Smart Vehicle Concepts Center (SVC)

A National Science Foundation

Industry-University Cooperative Research Center

THE OHIO STATE UNIVERSITY

www.SmartVehicleCenter.org

Annual Newsletter

December 2020 Issue

SVC Companies	Status
American Axle and Manufacturing	Former Member
Advanced Numerical Solutions	Former Member
Army Research Laboratory	Former Member
Autoliv	**Current Member**
Battelle Memorial Institute	**Current Member**
BorgWarner	Former Affiliate
Bridgestone Americas Tire Operations, LLC	Former Member
Eaton Innovation Center	Former Member
Edison Welding Institute	Former Member
Ford Motor Company	Former Member
F.tech R&D*	Former Member
Goodyear Tire & Rubber	Former Member
Honda R&D Americas Inc.*	**Current Member**
Hyundai-Kia Motors*	Former Member
LMS Software	Invited Observer
MIT Lincoln Laboratory	Former Member
Moog Inc.	**Current Member**
MSC Software	Invited Observer
NASA Glenn Research Center **	**Current Member**
Owens Corning	Former Member
Parker Hannifin	**Current Member**
REL, Inc.	Former Member
Romax	Invited Observer
Solidica	Former Member
Tenneco, Inc.	Former Member
The Boeing Corporation	Former Member
Tokai Rubber	Former Member
Toyota Research Institute, Inc. *	**Current Member**
Transportation Research Center, Inc.*	Former Member
YUSA	Former Affiliate

**Multiple memberships **Member and Invited Observer*

Mission

The mission of the Smart Vehicle Concepts Center (SVC) is as follows: (1) conduct basic and applied research on **smart materials and structures** applied to ground and aerospace vehicles; (2) build an **unmatched base of research**, engineering education, and technology transfer with emphasis on improved vehicle performance, unprecedented safety improvements, and enhanced vehicle efficiency; and (3) prepare **next-generation engineers** at the PhD and MS levels who possess both theoretical and experimental expertise applicable to auto and aerospace vehicles. For additional details on SVC's research programs, membership fees, and personnel, please visit: *www.SmartVehicleCenter.org.*

Spring 2021 Meeting Information

SVC's 14th Semi-Annual Project Review and IAB Meeting

Dates: *18-19 March 2021*

Location: *The Ohio State University (in-person TBD)*
E100 Scott Laboratory, 201 West 19th Avenue,
Columbus, OH 43210

Please visit www.SmartVehicleCenter.org for updates!

Welcome New IAB Representative

Bengt Pipkorn (Autoliv)

New SVC Faculty and Staff

Ardeshir Contractor, Professor of Practice
Sheng Dong, Research Assistant Professor
Travis Hery, Postdoctoral Associate
Navni Verma, Postdoctoral Associate

Center Leadership

From the left *(from Sept. 2019 meeting)*: Marcelo Dapino (Center Director), Victoria Hill (VentureWell/NSF Evaluator), Ryan Hahnlen (IAB Chair/Honda R&D), Jon Cartlidge (IAB Vice-Chair/Battelle Memorial Institute).

Autumn 2020 13th Annual Project Review and IAB Meeting

The Smart Vehicle Concepts Center held its 13th Annual Autumn Meeting on September 10-11, 2020. The meeting was held virtually due to the COVID-19 pandemic. Although the meeting remained mostly unchanged relative to previous instances, adjustments were necessary to accommodate the virtual format. The day 1 presentations were pre-recorded on video and made available to our registered guests in advance, while the day 1 IAB meeting and Executive Session, day 2 technical updates, and day 2 IAB meeting were held in real-time via video conferencing.

The special keynote presentation, "Autonomous air and ground vehicles – safely adapting to complex and changing environments," was delivered by **Prof. Jim Gregory**, whose talk provided an overview of his recent work with high-speed autonomous drones and a traffic management system that will help enable high-density operations in the future.

The Industrial Advisory Board convened twice during this meeting. The IAB meeting of day 1 focused on approval of previous meeting minutes, completion of action items, and continued discussions on the future of SVC as a graduated center. The IAB held its closed Executive Session focusing on engagement with national laboratories, Center advertisement, and post-graduation discussions. The day 2 IAB meeting included LIFE project reviews, an update on Center operations, financials, and members' perspectives.

