NFPA Roadmap Committee

Meeting Report on Capability Improvements
March 4, 2021

NFPA Technology Roadmap

The NFPA Technology Roadmap describes an industry-wide consensus regarding the pre-competitive research and development needs associated with improving the design, manufacture, and function of fluid power components and systems.

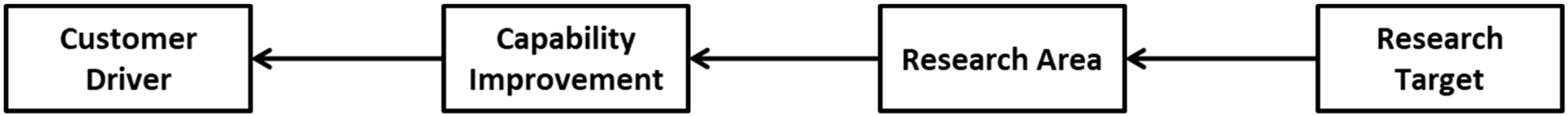
The research and development agenda it describes is focused on advancements that will help the fluid power industry meet the future needs of its customers, expand into new markets, and attract the best and brightest students to the field.

It is used by the NFPA and its academic partners to guide their research efforts, by NFPA members and other industry players to inform decisions about research partnerships and product development, and by academic, government, and other organizations that wish to pursue research and development projects of importance to the fluid power industry.

It is updated every two years under the guidance and leadership of the NFPA Roadmap Committee.

Roadmap Elements

The NFPA Technology Roadmap is comprised of the following four elements, each linked to the one preceding in an interdependent chain.



Customer Drivers are the business or technology objectives of fluid power customers. They help them serve the needs of their own customers, and are not necessarily connected to their use of fluid power.

Capability Improvements describe the ways in which fluid power systems must improve if they are to meet or better meet the customer needs described by the Customer Drivers.

Research Areas are the broad areas of pre-competitive investigation that could assist in bringing about the Capability Improvements.

Research Targets are the objectives that quantify or otherwise describe successful strategies for pursuing the Research Areas.

2021 Roadmap Process and Timeline

The NFPA Roadmap Committee is following this process and timeline for the 2021 update to the NFPA Technology Roadmap. This is the report from its meeting on March 4, 2021 to discuss, define and prioritize capability improvements.

Phase 1 – Customer Drivers

Nov 12	Launch of survey on customer drivers
Dec 17	Deadline to respond to survey on customer drivers
Jan 21	Virtual committee meeting to discuss, define and prioritize customer drivers

Phase 2 – Capability Improvements

Jan 28	Meeting report sent with prioritized customer drivers and setting the stage for fluid power alignment and capability improvements
	Launch of survey on fluid power alignment and capability improvements
Feb 18	Deadline to respond to survey on fluid power alignment and capability improvements
Mar 4	Virtual committee meeting at NFPA Regional Conference to discuss, define and prioritize capability improvements

Phase 3 – Research Areas and Targets

Mar 11	Meeting report sent with prioritized capability improvements and setting the stage for research areas and targets, including process for defining working groups for each capability improvement
	Launch of survey on research areas and targets
Apr 1	Deadline to respond to survey on research areas and targets
Apr/May	Virtual working group meetings to discuss and prioritize research areas and targets for each capability improvement
Jun 3	Virtual committee meeting at NFPA Regional Conference to review and harmonized research areas and targets for each capability improvement

Phase 4 – Final Roadmap Document

Jun	Draft Roadmap document written
Jul 8	Draft Roadmap document sent for review and comment
Jul 22	Deadline to return comments on draft Roadmap
Aug 17	Final Roadmap document presented at NFPA IEOC

