

40

1986 - II, 1987-I (Feb)

# COMPUTATION NOTE BOOK



43-648

Made in U. S. A.

Course *Dept. CB, NASA JSC, Houston, TX*

Name *W. Thornton, M.D.*

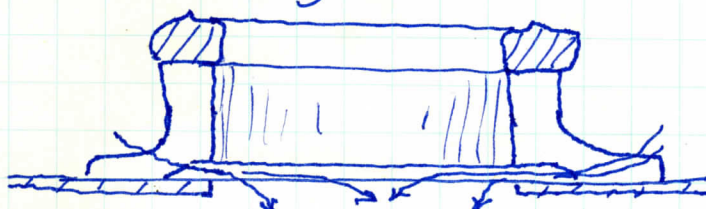
*If lost Plz call 713 483 3721*



1  
7 Mar. Functional Test 1 WCS Prototype (MK I)  
B-37 Toxicology Lab c Dick Sawyer, John Boya

Purpose: Daily use of device to find bugs & develop procedures for population use.

Put Gnd. Proto. on Dolly c 50 CFM blower - Using seat c annular air ring well below seat. Air stream is comfortable and efficiently handles wipes c no apparent turbulence. Use in



| <u>Date</u> | <u>Time</u> | <u>Size, est.</u><br>ml. | <u>No. Wipes</u> |            | <u>Comments</u>                                  |
|-------------|-------------|--------------------------|------------------|------------|--------------------------------------------------|
|             |             |                          | <u>Wet</u>       | <u>Dry</u> |                                                  |
| 5           | 1150        | 300, formed              | 2                | 7          | No odor during use -<br>Balos ~ 1/2 way up space |
| 6           | 0830        | 200, "                   | 1                | 6          | Thigh bars work well                             |
| 7           | 0830        | 250, "                   | 3                | -          | screw out of (2) restraint mount                 |



18 Feb

## Cont. of IWCS Test

Bldg. 37 Same arrangement -15 1/4 T

Cleaned smear No odor <sup>opening</sup> dry smear - Immed aready - No leaks  
 Sample Tissues wet wipe - Vacuum on  
Comments

| #   | Wt                        | Wet | Dry |                                                                                                                                                                                                                                                                                                |                |
|-----|---------------------------|-----|-----|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|
| 1A  | 89.7                      | 1   | 6   | - nl                                                                                                                                                                                                                                                                                           |                |
| 2A  | 163.7                     | 2   | 10  | - Semi liquid + liquid                                                                                                                                                                                                                                                                         |                |
| 3A  | 159.2                     | 1   | 6   | - solid (? partially frozen)                                                                                                                                                                                                                                                                   | 1548           |
| 4A  | 171.7                     | 1   | 6   | - " compressed to ~ 1/2 vert<br>smear on bottom                                                                                                                                                                                                                                                | 1554           |
| 5A  | <del>145.3</del><br>118.6 | 2   | 6   | - Dried flakes on paper rack                                                                                                                                                                                                                                                                   |                |
| 6A  | 145.3                     | 2   | 6   | - semi solid, UQ paper didn't stick                                                                                                                                                                                                                                                            |                |
| 7A  | 60.0                      | 1   | 6   | - 1/4 T override at end, overr. on pickup                                                                                                                                                                                                                                                      | 16 5/8         |
| 8A  | 212.4                     | 1   | 6   | - override on P/W (semi liquid, splattered)                                                                                                                                                                                                                                                    | 16 1/2<br>1626 |
| 9A  | 274.5                     | 1   | 6   | -                                                                                                                                                                                                                                                                                              |                |
| 10A | 214.7                     | 1   | 10  | - wet wipe + 10 dry + 2 connected<br>rubber gloves - piston jammed just past closure -<br>returned leaving piston pad & tried a fresh<br>pad - gloves were undisturbed & jammed at same<br>spot - removed gloves & 2° pad & put in fresh<br>pad & closed with difficulty -<br>Removed vacuum - |                |



## Abstract for intersociety mtg.

An Improved Waste Collection System for Space  
W. Thornton, H. Whitmore & B. L. Flond  
~~Fecal Sequestration and Collection System~~

Human

Waste collection in space remains a problem and existing systems do not ~~meet~~ appear to meet Space Station requirements. Relatively small improvements should solve urine collection problems but fecal collection required new approaches. The most promising is a sequestration and compaction system in which a piston in a cylinder is fitted a disposable pad prior to each use. This pad provides several functions including: protection of piston from contamination, <sup>positive</sup> collection of feces & wipes, cleaning of collection area and sequestration of waste into successive layers for efficient isolation & storage. This system ~~not only~~ provides a cleaned volume for use but and provides storage in containers which may be easily <sup>sealed &</sup> removed for processing. <sup>It is small, clean & efficient;</sup> Extensive feasibility and operational tests, including <sup>manual</sup> subject use, have been completed and prototypes are ready for an early flight. Automatic designs for shuttle and space station are under way.

1. NASA JSC, Houston, TX

2. Whitmore Enterprises, San Antonio, TX



# 7 Mar. B.S. Tape data reduction

In attempt to get heart rate the B.S. records were KronHite band pass filtered & recorded. By empiricism ie knob twiddling 3550 Found 5 → 30 or 40 Hz gave excellent reproduction from CW in Filt. Tape 5102 - WT had fair signals on Penn state record at in BP 5-20 but poor on those at home

Buchli - 1g Pre 51C

Time Tape Count

128

0:00 006

5:00 105

10:00 200

15:00 278

? of whether mics were properly sealed.

Mics ~~not~~ not sealed

Charlie W. 51 D2A 0/01:52 - 0/02:40 <sup>before medicine</sup>

0:00

No record

51 D2B 0/07:28

c Reglan

20-

~~0:00 018~~

29

0:00 034

5:25 152

10:00 237

7

15:00 323

10

20:00 399

1

25:00 471

4

30:00 537

1

35:30 606

10

40:00 659

11

44:10 706

16

cough (?) Quietest Belly I've heard

moving

CW 51 D1A 0/08:26 as above @ 10-40 Hz @ 4.3 kHz

↓

0:00 005

05:00 099

8

10:00 200

14

15:00 ~290

27

20:00 369

26

25:00 447

29

30:00 513

29

35:30 585

21

40:00 642

10

45:04 698

10

moving essentially no sounds & movement  
for still

may be artefact



Cont'd. on next pg-



# Data Reduction, B.S. Contd.

C.W.

6/16:55 p breakfast

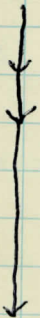
132 Time

Tape

Count

0:00 012  
5:00 122  
10:00 220  
15:00 307  
20:00 387  
25:00 459  
30:00 514  
35:00 579  
40:00 641  
45:00 699

moving  
~~Doing Echo 7~~ or stowing Lockers



CW

0/00;25:50 61 B1A

thru phones (L) 4-3 KHz  
(R) 10-40 Hz

312 0:00 000

5:00 104 32  
10:00 201 41  
15:00 287 53  
20:00 367 44  
25:45 450 63  
30:08 508 34  
35:05 571 94  
40:10 633 122  
45: 1688 122

Still in seat

High ambient noise

moving

moving

stowing

sounds v. cheerful  
← filter, good sounds  
at 501 made remark

v. good sounds & rushes

Replay 13 Mar.

16 Mar p F.H. P. Nelson - 0830 → 0900

(L) channel only

11 Mar - B

(L) - 15-40 Hz (R) 4-3 KHz Max earphoot

0:00 030  
5:05 143  
10:05 238  
15:49 327  
20:00 466  
25:19 475  
30:19 543?

← BKfst 1 hr. ago granola & o.j. - Cup of Coffee

Recorded (L) Ch on both channels { lower 15-30 Hz  
Upper 4-3 KHz

sudden ↓ in H.F. - closer coupled

p F.H. 30 Oct 85 B. Nelson 2 hrs. p Scop. Dex. 1014 →  
0:00 Line Out - (L) (lower) trace 15-30 Hz (R) 4-3 KHz  
Tape Blank



13 Mar

B.S. Data Reduct.

6:10 AM B. Nelson 12-13-85 (L) (lower) trace 15-30 Hz (R) 4-3, KHz  
 Time Tape No. Notes E Scop. Dex.  
 0:00 ~~092~~ ~~0610~~ Flailing & MICS!  
 0:00 164 MICS being taken on & off? Don't Count  
 5:00 257 Flails! Hyperactive when recorded  
 10:05 341  
 15:00 416  
 20:00 486 Movement  
 25:00 "

Garr

12 Feb '85 3:02 → 3:36 PM(?) Rec #6 ? 16 Trs.  
 Tom Moore Present

0:00 380 Mics ? located properly?  
 5:00 382 Faint sounds (L) side - ~~not~~ Conversation  
 10:00 455 N.B. sounds come in rushing complexes primarily (L)  
 15: Invaded by?

Garr

4-2-85

(L) 15-40 Hz R 4-3, KHz Rec #008 1955 CST  
 Sitting in Motel?

0:00 042 Good sound esp. (R)  
 5:02 152 N.B. prob. post prandial  
 10:00 245  
 15:00 328 Virtually Continuous  
 20:00 405 (L) side active  
 25:00 476  
 30:00 5042  
 35:02 605  
 40:15 666  
 45: → 705  
 43:40

Shriver

Pre flt 1-13-85 2010-2055 replay as above  
 Faint (R) sided sounds ~~overlaid~~ ? Home

0:00 015  
 05:00 130  
 10:25 235  
 15 Mics up intermittently, (L) probably not seated



## 13 Mar B.S. Reduction Contd.

| Time  | Tape      | No       | Remarks                                   |
|-------|-----------|----------|-------------------------------------------|
|       | Nagle 1g- | 3 Mar 86 | ① 15-40 Hz ② 4-35 Hz<br>1545              |
| 0:00  | 004       |          | T.V. on                                   |
| 5:00  | 118       |          | Movement, Miss, Up Intermittantly         |
| 10:00 | 217       |          | Beginning Meal                            |
| 15:00 | 303       |          | Sounds are phasic, gastric's are starting |
| 20:00 | 382       |          |                                           |
| 25:00 | 455       |          | Phasic bursts of activity                 |
| 30:17 | 525       |          |                                           |
| 35:   |           |          | Mics Up                                   |

Nagle 51G1A MD 2 ~2245 ① -15-40 ② 4-3k

|       |     |       |                                                |
|-------|-----|-------|------------------------------------------------|
| 0:00  | 051 |       | ② Mic Inter. Up.                               |
| 5:00  | 159 |       | hyperactive bilat. sounds In seat on Flt. Deck |
| 10:00 | 252 | 22:58 | cacophony of noises too freq. to count         |
| 15:00 | 335 |       | incredible! cant count                         |
| 20:04 | 412 |       | ↓ ↓                                            |
| 25:05 | 483 |       | ↓ ↓                                            |
| 30:00 | 547 |       | ↓ ↓                                            |
| 35:00 | 610 |       |                                                |
| 40:06 | 670 |       |                                                |
| 40:11 | 706 |       |                                                |

Nagle 51G2A 1/10:00 on Flt. Deck?  
Hyperactive Bilat, rushes ② Flt 2-40 Hz  
sounds are phasic

|       |     |  |                      |
|-------|-----|--|----------------------|
| 0:00  | 010 |  | moving               |
| 05:00 | 124 |  | now primarily ② side |
| 10:00 | 223 |  | ?? emesis ??         |
| 15:00 | 308 |  |                      |
| 20:00 | 386 |  |                      |
| 25:05 | 459 |  |                      |
| 30    |     |  |                      |
| 35    |     |  |                      |
| 40    |     |  |                      |
| 45    |     |  |                      |



13 Mar B.S. Reduction contd.

Time Tape Count Remarks  
Nagle 5163 A 1/23:13

0:00 013

5:19 133

Too many to count

10:00 223

15:00 309

20:00 387

25:00 459

18 Mar. finished replay (L) 2-40 Hz  
(R) 4-3 KHz on flt. deck

30:16 529

35:00 588

40:08 649

44:45 701

Nagle 5164 A 5/08:20

0:00 014

5:00 126

10:00<sup>2</sup> 221

(L) sided activity,  
off 7:15 (170) on 8:00 (180) orders of magnitude less activity

15:00 306

20:00 384

25:00 456

30:12 526

35:00 587

0:00 ~10

Nagle 5163 B replay 18 Mar. MET 1/22:03

5:00 118

Not possible to count at such a high rate  
on Toilet

10:00 216

15:03 303

sounds on (R) tympanic  
moving

20:00 381

25:00 453

satellite launch preparation

30:03 521

35:13 586

40:00 644

N. working on launch setup

45:00 701

0:00 006

Nagle 5161 B 23:50

on flt. deck

5:00 119

Belching

10:00 216

15:00 303

opening sun shield

20:00 381

25:06 458

40:00 644

30:03 522

Belching

45: 702

35:00 585



18 Mar B.S. data reduction

| Time  | Tape Number | Remarks                                                             |
|-------|-------------|---------------------------------------------------------------------|
| 0:00  | 031         | Nagle 5162B 1/11:33                                                 |
| 5:00  | 141         | In Toilet - (L) mic intermittently up - <del>2</del> L: O.H. Change |
| 10:00 | 239         | (L) Mic down, brushing teeth                                        |
| 15:00 | 320         | ? going to sleep                                                    |
| 20:00 | 397         | in bunk                                                             |
| 25:00 | 468         | (R) side primarily                                                  |
| 30:00 | 534         |                                                                     |
| 35:00 | 597         |                                                                     |
| 40:00 | 656         |                                                                     |
| 44:16 | 703         | put 20-40Hz on (R) & 4-3 KHz (L)                                    |

Nagle 3 Mar 19

Amplitude in Radr. in phone mics max vol (L) 2-4 Hz (R)

Sitting

↓

walked

greatly reduced amplitude  
suspect most of activity  
is lower bowel -

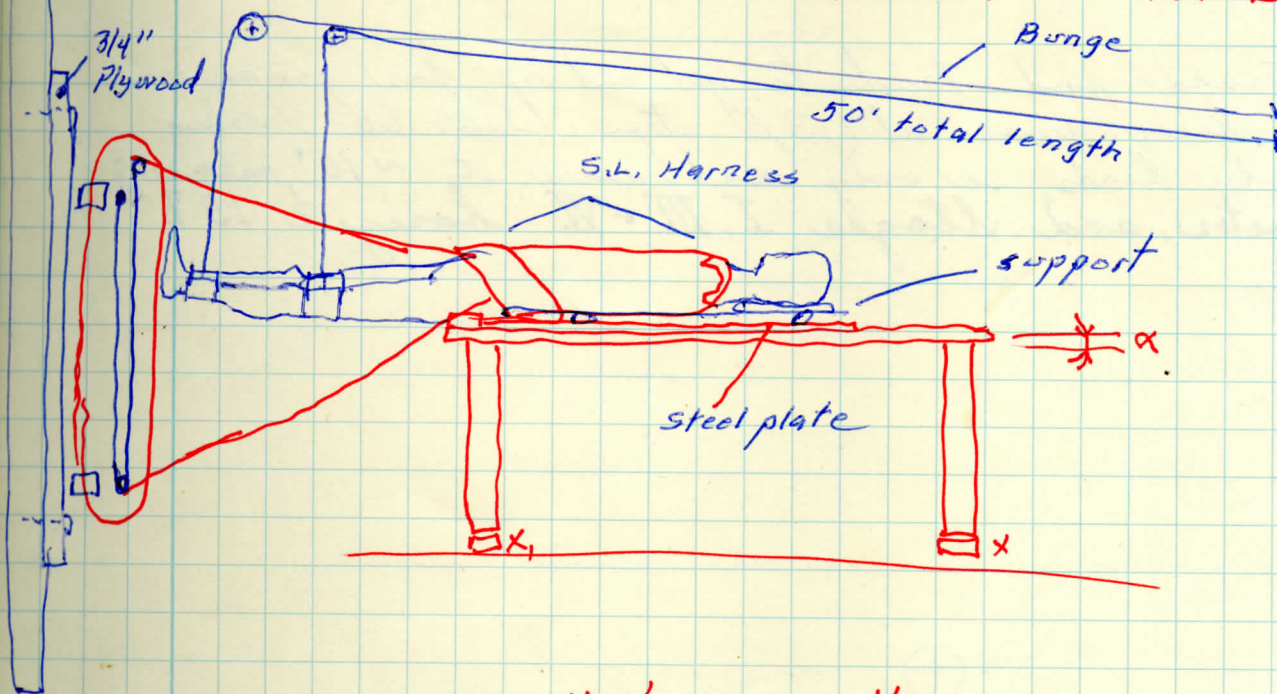
Replay Gain set at inflt. level - but put to redr. from line & jack  
up & walking

|                    |     |
|--------------------|-----|
| 0:00               | 013 |
| 5:00               | 127 |
| 10:00              | 224 |
| 15:00              | 309 |
| 20:00              | 388 |
| 25:00              | 461 |
| 30:04              | 529 |
| 35:00 <sup>s</sup> | 592 |



2x4's secured to wall

# 20 Mar Horizontal Locomotion BAFB



$\frac{38}{4}$   
152#

9 meas E  
protractor  
(bubble)

| Time | $\alpha$ | Stage | Vert. Force # |      | Hor. Force # |      | Time, sec | Tape     |
|------|----------|-------|---------------|------|--------------|------|-----------|----------|
|      |          |       | L.L.          | R.L. | Front        | Rear |           |          |
| 1548 | $\sim 4$ | 1     | 10            | 12   | 38           | 38   | 19-20     | 16 mm    |
| 1615 | $\sim 4$ | 4     | 10            | 14   | 43           | 45   | 14        | 377 16 " |
|      | $\sim 8$ | 1     | adj.          |      |              |      |           | 381      |
|      |          | 3     |               |      |              |      | 48-52     |          |
|      |          | 6     |               |      |              |      | 58-60     |          |
|      |          | 1     |               |      |              |      | 4.2       |          |
|      |          | 3     |               |      |              |      | 5.7       |          |
|      |          | 6     |               |      |              |      | 7.3       |          |

Total 'Wt.' =  $86 + 90 + 21 = 197\#$

Reviewed above arrangement  $\bar{c}$  35mm. photos. and installed EKG <sup>+ T.M.</sup> monitor. Made a brief run  $\bar{c}$  35mm., Arriflex 16 mm. + BAFB video. Then started  $\sim 10$  min walk at above setting + brief jog. Recorded this on 2 ch. tape. Mac's crew do not work late so could not complete planned comparison. Tomorrow will try to run at two settings to compare H.R. under above conditions vs. 1g.

A number of points became apparent. Support of the legs must be distributed. The 'weight' bungees must be rearranged such that it can be adjusted at the treadmill end (and monitored). A form fitting support should be tried. cont'd on next pg.

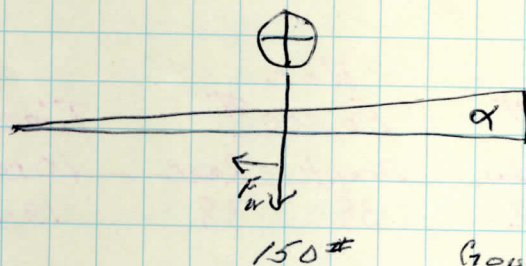


21 Mar Horiz. Locomotion BAFB

Returned and tried to get set up for comparison  
1g. + horiz. runs at 1, 3, 6 steps. Table full breaking  
recorder leads so only made runs at  $\sim 10^\circ$  meas.  $\bar{c}$   
clinometer, and stages I, III + VI horiz  $\bar{c}$  198#  
wt.

2.12

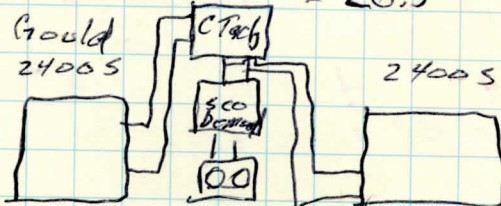
2.12



$$\alpha = 8^\circ$$

$$F_w = \sin 8^\circ \cdot 150$$

$$\text{Brotach} = 20.9$$

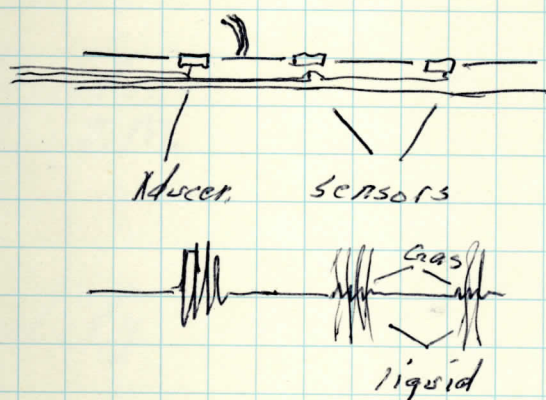


Replay of Tape: set up as here

ERG

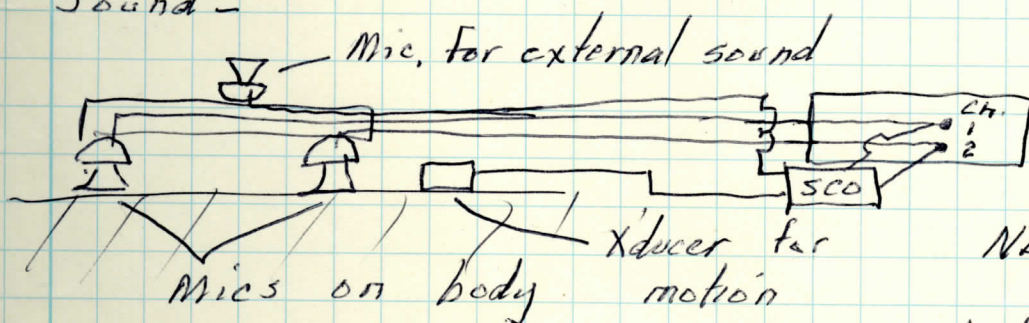


Catheter which senses liquid, gas phases



NB duplex press.  $\bar{c}$   
sounds on semi cond.  
transducer.

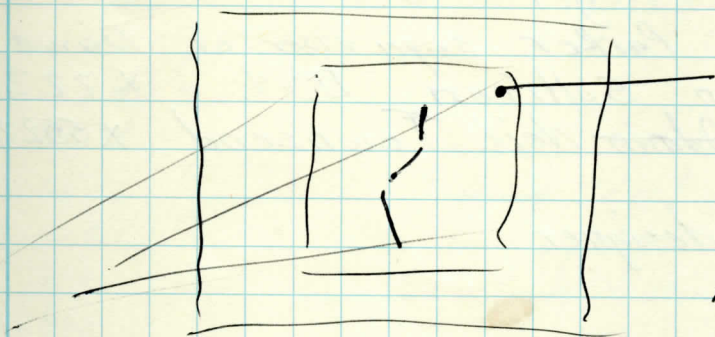
Sound -



NB. Ext. sound & motion would gate body mic. output -



28 Mar. Horiz. Locomotion, Film analysis



Tracing paper marked 9 frame

Made crude tracings of leg angles, local vertical, T/M  $\angle$  and vertical displacement

16 mm stop motion proj.

Made meas. of vertical motion and leg  $\angle$  while walking at step I &  $\sim 10\%$  H. + V. ( $9^\circ \sim 8.5^\circ$  respectively)  $\bar{\Sigma}$  corr. for camera subj. difference - Nearer camera during Vert. runs. Scaled distances to 2" (1x2) board.

Vert' movement:

2" = 1.5 unit

H. 1.0 " or .66x2, = 1.3"

V. 1.90 " = 1.3"

Knee  $\angle$

|   | Toe off | Heel <del>off</del> Down |
|---|---------|--------------------------|
| H | 170°    | 121.5° 48.5° $\Delta$    |
| V | 180°    | 163° - 17° $\Delta$      |



1 Apr.

1 W C S

Financial → Dawn(?) Hoyel 6<sup>th</sup> floor X3821  
 " Hal Parker supervisor of Dawn X2650  
 Contr. Officer Ann Sullivan DC-4 X2231  
 Administrative → Admin Neil Townsend X5523 VP-4  
 LLC.  
 Aimee Alex Ame designer  
 Withey  
 Roseanne

Q &amp; A.

Bob (RH) Steele Reliability NB-5 ~~3~~3591  
 Gil Perez X2576

Boeing quality

Chuck Holloway ND-7 5165

Fred McAllister (under Perner)

& Rockwell certifying under Generic cert.  
 Travis Brown ← Bag.

2 Apr.

Handover mtg. c Townsend, Lofland, etc  
 Agreed to

4 Apr.

ILC gave Lofland outdated costs and yesterday  
 after we used the data gave hours expended almost  
 double and c more hours to complete claiming  
 'added' requirements were responsible and almost  
 doubled material costs. Morehead not in town.



1 April  
86

## Data Reduction B.S.

Crip 41GAI (1A 41G) <sup>label & tapes</sup> 0/23:10 also 6/0010 on label refers to 18

Time Tape

00:00 015 line out

05:03 131 max level out 7. headphone @ Ch-2-40Hz

10:00 226 food prep. ? "passing in Coast India"

15:40 325 activity shifting to @ side, runs developing

20:00 392

25:25 470

30:00 533

34:50 656

Stop

Crip 41GIB 22:50 6/0010 (R) mic only & off surf 1014

SIC Gary Payton 1G Baseline 13 Jan '85 side A

@ Ch 2-40 (R) Ch. 4-3.KHz Awake 2 hrs only 1/2 cup C.

00:00 010 soft distant sounds,

05:12 131 occ. loud runs from @ side

10:15 229

15:00 311

20:02 390 very active focus on @ side

25:00 462

30:00 560 scattered faint pings

35:00 594

44:00 651

39:41

G. Payton "1051 AM ?" Side B

00:00 016

05:10 133

09:05 212

41G Tape ? A Sullivan 1/00:07

(R) mic only -

00:00 020 not certain mic is seated - OK, occ. off skin

05:00 133 quiet gut

10: 2 loud background noise, machinery, impossible to read

Sullivan 6/22:40

- Noisy -

C. Walker - 0/13:35? Line @ 2-40Hz R 4-3.K

00:00 010

05:00 123

10:00 220

15:00 307

20:00 385

25:30 464

In Seat

v. quiet occ. pop

Ticks from @

sound &amp; movement

? out of seat

1:00 hr. p launch

Cont'd. Next Page Isol. pops



1.4.86 Data Reduction BS

Time Tape 61B1A cont

30:00 524

' 8/01:17 '

35:00 587

suddenly active sounds

40:00 647

44:58 703

Tape 61B1B CW started ?

00:00 010

05:00 124

10:00 221

15:00 307

20:00 385

25:00 458

Belching  
doll popsI/02:33 vomits (423 tape) machinery on  
Noise to EOT

C.W. had increase in B.S. ~~vomiting~~ apparently  
related to seat egress + activity. Second tape ? 2 hrs.  
later  $\bar{p}$  vomiting and had modest sounds. Subsequent  
recording sessions blanked by machinery noise. ? filter.  
@ This is second record to N sounds

14 Apr.

Tom Stoa - Remaining Tapes -

Walker Baseline

Cenker

Buchli Baseline

Hawkey

Bolder Baseline (ontape)



2 Apr Suits Schl-

US AF emergency suit 60's = Gemini (was O<sub>2</sub>)  
GT-4 soft helmet

Mercury = Navy MK III Goodrich  
O<sub>2</sub> 3.2 PSI Convection LiOH

Pre Apollo - H<sub>2</sub>O cooling - to A-14 O<sub>2</sub> - 4.0 psi 3.8-4.2  
S.C. modified A-7L also ASTP.

Shuttle IVA

ARC - 9 PSI Hard Suit - single seal.

S-72-3741 V

S 83-42593

S 64-36908

S 65 30431

S 66 1597

S 66 1847

S 68 4313

S 69 19047

S 69 19056

S 69 52734

S 70 27341

S 82 35317

12 hrs 10.2 LEH 1.0 Hr 100%

↳ 25.9%

Conting. 3.5 PSI

3327

- 3000.

327.

8,250 - hrs.

105,000

30 K

25)

16 Apr-

ILC Rose Anne -

Fab. of flt. proto. Hdw.

ILC Whitmore can't  $\approx$  ILC + ILC insp.

Motor-EMI - Improper paper work by ILC

Procedures -

Hold For Box

Thigh restraints

Ed Rains For Procedures -

No

125 hrs.

1-2

4 hrs.



16 Apr '86 Bowel Sounds  
 Time Tape Crip 419 9.10.84  
 min. # sim day 7.  
 0:00 309 (R) 4-3. kHz  
 5:00 387 (L)  
 10:00 446 line out  
 10:08 461  
 15:00 526  
 20:00 580  
 25:00 638  
 28:48 690

Thornton 25 Apr. Reglan  
 0:00 006 Max gain  
 099 record from moved mics to  
 5:03 121 E'phone (R+L) LQ from  
 10:00 217 1 (R+L) LQ  
 15:04 306 Prep. for injection - 10mgm. Reglan  
 20:00 384 Inj. 10mgm, Reglan ? mics to R+L LQ?  
 25:00 456  
 30:00 524  
 31:28 544

51G4B Nagle - 5/14:25  
 0:00 007 Line out to recdr.  
 5:04 123  
 10:00 218  
 15:00 304  
 20:00 382  
 25:03 454  
 30:00 521  
 35:15 587  
 40:00 644  
 45:00 701

Thornton 51B5A 6/06: MD7  
 0:00 011 (R+L) LQ Redr. 6 Unit?  
 5:00 122  
 10:00 222  
 15:00 305  
 20:00 383  
 25:00 455  
 30:00 522  
 35:00 585  
 40:00 645  
 45:00 701



17 Apr. DSO Rpt - Rqmt. for 15 May -  
T.M., discussed ē

Leg Vol.

Pre & Post -

All but Nelson -

STS-8 }

-7 }

Pailes, W.T., N.T.

C.W. \*

Garp \*

Rudolpho \*

Nelson ?

W.T. Δ Jake Δ

W.T. Δ C.W. Δ

Pailes Δ Rudolpho Δ

Need stats.

\* cont.

Δ Pre-post  
(stand)

B.P., H.R.

Clin. Charact.

EHT

Bowel Sounds

1300

Perez

Ross

QSA  
white approval

TPS

Lofland

Agreed that we do not require qual. insp. for assy & that unit  
can be assembled by Wmore. and insp. by QSA on acceptance.



# 19 Apr B.S. Data Reduction

Coats (side) 1 TAPE 2A 41 D Day 2  
 (L) channel (R) lower (R) Ch upper EarPhones 8.0

| Time                 | Tape |                                                                      |
|----------------------|------|----------------------------------------------------------------------|
| 0:00                 | 065  | Good Mic contact                                                     |
| <del>5:00</del> 4:50 | 117  |                                                                      |
| 10:00                | 217  | movement                                                             |
| 15:00                | 304  |                                                                      |
| 20:01                | 384  | moving                                                               |
| 25:00                | 457  |                                                                      |
| 30:00                | 525  |                                                                      |
| 35:00                | 589  | 1 <sup>st</sup> real solid sound (? post H <sub>2</sub> O ingestion) |
| 40:00                | 650  |                                                                      |
| 45:00                | 707  |                                                                      |

51 B 2 A W.T. Earphone output to red. level 6.0 start Time MD-1 11/4/84

| Time     | Tape |                                    |
|----------|------|------------------------------------|
| 0:00     | 066  | stewing                            |
| 5:00     | 171  |                                    |
| 10:00    | 261  |                                    |
| 15:00    | 343  | drank 8 oz H <sub>2</sub> O slowly |
| 20:00    | 418  |                                    |
| 25:00    | 488  |                                    |
| 30:05    | 557  | "short tempered"                   |
| 35:00    | 615  |                                    |
| 40:00    | 674  |                                    |
| 45:42:42 | 704  |                                    |

51 B 1 0/03121

| Time | Tape |                   |
|------|------|-------------------|
| 0:00 | 004  | Marked stocking - |
| 2:13 | 060  |                   |

NB Lower Tr. is (R)  
 Upper (L)

## 19 Apr. B.S. data reduction -

ES 1000 2 DC Amp & KH 3550 Filt.

(L) & (R) 4 → 3.0 KHz. Line to ventr phone out. 8  
 W.T. 24 Nov '84 1A

| Time  | Tape |                                    |
|-------|------|------------------------------------|
| 0:00  | 033  | Starting meal, (R) side ↑ activity |
| 5:01  | 145  | sl. activity (L)                   |
| 10:00 | 239  | ↑ activity (L)                     |
| 15:05 | 325  | meal finished                      |
| 20:27 | 409  | coffee, continuous activity on (R) |
| 25:00 | 474  | phasic activity on (L)             |
| 30:00 | 541  |                                    |
| 35:00 | 605  | Leaving table                      |
| 40:00 | 665  | continuous activity                |
| 44:06 | 710  |                                    |

W.T. 24 Nov 84 1B

| Time  | Tape |             |
|-------|------|-------------|
| 0:00  | 007  | trying down |
| 5:31  | 132  |             |
| 10:00 | 218  |             |
| 15:19 | 311  |             |
| 20:25 | 391  |             |
| 25:14 | 462  |             |
| 30:07 | 528  |             |
| 35:23 | 595  |             |
| 40:55 | 662  |             |
| 45:00 | 708  |             |



19 Apr B.S. Data Reduction  
 Gar 31 Jan 85 1948 → 20340

| Time                           | Tape |                                                  |
|--------------------------------|------|--------------------------------------------------|
| 01:00                          | 012  | Resting quietly, presumed to<br>be post prandial |
| 5:00                           | 126  |                                                  |
| 10:00                          | 222  |                                                  |
| 15:37                          | 320  |                                                  |
| 20:00                          | 388  |                                                  |
| 25:00                          | 460  | started music                                    |
| 30:00                          | 528  |                                                  |
| <del>35:00</del> <sup>35</sup> | 600  |                                                  |
| 40:00                          | 652  |                                                  |
| 45:00                          | 709  |                                                  |

Called by Barry Lev. 16<sup>th</sup> & told that summary DSO reports  
 were req'd. by Washington (NASA HQ) Jan. 15 - no  
 other info - grooved

22 Apr. T. Stoa May 28.

Nagle - define period of SMS

Baseline

Buchli  
 Cenker  
 Walker  
 Bolden  
 Hawley

NASA Rpt. Data

- 1 - minute + 5 min -
- 2 - Means
- 3 - 5 min. <sup>sums</sup> ~~mean~~ of  
few selected periods
4. Statistics

6 loads Time of onset.  
 Seat exit W.T.

BP/HR. NASA Report

Background

Procedures & Protocol  
 Results / Analysis  
 Conclusions

Tech Appendix -

Data

- 1° - Print Out (1)
- 2° - Each BP/HR record
- 3° - statistics
- 4 - Epochs - ~~100~~



22 Apr. Shumate, Kerwin  
Ventilation:

W.T. - did good + unusual job  $\bar{s}$  support + in face of opposition; have made every attempt to do desired documentation and have made reports etc which have been lost, misrepresented will not turn over reports to either bolster existing DSO organization nor for other biopolitical purposes.

J.K. - work is worthless  $\bar{s}$  documentation - is under pressure from Nicogossian to disband program in favor of SK experiments - Agreed to finish SBR presentations for May 15 + B.P. 3 wks later.

23 Apr. TO DO  
Bone Act. Mon.  
Charact +  
Etiol SMS

GI Motility

Fluid Shifts

1 WCS, procedures  
etc.

Px. Landolt C's (?)

Finish B.S.

2 May B-4 Rm.-3  
Rose Ann -  
Whitmore - Frames



1 WCS

Ross X2676

Parts List - 1 LC

Dwg. Piece Parts  
 Assy. Dwg.  
 Top "

Directed for Neil  
 1 LC (1449)

CCB - ✓ that no chg. Townsend

Whitmore will red line

Certify for safety &amp; compat.

Final Assy. Torques etc TB done JSC to JSC Insp.

Wmore. needs adhesive Howard Kinsey mat'l's -  
 & mold compound -

Motor testing for EMI

Wiring of control box &amp; motor - 1 LC.

Ship box to 1 LC W'm.

R/A to provide dwg. for wiring ✓ WT &amp; 1 LC

Hold container for flt. frames.

Fabricate flt. frames - after ✓ by Henry - 1 LC

Hold thigh restraint changes

Gaskets for velcro - 1 LC.

Doct hose to be deliv 12 May.

