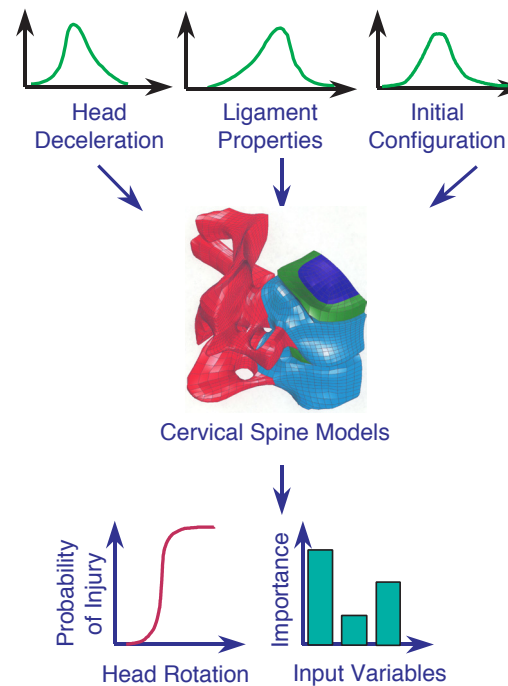


## PROBABILISTIC CERVICAL SPINE INJURY ANALYSIS

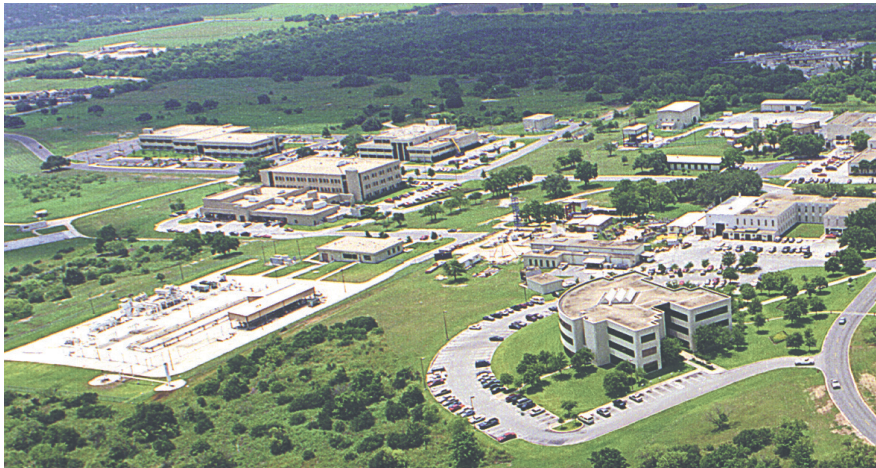
SwRI engineers are working to quantify the difference in risk of injury between male and female pilots. Because ejection systems are designed for the average male aviator, it is possible that females could be more prone to injury during ejection because of their smaller physical size. Uncertainties, whether due to the systematic size difference between males and females, or due to the inherent randomness in configuration of the spinal components or physical properties, are simulated by analyzing the model using SwRI-developed advanced probabilistic analysis techniques.

Using parametric design methods in combination with these advanced techniques, the difference in risk of cervical spine injury between male and female Naval aviators is quantified. Variations in aviator anatomy are included within a probabilistic mechanics framework to quantify the risk of neck injury during high-g aircraft maneuvers. Results will indicate design improvements to aircraft systems that improve pilot safety.



D0016030

## ADVANCED TECHNOLOGY FOR ORTHOPAEDICS



*Southwest Research Institute® is an independent, nonprofit, applied engineering and physical sciences research and development organization using multidisciplinary approaches to problem solving. The Institute occupies 1,200 acres in San Antonio, Texas, and provides nearly two million square feet of laboratories, test facilities, workshops, and offices for more than 3,000 employees who perform contract work for industry and government clients.*

**We welcome your inquiries.  
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*SwRI's Bioengineering Section is ISO 13485:2003 certified and compliant with the FDA Quality System Regulation.*

**O**rthopaedic impairments and arthritis are the primary physical causes limiting activity in people of all ages worldwide. Southwest Research Institute® (SwRI®) develops and applies advanced engineering technologies to solve critical problems in orthopaedics. The Institute also blends traditional orthopaedic technologies with advances in computer science and electronics to provide improved orthopaedic care.

### TECHNOLOGY AREAS

- Orthopaedic implants
- Surgical tools
- Biosensors
- Imaging sensors
- Biomaterials, coatings, and surface modifications
- Mechanical modeling of hard and soft tissues
- Probabilistic and risk analyses



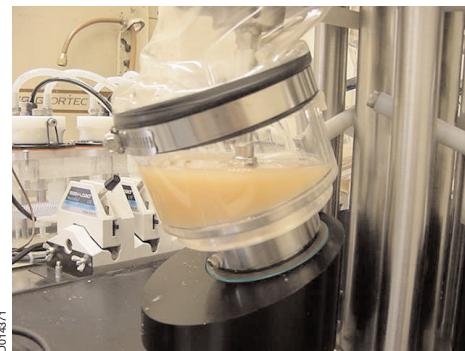
Through the SwRI Internal Research Program, an interdisciplinary project team has developed an orthopaedic sensor to monitor spinal movement in vivo.

### DEVICE DEVELOPMENT CAPABILITIES

- FDA qualified product design
- Mechanical
- Electrical/wireless
- Embedded systems
- Imaging/signal processing
- Optics
- Modeling and simulation
- Materials
- Failure analysis
- Transfer to manufacturing

### TESTING AND EVALUATION

- Environmental
- Mechanical
- Electromagnetic compatibility (EMC) and electrical safety
- Biocompatibility
- Animal and clinical trials
- Fatigue and wear, including radioactive tracer technology
- Material characterization



SwRI maintains a Shore Western six-station hip simulator used in conjunction with a radioactive tracer technology to measure minute amounts of wear in cross-linked UHMWPE and CoCr orthopaedic materials.

Artificial joints often need to be replaced after about 10 years of use because of wear and fatigue-induced delamination of the polymeric component. Institute engineers are designing improved materials and technologies to extend the lifetime of orthopaedic implants.

