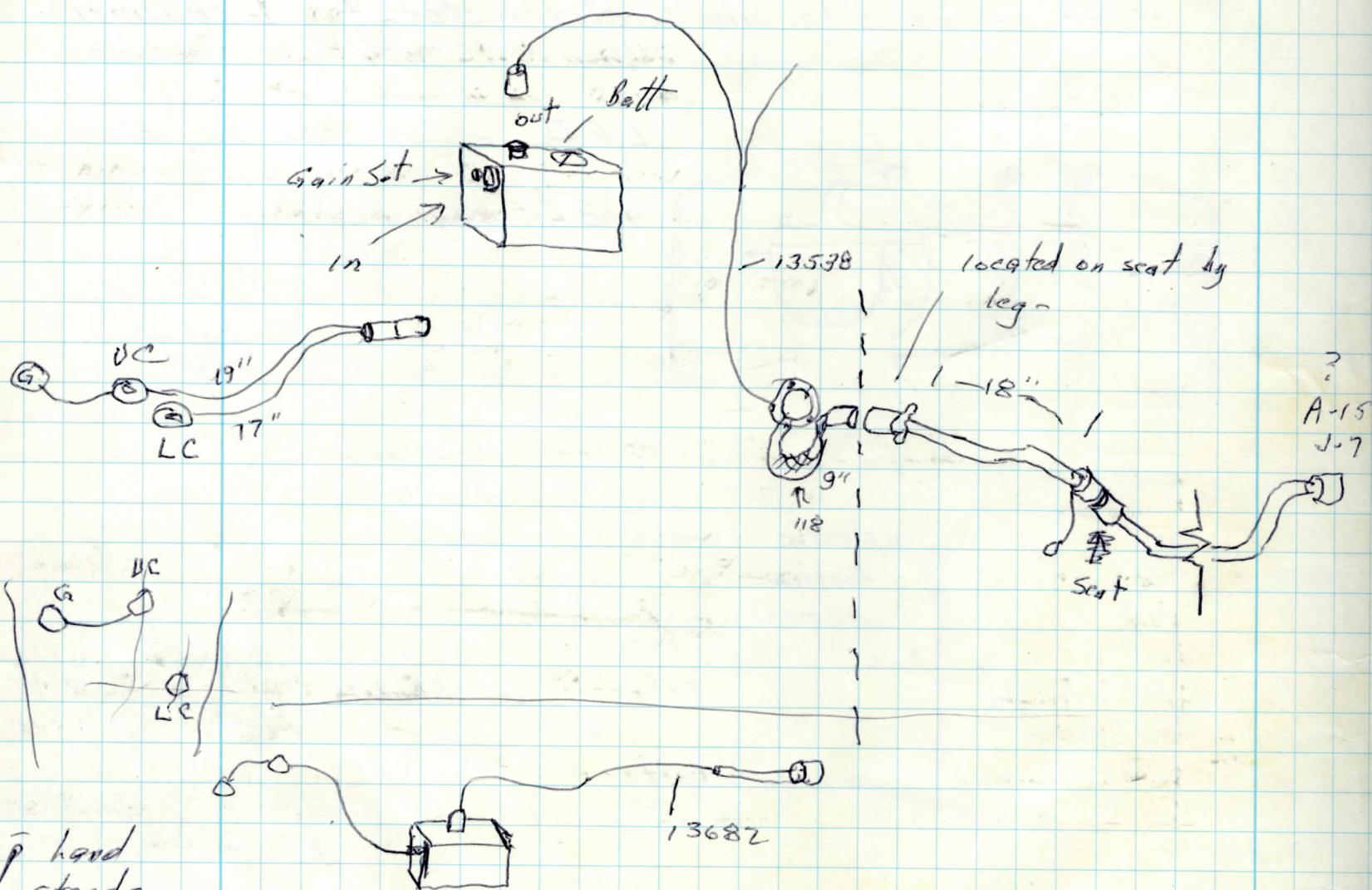
1 July
Vp-



2 - channels

1 July Discussed above concept & VdP who agreed, would like to use it starting & S/S. Discussion included problem areas such as existing large investments and groups. Expressed my desire to cooperate & them as long as they do not interfere by wild plans. Agreed to share pub. credits equally, etc. I will proceed on this.

