

**CENTER FOR COMPACT AND EFFICIENT FLUID POWER**



A National Science Foundation Engineering Research Center



# **Achieving CCEFP Sustainability**

**Mike Gust – CCEFP ILO**

**July 28, 2017**

# CCEFP Vision

*Fluid power is the technology of choice for power generation, transmission, storage and motion control.*

*Creating new markets!*



*Educating the next generation of leaders*



*Partnering with industry*



*Improving existing applications!*

- The subject of CCEFP sustainability first came up during our 6<sup>th</sup> year renewal site visit.
- Developing an acceptable sustainability plan was a key condition for year 6 grant renewal.
- We partnered with an industry association called the National Fluid Power Association (NFPA) to develop a mutual sustainability plan called the “Pascal Society”, a giving society of industry donors.
- A \$2 million annual fund raising goal was established (\$1.5million minimum).
- Despite everyone’s best efforts we were unable to raise enough industry dues to fund both administration and research.
- Our ten year NSF CCEFP grant just ended on 6/30/2017, including a one year carry forward.
- NFPA Pascal Society funding for research continues until 6/30/2018.
- CCEFP has developed a replacement sustainability plan that leverages new sources of government funding.

- If it hasn't already, the subject of sustainability will come up for your ERC before you know it.
  - CCEFP leadership meets weekly on sustainability
- Sustainability has proven to be our greatest challenge.
- Administration costs are the most difficult to cover.
- One should be flexible and open minded to new strategies and directions for sustainability.
- Understand your ERC's value propositions.
- Communicate with your industry members constantly.

- **Research leadership**
  - CCEFP has developed the fluid power research strategy that is the model for the world.
- **Advocacy**
  - CCEFP actively lobbied government agencies to build interest in fluid power research
- **Pre-competitive research**
  - Not surprisingly, a compelling research program is the key to sustainability.
- **Educate**
  - We educate the next generation of leaders through our research program. This is highly valued by industry.
- **Network**
  - We provide a desirable venue for academics, students and industry to meet.

# Pascal Society Sustainability Model



- Began transitioning in year 9 with NSF's concurrence.
- Worked with NFPA to convert industry members over to NFPA "Pascal Society" Foundation supporters.
- NFPA established and collected industry dues.
  - Received \$650,000 support in years 9 and 10.
  - \$800,000 for years 11 and 12. Funded ten research projects at \$80,000 each.
- Universities have low (0-10%) indirect on industry consortium monies for research
- CCEFP to focus on new sources of government funding.
- NFPA covered part of ILO and ED costs
  - ~\$150K and \$300K the past two years

## Current Pascal Society-CCEFP strategy

- Directly support pre-competitive fluid power research with pooled industry donations.

## Future Pascal Society-CCEFP strategy

- Maintain core CCEFP administration that will indirectly support pre-competitive fluid power research by creating new government funding opportunities.

## Rationale for new strategy

- Unable to directly fund research projects and CCEFP administration.
- Ability to obtain significantly greater funding from government agencies.
- CCEFP has the credentials, network, and experience to succeed.

