

CONNECTED VEHICLES- INFRASTRUCTURE UTC:

Twelve
Month
Update
and
Review



MORGAN
STATE UNIVERSITY



RESEARCH FUNDING

- **The Spring Research Call ended in just under \$1.2M spent on 8 research projects.**
- **Two-thirds of the projects funded were from VTTI.**
- **One UVA project was funded.**
- **One Morgan State project was funded.**
- **One collaborative project was funded (UVA and Morgan State).**
- **Half of the projects have a graduate student in a lead research position.**

RESEARCH FUNDING

- Overall, a little over \$2.6M has been spent on research for the two research calls in 2012-2013.
- This equates to about 58% of the total UTC fund has been spent on research.
- With the additional funding acquired from RITA in Nov. 2012, two similar research calls could take place between 2013-2016 funding an additional 16-18 projects at around \$150K each.
- This also depends on Equipment, Education, and Outreach needs during that same time period.

FUNDED RESEARCH PROJECTS

| Research Projects: | Primary Investigator | School | Secondary Investigator(s) | School | Budget/Funding |
|---|--------------------------------|---------------|---|---------------|-----------------------|
| Connected Motorcycle Crash Warning Interfaces | Zac Doerzaph | VTTI | Shane McLaughlin | VTTI | 166,025.00 |
| Connected Motorcycle System Performance | Reginald Viray | VTTI | Zac Doerzaph & Shane McLaughlin | VTTI | 149,604.00 |
| Developing and Evaluating a Smartphone Application Aimed at Reducing Crashes Involving Motorcycles and Bicycles | Arash Jahangiri | VTTI | Hesham Rakha & Tom Dingus | VTTI | 149,999.00 |
| Develop and Test Connected Vehicle Freeway Speed Harmonization Systems | Hao Chen | VTTI | Hesham Rakha | VTTI | 150,001.00 |
| Reducing School Bus/Light-Vehicle Conflicts Through Connected Vehicle Communications | Darrell Bowman | VTTI | Andy Shaudt | VTTI | 150,000.00 |
| Next Generation Transit Signal Priority with Connected Vehicle Technology | Byungkyu (Brian) Park & Jia Hu | UVA | Young-Jae Lee | Morgan | 149,861.00 |
| Prototyping and Evaluating a Smart Phone Dynamic Message Sign Application in the CVI-UTC Testbed | Brian Smith | UVA | Jiaqi Ma | UVA | 110,481.84 |
| Measuring User Acceptance of and Willingness to Pay for CVI Technology | Hyeonshic Shin | Morgan | Michael Callow, Young-Jae Lee & Andrew Farkas | Morgan | 149,733.00 |
| | | | | | 1,175,704.84 |

RESEARCH PROJECT NEEDS

"Motorcycle Crash Warning" Doerzaph/McLaughlin:

- Estimated test time June - December 2013
- Need Smart Road Time
- Need 2 CV light vehicles
- Need 2 CV motorcycles
- Will have outside participant data

"Motorcycle System Performance" Viray/Doerzaph/McLaughlin:

- Estimated test time June - October 2013
- Need Smart Road Time
- Will do NRV testing off testbeds
- Need 2 CV light vehicles
- Need 2 CV motorcycles
- Will have outside participant data

"Smartphone App Motorcycles/Bikes" Jahangiri/Rakha/Dingus:

- Estimated test time January - July 2014
- Unsure of needs; but fairly sure no testbed or vehicle requirements
- Does not need outside participants

"Freeway Speed Harmonization" Chen/Rakha:

- Estimated test time June - December 2013
- Need NOVA test bed
- Need 1-2 vehicles (at least 1)
- Might use outside participants

"School Bus/Light Vehicles" Bowman/Schaudt:

- Estimated test time August - December 2013
- Need VIR Time
- Need 1-2 vehicles (at least 1)
- Need 1 motorcoach/bus
- Will have outside participant data

"NextGen Transit Signal Priority" Park/Hu/Lee (UVA/Morgan State):

- Need to determine time frame, estimate Summer 2013
- Need NOVA test bed
- Need Smart Road Time
- Need 2-3 motorcoaches/buses
- Does not need outside participants

"Smartphone DMS" Smith/Ma (UVA):

- Estimated test time October - December 2013
- Need NOVA test bed
- Need 1-2 vehicles (at least 1)
- Will have outside participant data

