

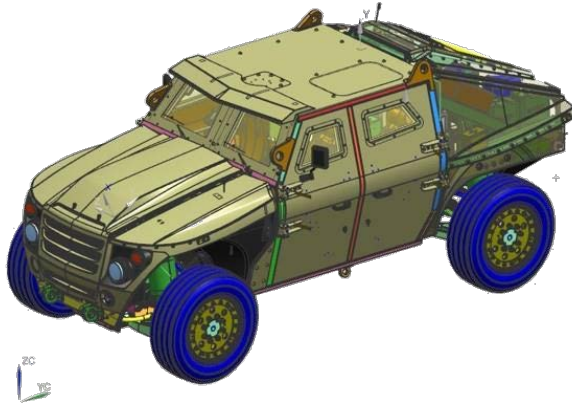
AVT-308
Cooperative Demonstration of Technology
on
Next-Generation NATO Reference Mobility Model (NG-NRMM)
Development

Version 4
13 September 2018

Venue
Keweenaw Research Center (KRC)
Michigan Technological University
Houghton, Michigan, USA
<https://www.mtu.edu/cdt/>

Dates
September 24-27, 2018

KRC Lead
Scott Bradley, Program Manager
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Summary

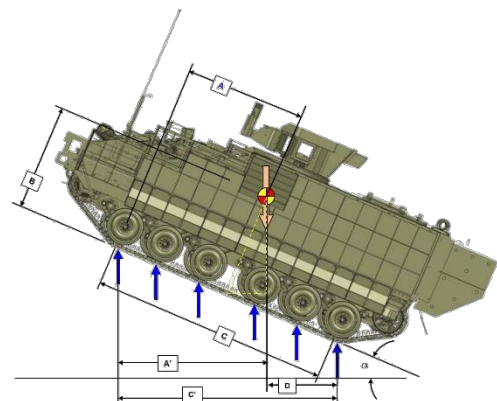
AVT-308 is sponsoring a Cooperative Demonstration of Technology (CDT) at Michigan Technological University's Keweenaw Research Center (KRC) located in Calumet, Michigan, USA. The CDT will be conducted over three days from Tuesday, 25 September 2018 through Thursday, 27 September 2018. Senior Executives (VIPs) are invited for a one-day program on Wednesday, 26 September 2018. The purpose is to highlight the work of AVT-248 to develop a Next-Generation NATO Reference Mobility Model (NRMM).

The CDT is meant to display the state of the art for ground vehicle mobility prediction. In a simplified view, appropriate vehicle and terrain data is gathered and a representative mobility scenario is defined. State of the art computer simulations are then conducted over digital representations of this terrain and the results are compared to physical tests. To advance technology, diverse and multiple solution methods including 3D, high-resolution, physics-based computer simulations traversing surfaces modelled using simple and complex terra-mechanics are preferred and encouraged. The initiative is meant to exercise and advance the process required to collect, use, and report data required to predict ground vehicle mobility.

Background

Legacy NRMM

Originally released in the 70's, NRMM uses vehicle and terrain information to create a visual go/no go and max speed decision map for a given region. The region of interest is divided into terrain units that possess homogeneous terrain parameters. Mobility, as defined by vehicle speed within a specific homogeneous terrain unit, is determined via simple vehicle dynamics mobility models and plotted to create a mobility map.

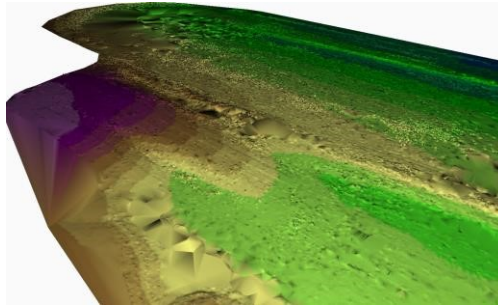


Next Generation NRMM

Legacy NRMM still remains a viable software code; it was last upgraded in the 90's. The current upgrade effort is referred to as the "Next Generation" NRMM and the primary focus is to leverage technological advances in computational capacity and simulation software. Commonly referenced as "Big Data," data extraction from high resolution aerial imagery and topology scans are increasing the fidelity of the terrain input. Vehicle simulation improvements are focused upon interaction with deformable soil.