# Focus Areas for Government Funding



**Zongxuan Sun**  
U of Minnesota

## OFF-HIGHWAY VEHICLES



**Eric Barth**  
Vanderbilt

## HUMAN SCALE SYSTEMS



**Tequila A. L. Harris**  
Georgia Tech

## FLUID POWER MANUFACTURING



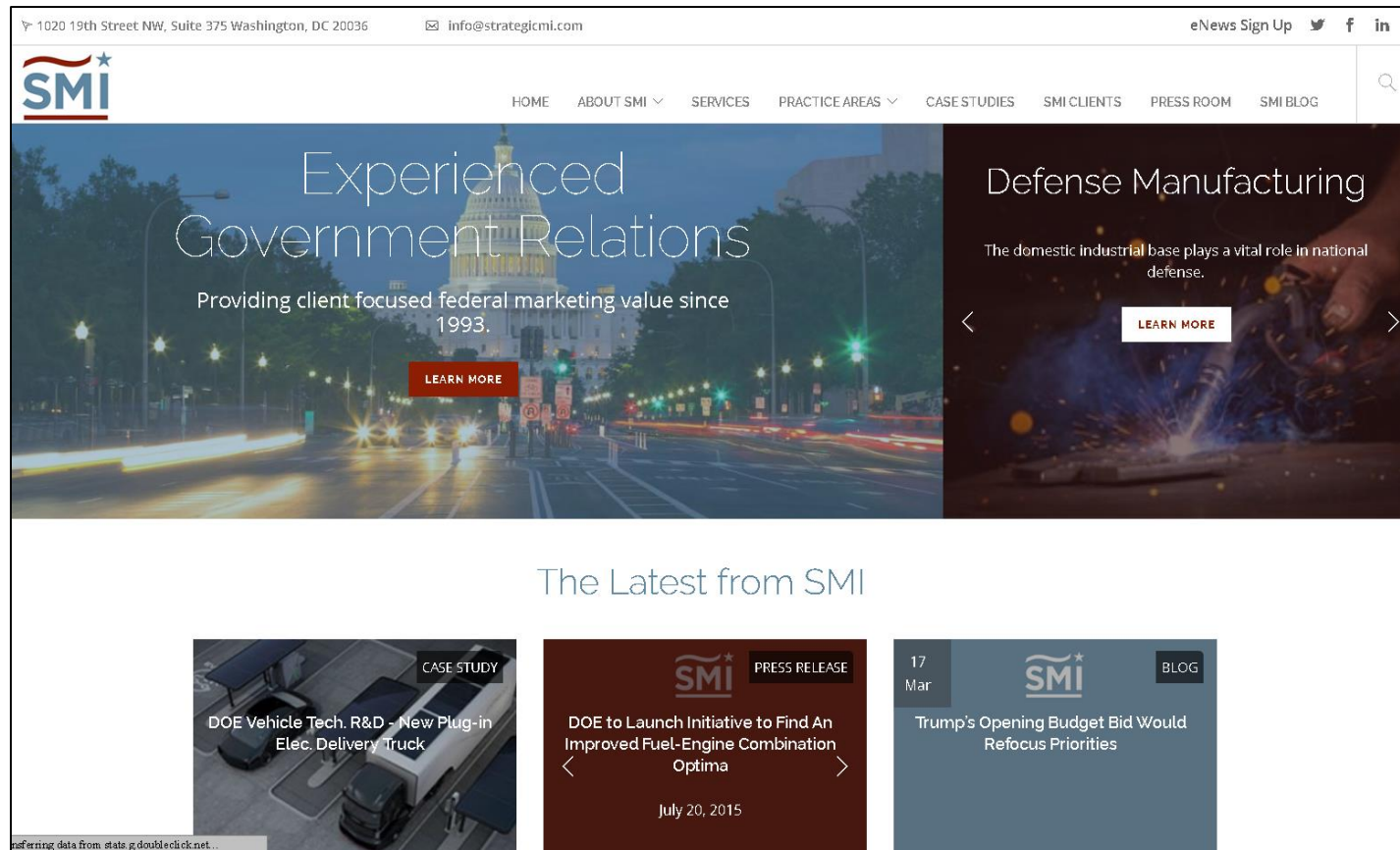


# Off-Highway Vehicles

# Strategic Marketing Innovations (SMI) Consultants



*SMI supports companies, universities, and academic institutes secure federal funding for research and development, and technology procurement.*



- **Technical and policy experts, lobbyists, and former executive branch decision-makers.**
- **Defense, Energy and Human Sciences expertise and networks.**

# Advocacy Trip to Capitol Hill



- **Dudley Shepard of Motion Industries and Randy Hydrick Of Flow Dynamics meet with Representative Robert Aderholt from their home state of Alabama.**
- **Rep Aderholt is a member of the House Energy and Water Appropriations Committee.**

**Washington DC – Feb 27 & 28, 2017**

# Senators and Representatives visited

## Sen. Alexander (TN)\*

Sen. Baldwin (WI)\*

Sen. Boozman (AR)\*

Sen. Brown (OH)

Sen. Casey (PA)

Sen. Durbin (IL)\*

## Sen. Feinstein (CA)\*

Sen. Franken (MN)

Sen. Graham (SC)

Sen. Grassley (IA)

Sen. Kirk (IL)\*

Sen. Klobuchar (MN)

Sen. Schumer (NY)

Sen. Shelby (AL)\*

Rep. Terri Sewell (AL)

Rep. Cheri Bustos (IL)

Rep. Charles Dent (PA)

Rep. Bill Foster (IL)

