

**Agendum
Oakland University
Board of Trustees Formal Session
June 28, 2024**

**VEHICULAR WIRELESS COMMUNICATION TEST SYSTEM (ANTENNA CHAMBER)
A Recommendation**

- 1. Division and Department:** Academic Affairs, School of Engineering and Computer Science (SECS), Finance and Administration.
- 2. Introduction:** Oakland University was awarded \$3,000,000 for the proposal entitled, “Oakland University Vehicular Wireless Communications System Testing and Standards Facility” by the National Institute of Standards and Technology (NIST) within the United States Department of Commerce (DoC) through funding opportunity number 2023-NIST-RFA-CIPP-01 which is the 2023 Congressionally Identified Scientific and Technical Research Services (STRS). The proposal was submitted by Dr. Daniel Aloï as the Principal Investigator on behalf of the Applied EMAG and Wireless Lab at Oakland University with the intent to provide faculty, students, researchers, and industry personnel with state-of-the-art equipment to assess wireless communication performance on complex mobile platforms such as automobiles. The location of this equipment at Oakland University enables this new system to be utilized for research and training, which will create research opportunities for students and enable key partnerships to be made with industry, government entities, and other universities.

This new facility is a spherical near-field antenna measurement system capable of measuring both on-vehicle antenna and wireless system (antenna plus radio) in the frequency ranges from 600 MHz to 18 GHz for a variety of vehicle platforms. The principal components of this system include: 1) Vehicle Level Radio Frequency Chamber; 2) Position System to gather measurements over a hemi-spherical surface (Fixed arch with multiple probes, turntable, and vehicle lift); 3) Radio Frequency Equipment (vector network analyzers, signal generators, cellular call box, and channel emulators); and 4) Data collection and processing segment that includes a data acquisition system and an analysis workstation to operate the position controllers and radio frequency equipment.

This facility will be housed in the SECS Research and Innovation Center (RIC) located at 2871 Research Drive in Rochester Hills, Michigan.

The total cost for the Vehicular Wireless Communication Test System is estimated to be \$4,300,000. \$3,000,000 of which will be dedicated to the purchase of the turnkey system and is funded from the Federal NIST grant. \$1,300,000 will be used for the structural modifications required to the RIC building in order to accept this new facility, this will be funded from existing recourses within SECS and an internal loan from the University.

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The project timeline is July 2024 – January 2026. A business plan was provided for SECS to repay this loan (including interest) within 10 years from revenue generated from research grants, training, and industry test fees. The estimated construction costs were developed by the office of Capital Planning, Design and Construction working with the Smith Group to generate architectural drawings and Clark Construction providing a budgetary quote. The plan is to use Clark Construction for the construction contract as they are the contractor that performed the renovation work at 2871 Research Drive.

A competitive bidding process managed by OU's Purchasing Department was conducted. Representatives from SECS and Purchasing were on the selection committee. A total of 5 companies provided bid responses. As a result of the extensive review process, it was determined that AeroGT Labs' bid provided significantly more capability for the \$3,000,000 available through the federal award.

- 3. Previous Board Action:** None.
- 4. Budget Implications:** \$3,000,000 contract to AeroGT Labs to be funded from active Federal NIST grant and approximately \$1,300,000 construction costs to be funded from existing resources within SECS and an internal OU loan to be repaid with interest of 4.25% over 10 years or less with incremental revenue earned from the Wireless Communication Test System.
- 5. Educational Implications:** The new system to be utilized for research and training, which will create research opportunities for students and enable key partnerships to be made with industry, government entities, and other universities.
- 6. Personnel Implications:** None.
- 7. University Reviews/Approvals:** This recommendation was formulated by the Director of Research SECS, the Dean SECS, and reviewed by the Purchasing Department, Office of Legal Affairs, Vice President for Finance and Administration, and President.
- 8. Recommendation:**

RESOLVED, that the Board of Trustees approves the selection of AeroGT as the vendor for the Vehicular Wireless Communication Test System; and, be it further

RESOLVED, that the Board of Trustees approves the construction project necessary to fully implement the system within the RIC; and, be it further

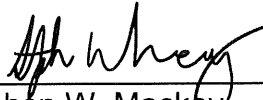
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RESOLVED, that the Board of Trustees authorizes the President, the Vice President for Finance and Administration, and their respective designees, to perform all acts and deeds and to execute and deliver all contracts, instruments and documents required by this resolution that are necessary, expedient and proper in connection with the work; and, be it further

RESOLVED, that said contracts, instruments and documents shall be reviewed by and be in a form acceptable to the Vice President for Legal Affairs and General Counsel prior to execution, and be in compliance with the law and with University policies and regulations and conform to the legal standards of the Vice President for Legal Affairs and General Counsel.

