



# Spacercise: Keeping Fit, Impact Free

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# Exercising in Space



- Importance of exercise in space
- Problems with exercise and exercise equipment in space
- Past exercise programs
- Current exercise procedures
- Future of exercise and exercise equipment in space

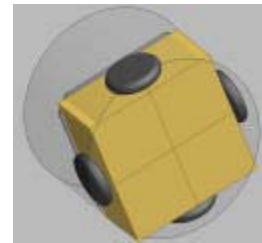
# Importance of Exercise in Space



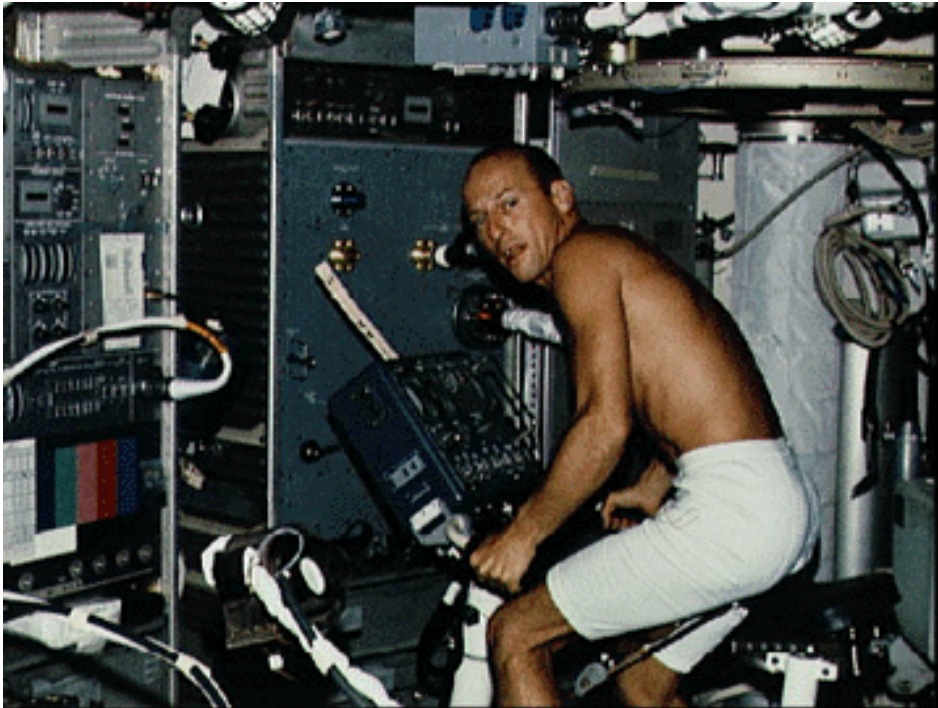
- Living in space has similar effects as being on bed rest
- Bones and muscles atrophy when not being used
- Long duration missions of most concern

# Spacercise Concerning Factors

- Vibrations
- Power consumption
- Volume constraints
- Time consuming
- Human Factors<sup>1</sup>



# Past Exercise Programs



- Cycle Ergometer<sup>2</sup>
- Used in Skylab/Salyut
- Used to study cardiovascular deconditioning
- Had little effect on the body
- LBNP suites

# Current Exercise Procedures



- waist belt
- two shoulder straps
- four extender hooks
- physiological monitor
- Used in Shuttle & ISS<sup>3</sup>
- Isolated/Stabilized Exercise Platform<sup>4</sup>