\* Member of Senate Appropriations Committee

***Chair & Ranking Member of Energy and Water Development subcommittee shown in bold & italics***



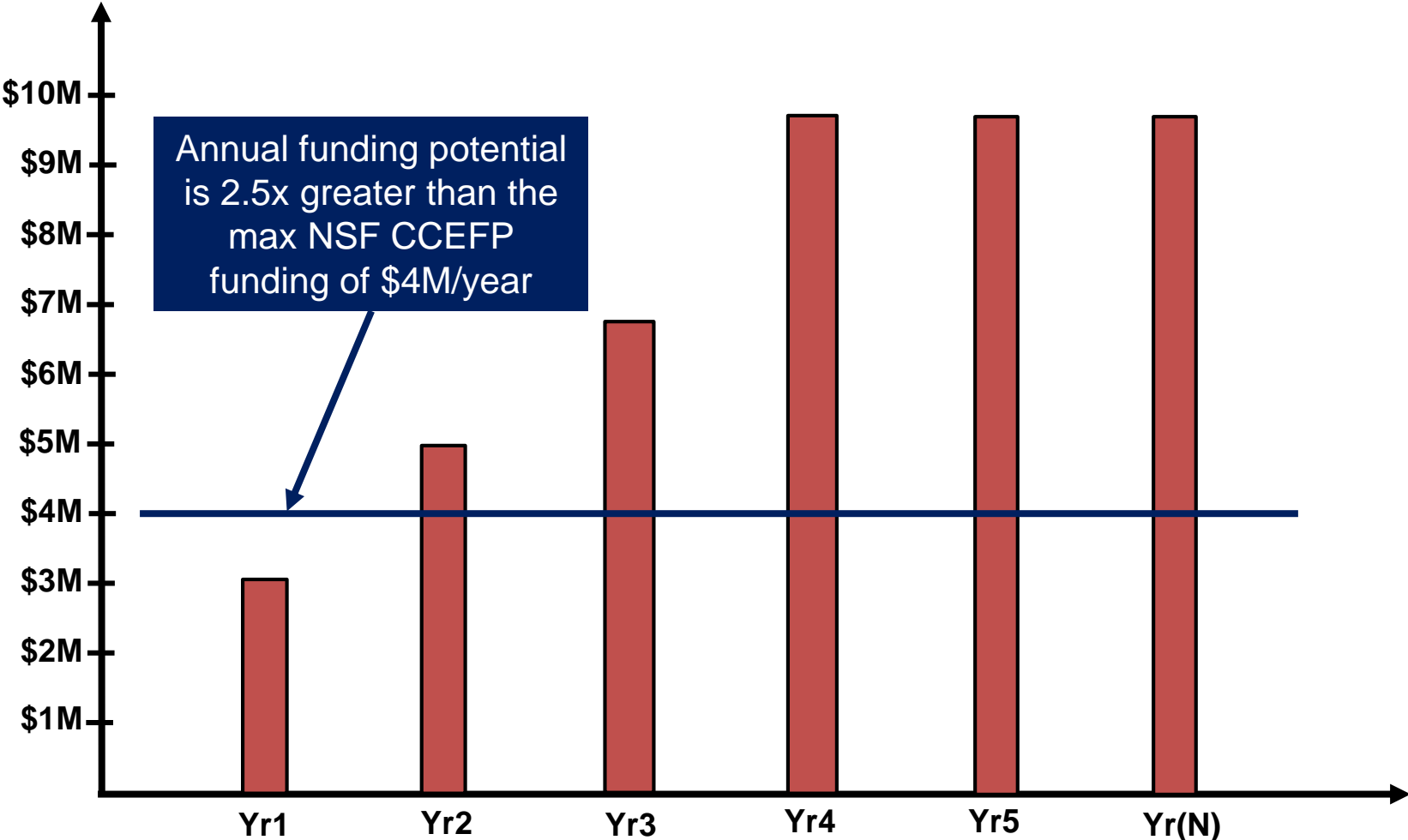
FY17:

*\$5 million has been allocated for R&D to improve the energy efficient of fluid power systems for commercial off-road vehicles. UMN is well situated to win an affiliated grant.*

FY18:

- 1) House committee has recommended \$10 million be allocated for energy efficiency improvements for commercial off-road vehicles.*
- 2) Senate Committee recognizes that the commercial off-road vehicle sector consumes over 2 Quads of energy per year and directs the Department to continue activities to reduce the energy consumption of commercial off-road vehicles. This Committee recommends \$5 million for off-highway fluid power efficiency improvements.*

