

Michigan Tech Aerospace Engineering Research Center (MARC)

Michigan Technological University

Annual Report FY2022

Director:

Greg Odegard – MEEM

Statement of Purpose

To establish Michigan Tech as a leader in aerospace engineering research and education

Mission Statement

The institute will serve as a focal point at Michigan Tech for activities related to Aerospace Engineering. Specifically, the institute will

- Enable world-class research
- Foster undergraduate and graduate educational programs

Membership

The criteria for membership in MARC is simple: Michigan Tech researchers who either supported the original proposal and/or are actively participating in the center. The current members are:

- Greg Odegard – Center Director (MEEM)
- Brad King (MEEM)
- Trisha Sain (MEEM)
- Paul van Susante (MEEM)
- Kazuya Tajiri (MEEM)

The members of MARC will be engaged through a regular strategic planning meeting in which we will discuss funding opportunities, resource utilization, IRAD return usage, and research collaboration. The goal of these meetings will be to use our resources in the best manner to facilitate the members' research success and the growth of aerospace engineering research at Michigan Tech. While no new members joined during the past year, the existing members have been successful in garnering new research funding under the center.

Major facilities/projects

Planetary Surface Technology Development Lab (PSTD), aka Huskyworks

- Director: Paul van Susante
- Location: MEEM 701A and Benedict Lab U112

Website: <http://www.huskyworks.space/>

Ultra-Strong Composites by Computational Design (US-COMP)

- Director: Greg Odegard
- Website: <http://www.us-comp.com/>

IRAD return usage

In FY 2022 MARC used IRAD return for the following items:

- Services (moving storage container for Van Susante Lab; Minerals and Materials) \$ 4,840

• Supplies	\$ 4,108
• Transfer to MSE – Shared Facilities Fee	\$ 1,000
<u>Total IRAD Expenditures</u>	<u>\$ 9,948</u>

Strategic planning

MARC is planning to invest funds in part-time staff support. With the rapid increase in grants coming through MARC, there is a need to have help with financial management. In particular, Paul van Susante has many grants, and he needs help in managing spending and balancing the budgets on the grants. We are currently prototyping an approach for using MEEM’s Coordinator of Research and Marketing (Donna Jeno-Amici) for this support. We currently are planning to cover 20% of her time in the 2022-23 AY for this task, but we will adjust this number if necessary.

Total Center Proposals Submitted & Awards Per FY

Number of proposals	11	13	12	20
Number of PI's who submitted	3	12	3	5
Total requested amount	\$1,354,629	\$4,347,348	\$6,823,005	\$7,322,017
Number of awards	5	7	7	10
Number of PI's who were awarded	2	2	1	3
Total award amount	\$5,117,712	\$4,165,912	\$1,310,043	\$3,694,966

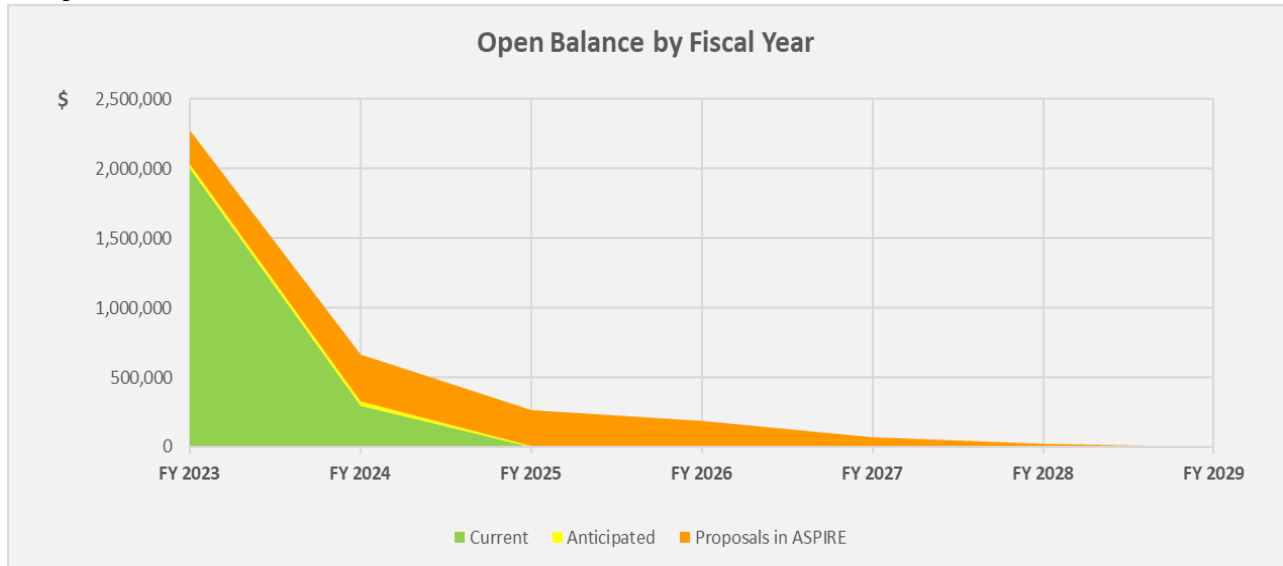
Source: MARC Awards and Proposals spreadsheet for report FY (requested from VPR, Manager of Business Systems)

