

### PROJECT GOALS

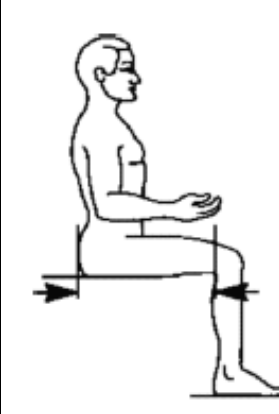
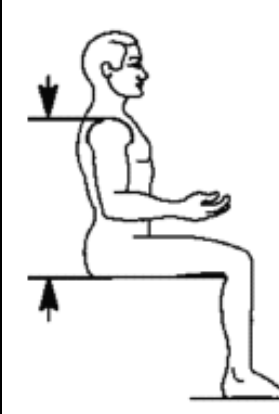
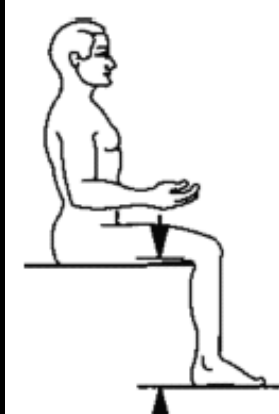
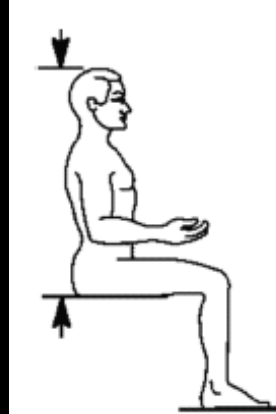

The goal of this project was to produce a test device and methodology capable of measuring the mechanical efficiency of manual wheelchairs. The result would provide an objective measure of wheelchair performance that are required to effectively prescribe wheelchairs and to code wheelchairs properly for reimbursement.

### DESIGN CRITERIA

- 1) Adjust to different wheelchair configurations (e.g. camber, axle location, pushrim size, wheel dia.,...)
- 2) Replicate loading as seen by the wheelchair
- 3) Perform prescribed maneuvers autonomously
- 4) Manifest human inertial characteristics
- 5) Measure work input and energy output over time

