



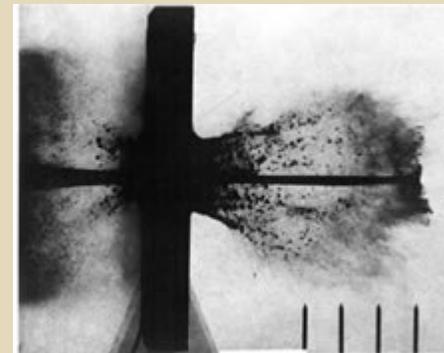
# Real Time High-Speed 3 Dimensional Modeling (RTH3M)

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**Patent Application # 12,509,428**

# Why did we make it?

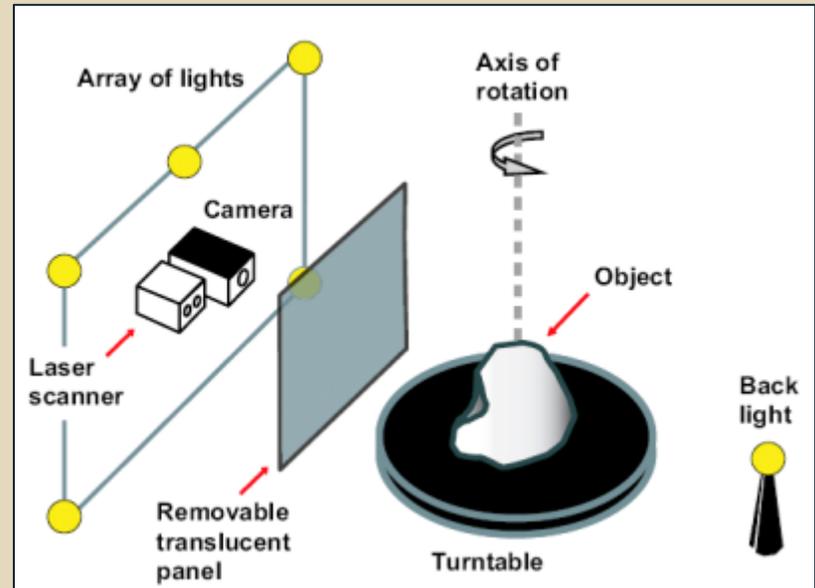
- **Current methods of capturing ballistic events are limited to three primary methods.**
  - **Orthogonal X-ray.**
    - Can see through smoke.
    - Does not give any 3d information.
  - **High Speed Photography.**
    - Can show Some 3d information
    - Vulnerable to smoke and flame
  - **Time lapse Photography.**
    - Only shows overall path of projectile.
    - Vulnerable to Smoke and Flame.
- **Status: concept**



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- The currently available equipment is not capable of supporting the high speeds required to capture ballistic events.
- The cutting edge of moving object rendering can only capture the movements of a person in real time.
- Ballistic events occur at speeds of 1000 feet per second (fps) to 10,000 fps.



# Current Projectile 3d Modeling Methods

Currently, the primary method for modeling projectiles in 3d is based on user assisted outlining of orthogonal X-rays.

– **Slow**

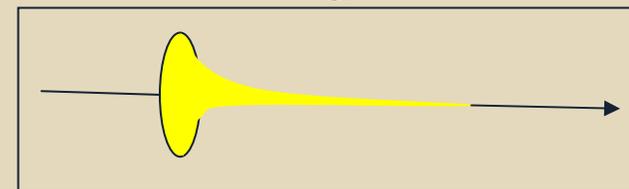
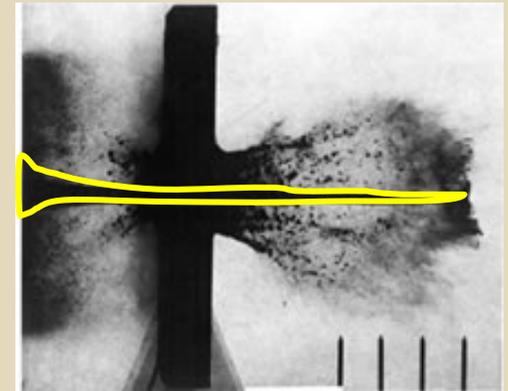
- The process requires the orthogonal x-rays to be developed and digitized. Then the silhouettes are outlined by hand. A computer is used to interpolate the profile of the projectile based on two views. The process takes approximately 20 man hours per image.