9 June Check List For STS-4 Biomed.



hand
stand -
Remove harness
Helmet
Unzip +
pull suit
over head

Turner - Sig Cond -
Gain - 800 on all but
launch which are trimmed
Batt. life - 400 Hrs.

Sig Cond -

G = 2800 @ 10 Hz

Noise < 10 μ V PP

17 sec recovery

3db .05 + 100 Hz

Zin 40 M-

CMMR 80db-

stowed

MF 43 H - PIT.

MF 28 H - Cdr

" " " Lower tray - 13682

Spent morning c Tom Tucker, Jim Schlosser 2805,
Ed Fendell, tying down OBS -

Launch
Sig Conds.
uplogged
Reentry
Use 20
C/W garment

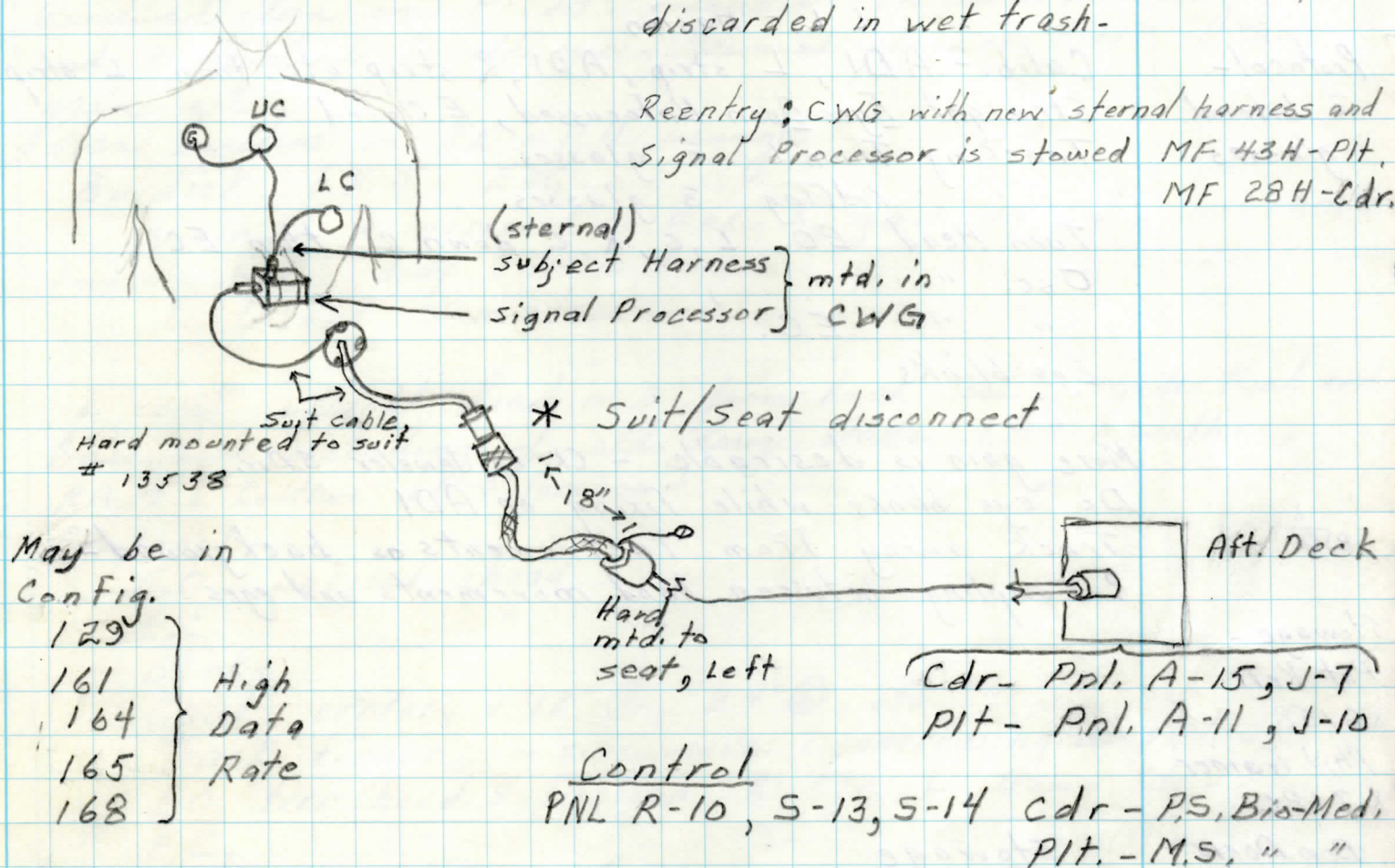
10 June Special Recording

Normal (STS-4) Procedure - OBS

and Signal Processor

Launch: CWG with sternal harness, is discarded in wet trash.

Reentry: CWG with new sternal harness and Signal Processor is stowed MF 43H-Pit, MF 28H-Cdr.



Cannot be in:

162	FCS Firing	} Low Data, Rate
163	GPC Mem. Dump	

Spare electrode installation kits for electrodes containing 30 adhesive rings, paste & wipes are stowed

IVA - MF 28H - Cdr - Lower Tray

EVA - ?

IVA Harness in MF 28H Cable # 13682

Special Procedure -

1. Remove signal processor & sternal harness from Launch CWG prior to discard (NB. disconnecting sig. proc. from suit turns it off - batteries are rated for 400 hrs.) -
2. Obtain IVA harness & electrode svc. kit from MF 28H (lower tray) and connect between suit/seat disconnect and signal processor. This will provide adequate length for electrode placement - (NB disconnect signal processor from IVA cable when not in use)

10 June

Baseline ENG - Dry run -

Burdick EKG - 25 mm/sec + 1 mV/cm -

In 1 g trainer - gnd. to panel - Plt seat -

Lead I: LA - R Canthus Rise time - ~15 mSec - 1/2 mm overshoot

RA - L Canthus L.F. T.C. - 2 mm/1 sec - (10 mm ampl.)