Hourly mtg. Fri -

1 LC badge to M.W.



29 April B. S.

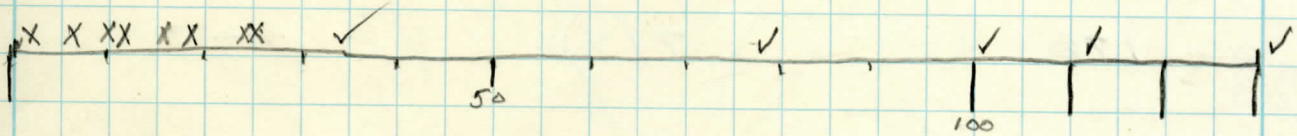
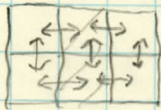
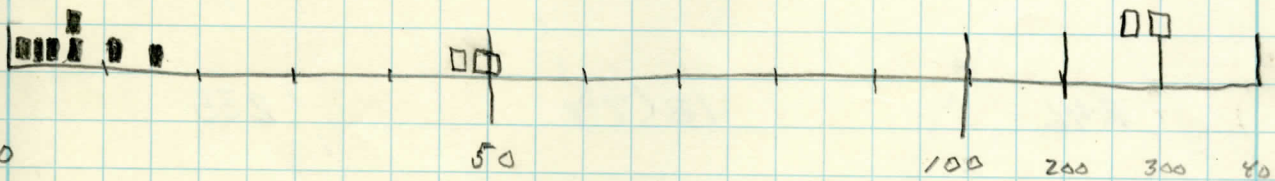
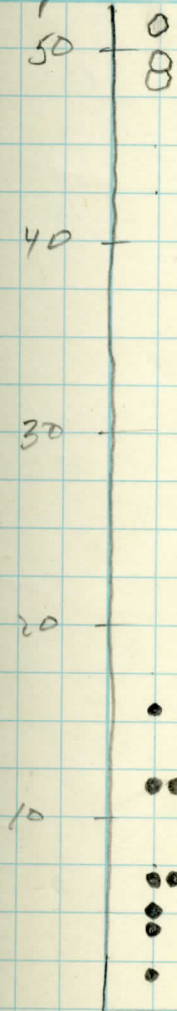
|       | Pre -<br>Number/5min. X                    | recovery<br>SMS $\langle \frac{1}{100} \rangle$ $\bar{p}$ SMS<br>Number (% base) | Post                      |
|-------|--------------------------------------------|----------------------------------------------------------------------------------|---------------------------|
| * Q ✓ | 172                                        | 8, 18, 19 $\bar{12}$ (7%) 100, 104 - $\bar{102}$ (52)<br>(12)                    | -                         |
| * B ✓ | -                                          | 2 (2)                                                                            | 86                        |
| E     | 72, 78 $\bar{75}$                          | 221 (300)                                                                        |                           |
| L     | 72, $\bar{66}$ (7+7)                       | 34 (47)<br>(56)                                                                  | 61 (85)                   |
| * N ✓ | 77, 95, 116 $\bar{96}$                     | 17, 22, 27, 49 $\bar{16}$ (16)<br>(14)                                           | 114                       |
| H     | 219                                        | 107 (49)                                                                         |                           |
| * I ✓ | 197                                        | 12, 7 $\bar{10}$ (5)                                                             |                           |
| * J ✓ | 215, 137, <del>221</del> , 385 $\bar{246}$ | 15, 3, 19 - $\bar{18}$ (7)                                                       | 104, 280, 321 $\bar{235}$ |
| * M   | 33                                         | 180                                                                              | 106                       |
| P     | 248                                        | 441 (180)                                                                        |                           |
| * C   | 178                                        | 7 (4)                                                                            |                           |
| F     | 128                                        | 78 (51)                                                                          |                           |
| * K   | 208, 237, 185 $\bar{210}$                  | 25 (12)                                                                          | 77                        |

219) 107.0  
 875 069  
 172) 17.00  
 1032  
 1688  
 .52  
 176) 102.0  
 17 380  
 22 1400  
 27  
 86  
 13 16 77  
 579 96  
 3 116  
 1288  
 .023  
 86) 2.00  
 172  
 8280  
 72) 61.0  
 576  
 340  
 3  
 75) 221  
 225  
 .56  
 61) 31.0  
 309  
 350  
 .51  
 66) 34.0  
 330  
 .47  
 72) 37.0  
 288  
 520  
 96) 16.0  
 96  
 1964.0  
 119) 16.0  
 119  
 406  
 215 104  
 137 280  
 285 32125  
 31737 31705  
 16  
 107 10  
 246 18.00  
 180  
 248) 441  
 248  
 1930  
 4  
 178) 700  
 712  
 .51  
 128) 780  
 768  
 120  
 208  
 237  
 185 210) 250  
 530 210  
 40



30 Apr

# Bowel Sounds





2 May Bowel Sounds, Means of P-30

Number-5Min<sup>-1</sup>

| SMS Subj. | Pre Flt.<br># | During SMS<br># (%) | Post SMS<br># |
|-----------|---------------|---------------------|---------------|
| * Y = *   |               |                     |               |
| * Q       | 172           | 12 (7)              |               |
| * B       | -             | 2 (2)               | 86            |
| E         | 75            | 221 (300)           | -             |
| L         | 72            | 34 (47)             | 61            |
| * N       | 96            | 16 (16)             | 114           |
| H         | 219           | 107 (49)            | -             |
| * I       | 197           | 10 (5)              |               |
| * J       | 246           | 18 (7)              | 235           |
| * M       |               |                     |               |
| P         | 248           | 441 (180)           | -             |
| * C       | 178           | 7 (4)               | -             |
| F         | 128           | 78 (51)             |               |
| * K       | 210           | 25 (12)             | 72            |



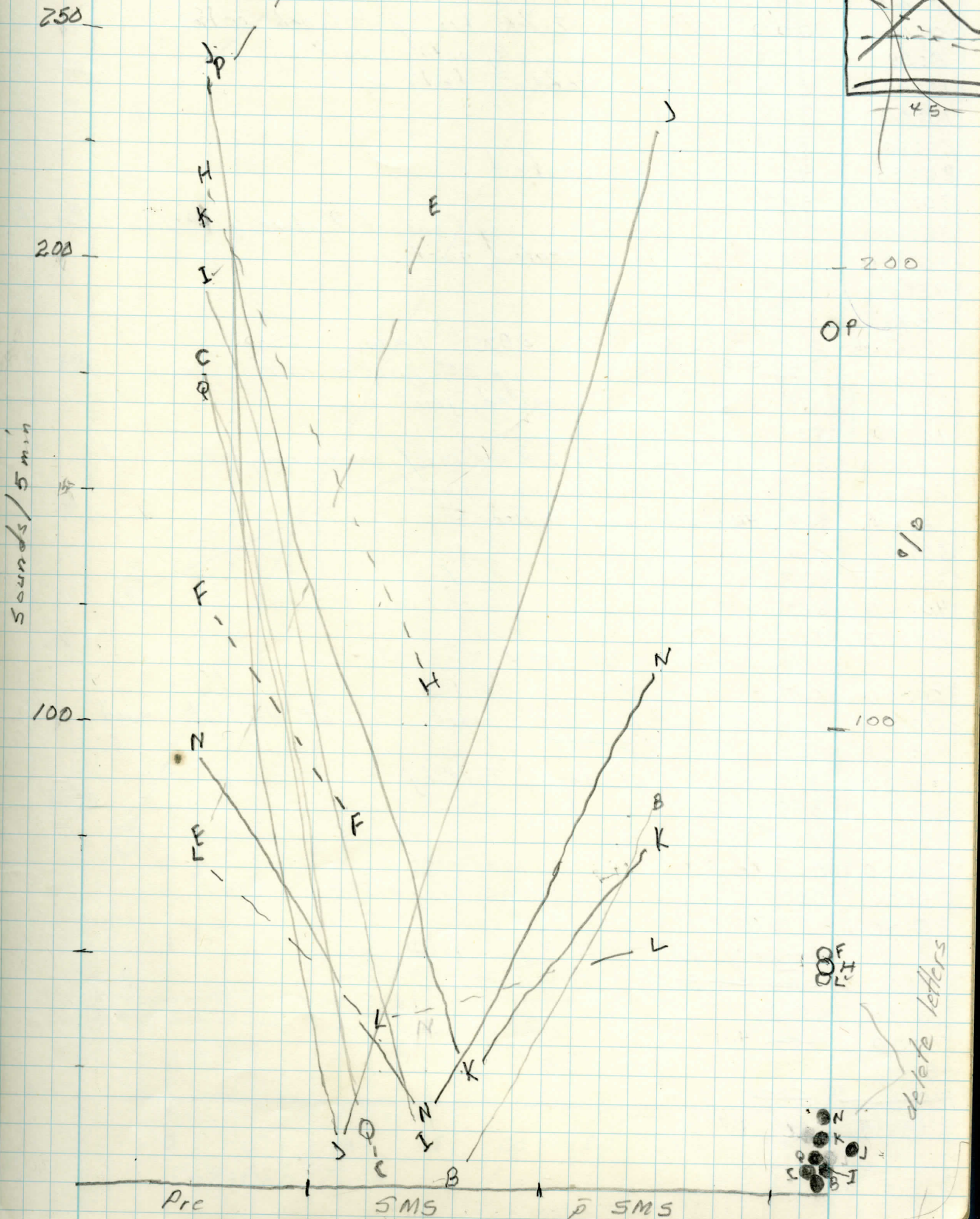
Fig 6

↑  
441

300 DE

33

Shrinney 488-9005





4.3.86

B. S.

1658  
21  
1729

C. Walker Post flt. 4.30.86

Time Tape 1A- (B) H-3, KH 1658 start - 1743 finish.  
 0:00 000 2 1/2 hrs p lt lunch coffee  
 5:00 ~120 physically active, walking  
 10:00 216 standing, talking  
 15:00 302  
 20:10 384  
 25:33 461 seated  
 30:13 523  
 35:00 583 31120 chgd. output to phone jack from line out.  
 40:00 643 seated, quiet  
 45:00 700  
 45:46 EOT

C.W. P. flt. 5.1.85 0805 1 may 0850  
 0:00 819 025 up 300 juice & coffee only  
 5:00 135 seated, quiet  
 10:10 2134  
 15:00 315 time 0818 tape counter 278 eat bkfst. sausage, eggs, coffee, biscuit  
 20:00 393 continuous sound  
 25:00 464 411 → end meal, coffee  
 30:00 530  
 35:00 593  
 40:00 653  
 44:27 703

May 1-86 C.W. 1134

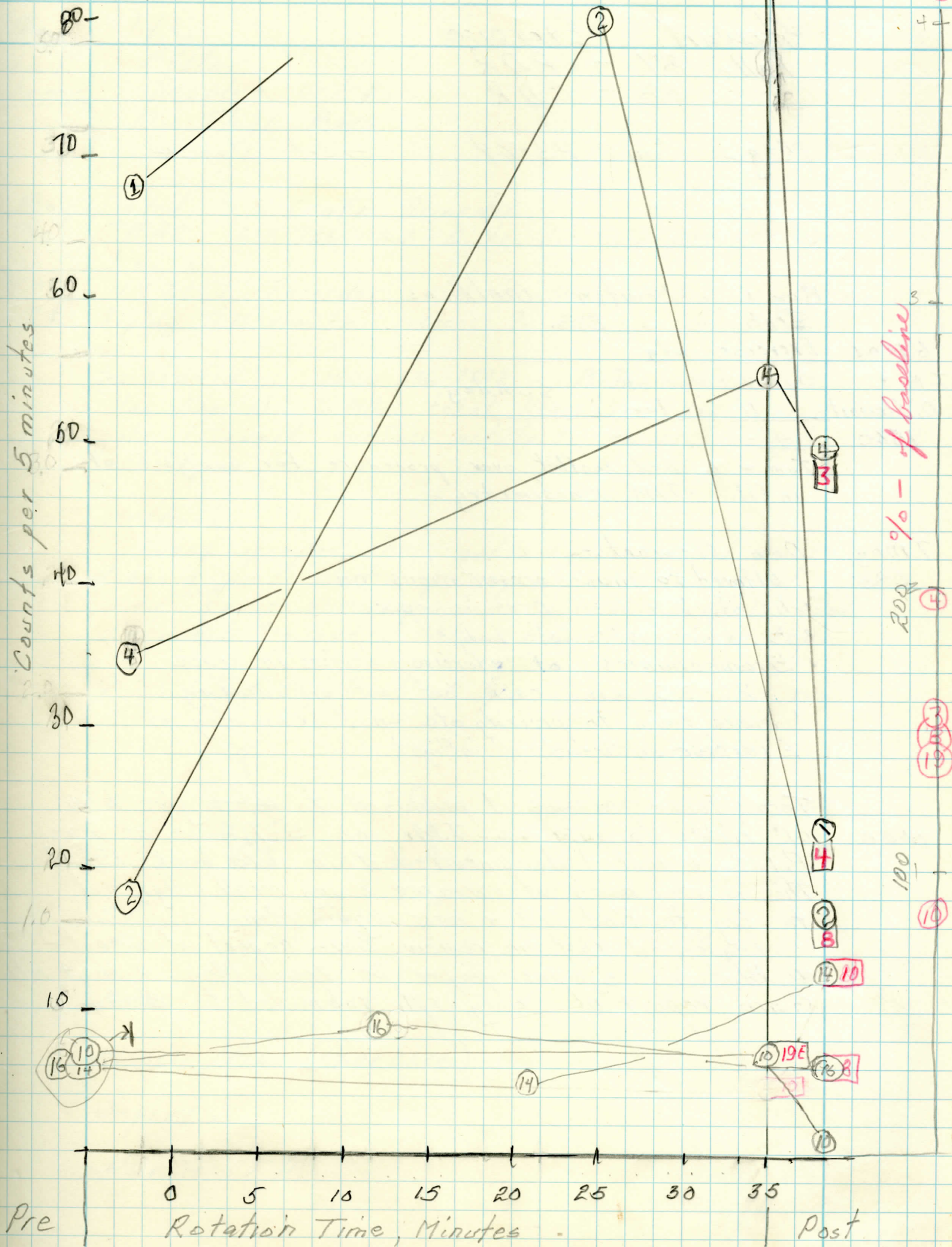
0:00 017  
 5:07 132 sitting, ofc. work quiet distant sounds  
 10:00 224  
 15:00 311 at desk, talking  
 20:00 389 " "  
 25:00 460  
 30:00 527  
 35:00 590 explosions, tympanitic (colon?)  
 49:40 EOT

280 Crip 1G 9.10.84 repeatability

0:00 280 39 310  
 5:00 389  
 10:00 449 461  
 15:02 578 noise  
 20:16:20 EOT  
 19:30 580 EOT



Sony  
Phones CD-7





Stewart - Exercise  
Fall - '87 - PDR  
88 - CDR

Mtg - Jun 23-24 → 5th Stage ←

May 6 Levitan, Galkins  
Statistics - B.S.

6 May Exercise mtg.

T.M. & D. Stewart  
1830 Overview - of - Sunday  
11 invitees  
4

Tom & I had conflict over procedure for analysis of  
in flt. T/M Kinesimetry -

7 May  
0830

Don Stewart -

- Offered to make presentations on
- Hx of Mus Skel lives in space
  - Biomechanics of body " "
  - Biomechanics of exercise + devices in space

20-25 mins each but not on Sunday  
I made claim to priority etc on Kinesimetry of  
Exercise on treadmill in flight

1000 Tom Moore; claims I promised to allow give him  
all rights to data on T.M. on 5-7, 8 i.e. he was  
P.I. - & that I documented it in note book - 1985?  
This is very much at variance to my recall - Agreed  
to try to find N.B. & meet again Mon.

Requested that he review Garn Report at Omni P-  
& that his sympos. paper be ready Mon. & that entire  
Garn report be only rpt. submitted to Bungo -



7 May 1 LC  
 short Filter  
 Items Resolve Velcro  
 No Thigh Bars.

9 May Called: Data Recorder  
 TEAC 213-726-0303 Distr. B.J. Wolfe 213-877-5518  
 John Lee

# 4K HR 30 Recorder 7 ch. DC-39 Hz 24 hrs. 1 v or 100 mV in  
 7K Replay R-71 real time others to 2K

Sonicaid - 800-336-7212 Bob Lackman  
 Has line of 2 MHz fetal heart recorders one c Fixed  
 gate to avoid surface artifact. mother(?) indicates fetal  
 activity.

Medtronic -

Called apropos their activity controlled pacer -  
 It has a "piezo electric pickup on case" - Has not been  
 used <sup>much</sup> ex. ~ 500 experimentals but widely used in  
 Europe - Requested lit. & name of local rep.

Q? : What is effect of force generation on running -



$$F = mg + ma$$

$$v_y = at = \dot{y} \quad y = \frac{1}{2}at^2$$

S.P.

Gorn

Bone

Muscle/Bone (exercise)

Reports

Horiz TM

T.M./



13 May Vol. A, Legs. Bed Rest vs Weightlessness

### Bed Rest

Nixon -

50° Skylab technique -

71 Kg. Subjs. 24 hrs -

$$7.5 \pm 8 - 7.1 \pm 7 = 400 \text{ ml. X}$$

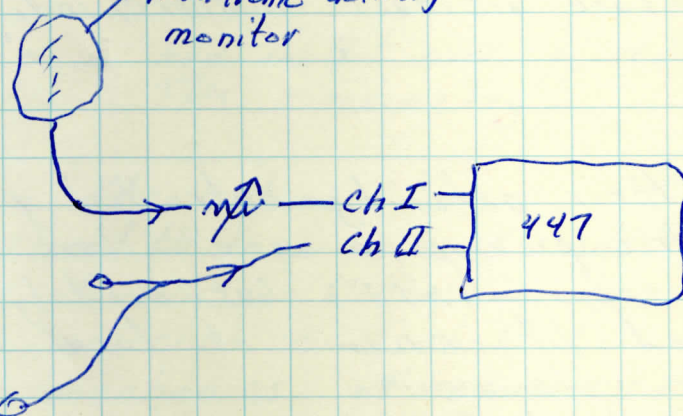
$$R = 800$$

Skylab mean -

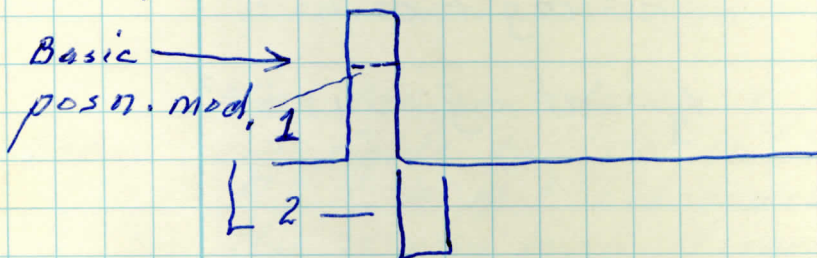
$$931 \times 2 = 1862$$

22 May

Medtronic activity monitor



? Add Thigh monitor -





13 May Ross Anne 1LC  
1400 Incomplete to W/M

Filter

Thigh

Hose, Vamp

O ring

Hours - 103. - 12

1530

W/M - busy

22 hrs

91 hrs

Tech-mfg. -  
6 hrs switch

T/M still disagrees on my supposed promise to give him control of treadmill data analysis.

Summary of work on reports

Bunga set deadline for reports on all DSO's for May 15 including those I initially did prior to SBRI, the majority. Shumate arranged support & now have Garn report finished @ SBRI M/S almost finished. Mike went to Wash. H.Q. @ other reports. 13<sup>th</sup> today.

Now to get future reports done.

Individual or summary reports on various flights  
Do individual ones @ summary.

+ fluid  
Cardiovascular studies

BP

liquids - 180

tonometry, tissue

photo documentation of Body Fluid shift

tonometry, oph.

Fluid distribution studies

liquids 180

tonometry

tissue

oph

Plethysmography

14 Mar Another unsuccessful attempt to resolve data question @ T/M. He wants outside, university arbitration.  
Call to Townsend apropos 1LC, will set up mtg. tomorrow.



16 May

Recorders -

Gower's inlaws

TEAC - 0-30 - 24 HrsEEG

Oxford - 8 ch 24 Hrs - subcarrier

DMA.

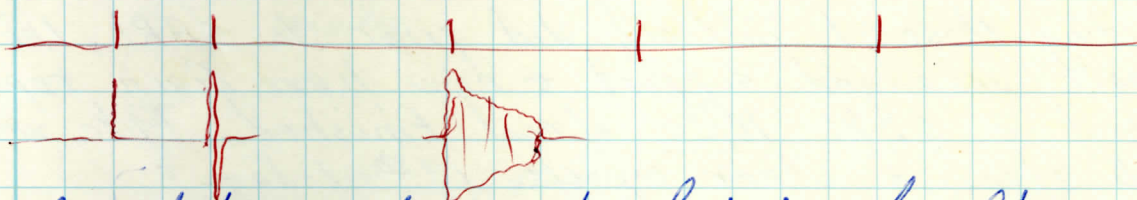
8 ch - .05-40 Hz

DC-5 Hz

W.T.

Wm D6 - Sony -

EV



Described several projects that I thought would be useful to an EE + B.M.E.

Richard Honaker came by and discussed working on EEG's (flight), one day week. Stressed that in view of my current problems over priority would promise him nothing but opportunity to work.

Tom Moore had another go at me for not giving him data from 5, 7, 8.

17 May Call from Linder apropos work on Ex. Dc. Reax Time. Wants to come in June & promised to get back in a wk.

Work that wants doing in leg volumes -

Measure body <sup>(leg)</sup> shifts of fluid -  $\rightarrow \uparrow \rightarrow \rightarrow \downarrow$  & during immersions - of osteopathy

2 June - T.M.

A. Coll, Sp. Med Peter Raven - Tex Coll

Med. &amp; Sci. in Sp. &amp; Exercise &amp;

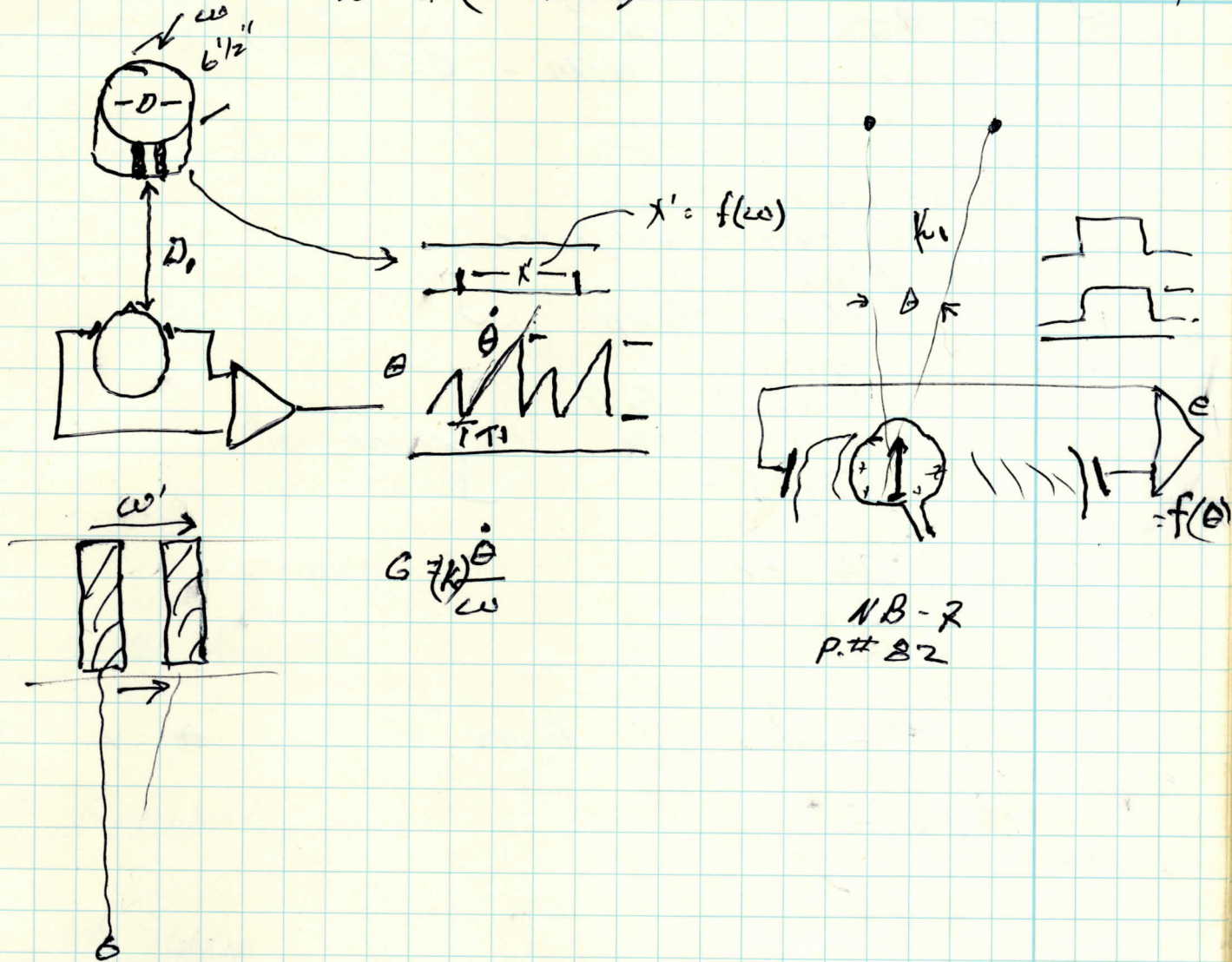
T.M. film analysis -

1. T.M. to gather and have analyzed cine film & have senior authorship of a paper in open lit. on methods of data gathering & results only cont'd next pg.



20 May Honaker - EOG (OKN)

4384



See P NB 7

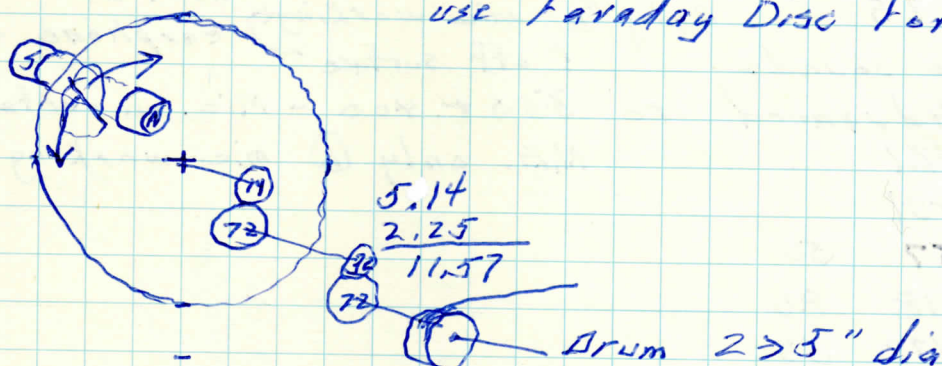
2. Film will be collected under same conditions as in F11, a addition of ~~F11~~ large T/M. or grounds of suitable slope
3. Gideon Ariel will be offered opportunity to analyze Film on a contract only basis
4. W.T. will ~~use be~~ have cognizance of T.M. arrangement in lg & data collection/analysis, will have ~~free~~ free & unrestricted use of data -

Initial Film analysis - Camera speed variation, lens distortion -

Treadmill speed - estimate of load -



use Faraday Disc For braking:



27 May Withy/O rings Primer, Hose Clamp, Velcro, Hose  
7th Apr. Mtg. all for W/m. (shape 2 H<sub>2</sub>O)

27 May Jackson  
John McConville 513-767-7226  
Joe Mc Daniels 82 513 255 2558  
Called McConville who encouraged that the publication of the 1978 anthropometric data. If it can be expeditiously done, a supplement to the anthropometric Handbook is a desirable vehicle. Also a presentation Stammler - Phd. AOM grad.  
Wolford & Brown - Anthropometric Lab, B-29 -  
Meas. last group  
John Jackson } 2° groups -  
Coleman }  
Wolford & Brown

| 28 May         | Rich. Holt, Schneider |
|----------------|-----------------------|
| Publication    |                       |
| UT Effort      |                       |
| Current Status |                       |

UT H555A

Nico. 12 + 13 May -

NASA hard to find -  
supplement -

Talk  
Triplet, Sheridan

Bailey - Archives -

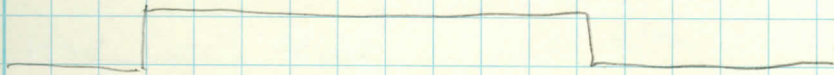
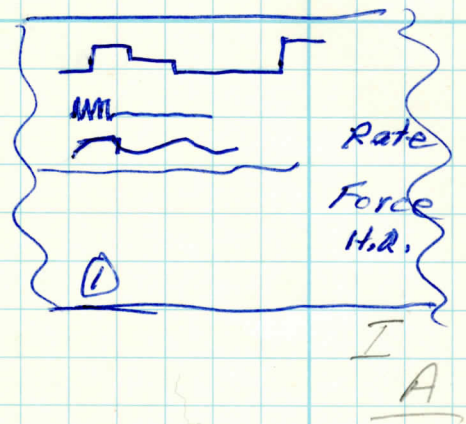
Need Biostatistician, Talk to



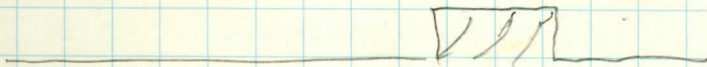
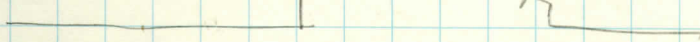
3 Jun

## Bed Rest Phase I

1. Hx of subjects activity
2. Replication of activity erect -
3. " of " at bed rest



number of steps



I want preliminary study using:

position switch & watches to accumulate total time in various postures Hor., Vert., Sit and pedometer and Hx for locomotion -

Protocol - Bed Rest -

4 Jun  
08002<sup>nd</sup> discussion c Sam on Bed Rest & Exercise -

Think he agrees to a preliminary study of as above with limited instrumentation i.e. free ranging, controlled exercise, ~~can~~ bedrest to est. Catt loss, bedrest & exercise to reverse loss. S- wants a 2x30 min limit to correspond to proposed Sp.Sta. protocol - I described instrumentation for above and follow on instrumentation for 2<sup>nd</sup> & 3<sup>rd</sup> where forces etc. are measured. P.S. agreed to meet c Johnson - Agreed c my role in exercise work - i.e. to support my efforts at definition of exercise for Sp.Sta. & give my ideas a chance, to participate in ISC recommendations & present data etc. at mtg.

0930

T/M - Sam app. told Tom support (salary) money not available & unless Bungo had money he would be terminated.



2 Jun Gene Winkler -

[5421]

Operation of WCS - urine collection

Mode - WCS/EMU  
Install Urinal Funnel  
(Vair) ←

Add to  
✓ list

Use as reqd. — After IWCS use & shut down

Remove Clean + Stow Urinal Funnel

3 Jun '86

#### Use of WCS (Urine Collection)/IWCCS

##### Preparation: WCS

1. Install urinal funnel.
2. Mode WCS/EMU, check air flow.

##### Set Up IWCS

3. Fan Switch - ON
4. Check light indicator on, motor running.
5. Open seat slide valve by turning hand crank CCW  $\leq 19$  times or until override actuates.
6. Remove one full wiper frame from wiper frame stowage assembly.
7. Open wiper frame slot lid (located just behind seat).
8. Remove empty wiper frame and place in empty slot of wiper frame stowage assembly.
9. Insert full wiper frame (white side facing seat back).

##### Body Positioning:

11. Route urinal hose as required
12. Adjust thigh restraints as desired.

##### Clean Up:

13. Count number of wipes.
14. Turn hand crank slowly CW  $\leq 19$  times or until override actuates.
15. Check seat cover closed.  
Note: Rapid crank operation may cause override to actuate.
16. Fan Switch - off.

##### WCS Shutdown:

17. Mode - OFF
18. Remove, clean, and stow urinal.
19. Complete questionnaire.

Used set up routinely this A.M. Gene St. will use & hope to start crew tomorrow. A few signs need posting & questionnaire is in work.

3 Jun

1500

Tag up 2 Townsend -



3 Jun. Gastric Motility

Visited Norman Weisbrodt

Dept. Physiol. U.T. Med. School

6431 Fannin, Houston 77030

Described bowel sound effort + showed results  
He felt gastric motility group would be interested and  
offered a poster session at upcoming motility meeting  
in HOW in Oct.

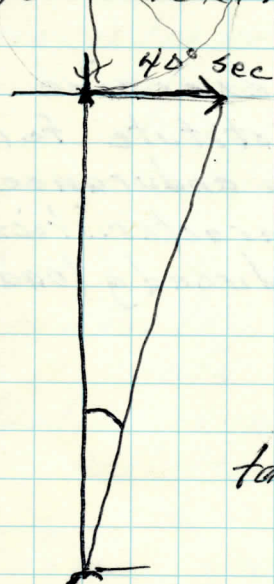
4 Jun Ran, graphically recorded mag. tape records  
1800 from 5-7 EOG Tg.

5 Jun Again ran records from 5-7 Tg.  
1800 Will take them to Matsco today

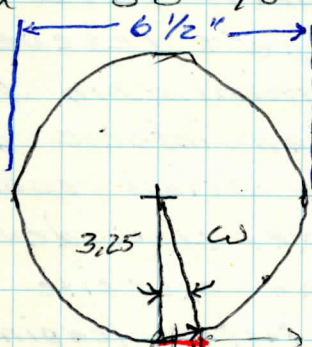


3 Jun Photo  
 D A C Don Yeates X3611  
 10 mm -

3 Jun - Nystagmus -  
 Eye tracking - max -  $30-40^\circ/\text{sec.}$



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



24"

$$\begin{aligned}\pi d &= \pi r \\ &= 6.28 \\ &= 20.42 \text{ "/sec.} \\ &= 6.1 \text{ "/sec.}\end{aligned}$$

N.B. eye tracking rate not compatible  
 with drum rate + all visual tracking  
 appears to limit at  $\sim 25^\circ/\text{sec.}$

4 Jun. Did a quick look at lg + inflight records. Above  
 based on Tg's first baseline which was not represent-  
 ative of later records which show a clear increase  
 in rate of eye motion to some limiting velocity. There is  
 still a discrepancy between Tgl + eye rates.

UA 937 2011

John Farrar - Richm. 804-230-1311  
 Arch. MS Guire 23249

Gastrology - Rise Goyal - 617-735-2136 Beth Isra Har  
 Digestive Diseases - Editors - Frank Brooks -

215 662-4000 U Pa

discussed with Brooks who evinced interest + will look at MSS.  
 Left word to Farrar

5 Jun Discussed with Farrar who agreed to review informally



## 5 Jun Exercise -

Major concerns:

Maintain adequate C.V. &amp; Mus. skel. reserve to function on return -

\* to what level?

\* escape &amp; rescue?

Use minimum time for exercise on orbit

\* Can intense activity substitute for  $\Sigma$  Forces\* No obvious substitute for endurance Exercise time

\* Exercise devices - characteristics of.

Artificial G - Can exercise under reduced g loads be effective  
\* eg. faster, <sup>①</sup>leaping, running.Bed Rest.

I Monitor - g profile

steps walked.

time speed distance jogged or run

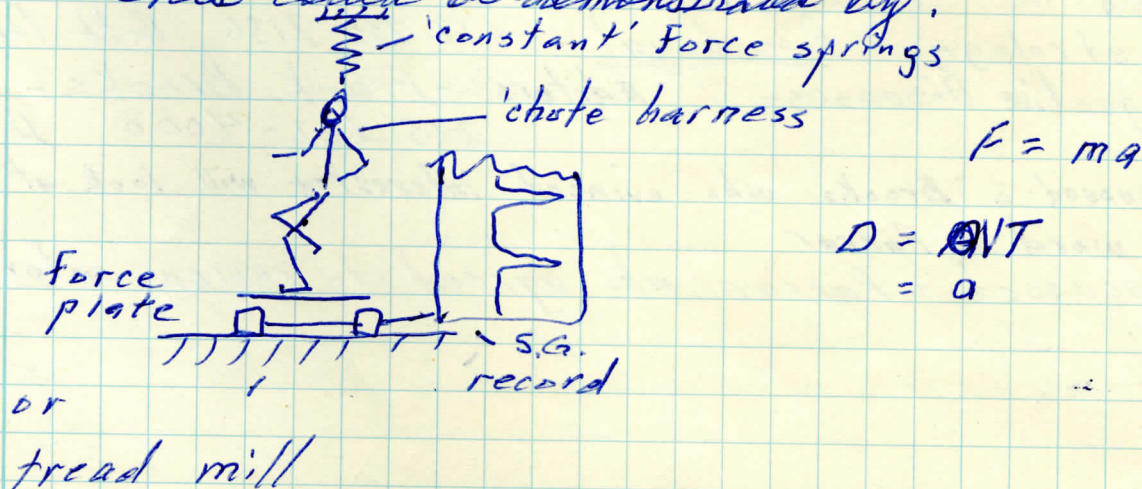
EKG Holter

Activity monitor

## Activity - EKG

- ① Questions here are whether larger forces at greater or equal locomotor speed can be generated. If traction can be maintained then larger forces can be generated but obviously under  $\bar{c}$  greater excursions i.e. running, ~~more~~ jogging would have larger vertical excursions and longer times. Standard locomotion would provide correspondingly lower forces.

This could be demonstrated by:



$$F = ma$$

$$D = \frac{F}{a}$$

$$= a$$



51 P. Johnson, S. Pool, W.T.

Pilot study - human use only no peer review  
Other aspects agreed to -

Baseline section at home

Monitored baseline in hospital

Sufficient time at B.R. to establish Flux  
then intervention

Horizontal bed rest, monitored exercise

Made a strong plea for minimum instrumentation but  
Sam wants indication of metabolic activity.

