The Bentil Group
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Short Course Program

"Basics of Blast Physics and Simulation for Injury Studies"

Hosted by Iowa State University's Mechanical Engineering Department

Dates

June 23, 2025 (Monday) — June 24, 2025 (Tuesday)

Short Course Overview

ABSTRACT

This two-day short course is intended as an introduction to blast physics, loading, and target response for researchers investigating blast injury phenomena, developing diagnostics or treatments/therapies, as well as biomechanical engineers and material scientists developing protective technologies. Key aspects of theory, modelling, and experimentation will be covered, and important terminology regarding shock processes and gas-dynamic flow conditions will be explained. Emphasis will be placed on understanding the fundamental principles of blast to a sufficient extent that experiments and models can be properly staged and interpreted

FORMAT

The format for the course will be informal with as much allowance for discussion as can be afforded through the sessions. Live demonstrations will be performed using the advanced blast simulator (ABS) at Iowa State University. See the following link to learn more about the ABS: https://www.me.iastate.edu/sbentil/2024/05/24/advanced-blast-simulator-abs-commissioned-at-iowa-state-universitys-cares-lab/.

Course Instructor Biography

Dave Ritzel holds a BSc in Mechanical Engineering and MSc in Aerospace Science. He has over 45 years of experience in blast research studies covering the theoretical, experimental, and computational modeling aspects of blast physics, damage, and injury. His research positions have included Head of Explosives Effects Group at Defence R&D Canada, and Head of Weapons Terminal Effects Group with the Defence Science and Technology Group, Australia. In 2000, he formed his own research company Dyn-FX Consulting supporting studies of blast effects and protection technologies for Defence departments, federal security agencies, university researchers, and private industries in Canada, the US, and Australia. For the last 20 years, his research activity has been concentrated on blast-injury biomechanics, including the special challenge of blast-induced traumatic brain injury, as well as the development of experiments and instrumentation. He patented the "Advanced Blast Simulator" design currently used by leading research agencies in Canada, the US, and Australia.

Sponsor

This short course is financially supported by the U.S. Office of Naval Research under PANTHER award number N000142112906 through Dr. Timothy Bentley

Organizing Committee

The organizing committee is comprised of the following members:

- Dr. Sarah A. Bentil *(Chair and Hostess)*
- Samantha Hand
- Katie Lott
- Emma Phares

(TENTATIVE) **Short Course Schedule**

June 23, 2025 (Monday)

Location: Student Innovation Center (Room: 0114); 606 Bissell Road, Ames, IA 50011

Time	Session Details
8:00 AM – 3:00 PM	**Registration Open** *Registration will close at 3:00 PM*
8:45 AM – 8:50 AM	**Opening Remarks** **Dr. Sarah A. Bentil** *Iowa State University*
8:50 AM – 9:00 AM	**Welcome Remarks** ***(TENTATIVE)*** **Dr. Caroline Hayes** *John and Nancy Hayes Department Chair in Mechanical Engineering, and Professor, Mechanical Engineering Department, Iowa State University*
9:00 AM – 9:30 AM	**Introduction and Course Overview** **David V. Ritzel** *Dyn-FX Consulting*
9:30 AM – 10:30 AM	**Session I: Shock-Wave Fundamentals** • Basic fluid dynamics, compressibility, and shocks
10:30 AM – 10:50 AM	**COFFEE BREAK** *Location: Student Innovation Center (Room: 4250)*

June 23, 2025 (Monday)

Location: Student Innovation Center (Room: 0114); 606 Bissell Road, Ames, IA 50011

Time	Session Details
10:50 AM – 12:00 PM	**Session I *(continued)*: Shock-Wave Fundamentals** 1D wave-dynamics and the classical shock tube
12:00 PM – 1:00 PM	**LUNCH** *Location: Student Innovation Center (Room: 4250)*
1:00 PM – 3:00 PM	**Session II: Blast-Wave Flow Conditions** • Idealized blast flow-field and energy partitions • Complications of real-world blast; improvised explosive devices (IEDs)
3:00 PM – 3:20 PM	**COFFEE BREAK** *Location: Student Innovation Center (Room: 4250)*
3:20 PM – 4:30 PM	**Session III: Blast Loading and Damage Processes** • Blast reflection, diffraction, and drag forces on targets • Target/material response and damage

June 24, 2025 (Tuesday)

Location: Student Innovation Center (Room: 0114); 606 Bissell Road, Ames, IA 50011

Time	Session Details
9:00 AM – 12:00 PM ***(20-minute break, as required)***	**Session IV: Blast Experiments** • Blast instrumentation and field trials • Blast simulation for laboratory studies
12:00 PM – 1:00 PM	**LUNCH** *Location: Student Innovation Center (Room: 4250)*
1:00 PM – 1:30 PM	**Commute to The CARES Lab (1351 Patterson Hall)** *Transportation will be provided from Student Innovation Center (Room: 4250) for registered participants only*
1:30 PM – 1:45 PM	**GROUP PHOTO** *Location: The CARES Lab (1351 Patterson Hall)*
1:45 PM – 4:30 PM ***(20-minute break, as required)***	**Session V: Wrap-Up** *Location: The CARES Lab (1351 Patterson Hall)* • Demonstration: Advanced Blast Simulator (ABS) at Iowa State University (The CARES Lab) • Wrap-up workshop with questions/answers • Closing remarks
4:30 PM – 5:00 PM	**Commute to Student Innovation Center** *Transportation will be provided from The CARES Lab (1351 Patterson Hall) for registered participants only*