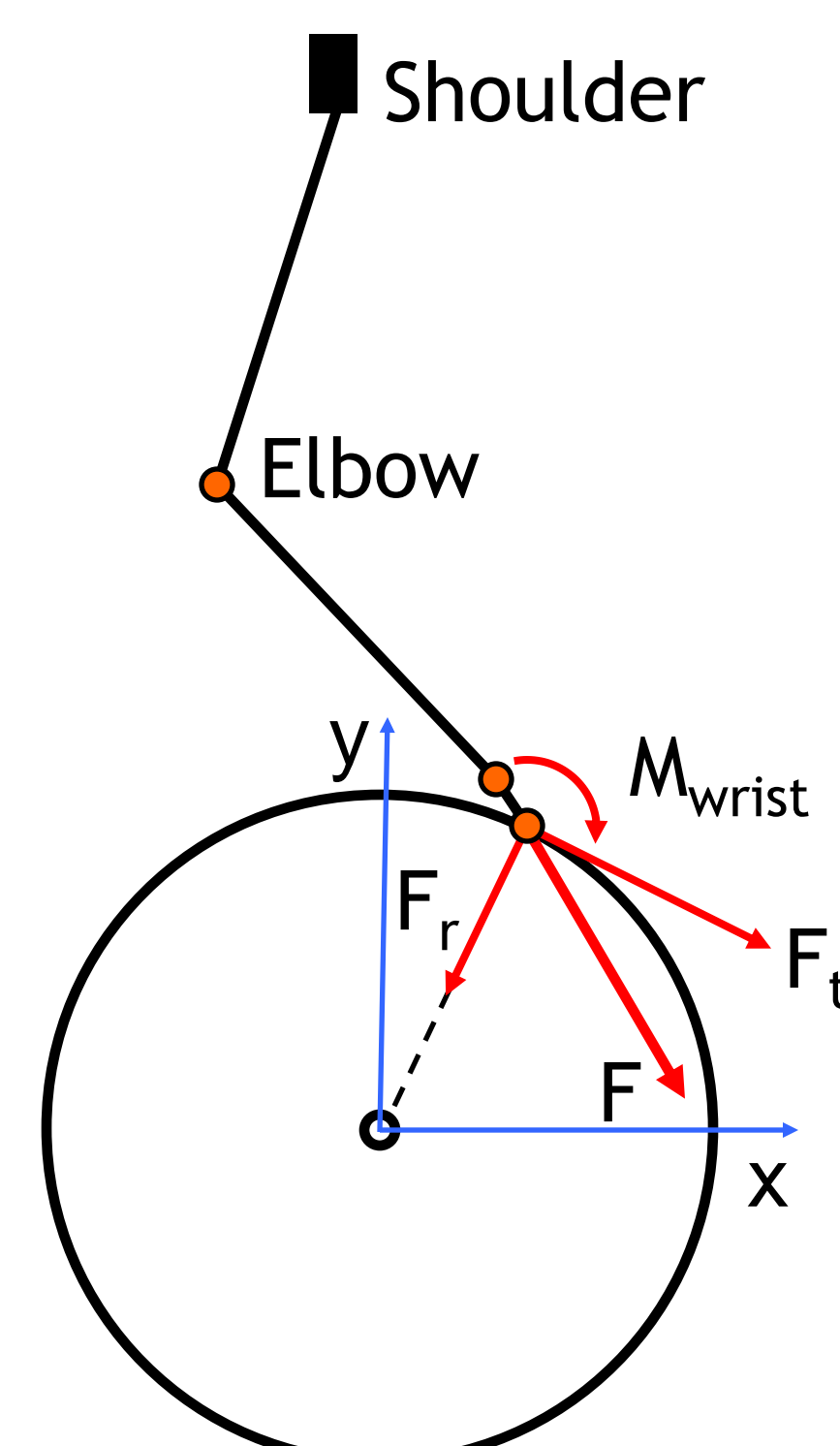
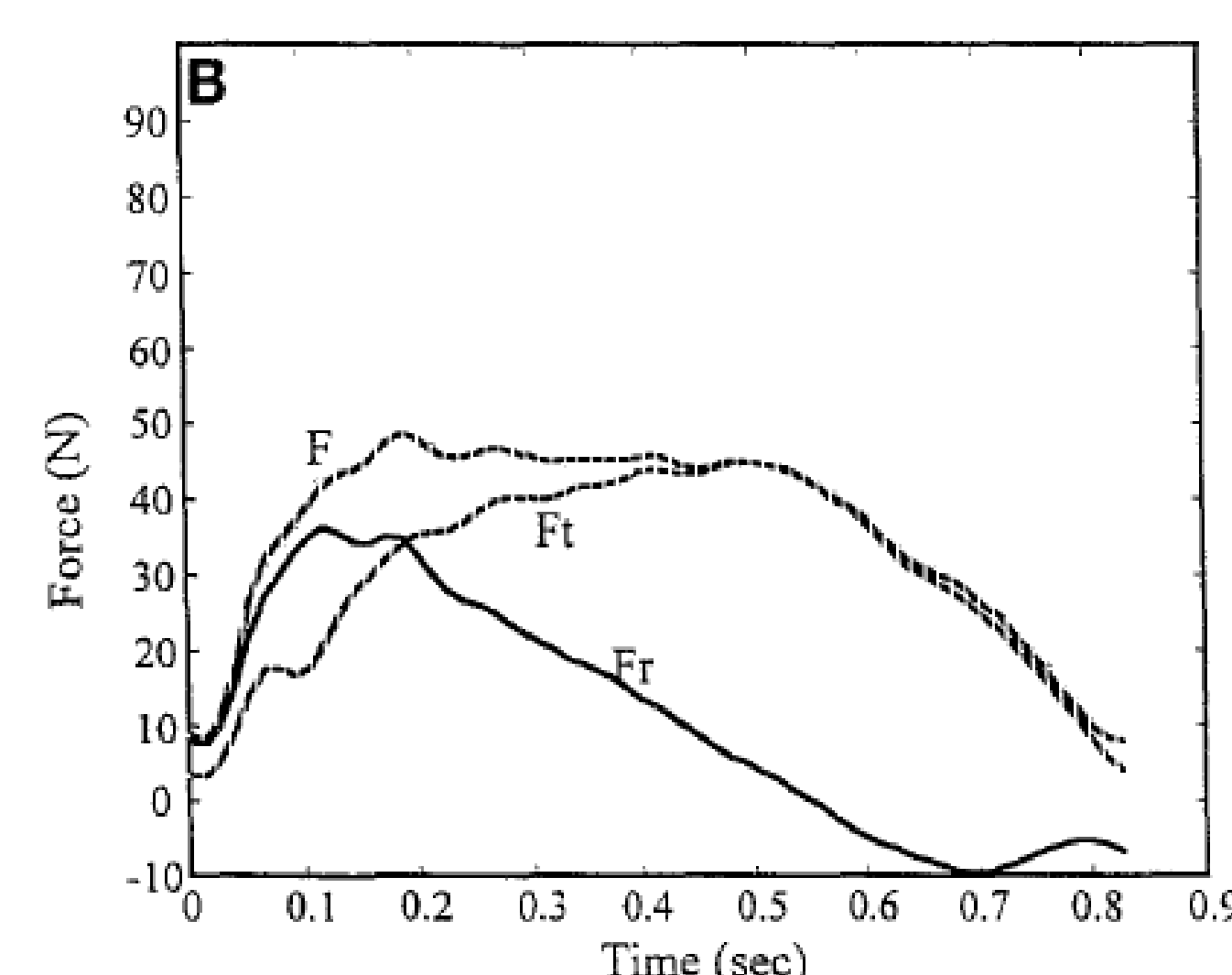
### AMPS CHARACTERISTICS

Key measurements for anthropometric similarity:

Buttock to Popliteal Length	Midshoulder Height	Popliteal Height	Sitting Height	Hip Breadth
				
19.5 in.	22.9 in.	17.3 in.	35.7 in.	16.3 in.