High resolution aerial imagery



High resolution topology scans



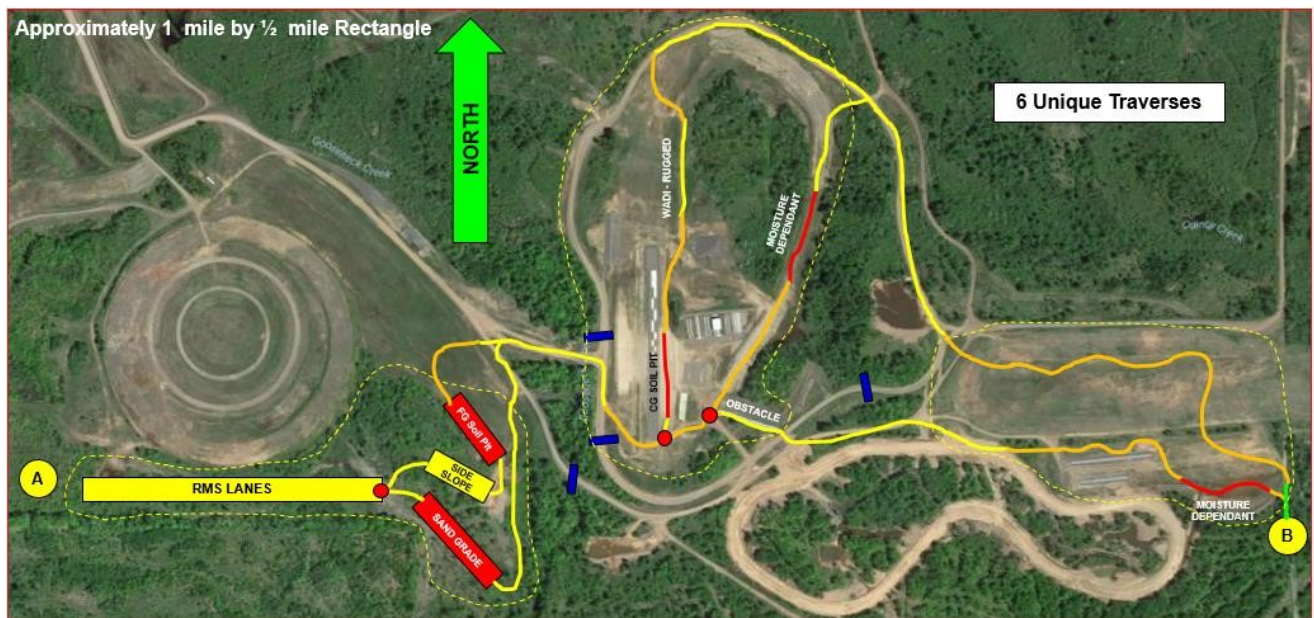
Discrete element modeling

What to expect

Comparative Testing

The purpose of the CDT is to demonstrate to participants the enhanced capabilities of NG-NRMM vs. NRMM. The Fuel Efficiency Demonstrator (FED-Alpha aka FED-A) developed by Ricardo, PLC was selected to be the NGNRMM CDT demonstration platform. The FED-A possesses a fairly substantial performance data set that is TARDEC owned and openly available. Commercial simulation software vendors will combine high resolution terrain data of the KRC test course with the vehicle data to complete mobility simulations. The FED-A will be instrumented and physically subjected to mobility maneuvers by KRC to obtain a vehicle behaviour data set that will be used to evaluate the predictive capability of current mobility software. The computer simulations from software developers will be shown that predict vehicle performance over a variety of events and terrains. Following these descriptions, the group will move outside to observe vehicles perform a subset of the same maneuvers over similar terrains. The different results predicted by legacy NRMM vs NG-NRMM will be emphasized.





