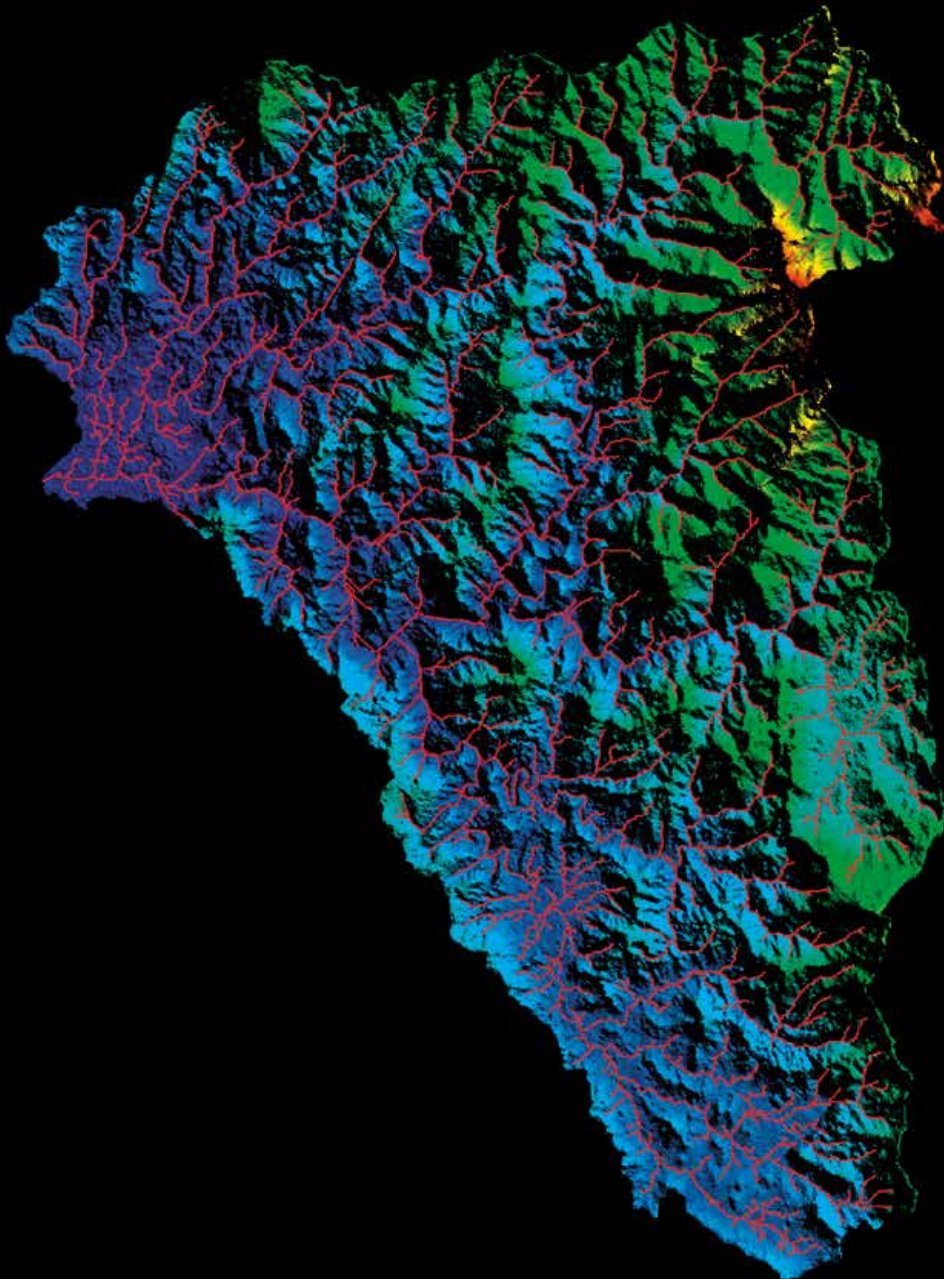


SURVEILLANCE AND INTELLIGENCE

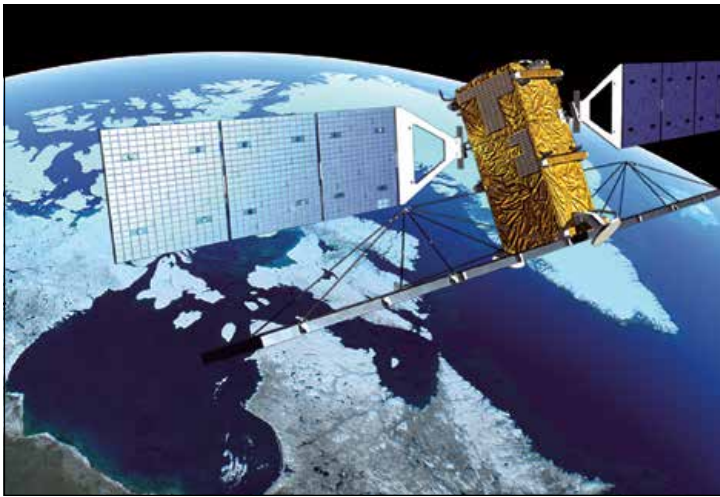
# ELEVATION MODELING PRODUCTS



**MDA is a leading producer and supplier of elevation products, including Digital Elevation Models and Ortho Rectified Images, for a variety of applications.**

### **Made-To-Order with the Latest Data**

As the operator of the RADARSAT-2 satellite, MDA utilizes its complete operational control of the satellite to rapidly acquire elevation data over customer-defined areas. This means that MDA's elevation products use the most up-to-date data available, giving you a competitive edge in a changing landscape.



*MDA developed and operates the RADARSAT-2 satellite, which is used to acquire fresh imagery for DEM customers.*

### **Rapid Acquisition, Regardless of Cloud Cover**

Unlike spacecraft or aircraft with optical sensors or LIDAR, MDA's RADARSAT-2 satellite acquires imagery day and night, through cloud, enabling fast acquisitions of data regardless of weather conditions. MDA's technical enhancements reduce the turnaround time from product order to delivery. Additional