# DOE Off-highway Vehicles Energy Efficiency Program



# Human Scale Systems

- CCEFP has convinced ARM leaders of the necessity of fluid power actuation for future robotics and factory automation.
- ARM leaders are relying on CCEFP to connect with the fluid power industry.
- ARM is headquartered at Robotics Institute at Carnegie-Mellon University in Pittsburgh, one of the world's leading robotic research centers.
- \$253 million in combined research funding has been approved.
- Six CCEFP companies (Bimba, Eaton, Enfield, Innotronics and Parker) and four CCEFP universities (Marquette, Purdue, UIUC and Vanderbilt) are involved.
- CCEFP is coordinating fluid power efforts. We can help your organization get involved.

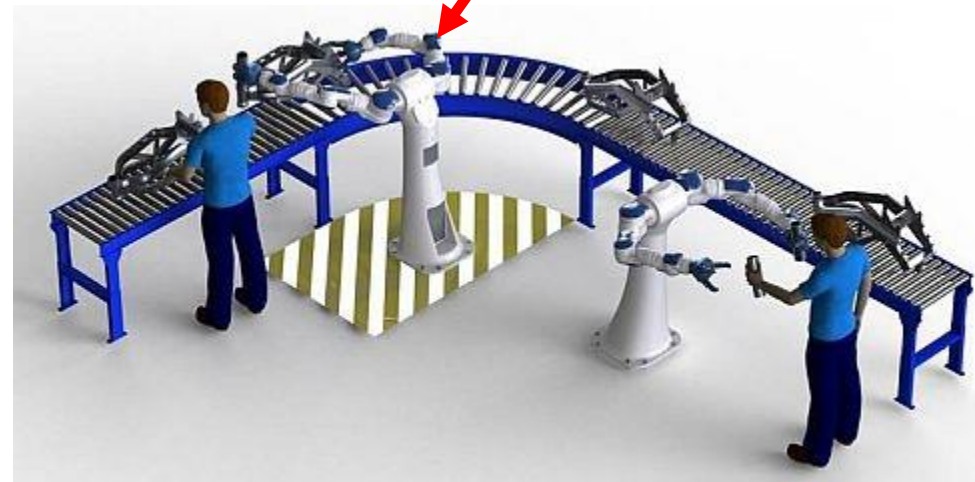


# ARM Project Examples



Hydraulic cylinders, valves and power supplies for human assist exoskeletons.

Robots and humans safely interacting in manufacturing environment. Pneumatics or soft robotics makes this intrinsically safe.



# NSF EFRI on Soft Robotics



**NSF** National Science Foundation  
WHERE DISCOVERIES BEGIN

Contact | Help

Search

NSB Research Areas Funding Awards Document Library News About NSF

Home > Research Areas > Engineering > Emerging Frontiers and Multidiscipl...

Email Print Share

## Emerging Frontiers in Research and Innovation

The NSF Emerging Frontiers in Research and Innovation program (EFRI) provides critical, strategic support of fundamental discovery at the frontiers of engineering research and education. These investments represent transformative opportunities, potentially leading to:

- new areas for fundamental or applied research;
- new industries or capabilities that result in a leadership position for the country;
- and/or significant progress on a recognized national need or grand challenge.

To identify promising future research opportunities, the EFRI program seeks continual input from the engineering community. This input comes from workshops, advisory committees, technical meetings, professional societies, proposals and awards, and NSF committees of visitors, as well as from periodic calls for EFRI topic ideas.

From this comprehensive input, the Engineering Directorate identifies, evaluates, and prioritizes those frontier topics that best match the EFRI criteria:

- holds potential for transformative outcomes,
- addresses a national need or grand challenge,
- involves multi- or interdisciplinary research,
- includes a community who is poised to respond, and
- offers a clear leadership role for Engineering.

Read the [FY 2017 EFRI program summary and solicitation](#) for requirements, contacts, and instructions.

- In 2016, (13) 4-year awards totaling \$26,000,000... (~\$500K/yr each)
- CCEFP led effort to convinced NSF to include “soft robotics” as one of two upcoming topics in 2017.