LL - nasion

Protocol -
2 bifocal
glasses

Calib. - ADI, L strip, ADI, R strip etc. then L strip, R strip

Straight Eyes Open Unfocussed, E. Closed

Tracking Thumb 2 glasses

" RedFlag 3 glasses

Turn Head EO L, C, R, C, down C then E.C.

Osc. " " "

" " E.C.

Eye blinks

More gain is desirable - Ch. on Jeweler S.Dir.

Do eye blinks while fixing on ADI

Track away from instruments as background -

? Coupling between hand movements and eyes -

6
8550

Stowage -

Pat Kerr

X6158

Phil Gainer

X3186

Don Doerr

Bioneng-

Cape

Stowage

Cables - Sternal Harness 2 electrodes 4 + 2 on launch CNG

1 ea MF 28 H

1 ea MF 43 H

2 ea MF 280

I.V.A. (# 13682)

1 ea MF 28 H(?)

Signal Conditioners 2 on launch CNG's

1 ea MF 28 H

2 ea MF 280

1 ea MF 43 H

attachment

Electrode Kits

Biu - IVA MF 28 H - Top dwr - Inside Kit IVA

EVA ~~Airtack stowage bag MF 43 H~~

MF 280

back Left.
bottom dwr400 -
4000increase
Gain
100

-DT- 500

-DT- 400

+AT- 1500

+2AT- 1800

3AT- 4000

11 June Vestib - STS-4, Vanderpl - W.T.

Fendell. OPS-1 Recorder constantly (for back up)
OPS-2 " will dump data -

Reviewed plan on P-129: only one IVA cable is being flown and K reluctant to add one - Reviewed plan on P-129 ex. adj. gain set.

Ran baseline on T.K. & H.H. using:

Burdick EK 5 EKG.

Gain X2 & increased to max - by gain adjust. $1\text{mv} = 26\text{mm}$,
1mm overshoot - drop 2mm in 1sec.

L-I and 25 mm/sec.

TK L seat upright, head ~ 3" from back rest. made trial and base line recording of std. horiz. leads. LA $\rightarrow$ R canthus, RA $\rightarrow$ L canthus LD $\rightarrow$ forehead
Protocol -

E.O., unfixed, ahead

E.C. "

Blinks

Calib. - center, $+12^\circ$ (R), 24° (L), etc.