Mission Loops on KRC Test Course

Event Summary

For three days, the NATO mobility committee members will assemble at the KRC to review the results of the software vendors. The KRC will be conducting test drives with the FED-A and a tracked vehicle on the same course used for the comparative testing. Attendees will be provided a first-hand review of vehicle behavior on relevant terrain to enhance simulation efforts. The event will be held outdoors on KRC's test course with presentations from the participating software vendors.

Please check www.mtu.edu/cdt/schedule for the most updated event agenda

Monday 24 September 2018, DAY 0

1500-1800 Registration and Social

Rozsa Center for the Performing Arts

Tuesday, 25 September 2018, DAY 1

Theme: Technology

0730	Registration and Transport to <i>Tent Site</i>	<i>KRC Main Building</i>
0830	Safety / Logistics Information	Scott Bradley
0845	Welcome	Jay Meldrum
0900	NATO Task Group and CDT Objective	Michael Hoenlinger
0945 **	Break	
1045 **	NG-NRMM Virtual and Physical Demonstration Plan	Ole Balling / Scott Bradley
1145 **	Thrust 1: Geospatial Terrain and Mobility Mapping	Matt Funk / Ryan Williams / Russ Alger
1230 **	Lunch	
1330 **	NG-NRMM Physical Demo / Walk-Around or Visit Booths	Scott Bradley, Lead
1530 **	Break	
1600 **	Thrust 2: Simple Terramechanics Model & Data	Michael McCullough
1645 **	Thrust 3: Complex Terramechanics Model & Data	Tamer Wasfy
1730	Summary and Tomorrow's Preview	Richard Gerth
1800	Transport to <i>KRC Main Building</i>	

Wednesday, 26 September 2018, DAY 2		Theme: Operational Scenario
0730	Registration and Transport to <i>Tent Site</i>	<i>KRC Main Building</i>
0830	Safety Brief	Jay Meldrum
0845	NATO Welcome	Christoph Mueller
0900	US DOD Welcome	Philip Perconti
0915	TARDEC Welcome	Paul Rogers
0930 **	History, Motivation, and Goals for NG-NRMM	David Gorsich
1000 **	Break	
1030 **	NG-NRMM Physical Demo / Walk-Around or Visit Booths	Scott Bradley, Lead
1230 **	Lunch	
1330 **	NG-NRMM Virtual Demonstration	Radu Serban, Lead
1500 **	Break	
1545	CDT Results and Vision for the Future	William Mayda
1630	Transport to <i>KRC Main Building</i>	
1800	Cocktail Hour	<i>Memorial Union Ballroom</i>
1900	Dinner Reception	
	After-Dinner Speaker	Richard Koubek, President, MTU

Thursday, 27 September 2018, Day 3		Theme: Future
0800	Registration and Transport to <i>Tent Site</i>	<i>KRC Main Building</i>
0900	Review of First Two Days and Plans for Today	Paramsothy Jayakumar
0930	Thrust 5: Uncertainty & Stochastic Mobility Maps	Nick Gaul / KK Choi
1015 **	Break	
1045 **	Thrust 6: NG-NRMM Verification and Validation	Ole Balling / Frederik Homaa
1145 **	NG-NRMM Standard	Michael McCullough
1215 **	Lunch	
1315	Software Developer Presentations	
	MSC	Military Vehicle Simulation with <i>Adams</i> : Mobility and Beyond
	CSIR	South African Mobility Prediction Software <i>MOBSIM</i>
	CM Labs	Real-Time Vehicle Simulation using <i>Vortex Studio</i>
	VSDC	Wheeled Vehicle Mobility Prediction using <i>NWVPM</i>
	AU	<i>ROAMS</i> , a Fast Running Mobility Simulator Utilizing GeoTIFF Terrain Maps
	ASA	<i>DIS</i> – A Complex Terramechanics Software Tool for Predicting Vehicle Mobility
1515	Break	
1545	Thrust 7: Gaps and Path Forward	Michael Bradbury / P. Jayakumar
1630	Open Discussion	All
1700	Conclusion of CDT; Transport to <i>KRC Main Building</i>	

** sign-up times available for traverse and terrain ride-alongs

Other Activities:

Traverse and Terrain Ride-Alongs: Sign-in Sheet
Exhibitor Booths
Soil Testing Exhibit
MSC Simulator in KRC Main Building

Monday, 24 September 2018

The Check-in Social will be held at the Rozsa Center for the Performing Arts. Appetizers and beverages will be served. Spouses are welcomed to attend.