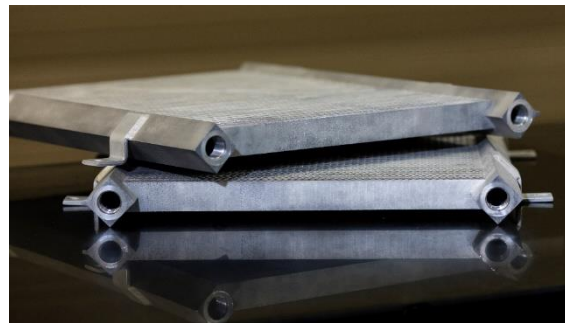
# Fluid Power Manufacturing

# Government Funding for Fluid Power Manufacturing

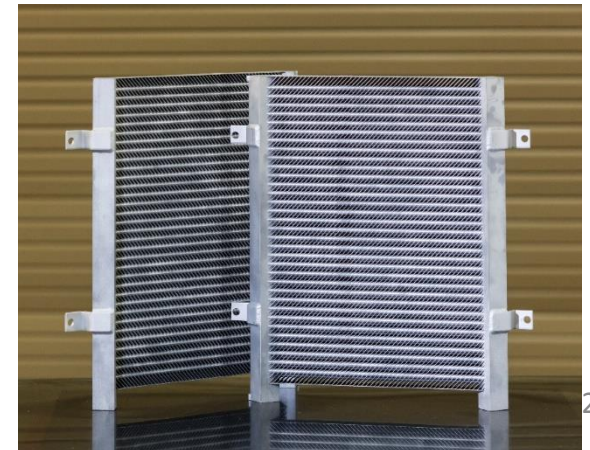
- Fluid power manufacturing research initiatives have been enthusiastically embraced by CCEFP industry supporters.
- A entirely new community of researchers and supporters have been engaged.
- The CCEFP has just completed a national fluid power manufacturing roadmap.
- Ten key technologies were identified.
- Many opportunities for federal funding already exist. We need to organize our efforts to secure them.

- Coatings
- Micro-machining
- Composites & Engineered Plastics
- Sintered Metals
- Additive Manufacturing
- Batch-free Heat-treating
- Robotics
- Hybrid Manufacturing
- Metrology
- In-process, Sensing, Feedback and Control

# ORNL-CCEFP Project AME (Additively Manufactured Excavator) unveiled at Las Vegas CONEXPO



Over 100,000 visitors to our technology booth!



## Multidisciplinary Research Program of the University Research Initiative (MURI)

DOD - Department of Defense (N00014-17-S-F006)

### Funding

**Amount:** \$1,250,000 - \$1,500,000

**Duration:** 3 years

### Scope

The MURI program supports basic research in science and engineering at U.S. institutions of higher education (hereafter referred to as “universities”) that is of potential interest to DoD. The program is focused on multidisciplinary research efforts where more than one traditional discipline interacts to provide rapid advances in scientific areas of interest to the DoD. Basic research is systematic study directed toward greater knowledge or understanding of the fundamental aspects of phenomena and of observable facts without specific applications towards processes or products in mind. It includes all scientific study and experimentation directed toward increasing fundamental knowledge and understanding in those fields of the physical, engineering, environmental, and life sciences related to long-term national security needs.