Publication Summary

This year has been good for Smart Vehicle Concepts Center publications. Forty-seven journal publications by faculty and students based on Center research appeared in prestigious journals; thirteen papers were presented at society conferences, and 17 theses were successfully defended.

Spring 2020 13th Semi-Annual Project Review and IAB Meeting

The 13th Semi-Annual Spring Meeting of the Smart Vehicle Concept Center was originally planned to be held over the typical two-day program, however due to COVID-19, an abridged virtual meeting was held by the Industrial Advisory Board and SVC leaders on March 27, 2020. All technical presentations and posters were prepared by the students and researchers, and made available to the registered industry guests and IAB representatives on the conference proceedings. No LIFE feedback was collected since no oral presentations were given.

The SVC leadership and Industrial Advisory Board met via video conference over a 90-minute period to discuss Center operations, the members' perspective, sustainability issues, and post-graduation plans. **Prof. Marcelo Dapino** was pleased to introduce a newly committed company member, **Autoliv** with **Dr. Bengt Pipkorn** as their IAB representative. New faculty leaders **Ardeshir Contractor** and **Sheng Dong** were introduced as welcome additions to the Center with their expertise and seed projects.

Dr. Ryan Hahnlen announced the September 2019 Outstanding Student Award was conferred to **Srivatsava Krishnan** for his presentation "Mechanoluminescent paintable light sources in automotive lighting systems" with **Prof. Vishnu Baba Sundaresan** as project leader and mentored by **Duane Detwiler, Nichole Verwys, Katy Richardson,** and **Anthony Smith** of **Honda R&D Americas**.

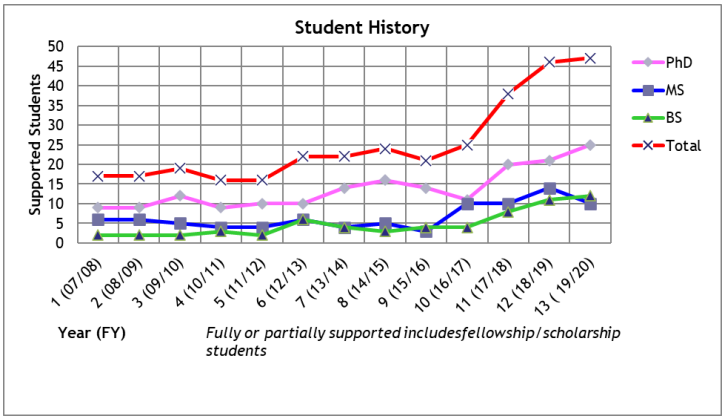
Patents

Date	Patent Status	Invention	Inventors
January 2020	Granted 10,531,421	UAM resistance spot weld joint transition for multimaterial automotive structures	R. Hahnlen, M. Dapino, L. Headings, M. Gingerich
October 2019	Provisional Patent 62/909,933	Electrically-activated laminated films for optical morphing in vehicle panels	M. Dapino, L. Headings, VSC Chillara
September 2019	Provisional Patent 62/896,384	Systems and methods for joining and repair using ultrasonic additive manufacturing with a contoured sonotrode	M. Dapino, L. Headings, M. Gingerich
September 2019	Provisional Patent 62/898,330	Stainless steel – NiTi surgical instruments produced with ultrasonic additive manufacturing	B. Panton, M. Dapino, J. Morris, L. Headings, M. Gingerich
September 2019		Reinforcement-metal laminates joined and sealed using ultrasonic additive manufacturing	M. Dapino, L. Headings, M. Gingerich
February 2019	Patent Pending 15/689,095	UAM resistance spot weld joint transition for multimaterial automotive structures	R. Hahnlen, D. Detwiler, A. Sheldon, M. Dapino, M. Gingerich, L. Headings
2019	Provisional Patent 62/810,656	Functionally-graded cathode architecture for potassium-oxygen batteries	V. Sundaresan, P. Gilmore

Click here for Sept. 2020 State of the Center

Students Supported from August 1, 2019 to July 31, 2020

PhD	25
MS	10
BS	12
TOTAL	47



SVC Graduates (January 2012 – December 2020)