Agreed to:

Activity Hx

Pedometry

G records of posture

Partial monitoring  $\bar{c}$  Holter

+ Activity controlled pacemaker

Must define goals & criteria -

6 Jan.

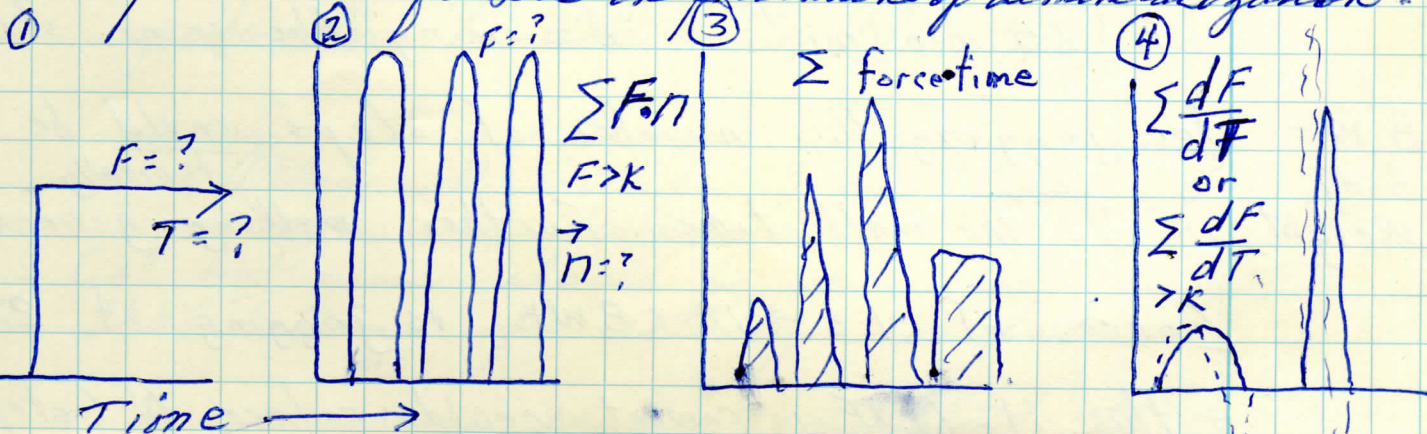
Locomotor

1. mineral content, ~~and~~  
usually  
taken to  
represent  
strength,  
~~is~~ may  
be only one  
aspect of  
bone.

Primary goal is demonstration that brief periods  
of large forces will maintain bone mineral (and  
muscle) although the majority of investigators  
have not accepted the premise that force will  
prevent loss. If as P.J. claims, it is accepted that  
'4 hrs. day' of walking is effective then the question  
of minimum amounts is crucial & becomes the  
first problem. The question next arises as to endurance  
of muscle & C.V. system and that of orthostatic tolerance  
is sure to be raised.

1. Magnitude, nature, duration of forces

While it is well known that a relatively few  
reps. even every other day will maintain muscle  
strength we have no such knowledge of bone. Indeed  
this is the proper goal of the study. The following  
are possible factors in prevention of demineralization.





## Rationale, cont'd.

Of the various cases it would appear that we can dismiss ① for it has never been possible to prevent bone losses by standing and static forces larger than 1 g. are not practical. ③ is certainly possible and if this were the case we would simply adjust the time duration however I expect forces below some threshold are not effective (except possibly in modifying other characteristics of bone). It seems more likely that ② or ④ will be the case. In ② there must be a total number of force cycles greater than some threshold value. This would be equivalent to muscle strength training and the  $N$  for muscle is small. (piezo) ④ would be consistent ~~with the~~ <sup>with the</sup> effects of piezoelectric stimulation as the cause of bone mineralization. There is of course evidence for this including maintenance of trabecular bone in magnetic fields in animals. In this case some number of cycles of change in force  $\Delta F$  must occur or more likely some number above a threshold must occur to produce the effect. This case is obviously related to ②, the number of force applications but may differ importantly in that smaller numbers of rapid onset forces, sprinting vs. jogging would be effective.

My approach is to assume ② or ④ is effective and on the assumption that the stimulus is related to  $N \times F$  attempt to ~~sub~~ reduce  $N$ , hence time by increasing  $F$ . Eg if a person walks 4 mi/day & jogs 2 then the number of steps might be;

$$\frac{5280 \text{ ft mi}^{-1}}{6 \text{ ft step}^{-1}} = 880 \text{ steps for a time of } 15 \text{ min. mi}^{-1} \quad \text{Assuming the same stride}$$

B.W. = for jogging this number of steps could be covered typically in  $\frac{1}{2}$  the walk time. Further walking generates

Forces of  $1.5 \rightarrow 1.8 \times \text{B.Wt.}$  vs jogging of  $2.5 - 3.0 \times \text{B.Wt.}$   
 + this, if  $N \times F$  is correct could reduce  $N$  (steps) by  $\frac{1.8}{3.0}$



## Rationale, contd.

or 0.6. In this case the 4 mi. walking for 1 hr. 20 min. could be reduced to 4 hr. 80 min.  $\times 0.5 \times 0.6 = 24 \text{ min.} + 15 \text{ min.}$  jogged normally - for 39 min. total. I feel this is very conservative & would not be surprised to see this reduced much more, esp. if small amounts of sprinting were included. Conversely if this individual plays sports involving large accelerations eg tennis, H.B., soccer it will almost certainly require some intense running i.e. each case must be considered individually.

Secondly there is the question of muscle and here we know much more. Theoretically a few reps. day will maintain strength & mass and this should be achieved by brief sprints. The second factor endurance can only be achieved by force  $\times$  repetitions. Also cardiovascular endurance comes in at this point. Even cardiologists have learned enough about exercise to maintain C.V. endurance which may be done in many ways including bicycling. I do not feel this is a primary consideration here and would like to relegate this to a later test series.

These concepts will be implemented as follows:

1. Determination of subjects' <sup>usual</sup> locomotor force / repetition pattern:

History to estimate general activity - sports, walking, jogging, running.

g-meters to determine static loads (plus additional activity estimate information).

pedometer to determine  $N$  (steps)

diary to determine jogging, running  
this will include travels & measured distances

$\text{Ca}^{45}$  but urine should be monitored

2. Validation of activity - in lab.

An exercise profile equivalent to



## Rationale, contd.

his normal activity will be constructed (on a treadmill) and validated using the same instrumentation and Ca<sup>45</sup> balance.

3. After Ca<sup>45</sup> loss is established <sup>by bed rest</sup> an exercise prescription will be imposed and at this time the subjects, <sup>with</sup> precautions and monitoring will be subject to the prescribed protocol.

It is obvious that more elaborate ~~experiments~~ measurements will be req'd. for determination of probable control of mineralization i.e. case (2) vs case (4) and to determine metabolic/endurance aspects. Examples of such instrumentation include:

force plates  
ambulatory monitoring of:  
force  
steps

metabolic rates (by heart rate/activity monitors)  
isometric study of strength  
'stress' tests

N.B. if the subjects are unable to complete some prescribed period of exercise say 2 x 30 mins/day then several brief periods will be used say 4 x 15.

6 Jun Briefed S.P. on above, Pp 62-66, showed VTR of bed treadmill, & IWCS -  
S.P. agreed to initial simple study <sup>5</sup> Holter but <sup>2</sup> force plates. Also in principal <sup>2</sup> P-62

Shirley  
Gaskins  
919.658.3051

Pins for switch  
Magnets  
Ltrs.  
Library  
Anne S.

- Ni Fe - 2 x 2 x 2 x 2 x 1/2 - Warren Veeder -  
6 x 16.09



10 Jun S.B. + B.L. + L.G. - OMRT

6 slopes -

OMRT - first priority

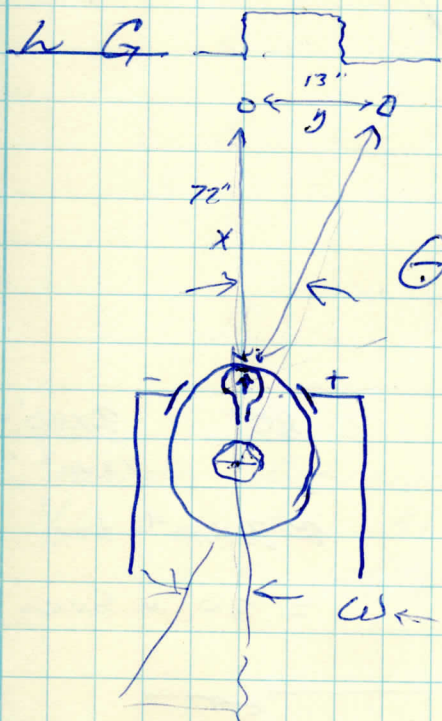
Glissades - 2<sup>nd</sup> priority - being measured

Rates - future

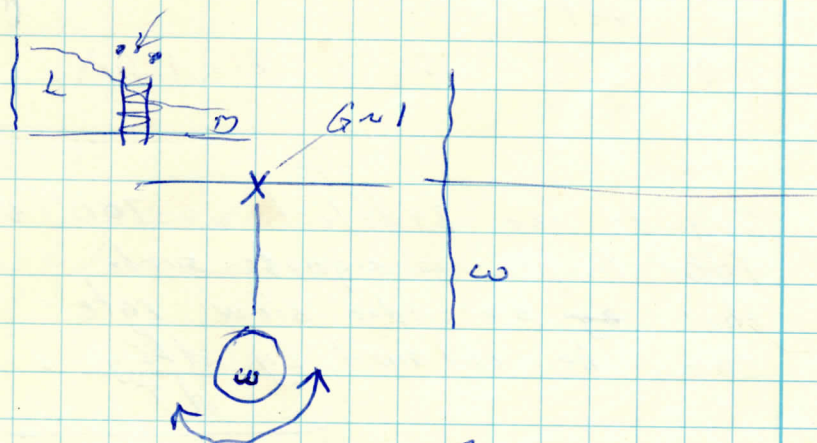
Histo. data -

Set limits -

Compare for sig Pre In + Post early late Sick + N.S.

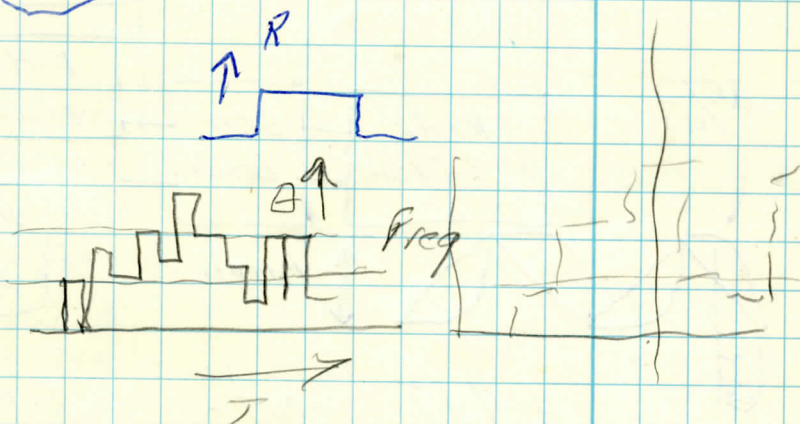


$$G = \frac{\theta}{\omega}$$



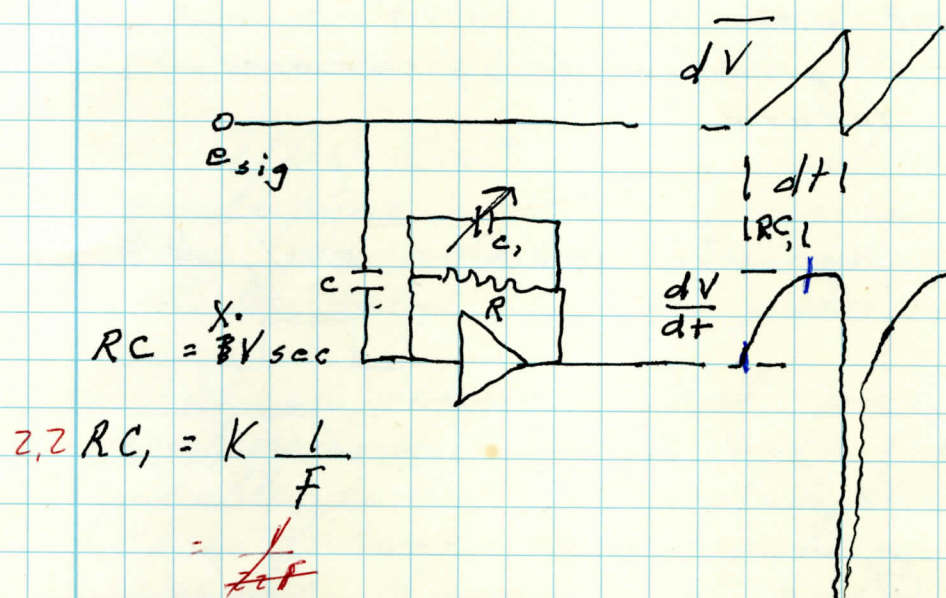
OPKN

$$\theta = |13.6|^\circ$$





11 Jan Replay DPKN Tg T 1a.



$$2.2 RC = K \frac{1}{F}$$

$$= \frac{1}{2.2 F}$$

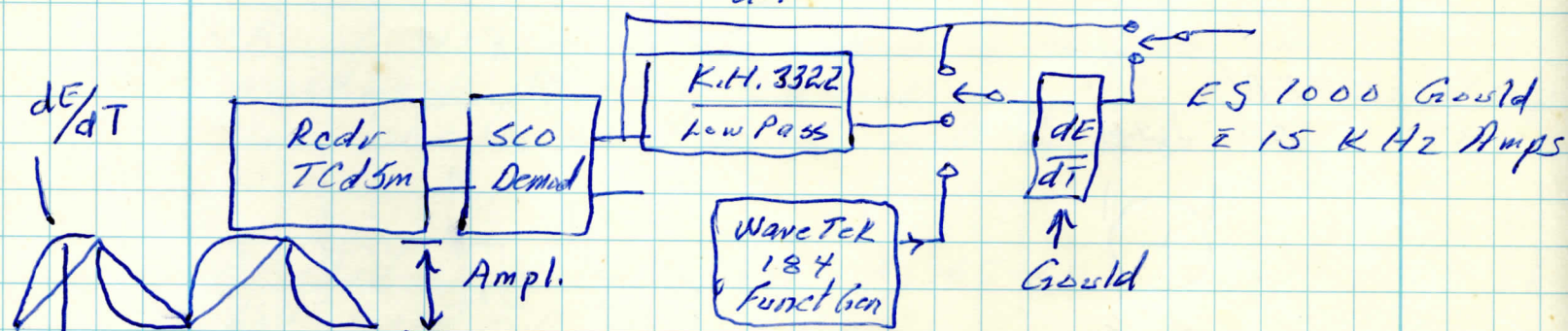
$$RC = \frac{1}{2.2 F} \quad F = 5 \quad RC = .1 \text{ Sec}$$

12 Jan  
1900

Try to use 24db/oct. 700°/sec  
Filter to process signals such  
that ~~eg~~ saccadic slew rate  
can be obtained by  $\frac{dE_{sig}}{dT}$ .

$$\frac{20^\circ}{7 \times 10^2 \text{ °/sec}} = 3 \times 10^{-1} \text{ sec}$$

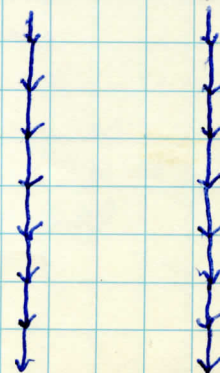
$$= 30 \text{ m Sec.}$$



$dE/dT$  input-

3 Hz

↓  
1 Hz



Filter

5 Hz

10 "

300 "

100 ↓

30 ↓

15 ↓

10 ↓

5 ↓

3 ↓

1 ↓

10 ↓

Ampl.

25.5

25.5

80.

80.

80.

80.

80.

80.

80

75

Response( $\tau$ )

m Sec

< 5

< 10

< 20

~60

~80

~150

~240

> 500

70



11 Jun B. Linder  
1930 O M R T

6 Subj's -

|        | Pre | in | Post | Affected |
|--------|-----|----|------|----------|
| 7 MS.3 | 1   | 9  | 2    | *        |
| 8 MS.1 | 3   | 4  |      | *        |
| MS.2   | 2   | 2  |      | *        |
| 3      | 5   | 6  |      | *        |
| Cdr    | 2   | 1  |      |          |
| Pit    | 1   | 1  |      |          |

Do Draft 14 23 2

Consider Corrective Saccades

Statistics For - Affected vs non Affected - Sick vs Recovery  
Pre vs in flight.

12 June 86

$dE/dT$   $\checkmark$  contd. filter - 10 Hz

$dT$  const -  $dE$  varied -

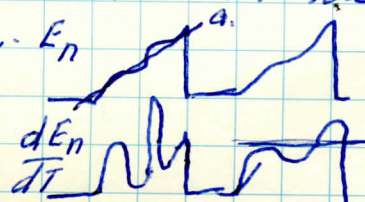
1 Hz Sawtooth

| Output | Input | %                    |
|--------|-------|----------------------|
| 55     | 72.5  | <del>59.5</del> 75.9 |
| 80     | 107,  | .748                 |
| 37     | 49,   | .755                 |
| 15     | 20,   | .750                 |
| 3.     | 4,    | .750                 |

13 June

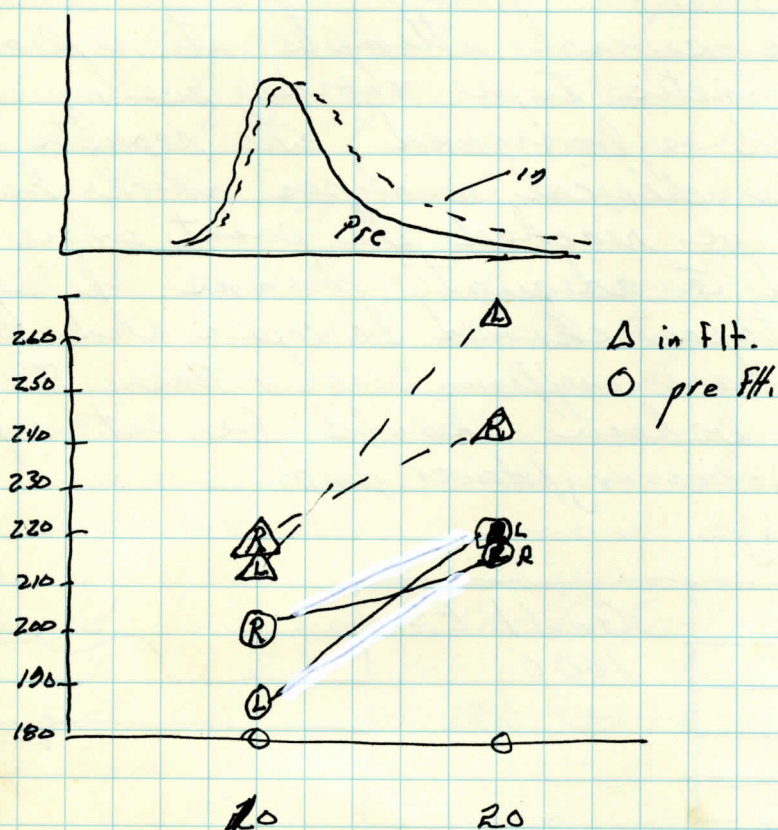
Attempted to.

1. Use a differentiator to obtain eye rates during saccadic shifts but records are noisy and duration of shift may be only 5 m sec. or a minimum filter cut off of 2-300 Hz.
  2. Optimize filtering for nystagmus rates. Most of the nystagmus beats are not at a constant rate & are frequently of short duration. eg.  $E_n$
- Under these circumstances the approx





13 Jun 86 O M R T



Found 25% difference in pre-inflight data in those  $\bar{c}$  SMS  $\bar{c}$  no change in those not affected in same period - Only 1 subject not affected was tested later in flt. & he increased - those  $\bar{c}$  SMS did not significantly ~~more~~ decrease

14 June Barry L.

Review of OMRT

If Leigh agrees go  $\bar{c}$  existing data

If additional data not complete in 6 wks go -

W.T. will try to have ratios in

16 Jun. Called Leigh who will review data -

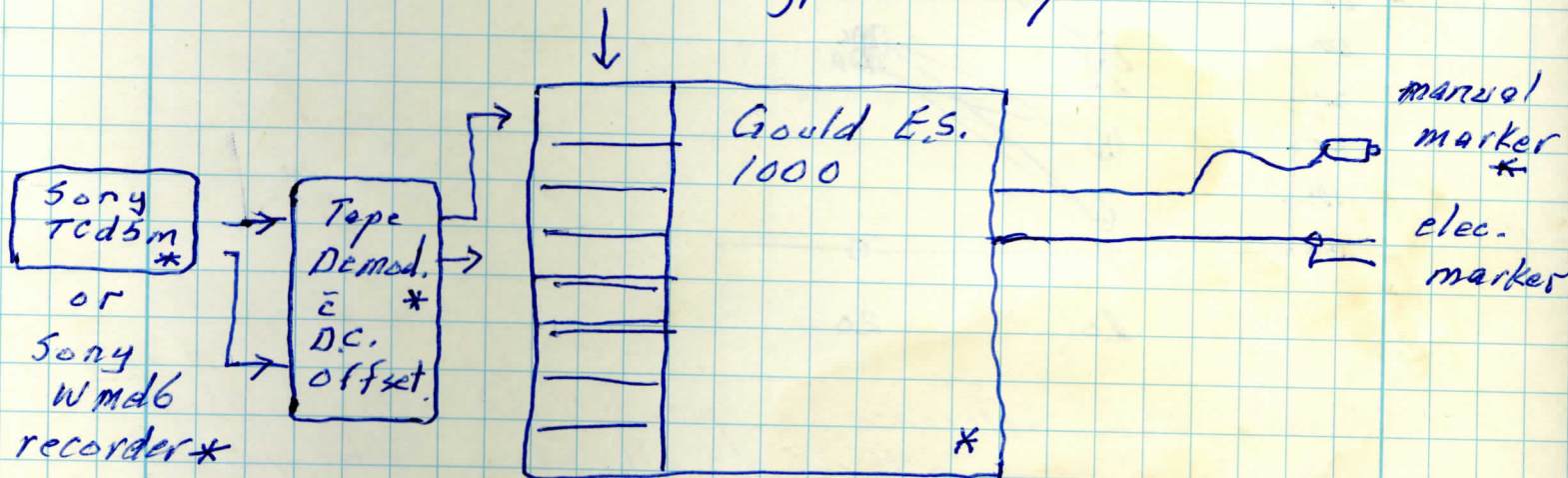


# 16 Jun 86 5-4-8 DSO Data Reduction/Analysis

We have made several attempts at reproduction of existing magnetic tape records using whatever could be begged or borrowed. The results were adequate to do clinical analyses which have been done however we reached the point where we cannot proceed & adequate means of reproduction.

First the tapes should be copied and the originals archived for they are suffering wear & tear. The arrangement below should be set up.

Accessory/driver Amps.



## Amplifiers/Accessories for ES-1000

- 4 ea DC - 15 KHz \*
- 2 ea Gould Differentiators \*\*
- 2 ea Cardiometers \*\*
- 2 ea Band pass Filters & separate high L.P. & H.P.  
0.05 Hz to 20 KHz \* \*

The items marked \* are available at various sites within NASA, after working hours. The \*\* items are available but must be adapted to the recorder by a custom adapter or by harnesses. ~~Being in~~ All of the above is available but the missing element is someone & the ability and desire to assemble & maintain the apparatus.

Data reduction, after graphic records have been obtained could be reduced several



Data, cont'd.

fold by any good computer hacker but using the best that was available was such a frustrating experience that I would recommend against it. This means large amounts of time must be expended in manual effort.

- At the outset of this work when the OBS system was used for data transmission I was promised record (mag. tape) archival by Hahn of T.I. & was assured this was being done until the missions were over & then told it had not been.

17 Jun, 1400 M. Burco told Biker to ignore all ~~the~~ requests for support unless I had personally had them approved by M.B.

Goold Inst. Local Charlie Snodgrass 680-1121

10% list Price - lease

80% toward purchase

# scope 5500-

3009-1150-20 8 ch rcd.

~~15.1K~~ ~~17K~~ 17K } 20.95

15.22 - 2095-

# 5+5 Take

Timer Printer 5K

Amp DC 50-100 230-110-11.2K

4 ch. multiplex 400A 3K 23-110-14

1K Hz

Biotach 1190

AE/at 1150

PFS \$500

221

Permag - 214-699-1121 DAL Larry Ryan - Will ship to Whitmore ~~to~~ 18 - 100 to me

Puma, has a shoe heel attachment designed by Cavan - which is a variable threshold inertia switch "calibrated to the individual" which "calculates distance, time & calories expended", when dumped into an Apple, IBM PC. PC can set threshold to count total steps in a day, ? rate.

Angela, PC's scty. says contact Fritz Brendenbeck 617-875-0660 \$200 - 909 75 R.S. Computer - includes S.W. & extra cards avail.

28 Jun Cal Ruas - R.S. Shoes 400 m - run start

# Time Sec

strides

1 2:17.0 185(?)

2 1:28.7 135.5

3 8:53.0 180, ?, 178, 183/1/4 subtract ~ 2 sec. stdg. start

4 2:25.0 192.5 400 m. st

5 1:54.0 159.5 ↓ ↓

watch cal c Seiko - 60 s 5 = 60.1 s.w.

15:00

15:00.05

1250  
350



16. Jan

Tape  
Files

S-6, 7

TB 3 &amp; 6

moved to O.P.

Tape # (A)

Replay Tape Tg S-T 1A

70 } - Cal - No Filt. .1 v/cm 100 mm/sec.  
 + 130 } Tg -  
 002 } Fag -

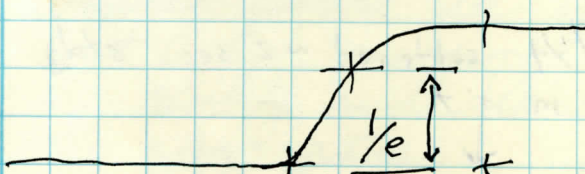
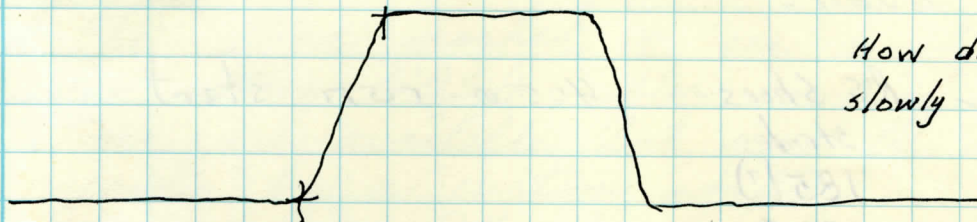
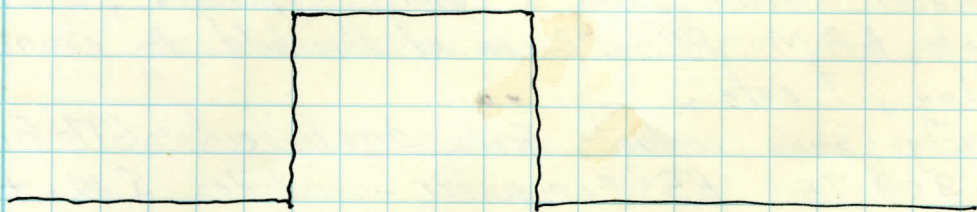
Ben. records from S-T Tg, Fa, Hk - For DMRT.  
 records from HK for OPK.

R3, 4

NRC committee on Vision of NAS.

Preliminary meeting to decide if there are problems to be considered by the NAS in vision in long term space flight. It was probably organized by W & R H.Q. NASA & rest. by ARC. It was characterized by great quantities of misinformation esp. on operations and SMS. Several competent people in their own fields. The major valid issues which seemed to occur were:

1. looking at peripheral vision which is more sens. to many influences
  2. dynamic visibility tests
- Could evoke no interest in appliances, etc. Basic drift was to discover areas for exotic research.



How does slope affect more slowly rising times - directly add?

$$e^{-\frac{t}{RC}} \quad \text{or} \quad t = RC$$

$$\text{for A.C. } f = \frac{1}{2\pi RC} \quad \text{for } 3 \text{ db } (3) \text{ pt}$$

$$RC = \frac{1}{2\pi f}$$



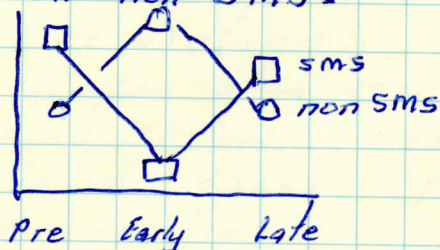
25 Jun

Review of data  $\bar{c}$  Len G. & Susan B. Bowel sound means are impressive for SMS case but have insufficient data on non-SMS.

May try to publish OMRT data from 6 subjs.

483-6174

H.S.  
statistics



26 Jun  
S. Brand  
For

Conf.  $\bar{c}$  Pool.

Still meet  $\bar{c}$  Shumate tomorrow for data reduction session. Agreed to present Mus Skel rationale, data & equipment at Mus Exercise Conf.

Discussion  $\bar{c}$  J.Y. & G. Fullerton today apropos Space Station. They want office position. I asked opportunity to present rationale. L.Y. wants artificial gravity. Need a new Rationale.

A Rationale For Exercise in Space Station

Background

Space

Theory

Experience

Projected Environment

Proposed Countermeasures

Apparatus

Verification

Mtg.  $\bar{c}$  Pool, Shumate

Only scrape of support will be made available for my data reduction and analysis. Alternatives are formal requests - months to year or dispensation from Herwin. Shumate has directed Omropla Matsco via Schneider to lease for 2 mos. the gear on P-72 to allow processing of records for nystagmus, OMRT, etc. Pool has approved for replay and analysis for OMRT the digital tapes from 5+16. The screen display which this produces is small by our standards, hence concerns for adequate resolution: I & P want show and tell data for Herwin. It is this kind of demand which has diluted & delayed effort to date.



## 27 Jun. Methodology & requirements for EOG Data Recording and reduction.

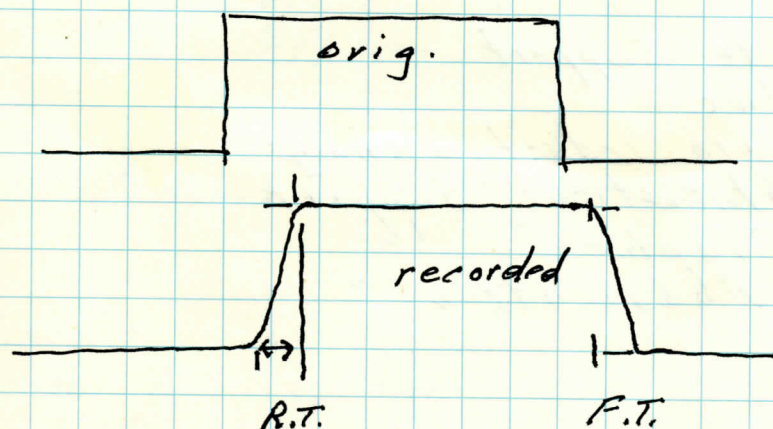
Time resolution:

Paper ~~show~~ speed should allow  $5 \times 10^{-3}$  s. resolution - and if reliable resolution is 0.5 mm this gives a required speed of  $.5 \text{ mm} \div 5 \times 10^{-3} \text{ s.} = 10^2 \text{ mm Sec.}$

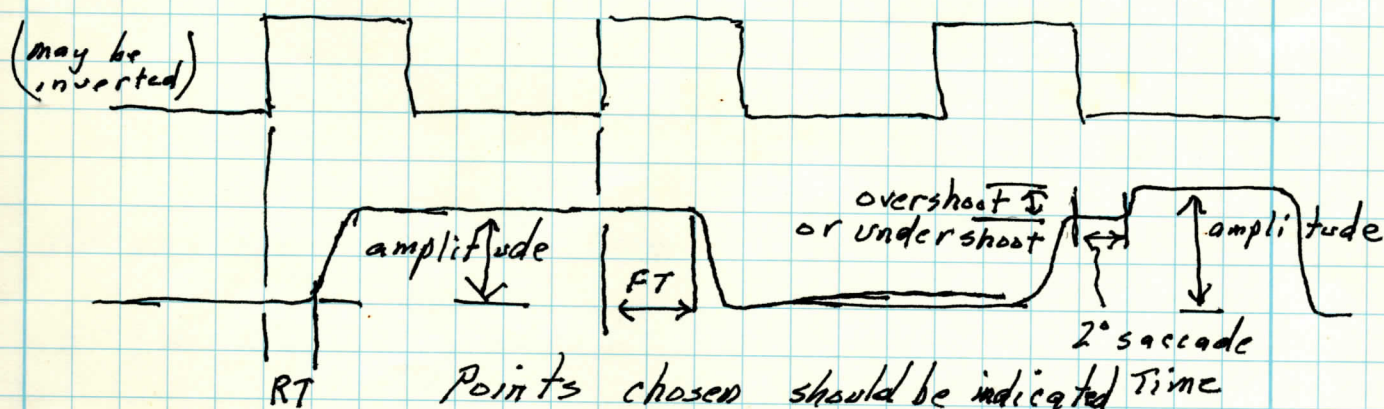
Response time:

This is already limited by previous amplifier times, etc. but all filtering should be removed and replay, recording limits measured to the time synch. pulse during cal. This pulse was fast i.e.  $\mu\text{sec}$  rise & fall times.

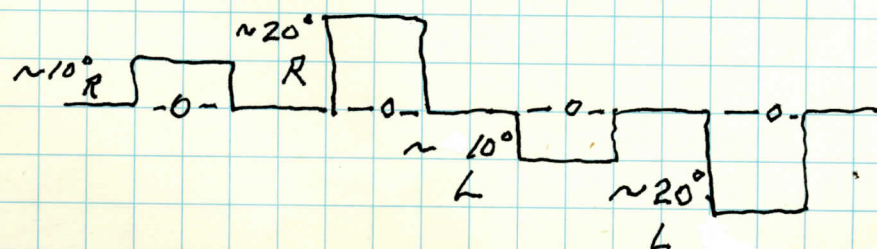
We need to know any differences in the channels as replayed.



Data reduction: OMRT



EOG  
Deflections





2 July '86 Data

by Bungo

B. Levitan told me he had been directed to move the data to the junk room of the radiography lab. and put on a lock & keys to myself and Bungo. This is in contradiction to agreement & Poof and Shumate. Neither of these are available (in Washington). This destroys all purpose of moving data & there is no way to exist under Bungo. Confrontation is inevitable.

Tried to reach S.P. at Nicog's, couldn't. Joe also in Wash. & B.S. Went to G.A. for advice. He will see Joe K. All bets off.

I need-

1. Decent, Secure Storage

2. Adequate Support

A. Hide.

B. Data reduct & analy.

C. Statistical Support

D. Graphics "

E. Publication "

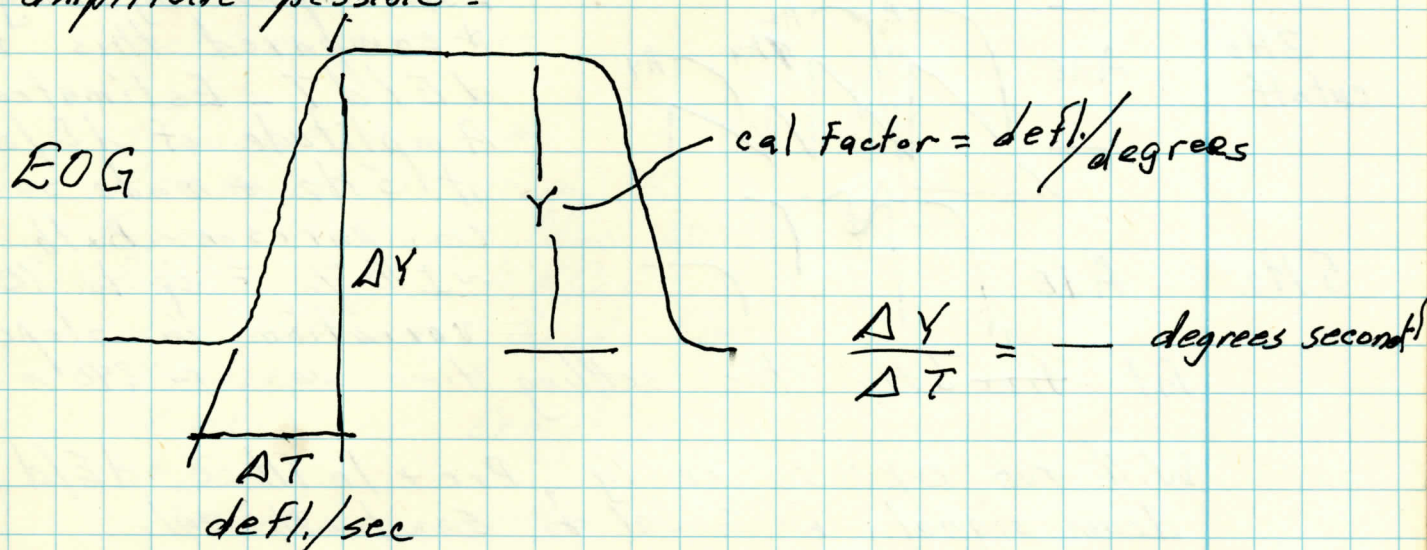
F.



