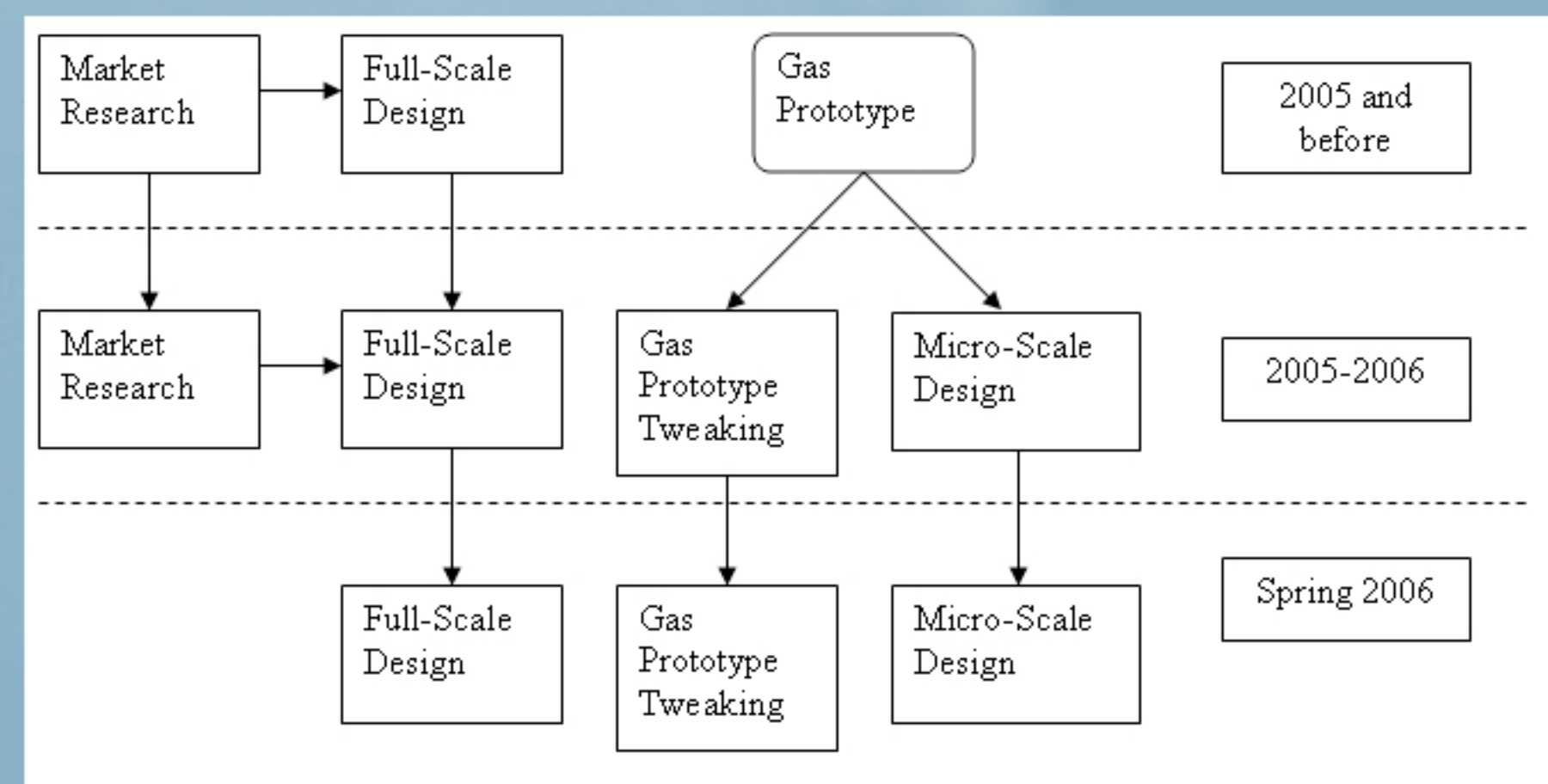


# IPRO 317: VTOL for the Masses

## Project History



### Full-Scale Design:

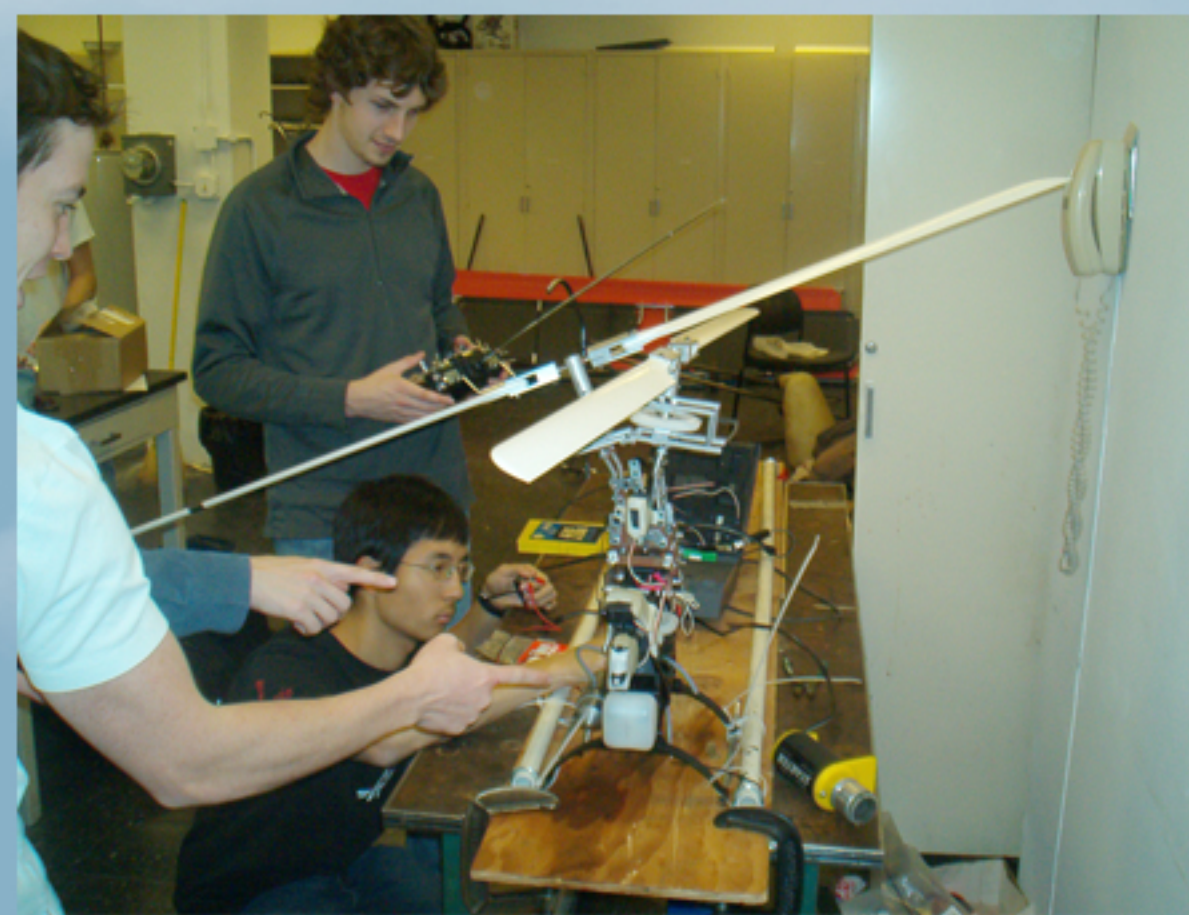
