



W. Thornton, M.D., 1998  
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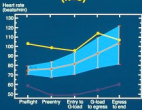
## Ambulatory Blood Pressure and Heart Rate During Early Shuttle Flight and Landing

# Goals of Ambulatory Blood Pressure/Heart Rate Study

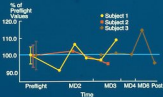
## Document:

- Practicality of Recording ABP/HR in Space Flight
  - Effects of Weightlessness
  - Effects of G-loads during Entry/Landing
  - Postflight vs Preflight Values
  - Hypotension or Heart Rate Changes Associated with Orthostatic Symptoms
- \*Compare values from crew with and without protective garments

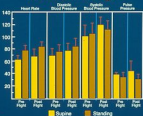
## Mean Heart Rate (n=8)



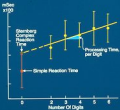
# Simple Reaction Times During Flight



# Mean Blood Pressure/Heart Rates, Pre and Post Flight



## Derived Quantities

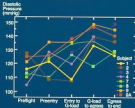


## Subject Characteristics, A BP/HR Study

Study	Age (years)	Ht. (cm)	$\dot{V}O_{2\max}$	Weight (kg)
1	49.4	175.0	39.5	76.0
2	40.7	174.0	38.9	71.0
3	52.5	180.0	55.7	79.0
*4	38.6	170.0	42.3	81.0
*7	56.0	184.0	45.2	92.0
8	53.0	172.0	37.1	70.0
9	36.0	171.0	43.6	67.0
9A	36.4	171.0	43.1	67.0
Means	45.4	174.6	43.2	75.4

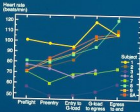
\*=Astronaut, 9A=second flight of subject 9

# Individual Mean Diastolic Arterial Pressure





# Individual Mean Heart Rate



(W. Thomson 1993)



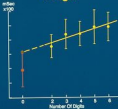
# A Complex Reaction Time Study (Sternberg) in Space Flight

W. Thornton, M.D., 1999  
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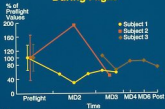
## Goals of a Shuttle Sternberg Study

- Compare reaction times:
  - On Earth and in Space Flight
  - During and after Space Motion Sickness
  - In Crew affected and not affected by Space Motion Sickness
- Demonstrate the practicality and utility of such measurements in Space Flight

## Example of Sternberg Reaction Times - Inflight



## Processing Time/Digit in Sternberg Test During Flight

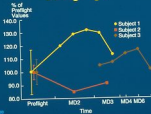


## Sternberg Studies Obtained

<u>Subject</u>	<u>Pre_Flt</u>	<u>In_Flt</u>	<u>Post_Flt</u>
	<u>Training</u>	<u>Test</u>	<u>FD 2 3 4 5 6</u>
1	20+	3	4 4 -
2	10+	4	1 1 -
3	12	26	6 6 4 3(R+2)

FD-Flight Day. Another subject did 3 demonstration  
inflight tests not included.

## Complex Reaction Time (Sternberg) During Flight



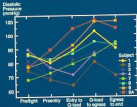
## Factors with Potential Relevance to APB Study

Study	SAS Grade	Fluid Load	Symp O/S	G-Suit Level	Flight Days
1	2	+	+	-	8
2	1	+	-	3	8
3	3+	+	+	3	7
*4	0	+	-	-	9
*7	2	+	-	-	7
8	0	+	-	-	7
9	2	+	-	7	6
9A	2	+	-	3	7

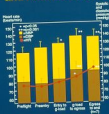
\*=Astronaut, 9A=second flight of subject 9, G-Suit level 3 = 1.5 PSI pressure, SAS grade range from 0 = none to 4 = incapacitated



# Individual Mean Systolic Arterial Pressure



# Group Mean Heart Rate and Arterial Pressure



# Time Divisions/Activities



## Summary of Results: ABP/HR Studies

- No Significant differences in A HR/ABP during equivalent activities pre and inflight
- Response to G-loads was a significant increase in HR, DBP and SBP
- HR, DBP and SBP were significantly increased post flight vs. preflight
- Hypotension was not seen in two subject with signs and Sx of orthostasis
- HR and SBP were elevated in crew wearing protective clothing

# Comparisons

## Early vs. Late Shuttle