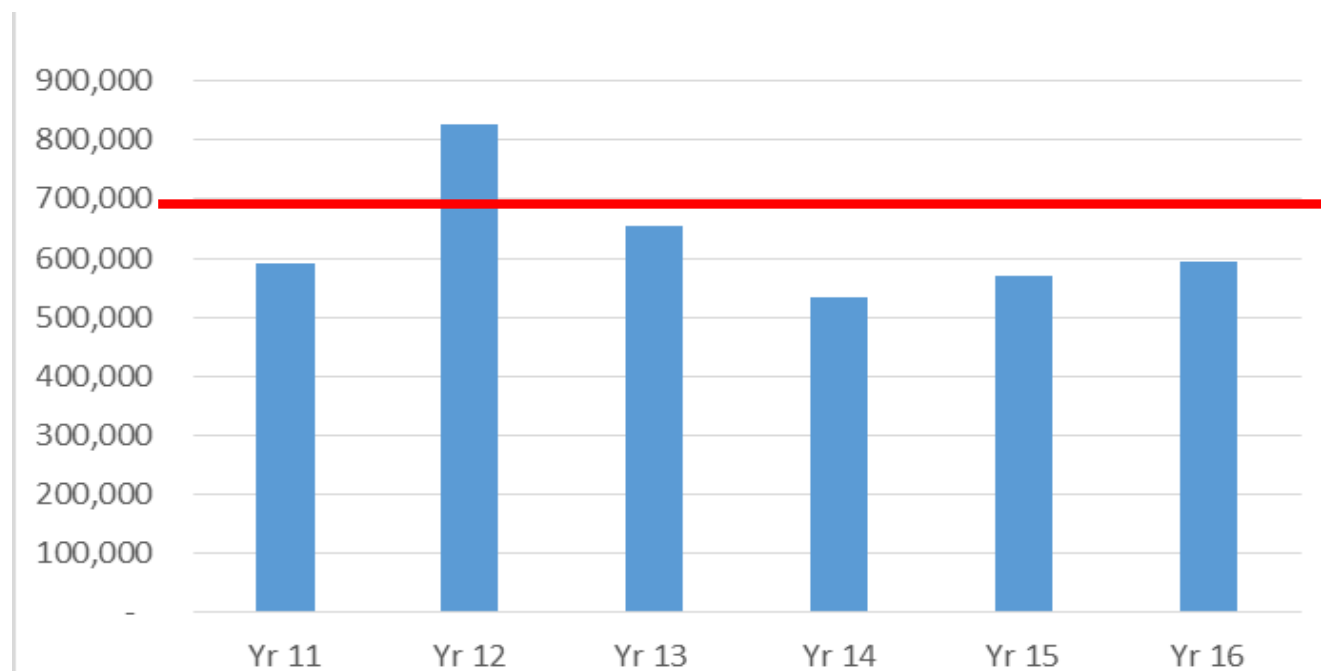
### DEADLINES

**LOI:** 07/17/2017

**Proposal:** 11/01/2017

- Army Research Office (ARO), Air Force Office of Scientific Research (AFOSR) and Office of Naval Research (ONR) are sponsors.
- MURIs are typically only open to U.S. institutions of higher education.
- Typical annual funding per grant is in the \$1.25M to \$1.5M range.