Track finger, ~ sine wave $\bar{c}$ increasing amplitude

EO, turn head $\bar{s}$ Fixation R, Ctr., L, Down, Ctr.

EC, " " " " " " " "

Osc. head, Eyes Fixed

" " " Closed.

Comments -

TK calib. $24^\circ \approx 3\text{mm}$ or $8^\circ/\text{mm}$ & $1^\circ \approx \frac{1\text{mv}}{26\text{mm}} = 38\mu\text{V}$ or $48\mu\text{V}/^\circ$

No nyst.

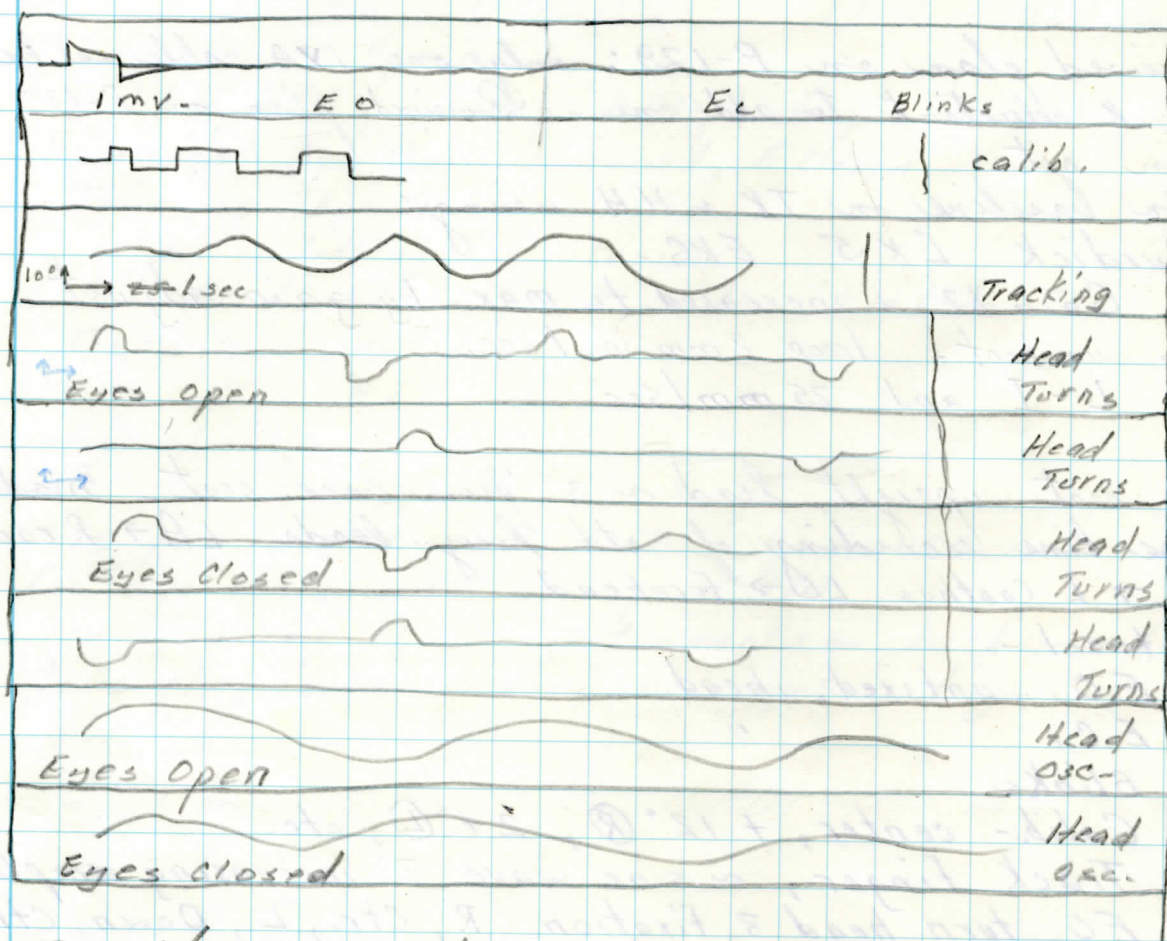
Good record of head osc. at $\sim .2\text{ Hz}$ & 14mm or 112°
 $\bar{s}$ nyst.