IRAD Fund Income and Use Per Fiscal Year

		FY19	FY20	FY21	FY22	FY23
Expenditures						
	Services	\$0.00	\$0.00	\$0.00	\$4,840.00	
	Supplies	\$0.00	\$0.00	\$27,338.00	\$4,108.07	
	Equipment	\$0.00	\$5,000.00	\$0.00	\$0.00	
	Travel	\$0.00	\$0.00	\$0.00	\$0.00	
	Transfers Out	\$0.00	\$12,000.00	\$5,000.00	\$1,000.00	
	Designated Fund Fee	\$389.98	\$0.00	\$0.00	\$0.00	
	Total Expenditures	\$389.98	\$17,000.00	\$32,338.00	\$9,948.07	
Income						
	IRAD	\$27,121.10	\$29,128.03	\$26,800.53	\$57,351.67	
	PI Transfers	\$0.00	\$0.00	\$0.00	\$0.00	
	Other	\$0.00	\$0.00	\$0.00	\$0.00	
Total Income	\$27,121.10	\$29,128.03	\$26,800.53	\$57,351.67		
Carryforward	\$0.00	\$26,731.12	\$38,859.15	\$33,323.68		
End FY Balance		\$26,731.12	\$38,859.15	\$33,321.68	\$80,727.28	

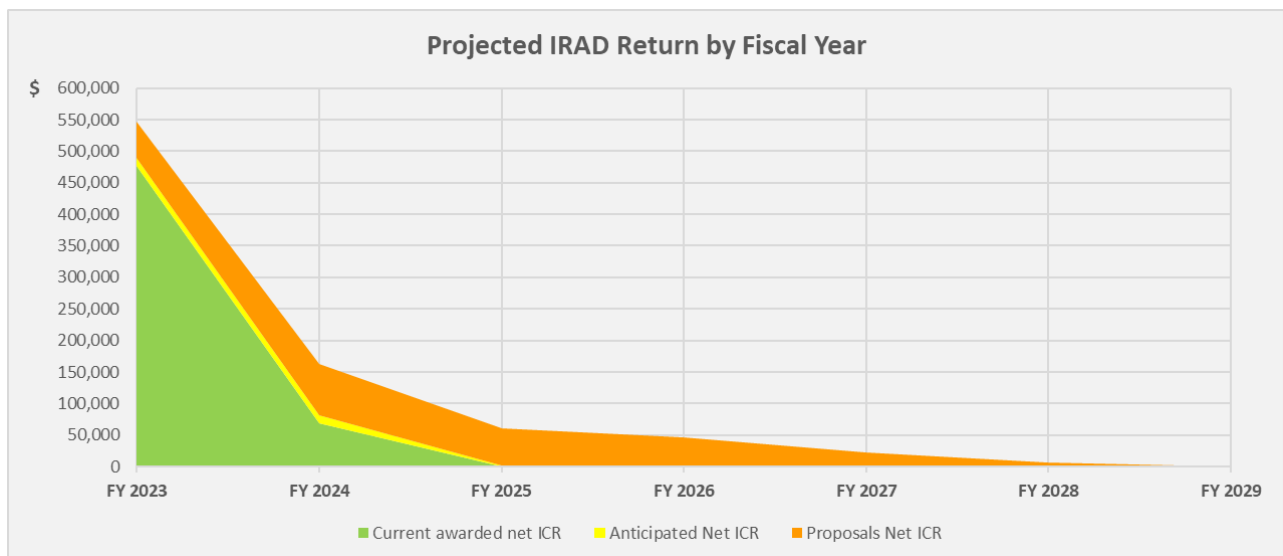
Source: WebFocus Financial Reports, Budget vs. Actual for index E35519, FY2022.