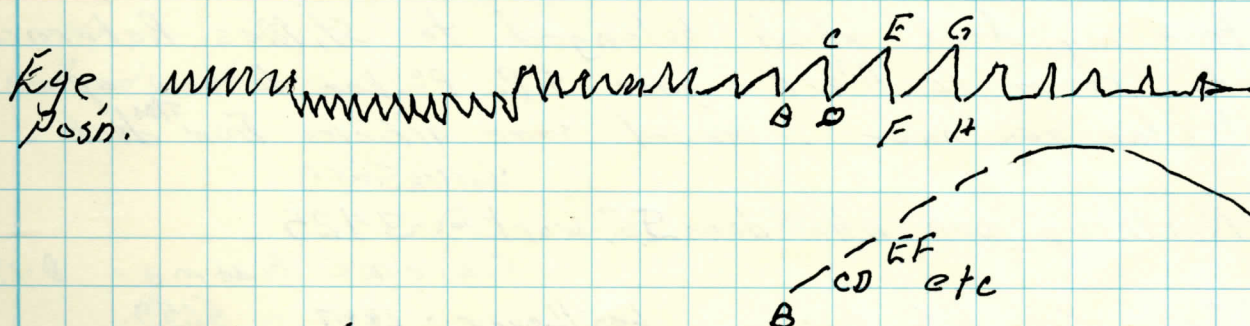
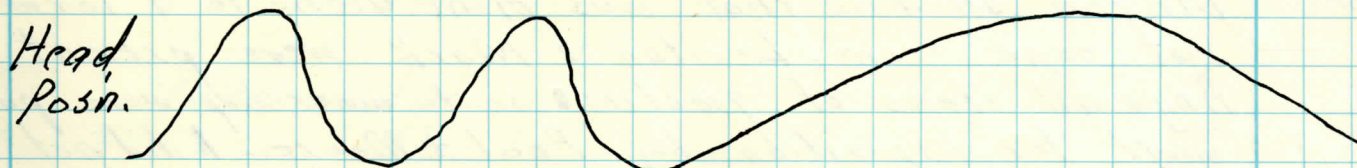
# Data reduction, cont'd.

Slew rate;

Chart speed should be  $100 \text{ mm Sec}^{-1}$   $\bar{c}$  largest amplitude possible.



Head synchronized target tracking:



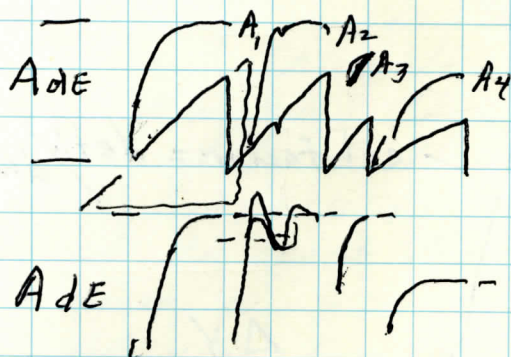
Reconstruct EOG from segments if possible



2 July O.K.N. Honaker

Couldn't start for absence of records  
Reviewed electronic  $dE/dt$  as follows.

3 Hz  
cutoff



Est. slopes by dwg.  
& compared this to  
 $dE/dT$  - Estimated  
Amplitude of  $dE/dT$   
at 5 Hz & made some  
comparison - Both were  
 $\sim \pm 5\%$  & up to 10%  
variation in slope est.

At five 3 Hz the settling time was  $\sim 240$  m Sec.

Will run O.K.N.'s on  $T_g$ , Pre & In Flt  $\bar{c}$   $dE/dT$  &  
drum signal, EOG cal & Sawtooth cal.

3 July

Met  $\bar{c}$  S.P. who agreed to the two of having the keys.  
Will contact Sh. & K. about my complaints to G.A.  
Called B.S. & told him what I had done.

1000

Moved all data that was mine alone to a former  
rat cage room. Levitan & Mark were present & aided.  
Any & all items of questions as to ownership were put in a  
vault for disposition by Pool & Moore. I did not touch  
T.M.'s desk ex. to remove a Gemini book he had taken  
from my desk which belonged to St. Mos. Returned key  
to room to Mark & gave S.P. 2<sup>nd</sup> key to new space.  
Levitan may have removed some articles from desk.

Warren Serr

Northrop man who does  $\bar{c}$  work - 3425 -

Clarence Blaine - B-23

Cal run R.S. shoes -

Lessfeger - 2807 5159

|   |       |             |                                   |             |
|---|-------|-------------|-----------------------------------|-------------|
| 1 | 164.5 | 2:05.1      | 400 m R.S.                        | Shoes       |
| 2 | 180.  | $\sim 2:15$ | $\frac{1}{4}$ mi $\frac{2}{3}$ mi |             |
| 3 | 360.  | $\sim 4:30$ | "                                 |             |
| 4 | 540   | $\sim 7:05$ | }                                 | 986 strides |
| 5 | 720   | $\sim 8:50$ |                                   |             |
| 6 | ?     | 10:05       |                                   |             |
| 7 | 180   | 13:19.4     |                                   | 13:26       |



7 July

Stewart -

Greenleaf X

Cava -

Blomquist } C.V.

Gaffney } "

Egerton - U.S.

Tipton -

Stauber - W.Va.

Premiln - neuro. Ill.

Bernard - Ex. Phys U.C.D

Dan Ellis A.R.C.

Ron Bullion Grad. Stud -

Weedon - X

Rucker - Eraghton - Chris Dalladeker endoe -

Frey

Covertina ← ↓

Problems of space -

16 Knowledge pertinent  
Effects

HMD - began

Recommendations

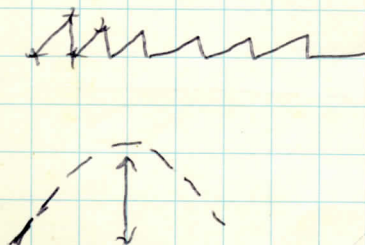
10 - 30 min - effects

Environments

Histo

Biodynamics - ]

Hd. Mid. Tgt.

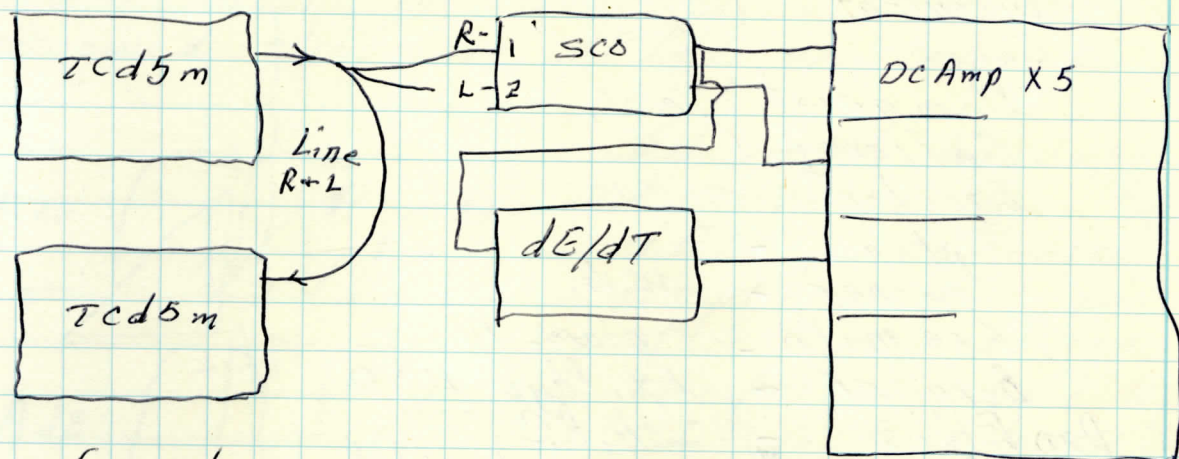




8 July

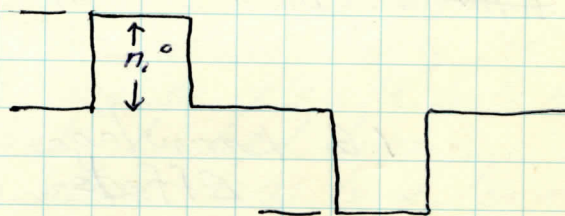
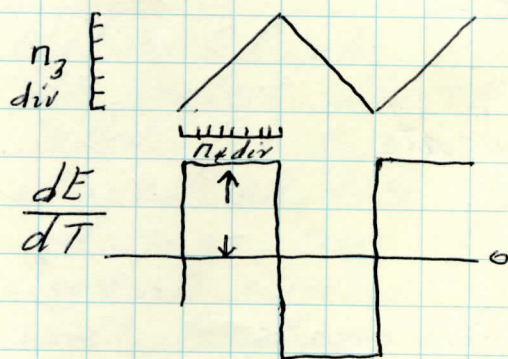
Matsco Gould Set

ES-1000



Transferred STS-7 tape, 1A Tg, to 2° tape & then replayed it through above to obtain OKN -

$\frac{dE}{dT}$  cal.



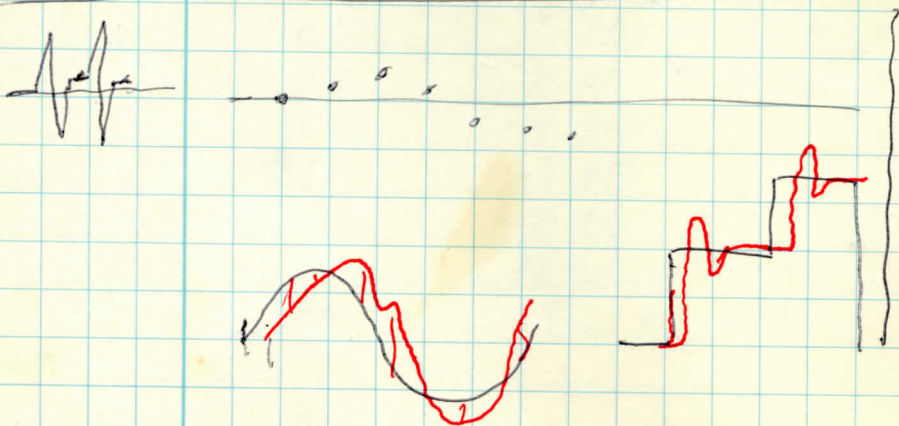
$$n_2 \text{ div} = n_1^\circ \text{ & } 1 \text{ div} = \frac{n_1^\circ}{n_2 \text{ div}}$$

$$n_4 \text{ div} = n_5 \text{ sec}$$

$$1 \text{ div} = \frac{n_5 \text{ sec}}{n_4}$$

$$\frac{dE}{dT} \approx \frac{n_3 \cdot \frac{n_1^\circ}{n_2 \text{ div}}}{n_6 \cdot \frac{n_5 \text{ sec}}{n_4}}$$

11 July See -





12 July Struct. & Lab.

W.T.

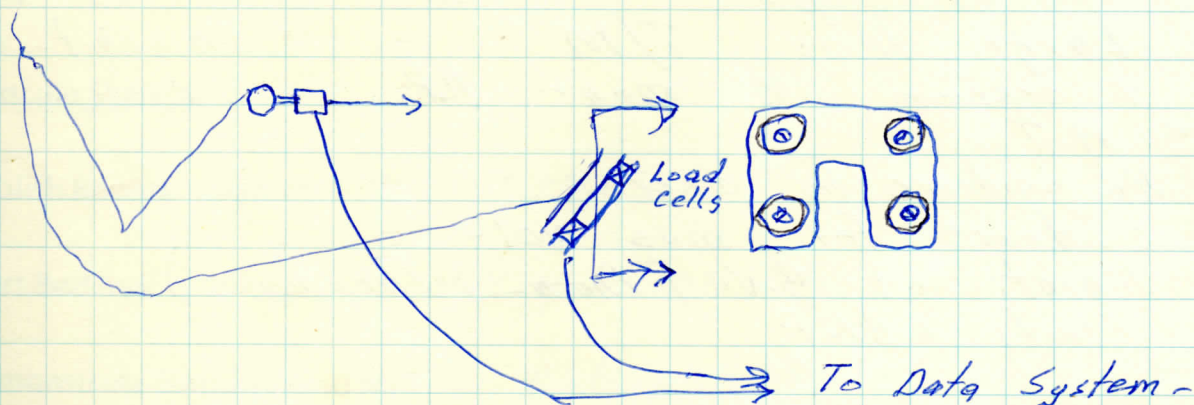
Seat - 17"

Handle - 42"

1

↑

Rowing Machine



Data recored by existing collection system.

18 July Hypogravity:

22 " Cont.

Gemini - 5 EVAs - gas colled, 02400  
2 premature terminations 5-85-02408, 9

Apollo - liquid cooled 5-85-74-3766, 3765, 67  
EVA met. rate - liquid cooling  $\Delta T$   
O<sub>2</sub> usage  
H.R. -

Covertino -

Compliance & muscle mass.

Immersion -

Sedentary  
Distance runners } showed post immersion  
Swimmers } vasc. instab.

Bone - 90

Calc. - 15% Tibial - 15%

Radius - 6%

Tipton -



C.N. - Blomquist.

Maint. of preflt. level of  $O_2$  Transp.

Meas. of  $\dot{V}O_2$  3-pts -

Var. of ways - 4 - 30

Large Mus. T/M -

1 session wk mon - H.R.

70-80%  $\dot{V}O_2$   
On orbit - Gas Analy

D.S. H.T.

No evidence for exerc.

Evidence for mus. vol.

Maint. of B.V. (Pharm., Thevm.)

Fluids LBNP

N.M.S. -

2 Exer. Progs.

Conc. on max. perf. on EVA -

Pre fli. tag. displ. & targ. of joints - tag. in suit

last. Sp. Suit - Record program -

3 min/day 3X wk - In fli.

Prevent. of atrophy

Min. Atrophy -

Opt. Exercise -

Several devices -

T.M.

Row. Mach.

Jump -

Individual joint testing

Research

Bed Rest. biopsy, NMR.

Bone -

Need added data -

Prevent. loss.

Countermeasures - locomotion - Impacts, torsion, ? musc.

2X day - Flexibility - Treadmill -

Trampoline -

Rat Compulsory & Var.

Research -

1. lack of baseline - T.B. Ca<sup>45</sup>, rates of Ca<sup>45</sup> loss -

2. Confirm B.R. bone loss

3. " exercise effects -



24 July Mtg. E Pool & Stewart on Ex. Conf.  
 W.T. proposed the following items as follow on  
 essentials to Conference directions

### Musculo Skeletal

✓ Publish Report - agreed need for graphics w/o

Start Bed Rest - shoot film write up - Tues

Demonstrate Station Tread Mill - Proto - W/M

### Data on Treadmill

✓ Photo Phone Cavanaugh - must do repeat

Force - Get - E.S. if possible

Finish Rowing Machine - Report - Instrument

Report ✓

Sam wants KC-135  
 Film & force loads

KC-135 Parabela Flight ←

Demonstrate Universal Load Unit - Whitmore -

### Finish In Bed Treadmill

T.V. & ASAP

Call to Concept II (Rowing Mach.) Morrisville, Vt.  
 802-888-7971 Dick — ? promised to send data  
 on machine studies, I, drag, forces, refs., etc.  
 Also Dr. Hagermann, OH Univ, Athens - 614-593-1000  
 O.O.T. - Ret. Mon. - 2291

02 ↑



30 July Brand

OMRT - Explore analog-replay - #1 Safar  
Move computer to ~~Ept~~ Matsco -

Fri - +3 day

? of low gain records showing 2-1/2/s

Called Sauer in effort to find area to unload INCS.

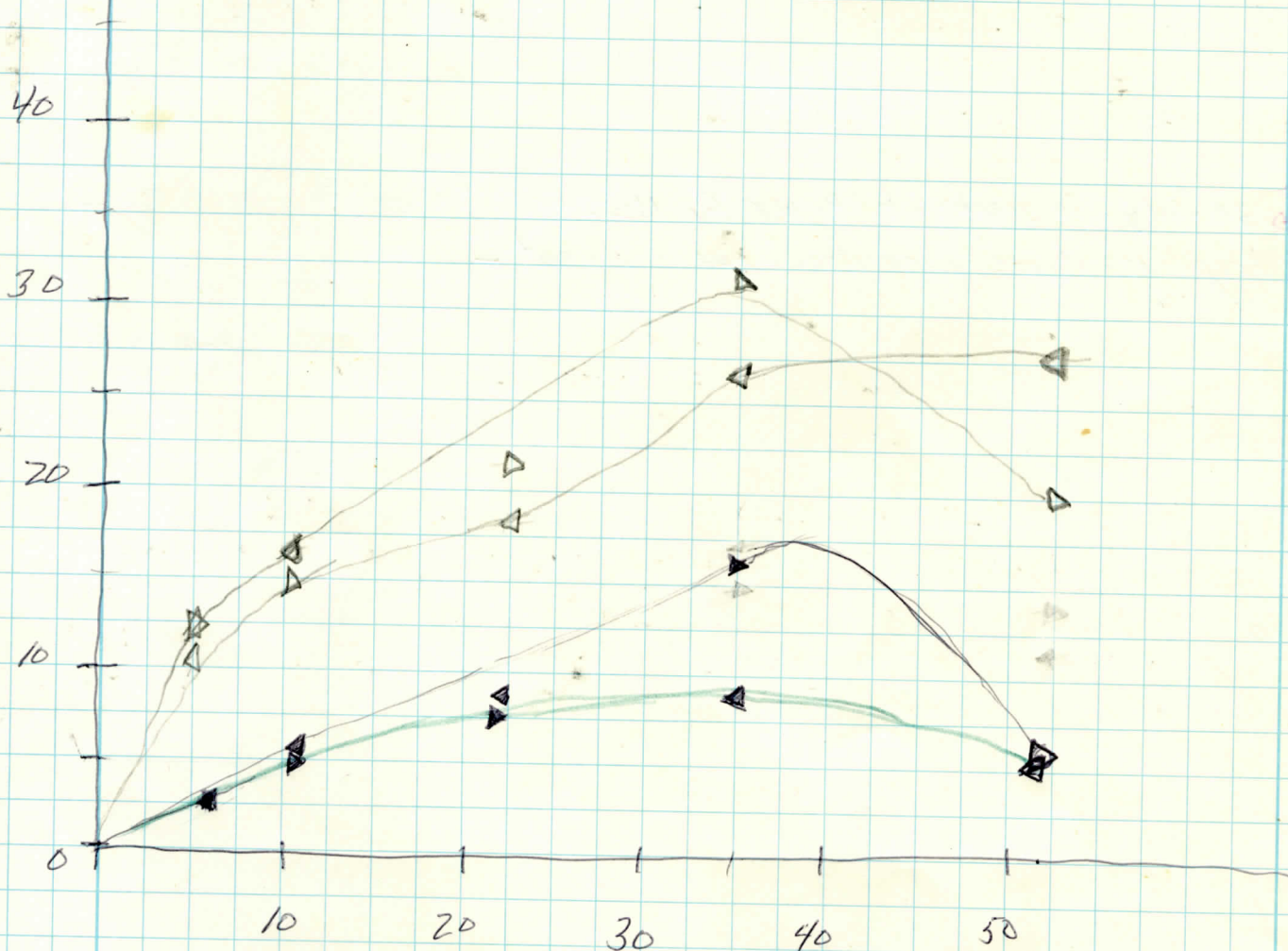
Plan to get base line photos of treadmill -

Will use DAC + same set up as inflight -

Shelley promised to move T.M. to 9A. - ILC has T.M. & M.W. promised to move it.

MATSCO to run OPKN tapes. + work c R. Honaker

50 - Showed Jock how to run + call tapes. using integrator





10 Drum Speeds - 5 patterns (cm = units)

1. 16.2 cm/rev at 2 cm/sec  $\Rightarrow \omega = \frac{2}{16.2} = 0.123 \text{ cps} \Rightarrow 0.7757 \text{ rad/s}$   
 $\frac{27.36^\circ}{44.44\%} \Rightarrow 0.6156 \text{ sec}$   
 $\text{eye} \Rightarrow \frac{3.5^\circ}{0.6156 \text{ sec}} = \underline{5.686^\circ/\text{sec}}$
2. 20.2 cm/rev at 5 cm/sec  $\Rightarrow \omega = \frac{5}{20.2} = 0.248 \text{ cps} \Rightarrow 89.109^\circ/\text{s}$   
 $\frac{27.36^\circ}{89.109\%} \Rightarrow 0.30704 \text{ sec}$   
 $\text{eye} \Rightarrow \frac{3.5^\circ}{0.30704 \text{ sec}} = \underline{11.399^\circ/\text{sec}}$
3. 10.5 cm/rev at 5 cm/sec  $\Rightarrow \omega = \frac{5}{10.5} = 0.476 \text{ cps} \Rightarrow 171.429^\circ/\text{s}$   
 $\frac{27.36^\circ}{171.429} \Rightarrow 0.1596 \text{ sec}$   
 $\text{eye} \Rightarrow \frac{3.5^\circ}{0.1596 \text{ sec}} = \underline{21.930^\circ/\text{sec}}$
4. 6.6 cm/rev at 5 cm/sec  $\Rightarrow \omega = \frac{5}{6.6} = 0.758 \text{ cps} \Rightarrow 272.727^\circ/\text{s}$   
 $\frac{27.36^\circ}{272.727} = 0.10032 \text{ sec}$   
 $\text{eye} \Rightarrow \frac{3.5^\circ}{0.10032 \text{ sec}} = \underline{34.888^\circ/\text{sec}}$
5. 4.4 cm/rev at 5 cm/sec  $\Rightarrow \omega = \frac{5}{4.4} = 1.136 \text{ cps} \Rightarrow 409.091^\circ/\text{s}$   
 $\frac{27.36^\circ}{409.091} = 0.06688 \text{ sec}$   
 $\text{eye} \Rightarrow \frac{3.5^\circ}{0.06688} = \underline{52.333^\circ/\text{sec}}$

- June 83 MS3 STS-7 Preflight

Calibration  $\Rightarrow$  Left  $\Rightarrow 10.17^\circ = 6 \text{ mm} \Rightarrow 1.695^\circ/\text{mm}$

$20.31^\circ = 12 \text{ mm}$

Right  $\Rightarrow 10.17^\circ = 5.5 \text{ mm} \Rightarrow 1.800^\circ/\text{mm}$

$20.31^\circ = 11.5 \text{ mm}$

| eye dir. | chart speed | rise (mm)             | run (mm)                | Deg            | Time(s)         | Vel (%)          | Drum speed |
|----------|-------------|-----------------------|-------------------------|----------------|-----------------|------------------|------------|
| L        | 10 mm/sec   | 30, 25, 25            | 55, 45, 45              | 50.85, 42.375, | 5.5, 4.5,       | 9.24, 9.42       | 5.686 %    |
|          |             | 20, 20                | 35, 35                  | 33.9           | 3.5             | 9.69             |            |
| R        | 10 mm/sec   | 15, 55, 20, 55, 55    | 20, 100, 35, 90, 90     | 27.12, 99.49,  | 2, 10, 3.5, 9   | 13.56, 9.95,     | 5.686 %    |
|          |             |                       |                         | 36.16, 99.99   | 6.8, 1.24, .85, | 10.33, 11.05     |            |
| R        | 25 mm/sec   | 55, 16, 8, 25, 25, 15 | 170, 31, 22, 60, 60, 35 | 45.2, 27       | 2.4, 1.4        | 14.6, 23.3, 16.5 | 11.39 %    |
|          |             |                       |                         |                |                 | 18.8, 19.3       |            |



# 7/9 Differentiated Signal

Trace - 9-June 83 MS3 STS-7 Preflight

## I. Eye Calibration:

|           |        |              |                    |
|-----------|--------|--------------|--------------------|
| Left 20°  | ⇒ 57mm | ⇒ 0.351 °/mm | } avg = 0.369 °/mm |
| Left 10°  | ⇒ 26mm | ⇒ 0.335 °/mm |                    |
| Right 20° | ⇒ 54mm | ⇒ 0.370 °/mm |                    |
| Right 10° | ⇒ 27mm | ⇒ 0.370 °/mm |                    |

## II. Differentiator Calibration:

signal ⇒ (rt)

Ampl - 60mm

= 22.14°

time - 72mm @ 25 mm/s ⇒ 2.88 sec

⇒ signal = 7.688 °/sec

$dE/dt$  ⇒

Ampl - 16mm

⇒  $dE/dt$  = 0.480 °/sec/mm

skip middle signal.

signal ⇒ (Lt)

Ampl - 60mm

= 22.14°

time - 13.5mm @ 25 mm/s ⇒ 0.54 sec

⇒ signal = 41.0 °/sec

$dE/dt$  ⇒

Ampl - 86.5mm

⇒  $dE/dt$  = 0.474 °/sec/mm

⇒ avg  $dE/dt$  = 0.477 °/sec/mm

## III. OKN

Chart speed

25 %/sec

(rt slow eye dir.)

to Lt on tracing)

Drum Speed

Stim Speed

$dE/dt$

$dE/dt$

%/sec

Rt

1.136 rev/sec

52.3 %/s

15, 12, 7, 16, 15, 13, 18, 16, 17, 12, 15, 9, 11

13.538

6.45

Lt

1.136

52.3 %/s

14, 12, 16, 12, 12, 8

12.33

5.88

Lt

0.758 rev/sec

34.9 %/s

27, 22, 16, 17, 13

19.0

9.0

Rt

0.758 rev/sec

34.9 %/s

29, 32, 30, 37, 36, 34, 39, 37, 38, 32

34.9

16.6

Rt

0.481 rev/sec

21.9 %/s

19, 18, 17, 18, 15, 17, 12, 9, 11, 10, 8, 12, 14, 17, 19, 5, 27, 27, 23, 23, 29

15.75

7.5

Lt

0.481 rev/sec

21.9 %/s

23, 19, 17, 13, 14, 15, 17, 16, 22, 19, 20, 15, 20, 18, 18, 18, 9, 14, 19, 17

17.5

8.3

Lt

0.260 rev/sec

11.4 %/s

9, 9, 10, 11, 16, 13, 10, 12, 16, 18, 12, 10, 10, 11, 12, 11, 10, 15, 17

12.21

5.8

Rt

0.260 rev/sec

11.4 %/s

10, 11, 5, 10, 12, 13, 13, 10, 10, 8, 9, 10, 11, 7, 10, 7, 13, 16, 17, 14

11.475

5.4

Rt

0.132 rev/sec

5.7 %/s

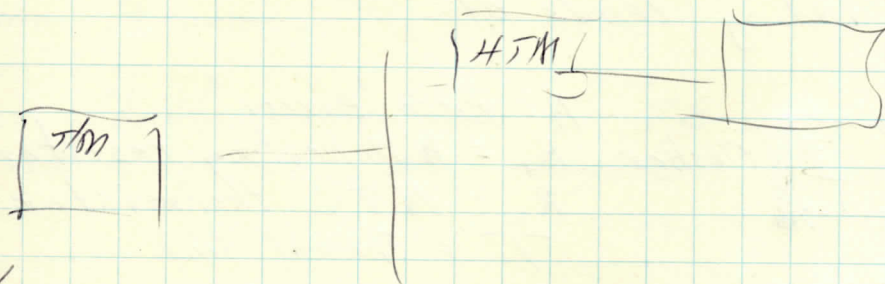
5, 9, 7, 5, 5, 7, 5, 6, 6, 8, 7, 4

6.0

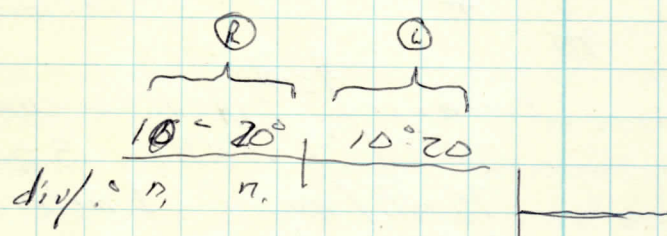
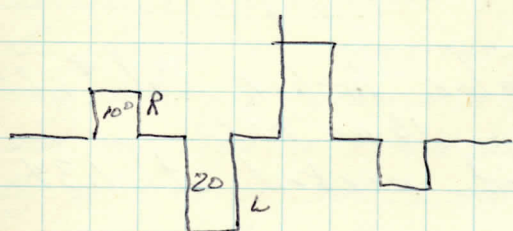
2.8



31 July Cavanaugh & Stewart -  
ROM 1g vs. flt. treadmill - 10 -  
C. wants to long term studies -



Loc WH



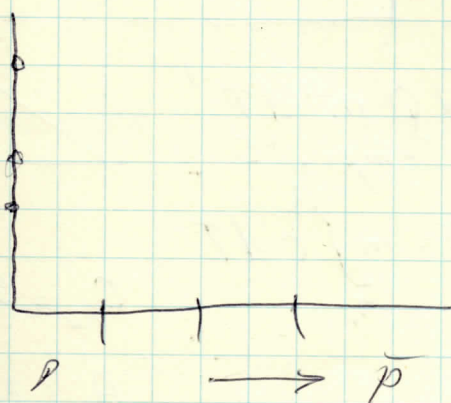
sec



deg/sec.

4 Aug

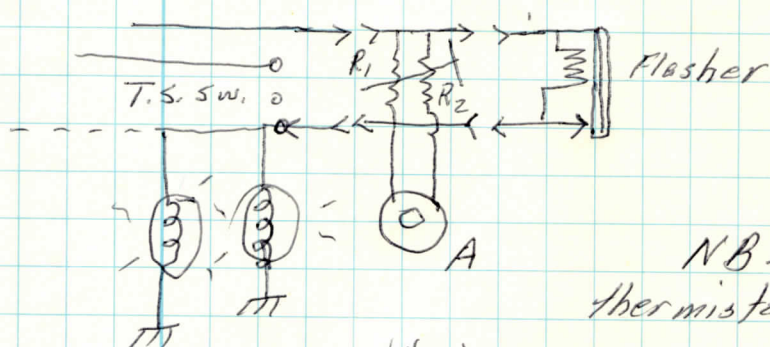
L<sub>1</sub>G - VOR Gain





1 Aug 86 Home-Turn Sig.

MK-I - Increasing amplitude of audible signal after time delay - Unit to plug in between Flasher & socket & adding leads etc.



A = Piezo 'Buzzer'

$R_1$  = W.W. heating resistor

$R_2$  = NTC thermistor

T = Thermal sink

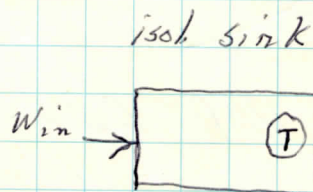
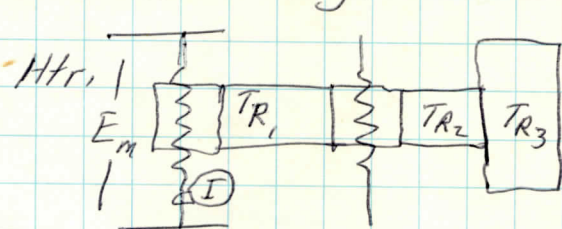
NB - may be possible to incorporate thermistor into heated portion of flasher.

Purchased <sup>(#2.9)</sup> typical sound generator Archer Cat #273-065  
 3.8 KHz  $\pm$  .5 KHz 3.-20. VDC. 13 ma max.  
 75 dB/meter (1 meter?) unit worked at 1.34 V  $\pm$   
 1 K resistor in series -

Called Dale &

thermistor mfgs.

Thermal Delay:



$$T \approx \frac{W}{\frac{P_{WT}}{sp. Ht.} \cdot \text{Mass}}$$



$$P = E \cdot I$$

$$Q = \text{heat, cal}$$

$$C = dQ m^{-1} dT^{-1}$$

$$T = \text{Temp., } ^\circ\text{C}$$

$$m = \text{mass, gm}$$

$$E_{\text{mean}} = \text{duty cycle} \times K_{PC}$$

$$Q = m \int_{T_i}^{T_f} C dT$$

$$C_{cu} = 9.23 \times 10^{-2} \text{ cal/gm}^\circ\text{C}$$

$$A_1 = 2.15 \times 10^{-1}$$



## 5 Aug Anthropometric Reports

John Jackson & I made request to Shumate that anthropometric data be published. Current status as we know -

Anthropometrics of '78 candidates -  
All drugs, etc. MSS complete

## 5 & 6 Aug - Don Stewart - S.S. Ex.

5 - Review of organization & responsibilities - D. concerned over my driving program in a given direction. I offered to work @ D. as consultant and investigator & will discuss details of my program tomorrow - My position is that I will work in any way possible @ Life S, but in crucial areas will do whatever is possible to insure Sp. St. has a good exercise program which I have defined & will try to see implemented - This will be presented to D. tomorrow.

28 Aug - D. Stew. - Called D. who said he would provide Funds to Car. & Whitmore. Described my actions in try to get money for TLM & Force gen. He expressed desire for coordinated efforts and will brief me on his program. Offered him opportunity to sit in on discussion @ Sam tomorrow apropos TLM & Force gen.

Cavanaugh - Called to tell him trial Film will be sent next wk.



11 Aug - Don Wade, Shelly<sup>280-12053</sup>, Thomas (4161)  
 Don Smith  
483-2276

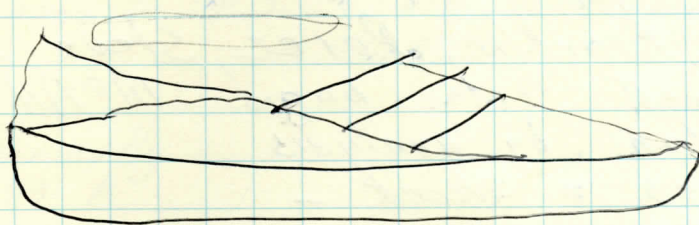
ROM

Treadmill -

Noise - McCullough  
 Goodman

Shoe -

Bungee - PBI - matl. - Elastic cord -



13 Aug - Neil T.

Agreed to look at force gen. for treadmill.  
 Have Shelly prepare ROM - I called Thomas

Don S. Logan won't allow money for treadmill.  
 20K for rowing machine, 10K for film analysis.

Neil T. has given Boeing technical direction to provide  
 force generators - Boeing wants to "buy it off the shelf".

Whitmore agreed to do unfunded work on force generators.  
 Escap

$$I \propto T$$

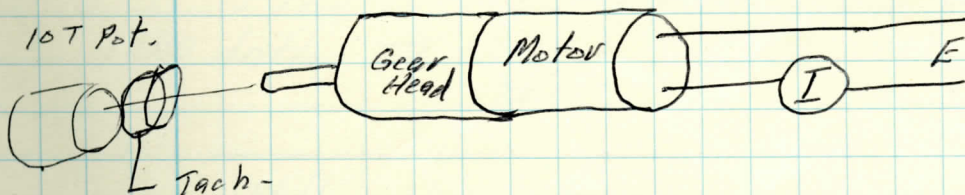
For Weight

$$I = K + M \ddot{X}$$

$$K = M \cdot k'$$

$$I = M(K' + \ddot{X})$$

10T Pot.



$$I = F = K \dot{X}$$

1st-kin -  $\dot{X} = K$

$$I = F = K \dot{X}$$



18 Aug - Work on IWCS reports & proto. acceptance  
Call to N.T. expressing concern over Guy and company  
at this point -

Gym:

211# 20 mi on R. Mach. @ 4 ea 5 mi. laps - 40:09

209# stopped 3-5 mins between laps -

1° 10:37 3 - 10:10

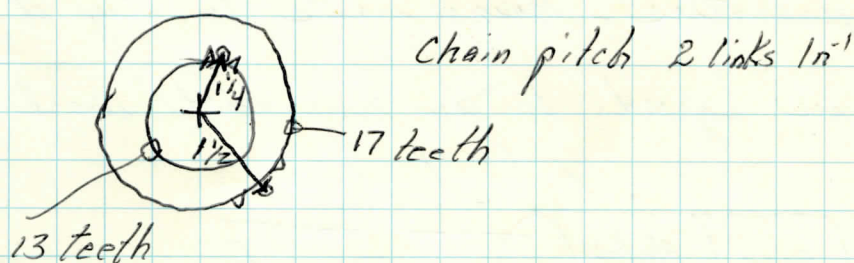
2° 9:36 4 - 9:59

Call from G. Winkler whom Guy told N.T. & he would do  
O.S. ~~trip~~ Accep. Described what I wanted & was told this  
would have to meet their reqmts.

20 Aug <sup>Paul</sup> Shelley, Franklin, Perez, Steve -  
Rockwell certs. bags' M<sup>c</sup> Allister -  
Vibration by analysis  
Stress & Shock -

(1203)

26 Aug - Tried flt. row mach. on Concept II frame -  
needs more inertia





Shelly, Franklin,

25 Aug 86 1 WCS Accept. 10178-20049-01

10108-10102-07  
1002

0850 Unpacked Motor &amp; Control Panel &amp; Util. Cord

Control Box sw. plate badly scarred.