PhD	33
MS	47
BS	25

Current Employment

Former Students Employed by: *SVC Member Organization during Phase II or III*	
Army Research Laboratory*	Made In Space
Bechtel	Magna Electronics
Bruel & Kjaer	Moog, Inc.*
China Automotive Systems, Inc.	NASA Glenn Research Center*
Cummins	NHK International Corp.
Edison Welding Institute*	Owens Corning*
F.tech R&D*	Procter and Gamble
Ford Motor Company*	Root Insurance
GE R&D	STERIS Corp.
General Motors	Tesla, Inc.
Goodyear*	Toyota*
Gorman Rupp	TRW
Honda R&D	US Army (Aberdeen Proving Ground)
Former Students Employed by Academic Institutions:	
Boise State University	MIT Lincoln Laboratory*
IIT Bombay (India)	OSU (post-doctoral researcher)
IIT Delhi (India)	South China University of Technology
IIT Tirupati (India)	Southern Illinois University

Accomplishments by SVC Researchers

Professor Vishnu Sundaresan joins DARPA

OSU associate professor Dr. Vishnu Sundaresan joined DARPA (Defense Advanced Research Projects Agency) as a rotating program manager in the Defense Sciences Office in September 2020. His current interests include high-energy density energy storage devices, structural computing for adaptive structures, and novel chemistries for emerging manufacturing paradigms. At DARPA, Sundaresan looks to bring together the fundamentals of chemical physics of materials, dynamics and control theory, and structural design to develop novel device architectures for a broad portfolio of applications.

Sundaresan has a Bachelor of engineering from PSG College of Technology and doctorate from Virginia Tech, both in mechanical engineering.

Ohio State's RIYA Program persevered amidst COVID-19 pandemic

Posted: August 13, 2020

Sai Venkat, a third-year undergraduate in the Department of Mechanical Engineering at IIT Madras, was mentored by **Raj Singh** on a research project based on the vibro-impact phenomenon observed in torsional systems with clearances.

His work was focused on understanding and improving this model by using different methods, Sai Venkat said. The benefits of this research could have applications in the automobile industry.

Doing this project completely online came with its own set of challenges for Sai Venkat who is a self-proclaimed visual learner.

"I could understand things much better if I saw it and felt it. Most of my earlier projects were also more experimental where I could get the feel of the things," Sai Venkat said. "This made me change my learning strategy to understand concepts without any visual aid. This was challenging and fun. Ultimately, this was a completely new experience for me."

Sai Venkat plans to pursue more research in either robotics or non-linear dynamics while pursuing a masters and Ph.D.

Harsh Manani, an undergraduate student at the Indian Institute of Technology Bombay, worked with **Prof. Ardeshir Contractor** and **Dr. Navni Verma** in **Smart Vehicle Concepts Center** on a project based on energy generation from a curved solar panel mounted on a vehicle roof.

Manani found challenges of an online internship because in his area the connection to the internet was poor and the major time change difference. Even though, he had a great experience and he says it prepared him for remote work in the future.

"I would like to thank **Prof. Singh, Prof. Contractor, Dr. Verma** and other people for making this program possible during this pandemic," he said. "Despite the devastating impact COVID-19 is having over the world, The RIYA program helped me gain clarity about research and future decisions."

Manani plans to pursue a Ph.D. after completing undergrad with a dual degree from IIT Bombay.

Professor Raj Singh will serve as the president of the INTER-NOISE 2021 Congress

The Congress will be held in Washington, D.C. on 1-4 August 2021. The theme is "Next 50 Years of Noise Control" and the program will cover all aspects of noise control engineering, acoustics and vibration.

Arun Ramanathan earns 2020 MAE GTA Award

Posted: May 28, 2020

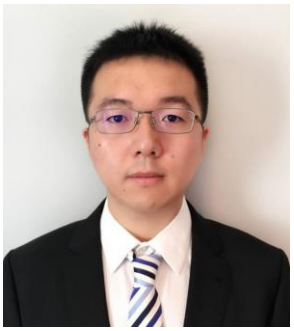
Arun Ramanathan earned the 2020 Graduate Teaching Associate Award in the Department of Mechanical and Aerospace Engineering. Arun is pursuing a PhD in mechanical engineering with focus on flexible distributed sensors for vehicle applications under the guidance of Prof. Marcelo Dapino. He is a post-candidacy PhD candidate in the Smart Materials and Structures Laboratory and the Smart Vehicle Concepts Center.