enhancements include a new beam mode that provides wider imaging swath widths at high resolution, enabling elevation data to be acquired faster than competing systems.

### **Rapid Production by an Experienced Team**

With decades of experience producing elevation products, MDA has created a mature production line capable of routinely generating 50,000 km<sup>2</sup> of Digital Elevation Models (DEMs) and orthorectified map sheets per week, with a peak operational capacity of up to 100,000 km<sup>2</sup> per week.

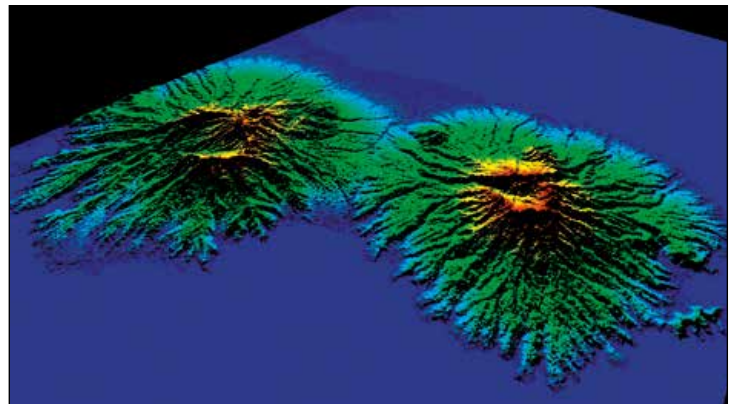
MDA personnel work on large-scale DEM campaigns that support the geospatial requirements of a wide range of domestic and international



*MDA has an experienced team and an operational DEM production facility capable of quickly responding to new orders.*

civil users, mapping agencies, and military customers. Over one four-month period, the team generated over one million square kilometers of DEMs, over one thousand 1:50,000 scale ortho imagery-based map sheets, and delivered a complete national DEM to support customer geological applications.