# Operating cost of CCEFP

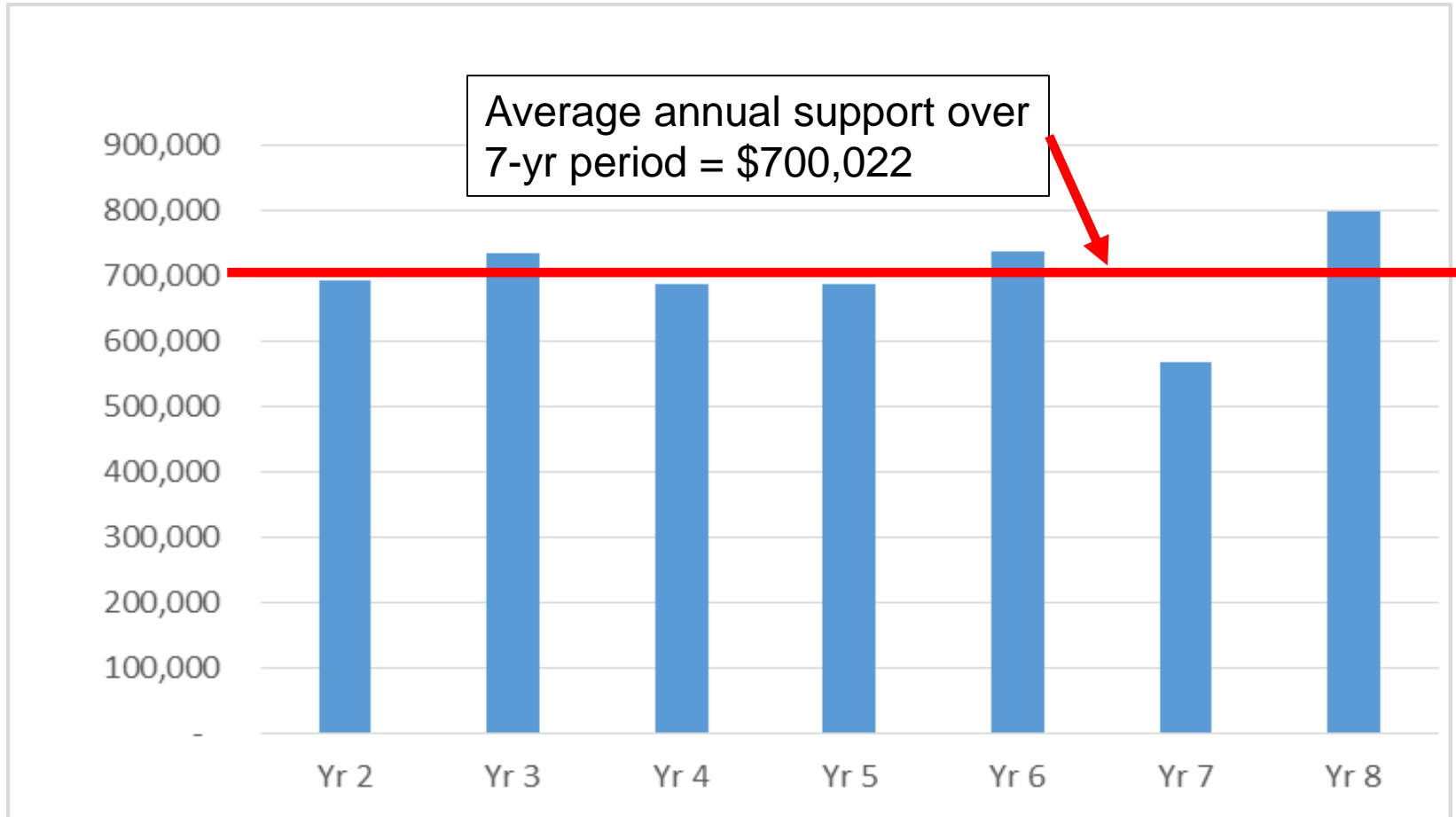


## Explanation of Year Over Year Changes:

- Increase from Yr 11 to Yr 12 - 13 months of expense due to change in fiscal year, additional lobbying and related travel, industry summits, and overhead of 10% applied; offset of expenses from government grant support
- Decrease from Yr 12 to Yr 13 – 12 months of expense, overhead expense offset and additional government grant support (expense offset)
- Decrease from Yr 13 to Yr 14 – elimination of lobbying efforts and increase in government grant support (expense offset)
- Increases thereafter – inflation



# Historical CCEFP Industry Dues



# New CCEFP Sponsorship Structure



Company size	Annual global fluid power sales	CCEFP Sponsorship
Very Large	Over \$1.5 billion	\$60,000
Large	Between \$500 million and \$1.5 billion	\$40,000
Medium	Between \$50 and \$500 million	\$20,000
Small	Between \$10 and \$50 million	\$10,000
Start-Up	Below \$10 million	\$2000
<b>Supporter Benefits</b>		
Selection of fluid power research projects funded by CCEFP (based on available budget)		✓
Elected leadership positions on CCEFP Governance Committee		✓
Invitation to CCEFP Summits, FPIRC, and other special events		✓
Participation in IEC monthly teleconferences, research and special topic webinars		✓
Early access to research progress and results		✓
Networking opportunities with students, faculty, and other industry supporters		✓
Notification of government funding programs and industry/academic partnerships		✓
Tax-deductible donation		✓
<b>Funding Supports</b>		
CCEFP research projects, events, fluid power advocacy programs, travel, and administration		✓

**New CCEFP will have only one level of membership for all its industry supporters.**

# Projected Industry Support

<b>☐ Current Supporter</b>	<b>43</b>	<b>\$ 1,066,000</b>
1 - Very Large	5	\$ 300,000
2 - Large	8	\$ 320,000
3 - Medium	17	\$ 340,000
4 - Small	10	\$ 100,000
5 - Start-up	3	\$ 6,000
<b>☐ Newly Identified Companies</b>	<b>6</b>	<b>\$ 140,000</b>
1 - Very Large	1	\$ 60,000
3 - Medium	3	\$ 60,000
4 - Small	2	\$ 20,000
<b>Grand Total</b>	<b>49</b>	<b>\$ 1,206,000</b>

## Most Probable:

60%	of Current Supporter Total	\$ 639,000
20%	of Newly Identified Co's Total	\$ 28,000
		<u>\$ 665,000</u>

# Other Sources of Support

- Private foundations (Eaton, Danfoss, Parker and CAT)
- Individual gifts
- Government grants with administration or project management support
- Education grants
- Job sharing
- Part-time employment
- Travel grants
- Event admissions

# Questions