H.H. Ran 1 record as above

Cal. $24^\circ \approx 10\text{mm}$ or $2.4^\circ/\text{mm}$ & $1\text{mv} = 26\text{mm}$ or $16\mu\text{V}/^\circ$

12 Jun Vestib. Contd.

Only S.P. will be in town and he has agreed to track.
Will put Records Together by photographing strips -



EDW/ Shoes, etc.
Camera
Vestib-
Radio act-

18 June Resume'

17 June Mtg. c Pool, Hunley, Vanderp-, Hahn -

Reviewed ENG, the people who have been involved - decision to keep operation confidential. Sue? will communicate c crew and need for info. exchange including times of recording and results. Sam has informed Kraft who is supposed to be v. interested but he promised to consult me before showing him anything. Also discussed in great detail in potential problems in receiving/recording data c Hahn and means for sending data to me at EDW. TK will brief flt. controllers on ENG to avoid conflicts on recording.

18 June Wrote up cue cards and other information & brief discussion c crew. Gave TK. tonometer, tape.

Discussion c N. and left to his discretion ^{discussion of} his knowledge of ENG on this flt. He promised \$75K for treadmill and \$25K for wrist watch monitor. Pool agreed to loan 5K for Moore to work on T/M.

27 Jun EDW - Call to S.P. - had contacted crew & TK was going to do recording - neither crewman had probs. Met Vp. at Lancaster Had received record times & Hahn was recording it. Hahn had vomited today. Hahn received/recorded data and amplitude was apparently low. Will call S.P. in AM and encourage:

1. Record from Hartsfield
2. Recording additional data
3. Increase gain

28 Jun EDW - S.P. not enthusiastic about recording from Hahn
0630 ('future opportunities') Strongly encouraged it and arranged for T/E to bring data out and is now on way - Also strongly requested that gain be increased, etc. Time lag is real problem. Ellen will talk to them in 2 hrs.

1000 Vp debriefed Ellen. Crew denies any upset today but no recordings & too busy for more today! Another oppor. lost.

1530 Hahn says each crewman recorded today! Will call in 2 hrs.

1700 Following to PMD at 0600 CDT - Nos 486-7565 RJW-333-3071 Pete-334-4773 Bo-334-1437

1730 Both Cdr. & Plt. recorded as follows:

Plt. 180:20:40 - :21:04, :21:04 - :21:09 Cdr. - :21:10 - :21:30

Plt. sect. recd. "looks good" - delay for priority data on wet tiles.

1740 Called P.S. who agreed to pick up data & bring to PMD by 0900

STS-4 Ops

30 June

Hahn called saying they had 3 good records - 1° from TK then from Hahn, T.K. - Increased ampl. made a good record. App. they called times down and requested feedback on ENG on open loop - Hahn did not use T/M today. Drove to PMD to pick up data & Shriver had driven it to EDW. Left sword for Vp to get it, look at it & send word back to crew. Ellen requested they repeat format free floating and 'upside down'. Still try to lash up O.K. tape and try to get $\bar{p}$ flt. record as soon as possible.

Next mission -

1. fixed calib. & lts.
2. O.K. proj. on eye screen.

1 Jul-

Two records avail. but can't get plt. for A/C still get P.I. or O.G. to bring them at 1300 tomorrow.

2 Jul-

Threads broke on T/M harness pin. Crew has lashed it up -

Procedures for ENG -

Electrodes - 5-10 mins.

O.K. - procedure

Calib. -

Conc. on eyes closed tgt.

Calib. at end

Measure eye distance

Passed to Jim Vp. who was going to give to Ellen for crew. Still try to T/P msg. up if necessary. Will know conc. on getting $\bar{p}$ flt. studies. C Bolden is flying data to us

7 July

Review 1600 - T.K. on Mag-~~11~~ onboard T/M - to end.

8 July

Review of ENG tapes - Bob Hahn in SSR - Talked to Jim Vp. who requested that I attend med debrief 7:21

29 Jan Quick look analysis of ENG

Record - Start - noise ~ 8 mm

T.K. 24° - ~ 2.5 mm slow drift, random (? electrode)

000:13:50 few nystagmoid signals @ & @ but also present on 1g. baseline

14:10 E.O., tracking up ~~to~~ ± 4 mm.

