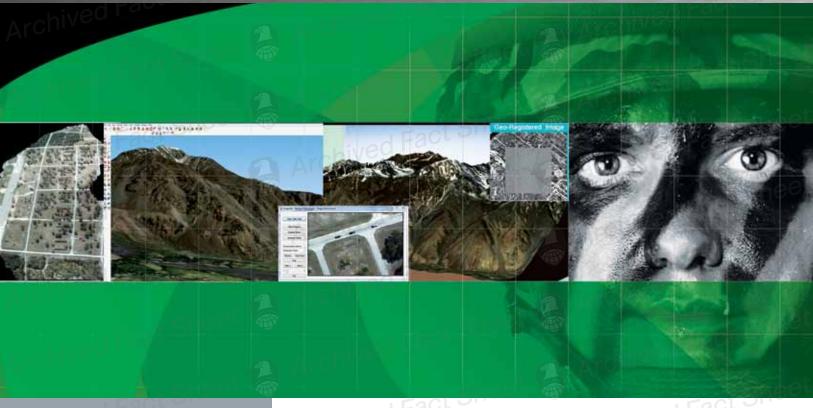# ImageNet

Discriminatory Imaging and Network Advancement for Missiles, Aviation, and Space

Summary

How ImageNet is used:

- 3-D scene generation

- Situational awareness

- Immersive display and audio environments

- Intelligence preparation of the battlefield

- Better portrayal of the operating environment

- Enhanced battle management imaging technology

- Modeling of relevant operational environments

- More effective training using immersive environments

ImageNet demonstrates improved Soldier preparedness through enhanced battle management imaging technology and mission preparation using immersive training environments.

ImageNet is a Space and Missile Defense Battle Lab (SMDBL) collaborative initiative with the University of Kentucky focused on developing, testing, demonstrating, and validating advanced imaging to support training concepts for military applications. We are integrating immersive environments, scenarios, and network concepts for battle management of "attack the network" applications within an advanced 3-D training prototype.

ImageNet is helping provide more accurate, up-to-date representation of a tactical operational environment that can be viewed with off-the-shelf software and hardware. Existing government-owned, non-proprietary capabilities are integrated with emerging technologies to meet training objectives.

ImageNet is an SMDBL capability that supports the needs of the military to develop timely and relevant training representations of the tactical operational environment. ImageNet compresses the "collection to classroom" timeline by automating the production of operational environment models. ImageNet leverages existing government off-the-shelf products and integrates innovative non-proprietary tools developed to provide:

- More effective training and decision aid tools
- More timely, more current Geographical Information Systems data sets
- More realistic and relevant training
- Improved timeline from collection to classroom
- Improved tactics, techniques, and procedures

The 3-D Terrain Model Development capability includes three government-owned tools: ImageNet's plug-in to Google SketchUp, the Image Enhancement Tool, and the Automated Mosaicking and Georectification Tool. Each tool can be used individually or together as a single system that can produce accurate 3-D representations of operational environments.

- The plug-in to Google SketchUp is a tool that imports imagery and elevation data to quickly produce realistic 3-D terrain models that can be used to train, plan, and perform post mission analysis and forensics. This tool imports multiple images and blocks of elevation data and stitches them together into a contiguous model up to 10 km X 10 km.

  The plug-in tool reads GeoTIFF files and elevation data to produce 3-D terrain models, comprising blocks of imagery and elevation data that can be used for fly-through examination of the tactical operational environment. The plug-in stitches the data together so that there is no seam apparent along imagery boundary lines. This tool benefits the Soldier by providing relevant training materials from recent surveillance collections using government-owned tools that can run on commercial off-the-shelf laptops with very little user training.

- The Image Enhancement Tool provides improved imagery in GeoTIFF format from a full motion video feed by producing an image that exceeds the resolution limitations of the camera. It combines data from multiple images within the video clip to create a composite image that is clearer and contains more information than originally available in any single image from the full motion video.

- The Automated Mosaicking and Georectification Tool produces geo-referenced mosaic imagery and the capability to generate a clear and accurate geo-referenced and geo-rectified mosaic from full motion video with no meta-data. The mosaic can be used on modern viewers such as Google Earth and can also be incorporated into 3-D terrain models.

Additional capabilities that are a part of ImageNet include:
- Concast: a many-to-one in-network merge process in which Internet protocol packets sent from different senders to the same receiver are merged inside the network, so that the receiver only has to deal with a single message.
- Software engineering: A method for evaluating consistency of requirements that are provided in natural language text, specifically focusing on temporal requirements.
- Dynamic environment capture: A method for capturing dynamic scene information, such as human patterns of life and environmental conditions, along with static properties of a scene. This information is incorporated into 3-D-training simulations to enhance realism, and hence increase the value of training.
- Immersive display: Creates high fidelity, high resolution immersive systems using commercial off-the-shelf hardware that are portable and can increase realism and effectiveness of training.
- 3-D modeling: Produces a 3-D model from a point cloud captured using Light Detection and Ranging equipment. Planar surfaces are identified and grouped into building blocks to recreate structures. Algorithms can automatically create 3-D structures.
- Aerial platforms: Provides autonomous control for deployable-wing and perching UAVs. Provides aerial platforms support for video data gathering, networking, design, modeling, flight tests, and requirements development.

For more information, please contact:
USASMDC/ARSTRAT Public Affairs Office
P.O. Box 1500
Huntsville, AL 35807
Phone: 256-955-3887
Fax: 256-955-1214
www.facebook.com/armysmdc
www.twitter.com/armysmdc
www.flickr.com/armysmdc
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