1. Conn. Motor to Control Box to Orb. Vac. Clnr. Test Cons.  
3 phases to N. 115 V. set,

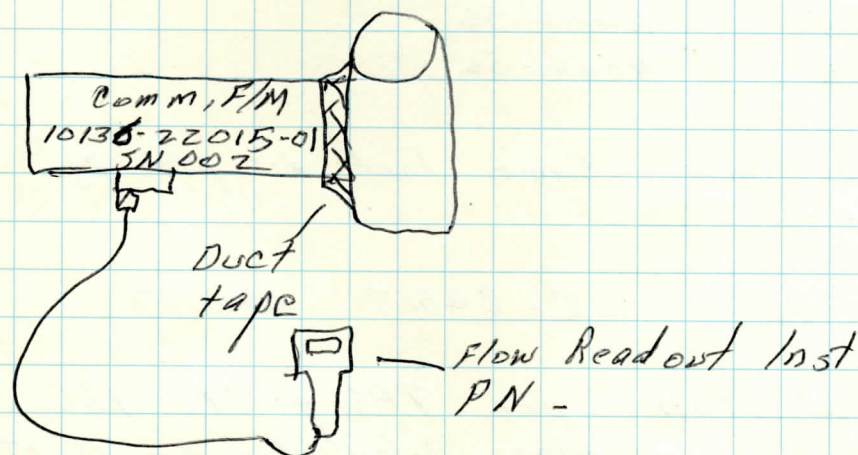
Pwr. supply apparently does not have output ckt.  
protection - Delayed test to get protection -Added TA Fuses to P.S. - Mtr. start current 6.8A  
Run "

Motor ran normally -

A - .99 A.

B - .78

C - .96



Temp - 72.3°F

Flow - 1200 FPM

1380 drifts → 1200 "

1200 "

With valve in series

74°F

1010 FPM

↓ drift

920

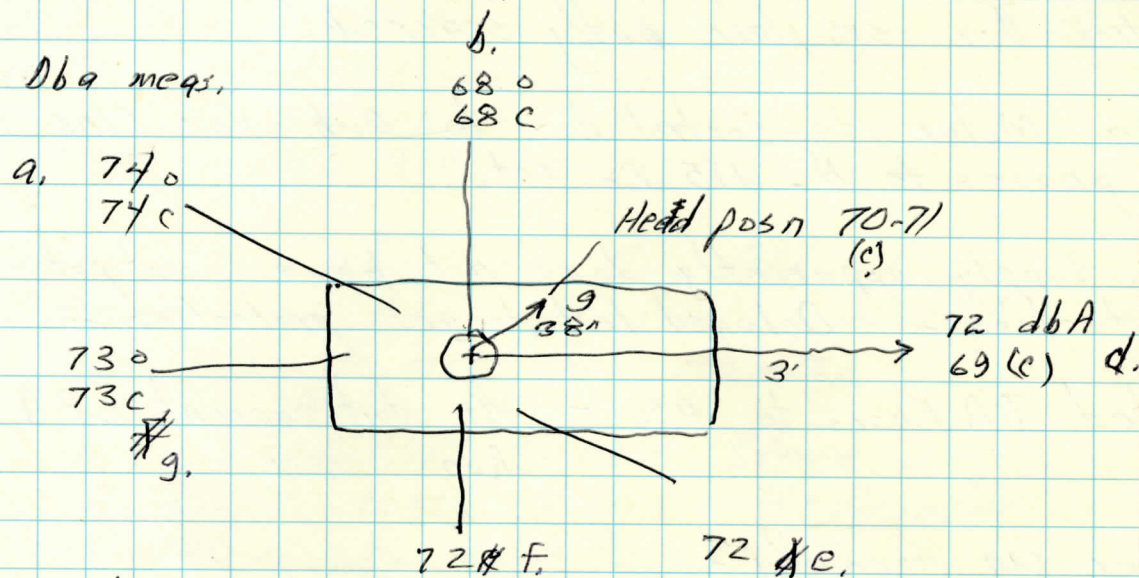
- 1.15, .93 &amp; 1.10 A



26 Aug. 1 WCS Boeing - Franklin, Mindiola, Davis, Carlos, QC  
JSC C' 25737

B&K 2215 NASA 667176  
SPR - meas - 3' dist. on table - meas from <sup>ch</sup> seat opening

DbA meas.



Octave at posn. 9

|      |    |         |         |
|------|----|---------|---------|
| 31.5 | 51 | 500-72  | 8000-50 |
| 63.  | 55 | 1000-59 | 16K-65  |
| 125. | 55 | 2000-56 |         |
| 250. | 66 | 4000-56 |         |

Air Flow Same Inst. as prev. pg.  
Lin 74.0 - 74.8

Wt. 108 1/2 # C-20567 08:01:87

Completed acceptance per TPS & TP. ILC items returned for rework - sharp edges, detent too small, etc.

ILC had disassembled vacuum test jig - partially reassembled it.

Overall machine performed well - do not believe air flow meas. 65 CFM & flow meters are being calibrated.

Red lined dwgs. turned over to Spolly - Boeing -



8 Sept. Matsco - Alan & Sus -

STS-8 all graphic -

|       |    |     |   |     |        |   |      |   |
|-------|----|-----|---|-----|--------|---|------|---|
| Th-   | 13 | pre | 6 | in. | 1 post | * | Work | • |
| D.G.- | 4  | ↓   | 4 | "   | 0 "    | * | "    | • |
| G B   | 5- | ↓   | 2 | "   | 1 "    |   | "    | • |
| Tr    | 3  | ↓   | 1 | "   | 1 ?    |   | "    | • |
| Br    | 4  | ↓   | 1 | "   | 1      |   | "    | • |

S-7 Tg \* Compl- •

Fa 3

Ri

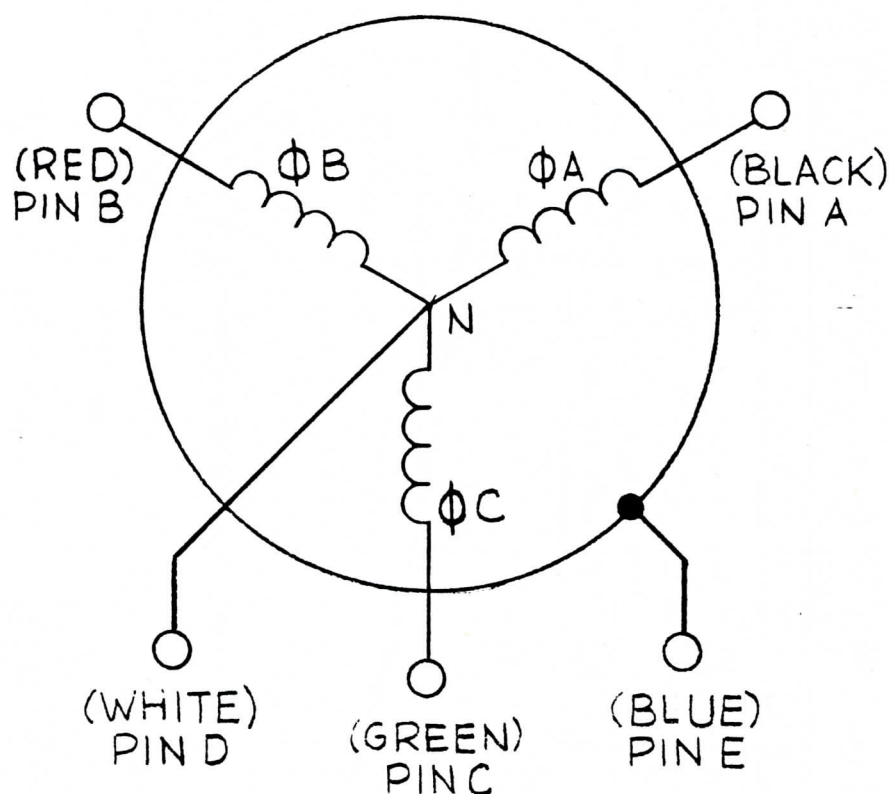
Ha —

Cr —

Agreed that we would try to complete Tg + S-8 by Fri.  
ex. stats. Tg's is complete ex. stats.



WIRING DIAGRAM  
 IWCS BLOWER MOTOR  
 P/N 60621-1-1, S/N 25-740



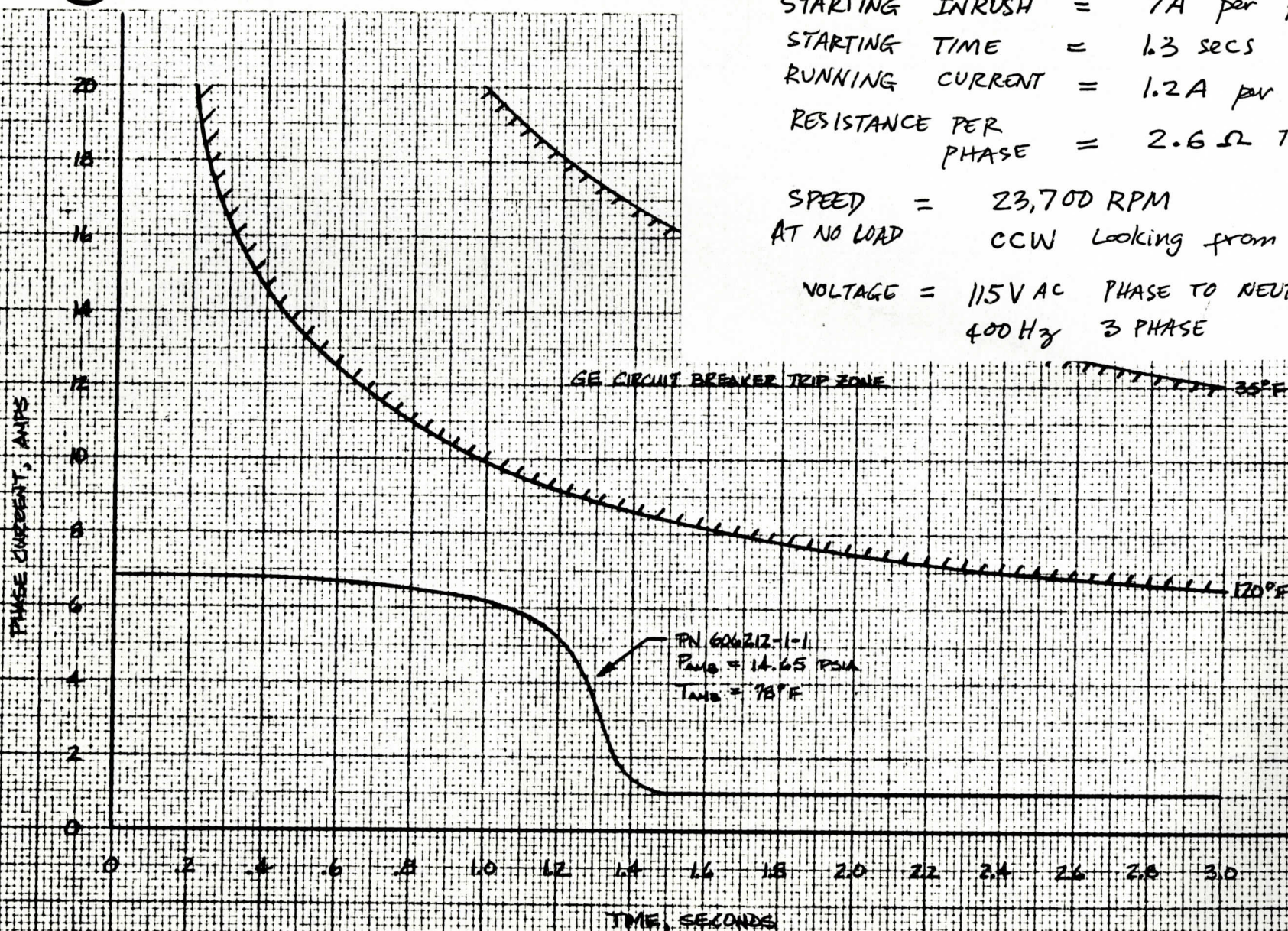
|                   |                  |   |          |
|-------------------|------------------|---|----------|
| * SHUTTLE OUTPUT: | PINS A: $\Phi A$ | D | } SPARES |
| NBOE12-10SNT      | B: $\Phi B$      | E |          |
| RECEPTACLE/SOCKET | C: $\Phi C$      | G |          |
|                   | F: GRD           | H |          |
|                   | J: NEUTRAL       | K |          |
|                   |                  |   |          |



STARTING INRUSH = 7A per PHASE  
 STARTING TIME = 1.3 secs  
 RUNNING CURRENT = 1.2A per PHASE  
 RESISTANCE PER PHASE =  $2.6 \Omega$  TO  $3.0 \Omega$

SPEED = 23,700 RPM  
 AT NO LOAD CCW Looking from inlet

VOLTAGE = 115V AC PHASE TO NEUTRAL  
 400 Hz 3 PHASE



CALCULATED BY E. SAKURADA

TRACED BY

CHECKED BY

APPROVED BY

UNIT NO.

CURRENT VERSUS TIME CHARACTERISTICS FOR  
 AIRRESEARCH MOTOR-DRIVEN COMPRESSOR,  
 PN 606212-1-1



AIRRESEARCH MANUFACTURING COMPANY OF CALIFORNIA  
 A DIVISION OF THE GARRETT CORPORATION  
 TURRANCE, CALIFORNIA

9-2-85



Treadmill S.S.

50K -

Basic TM is force -

Floor area -

18" longer - 2" wider

44

- 14\* fold up -

62\*

6 mph  
Attach pt.

Provision for motor -

20 K - Demo. Force Gen &

Disp - 2' min 3' DG

Force - 25" 50# DG

Forces - wt

- Spring
- Resistance
- Inertia
- Const.

Above discussion c w/M following D.G.'s allocation of 70K  
for above - D.G. directed me to call Jim Smith X 6557

Gil Chilsom X 3973

Ralph Albon

Called Smith who needs form

1223 completed - Told him

would delay direction of

funding til S.P. returns Fri-<sup>1400</sup> Smith out of town til Tues.

D.G.'s ofc. has forms -

D. Stewart back in town but no word from him no Johnson -

28 Aug.

1 g. - treadmill -

Took prototype to 1G mock up and



28 Aug '86

## 1 G Treadmill Photography

S.T.S.

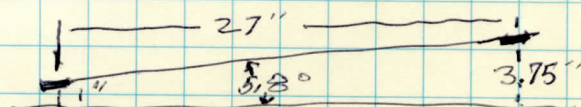
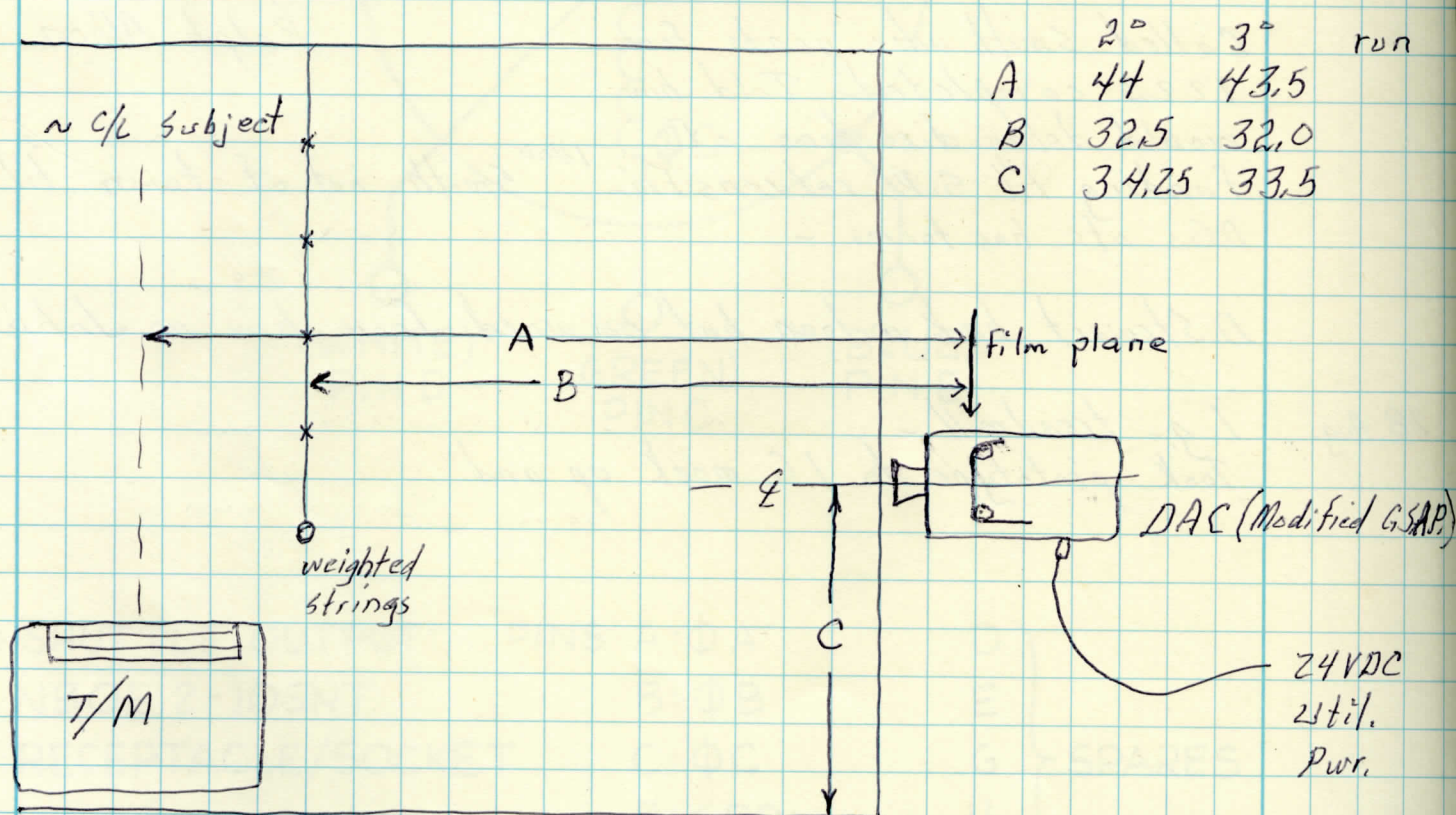
Set up in mock up as in flight on STS 7 & 8 using prototype T/M and same camera & lighting. Harness & bungees not used - T/M elevated  $5.8^\circ$  and runs were

A xtal watch was photographed at end of run.  
made at a walk, fast walk & slow run. Weighted strings

(5) were placed in a parallel line 12.0 inches apart in 'front' of subject as <sup>shown</sup> below. Tape was placed every 12.0 ins.

(bottom of tape to bottom of Tape) on the strings -

Camera 24FPS  $\frac{1}{60}$  10mm F1.8 400 ISO color film -





11 Sept. Johnson, Schneider, Pool  
 Proposal by end Sept. - Pool Mid Oct.  
 No budget -

Timers -

Accelerometers - 2.5 K

Pedometers

Treadmill - 1 or 2

20K

(lease)

Recorders - on site

1 man year -

Holters - 5 - 10 K

Clothes 3 K

80 K

0900

Shumate -

1300

Meeting interrupted by Cohen - resched. for 1300

Impression of bed rest effort -

It has now been a year since we talked about starting a pilot B.R. study to demonstrate the role of force in maintaining Ca<sup>2+</sup> in bone and at this time are further away than ever. S & J have obviously placed no priority on the project. It came out today that they had placed it #6 on money priority but again & again they have delayed while charging ahead on pharmacological studies. I do not know whether this is simply their modus operandi or is peculiar to this situation.

Robert Mann, MIT 617-253-1000 (2220) - Sci. Vol. 232

P. 1192 pressure implants in hip joint - Discussed his work which involves multiple discrete points and not force however findings are consistent c 1. muscles are primary force generators & 2. these forces increase with various activities as might be expected. His comment 'thought everyone knew that force & lack of force is space caused bone loss!'. He promised a ltr. supporting <sup>my</sup> ~~our~~ position.



23 Sep. Alan (Susan back Thurs) O M R T

Data Reduction

STS - 7- Tg - Compl.  $\bar{z}$  Means & S.D.

1 add  $\bar{P}$   
Format

8- All but few

STS - Th -

8 Tr -

Gd -

B1 -

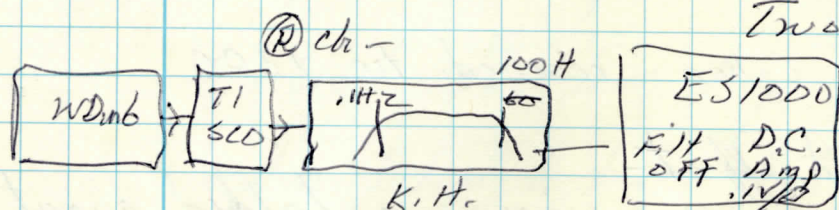
Br -

Subj - Pre In Post  
Early Late

Do Histograms on this -

Garn -

Two Reds. for Goldberg



02:00:47 +

04:04:56 +

29 Sep -

1400 5. Treadmill - Thomas, Townsend, Shelly, W.T.  
Noise - Viton - Franklin, (Boeing?)  
Correct erratic loads  
Meas. & Control " "  
Footwear

Secure Attachment. \*

Thomas needs dwgs.



Virginia -

Lelia - Peabody \ Scholarship - 1898  
 2 yr Univ. of Nashville 1903 - ~~AB~~ Lic. in Instr. → AB  
 1 yr. Tallegda teaching -  
 Married 1906 → 1929 Columbia → Spanish  
 Carson Newman -

Virginia - home taught til 11 -

Carson Newman 1925 - Spanish & France

Chicago MS → English

" Ph.D → "

Lewell L. 1940

Westminster → '36 starting -

OSU -

2 yr C.N. →

Janet → Wholesale Drug

W.C. - 1 yr.

1 yr nursing →

Faison 1915 - John WMS - Died - 1924

Lived c Everett -

Bachelors C.N. → Teaching didn't like

L.Va. → Library

Peabody →

Lee's College - Jackson Ky

Wolf

✓CI

22:877

1843



15 Oct.

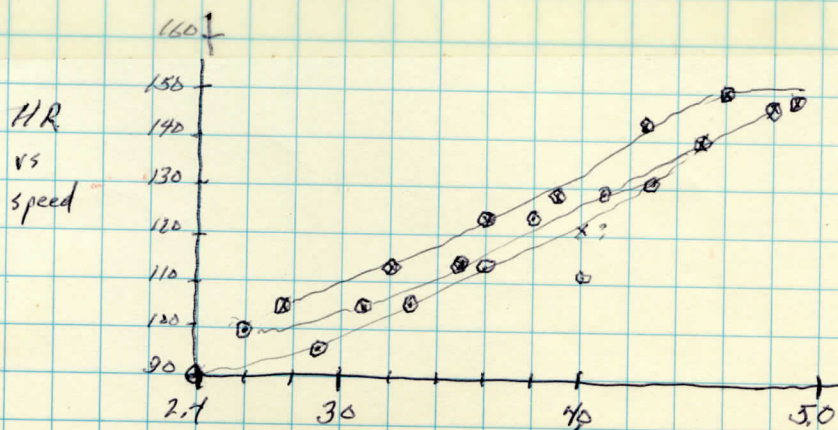
Test of T/M #1005 (MK II) at Boeing  
 Subj. was W.T. - Runs were made at each speed using 3 grades  
 before progressing to the next ~~test~~ speed. Order was 1 → 7

10/15/86

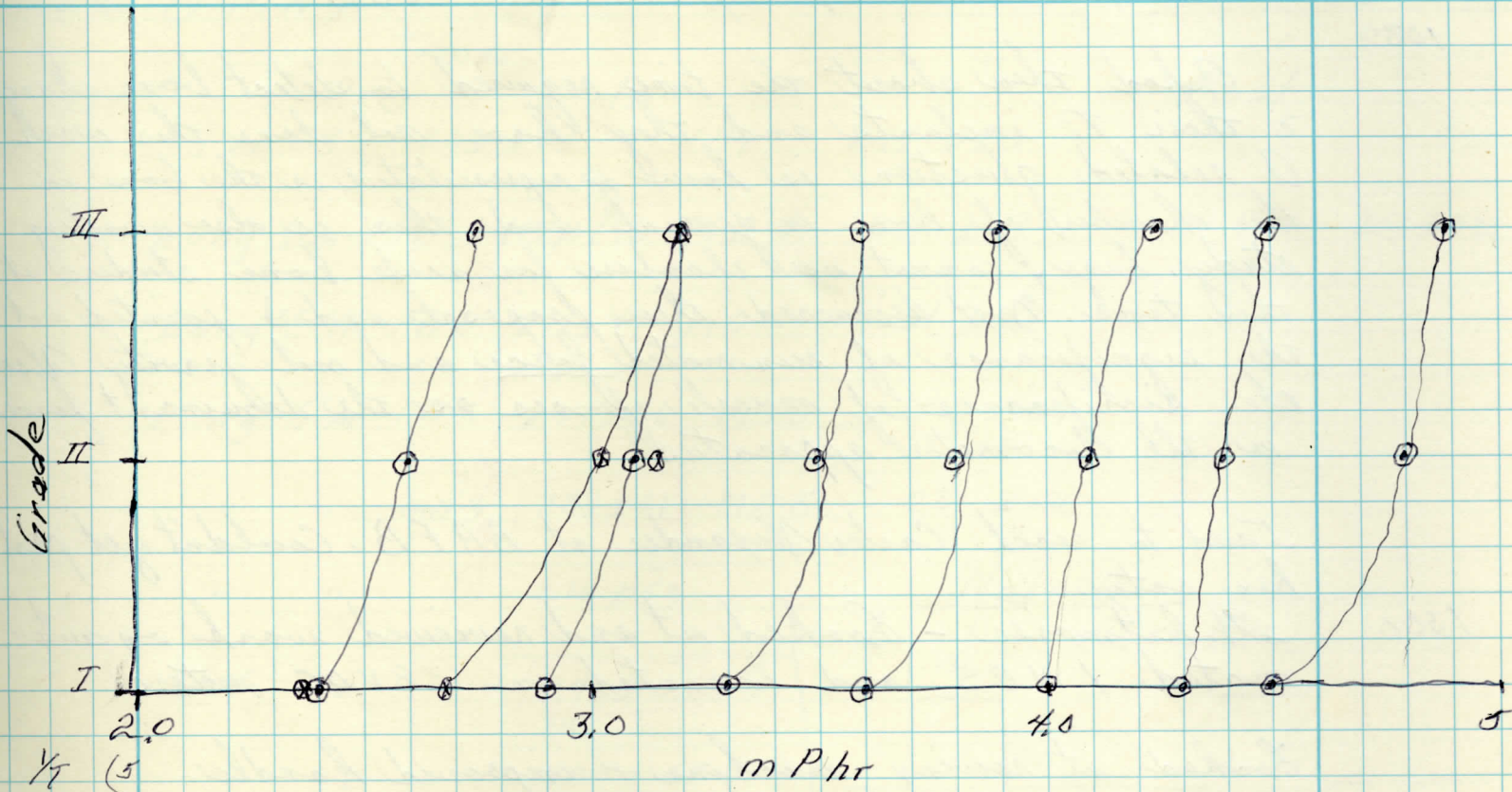
Subj. W.T.  
T.M. W.P.N. 210 #

| Level I<br>speed # | Tread mill<br>Time |       |       | HR    | Test Set-up | Indic. mphr |
|--------------------|--------------------|-------|-------|-------|-------------|-------------|
|                    | 1                  | 2     | 3     |       |             |             |
| 1                  | 17.70              | 18.01 | 17.18 | 90    | ↑           | 2.4         |
| 2                  | 14.75              | 14.50 | 14.49 | 96    | ↑           | 2.9         |
| 3                  | 12.96              | 12.95 | 13.23 | 106   | ↑           | 3.3         |
| 4                  | 11.94              | 12.18 | 11.99 | 113   | ↑           | 3.6         |
| 5                  | 11.04              | 11.84 | 10.93 | 111   | ↑           | 4.0         |
| 6                  | 9.95               | 9.97  | 10.0  | 131   | W           | 4.3         |
| 7                  | 9.37               | 9.41  | 9.29  | 140   | W           | 4.5         |
| Pre                |                    |       |       | 59    |             |             |
| Level II           |                    |       |       |       |             |             |
| 1                  | 16.72              | 16.40 | 16.53 | 100   | ↑           | 2.6         |
| 2                  | 13.90              | 13.92 | 13.77 | 105   | ↑           | 3.1         |
| 3                  | 12.26              | 12.22 | 12.15 | 114   | ↑           | 3.5         |
| 4                  | 11.23              | 11.53 | 11.35 | 124   | W           | 3.8         |
| 5                  | 10.25              | 10.55 | 10.44 | 129   | J?          | 4.1         |
| 6                  | 9.57               | 9.64  | 9.70  | ~ 140 | ↓           | 4.5         |
| 7                  | 9.03               | 9.14  | 9.12  | ~ 149 | J           | 4.8         |
| Level III          |                    |       |       |       |             |             |
| 1                  | 15.80              | 15.75 | 15.53 | 106   | ↑           | 2.75        |
| 2                  | 13.61              | 13.46 | 13.15 | 114   | ↑           | 3.2         |
| 3                  | 12.11              | 12.07 | 12.06 | 123   | W           | 3.6         |
| 4                  | 10.90              | 11.07 | 10.98 | 129   | ?           | 3.9         |
| 5                  | 10.19              | 10.11 | 10.22 | 144   | J           | 4.25        |
| 6                  | 9.37               | 9.46  | 9.23  | 150   | J           | 4.6         |
| 7                  | 9.02               | 9.07  | 8.89  | 149?  | J           | 4.9         |

S.W. AMF American  
 EQUIPMENT DIVISION  
 200 AMERICAN AVE  
 SEARS Mod

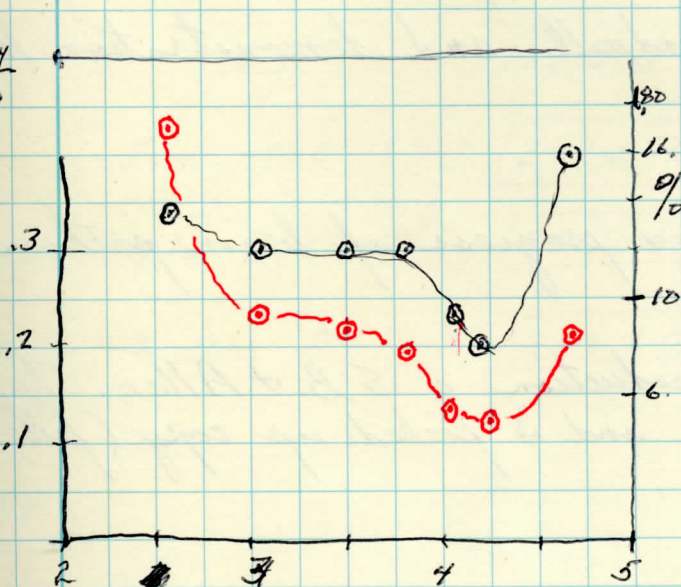






4% 2.04  
4.4) 2.00

Δ MPH.  
I → III



Change in Speed MPH\*

̄ grade change 2.6

q̄ f(velocity) 3.1

— ○ — I → III 3.5

3.8

4.1

4.4

4.8

Δ MPH I → III

.34 .11 .2

.3 .1 .2

.3 .1 .2

.3 .1 .2

.23 .13 .1

.2 .1 .1

.4 .1 .3

II → III

\* Stage II

4% 1.70  
26) 3.40  
26  
180

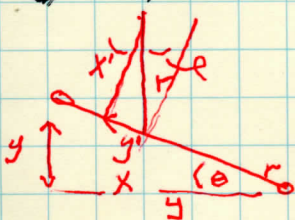
31) 3.00  
279  
210

35) 3.00  
280  
200

38) 3.00  
266  
340

41) 23.0  
205  
425

44) 2.00  
176  
220  
48) 4.00  
384  
60

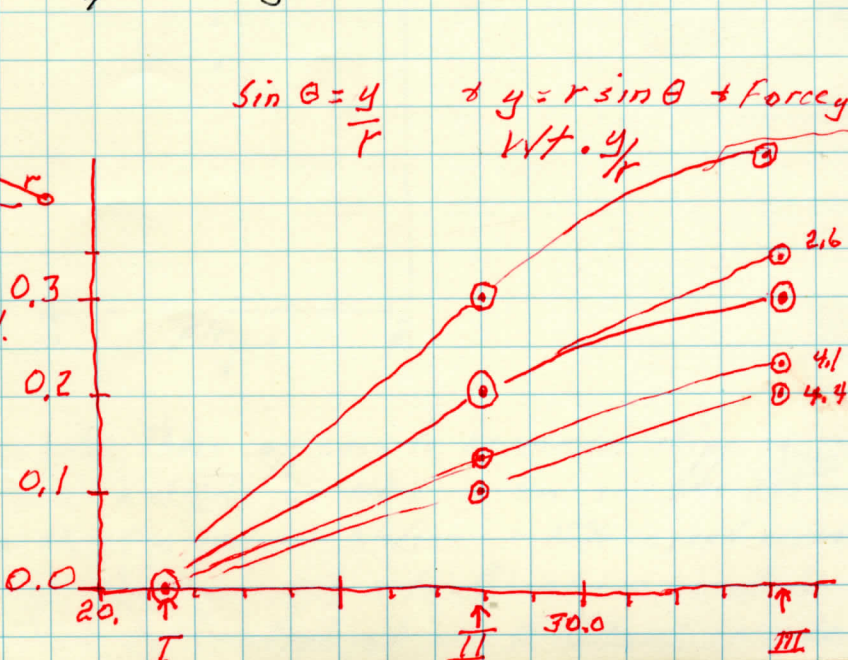


$$\sin \theta = \frac{y}{r}$$

$$y = r \sin \theta + \text{Forcey} = \text{wt} \cdot \frac{y}{r}$$

| wt   | Grade | $\sin \theta$ |
|------|-------|---------------|
| 210  |       | .102          |
| 214  | I     | .128          |
| 269  | II    | .128          |
| 34.2 | III   | .163          |

Δ Vel.  
MPH 0.3  
0.2  
0.1  
0.0





16 Oct Holt, , Triplett at UTSA  
1030

Asked them about the time required to detect bone changes in their T<sub>1</sub> implants and they have not done this work. A related question is how representative is the bone in the chamber of bone in general and this is also awaiting study. Engo, cannot use chambers for acute bone studies at this time. Next discussed their proposal and I pointed out the significance of summated force and not gravity. Also the significance of muscle forces as the dominant force in the locomotor apparatus.

Tried to reach Carter Alexander at BAFB. Couldn't get past his secy.

1300 St. Hittmore's - Looked at and reviewed work on automated IWCS and insisted on 28VDC motors.

Looked at rowing machine & improved handle.

Reviewed S. Station treadmill and demonstration loading devices.

17 Oct. Review of description & progress of brain pathways  
w/ LRI & Ross -

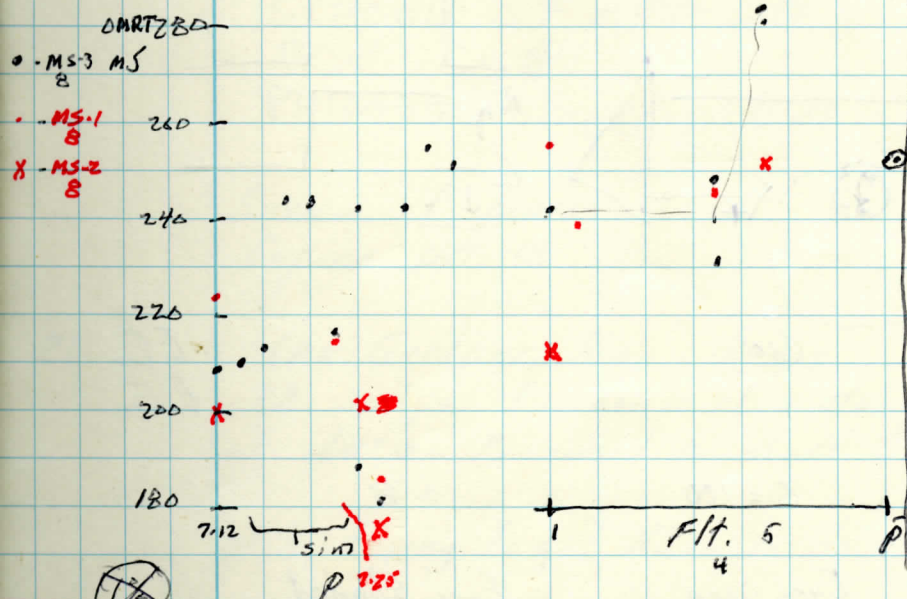
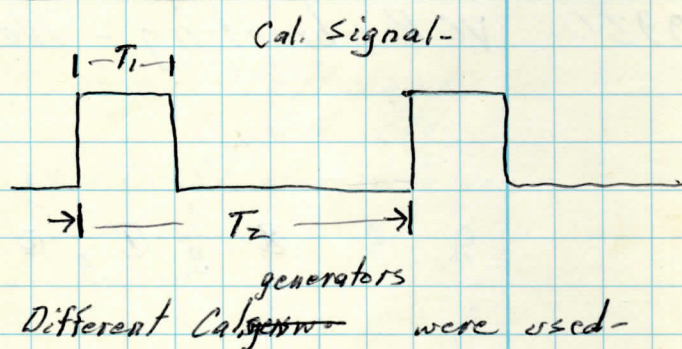
Review of OMRT data reduction w/ S.B. & Allen. They sent raw data to Leigh and I picked up copy. (following pp.)