– **Inaccurate**

- The 3d model is based on only two images. The software can not adjust for cavities or surface irregularities at any other points about the axis
- The method works fine for objects symmetrical about the line of motion.

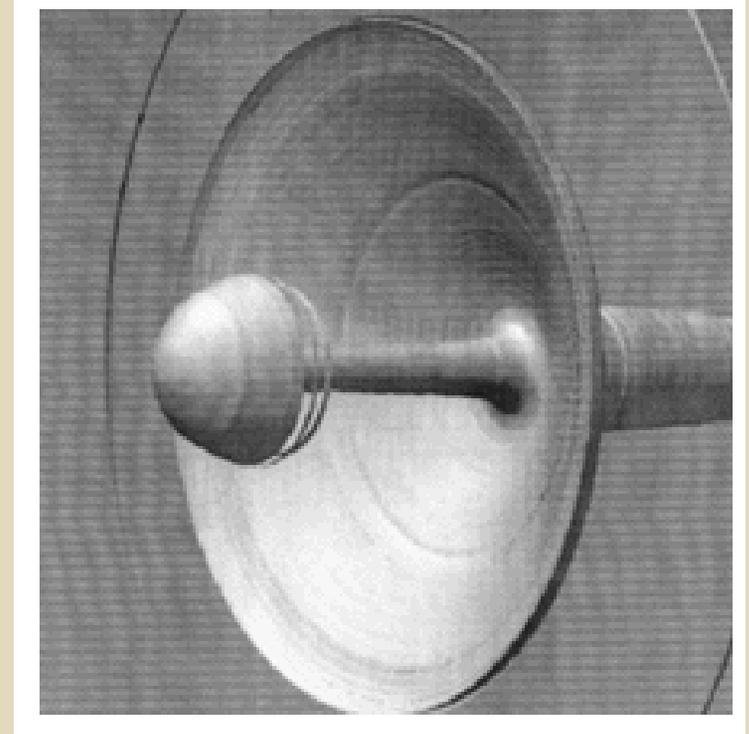
– **Subjective**

- The user determines which dark silhouettes are a portion of the actual projectile.



# What makes it special?

- **Expedient**
  - The 3d modeling should take place as the event is happening.
  - The system should automatically determine the shape size and speed of the projectile.
  - 3d system should be able to capture information on an object moving as fast as 10,000 fps.
- **Accurate**
  - The 3d modeling method needs to provide a complete 360° view including cavities and surface features.



# What are its main components?

- **Lasers**

- Multiple laser lines allow the camera to record various sections of the projectile simultaneously.
- The lasers are spaced based on the velocity of the projectile to allow the computer to capture all of the projectile as it moves.