"User Acceptance and Willingness to Pay" Shin/Callow/Lee/Farkas (Morgan State):

- Estimated test time January-April 2014
- Need NOVA test bed
- Need 1-2 vehicles (at least 1)
- Will have outside participant data

EQUIPMENT PURCHASED

- **What was purchased?**
 - **65 Savari OBEs (\$117K).**
 - **3 DGPS Units (\$24K).**
 - **220 DAS units (\$500K).**
 - **Smart Road Control Center Equipment and Server Upgrades for Research Data. (\$5K)**
 - **Just under \$1.2M has been invested in equipment, funded through VDOT cash match for purchase and RSE installation.**
 - **This initial estimate is higher when labor costs are factored in for installation and development.**

EQUIPMENT INSTALLATION AND TESTING

■ Smart Road:

- 11 RSE units will be active on the Smart Road (red dots).
- 3 have the ability to be mobile units, and are able to be adjusted per research project.
- Current Challenge: Complete installation and begin research.
- Estimated Completion: End of January.



EQUIPMENT INSTALLATION AND TESTING

■ Northern Virginia:

- **Phase 1:** 8 RSEs will be installed on I-66 (October 2012).
- **Phase 2:** Routes 29 and 50 (est. 18 RSEs; Fall 2012).
- **Phase 3:** Gallows Road and I-495 (est. 18 RSEs).
- **Current Challenges:**
 - Major construction on Gallows and I-495
 - Cox, Verizon, and Comcast updating communication cable
 - Finding opportune times to install because of traffic
- **Estimated Completion:** February/March (at the latest).
 - But research can still occur on the different roads at earlier completion times because of the phased roll-out schedule.
 - Also with plans for mobile RSE trailers, research can still take place without a fully installed testbed – especially in locations with unique infrastructure attributes.

EDUCATION

- Here are the current Short Courses that will be continued to be adapted and developed through 2013:
 - *The Cost-Benefit Analysis of Connected Vehicles (Schaudt/Medina; VTTI)*
 - *Development, Testing, and Verification of Algorithms that Trigger Warnings/Countermeasures in Vehicles (Perez; VTTI)*
 - *Connected Vehicles and the Environment (Rakha; VTTI)*
 - *Modeling of Connected Vehicle Applications (Rakha; VTTI)*
 - *Cooperative Adaptive Cruise Control Systems (Rakha; VTTI)*
 - *An Introduction to CVI Technology to Improve Safety (Medina; VTTI)*
 - *An Introduction to CVI as a Workshop and Distance Learning Practicum (Park; UVA)*
 - *CVI Technology for Roadway Health Assessment and Road Monitoring (Flintsch; VTTI)*
 - *Various Optimization Techniques and Optimal Control Theory for CVI Applications (Kishore; VTTI)*
 - *Artificial Intelligence, Game Theory, and Various Soft Computing Techniques for CVI Applications (Zohdy; VTTI)*

EDUCATION

- **Each Short Course will cost \$20K for a total of \$200K currently invested in the short course program.**
 - **There has been no additional short courses proposed at this time – maybe a spring call?**
 - **We can look into a second call for short courses this spring to fund in the 2013-14 academic year, and devote another \$200K for education.**
 - **We would like to see additional consortium participation and anticipate this will occur upon research completion this spring.**
 - **We could also consider using education funding to bring in relevant and useful outside “guest lecturers” from other universities, organizations, and CVI industry to perform 1 to 2.5 day “short courses”?**

UPCOMING PLANNED OUTREACH 2013

- **ITS America in Nashville, TN (April 2013)**
 - Booth only
- **CUTC Summer Meeting in Memphis, TN (June 2013)**
- **Do we want to have participation in the Automated Vehicle Conference sponsored by TRB in Stanford, CA (July 2013)?**
- **Individual consortium schools outreach projects with local community members.**
- **We will also again seek to apply for to be the CUTC Summer Meeting host school in 2015.**

UPCOMING CHALLENGE: RESEARCH

■ Third Research Call (June 2013?):

■ Who to call?

- Do we still want to consider outside consortium applicants and how do we target them?

■ Should we hold another call?