17 Oct 86 O MRT

| Subj's-<br>W.T. | Time<br>Pre                  | In       | Post                          |
|-----------------|------------------------------|----------|-------------------------------|
|                 | 7-12-83                      | 209 ± 69 | FD-1 241 ± 40                 |
| Long Sim-FD2    | (10) <del>241</del> 210 ± 45 | MD 4     | 248 ± 67 (12) 26 Dec 252 ± 82 |
| Long Sim-FD-2   | (1) 213 ± 47                 | MD-4     | 231 ± 67 (11) ↑?              |
| Long Sim FD-3   | (5) 244 ± 56                 | MD-5     | 283 ± 187 (13) ↑?             |
| " "             | (9) <del>244</del> 233 ± 61  | MD-5     | 281 ± 126 (14) ↑?             |
| " "             | (1) 216 ± 53                 |          |                               |
| July 26         | (2) 242 ± 59 (239)           |          |                               |
| 28              | (3) 180 ± 55 (204)           |          |                               |
| 27              | (4) 189 ± 71 (203)           |          |                               |
| Sim MD-4        | (6) 243 ± 70                 |          |                               |
| Sim MD-4        | (8) 256 ± 64 (212)           |          |                               |
| 26 Dec 84       | 252 ± 82                     |          |                               |

Note ①

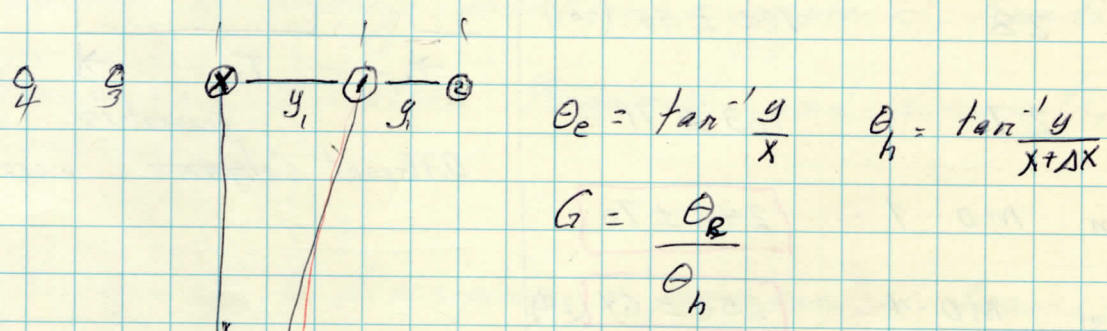


210/20 Recorder error 77 N.B. There appears to be mode skipping in data - e.g. means of 209, 210 + 213 =  $\bar{x}$  of (212) on MD-2 in Sim vs 244, 233 on MD-3 & 243 + 256 on MD-4 - say  $\Delta = 26/212 = 12\%$  speed errors this large seem unlikely - however see note ① above - need to see histograms Records were rerecorded and replayed on 2 different recorders Tcd5m -



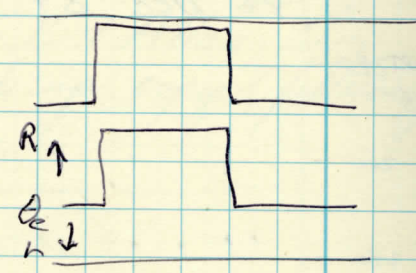
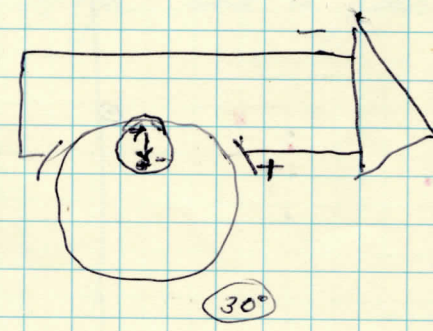
20 Oct. '86 Pilots mtg. Geo. Abbey, Kerwin -  
 P.J.W. to Cohen's Asst. - { Satellites - Hawley, Brandenstein  
 Hank H. to J.P.'s asst.  
 Feb. '88 is optimistic -  
 Talk of phase 1 + 2 Fixes - \$17x10^6 for Arrow test  
 Brand attending Staff Mtg.  
 Charlesworth is asst. to Director  
 G.A. reports directly to Director  
 Leach & Cohen - 'Things are different'  
 Operations + Sci. & Technology  
 Need to put people in right places -  
 Bring back Kraft, Lowes etc.  
 Brewster to Head Rockwell element -

0930 VOR briefing - Alan & Susan



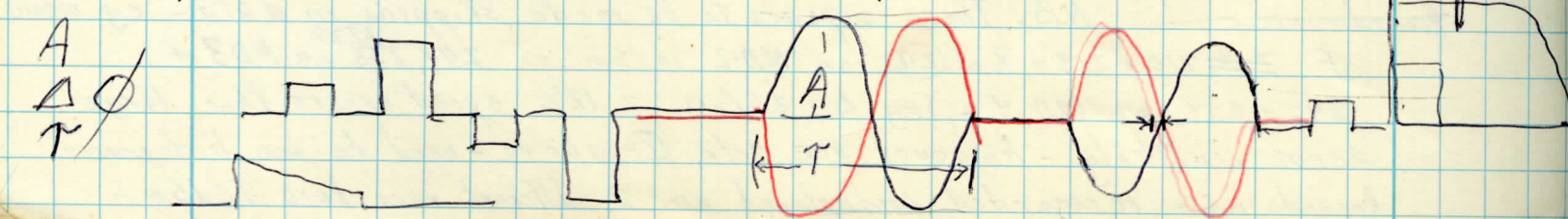
Error  
 Geom. of tgts  
 1. layout errors  
 2. Eye/Head

Elec. recording.  
 Pot dead band  
 Eye Adaptation.



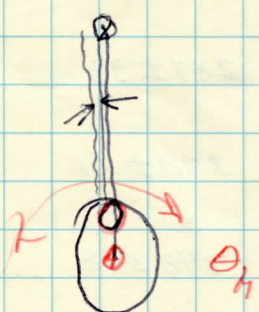
E.C.  
 E.S.

21



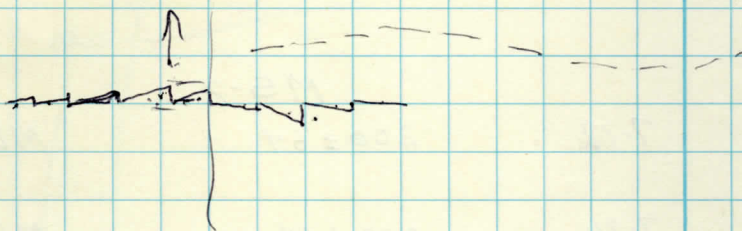
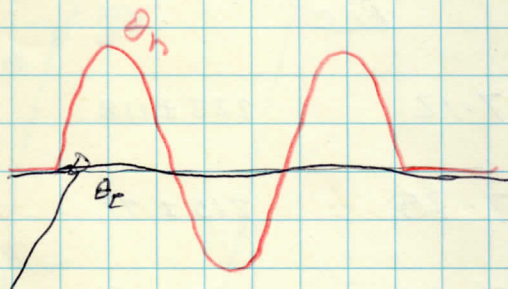


VOR contd



$$\theta_e \approx 0.0$$

$$\theta_n \approx \pm 30^\circ$$



1330

Uri - Pathways -  
 Original sketches  $\bar{c}$  Russ -  
 Copy of refs. MATSCO - (Al. + S.) Ventricle -  
 " " description " (Dolly)

Pathways  
 Em. Ctr.

218 S. 43 RD ST  
 APT 2-F  
 PHILADELPHIA, PA 19104  
 (215) 222-5459

UNIV. OF PENNSYLVANIA  
 SCHOOL OF MEDICINE  
 BOX 6584  
 PHILADELPHIA, PA 19104

Review of plates - Uri - ? 3 wks - Xpress mail -  
 Copies ~~URI~~ III

21

Len Gardner, Alan, Susan -  
 12 subjs. Discussion of status of Gardner's review + documentation  
 of data - Promised to start  $\bar{c}$  STS-5 and review all background -  
 still trying to get Russ to do a complete plate -



21 Oct. OMRT - MS-1 S-8  
Pre In

P

|      |           |      |          |
|------|-----------|------|----------|
| 7.12 | 223 ± 118 | MD-1 | 257 ± 98 |
| 7.25 | 215 ± 44  | -2   | 239 ± 61 |
| 7.28 | 187 ± 56  | -4   | 248 ± 68 |

|           |           |      |           |
|-----------|-----------|------|-----------|
|           | MS-2      |      |           |
| 7.12      | 200 ± 64  | MD-1 | 213 ± 32  |
| 7.26      | 203 ± 64  | MD-5 | 251 ± 117 |
| 7.28      | 171 ± 56  |      |           |
| Sim Day 4 | 265 ± 119 |      |           |

|      |                                 |      |          |
|------|---------------------------------|------|----------|
|      | CDR                             |      |          |
| 7.12 | 209 ± 45                        | MD-1 | 194 ± 25 |
| .26  | 198 ± 26<br><del>203 ± 64</del> |      |          |
| .28  | 163 ± 46<br><del>171 ± 56</del> |      |          |

|        |          |      |            |            |
|--------|----------|------|------------|------------|
|        | S-7      | Tg   |            |            |
| 6.7.83 | 215 ± 31 | MD-1 | 183 ± 38   | 10.25.85 2 |
| 6.9.83 | 182 ± 14 | MD-2 | 278 ± 68   | 185 ± 34   |
|        | 185 ± 31 | MD-3 | 303 ± 40 ① | 200 ± 35   |
|        |          |      | 185 ± 34 ② |            |
|        |          | MD-4 | 259 ± 49   |            |
|        |          | .5   | 300 ± 37   |            |

CDR

|      |           |
|------|-----------|
| MD-2 | 276 ± 152 |
|      | 249 ± 89  |
| MD3  | 281 ± 79  |
|      | 195 ± 21  |



OMRT

S-8

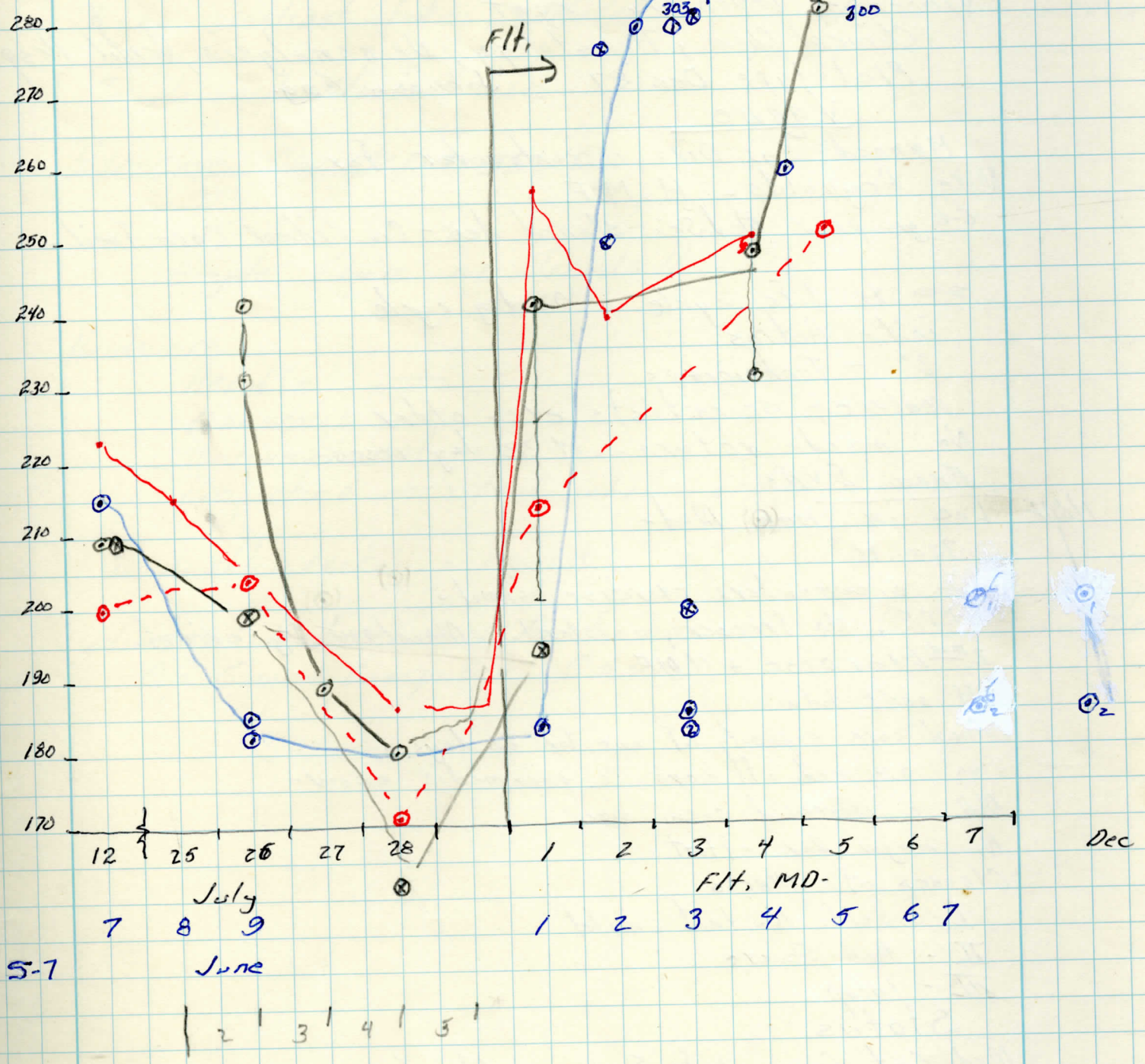
MS-30

MS-1

MS-2

CDR

S-7  
Tg CDR





22 Oct. Advanced Dev. Res. Medical - Env. - Performance  
 Vincent - Inventory mgmt  
 Clinical Chem., Hematology, Urinalysis, Ventil Respir  
 Prototype Dev. '87 Johnson Eng.  
Vague

Manned Sys. Div. is contractor for  
 Mike Reynolds - H.M.F.  
 5-6 yrs. prev. Med. Sci. started dev. - Civ. Critical Care Facil.

20 yr life cycle 90 day cycle  
 init. Astros  
 2° - Technicians  
 mature - scientists etc. older  
 No Immed. return - 14-28 day rescue  
 Freq. EVAs

HMF Loc in Hab. Mod -  
 320 ft<sup>3</sup>

2 crewmembers exercise siml -  
 GFE, No freezer, no steril., Maintain Ig orient.  
 2 <sup>mod</sup> Exercise + HMF  
 Off shift bdw.

Critical care capacity of one for 28 days  
 Two S.S. med. officers & paramedic equiv -  
 MOD & increased crew size

No major dev. effort -

Classes of Illness

I - Self. limited, mild

II - Mod. Severe

III - Incomp.

Status

Med. Crit. Care Life Supp - Ventil - Surg -  
 Patient Mon. Marsupette trans. TPR (inv. + non inv.)

Defib - Aspirator -

Compst - Mast -

Ventilation & Monitor Exercise -

German Vent. unsuit -

O<sub>2</sub> Cons -

Surgery + Anesthesia -

Hargens

Tighter Health Stabilization - 14 days

Computer System is Critical



HMF

Xray - contrast studies, catheter

Comm -

To Harvard Stanford etc

Ph or Film Screen

Exercise Countermeasures

Bicycle Ergom or Treadmill

Hardware

Aerobic —

Anaerobic —

Motivational-

Projection — read while riding bicycle -

2 double racks ~ 140 cu ft. 7

Human Behavior + Performance

Op Sim = Computer Games

ARC Y. Clearwater



22 Oct. OMR T - Cal- Signal. timing - W.T. - 5.8

| Sim | $\tau_1$ | $\tau_2$    | Paper Speed |
|-----|----------|-------------|-------------|
| ?   | 58       | 171         | 100 mm/s *  |
|     | 58       | 170.5       |             |
|     | 57       | 169.0       |             |
|     | 57.5     | 169. ✓ 1.00 |             |

July 26 -

|          |     |              |            |
|----------|-----|--------------|------------|
| OMRT 240 | 60. | 167          | 100 mm 5 * |
|          | 60. | 167          |            |
|          | 60  | 166.5        |            |
|          |     | 167. ✓ 1.017 |            |

28 NB - irreg. baseline \*

= ? speed variation

$$\begin{array}{r} 1.2 \\ 57 \overline{) 60.0} \\ \underline{50} \end{array}$$

$$\begin{array}{r} 1.33 \\ 57 \overline{) 60.0} \\ \underline{54.0} \end{array}$$

July 27

|      |       |                     |
|------|-------|---------------------|
| 51   | 131.5 | 100 mm 5 *          |
| 52   | 130.0 | * = not measured    |
| 51   | 130.5 |                     |
| 51   | 131.0 |                     |
| 51   | 130.0 |                     |
| 62.  | 159.  | 100 mm 5 = 102.5 mm |
| 61.5 | 158.  |                     |
| 62.0 | 158.  |                     |

| $\tau_1$             | $\tau_2$ |
|----------------------|----------|
| Sim - MD. 3          |          |
| 100 mm/sec = 101 mm. |          |
| 59.                  | 169.     |
| 58                   | 167      |
| 59                   | 166.5    |
| Sim MD - #4          |          |

\* = irreg. base-line

|                       |       |
|-----------------------|-------|
| 100 mm/sec = 102.5 mm |       |
| 58                    | 172   |
| 58.5                  | 171.5 |
| 58.5                  | 171.  |
| 58.                   | 170.5 |
| 58                    | 170.5 |

|            |       |
|------------|-------|
| Sim MD - 2 |       |
| 100 = 101  |       |
| 57.5       | 163.5 |
| 58.        | 163.5 |
| 58         | 163.5 |

|             |       |
|-------------|-------|
| Sim MD-4    | 1145  |
| 100 = 101.5 |       |
| 70          | 173.5 |
| 70          | 174.5 |
| 70          | 174.5 |

| $\tau_1$      | $\tau_2$ |
|---------------|----------|
| Sim MD ?      |          |
| 100 = 101     |          |
| 58            | 165      |
| 58            | 165      |
| 58.5          | 165      |
| Sim MD-2      |          |
| 100. = 102. * |          |
| 53.5          | 158.5    |
| 54.5          | 158.5    |
| 53.           | 158.     |

Flight MD-4

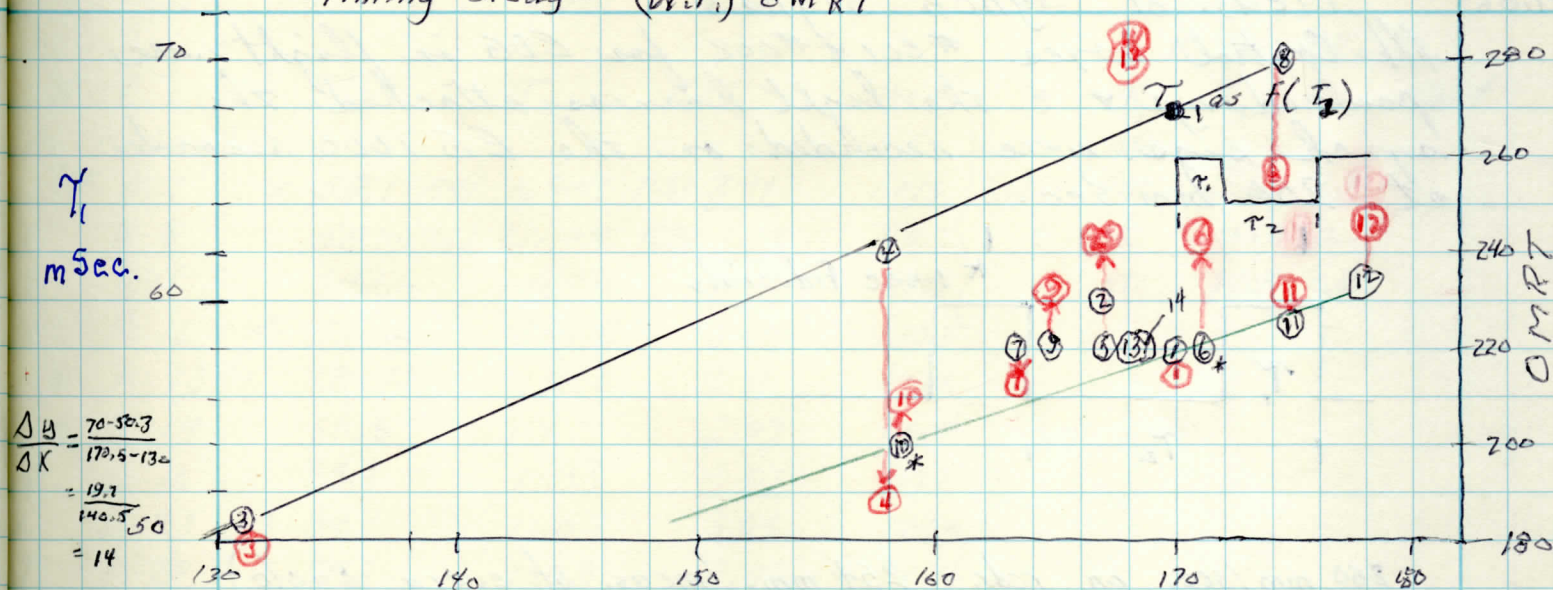
|             |     |
|-------------|-----|
| 100 = 102.5 |     |
| 59          | 175 |
| 59          | 175 |
| 59.5        | 175 |

Flight MD-4

|             |       |
|-------------|-------|
| 100 = 102.5 |       |
| 59          | 179   |
| 59.5        | 177.5 |
| 60.         | 176.5 |

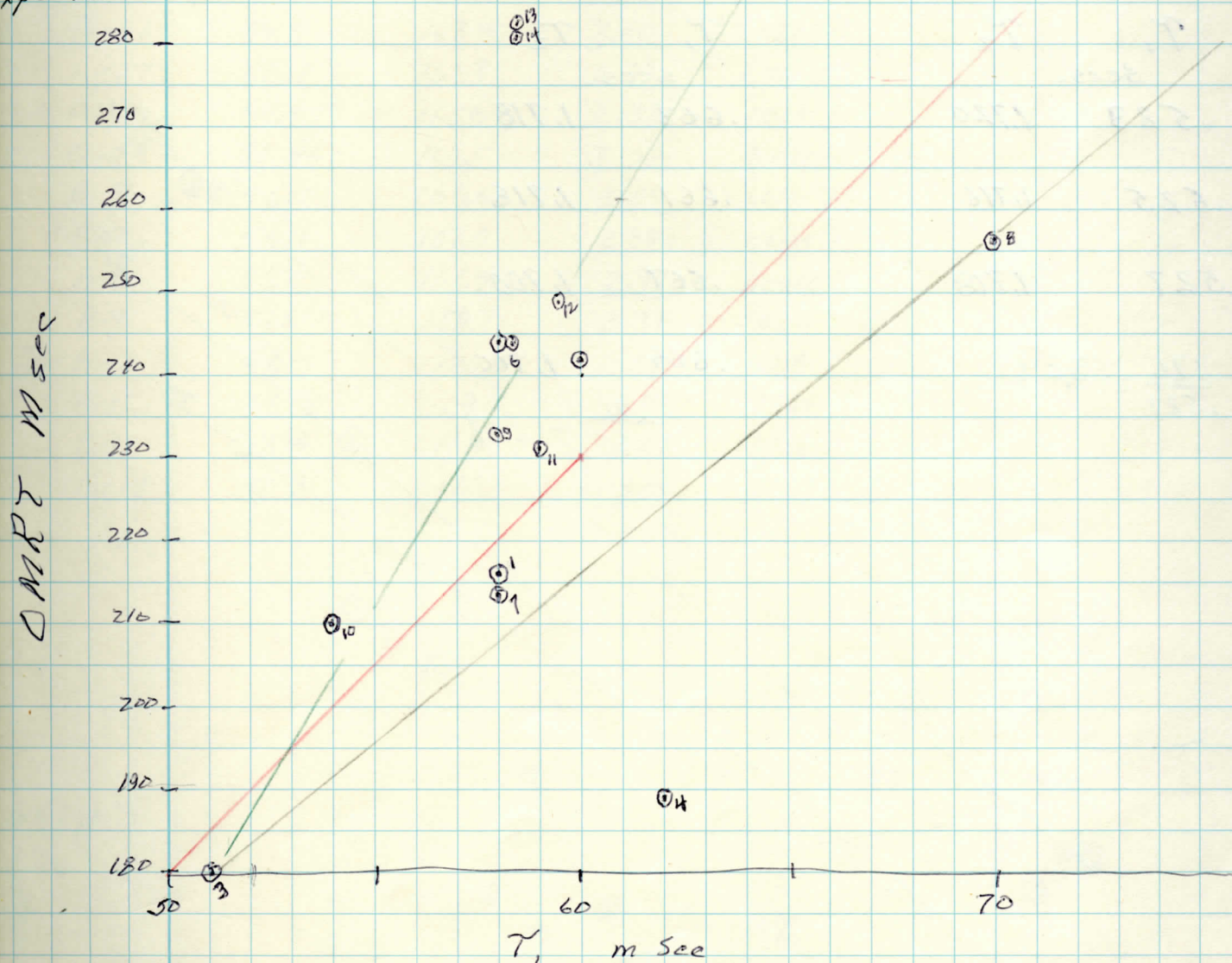
| $\tau_1$  | $\tau_2$ |
|-----------|----------|
| Fit. MD-5 |          |
| 100 = 101 |          |
| 58.5      | 171      |
| 58.5      | 168      |
| 58.5      | 168      |
| 58.5      | 167      |
| 100 = 101 |          |
| 58        | 168.5    |
| 58        | 168.5    |
| 58        | 168.5    |



Timing study - (W.T.)  $\Delta MRT$ 

$$\frac{\Delta y}{\Delta x} = \frac{58}{168} = 3.45$$

$\gamma_2$  mSec.



$$\frac{\Delta y}{\Delta x} = \frac{261 - 180}{10 - 51} = \frac{81}{-41} \approx -1.98$$

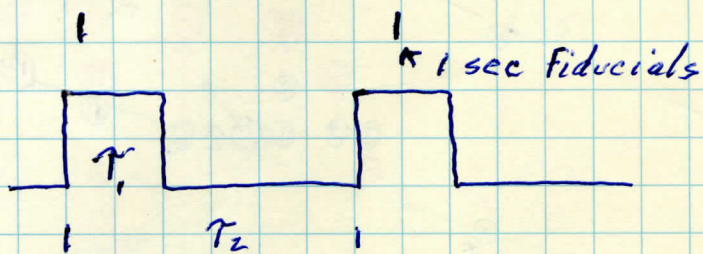
$$\frac{58}{260} = 0.22$$



22 Oct. '86

# Meas. of Synch Signals

The Control boxes #001 & #002 for EDG in flight were powered up & the light harness attached the synch sigs. were recorded on the ES-1000 recorder at 250 mm/sec.

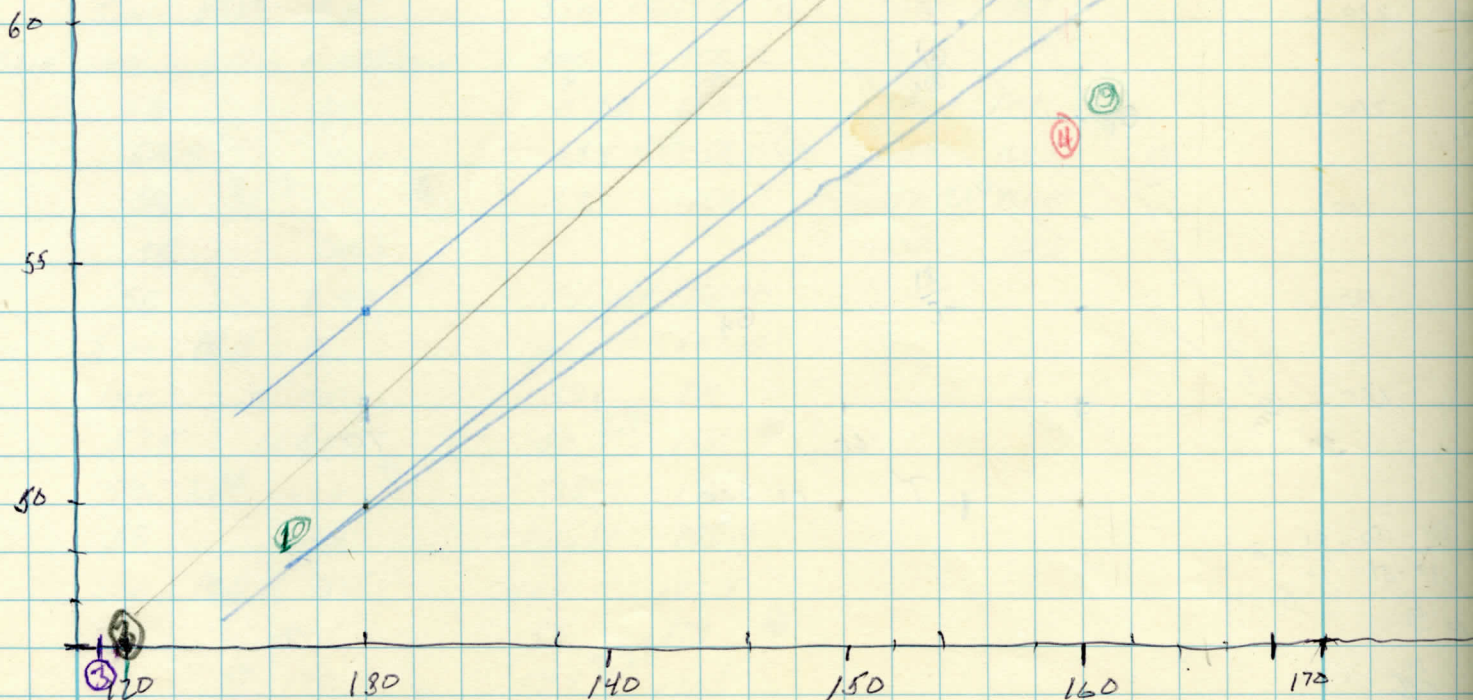


250 mm/sec. on recd. = 254 mm. (meas. of every cycle)

| Cycle | 002            |       | 001            |       |
|-------|----------------|-------|----------------|-------|
|       | $T_1$<br>secs. | $T_2$ | $T_1$<br>secs. | $T_2$ |
| 1     | .529           | 1.720 | .663           | 1.718 |
| 2     | .525           | 1.716 | .661           | 1.718 |
| 3     | .527           | 1.718 | .667           | 1.700 |
|       |                |       | .665           | 1.700 |

$$\frac{1.71}{.527} = 3.24$$

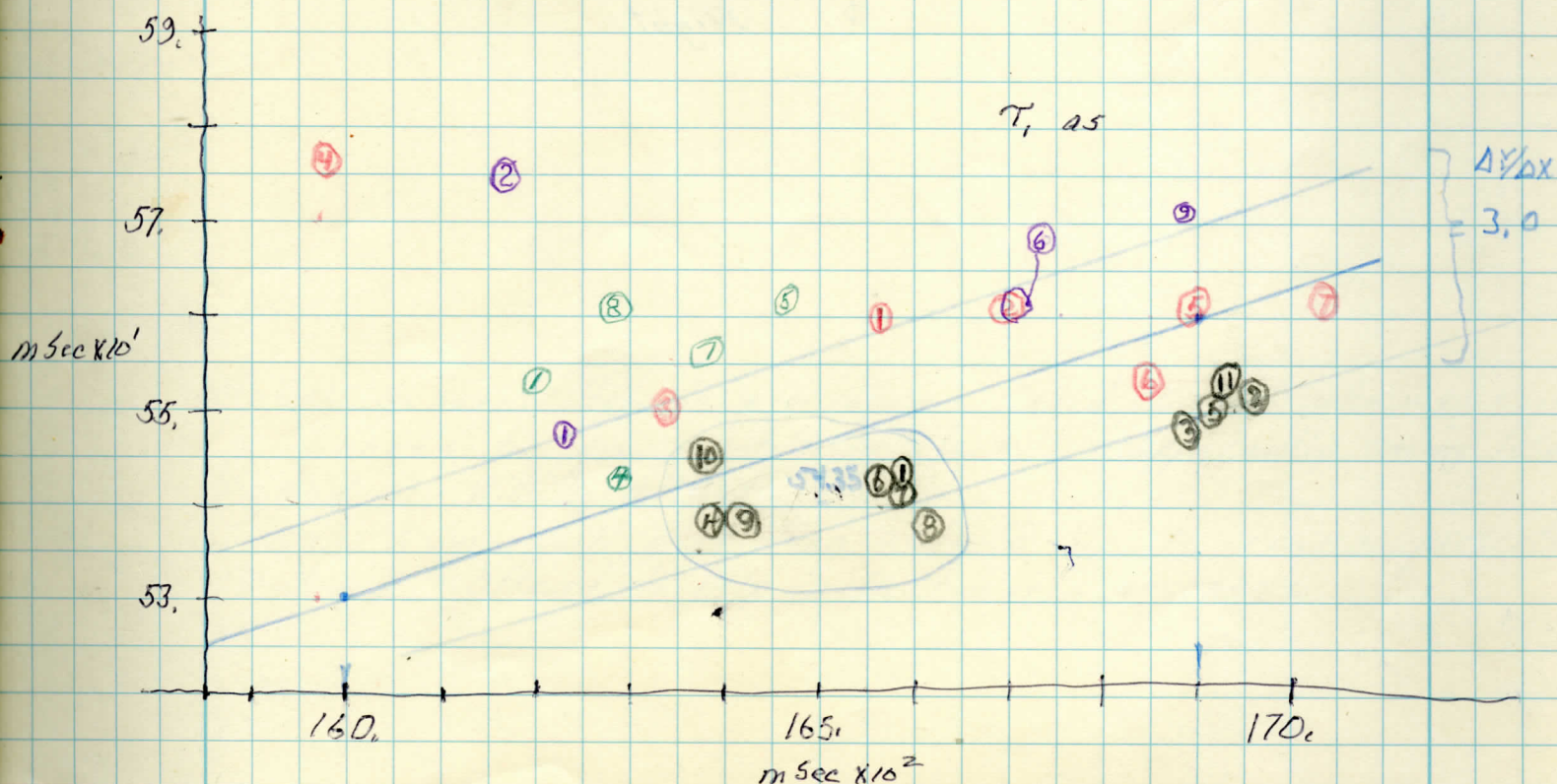
$$\frac{1.71}{.665} = 2.57$$





23 Oct. Synch. Signal Cal- OMRT

| S.C.R.             | $T_1$   | $T_2$ | $T_2:T_1$ | Chart  |      | Post FH- | $T_1$ | $T_2$ | $T_2:T_1$               | Chart | Tag |
|--------------------|---------|-------|-----------|--------|------|----------|-------|-------|-------------------------|-------|-----|
| strip Chart record |         |       |           | corr.  |      | mSec     |       |       |                         |       |     |
| 1 # AB-7           | ✓ 55.1  | 54.4  | 168.05    | 165.9  | 3.04 | 1.013    | 6nd 6 | 580   | <del>1681</del><br>1620 | 2.9   | 24A |
| 2 A-7              | 55.95   | 55.2  | 174.83    | 169.6  | 3.07 | 1.013    | 1.    | 561   | 1655                    | 2.95  |     |
| 3 A-11             | 54.86   | 168.9 | 3.08      | 1.021  |      |          | 472   | 1205  | 2.55                    |       | 2A  |
| 4 A-12             | ✓ 53.85 | 163.8 | 3.03      | 1.023  |      |          |       |       |                         |       |     |
| 5 A-13             | 68.4    | 172.0 | 2.51      | 1.004  |      |          |       |       |                         |       |     |
| 6 A-14             | 68.6    | 171.2 | 2.49      | 1.004  |      |          |       |       |                         |       |     |
| 5 A-16             | 55.1    | 169.3 | 3.07      | 1.022  |      |          |       |       |                         |       |     |
| 6 A-21             | ✓ 54.4  | 165.7 | 3.04      | 1.024  |      |          |       |       |                         |       |     |
| 7 A-22             | ✓ 54.2  | 165.9 | 3.06      | 1.021  |      |          |       |       |                         |       |     |
| 8 A-24             | ✓ 53.8  | 166.2 | 3.08      | 1.026  |      |          |       |       |                         |       |     |
| 9 A-25             | ✓ 53.9  | 164.2 | 3.04      | 1.023  |      |          |       |       |                         |       |     |
| 10 A-26            | 54.5    | 163.8 | 3.00      | 1.027  |      |          |       |       |                         |       |     |
| 12 * A-27          | 62.1    | 161.3 | 2.59      | 1.010  |      |          |       |       |                         |       |     |
| 13 * A-28          | 64.4    | 165.0 | 2.52      | 1.009  |      |          |       |       |                         |       |     |
| 11 A-23            | 55.46   | 169.5 | 3.03      | 1.033  |      |          |       |       |                         |       |     |
| 1 B-7              | 56.0    | 165.6 | 2.95      | 1.012  |      |          |       |       |                         |       |     |
| 2 B-7a             | 56.1    | 167.0 | 2.98      | 1.0105 |      |          |       |       |                         |       |     |
| 3 B-8              | 55.0    | 163.4 | 2.97      | 1.0265 |      |          |       |       |                         |       |     |
| 4 B-9              | 57.6    | 159.7 | 2.77      | 1.024  |      |          |       |       |                         |       |     |
| 5 B-10             | 47.15   | 120.0 | 2.54      | 1.018  |      |          |       |       |                         |       |     |
| 6 B-11             | 56.05   | 169.0 | 3.02      | 1.024  |      |          |       |       |                         |       |     |
| 7 B-12             | 55.4    | 168.5 | 3.04      | 1.026  |      |          |       |       |                         |       |     |
| 8 B-13             | 56.2    | 170.3 | 3.01      | 1.028  |      |          |       |       |                         |       |     |





24 Oct

Alan  
DMRT Corrections  
Chart Speed  $\frac{100. \text{ mm/sec}}{\text{Actual mm/sec}} \times \text{recorded chart time} -$   
Tape Speed -  
Mean of small devs.