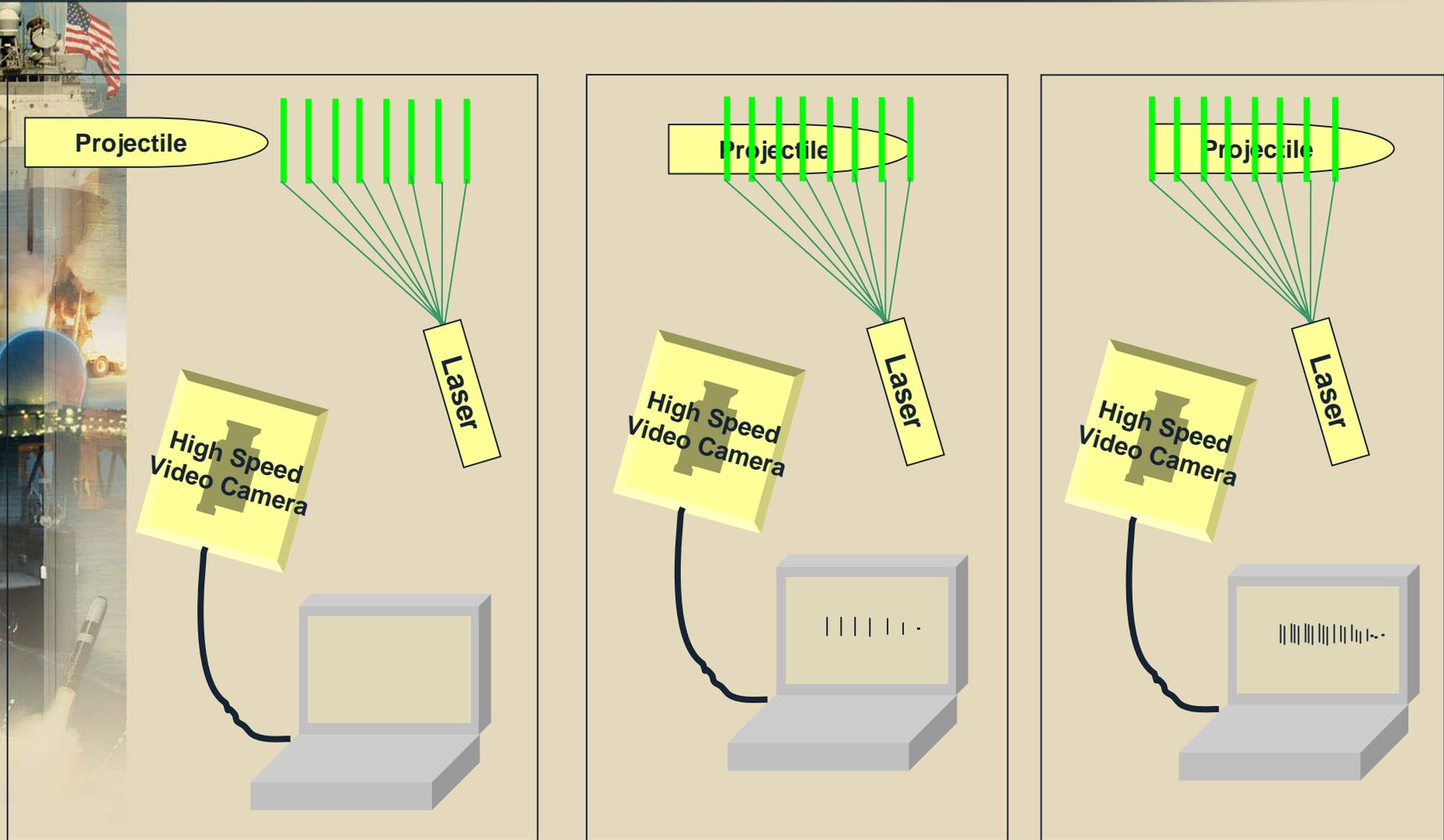
- **Digital Cameras**

- High speed digital video cameras are used so that the frame rate is sufficient to reduce the time of travel of the projectile between frames, thus increasing the resolution of the model.
- Multiple cameras are used to allow complete 360° visualization.
- Multiple cameras are used per angle to increase the frame rate further increasing the resolution of the model.