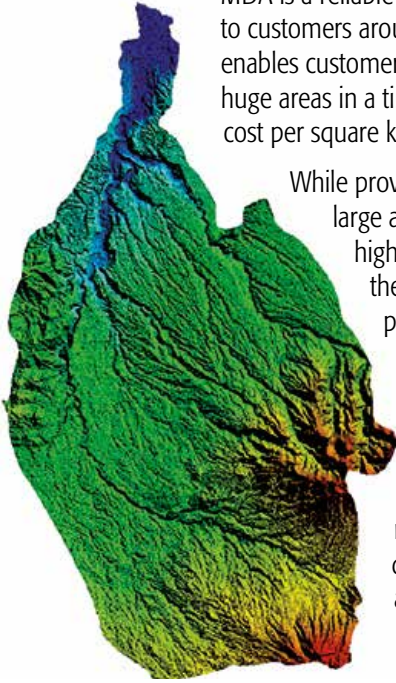
As a global leader in DEM production, the Company continues to invest in the expansion of its production facilities. Its suite of sophisticated automated algorithms is integrated with commercial hardware and software. This system enables massive quantities of elevation products to be quickly generated. MDA's two production facilities are equipped with industry-leading Digital Photogrammetric Workstations that have been augmented with proprietary algorithms and workflow improvements.



*Bataan Nature Park (left) and Mount Mariveles (right), on the island of Luzon in the Philippines. Manila Bay can be seen in the background. Red and yellow areas in the image indicate higher elevations, while green and blue indicate lower terrain.*

### Cost Effective, Highly Accurate Solutions

MDA is a reliable provider of elevation products to customers around the world. MDA's process enables customers to acquire elevation data over huge areas in a timely manner at a reasonable cost per square kilometer.



*A shaded relief image of Cagayan de Oro, Philippines, provides a 3-D perspective of a DEM derived from RADARSAT-2 imagery.*

While providing efficient coverage over large areas, MDA is well known for the high level of accuracy, and quality of the resulting elevation information products. RADARSAT-2's multi-polarization options enhance the discrimination and recognition of surface features and targets. Attention to detail in the production process has resulted in less than one percent data voids being delivered across all DEM projects, due to the multiple stereo collection approach.

An independent study of MDA's results by the University of the Philippines during the 2013 National DEM Project noted that over a 45,000 km<sup>2</sup> area, the vertical accuracy delivered was 6 m (LE90) with a Route Mean Square Error (RMSE) accuracy of 3.7 m.

### Improved Intel Over Inaccessible Territory

For inaccessible areas (often referred to as denied territory) where airborne surveillance is not possible, MDA provides made-to-order satellite imagery and elevation products.

### Commercial and Civil Government Applications

As a provider of a range of mapping products and services, MDA routinely utilizes elevation data to provide services to its customers around the world. In addition to standard mapping applications, MDA elevation products can be used to support:

- Flood, landslide, avalanche modeling
- Disaster management
- Coastal management, inundation and tsunami modeling
- Water supply management
- 3D flight planning and aviation safety
- Line of Sight analysis
- Surface analysis

- Climate impact analysis
- Water and wildlife management
- Hydrological and geological modeling
- Pipeline route optimization
- Planning and construction