# Current Exercise Procedures

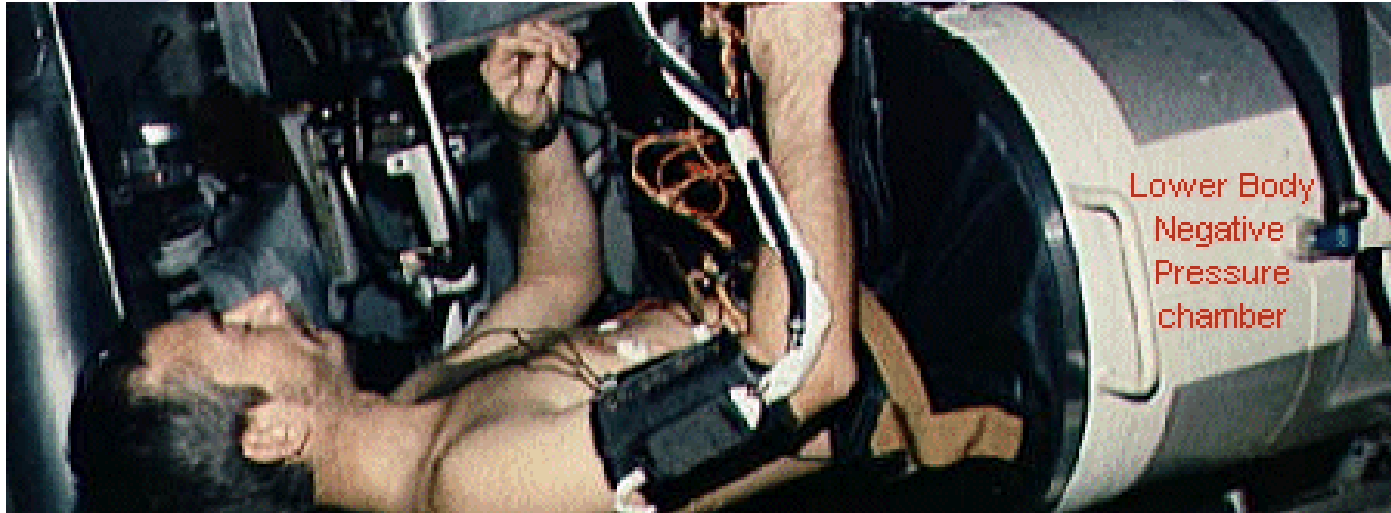
- "The goal is to create an exercise device that crew members can use any time of the day or night without imparting destructive vibrations on sensitive experiments," – Navias<sup>5</sup>
- Exercise Bike
  - Strategically positioned
- Resistive Bands (IRED )<sup>5</sup>
  - Used for squats, leg curls, calf raises, knee lifts and other calisthenics

# Future of Exercise in Space

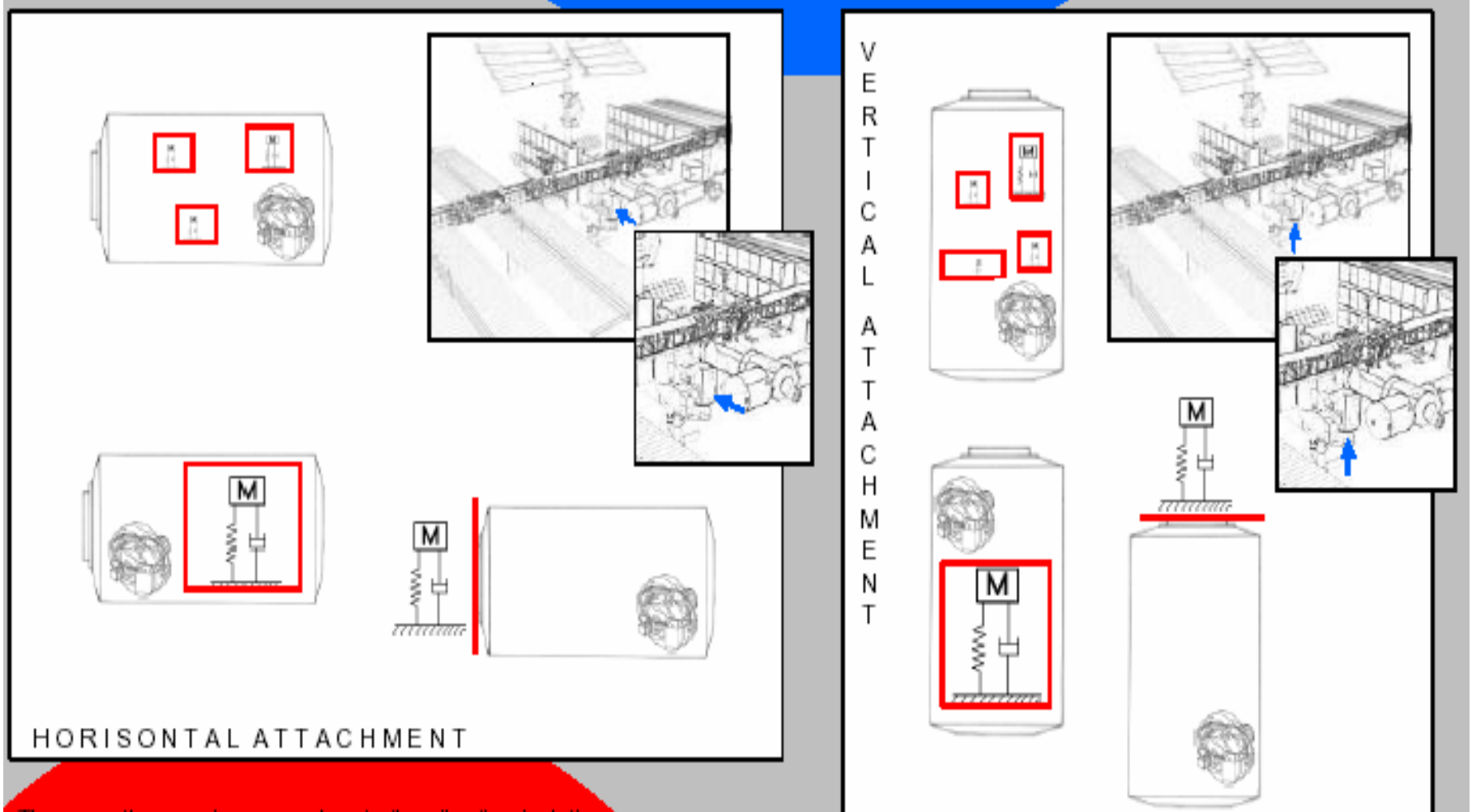
- Artificial Gravity<sup>7</sup>
  - Human powered centrifuge
- Improved LBNP
- Separate Exercise Module<sup>8</sup>



