Summation -

There are two aspects of significance from this study - the technical & operational and the biomedical results. I'm treating the latter first: NB there ~~Can~~ were a number of firsts in this area including - ~~The first~~ continued ~~documentation~~ extended study of ~~height~~ & leg volumes ~~who~~ including the critical first day - ~~The first~~ measurements of leg volume during orthostatic stress, documentation of gastrointestinal activity during onset and recovery from SMS and the first demonstration of inflight ~~EGG~~ recording of the electrogastrogram.

Cardiovascular studies: The significance of this data can probably be best shown by ~~fitting it into~~ comparing it to our present hypothesis of the system ~~who~~ and seeing if it fits, fills or alters the hypothesis.

The major mechanisms of adaptation of this system are fluid shifts and losses, loss of metabolic loads on the heart and in all probability neurogenic effects.

We know that large volumes (.2-4L) of blood & tissue fluid were shifted from

Stet

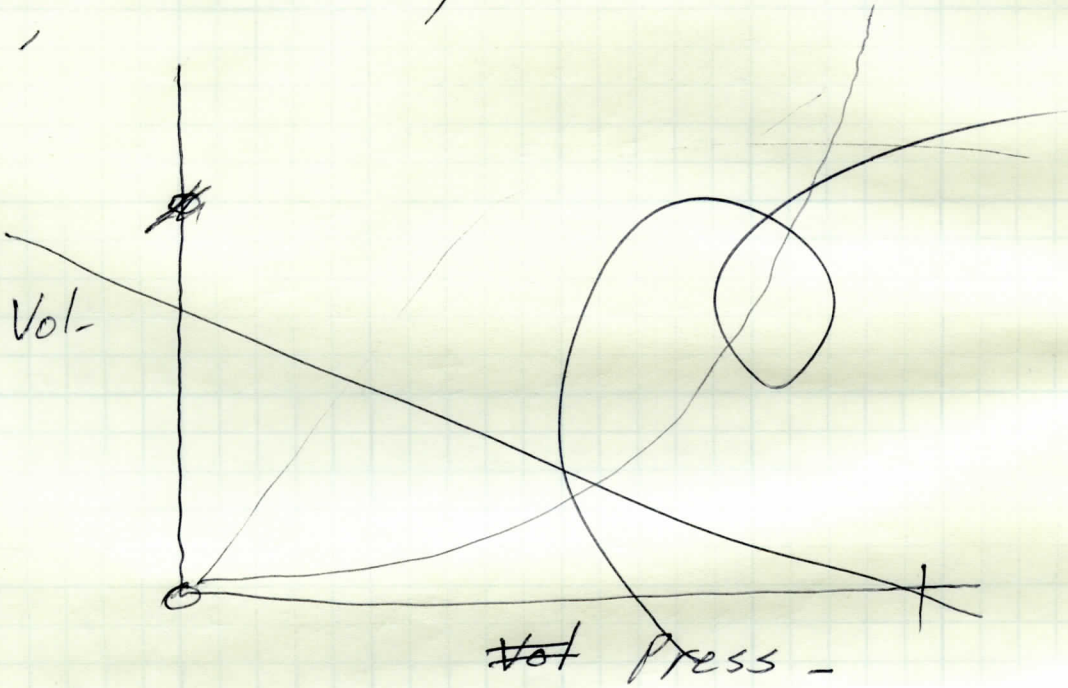
if any

the legs in weightlessness in the first few days of flight. Also during this time 3-4% of body mass is lost and is presumed to be body water. Changes caused by loss of ~~,~~ large metabolic loads will not be discussed. There is also some data showing the calf area of the leg will accept more blood under ~~orthostatic~~ a given level of negative pressure ~~.~~ after this loss of fluid.

On return to earth then the body ~~is~~ has less than adequate fluid to refill the legs and ~~possibly~~ presumably increased capacity (increased compliance) in the legs. Addition of ~~or~~ moderate amounts of salty water just prior to ~~re~~entry is only partially effective ~~in~~ preventing the increased heart rate and reduced blood pressure during ~~orthost~~ quiet standing ~~. The fact~~ an indication that insufficient blood is being returned to the heart. There have been several cases of syncope or near syncope on first leaving the seat.

Data obtained on this flight speaks to several of these issues including: demonstration of the time course ~~of~~ in going from 1 g to weightlessness ~~ss~~ and vv. ~~The~~ Loss of leg volume appears to be exponential ~ a loss of 50% in

approx. 2 hours. This is in contrast to post flight where the legs ~~have completed~~ volume has equilibrated in 1½ hours and in all likelihood much more quickly. This would imply a nonlinear compliance curve for the legs



~~with~~ in which the force of gravity is adequate to rapidly ~~empty~~ fill the legs ~~but~~ which ~~fill~~ empty more slowly ⅙ gravity. The practical effects of this are -1, there will be a very rapid flux of fluid from upper to lower body on return to 1 g. 2. If fluid could be ~~not~~ added to the legs shortly before reentry a sizable ~~ca~~ portion would be retained. At first glance this rapid shift of fluid would seem to offer a ready explanation for the syncopal presyncopal episodes on seat egress ~~Unfortunately~~ Blood i.e.

Σ

& heart rate were also

Blood pressure, were recorded during this period and ~~do not correspond to~~ are not consistent c ~~classical expected results from~~ data usually seen in orthostatic hypotension. There is certainly no evidence of hypotension during reentry, rather there is a moderate increase in all pressures which peaks at touchdown c a small increase in heart rate. On seat egress and presumably ~~upon~~ standing, a significantly ~~more~~ large G load than ~~as~~ being seated, there is a downward trend in BP but never below normal values. H.R. is not elevated for the circumstance & and I suspect is inappropriately low for it is likely that fluid shifts continued during this period. Two days later, after time for

80 / 43 84 / 43|37.0 / 344 / 160

70 / 48 4 / 48|22.0

48|10.0 20 / 96 / 40

380 420

more complete equilibrium, his average H.R. was as great as the peak under what should have been ~~the~~ 9 more stressful situation following reentry. This ~~seeming con~~ incongruity is further supported by the leg volumes and B.P.-H.R. during the stand test for here a smaller leg volume change 420 vs 580 ml. produced a larger heart rate. ~~48 vs 58~~ 20% vs 84% overall

There are two possible ~~explanations~~ phenomena at work. Cardiac output is low and ~~or sclerosis~~ peripheral resistance is high or the heart rate response is blunted ~~and~~ on landing. Both may be active. In several of the near syncopal cases, blood pressure and heart rate are reported to have been normal.

What could be hypothesized then is that blood doesn't pool in the legs, either because the previous hypothesis of increased compliance is wrong or cardiac output is down. The latter is suggested by the slow filling curve on the stand test. While there is a significant heart rate increase it -

TBD