9. Attachment: SECS Presentation.

Submitted to the President
on 6/19, 2024 by



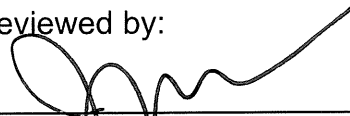
Stephen W. Mackey
Vice President for Finance and Administration
and Treasurer to the Board of Trustees

Recommended on 6/21, 2024
to the Board of Trustees for Approval by



Ora Hirsch Pescovitz, M.D.
President

Reviewed by:



Joshua D. Merchant, Ph.D.
Chief of Staff and
Secretary to the Board of Trustees

Agendum:
OU Vehicular Wireless Communications Systems Testing
and Standards Facility

28 June 2024

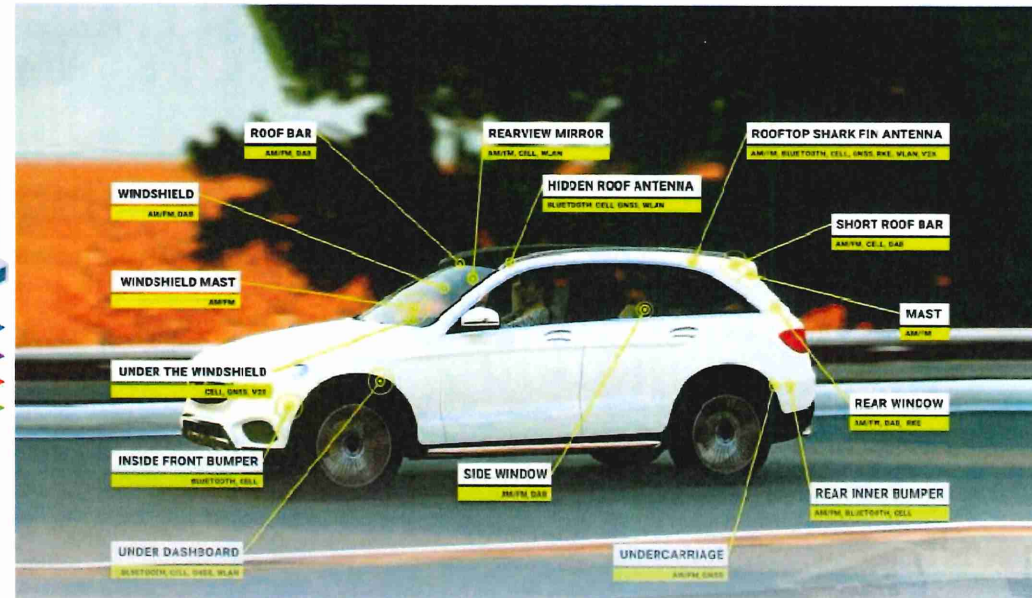
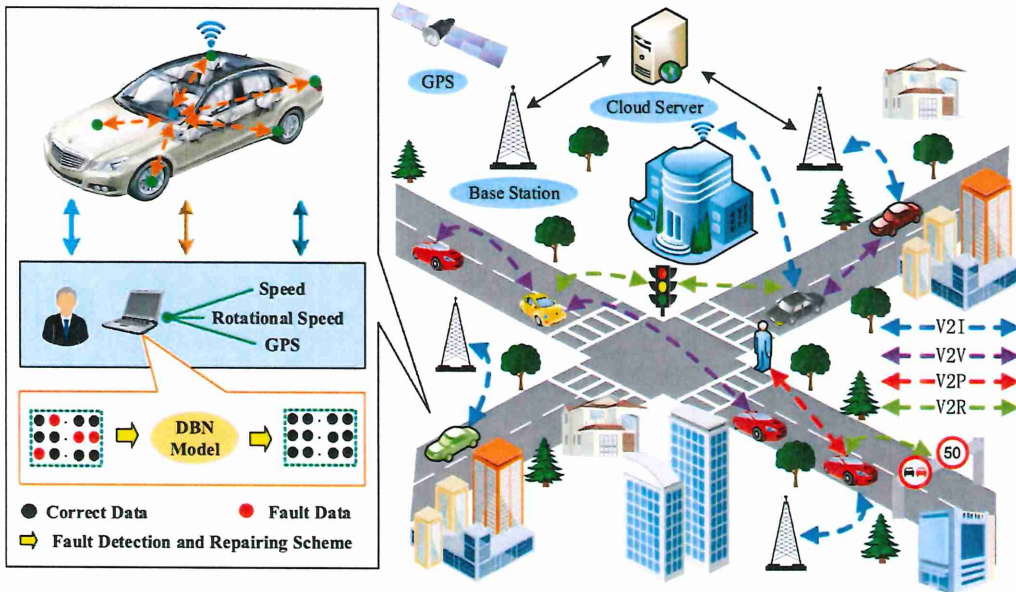
Daniel N. Aloï, Ph.D.