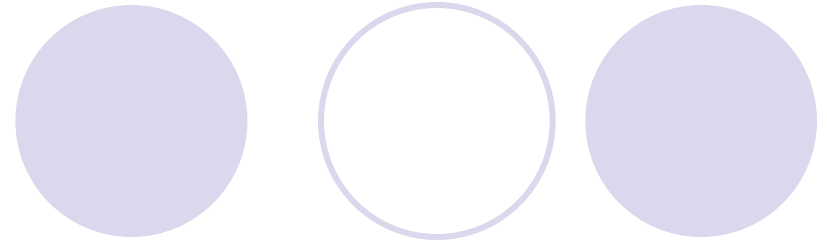
# LNBP Improvements



# Separate Module on ISS

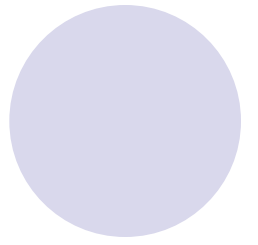
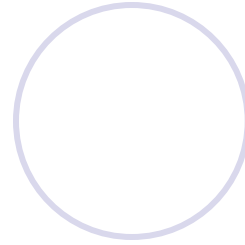
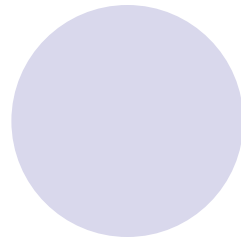
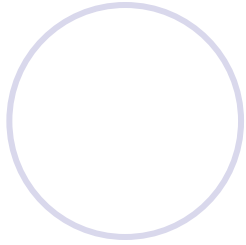
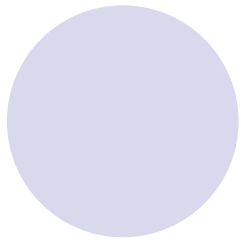


# Take Home Lesson



- Exercise is necessary during long duration space travel
- Exercise equipment must be:
  - Compact
  - Use little to no power
  - Vibrations must be muted
  - Effective and enjoyable to use





Questions?

# References

- 1) [http://www.ark3.lth.se/projects/stars01/phase3/proj\\_grav\\_force.pdf](http://www.ark3.lth.se/projects/stars01/phase3/proj_grav_force.pdf)
- 2) [http://starchild.gsfc.nasa.gov/docs/StarChild/space\\_level2/conrad\\_bicycle.html](http://starchild.gsfc.nasa.gov/docs/StarChild/space_level2/conrad_bicycle.html)
- 3) [http://science.ksc.nasa.gov/shuttle/technology/stsnewsref/sts\\_egress.html#sts\\_exercise](http://science.ksc.nasa.gov/shuttle/technology/stsnewsref/sts_egress.html#sts_exercise)
- 4) <http://lmms.external.lmco.com/newsbureau/pressreleases/1992/9207.html>
- 5) [http://216.239.41.104/search?q=cache:rag4ltEK-fgJ:www.space.com/missionlaunches/missions/sts106\\_treadmill\\_000916.html+exercise+equipment+international+space+station&hl=en&ie=UTF-8](http://216.239.41.104/search?q=cache:rag4ltEK-fgJ:www.space.com/missionlaunches/missions/sts106_treadmill_000916.html+exercise+equipment+international+space+station&hl=en&ie=UTF-8)
- 6) [http://science.nasa.gov/headlines/y2001/ast02aug\\_1.htm](http://science.nasa.gov/headlines/y2001/ast02aug_1.htm)
- 7) <http://216.239.57.104/search?q=cache:CSB4IzD2zN4J:astrobiology.arc.nasa.gov/news/expandnews.cfm%3Fid%3D9339+exercise+equipment+future+space+travel&hl=en&ie=UTF-8>
- 8) [http://www.ark3.lth.se/projects/stars01/phase3/proj\\_grav\\_force.pdf](http://www.ark3.lth.se/projects/stars01/phase3/proj_grav_force.pdf)