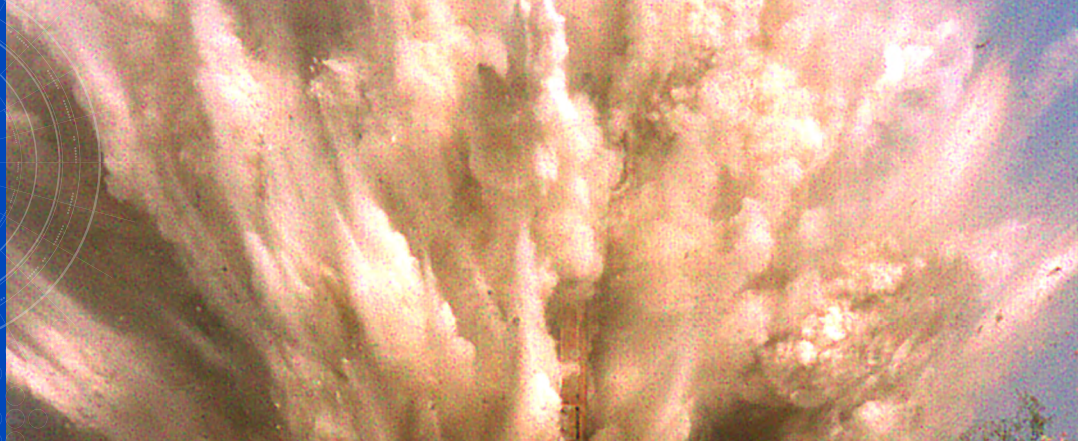




SOUTHWEST RESEARCH INSTITUTE



# High-Speed Imaging and Analysis

Southwest Research Institute® (SwRI®) operates specialty high-speed imaging equipment for measurement and analysis of a wide range of sub-millisecond events such as ballistic impacts, explosive events, material cracking/failure, vehicle engine dynamics, and fluid flows. The equipment is operated by experienced technicians and engineers who create custom setups and processing codes to meet unique requirements.

## Imaging Hardware

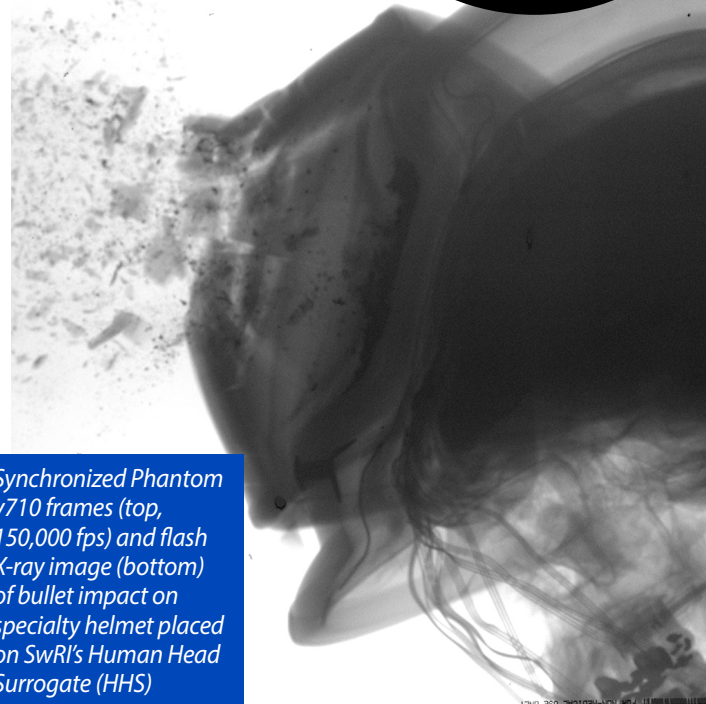
- 4x Phantom v7xx: high-ISO, HD 720p, 8,000 fps (1 million fps max)
- 4x Phantom v7.x (1 color, 3 monochrome): SD resolution 7,000+ fps
- Phantom Miro 3 high-G rated rugged camera: 2,000 fps, SD resolution
- Imacon ultra-high-speed: 16x 1-megapixel images up to 20 million fps
- Flash X-ray systems: 150 kV and 300 kV, ~50 ns pulse, digital development
- Armored housings and mounted hardware for extreme environments

## Analyses and Services

- Operation of high-speed imaging equipment
  - SwRI-owned Phantom and Imacon cameras
  - Experience with Photron and Shimadzu HPV-X
- 3D and 2D digital image correlation (DIC)
  - Deformation-time and strain-time histories on surfaces of any size
  - Rates from <24 Hz to 100,000+ Hz
  - ARAMIS software and GOM-test calibration hardware
- Development of advanced strobe illumination and precision triggering
- Imaging in high-G and harsh environments
- Precise synchronization of multiple video cameras and other hardware
- Velocity measurement from high-speed video (projectiles, frags, etc.)
- Velocity and frag sizing measurement from dual-pulsed flash X-ray
- Detection and tracking of cracks and damage at 200,000+ fps
- High-speed particle image velocimetry (PIV) measurements



Synchronized Phantom v710 frames (top, 150,000 fps) and flash X-ray image (bottom) of bullet impact on specialty helmet placed on SwRI's Human Head Surrogate (HHS)



Split Hopkinson pressure bar (SHPB) test: DIC strain measurement (100,000 fps)





Miniature stereo high-speed camera pair in fixture custom-designed and fabricated by SwRI for 3D DIC in high-G tests

## Video Editing

- Conversion between video formats/codecs (avi, mp4, wmv, etc.)
- Videos stitched together end-to-end or within the same frame
- Video compression for web and email delivery
- Watermarking and title/subtitle insertion
- Videos created from image sequence formats and vice versa

Ballistic impact on a single yarn extracted from a fabric armor panel with horizontal fiducial lines superimposed for motion analysis (Imacon, 200,000 fps, 800 ns exposure)

We welcome your inquiries. For more information, please contact:

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## SOUTHWEST RESEARCH INSTITUTE®

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Designed & printed by SwRI MPS 18-0724 JCN 272375 tp