School of Engineering and Computer Science
Electrical and Computer Engineering Department
Applied EMAG and Wireless Lab

Outline

- Background
- Vehicular Wireless Communication Test System
- Capabilities and Impact
- Budget Implications
- Construction Loan Payback

Wireless Connectivity



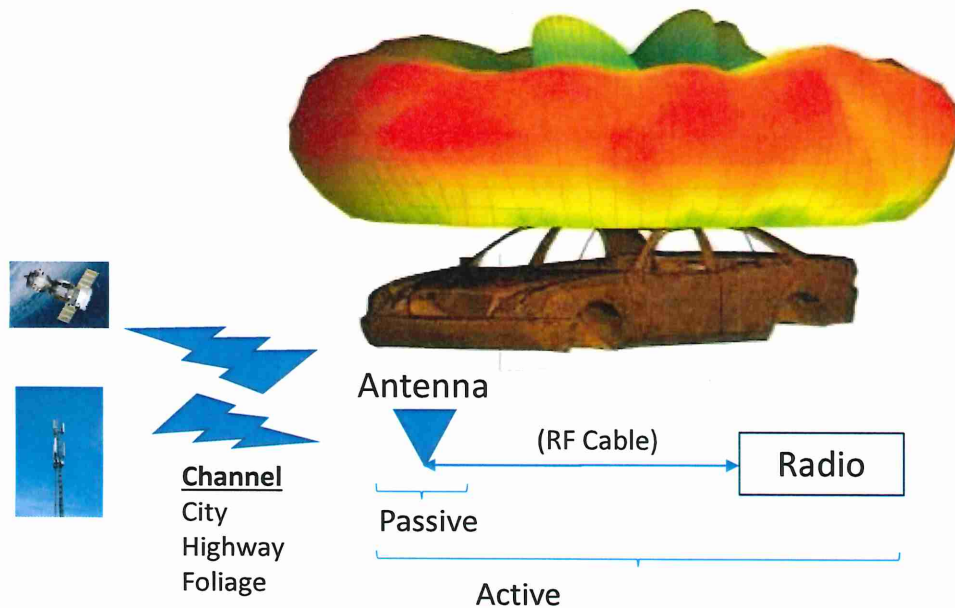
ICV: One of the most important integrated wireless system
Connectivity is the key enabler for in-car experiences

OU Vehicular Wireless Communications System Testing and Standards Development Facility



System Capabilities	
Max AUT:	5m (L) × 2m (W) × 2m (H)
Chamber size:	14m (L) × 12m (W) × 7.9m (H)
Freq:	A: 0.6~ 18GHz
Door:	3m × 3m
Turntable:	6m
AUT weight:	5t
Max Lift height:	1.8m
Turntable resolution:	0.1°
Turntable location accuracy:	±0.015°
Test radius:	4m
Probe No.:	12 (0.6-8GHz)+12 (6-18GHz)
Theta test range:	0° ~120°
Probe resolution:	0.1°
Probe location accuracy:	±0.015°

Passive and Active Measurements



Performance Metrics

➤ Antenna

- Radiation Pattern Shape and Intensity
- Polarization
- Gain or Directivity
- Efficiency