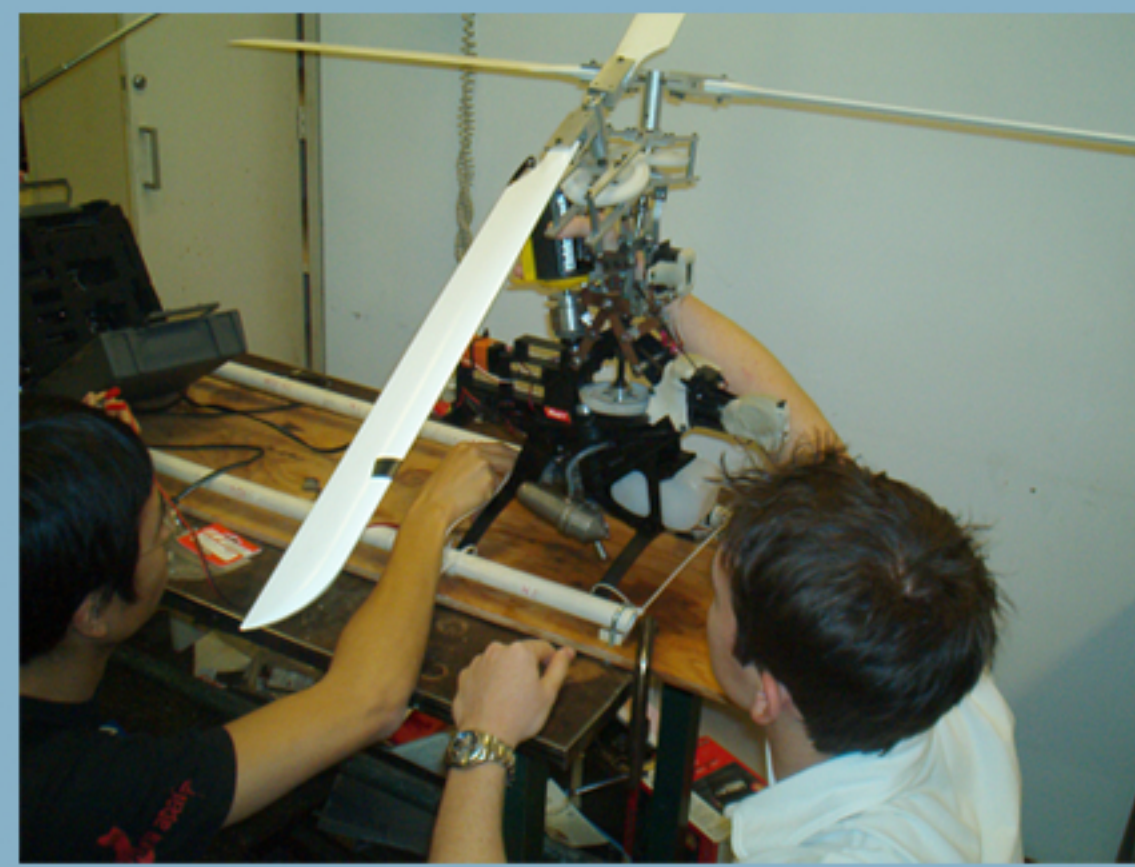
- Researched materials left by past semesters' teams
- Settled on a design close to previous X-Plane Model
- Prototype is stripped down version of model, designed with real components and materials
- Future: analysis of physical stresses and structure, eventually leading to assembly.