Arun earned the GTA award as a teaching assistant in Spring Semester 2020 for ME 3260, System Dynamics and Vibrations.

We wish Arun all the best in his endeavors and congratulate him for this achievement!

MAE PhD student Ming Yang selected as Ohio State Presidential Fellow

Posted: May 13, 2020



Ohio State mechanical engineering PhD student Ming Yang was selected as one of this year's recipients of the Ohio State Presidential Fellowship.

Yang is advised by Dr. Soheil Soghrati and is a fourth year doctoral candidate who came to Ohio State from China.

The fellowship is given to students who "embody the highest standards of scholarship" in the graduate programs at the university going into the last stages of their dissertation research or terminal degree project. Recipients are given a monthly stipend for living expenses so they can focus solely on completing their research, as well as help with travel expenses to present at national conferences.

Yang's research focuses on creating an efficient numerical framework, including microstructure reconstruction, mesh generation, finite element simulation, and deep learning algorithms, for the computational modeling of novel materials with complex microstructures. It will significantly reduce the time and labor cost associated with the modeling process.

NEW GRANT: An STTR phase II was granted by the Air Force to SVC partner **SciFi Innovations, LLC** for the project "Smart carbon fiber integration," a collaborative effort involving **SciFi's CEO Rick Myers**, OSU professor Marcelo Dapino, and University of Tennessee professor Suresh Babu. The focus of this grant is to conduct the fundamental research necessary to bring carbon fiber-metal structures to Air Force's attritable aircraft, and to advance commercialization efforts toward moving the technology to the civilian market.

Hoelzle's surgical robot brought to life by MAE graduate student and OSU machinist

Posted: March 5, 2020

Dr. David Hoelzle, a professor in the Department of Mechanical and Aerospace Engineering, and Dr. Desmond D'Souza, a surgeon at The Ohio State University Comprehensive Cancer Center – Arthur G. James Cancer Hospital and Richard J. Solove Research Institute, are working in tandem to develop a device that will be able to print soft tissues, bones, and someday even organs inside the hum an body during surgery.

For the creation of the physical device, Andrej Simeunović, a NSF Graduate Fellow in Ohio State's Hoelzle Research Lab, and Kevin Wolf, the 3D Printing Laboratory Supervisor, Research Machinist, and Student Shop Supervisor at Ohio State's machine shop, collaborated to make a surgical robot that is now ready for testing.

"A lot of research is purely theoretical, whereas this project is the opposite. Most of my time is spent making the device and making it work correctly, so we can then use it to demonstrate real-world outcomes," Simeunović said. "For me personally, that is something I really value.

Professor named International Society for Optics and Photonics fellow

Posted: February 14, 2020

Marcelo Dapino, professor of mechanical and aerospace engineering, the Honda R&D Americas Designated Chair in Engineering, and director of the NSF IUCRC Smart Vehicle Concepts Center has been named a fellow of the International Society for Optics and Photonics (SPIE).

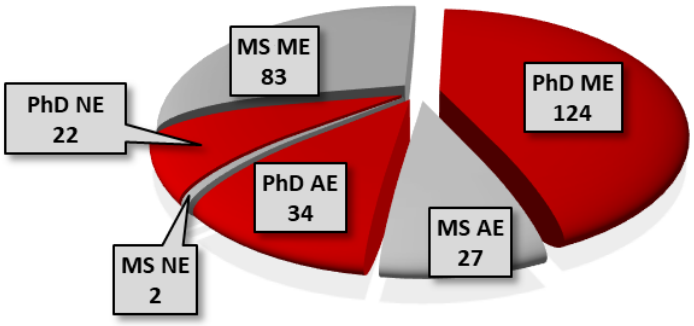
SPIE fellows earn this distinction by making significant scientific and technical contributions to the multidisciplinary fields of optics, photonics, and imaging. More than 1,500 SPIE members have become Fellows since the Society's inception in 1955.