MET Head turns - hard to follow -

179:04:50

05:10

GMT

2^o Run - 05:06:01

noise ~ 0.6 mm. RMS

no nystag. on EO & EC straight ahead

24° cal. ~ 2 mm.

Tracking - visual smooth $\bar{c}$ max 7 mm $\approx 84^\circ$ PP.

Head turns -

EO, @	biphasic	3 mm	E.C.	5 mm
C		5 " $\sim 60^\circ$		5.5 "
@				4.0 "
C				7.5 "
D -	—			—
U -	—			—

Head Osc -

E.O. 5 ea

5.5 mm $T = 30$ mm = 3 sec

P-P

E.C.

4 mm $T = 30$ mm

P-P

2 cycles sinusoidal &
= 3 sec. then $\sim$ sq. wave 4 mm.

Summary - Low amplitude made assessment difficult. Other than eyes closed head osc. could see no real difference from 1g. baseline.

STS-4 Analysis, ENG

1 July

Plt.

Hartsfield

180:21:00

1° run

During settling period of ampl. there is clear @ N(ystr.)

Cal - $24^\circ = 11 \text{ mm}$. normal Saccades -

Optical tracking - good, ~ 4 isol N. 1 L 3 R

Head turns: slow sgs. drift. ? artefacts.

2° run - 180:21:09

H.H.

Pre flt-

Forward Gaze, eyes open -
unremarkable,

MD-3

recording zero, ? @ nystagmus

MD-5

unremarkable

Pre flt.

Forward Gaze, eyes closed -
Unremarkable

MD-3

data lost

MD-5

Calib., Saccadic Tracking

Pre flt.

 $24^\circ \approx 11 \text{ mm}$. $\sim 2.2^\circ/\text{mm}$; $1 \text{ mV} = 27 \text{ mm}$ or $370 \mu\text{V}/10 \text{ mm}$. or $\sim 37 \mu\text{V}/\text{mm}$
 $\sim 17 \mu\text{V}/^\circ$

MD-3

*

 $24^\circ = 11 \text{ mm}$. $\pm 1 \text{ mm} \sim 2.2^\circ/\text{mm}$, ? ↑ ripple

MD-5

*

 $24^\circ = 11 \text{ mm}$. $\pm 1 \text{ mm} \sim 2.2^\circ/\text{mm}$, def. tilt (contra-lat drift)

STS-4 ENG

Analysis, Cont'd.

H.H.

Visual TrackingPre Flt.
10.5Small saccades on $\odot$ excursions & increasing deviation
 $\pm 25^\circ$

MD-3

7 cycles $\pm 40^\circ$ small $\odot$ saccades nr. peak excursion, bilat.

MD-5

 $\pm 26^\circ$ few small bilat saccadesHead Turning, Eyes Open

Pre Flt.

Dev-Turn Ampt./Period sec/Under- $\ominus$ Overshoot $\oplus$

$\odot$ 33°/0.9/11° $\rightarrow$ $\odot$ 33°/0.9+/11° $\rightarrow$ $\odot$ 11+° $\rightarrow$ $\odot$? $\odot$ - $\odot$ ~2h

MD-3 35°/0.4/11° 48°/0.6/40+ 44°/0.6/26.4 62°/8/11+ 26.4/7/4.4

biphasic $\downarrow$ biphasic

MD-5

Head Turning, Eyes ^{closed} Open

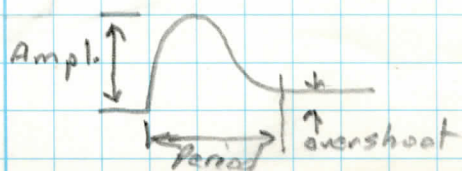
Pre Flt.

Tu

$\odot$ 24.2/0.7/11° $\odot$ 24.2/1.0/8.8 $\odot$ 44°/0.8/35.2 $\rightarrow$ 17.6°/0.6/13.2° $\odot$ 11°/2.5/0° $\odot$ 15.4°/~5/0

MD-3

MD-5



STS-4 ENG

Analysis, Contd.