27 Oct.

Alan Working on other projects, tomorrow

28 "

"

"

"

"

"

For a wk. (Leach &amp; Vicog.)

28 Oct.

Met Dr. Borison - 4 seasons - Reviewed & lightly my views of SMS - No disagreement - He encouraged me to maintain contact & visit him -

$$\dot{x} = \frac{x}{T}$$

$$x = \frac{1}{2} a t^2$$

$$\dot{x} = \frac{1}{2} a t$$

$$\dot{x} = \dot{x} T$$

$$= \frac{1.05}{2}$$

$$= 16.$$

$$\dot{x} t = \frac{1}{2} a t^2$$

$$= \frac{a t}{2}$$

$$x = 16.6$$

$$t = \frac{1.05}{2}$$

$$26 = 32 t^2$$

$$\sqrt{\frac{12}{32}} = .612 \text{ sec}$$

$$x = \frac{1}{2} a t^2$$

$$= \frac{32 \cdot (.612)^2}{2}$$

$$= 16.$$

$$= 6$$

$$40 t$$

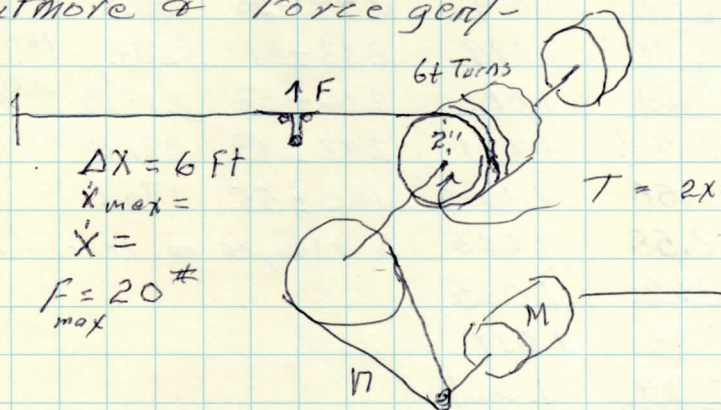
$$\dot{x} = \frac{a t}{2}$$

$$= \frac{32}{2}$$

$$= 16$$

for

Don Stew. out & family illness -  
Whitmore & Force genl -



$$T = 2 \times 20 = 40 \text{ in lb} = 3.33 \text{ ft. lb}$$

$$\rightarrow 640 \text{ inoz}$$

$$NB \bar{E} N$$

$$= 100:1$$

$$T_M = 6.4$$

30 Oct. No ans. to ltrs. on publication - Called Biggers who was cool on chances for job. in delayng etc. but is apparently having them looked at. Will try AMA, etc.

31 Oct. 5 am - will meet Mon 0800 & Vic to review presentation to Joe K. Offered to help in D. Stewart's absence.



| 24 Oct      | OMRT            | Synch   | Signal        | Cal.              |                                |                         |             |                          |   |
|-------------|-----------------|---------|---------------|-------------------|--------------------------------|-------------------------|-------------|--------------------------|---|
| S.C.R.<br># | $T_1$ *<br>secs | $T_2$ * | $T_2: T_1$    | S. Chart<br>Corr. | OMRT x                         | $\frac{1}{SCR}$<br>corr | X           | $\frac{1}{Data}$<br>corr | = |
| 1 C-5       | 54.7            | 163.3   | <u>2.98</u>   | 1.016             | 209                            | 20.7                    |             |                          |   |
| 2 C-6       | 57.5            | 161.7   | 2.81 ?        | 1.0195            |                                |                         |             |                          |   |
| 3 C-7       | 46.8            | 119.7   | 2.55          | 1.0225            |                                |                         |             |                          |   |
| 4 C-8       | 65.8            | 167.7   | 2.54          | 1.021             |                                |                         |             |                          |   |
| 5 C-9       | 57.1            | 168.8   | <u>2.96</u>   | 1.024             |                                |                         |             |                          |   |
| 6 C-10      | 56.1            | 167.05  | <u>2.98</u>   | 1.008             |                                |                         |             |                          |   |
| 1 D-12      | 54.3            | 162.9   | <u>3.00</u>   | 1.0185            | 209 ± 69                       | 205.7                   | 162.9/165   | 208.4                    |   |
| 2 D-13      | 52.9            | 148.6   | <u>2.94</u>   | 1.0215 *          | 210 ± 48                       | 205.6                   | ?           |                          |   |
| 3 D-13a     | 49.06           | 144     | <u>2.94</u>   | 1.01 *            | 213 ± 4                        |                         | 116         |                          |   |
| 4 D-14      | 55.35           | 162.0   | <u>2.93</u>   | 1.01              | 213 ± 47                       | 210.9                   | 162/165     | 214.8                    |   |
| 5 D-15      | 56.2            | 164.7   | <u>2.93</u>   | 1.008             | 237 ± 72                       | 235.1                   | 165/165     | 235.1                    |   |
| 6 D-16      | 55.3            | 162.7   | <u>2.94</u>   | 1.009             | 244 ± 56                       | 241.8                   | 163/165     | 252.4                    |   |
| 7 D-17      | 55.76           | 163.8   | <u>2.94</u>   | 1.024             | 233 ± 61                       | 227.5                   | 164/165     | 228.9                    |   |
| 8 D-18      | 56.2            | 162.8   | <u>2.89</u>   | 1.01              | 216 ± 53                       | 213.8                   | 163/165     | 216.5                    |   |
| 9 D-19      | 58.4            | 161.2   | <u>2.76</u> ? | 1.021             | 242 ± 59                       | 237.0                   | 161/165 (?) | 242.9                    |   |
| 10 D-20     | 49.24           | 126.43  | <u>2.56</u>   | 1.0215            | 180 ± 55                       | 176.2                   |             |                          |   |
| D-21        | 55.42           | 143.5   | <u>2.58</u>   | 1.023             | Δ - changes in recording speed |                         |             |                          |   |
| D-22        | 55.5            | 166.43  | <u>3.00</u>   | 1.025             |                                |                         |             |                          |   |
| D-24        | 67.2            | 171.0   | <u>2.55</u>   | 1.017             |                                |                         |             |                          |   |
| D-25        | 56.6            | 167.9   | <u>2.94</u>   | 1.024             |                                |                         |             |                          |   |
| D-26        | 56.0            | 168.3   | <u>3.00</u>   | 1.022             |                                |                         |             |                          |   |
| D-27        | 56.5            | 167.8   | <u>2.87</u>   | 1.023             |                                |                         |             |                          |   |
| D-28        | 55.4            | 165.2   | <u>2.98</u>   | 1.008             |                                |                         |             |                          |   |
| D-29        | 56.1            | 165.4   | <u>2.95</u>   | 1.008             |                                |                         |             |                          |   |
| D-31        | 65.9            | 169.9   | <u>2.58</u>   | 1.009             |                                |                         |             |                          |   |

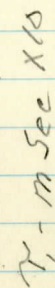
3 Nov. Correct  $T_1$ 's for 1. SCR 2. records 3, 5, 11, 16, 7, 23 to  $T_1 = 54.35$   
 3. do histogram  
 \* corrected for differences in chart speed



— 3-7

5-2

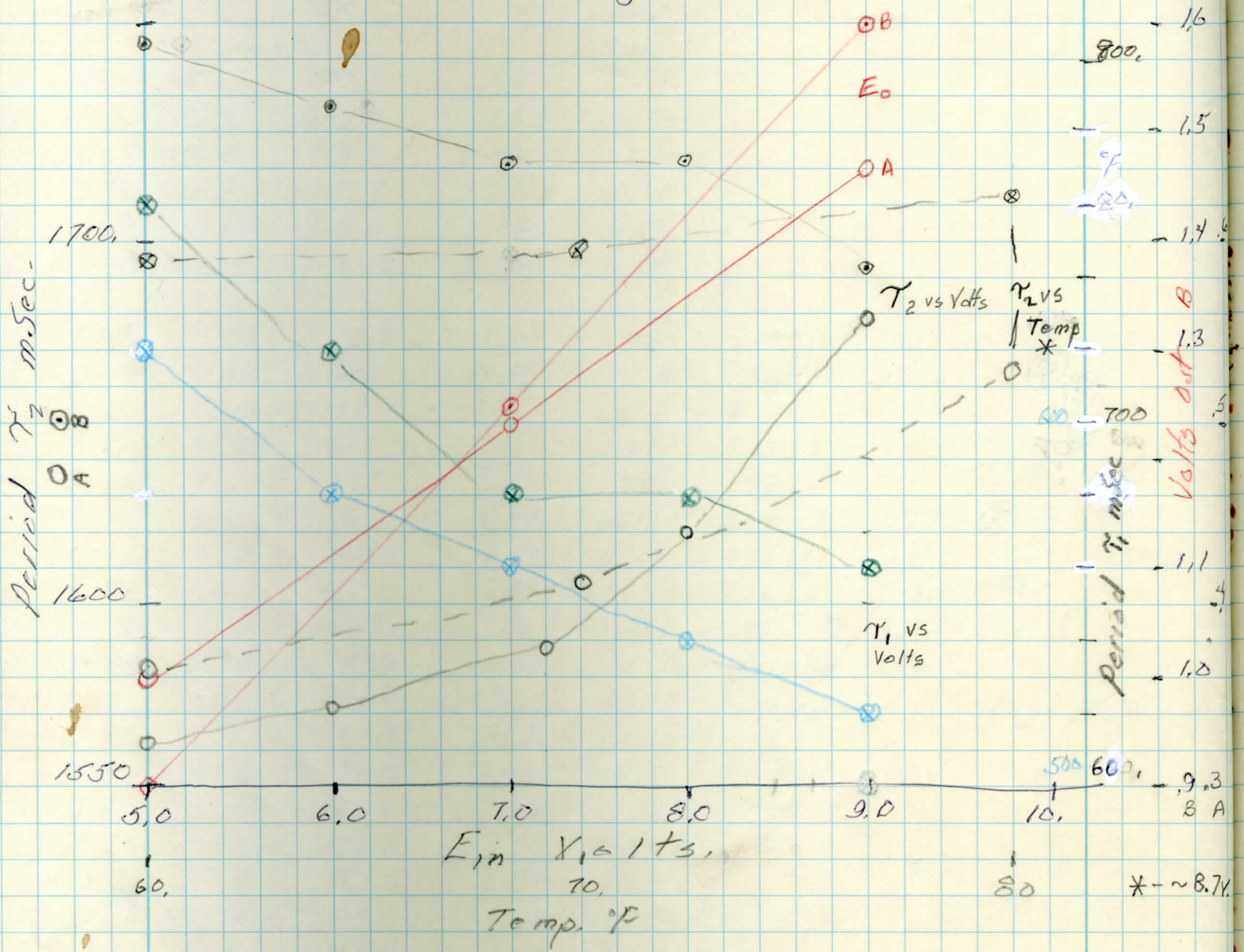
S-E W70

$$T_1 \text{ as } f(T_2)$$


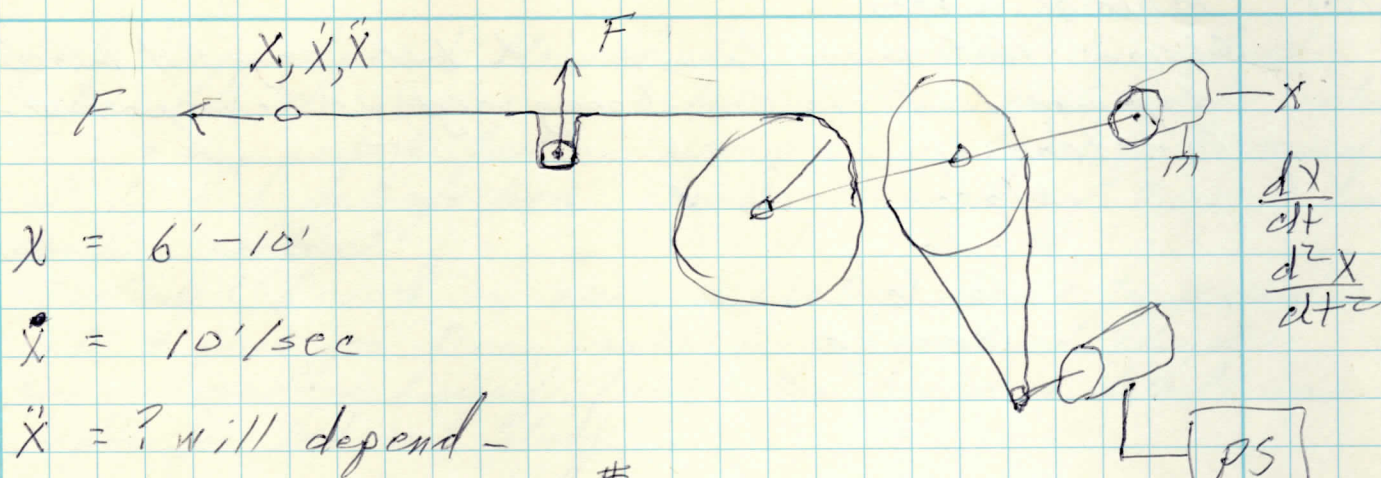
327



# $T_1 - T_2$ Synch Sig. for OMRT Gainer







1)

$$F_t = F_g + F_x = mg + m\ddot{x}$$

$$F_t = 50\# = 20 + F_x$$

$$F_x = 30\# = m\ddot{x}$$

$$= \frac{30\#}{(20/32 \text{ s}^2)} = \ddot{x}$$

$T \propto I$

2)  $F_{tot} = m\ddot{x}$

3)  $F = kx$

WT - motor

J - force sensor

- Pot

- differentiator

J & WT - P.S.

7 Nov.

Meetings E Herwin -

1000 Pool & Johnson - presented plan for bed rest study  
K. approved.

1300-11. briefly described publication difficulties SAEM, etc.

2. Outlined my plans e.g. publish data some way

6. develop exercise devices c. do bed rest.

Agreed to present plan to J.K. for completion of data analysis  
& an S.P. - J.K. wants broad base but logic dictates restriction.

Delivered 2° ltr. to G. Sevier who tried to draw me out. Promised

10 Nov. answer in day or two. Claimed previously too busy.

77 Called J.K. pointing out still no answer from SBRI. He made appt.  
contd. P-1126



14 Nov

## Animal Cages

Obvious that no one knows how to build a cage that collects waste dispenses food etc. Also cleaning cage will be a problem.

Functions -

Water - Lixit

Food -

Waste -

Cleaning.

Publication Probs. - contd from P-125

18 Nov.

2 M. Bongo per ~~11:00 AM~~ AM, 18<sup>th</sup> & promised me a call 19<sup>th</sup>.  
Call from Pohl that data had to be moved. Passed this on to Bill Shumate.

20 Nov.

Called J.K. who has instructed M.B. to have Jack S. to provide me c requested info.

21 Nov

Call to J.K. that Sivier's ltr. was acceptable & printed <sup>then</sup> out data storage problem which he observed was a product of my being an astronaut & not working in L.S. No help.



24 Nov

20 Nov

Jack S. produced ltr. which is acceptable in which ostensibly the papers will be rewritten. Will try to combine T.M. & my papers but on seeing Tom's realize he rewrote it to his satisfaction claiming everything. Now I have another conflict.

21 Nov

Meeting c Don S. on exercise status. Agreed to proceed c T.M. & force gen. Don wants to do combined bicycle-rowing machine himself. Agreed. Also briefed in detail on hoped for bed rest study.

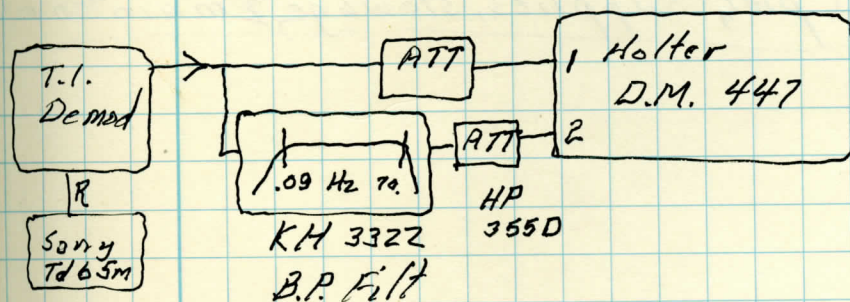
24 Nov.

Called Skimate about room for data storage & he has not seen Schneider w/propos MATSCD storage. Agreed to talk it over c S. Called S. who was in B.P. this morning have tried to set up 3<sup>rd</sup> mtg.

11 Dec. '86

Tried to reach Pam T. yesterday & today -

### Transfer of EKG to Holter Tape



| Tape  | MET<br>D:H:M | Holter<br>Time | Att.<br>-db. | Condition  |
|-------|--------------|----------------|--------------|------------|
| D15 A | 01:23:54     | 0:00 (AM)      | 60           | SMS        |
| B     | 01:23:06     | 1:00           | 60           | "          |
| D16 A | 02:00:47     | 2:06           | 50           | Recovering |
| B     | 02:01:34     | 2:49           | 50           | "          |
| D14 A | 04:04:56     | 4:34           | 50           | Recovered  |
| B     | ~05:00:00    | 4:35           | 50           | "          |



16 Dec Win Kler - Gene Winkler

User. adequate

- Clean ~~Hot~~ Receptable
- Accept all assoc. waste <sup>used</sup>
- No user interaction beyond personal clean up
- No odors, or other contamination
- Positive containment
- Use of apparatus should not significantly

Operational constraints { • Simple, clean maintenance  
Minimize consumables, stowage, transport  
Minimize size, wt - pwr, maintenance  
Reliability (manual backup), ~~fit~~ operational life

Design considerations

1. Positive <sup>con</sup> & compaction
2. Adequate airflow to entrapment odors & materials  
in weightless ness -
3. Manual override
4. Automatic Nominal automatic operator

Status & Test Results - Thornton Brief -

Feasibility Test ~~in~~ prior of collection & compaction ~~in~~ pad.  
Worked Jan Jan, July, Aug - 85 - ~~for~~ Simulated & Real Fees  
Worked as planned - no obvious difficulties

Started Manual Prototype for flight test - Jun-86

Delayed by Explosion

1g prototype tested for:

reliability

Performance (~~100~~ 100+ usages ~~in~~ Sim Fees.

Crew Interface (

Flight Prototype

~~acceptance~~ tested in cluding function ~~in~~ simulated  
Fees - Now in bonded storage -

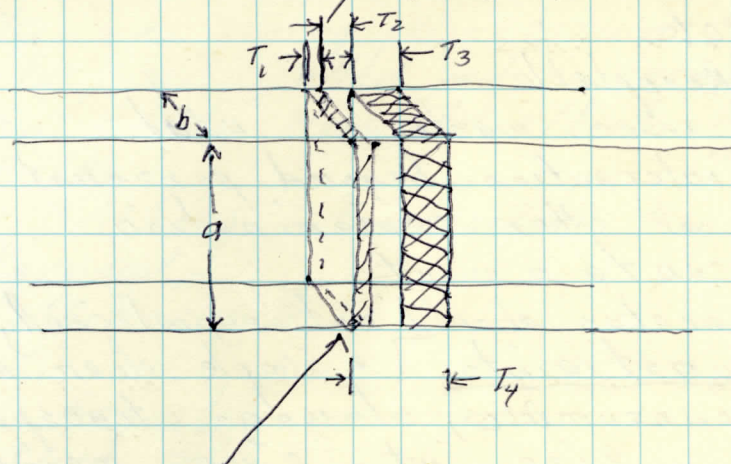
1g Prototype now being automated

Flight test still planned -

Briefed Mar. Mar. - Winkler offended at my criticism of G.E.W.S



1 W C S - Compaction efficiencies, etc.



Pad (actually folds back on piston)

Pad Tare -

$$a \times b \times T_1 = 10' \times 10' \times .025 = 1 \times 2.5 \times 10^6 \times 10^6 = 2.5 \text{ cu. in.}$$

Wt - 100' roll weighs  $3^{14} \text{oz}$   $\frac{1.2 \times 10^2 \cdot 10^2}{10} = 1.2 \times 10^2 \text{ fissures}$

Total vol. =



17 Dec. Don Stewart -

- 1400-1200
1. Transcript of Proceedings of
    - a. Introduction to SAS
    - b. Rationale for SS Ex.
    - c. Biomechanics of exercise & devices

- Tombirau

## 2. Proxomotor Muscles

ARC wants to usurp exercise effort - which JSC wants to prevent. HQ has designated ARC as sedrest dr. & promised \$1M next yr. Don wants to utilize them. Also a variety of other parasites are present including data displayers & motivators. One researcher is after \$75K to validate H.T.M.

Don is working on status report which becomes a kind of road map for exercise - spent 1+ hrs. on this & a good deal more on theory. He also wants to do a paper. He feels it essential to keep distance (publicly) from me.

There is now an urgency to developing the tedw - in Don which is so obvious to me.

Work I ~~must~~ need to do.

\* 1. Transcript Papers

2. Rationale For S.S.

- a. Astro etc.
- b. Life Sci.
- c. publications

3. Treadmill

isolation

4. Force gen -

5. Bike - Row Machine

- a. paper on R. Machine
- b. study of current R. machine

\* 6. Bed Rest Study -

- a. correct proposal
- b. finish & test instr.

7. Instrumentation

8. Suit - Exerciser



30 Dec '86 Chapel Hill (Lect. to physics teachers.)

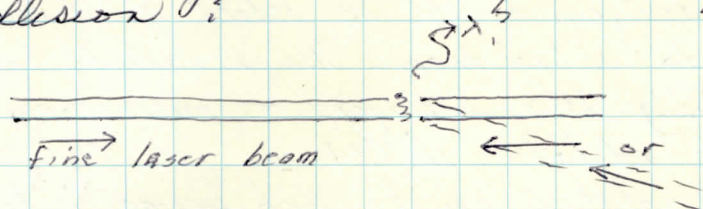
Long standing and persistent thought:

How particle like is a photon?

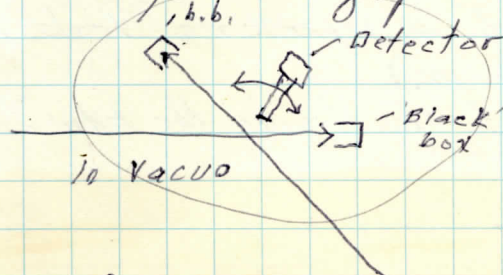
What is its size?

$E = mc^2 = h\nu$   $m = \frac{h\nu}{c^2}$  + assuming density is same as that of other  $C^2$  particles -  
calculate size from  $m \times d$  -

Can they collide or produce effects from near collision?



Calc. probability from above sizes & beam density -



Use scheme at ② to look for scattering or what have you.

Can they collide & combine??

- 2) Are emotional & cerebral conflicts capable of producing effects analogous to those from sensory conflicts such as SMS?

Should expect effects to be more diverse

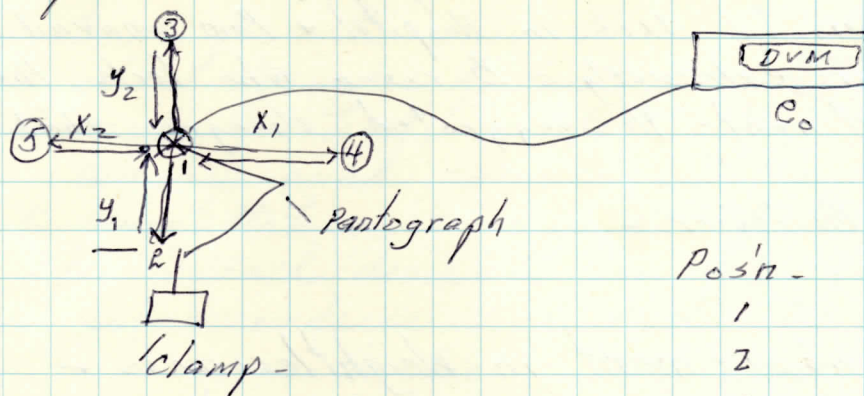
Can they be detected.

Points for dele



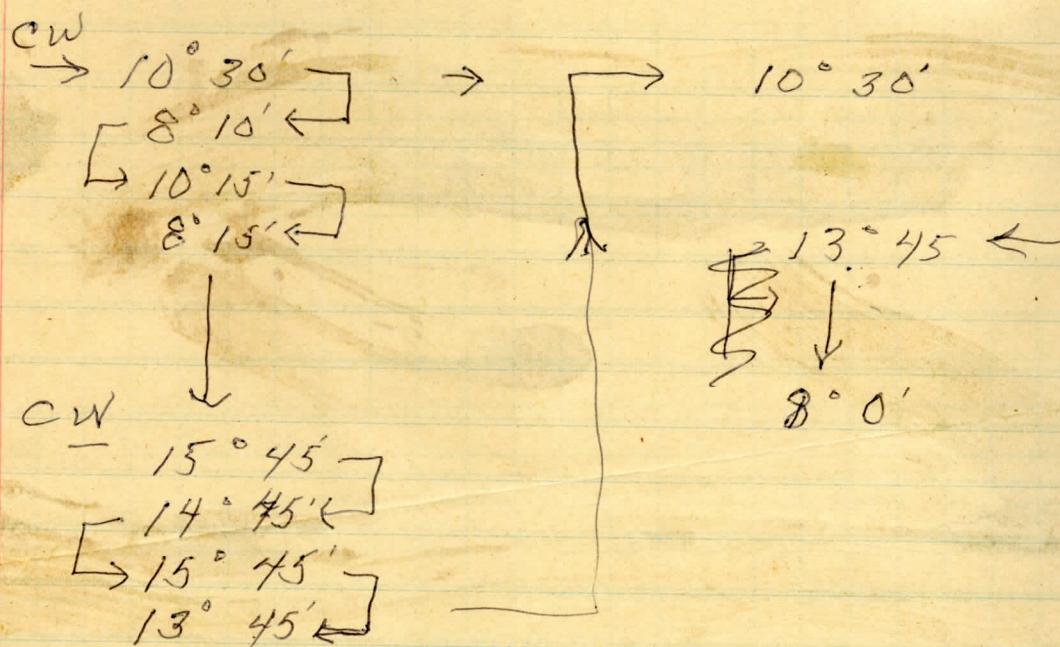
31 Dec

Test results from Pantograph - Copied  
Set Up in B-36 - Gainer



$x_1, 2.5$   
 $x_2, 2.5$   
 $y_1, -3.5$   
 $y_2, +3.5$

| Pos'n. | Volts- $e_0$ |
|--------|--------------|
| 1      | 2,369        |
| 2      | ,378         |
| 1      | ,378         |
| 2      | ,379         |
| 1      | ,378         |
| 3      | ,378         |
| 1      | ,378         |
| 4      | ,378         |
| 1      | ,378         |
| 5      | ,378         |
| 1      | ,378         |





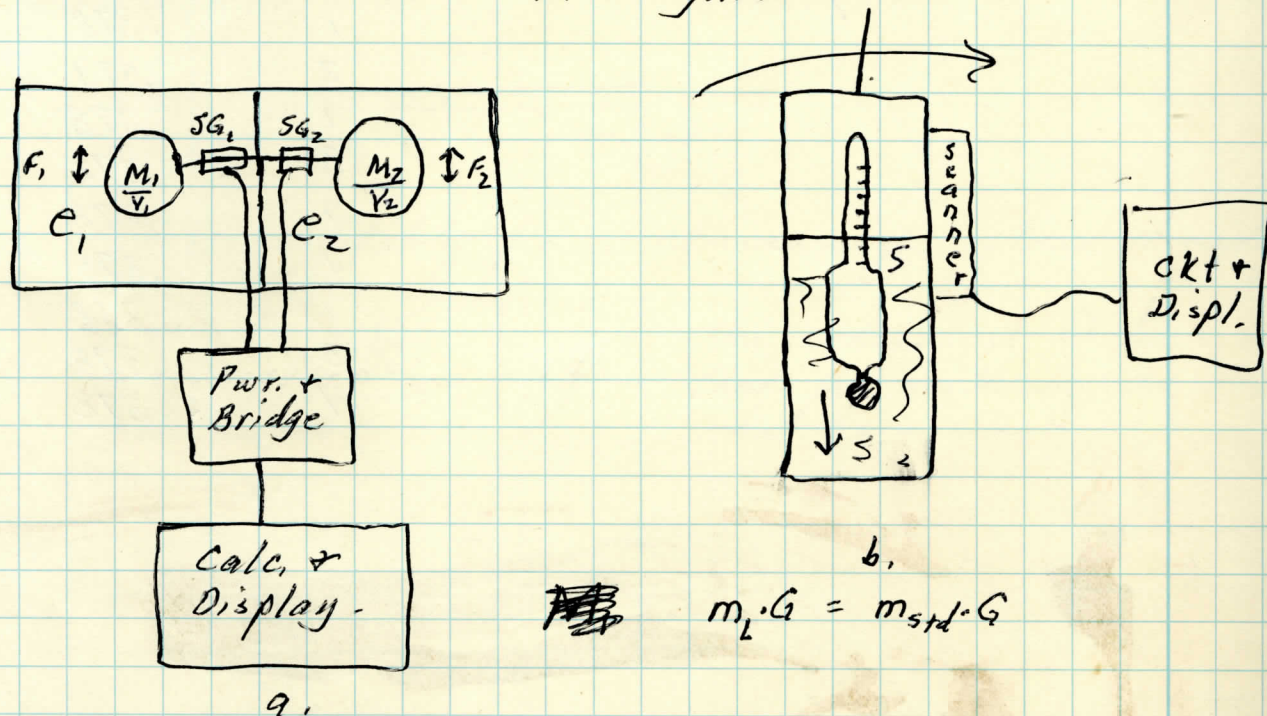
1987

Jan #9 Summary

Made multiple calls to Pam Thompson (Ms. Jack Sevier) apropos editing of papers but Jack in Hospital & Pam unavailable. Reviewed papers extensively & Borisov who feels they are well written & pertinent. He suggested changes which will be made.

left msg. for Ms. Sevier -  
1000 Mon.

1600 Sp. Gr. Measurement in Weightlessness -



In b. an ordinary hydrometer is placed in a tube & liquid and swung in an arc such that it balances between displaced liquid mass <sup>equal and volumes</sup>  $m_l$  & accelerated solid mass  $m_s$ . The scale can then be scanned. A better scheme uses fixed masses in ~~closed~~ compartments  $e_1$  and  $e_2$ . Forces in the axes  $F_1$  and  $F_2$  measured by strain gauges  $SG_1$ ,  $SG_2$ . Density of fluids may be measured by comparison of the forces produced, either under acceleration or gravity, and knowledge of the volumes & masses of  $M_{1,2}$  & other factors as follows: illustrated by a single example. ~~Place~~ Fill  $e_2$  & a stable fluid of known density and place the apparatus in an accelerated <sup>linear</sup> motion or a g field. A force  $F_2$  will be produced -  $F_2 = V_2 D_2 G - m_2 G$  where  $D_2$  is the density of the <sup>liquid</sup> fluid. If now a fluid of unknown density is placed in  $e_1$ , a similar force will be produced and the ratio of forces  $F_1$  &  $F_2$  may be used to determine the ratio of densities. In addition they may be easily calculated and displayed by well known techniques.



# 10 Bowel sound recorder / processor

Sounds generated within the body still give valuable diagnostic information to the clinician and occasional researcher. Examples of such sounds <sup>generators</sup> include heart, lung, blood vessel, G.I. tract, muscle and joints. At the present time study of such sounds are generally limited to direct auscultation & a passive or amplified stethoscope and life or death decisions are often made on the basis of a few seconds or at most minutes listening. It has been shown in virtually every physiological signal that has been studied for longer periods of time, that additional information can be obtained e.g. Holter monitoring of EKG. Very few extended studies, especially using modern electronic resources, have been made.

One recent study of bowel sounds was made on Shuttle flights to study the G.I. effects of S.M.S. which produces a temporary ileus in the stomach and upper G.I. tract. Various methods for studying G.I. motility are available e.g. the multi-port perfused catheter, telemetry pill, radiography, E.G.G. etc. but none were suitable for use under the conditions of space flight except the E.G.G. and this signal is too fragile for use during operations. As stop gap measure bowel sounds were continuously recorded from two sites, R & D UQ, & Andries\* electronic stethoscopes and a professional Walkman\*\* miniature tape recorder. They were scored by one physician monitoring as they and recording each event and then taking 15 min. averages of the number of events. Such a crude system was still invaluable in demonstrating a temporary ileus which always apparently accompanies SMS.

Conversely there were many shortcomings to the system including subjective evaluation of the records which was necessary since they were frequently noisy. Also the data reduction was labor intensive requiring more than 1:1 analysis to recording time by an expert. The obvious answer is machine processing which could evaluate the sounds for number, duration, amplitude and other qualities. This basic process can be simply done however differentiation of the signal from noise would require a formidable analysis program which might well require man years of programming. If the noise could be eliminated noise elimination then becomes the first step in making continuous or ambulatory monitoring of sounds practical.



16-Jan

Wh. Motor

20# 10 FPS max

.37

763. RPM

Clifton Prec. 215-622-1000 Keith sales -  
Bodine

EAD No servo

Hathway - call back Max Day

Electro Craft - 1800 Jim

586 Gear Motor - 800

115 VDC

Von Weiss - St Louis

Industrial Drives

201 Rock Road Radford Va 24141

H D - Torque - Velocity -

9.8" - 4.85" dia - 3.4 Ft lb - 40-"/lb -

C Tach - 12V - 1000

Pwr. - 5 BE-2 762.