➤ Wireless System

- Radiated Power
- Minimum Sensitivity
- Co-Existence
- Throughput

National Impact

Intellectual Merit

- **First Automotive MIMO Cellular 5G MIMO OTA Test System in North America.**
- **Work Force Development** to produce new talent and up-skill and re-skill existing engineers.
- Enables **Research** in antenna design, antenna measurements, and wireless systems.
- **Industry Standards Development**

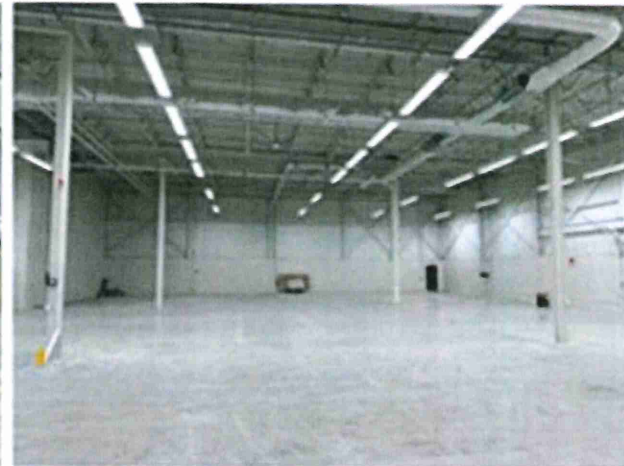
Broader Impacts

- Advances research in vehicle connectivity and autonomy.
- Contributes to our continued effort in graduate and undergraduate curriculum development and research training.
- Enhances our existing outreach programs to K-12 students, including underrepresented groups.
- Economic Impact to National Automotive Industry by having access to unique test capability.

Location – SECS Research and Innovation Center



(a)



(b)

Figure 6. (a) Exterior view of the SECS Research and Innovation Center and (b) Interior view of RIC where vehicle-level measurement system will be placed.

Budget Implications

- **Equipment Cost - \$3M**

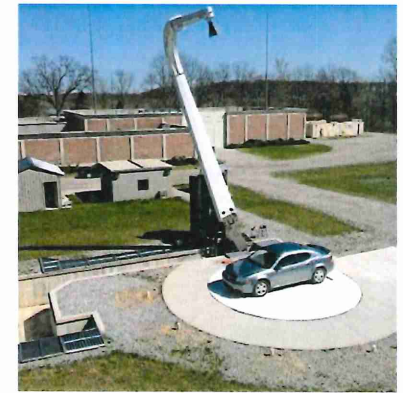
- OU Purchasing Department conducted a competitive bid in which five companies responded.
- AeroGT Labs was selected to provide the Vehicle-Level Wireless Communication Test System based on the most capability for the \$3M.
- Federal grant covers the \$3M cost.
 - Construction costs not allowed

- **Construction Loan Cost - \$1.3M**

- OU Capital Planning and Design contracted the Smith Group to provide architectural drawings for Clark Construction to provide a budgetary cost estimate.
- Clark Construction renovated 2871 Research Drive and will be retained for the new construction contract.
- Major items include:
 - Exterior garage door, Stormwater Improvements, Electrical transformer (400 V), Drywall around vehicle chamber, Electrical, Fire Suppression, and HVAC connections to the chamber, and re-routing of all ductwork and lights above chamber to maximize height to rafters.

Business Case Analysis – Loan Payback

- **The facility will be “branded” as a general test lab to secure industry and government fees.**
 - A menu of services with test rates for external and internal users.
 - Industry certifications for ISO 17025, CTIA, and 3GPP will be obtained.
- **OU faculty receiving grants that require facility use will include line items in their budgets.**
- **Applied EMAG and Wireless Lab has conducted industry testing for vehicle-level antenna pattern measurements since 2008.**
 - Over 65 companies have tested at OU
 - \$2.5M in test fees have been collected
 - Reputation, business relationships and business processes are in place (marketing, price quotes, testing, invoice, collections, front-end agreement, NDAs, etc.)
- **Loan payback comes from outside test revenue.**
 - A menu of services will be established with test rates for external and internal users.
 - All testing goes through the lab.