AMPS parameters are derived from ISO 7176-11 100kg dummy and Hybrid III 50% male ATD segment length.

### PUSHRIM FORCING



Robertson, R.N., et al., *Pushrim forces and joint kinetics during wheelchair propulsion*. Archives of Physical Medicine and Rehabilitation, 1996. 77(9): p. 856-864.

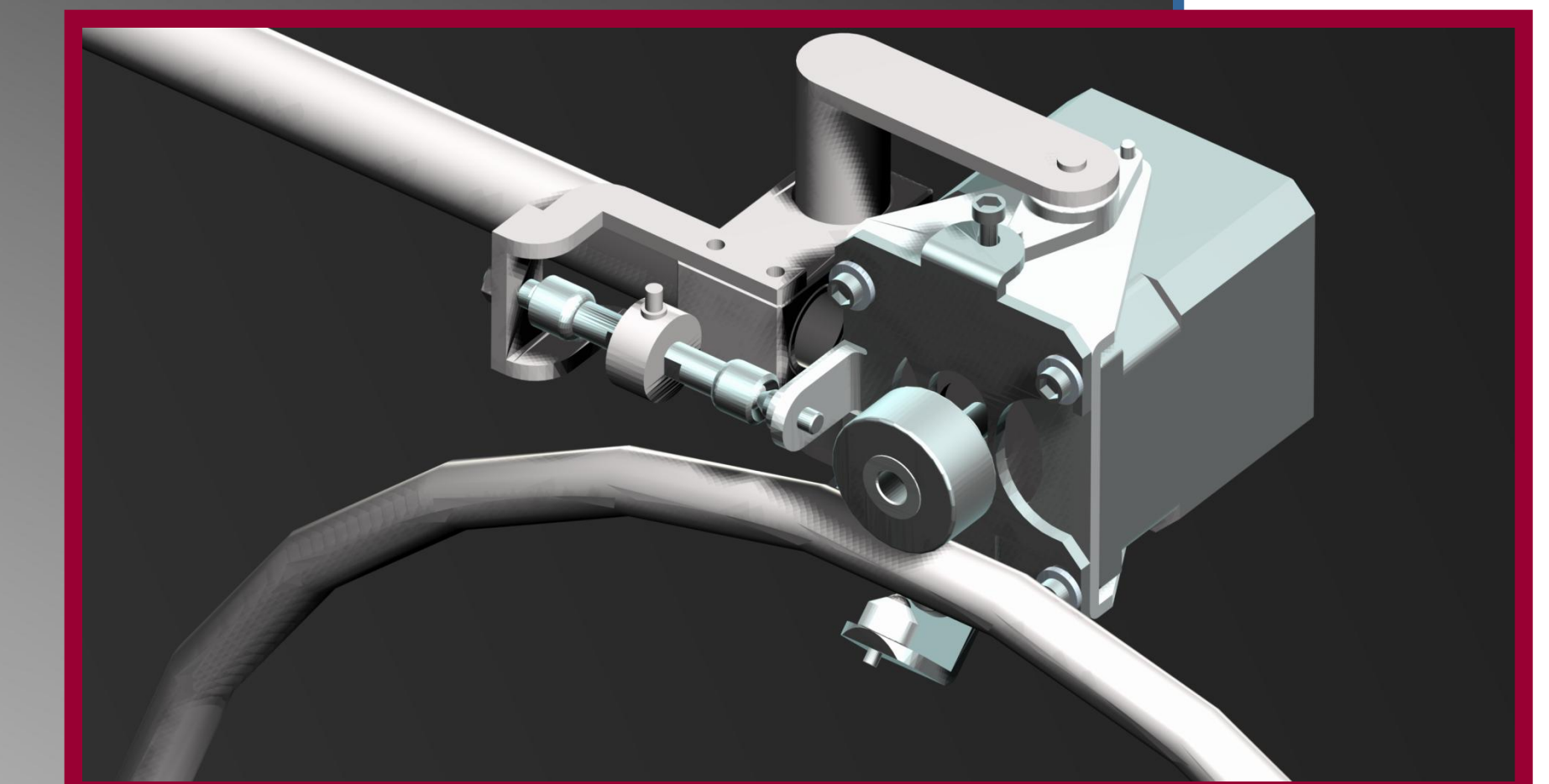
Self-contained power and control

Adjustable shoulder height

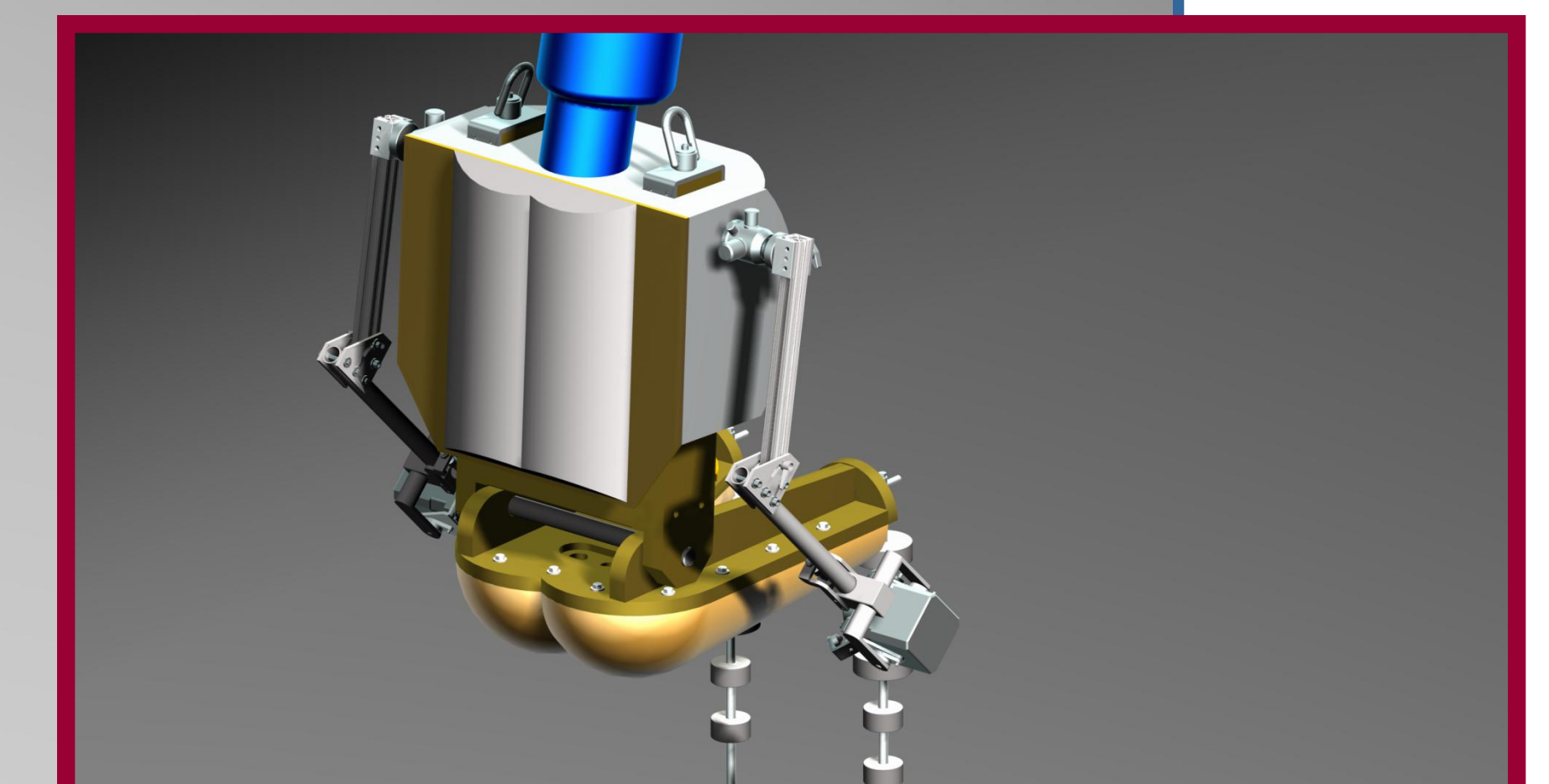
Independent wheel control

Femoral and tibial length adjustment

Strategically placed weights approximating body mass distribution



Direct measurement of tangential force



Back & buttock models for realistic load distribution



Dimensionally similar to 50% male ATD

### CANONICAL MANEUVERS

Work input and energy output measured over several fundamental maneuvers, e.g.

- Accelerate from stop to 1.2 m/s in 3 seconds then decelerate to a stop
- 180° T-turn
  - Reverse turn about left wheel for 90°
  - Stop
  - Forward turn about right wheel for 90°

### INERTIA MEASURING DEVICE required for energy calculations

- Determines yaw moment of inertia by monitoring small oscillations using an optical encoder
- Measures total weight and locates center of mass using built-in force transducers