If transportation is needed from your hotel to the Rozsa Center, call 906-487-2750 or visit www.mtu.edu/cdt/accommodations/transportation.

Tuesday, 25 September 2018

Parking, Bus Drop Off, and Check-In will be held in or near the KRC main building. All attendees will either park or be dropped off at the KRC main building. Transportation will be provided from the hotels to the KRC. Transportation will also be provided back to your hotel after the vehicle demonstrations.

Passenger vans will continuously transport attendees to and from the test course viewing area.

Wednesday, 26 September 2018

Parking, Bus Drop Off, and Check-In, will be held in or near the KRC main building. Transportation will be provided from the hotels to the KRC.

All other events (excluding the Hosted Reception) will be held at the KRC test course viewing area. Passenger vans will continuously transport attendees to and from the test course viewing area. Transportation will also be provided back to your hotel after the sessions.

The Hosted Reception will be held at the Memorial Union Building and will include a sit down meal with cash bar. Spouses are welcomed to attend.

If transportation is needed from your hotel to the Memorial Union Building, call 906-487-2750 or visit www.mtu.edu/cdt/accommodations/transportation.

Thursday, 27 September 2018

Parking, Bus Drop Off, and Check-In, will be held in or near the KRC main building. Passenger vans will continuously transport attendees to and from the test course viewing area. Transportation will be provided from the hotels to the KRC.

If transportation is needed to the airport, please call 906-487-2750.

Event Locations

Registration and Welcome Social

The Monday check in and social, on the 24th of September at 1600, and the sessions on the 27th of September at 0900, will be held at the Rozsa Center for the Performing Arts, located at 1400 Townsend Drive, Houghton, MI 49931.



Hosted Reception

The Wednesday night hosted reception, on the 26th of September at 1900 will be held at Memorial Union Building in the Ballroom, located at 1400 Townsend Drive, Houghton, MI 49931.



Location on Michigan Tech's Campus and Parking for the Registration and Welcome Social and Hosted Reception.