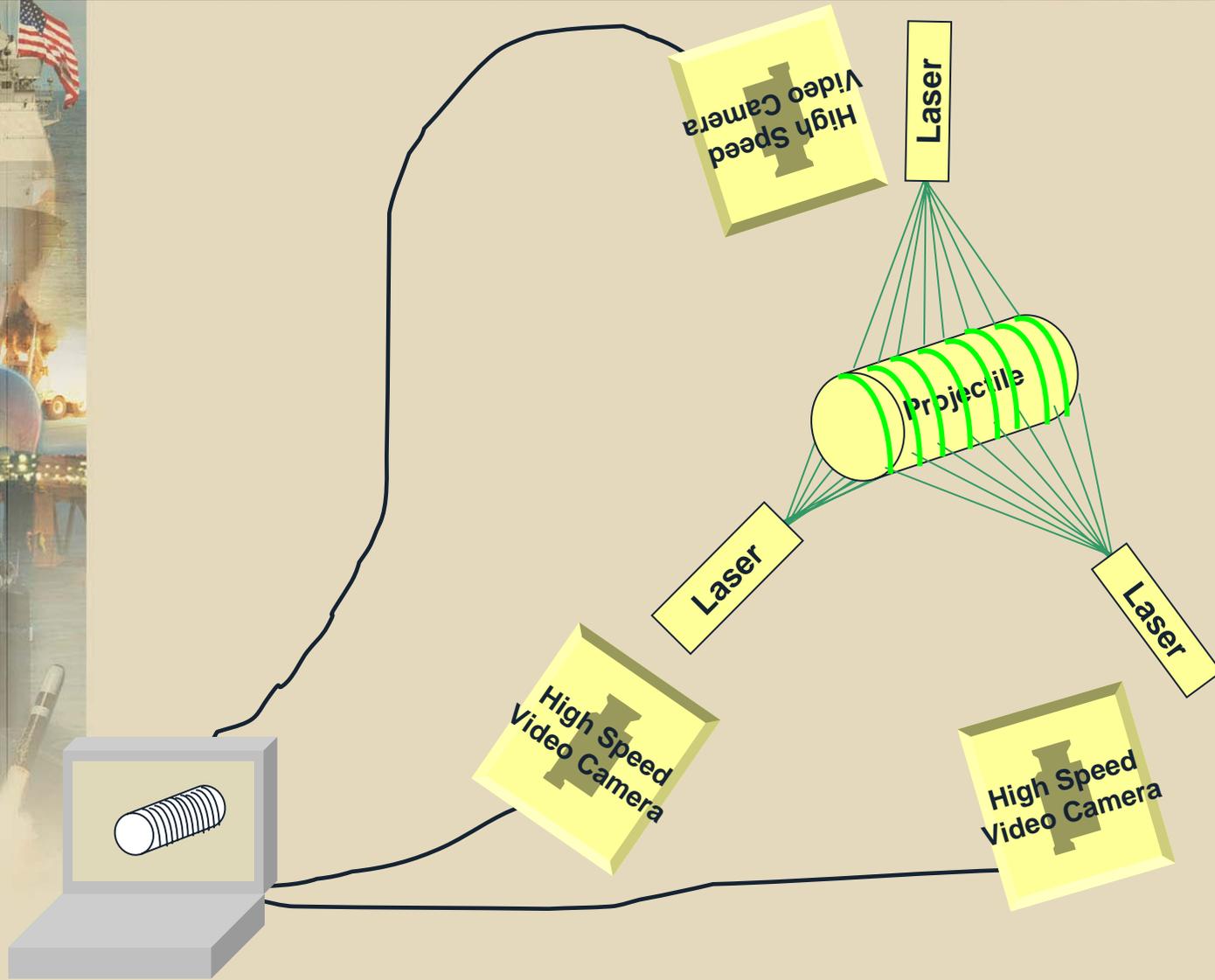
- **Computer**

- Large amounts of fast data storage are required to capture the high volume of information captured by the cameras.
- High-speed processors are required to analyze and interlace the data.

# How does it work?



# How does it work?



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# Commercial Applications

- **Who would use it?**
  - Research and Testing Organizations, Universities.
- **Why would they want it?**
  - More advanced and accurate than current methods of capturing high speed projectile test data.
- **How would it be used?**
  - During testing they would be able to record the propagation of moving components during high speed projectile testing.