### Gas Prototype Tweaking:

- Picked up where previous team left model
- Many mechanical problems sprang up
- Performed complete overhaul
  - Full tune-up of engine (weekly help of RC expert)
  - Reworking of support structure
- Future: completion of full flight testing

### Micro-Scale Prototype:

- Continued with design and purchasing of parts
- Further design of new control systems
- Assembly commenced, custom fabricated parts on order
- Future: complete assembly, begin flight testing



Our Vertical Take-Off and Landing (VTOL) "flying car" initiative enters its second consecutive year. For the Fall 2006 semester, we branched our efforts into three sub-projects:

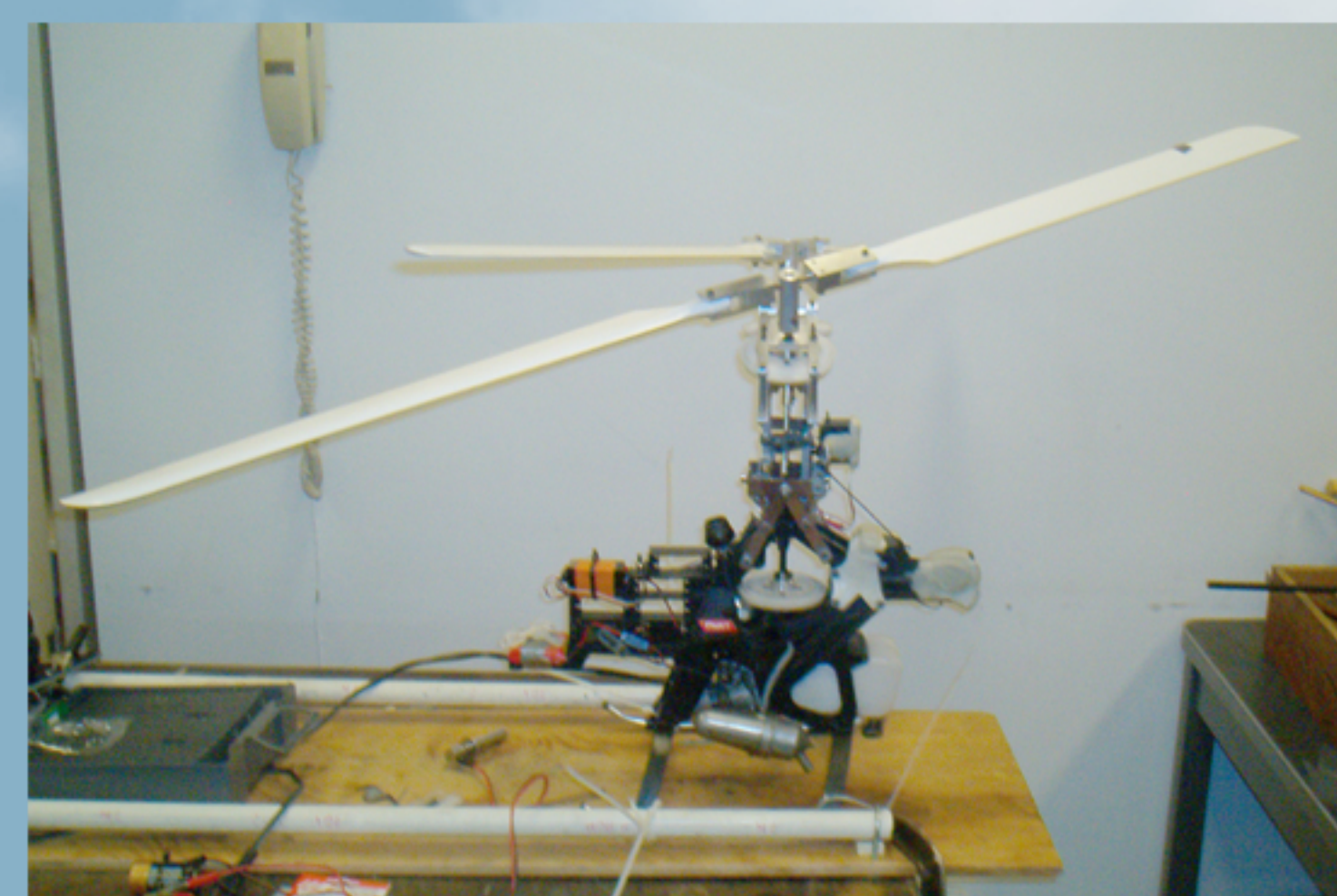
1. Design of a full-scale prototype for testing and evaluation.
2. Research, order parts for, and assemble the micro-scale model.
3. Continue testing and tweaking of the initial gas model.

### Old Model (Gas): Problems

- 1) Inability to maintain desirable running condition (rpm, IC engine)
- 2) Safety issues
- 3) Structural stiffness (screws coming loose)
- 4) Weight and dimensions (generating sufficient lift)
- 5) Rare spare parts (e.g., bevel gears)