Main Events - KRC Main Building and Test Course

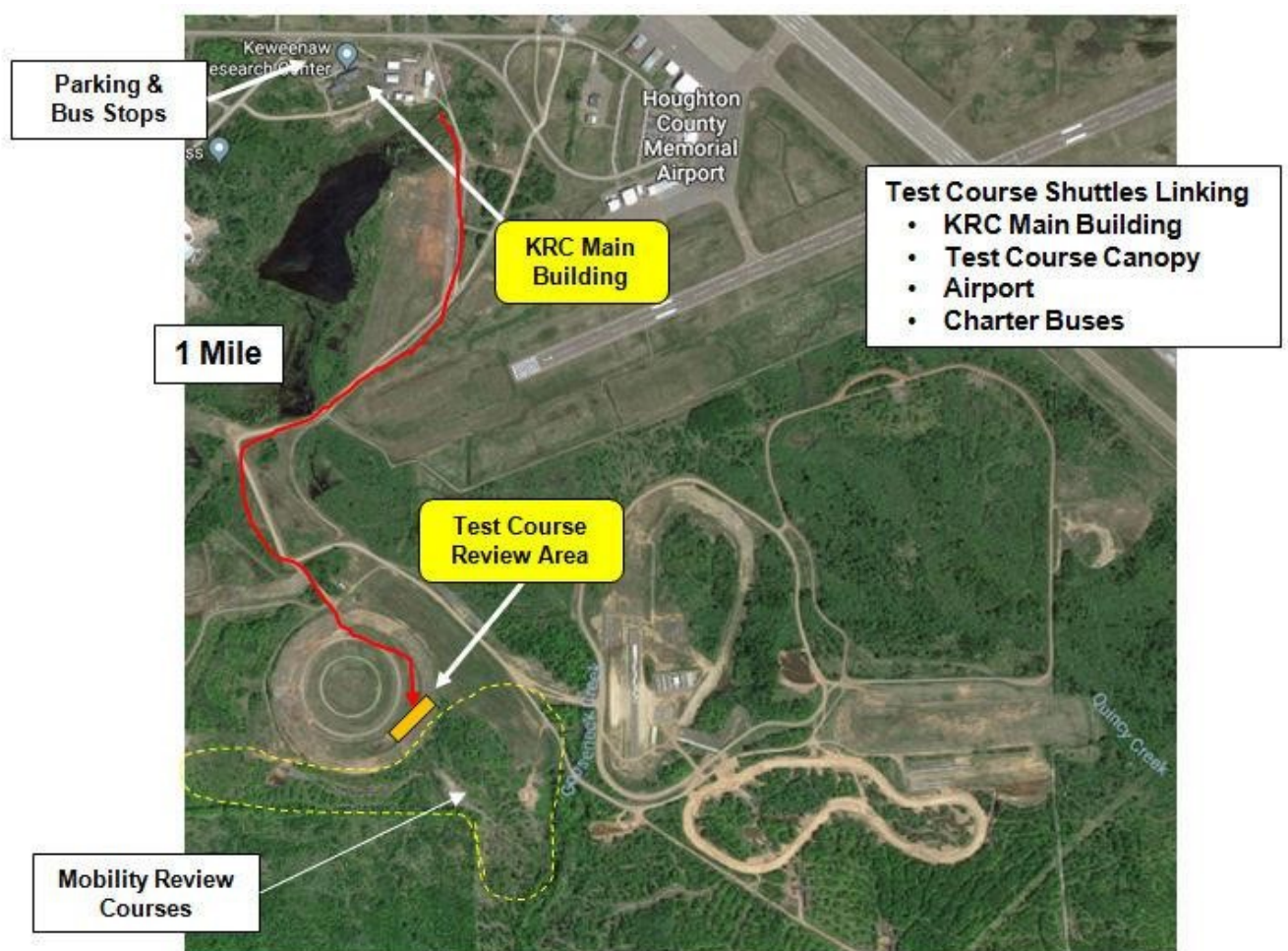
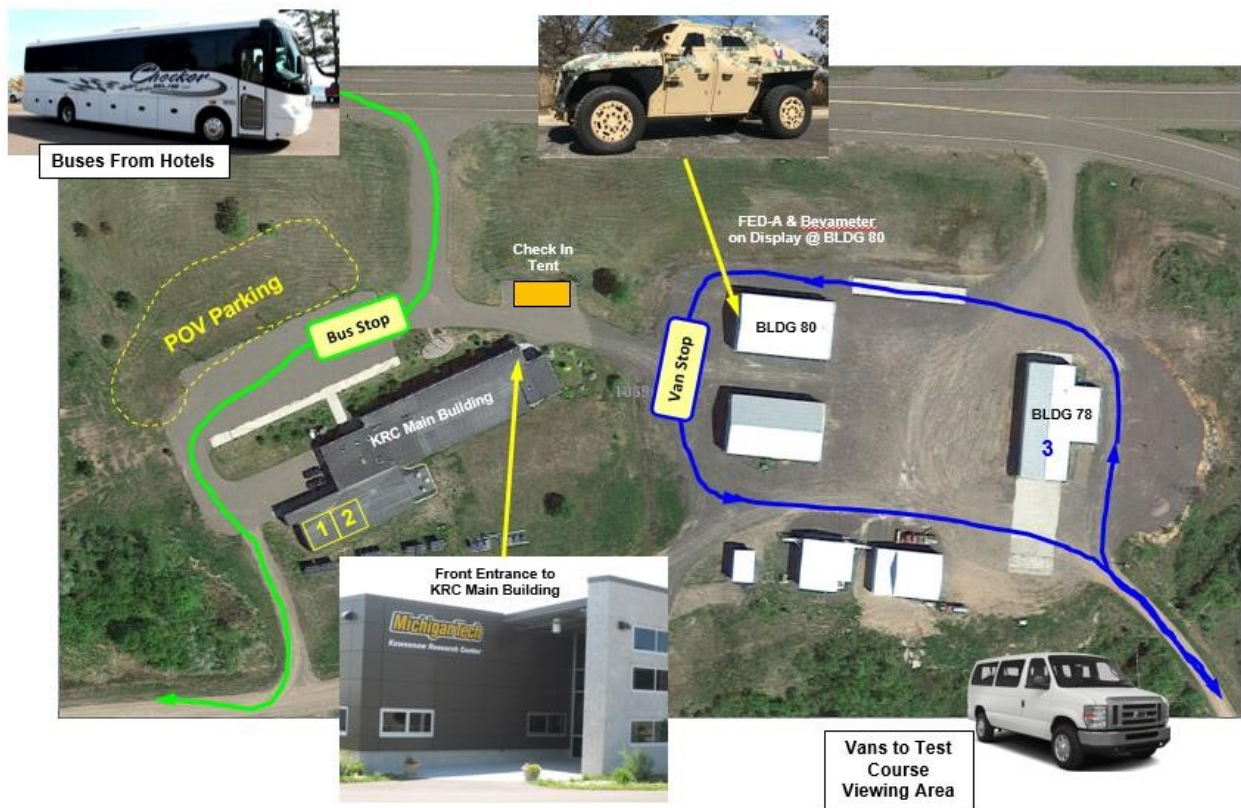
All other events will take place at the KRC located at 23620 Airpark Blvd., Calumet, MI 49913. Registration will be at the main KRC building. Transportation from the hotels to the KRC will be provided and parking is available for those who have their own or rented vehicles. Transportation from the KRC back to the hotels will also be provided from the main entrance of the KRC building.



