



U.S. ARMY

# Biodynamics Data Resource

Injury Biomechanics and Protection Group  
U.S. Army Aeromedical Research Laboratory



## Background

- 1971 - Navy established the Naval BioDynamics Laboratory (NBDL) to investigate the effects of indirect impact forces on the head and neck and their potential for producing injury.
- Results among first to establish human tolerance limits and are widely considered ground-breaking in the field of injury biomechanics.
- 1996 - NBDL closed by the Base Realignment and Closure (BRAC) committee and management transferred to the University of New Orleans (UNO). National Biodynamics Laboratory (NBDL-UNO) continued research and planned to create a database to archive the earlier NBDL work.
- 2005 - The NAVAIR Human Systems Department began overseeing the data preservation.
- 2007 - USAARL and NAVAIR established the Biodynamics Data Resource (BDR) and transferred materials and equipment to USAARL.

## NBDL Research Areas

- Development of methodology for collecting kinematic and physiology data
- Human response to horizontal and vertical impact simulating crash and ejection forces
- Development of methodology for anthropometric evaluation by x-ray
- Development and evaluation of Hybrid II and III necks
- Head supported mass effects in impact environment



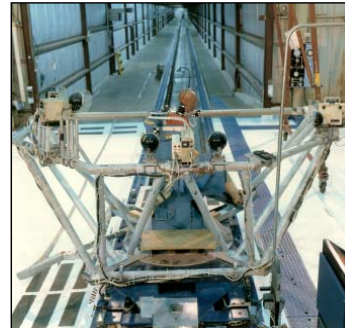
## Horizontal Accelerator

### Specifications

- Maximum acceleration: 140g
- Maximum payload: 5,000 lb
- Maximum velocity: 150 ft/s
- Power stroke: 9.8 ft
- Pulse shape: Sinusoidal, modified square, or trapezoidal
- Track length: 700 ft

### Data Collected

- Tests of side (+Gy), frontal (-Gx), supine (+Gz), and oblique (-Gx, +Gy) impacts
- Peak accelerations: 2 - 16 G
- 164 human research volunteers
- 3,040 human impact tests
- 1,500+ anthropomorphic test device (ATD) tests



## Vertical Accelerator

### Specifications

- Maximum acceleration: 75g
- Maximum payload: 1,500 lb
- Maximum velocity: 62 ft/s
- Power stroke: 3.5 ft
- Pulse shape: Sinusoidal, triangular, or trapezoidal
- Tower height: 42 ft

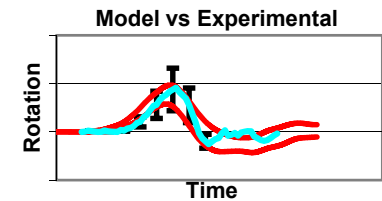
### Data Collected

- Tests vertical forces (+Gz)
- Peak accelerations: 2 - 12 G
- 53 human research volunteers
- 390 human impact tests
- 300+ ATD tests



## Value of the Data and Research Possibilities

- NBDL data is one of very few sources for volunteer response to impact; current human research standards render experiments unrepeatable.
- This volunteer data is necessary to understand impact response and to validate and improve manikins and computational models.
- Military applications include:
  - Blast environments
  - Crash loading and ejection forces
  - Effects of head supported mass (e.g., night vision goggles)



## Goals and Future Work

- Much of the NBDL data was never published, especially later results that are applicable to blast or ejection.
- Data is unusable in its current state
- BDR is reopening this valuable data source by digitizing and safeguarding the materials; and building a relational database which provides data and context (e.g., protocols, memos)

<http://www.usaarl.army.mil/>

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