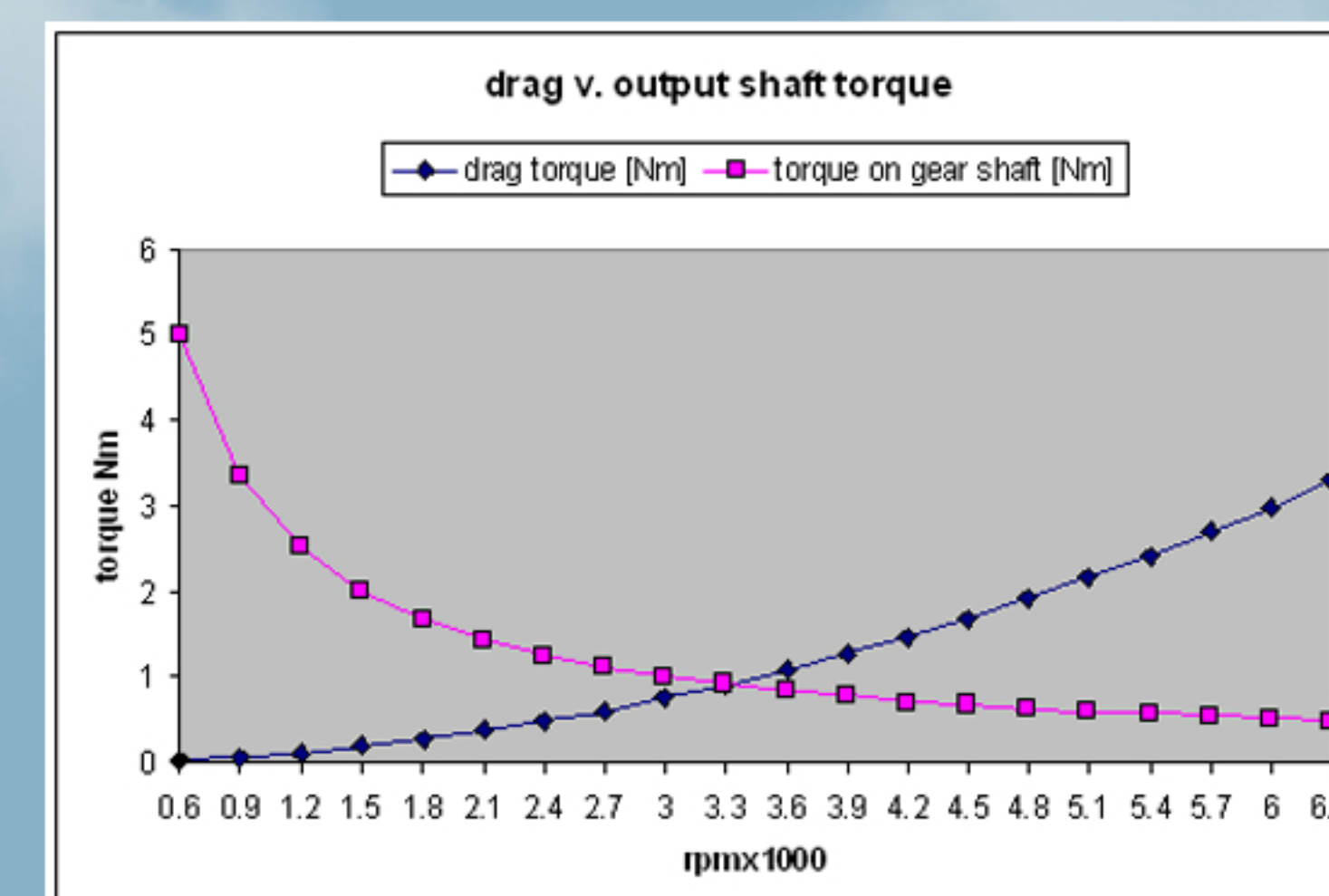
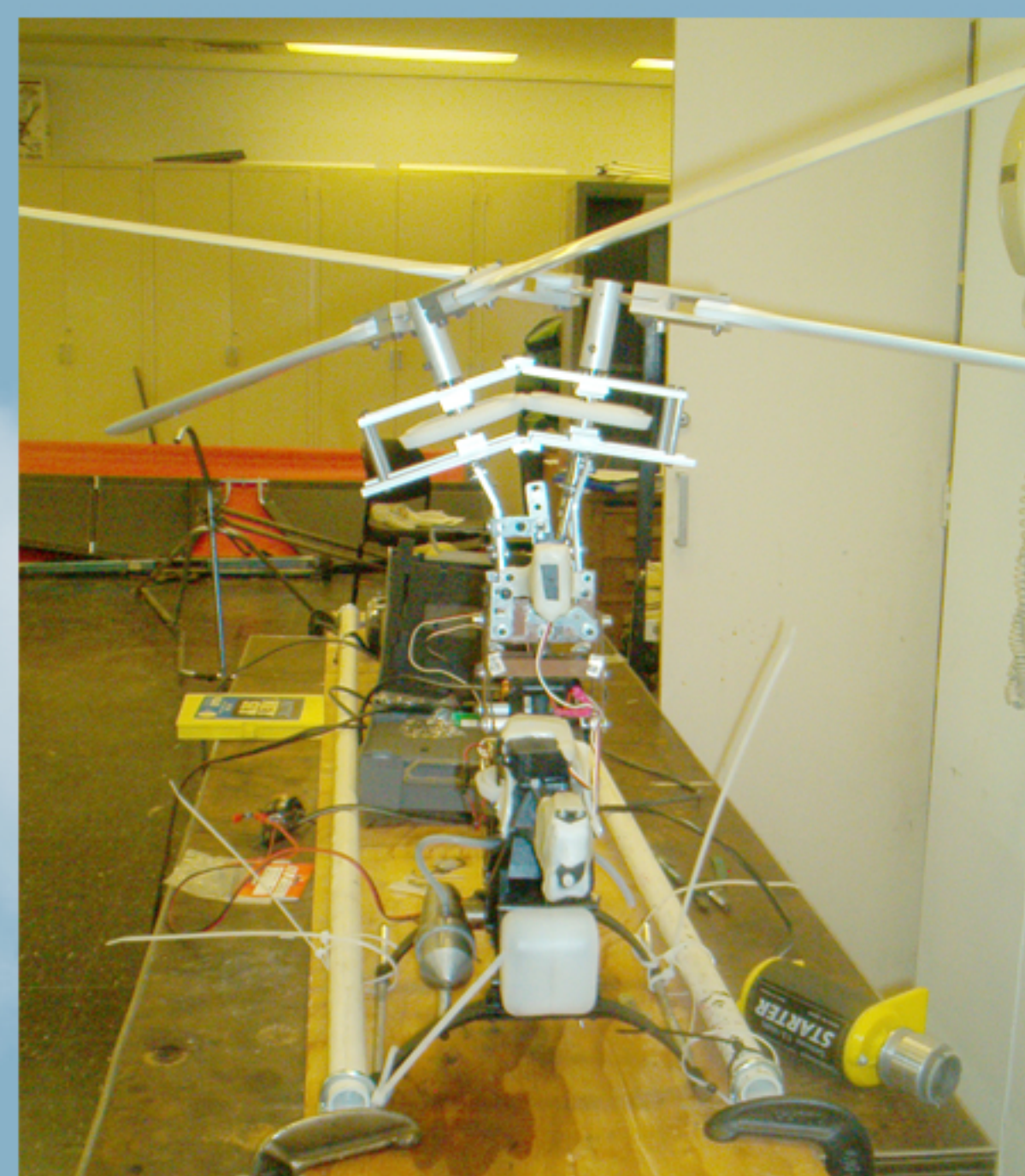
### New Model (Micro): Solutions

- 1) Two electrical motors used
  - Electronic Speed Control
- 2) Smaller size; more stable
- 3) Gimbal eliminated, center-of-gravity control system used for maneuvering
- 4) Carbon fiber rotors used to reduce initial weight by 50%
- 5) Careful selection of parts from generic vendors



Micro-Scale Barebones Design

Micro-Scale X-Plane Design



## Full-Scale Model

### Motor:

- Minimum power: 140 hp
- Rotary engines have characteristics that suit the VTOL--high RPM and low torque
- Mazda RX-7 engine prime candidate (255 hp, 6,500 RPM, and 217 ft. lb. torque)
- Prices from \$2500 to \$5000 (depending on features)



### Rotors:

- Rotors were researched and priced according to length
- 12ft rotors much more expensive than 10ft rotors
- Several private dealers quoted prices between \$500 and \$1500 for pairs of 10 ft. rotors
- Rear rotor unnecessary due to the counter-rotating main rotors

### Body:

- An "ultralight" body was selected for the prototype build
- Body made from chromoly tubing (aluminum tubing is lighter, but also weaker)
- Final weight of prototype body is significantly less than production model
- The prototype will only carry 1 person, while the production model will carry 2 or more.