In case of inclement weather, the sessions will be moved indoor into building 78 (shown on the map below).

Transportation to and from the parking and bus stop at the test course area will be provided from near the main entrance of the KRC building.





Details relating to the CDT will be continually updated through the KRC website: www.mtu.edu/cdt.

About the Facilities

The Keweenaw Research Center (KRC)

The KRC is a multidisciplinary research agency of Michigan Technological University (Michigan Tech) that is active across a broad spectrum of vehicle development. Originally established by the US Army for deep snow mobility testing, KRC has been involved in military, industrial, and commercial vehicle applications for over 60 years.

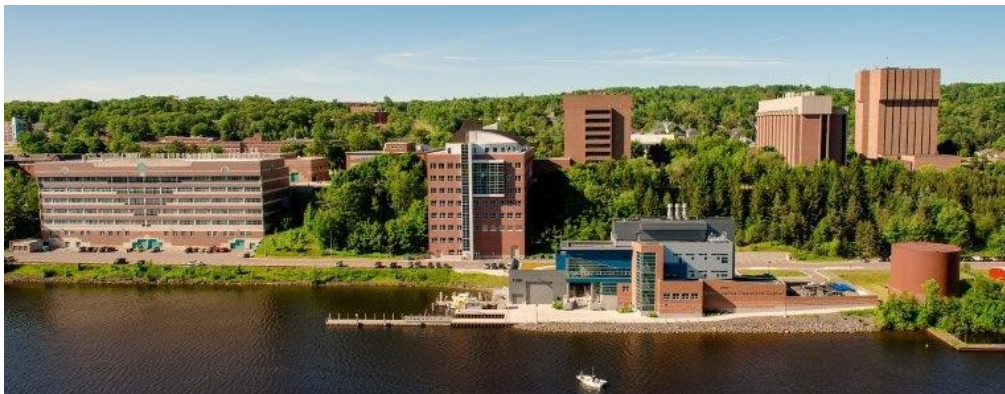
KRC maintains more than 900 acres of proving grounds specifically developed for the evaluation of ground vehicle systems. Along with this facility, MTU/KRC possesses the infrastructure and personnel to properly care for and evaluate vehicles and vehicular components.