- Or do we want to expand upon the 18 currently funded projects,
- Revise old submissions from the past two research calls,
 - There is a collection of 12 advisory board highly-ranked older submissions that may do well as “insta-submissions” because of the current work being done/completed and the testbed finalization and progression by the time the research would be up for review.

UPCOMING CHALLENGE: EQUIPMENT

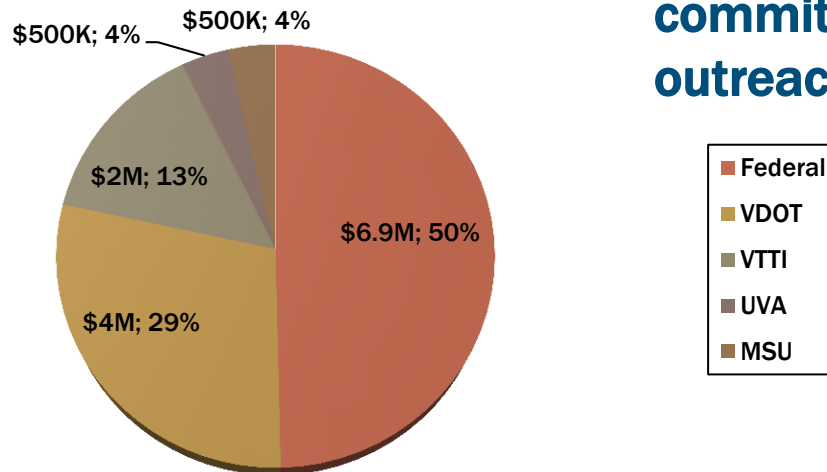
- **Installations for the available vehicles to be highly instrumented for research**
 - 2 motorcycles, 6 light vehicles and the motorcoach and the semi-truck for an initial fleet of 10.
- **Installation and customization of OBEs and DAS**
- **Resource Sharing during research Spring 2013**
 - Using vehicles for research in NOVA
 - Allowing all researchers access to equipment in a timely manner
 - We can work directly with Ray Resendes on this; initial discussion of housing the fleet vehicles at VT Arlington parking garage because of high security levels and close proximity to I-66

UPCOMING CHALLENGE: FUNDING & REPORTS

- **Additional 2013 Funding a Success!**
 - Funds were delivered from RITA to VTTI during TRB for a project total of \$13,897,600 (with consortium cost share).
- **Applying for 2014-16 UTC grant.**
 - Funding will decrease from \$3.5M to 1.5M for two years (with possibility of an additional \$1.5M to be offered if available on the successive year).
 - CVI-UTC will remain a Tier 1 UTC.
 - Due March 19, 2013

FUNDING GRAPHS & CHARTS

CVI-UTC Funding Sources

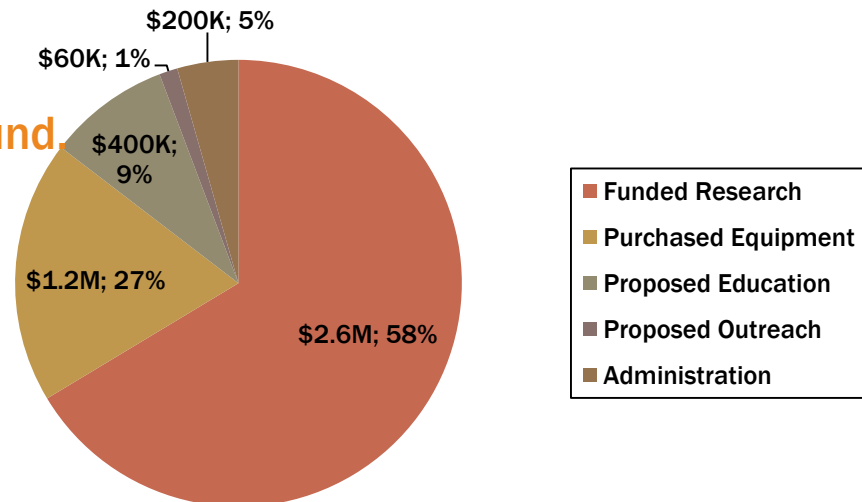


About \$4.46M of funding is currently committed to various UTC projects of research, outreach and education.

This commits about 32% of the initial \$13.9M fund.

(However, this “spent percent” could be higher, maybe closer to 45% funds committed, since cost-matching funds are not all spendable dollars.)

Used Funds as of Winter 2013



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