Dapino was selected for outstanding technical contributions in the field of smart materials and structures and for extensive service over the past 20 years to the SPIE Smart Structures and Nondestructive Evaluation conference.

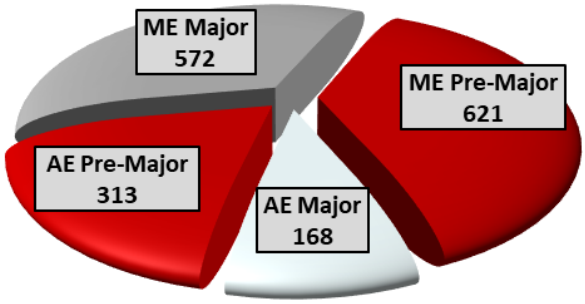
Prof. Dapino is widely recognized in the field of smart materials for the development of transitional research programs that approach foundational research with an industrial focus. Along with his students and collaborators, Dapino has authored 260 technical articles and book chapters while serving as primary advisor on over 50 dissertations and theses.

Department of Mechanical & Aerospace Engineering (MAE) Statistics

Graduate Student Enrollment
Autumn Semester 2020
MAE Graduate Students



Undergraduate Student Enrollment
Autumn Semester 2020
MAE Undergraduate Students



MAE Degrees Granted Academic Year 2019 - 2020					
Mechanical	**347**	**Aerospace**	**96**	**Nuclear**	**6**
BS	248	BS	69		
MS	73	MS	20	MS	3
PhD	26	PhD	7	PhD	3

O H - I O !!!

Links to NSF, IUCRC, and OSU Laboratories

NSF home page	http://www.nsf.gov/
IUCRC home page	https://www.nsf.gov/eng/iip/iucrc/home.jsp/
Smart Vehicle Concepts Center page	https://svc.engineering.osu.edu/
Acoustics & Dynamics Laboratory	https://adl.osu.edu/
Smart Materials and Structures Laboratory	https://smsl.osu.edu/
Automated Computational Mechanical Laboratory	https://acml.engineering.osu.edu/
Integrated Material Systems Laboratory	https://imsl.engineering.osu.edu/
Doan-Nguyen Group	https://u.osu.edu/doan-nguyen.1/
Hoelzle Research Lab	https://hrl.engineering.osu.edu/
Micro/Nano Multiphysical Dynamics Lab	https://mnmdl.osu.edu/

SVC Core Faculty

MARCELO DAPINO
Honda R&D Americas Chair
Professor; Director of SVC
Expertise: Smart materials; Nonlinear coupled systems; Design; Control

J.P. CHEN
Associate Professor
Expertise: Computational fluid dynamics; CFD simulation and coding; Turbulence modeling; Turbomachinery

HANNA CHO
Assistant Professor
Expertise: Nonlinear NEMS/MEMS; AFM cantilever dynamics; Multi-functional ferroelectric material energy systems; Nano- and bio-science

ARDESHIR CONTRACTOR
Professor of Practice
Expertise: Solar energy; Smart grids; Electric mobility; Renewable energy storage; Materials for energy conversion

VICKY DOAN-NGUYEN
Assistant Professor
Expertise: Synthesis; In-situ structural characterization; Smart materials; Advanced materials for energy storage/conversion

SHENG DONG
Research Assistant Professor
Expertise: Ultrasonic lubrication; Dynamic system modeling; Structural health monitoring

DAVID HOELZLE
Associate Professor
Expertise: Learning/adaptive control systems; Additive manufacturing processes; Microsystems for mechanobiology research; Dynamics systems analysis

RAJ SINGH
Emeritus Professor
Expertise: Noise & vibration control; Geared systems; Nonlinear dynamics; DSP

SOHEIL SOGHRATI
Associate Professor
Expertise: Advanced FEM; Modeling multiscale response of advanced/bio-materials and structures

VISHNU SUNDARESAN
Associate Professor
Expertise: Piezoelectric materials; Active polymers; Bio-derived materials

SVC Research Staff

LEON HEADINGS
Senior Research Associate

TRAVIS HERY
Postdoctoral Associate

NAVNI VERMA
Postdoctoral Associate

The Smart Vehicle Concepts Center would like to wish everyone a Safe and Happy Holiday Season!