Business Case Analysis – Projected Expenses

	2026	2027	2028	2029	2030	2031	2032
A. PERSONNEL							
1. Director - Faculty PI	\$ 54,999	\$ 56,649	\$ 58,348	\$ 60,099	\$ 61,902	\$ 63,759	\$ 65,672
2. Technician #1 (Antenna Measurements)	75,000	77,250	79,568	81,955	84,413	86,946	89,554
3. Secretary (Half-time)	18,000	18,540	19,096	19,669	20,259	20,867	21,493
4. M.S. Student #1 (Fall, Winter, Summer)	22,000	22,660	23,340	24,040	24,761	25,504	26,269
SUB-TOTAL	\$ 169,999	\$ 175,099	\$ 180,352	\$ 185,762	\$ 191,335	\$ 197,075	\$ 202,988
B. FRINGE RATES							
1. Director - Faculty PI (2.45%)	\$ 4,400	\$ 4,532	\$ 4,668	\$ 4,808	\$ 4,952	\$ 5,101	\$ 5,254
2. Technician #1 (Antenna Measurements) - (48.4%)	36,300	37,389	38,511	39,666	40,856	42,082	43,344
3. Secretary (48.4%)	8,712	8,973	9,243	9,520	9,805	10,100	10,403
4. M.S. Student #1 (0.0%)	-	-	-	-	-	-	-
SUB-TOTAL	\$ 49,412	\$ 50,894	\$ 52,421	\$ 53,994	\$ 55,614	\$ 57,282	\$ 59,000
C. EXPENSES - DIRECT COSTS							
1. Travel	\$ 7,000	\$ 7,000	\$ 7,000	\$ 7,000	\$ 7,000	\$ 7,000	\$ 7,000
2. HW Maintenance	25,000	25,000	25,000	25,000	25,000	25,000	25,000
3. Software Licenses	25,000	25,000	25,000	25,000	25,000	25,000	25,000
4. Supplies and Materials	10,000	10,000	10,000	10,000	10,000	10,000	10,000
5. Marketing	18,000	18,000	18,000	18,000	18,000	18,000	18,000
SUB-TOTAL	\$ 85,000	\$ 85,000	\$ 85,000	\$ 85,000	\$ 85,000	\$ 85,000	\$ 85,000
D. EXPENSES - NO DIRECT COSTS							
1. Student Tuition #1	\$ 14,400.00	\$ 14,832.00	\$ 15,276.96	\$ 15,735.27	\$ 16,207.33	\$ 16,693.55	\$ 17,194.35
SUB-TOTAL	\$ 14,400	\$ 14,832	\$ 15,277	\$ 15,735	\$ 16,207	\$ 16,694	\$ 17,194
E. TOTAL DIRECT COSTS	\$ 304,411	\$ 310,993	\$ 317,773	\$ 324,756	\$ 331,949	\$ 339,357	\$ 346,988

Business Case Analysis – Projected Loan Payback Schedule

Antenna Facility						
Summary of Financial Projections						
	Scenario 1 (low)		Scenario 2 (Nominal)		Scenario 3 (High)	
OU Loan Amount	\$ 1,300,000	Payback 11 yrs	\$ 1,300,000	Payback 7 yrs	\$ 1,300,000	Payback 6 yrs
Income	\$ 360,000	5% annual growth	\$ 450,000	4% annual growth	\$ 540,000	3% annual growth
	Loan Balance		Loan Balance		Loan Balance	
	Year	Amount	Year	Amount	Year	Amount
	Year 0	\$ (1,300,000)	Year 0	\$ (1,300,000)	Year 0	\$ (1,300,000)
	Year 1	\$ 1,267,049	Year 1	\$ 1,195,049	Year 1	\$ 823,049
	Year 2	\$ 1,220,091	Year 2	\$ 1,067,091	Year 2	\$ 638,749
	Year 3	\$ 1,162,626	Year 3	\$ 928,788	Year 3	\$ 446,880
	Year 4	\$ 1,093,998	Year 4	\$ 779,661	Year 4	\$ 247,215
	Year 5	\$ 1,013,515	Year 5	\$ 619,209	Year 5	\$ 39,520
	Year 6	\$ 920,446	Year 6	\$ 446,910	Year 6	\$ -
	Year 7	\$ 814,019	Year 7	\$ -	Year 7	\$ -
	Year 8	\$ 693,420	Year 8	\$ -	Year 8	\$ -
	Year 9	\$ 557,791	Year 9	\$ -	Year 9	\$ -
	Year 10	\$ 406,224	Year 10	\$ -	Year 10	\$ -

Questions?

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