### Defence Applications

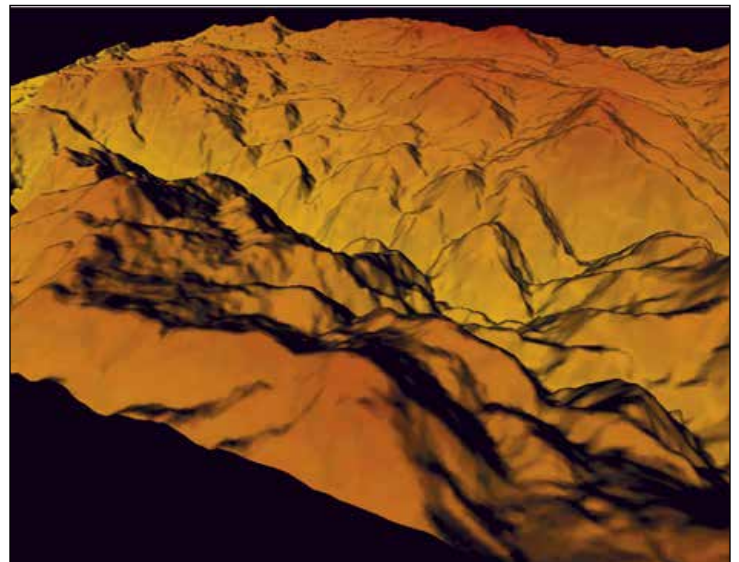
MDA is a leading supplier of military surveillance and mapping products and solutions, with a team of experienced photogrammetrists, mapping experts, and image analysts. Defence customers around the world incorporate MDA DEMs and orthorectified radar image maps into their workflow. Applications include:

- Inter-visibility analysis
- Terrain and slope analysis
- Trafficability analysis
- Disaster response planning
- Military planning

### Elevation Product Specifications

MDA's elevation products utilize satellite imagery to provide accurate coverage of large areas, with rapid production that is independent of weather conditions or restrictions of access to the territory.

MDA's elevation products typically meet the following specifications, based on more than 2.5 million square kilometers of DEMs produced to date.



*MDA's elevation products provide accurate, cost-effective data for large areas.*

STANDARD DEM		HIGH ACCURACY DEM	
Suitable Map Scales	1:50,000 and above	1:25,000 and above	
Post Spacing	1/3 arc seconds (10 m)	1/5 arc seconds (6 m)	
Vertical Accuracy (LE90)	8 m to 10 m, depending on terrain	6 m to 8 m, depending on terrain	
Horizontal Accuracy (CE90)	Typically under 6 m	Typically under 6 m	
Tile Size	1 degree x 1 degree tile (approx. 12,348 km <sup>2</sup> at equator) *	1/4 degree x 1/4 degree tile (approx. 722 km <sup>2</sup> at equator) *	
RADARSAT-2 Beam Mode	Multi-Look Fine	Ultra-Fine	
Delivery Format	GeoTiff format WGS84 Datum, Geodetic coordinate (latitude/longitude), 32-bit float		
Metadata Provided	Product specification, water body shape file, small island shape file, quality report, raw RADARSAT-2 metadata files for all input images used to create the DEM		
Standard Finishing	Lakes greater than 200 m flattened Rivers greater than 75 m flattened Oceans flattened to 0 m mean sea level Surface hydrology enforced: river and ocean shoreline confirmed above water line to ensure water flows correctly Spikes and wells manually interpolated to surrounding land Bridges removed Dams maintained Piers and docks greater than 100 m maintained as land; smaller removed Adjacent tile edges confirmed to be identical, seamless data verified		

\* Custom DEMs smaller than standard tiles are available upon request.

## Accuracy

Accuracy is expressed as linear error (LE) and circular error (CE). Linear error is an estimate of the overall vertical accuracy of the DEM at a stated confidence level. As an example, an LE90 of 10 m indicates that 90 percent of the pixels within the DEM vary by less than 10 m from the reference DEM. Circular Error (CE) measures combined horizontal accuracy of the final DEM using a circular radius.

## For more information, contact us at:

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## DEM Archive

In addition to developing new DEMs, MDA provides access to a DEM archive of more than 2.5M km<sup>2</sup>, with the majority of the archive made up of Standard DEMs. DEMs from the archive are more economical and can be delivered within days of order. The minimum size for Archive DEMs is 1,500 km<sup>2</sup> for Standard DEMs and 1,000 km<sup>2</sup> for High Accuracy DEMs. The MDA DEM Archive is continually growing, and can be used in a variety of applications.

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