[called Chas. W. Stockwell, Phd., Otol. O.S., Coll. Med. 614 420 8150
Co. Author - Barber & " , Manual of Electronystagmography
2nd Ed. Mosby 1980HH
Pre fltHead Osc., Eyes Open
66° P-P, $T = 6.5$.

MD-3

5 cycles, 70.4° P-P, $T = 3$ s.

MD-5

~~66° P-P, $T = 6.5$~~

Pre flt.

Head Osc., Eyes Closed
coarse saccadic movements on $\textcircled{L}$

MD-3

Only 1st & last cycle recorded
grossly distorted

MD-5

Pre flt.

Saccadic Tknng, Calib.

MD-3

11 mm bot under, overshoots
appeared to make 4 attempts. ? nyst $\textcircled{L}$ *

MD-5

21 July — Med. Debrief -

Sensory Visual Chg. Fixed visual shift - 15 mins p orbit -

No ^{other} visual changes, no flashes,

Anorexia - TK - M.H. - early appetite decreased.

Wanted more taste

H.A. - M.H. between eyes, ? eyestrain, not relieved by ASA (4 tabs)

Knot in stomach at sternal $\times$

Head was Full - TK felt H was dull, slow 1st 1 1/2 x day -

Excess urination -

No sleep probs - M.H. - 6 Hrs -

Subjectively too noisy - great difficulty in conversation -

Eye 'burn' - looked p am - had desire to close eyes -

Personal hygiene -

Affecting mental processes on reentry -

Response - 150 H R } Entry
130-40 " }

Medically relevant observations during entry STS-4

T. K. Mattingly 21 July 82

- The most significant thing was during the preflare.
- During preflare I had the feeling I was replaying Jack's remarks.
 - "mentally squinting to see through a mental fog"
 - "thought processes are intellectually intact but it takes longer for the thought to run through my head"
 - "I didn't have the feeling that the world was happening faster than I was ready for"
 - "something screwing up his CPU"
 - I think you don't see it if you don't have a task
 - *And here is 40 min. of relaxed ho hum activity and I was scrambling and sprinting to stay up with it.

No similar sensations during his Apollo flight.

- Classic vertigo and tumbling sensations.

More intense

Summary of STS - Anthropometry Meas

Mission

2, 3, 4

Crew

Day:

Time

Height, Ins.	Girth, Ins.					Tone			Pulse, B/M			
	Mid Thigh	Below Knee	Mid Calf	Ankle		Thigh	Post. Calf	Ankle				

STS-2

Before / After Exercise

Truly	$67\frac{3}{4}$	$20\frac{1}{2}$	$12\frac{3}{4}$	$13\frac{3}{4}$	$8\frac{1}{2}$	-	-	-	68			
F-11 *	-	$20\frac{1}{2}$	$12\frac{7}{8}$	$14\frac{1}{8}$	$8\frac{5}{8}$	-	-	-	132			
2/ 1:21:40	$69\frac{1}{4}$	-	-	-	-	8	13	3	-			
**	-	-	-	-	-	8	9	0	-			
Engle F-11	$72\frac{1}{4}$	$20\frac{5}{8}$	$12\frac{5}{8}$	$12\frac{3}{4}$	$7\frac{3}{8}$	-	-	-	74			
" *	$73\frac{1}{2}$	21	$12\frac{7}{8}$	$12\frac{3}{4}$	$7\frac{1}{2}$	-	-	-	112			

S3/Lousma

F-1	$72\frac{1}{2}$	$23\frac{1}{2}$	14	$15\frac{7}{8}$	$9\frac{3}{8}$	7	7	-				
5/ 4:10:30	$73\frac{3}{4}$	-	-	-	-	-	-	-	-			
6/ 5:07:00	-	21	$13\frac{1}{2}$	$15\frac{1}{2}$	$9\frac{1}{4}$	8	13	-	56			
After Exer.	-	$21\frac{1}{2}$	$13\frac{1}{2}$	$15\frac{1}{2}$	$9\frac{1}{4}$	9	13	-	96			
8/ 7:06:30	$73\frac{1}{2}$	-	-	-	-	-	-	-	56			
After Ex.	-	-	-	-	-	-	-	-	100			
Post												