As part of the University, Michigan Tech/KRC is a not-for-profit academic entity with an educational mission. Staffed by full time personnel, KRC draws upon the expertise & resources within the University community to provide diverse research and educational opportunities.



Michigan Technological University (Michigan Tech)

Michigan Tech is a public research university, home to more than 7,000 students from 60 countries around the world. Founded in 1885, the University offers more than 120 undergraduate and graduate degree programs in science and technology, engineering, forestry, business and economics, health professions, humanities, mathematics, and social sciences. Our campus in Michigan's Upper Peninsula overlooks the Keweenaw Waterway and is just a few miles from Lake Superior. Visit <http://www.mtu.edu> for more information on Michigan Tech.



Traveling to the Keweenaw Research Center

There are two flights per day directly into (afternoon and late night) and out of (early morning and afternoon) the Houghton/Hancock (CMX) Airport. You would fly through Chicago (ORD), the connecting hub, via United Airlines. Rental cars are available at the CMX airport from National Car Rental/Alamo Rent-A-Car.

Alternate options are flights from Detroit, MI (DTW) and Minneapolis, MN (MSP) to Marquette, MI (MQT), Rhineland, WI (RHI), and Iron Mountain, MI (IMT) via Delta Airlines; all followed by a two hour drive to Houghton, MI on a two-lane road. American Airlines also flies into Marquette, MI.

If transportation is needed from one of the alternative airport options to your hotel, call 906487-2750 for this special arrangement. If there is enough demand, a bus will be available.



Accommodations

Contact the hotels directly, prior to 30 July, 2018, to obtain the group rate using the group code:
NATO
CDT

American Lodge and Suites - Calumet
56925 South Sixth Street
Calumet, MI 49913
Phone: (906) 337-6463

Magnuson Copper Crown
235 Hancock Street
Hancock, MI 49930
Phone: (906) 482-6111

Country Inn & Suites by Carlson
919 Razorback Drive
Houghton, MI 49931
Phone: (906) 487-6700

Quality Inn & Suites Houghton, MI
215 Sheldon Avenue
Houghton, MI 49931
Phone: (906) 482-1400

Holiday Inn Express
1110 Century Way
Houghton, MI 49931
Phone: (906) 482-1066

Ramada Inn
99 Navy Street
Hancock, MI 49930
Phone: (906) 482-8400

Houghton Super 8
1200 E. Lakeshore Drive
Houghton, MI 49931
Phone: (906) 482-2240

Magnuson Franklin Square Inn
820 Sheldon Avenue
Houghton, MI 49931
Phone: (906) 487-1700
**Separate Group Code: 803122

Charter buses from area accommodations will be available each day for transportation to and from the various CDT venues. Ample parking for privately operated vehicles will be available at each of the CDT venues.

Visit www.mtu.edu/cdt/ for more information on the accommodations.

What to Bring

For registration, all participants and instructors will need to bring a passport or other form of identification. You will be issued a NATO AVT badge by the registrar. Dress will be casual with clothing suitable for field work. This includes a sturdy pair of boots. Both cool weather or rain are possible in Northern Michigan in September. Average highs are about 57F (14C) and lows of 40F (4C).

All attendees MUST bring proof of citizenship, with photo ID (passport or a driver's license w/birth certificate).

Expenses

Attendees are responsible for all travel and lodging expenses associated with their participation in the CDT. The hosted reception, breakfasts, and lunches will be provided by KRC and TARDEC. An early registration and welcome social will be the evening of 24 September on the campus of Michigan Tech at the Rozsa Center for the Performing Arts. All attendees are encouraged to attend the hosted reception on 26 September, on the campus of Michigan Tech at the Memorial Union Building as an opportunity to meet the AVT-308 members and fellow participants. Transportation will be available for all events.

Points of Contact

KRC Contact:

Scott Bradley

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