

Multiscale Model of Lung Injury and Personnel Protection

Software Simulates Explosive Impacts on Virtual Humans in order to Save Lives



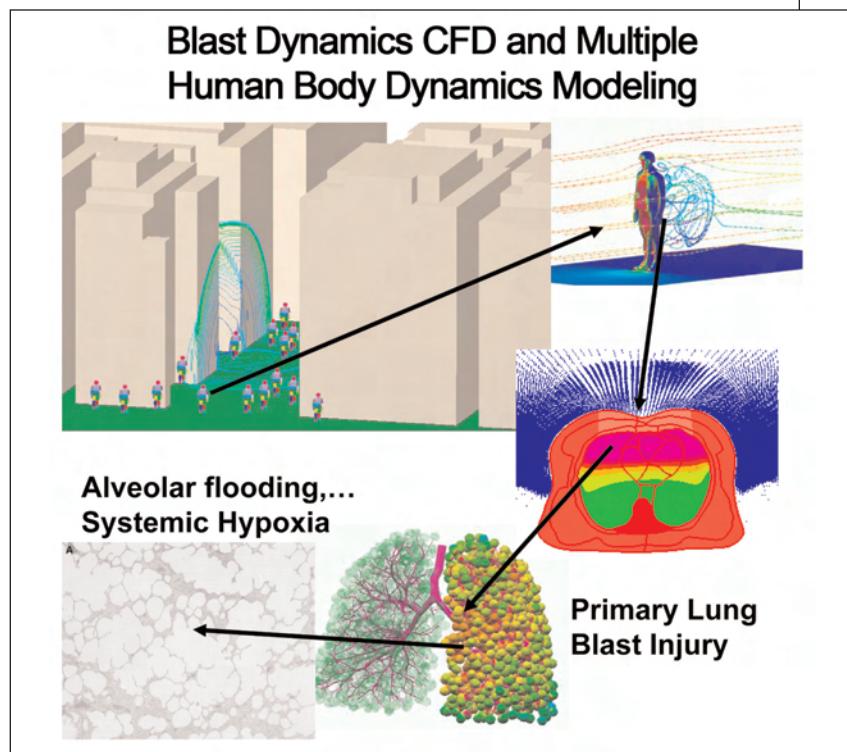
Technology and Innovation

Most terrorist attacks use explosive devices to maximize injuries to soldiers and civilians. CFD Research Corporation (CFDRC) is using DARPA Defense Sciences Office SBIR funds to develop software that simulates the effects of explosions on the human body in order to improve diagnoses, resuscitation, and treatment planning for blast victims.

The multiscale model software under development provides high fidelity, physiology-based modeling of blast injuries to the brain and lungs. Its integrated view of injury responses at the cellular, organ, and whole body levels simulates how explosion blasts affect the human body, body biodynamics, and biomechanics of vulnerable organs; and predict the pathophysiology of blast-related injuries.

Phase I of the project focused on lung injuries. CFDRC adapted existing fluid- and structure-dynamics modeling tools and integrated them into a framework to model blast explosion events, human body injury mechanics, and the body's systemic cardiovascular response. The software simulates wave pressure propagation in microseconds; tissue viscoelastic responses in seconds, and metabolic and neurophysiologic responses in minutes, hours, and days.

Phase II concentrates on modeling blast-induced brain injuries in a similar manner. For example, simulation will include the biomechanics of brain tissue and skull interaction, vascular

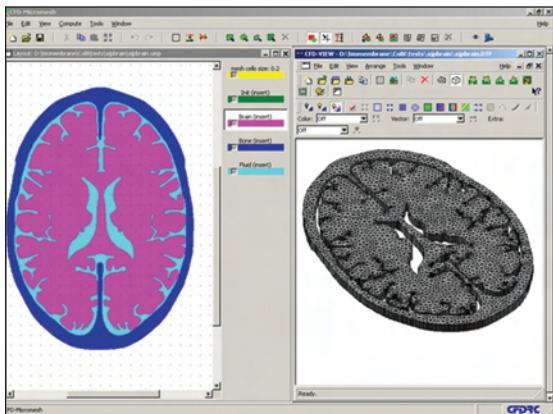


hemorrhage and hematoma formation, and secondary injury events such as hypoxia (oxygen depletion in the body) and ischemia (restriction of blood supply).

The software toolkit has many potential applications, including:

- Assessment of injury potential from explosive blasts
- Medical diagnoses, resuscitation, and treatment planning for blast victims
- Training of military medics and first responders
- Forensic study of terrorist incidents
- Development of personal protection armor, including novel helmets and vests

Multiscale model of blast lung injury



CFD Research Corporation's multiscale model software helps determine medical needs after blast injuries

- Study of drug delivery methods
- Pharmacological treatment planning
- Medical imaging
- Tissue engineering

Joint Collaborations

CFDRC has established partnerships with technology end users, lead research organizations, prime contractors, and system integrators for various purposes, including product development, software customization, research and development collaboration, technology advice, and strategic business alliances.

During Phase II of this project, CFDRC will be establishing partnerships with US Department-of-Defense-sponsored labs to conduct modeling experimental studies and with U.S. biomedical and pharmaceutical industries to commercialize the software developed under the SBIR program.

Lessons Learned

- Prioritize technology efforts based on end-user value creation rather than on technological desires. Be sure that end users serve on advisory panels that set requirements and assess performance.
- If planning to submit a proposal for a DARPA SBIR, be sure to take time to understand DARPA's needs as specifically

as possible by talking to the SBIR topic author during the pre-solicitation period.

Economic Impact

CFDRC is a several-time beneficiary of the SBIR program. Previous awards provided momentum for continued implementation, validation, and application of various modeling techniques and technologies, which contributed substantially to CFDRC's position as a leader in the use of computational fluid dynamics to model and simulate complex physical processes. The current SBIR award will result in commercial quality software tools for solving biomedical and biotechnology problems.

About the Company

Founded in 1987, this Huntsville, Alabama-based company specializes in engineering models that integrate multiphysics, multiscale simulations of fluid, thermal, chemical, biological, electrical, and mechanical phenomena for real-world applications.

CFDRC's products and services are used by over 500 organizations, including more than 50 Fortune 500 companies, worldwide. Major industries include aerospace, biomedical, defense, electronics, materials, and power. The company holds many patents and has received numerous awards in recognition of its successes in technology transfer, technology commercialization, and contributions to various organizations. ■

Company Information

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