Fullerton

F-1	$70\frac{1}{4}$	$20\frac{3}{4}$	-	-	-	5	9	-				
5/ 4:10:30	$71\frac{7}{8}$	-	-	-	-	-	-	-	-			
6/ 5:08:30	-	$20\frac{1}{2}$	-	-	-	7	12	-	58			
* 5:08:44	-	20	-	-	-	8	12	-	100			
8 7:05:35	72	-	-	-	-	-	-	-	48			
* After Ex.	-	-	-	-	-	-	-	-	108			
Post												

STS-4

Mattingly

MD-4

Pre Ex.	70.5	18	-	13	-	9	$8\frac{1}{2}$	54	90	100	110	
Post Ex.	70.7	$18\frac{3}{4}$	-	$13\frac{3}{4}$	-	11	$8\frac{1}{2}$		90	100	140	

5 Apr. 82 Audiometry - Self Test - Marco in noisy ofc -

	<u>R</u>	<u>L</u>
125	- 15	- 10
250	- 20	- 15
500	25	20
750	25	25
1000	25	35
1500	50	55
2000	45	60
3K	50	55
4K	45	50
6K	15	35
8K	35	35

Date/Subj	Start Time	Stop Time		
11 June/TKM	—	—	Pre Flt. F-16	(launch-21 June)
11 June/HH	—	—	Pre Flt. F-16	{launch time 178:15:00}
MD {TK	179:05:00	05:06	1° Run	00:14:00
01 {TK	179:05:06	:05:09 -	2° Run	02:06:13 X1-3
02 TK	180:21:13	:21:18 -		02:06:13 X2
04 TK	182:14:52	:14:55 -		03:23:52 X2
02 HH	180:21:02	:21:06 -		02:06:02
05 HH	182:15:05	:15:08 -		04:00:05

178:15:00
 MET MD
 MD-00: = 1,
 01 = 2

7/17/82

Misc Medical Notes from STS-4

- ENG: 1st exercise for TK ~ 0/14:00
2nd gain up as recommended. Then did full protocol in CDR suit.

2nd exercise for TK - used incremental gains -

• Treadmill -

I believe this data was collected on FD4.

Exercise protocol: setting 4 at start.

0-5 min ~ 2 mph HR $\approx$ 90

5-10 min ~ 2 1/2 mph HR $\approx$ 100

10-15 min ~ 3 1/2 mph HR $\approx$ 110 $\rightarrow$ 140

2 min post exercise HR $\approx$ 110

4 min " " HR $\approx$ 74

pre exercise HR $\approx$ 54.

body measurements -	pre exercise	post exercise
mid calf	13	13 3/4
max thigh	10 1/4	10 3/4
face circumference		
under nose.	19 3/8	18 3/4
height	70.5"	70.7"
penetrator under thigh	7mm	11mm
under calf	8 1/2 mm	8 1/2 mm

Hand exercised in FD 3, 4, 5, 6

TK exercised in FD 4, 5, 6

EXERCISE DATA

I noticed that when getting on treadmill with steady
since that they cleared up in very short order. ~ 2-3 min.
Saw this twice.

Both of us commented on how much better we felt
after exercise even at relatively low levels.

Suit sizing felt very good on F06. I believe the
LTA had been extended ~ 1".

Ave resting HR for TK throughout mission was ~ 60.

• Fluids & Food. -

Forced ourselves to drink a lot during mission and Hank
drank 4 entery Gatorade + salt tablets between 0100-1hr
and 05. TK drank 3 in this period and one
immediately post landing.

This protocol resulted in both of us having to
urinate a lot.

I used brake pedals and sides of rudder pedal well
to do isometric biceps and during entry.

My appetite wasn't very good by mid mission
and I had almost a revulsion to food by F07. Tanks
retained post dth. Had tank back ~ 2hr post ldy.

- TK needed his glasses almost immediately post ons 1
and found it back to normal when I checked it
~ 2hr post ldy. Hank thought his prescriptions
were not as strong as it is on the ground.

-TK.

EXERCISE DATA

FULLERTON

[illegible]

EXERCISE DATA

LOUSMA

[illegible]