Projections



\$ by Fiscal Year (FY)	FY 2023	FY 2024	FY 2025	FY 2026	FY 2027	FY 2028	FY 2029	Total
Current	2,000,359	293,930	0	0	0	0	0	2,294,289
Anticipated	33,962	33,962	7,075	0	0	0	0	74,999
Proposals in ASPIRE	244,713	336,145	259,932	185,369	73,714	19,282	0	1,119,155

Source: ASPIRE MARC Research Projection Report (Open balance), accessed 9-28-22. Excludes projects starting in FY23.



Projected IRAD \$ by Fiscal Year (FY)	FY 2023	FY 2024	FY 2025	FY 2026	FY 2027	FY 2028	FY 2029	Total
Current awarded net ICR	477,247	69,358	0	0	0	0	0	546,605
Anticipated Net ICR	11,765	11,765	2,451	0	0	0	0	25,981
Proposals Net ICR	57,210	82,248	58,484	46,600	21,662	5,852	0	272,056

Source: ASPIRE MARC Research Projection Report (Open balance), accessed 9-28-22. Excludes projects starting in FY23.

Active Contracts FY 22

1607060	6/15/2017	6/15/2023
Odegard, Greg, (PI: MEEM); Pandey, Ravindra, King, Julia, Sain, Trisha National Aeronautics & Space Administration <i>"Institute for Ultra-Strong Composites by Computational Design (US-COMP)"</i>		
2005067P1	05/22/2020	05/31/2022
Odegard, Greg, (PI: MEEM) University of Massachusetts <i>"ICME Optimization of Advanced Composite Components of the Aurora D8 Aircraft"</i>		
1905027	9/3/2019	9/2/2021
Odegard, Greg (PI: MEEM) University of Massachusetts <i>"Multiscale Modeling of Advanced Fiber-Reinforced Thermoset Composites During Curing"</i>		
1803004	9/25/2019	10/19/2022
van Susante, Paulus (PI: MEEM) Honeybee Robotics Ltd <i>"RedWater: Extraction of Water from Mars' Ice Deposits"</i>		
2001030	2/14/2020	4/30/2021
van Susante, Paulus (PI: MEEM) National Institute of Aerospace <i>"T-Rex (Tethered - permanently shade Region EXplorer)"</i>		
1811081	10/15/2019	10/14/2024
van Susante, Paulus (PI: MEEM) University of Central Florida <i>"Center for Lunar and Asteroid Surface Science (NASA SSERVI CAN)"</i>		
2001052	7/1/2020	12/31/2022
van Susante, Paulus (PI: MEEM) Trans Astronautica Corporation <i>"NIAC Phase 2: Lunar Polar Mining Outpost"</i>		
2009010	5/1/2021	5/09/2023
van Susante, Paulus (PI: MEEM) National Aeronautics and Space Administration <i>"Percussive Hot Cone Penetrometer (PHCP) and Ground Penetrating Radar (GPR) for Geotechnical and Volatiles Mapping"</i>		
2101012	5/19/2021	11/19/2021
van Susante, Paulus (PI: MEEM) Trans Astronautica Corporation <i>"Lunar Water Extraction Techniques and Systems (WETS)"</i>		