TT - 2933 - 1200

5 Stev. Gro FF -

Can supply virtually Entire system -

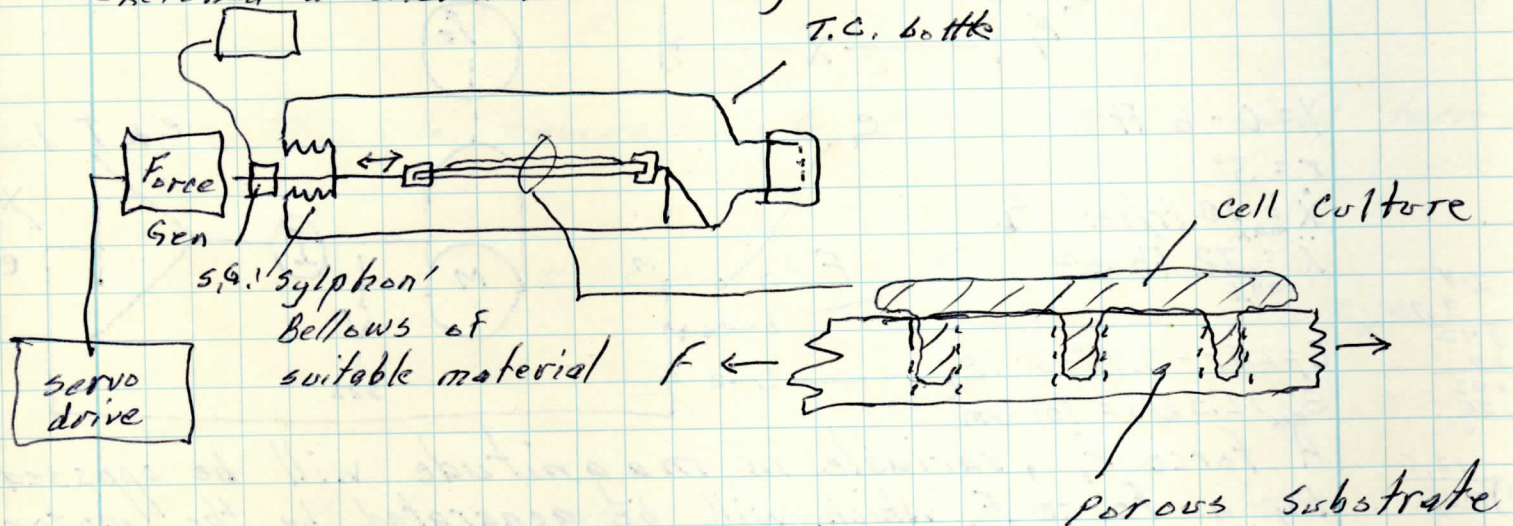
Gave copy of info to Henry W.

$$\begin{array}{r} 32.20 \\ 32 \end{array}$$



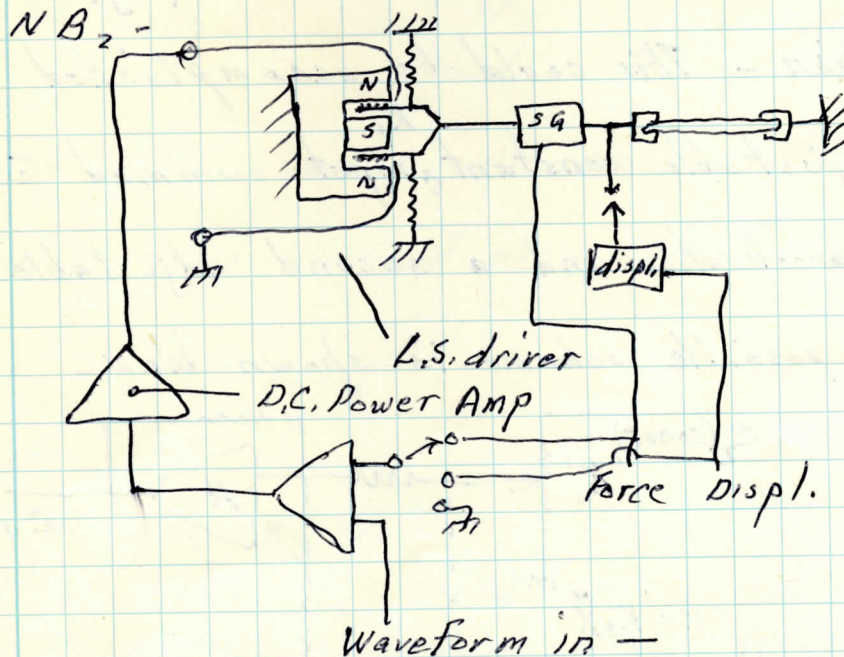
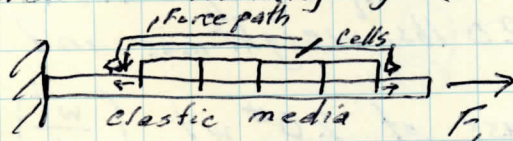
13 Jan Bone Tissue Culture

Millie stopped by a obvious idea of stressing Mineral depositing bone cell line. I had assumed this since last discussion - Sketched a brief means of doing it -



A wide variety of force amplitudes + wave forms can be applied and the old question of ~~the~~ force + mineralization might be answered - Use mineral content as indicator -

N.B. above scheme might not evenly distribute force e.g. if cell structure below is sufficiently rigid (low compliance) as compared to compliance of media then force path would 'shunt' cells between the ends -



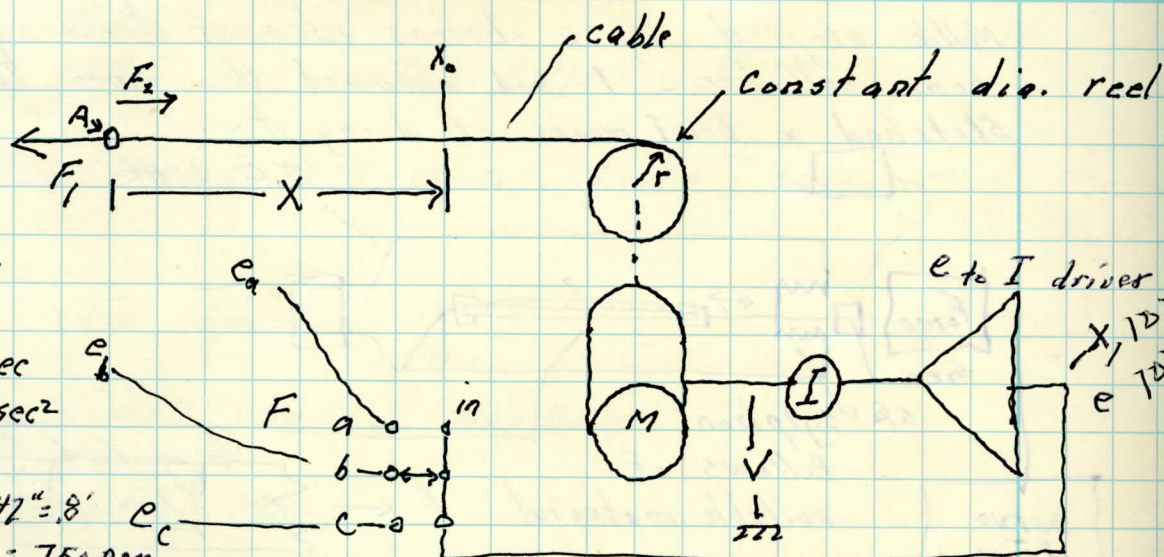
16 Jan Don stow. called apropos flt. test of raw. mach. in OG flt. Pointed out it wasn't configured for that.



1987

16 Jan

## Force Generator



$$X = 0 - 6 \text{ ft}$$

$$r = 3''$$

$$\dot{X}_{\max} = 10 \text{ ft/sec}$$

$$\ddot{X}_{\max} = 32 \text{ ft/sec}^2$$

$$C = 2\pi r = 9.42'' = .8'$$

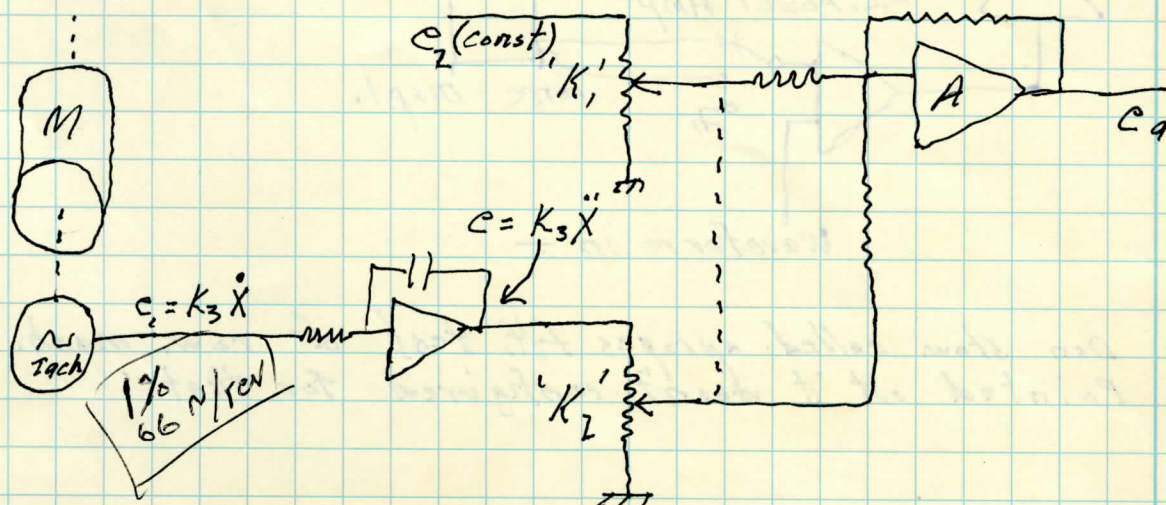
$$\Theta_{\max} = 12.5 \text{ RPS} = 750 \text{ RPM}$$

A force  $F_1$ , variable in magnitude will be opposed by a force  $F_2$  which will be generated by the motor  $M$  and transformed into linear motion  $X$  by the cord (cable) and reel,  $r$ , according to one (selectable) of the following.

$$F_g = K_1 + K_2 \ddot{X} \quad \text{where } K_1 \text{ is equivalent to } 20 \text{ lbs. weight}_{\max} \text{ and}$$

$K_2$  is equivalent to the mass of  $20 \text{ wt} \left( \frac{\text{wt}}{g} \right)$  and

$\ddot{X}$  is acceleration - This could be accomplished by an ~~variable~~ adjustable constant  $K_1$  input summed to the product of acceleration and a second adjustable constant  $K_2$  - A possible scheme is shown below.



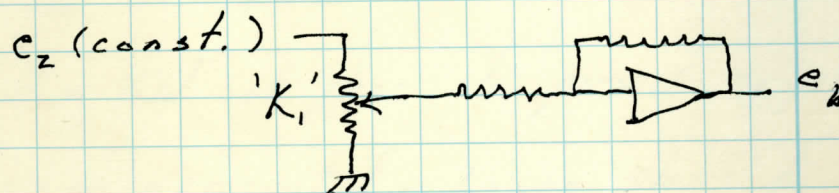
N.B. does not include system inertia



16 Jan Force Gen -

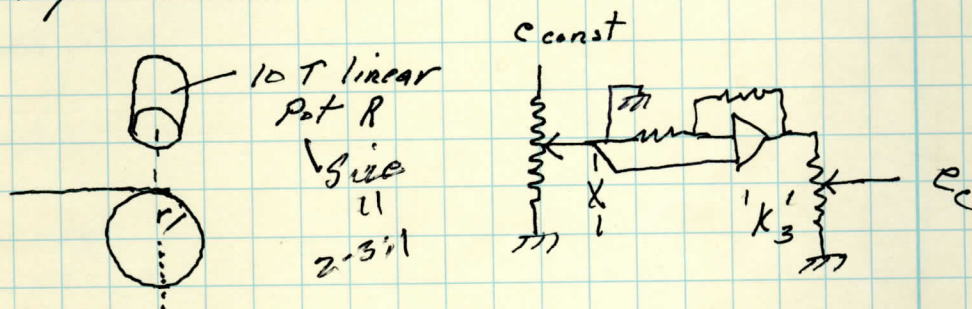
$F_b = K_1$  where  $K_1$  is equivalent to an adjustable  
wt. of 20 # max.

This is equivalent to  $F_a$  & the second term  
removed -



$F_c = K_3 X$  Where  $X$  is displacement - ~~max~~ 0-10 ft'  
and  $K_3$  is an adjustable constant with a max  
of 5 lb./ft displacement -

Wh



While the above will meet current requirements, in  
the future we will need other forces of the form -

$$F_d = K_4 \dot{X}^n$$

$$F_e = \infty'$$

when  $\dot{X}$  exceeds an adjustable limit i.e. a ~~variable~~ constant  
velocity below  $\dot{X}_{limit}$  produces no force while a constant  
velocity of  $\dot{X}_{limit}$  is reached -

- 1 Not shown are safety features such as velocity & position limits  
Also force  $F_2$  & displacement must be available for  
monitoring



27 <sup>Jan</sup> ~~Dec~~ - Stonesifer  
 Status -  
 Prev. Plans  
 Curr. "

New -

Cohen Present 20 min -  
 Mon. 5 min What we did -

T. Bagian - Contacted & Told of plans to present upgrade  
 old DSO's

New DSO's may be presented - Logan plans to present  
 DSO Presentation Resched to 5<sup>th</sup> Sep -  
 Promised sep. audience on return from Trl.

4 Feb. Tried to find log vol data in B-37 - J. Baker analyzed  
 SL data & disc. but no sign of it.

Copies of log vol. removed to B-4 include -  
 Stand Test all Flights

51 D Carr

51 A Thornton  
 Pailes

51 B Thagard

51 J Hilmeers

61 B Walker

61 B Ner's

51 B Lind



23 Feb.  
'87

# Stride studies

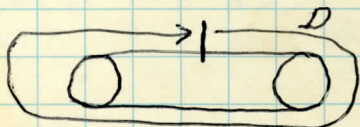
Have worn innovative time electronic pedometer daily during walking & exercise to get an estimate of activity  
(see pg. 152 for 1.) 2. look at stride length + rate vs velocity

## Calibration:

Treadmill, Quinton

$$D = 10' 3\frac{3}{8}" = 10.28'$$

Timed w Seiko watch -



$$1 \text{ MPH} = 5280 \text{ ft/mi} / 3600 \text{ sec/hr} = 1.466 \frac{\text{ft}}{\text{sec}}$$

| Indicated Vel. MPH | Time/10 revs (102.8) secs. | Vel. ft. sec. | Actual Vel. MPH |
|--------------------|----------------------------|---------------|-----------------|
| 4                  | 17.22                      | 5.96          | 4.06 105        |
| 4 1/2              | 1                          | 6.73          | 4.61            |
| 5                  | 13.70                      | 7.50          | 5.11            |
| 5 1/2              |                            | 8.32          |                 |
| 6                  | 11.25                      | 9.14          | 6.23            |
| 6 1/2              |                            | 9.93          |                 |
| 7                  | 9.60                       | 10.71         | 7.30            |
| 7 1/2              |                            | 11.38         |                 |
| 8                  | 8.53, 54.57                | 8.54 12.04    | 8.20            |
| 8 1/2              |                            | 12.79         |                 |

A series of 5 min runs at constant indicated speed were made with the following results:

| Indic. Vel. MPH | Strides 5 min | min <sup>-1</sup> sec <sup>-1</sup> | Actual Vel FPS  | Stride lgth. St. ft <sup>-1</sup> | Strides St. mi. <sup>-1</sup> | Other     |
|-----------------|---------------|-------------------------------------|-----------------|-----------------------------------|-------------------------------|-----------|
| 4               | 654           |                                     |                 |                                   |                               | walk (W)  |
|                 | 659           | 656                                 | 131.2 2.19 5.96 | 2.72                              | 1937.                         |           |
|                 | 655           |                                     |                 |                                   |                               |           |
|                 | 681           | 136.2 2.27                          |                 | 2.63                              | 2011.                         | jog - (J) |
| 4 1/2           | 737           | 147.4 2.45 6.73                     |                 | 2.75                              | 1920.                         | W         |
|                 | 769           | 153.8 2.56                          |                 | 2.63                              | 2011.                         | J         |
| 5 W             | 746 - 736     | 147.2 2.45 7.50                     |                 | 3.06                              | 1727.                         | W         |
|                 | 790           |                                     |                 |                                   |                               | J         |
|                 | 726           |                                     |                 |                                   |                               | W         |
|                 | 802           |                                     |                 |                                   |                               | J         |
|                 | 823           |                                     |                 |                                   |                               | J         |
|                 | 814 - 807.3   | 161.45 2.69                         |                 | 2.78                              | 1894.                         |           |

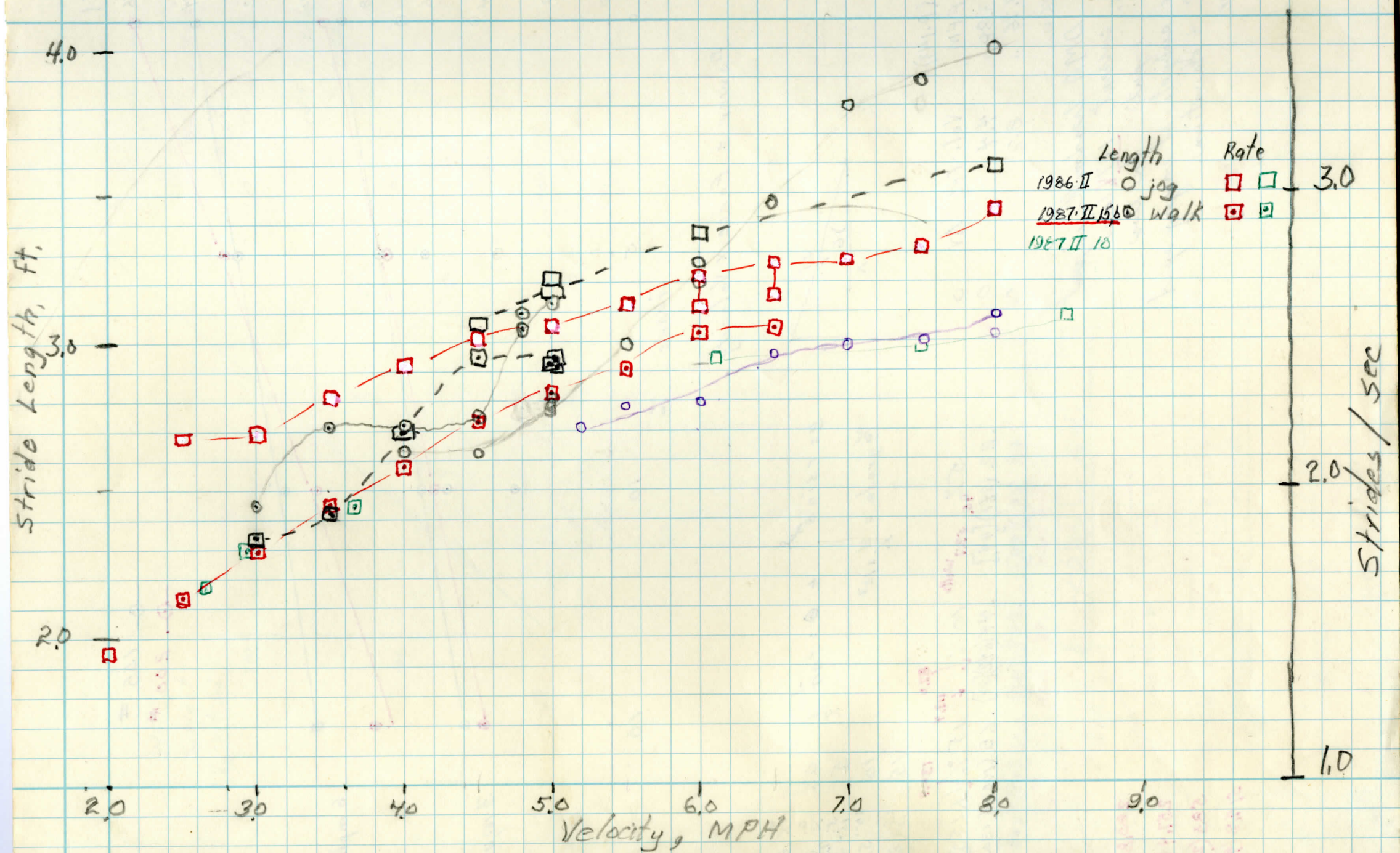


## Stride, Contd.

| Indic. Vel.<br>Mph     | Strides              |                   |                   | Act. Vel.<br>Fps | Str. lgth.<br>Str. Ft <sup>-1</sup> | Str. Rate<br>Str. mi <sup>-1</sup> | Other |       |      |       |               |
|------------------------|----------------------|-------------------|-------------------|------------------|-------------------------------------|------------------------------------|-------|-------|------|-------|---------------|
|                        | 5 min <sup>-1</sup>  | min <sup>-1</sup> | sec <sup>-1</sup> |                  |                                     |                                    |       |       |      |       |               |
| 5                      | 726*                 | 145.2             | 2.42              | 7.5              | 3.10                                | 1704                               | W     |       |      |       |               |
| ↓                      | 802                  | 813               | 162.6             | 2.71             | 2.77                                | 1908.                              | J     |       |      |       |               |
|                        | 823                  |                   |                   |                  |                                     |                                    | J     |       |      |       |               |
|                        | 814                  |                   |                   |                  |                                     |                                    | J     |       |      |       |               |
|                        | 741                  |                   |                   |                  |                                     |                                    | 148.2 | 2.47  | 3.04 | 1739. | 5 1/2 elev. W |
|                        | 796                  |                   |                   |                  |                                     |                                    | 159.2 | 2.65  | 2.83 | 1868  | ↓ J           |
| 6                      | 861                  | 857               | 171.4             | 2.86             | 9.14                                | 3.20                               | 1650. | J     |      |       |               |
|                        | 853                  |                   |                   |                  |                                     |                                    | J     |       |      |       |               |
| 8                      | 926                  |                   | 185.2             | 3.09             | 12.04                               | 3.89                               | 1355. | J     |      |       |               |
| 23 Feb 87<br>5         | 814                  |                   | 162.8             | 2.71             | 7.5                                 | 2.76                               | 1910  | J     |      |       |               |
| ↓ 5%                   | 831                  |                   | 166.2             | 2.77             | ↓                                   | 2.71                               | 1950  | ↓     |      |       |               |
| ↓ 7 1/2%               | 812                  |                   | 162.4             | 2.71             | ↓                                   | 2.77                               | 1905  |       |      |       |               |
| 5 1/2                  | 835                  |                   | 167.              | 2.78             | 8.32                                | 2.99                               | 1847  | ↓     |      |       |               |
| 6                      | 837                  |                   | 167.4             | 2.79             | 9.14                                | 3.27                               | 1611  |       |      |       |               |
| 6 1/2                  | 858                  |                   | 171.6             | 2.86             | 9.93                                | 3.47                               | 1521  |       |      |       |               |
| 7                      | 868                  |                   | 173.6             | 2.89             | 10.71                               | 3.70                               | 1426  |       |      |       |               |
| 7 1/2                  | 900                  |                   | 180.              | 3.00             | 11.38                               | 3.79                               | 1392  |       |      |       |               |
| 24 Feb 87              |                      |                   |                   |                  |                                     |                                    |       |       |      |       |               |
| 3 W                    | 273x2=546            |                   | 109.              | 1.82             | 4.47 calc.                          | 2.46                               | 2150. |       |      |       |               |
| ↓ J                    | — not practical      |                   |                   |                  |                                     |                                    |       |       |      |       |               |
| 3 1/2 W                | 288x2=576            |                   | 115.2             | 1.92             | 5.22 calc.                          | 2.72                               | 1942. |       |      |       |               |
| 7 1/2?                 | 820                  | max. cts.         |                   |                  |                                     |                                    |       |       |      |       |               |
| 8 1/2                  | T/M won't hold speed |                   |                   |                  |                                     |                                    |       | 12.79 |      |       |               |
| 5 J                    | 399.2 798            |                   | 159.6             | 2.66             | 7.5                                 | 2.82                               | 1873. |       |      |       |               |
| 5 W                    | 360.2 720            |                   | 144.              | 2.40             | ↓                                   | 3.13                               | 1687. |       |      |       |               |
| 5.5% J                 | 396.2 792            |                   | 158.4             | 2.64             | ↓                                   | 2.84                               | 1859. |       |      |       |               |
| ↓ 7 1/2%               | 400.2 800            |                   | 160.0             | 2.67             | ↓                                   | 2.81                               | 1877. |       |      |       |               |
| ↓ 10%                  | 406.2 812            |                   | 162.4             | 2.71             | ↓                                   | 2.77                               | 1906  |       |      |       |               |
| 25 <sup>th</sup> 8 mph | 2.449 898            | man at            |                   |                  |                                     |                                    |       |       |      |       |               |
| 4 1/2 W                | 691.2                |                   |                   |                  |                                     |                                    |       |       |      |       |               |
| 4 J                    | 798                  |                   |                   |                  |                                     |                                    |       |       |      |       |               |
| 4 1/2 W-5%             | 726, 707,            |                   |                   |                  |                                     |                                    |       |       |      |       |               |
| ↓ ↓ 7 1/2%             | 713,                 |                   |                   |                  |                                     |                                    |       |       |      |       |               |

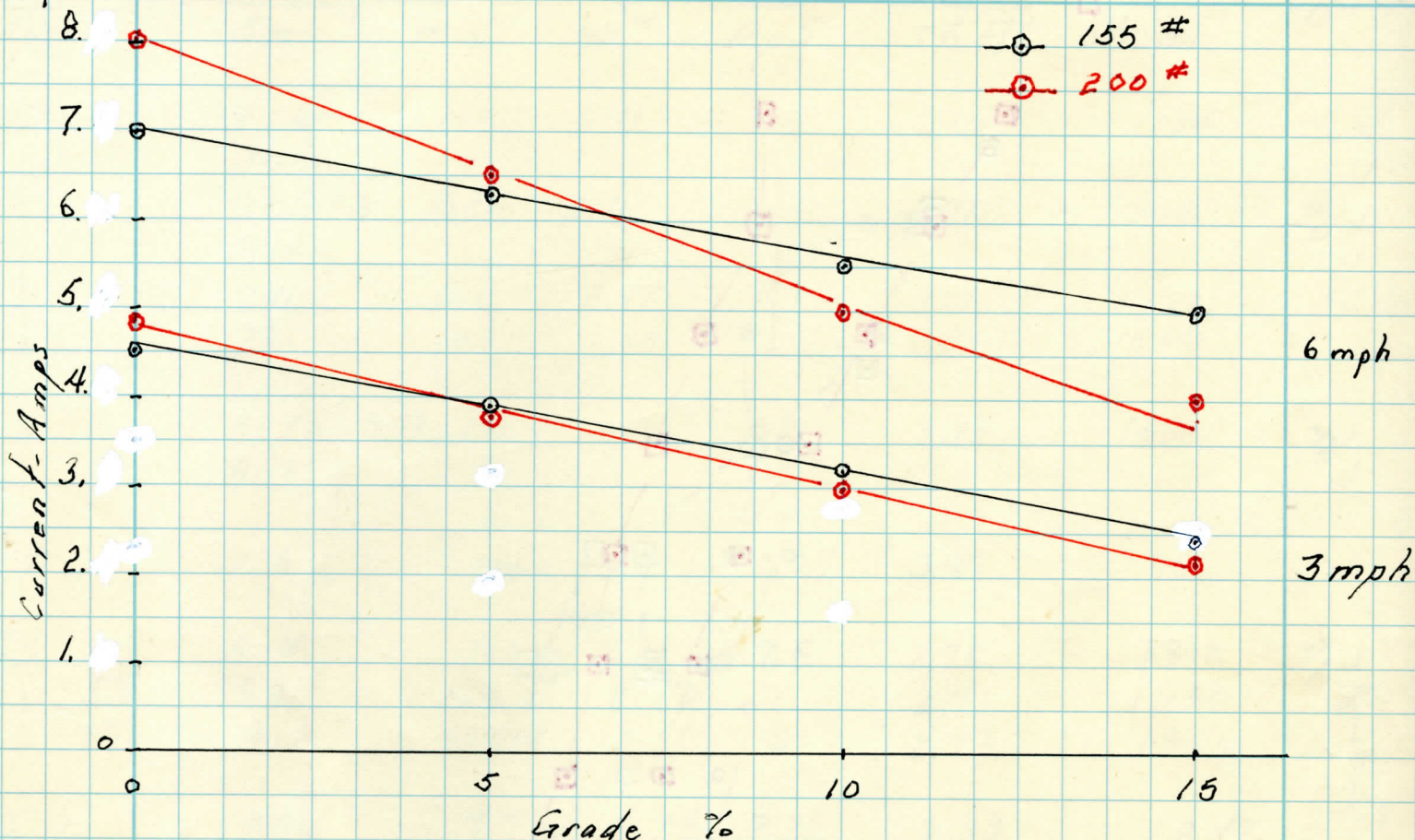


## Treadmill - Level

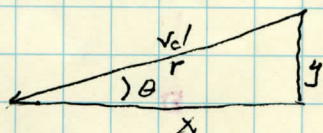




8 April.



Power = Force x Velocity.



$y = r \sin \theta$  &  $\theta = \tan^{-1} \frac{y}{x}$

% grade =  $\frac{y}{x} \times 100$

| Grade % | sin θ |
|---------|-------|
| 0%      | 0     |
| 5       | .087  |
| 10      | .174  |
| 15      | .259  |

1 mph = 1466 FPS (P.143)

= 87.96 FPM

Vel. FPS ΔV 0

3 mph = 263.88 "

4.4 0

6 " = 527.76 "

8.8 ~

550 FPS = 746 W.

| Grade % | 155 #             | 200 #              |
|---------|-------------------|--------------------|
| 5%      | .22 (34.1) [44]   | .44 (68.2) [88]    |
| 10%     | .44 (68.2) [88]   | .88 (136.4) [176]  |
| 15%     | .66 (102.3) [130] | 1.30 (203.5) [260] |

DMA treadmill in/out current 1.17% limit input for two subjects at varying speed & elevation.

G. Clin Res.

was Apr 14 1960

1st Floor

Method E. Conf.

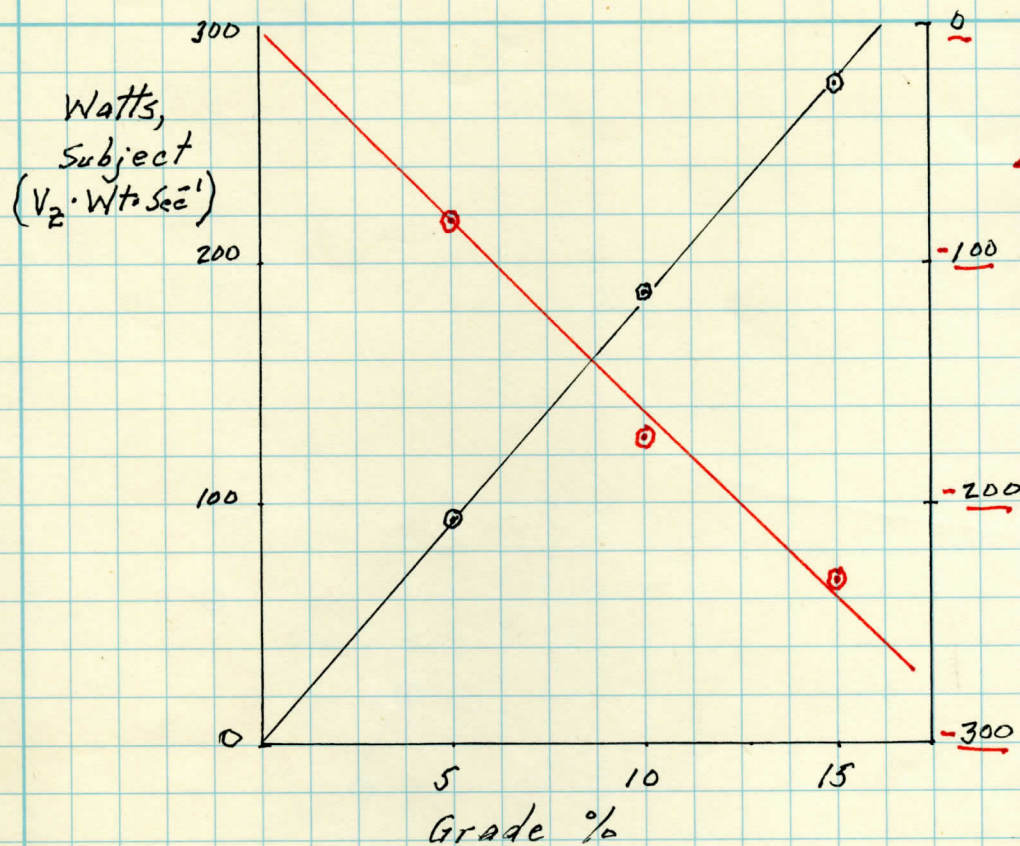
|       | 0%  | 5%  | 10% | 15% |
|-------|-----|-----|-----|-----|
| 3 MPH | 4.5 | 3.9 | 3.2 | 2.4 |
|       | 4.8 | 3.8 | 3.0 | 2.2 |
| 6 MPH | 7.0 | 6.3 | 5.5 | 5.0 |
|       | 8.0 | 6.5 | 5.0 | 4.4 |

220.8 (243.7)  
257.4 (304.2)  
585 (234.)  
514.8 (426.2)

Subject A - 155 lbs  
Subject B - 200 lbs

(in amps)





$\Delta$  Watts, Treadmill Power  
( $E_{ie} \times I_{in}$ )

Zero Level = 819 watts

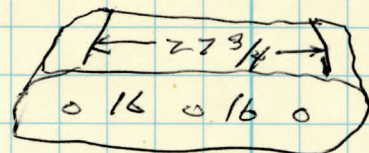
155 lb. subj. at  
6 mph.



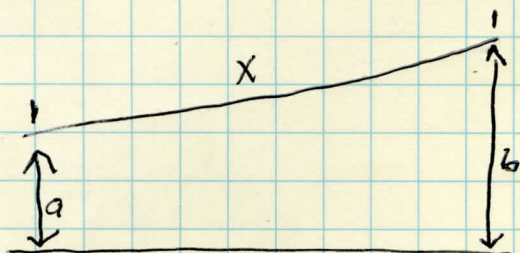
5 Mar 87 Basic line TM gait study  
 DAC - 1069 400 ASA  
 Lens - 5 mm (160°) F-2 24 1160 ht - 39

1 - Grid -

2 - Level 2 - Step 1 1.00 - 18.15  
 3 R ↓ 4 ↓ 13.29  
 4 ↓ 7 ↓



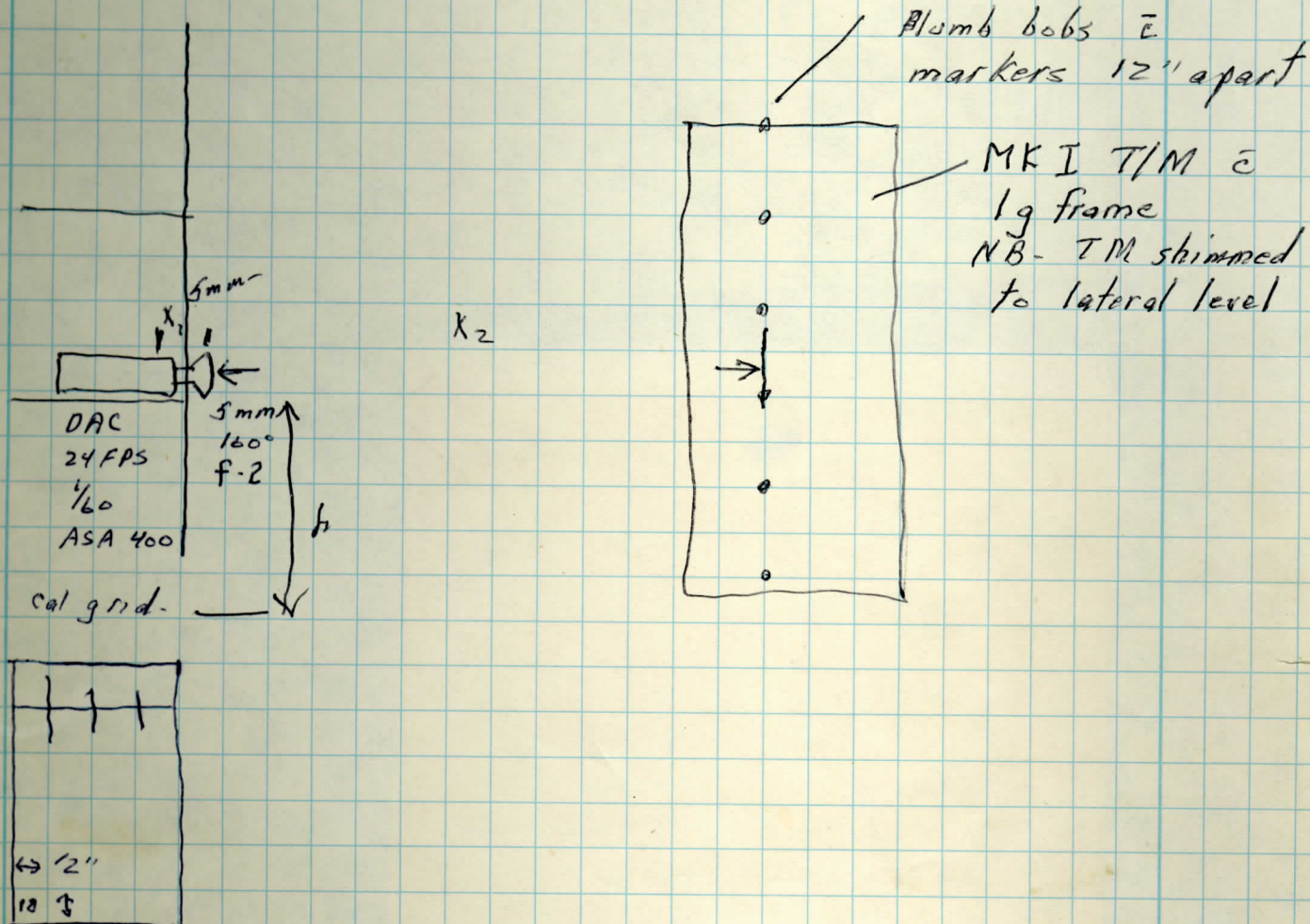
FD = 51 1/4



|     | X        | a       | b      | b-a  | %        |
|-----|----------|---------|--------|------|----------|
| II  | 39 15/16 | 11 5/8  | 16 3/4 |      |          |
| II  | ↓ .9375  | ↓ .585  | ↓ .625 | .75  | 5/3 12.8 |
| III | ↓        | 11 1/2  | 18     | 6.5  | 16.3     |
| III | ↓        | ↓       | ↓      | 6.5  |          |
| I   | ↓        | 11 1/16 | 15 3/4 | 4.06 | 10.2     |
| I   | ↓        | 11 1/16 | ↓ .69  | .75  |          |



25 Feb, Baseline photography for T.M. goat study  
Used CCT-



Film #1 Midpeak amb. light - + A.C. shuttle lt.

- 1- Cal. Grid -
- 2 Clock
- 3- W.T. on TM - Grid II Spd. I 1 min
- 4- ↓ " 4

2 Mar -  $X_1 + X_2 = 48 \frac{3}{4}$  5mm -  $h = 39"$

1- ~20 sec Spd. Grid & watch

2- ~60 " 1

3 60 " 4

4 60 " 7

stop, added lt. ~30 secs in

Film QX 851  
ASA 400

24FPS f.2 - Grid III

$\frac{9.92, 10.17, 10.023}{10.04} / 10 \text{ revs.}$

1

2 60 sec.

3 ↓

4

$15.96, 56, 59 = 15.70$

$11.63, 59, 52, 67 = 11.60$

$9.89, 88, 85, 74 = 9.84$

1

4

7