

## RAPIER® (RAPid Image Exploitation Resource) Ship Detection System

Software that automatically detects ships from high-resolution commercial overhead imagery and quickly outputs the results in various user-friendly formats.

The U.S. Navy seeks to commercialize U.S. Patent 8,116,522 (Ship detection system and method from overhead images); and U.S. Patent Apps. 12/711,110 (Method for classifying vessels using features extracted from overhead imagery); 12/851,738 (Method for fusing overhead imagery with automatic vessel reporting systems); and 13/032,712 (Adaptive automated synthetic aperture radar vessel detection method with false alarm mitigation).

### Background

High-resolution commercial satellite images allow ships to be seen from space, providing unsurpassed ocean surveillance capabilities for maritime law enforcement, disaster responders, port authorities, and search and rescue teams. Manual systems for detecting ships in high-resolution imagery take considerable time, requiring an image analyst to search for ships. Automated systems are faster, but often demand multiple user inputs, produce too many false detects, and do not take full advantage of panchromatic data - data that, if processed correctly, could provide improved capabilities for ship detection in clouds, noise, etc. A fully automated system that effectively processes such data could offer more detailed results, less false detects, and save the user time.

### The Technology

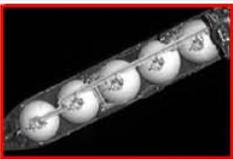
RAPIER® SDS is a software program that uses a suite of advanced image processing algorithms to automatically detect ships from high resolution commercial satellite imagery (Figures 1-4). For EO/IR processing, the algorithms mask land, detect and remove clouds, analyze background textures, remove glint and noise, detect anomalies, and measure and type ships (Figures 1-2). Results are output in various user-friendly formats, including a KMZ file for overlay onto Google Earth™ (Figure 4), and an easy to read HTML file (Figure 3) that lists and organizes data according to ship size.



**Figure 1:** RAPIER® SDS automatically processes high resolution satellite imagery (up to 4 GB), searching for ships.



**Figure 2:** Advanced algorithms detect ships behind clouds and in rough seas.

Ship 5		<b>Ship Classification Algorithm</b> Tanker: Liquefied Gas Carrier (99 %)	<b>Ship Latitude/ Longitude</b> 1.22060 / 103.65346	<b>Bow/Stern or Wake Detection Algorithm</b> 64.58 / <b>244.58</b> (71%) (Bow/Stern Algorithm)	<b>Compass</b> 	<b>Length (m)/ Width (m)</b> 202.69 / 48.77
--------	---	--	--	---	--	--

**Figure 3:** A sample row of results output to HTML.

### Key Benefits

- Processes images automatically with minimal user input
- Handles panchromatic NITF, TFRD, and Geo-Tiff formats from EO/IR, SAR, and Multispectral imagery
- Outputs to KMZ, OTH-G, HTML, XML, and RIT
- Plugs in to the RAPIER Framework, leveraging open source software that allows the user to modify existing algorithms and create new algorithms

### Development Status

- 1 U.S. Patent issued and 3 U.S. Patent Applications pending
- Total R&D: \$5M and 5 years
- DoD Technical Readiness Level 8: Actual system completed and flight qualified

For more information on technology transfer, please contact us at (619) 553-5118 or email [ssc\\_pac\\_t2@navy.mil](mailto:ssc_pac_t2@navy.mil)

Find us on:



@SPAWARPacificT2



**Figure 4:** This KMZ output to Google Earth™ shows detected ships in their geospatial context.

Space and Naval Warfare Systems Center Pacific (SSC Pacific) is one of the U.S. Navy's premier research, development, test, and evaluation (RDT&E) laboratories and fleet support centers for command, control, communication, computers, intelligence, surveillance, and reconnaissance (C4ISR).

<http://enterprise.spawar.navy.mil/techtransfer>