2003066P2	7/08/2021	7/28/2022
van Susante, Paulus (PI: MEEM)		
National Aeronautics and Space Administration		
<i>"NASA GSD: Molten Regolith Electrolysis Technology Maturation"</i>		
2109018P1	5/01/2022	4/30/2024
van Susante, Paulus (PI: MEEM)		
Colorado School of Mines (NASA)		
<i>"Autonomous Lunar Landing Pad Site Preparation"</i>		
2111044P1	5/01/2022	4/30/2023
van Susante, Paulus (PI: MEEM)		
University of Michigan/Michigan Space Grant Consortium		
<i>"Lunabotics Competition Robot"</i>		
2203026P1	3/01/2022	2/28/2024
van Susante, Paulus (PI: MEEM)		
Ashwin-Ushas Corporation		
<i>"Thermal Control in Lunar Rovers and Structures with Novel Electrochromic Variable-Emissivity Skins"</i>		
2204050P1	4/18/2022	8/01/2022
van Susante, Paulus (PI: MEEM)		
Goodyear Tire & Rubber		
<i>"GM/Goodyear material testing in DTVAC"</i>		
2108009P1	9/01/2021	6/30/2022
Tajiri, Kazuya (PI: MEEM)		
ARCTOS Technology Solutions LLC		
<i>"2021-2022 Aerospace Propulsion Program"</i>		

Pending Proposals at close of FY 22

PROPOSAL NUMBER	DATE SUBMITTED	SPONSOR	PROPOSAL TITLE	START DATE	END DATE	AMOUNT	PI Name
2111022P1	02-NOV-21	National Aeronautics & Space Administration	Molecular Dynamics Modeling of Carbon-Carbon Composites	01-SEP-22	31-AUG-24	\$ -	Odegard, Greg
2204056P1	29-APR-22	University of Massachusetts	FMRG: ECO: Enabling the Manufacturability of the Next Generation of Fully Recyclable Wind Turbine Blades	01-SEP-22	31-AUG-26	\$ 285,406	Odegard, Greg
2206038P1	17-JUN-22	Aurora Flight Sciences Corp	IMA2GE: Intelligent Manufacturing with Accelerated Allowables GEneration	01-AUG-22	30-OCT-27	\$ 500,000	Odegard, Greg
2206070P1	09-JUN-22	National Aeronautics & Space Administration	Institute for Ultra-Strong Composites by Computational Design (US-COMP) Extension	01-SEP-22	31-AUG-23	\$ 1,999,774	Odegard, Greg
2206042P1	22-JUN-22	National Aeronautics & Space Administration	3D printing functionally graded nanocomposited for cryogenic applications	01-JAN-23	31-DEC-25	\$ 649,999	Abadi, Parisa
2108020P1	16-AUG-21	Gallegos Space Industries	Water and Regolith Processor (WARP)	01-APR-22	30-MAR-23	\$ 35,026	van Susante, Paulus
2111014P1	02-NOV-21	National Aeronautics & Space Administration	Wear Characterization and Design Optimization of Excavator Mechanisms for Long-Term Wear in Extreme Lunar Environments (NSTGRO for Marcello Guadagno)	22-AUG-22	29-AUG-25	\$ 240,000	van Susante, Paulus
2111067P1	15-NOV-21	Dynovas Inc	Motorless Extension Leveling Tracking Array System	01-JUN-22	01-MAY-24	\$ 32,172	van Susante, Paulus
2111069P1	15-NOV-21	Lunar Resources Inc	FarView - An In Situ Manufactured Lunar Far Side Radio Observatory	01-APR-22	30-MAR-24	\$ 32,056	van Susante, Paulus
2203008P1	03-MAR-22	Lunar Outpost	Design and Implementation Tools for Lunar Surface Regolith Structure Construction	01-JUN-22	30-JUN-23	\$ 65,112	van Susante, Paulus
2206033P1	16-JUN-22	Masten Space Systems	Low-Energy Additive Construction for the Moon and Mars	01-AUG-22	31-JUL-24	\$ 44,826	van Susante, Paulus
2203022P1	21-MAR-22	National Science Foundation	A new phase-field approach to model quasi-static and fatigue fracture in fiber reinforced polymer composites	02-DEC-22	30-NOV-25	\$ 438,032	Sain, Trisha
2204054P1	28-APR-22	US Dept of Defense	A Novel Unified Phase-field Fracture Model for Fatigue Damage in Fiber-reinforced Polymer Composites	01-DEC-22	30-NOV-26	\$ 699,110	Sain, Trisha
2109040P1	17-SEP-21	National Aeronautics & Space Administration	Electrostatic and Magnetic Size Separation and Beneficiation of Lunar Regolith	10-MAY-22	09-MAY-24	\$ 1,846,949	Eisle, Timothy C. (Chemical Engineering)