

ESTD

Engineering Science & Technology Division

ROBOTICS AND ENERGETIC SYSTEMS GROUP  
RESG

## Force-Torque Sensor Technology

Accurate Sensing for Human Amplification and Robotic Tasks

### Technology Need

High capacity multi-axis force/torque sensors are needed to quantify robotic machines interactions with their environment as well as for applications where determination of payload, center of gravity, and contact forces are required or when large impact loads can occur.

Existing sensors suffer from several deficiencies:

- Small thermal gradients lead to large errors
- Lack of robustness: damage to one strain sensing element renders entire sensor useless and non-reparable
- Sensors are bulky

### Significant Enhancements over Commercial Units

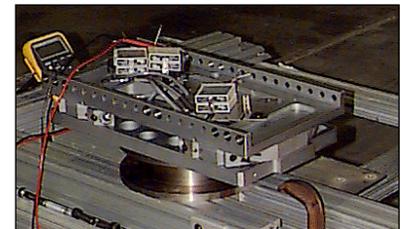
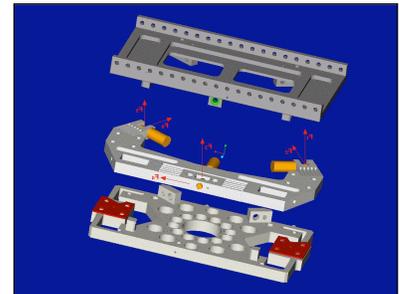
- High payload capacity
  - Demonstrated with >4500 lb load
  - Scalable to very high loads (100s of tons)
- High accuracy
- Enhanced temperature stability
  - Elements are individually:
    - Temperature compensated
    - Force isolated
    - Thermal gradients have almost no effect on accuracy
- Lower profile
- Lower cost
- Enhanced maintainability
  - Easily replaceable sensing elements

### Applications

Unique ability to combine high payload and high resolution make these force torque sensors ideal for high precision human amplification and robotics tasks where force/torque feedback is necessary to limit reaction forces or to guide insertion tasks. The patented technology (patent No. 6,532,830) is scalable to accommodate very high payloads.

#### Points of Contact:

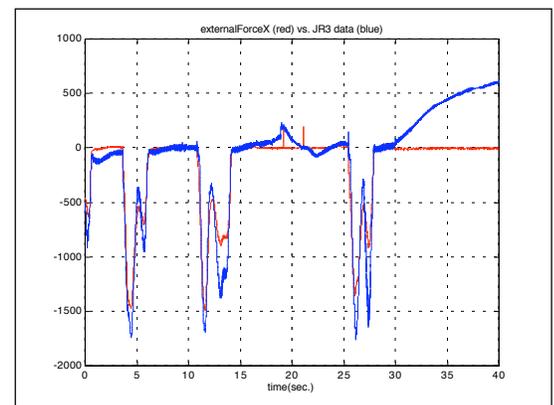
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ORNL's patented force torque sensor.



Material handling system with ORNL force torque sensor (shown lifting 4500 lb).



Enhanced temperature stability (ORNL sensor in red, commercial sensor in blue).