Meeting Participants

Committee Chair
- Mike Betz, Danfoss Power Solutions

Committee Vice Chair
- Bradlee Dittmer, IMI Norgren

Committee Members
- Brian Rhode, Afton Chemical
- Blake Cawley, AMETEK
- Benjamin Moses, Association for Manufacturing Technology
- Nathan Weaks, Automatic Feed Company
- Cory Geers, BDI
- Kent Sowatzke, Bimba
- Jon Frey, Bosch Rexroth
- Christian Eitel, Bucher Hydraulics
- Jeff Watts, Bucher Hydraulics
- Todd Harmon, Canfield Industries
- Jeff Ayers, CIM-TEK Filtration
- Michael DeFrancesco, Classic Coil Company
- Lane Boger, Comer Industries
- Zach Christenson, Continental ContiTech
- Michael McVay, Cross Company
- Dominic Catanzarite, Daman Products
- Matt Giloth, Daman Products
- Kevin Lingenfelter, Danfoss
- Jason Palmer, Delta Computer Systems
- Jerry Weber, Delta Power
- Ivan Sheffield, Des-Case
- Chris Heczko, Dura-Bar
- Jason Parr, Dura-Bar
- Jamie LeClair, Eaton Hydraulics
- Adam Livesay, Elevat IoT
- Jonathan Gamble, Enfield Technologies
- Ben Wallis, eShipping
- Tom Marino, Exotic Automation and Supply
- Joel Edwards, Faster
- Mitchell Wiese, Faster
- Mike Guelker, Festo
- Bert Martinez, Fluid Power Concepts
- Matt Loeffler, FORCE America
- Todd Pinkelman, Gates Corporation
- Derrick Dunn, Geartek
- Mark Paxton, HANSA-FLEX
- Tim Erickson, HED
- Chris Kolbe, HYDAC
- Mark Bokorney, Hydra-Power Systems
- Russ Schneidewind, HydraForce
- Brian Steward, Iowa State University
- Mitchell Baker, JARP Industries
- Joe Jackan, JARP Industries
- Jeff Bauer, John Deere
- Paul Marvin, John Deere
- Tom VanderMeulen, Kawasaki Hydraulics
- Gary Dostal, Komatsu
- Brian Thiel, Komatsu
- Russell Luzinski, Linde Hydraulics
- Kevin Hein, Master Pneumatic
- Rick Bush, Micromatic
- Douglas Lacina, Milwaukee Cylinder
- Paul Michael, Milwaukee School of Engineering
- Tom Wanke, Milwaukee School of Engineering
- Ari Almqvist, Moog
- David Geiger, Moog
- Bob Mosey, Moseys Production Machinists
- Alan McCay, Motion Industries
- Larry Wesley, Muncie Power Products
- Bob Bates, National Tube Supply
- Gary Throw, National Tube Supply
- Rob Wuertz, OEM Controls
- Brad Bomkamp, Parker Hannifin
- Guillaume Besnouin, Poclain Hydraulics
- Kevin Brown, QP Hydraulics
- Allan Scales, RSA
- Jason Looman, Scanreco
- Kevin Smith, Scott Industrial Systems
- Scott McCambridge, SMC Corporation of America
- Jeff Andrasik, Smithers
- Steve Meislahn, Sun Hydraulics
- Zeke Metzler, Texcel Rubber
- Michael Cook, Trelleborg Sealing Solutions
- Beth Figluilo, Trelleborg Sealing Solutions
- Nancy Getz, Trelleborg Sealing Solutions
- Johannes Kunze, Trelleborg Sealing Solutions
- John McLaughlin, Trelleborg Sealing Solutions
- Tom Zozokos, Trelleborg Sealing Solutions
- Jim Van de Ven, University of Minnesota
- Scott Jones, Womack Machine Supply

NFPA Staff
- Pete Alles
- Eric Lanke
- Maddie Parise

Customer Drivers

The Committee first reviewed the eleven Customer Drivers that had been identified at its January 21, 2021 meeting.

Customer Drivers

Fluid power's machine builders want to provide their customers with machines that offer:

- Increased availability and up-time
- Decreased lead time in getting the machine
- On-time delivery of the machine
- Increased productivity and performance
- Increased energy efficiency
- Compliance with environmental and safety regulations and machine directives
- Lower capital and operating costs
- Easier and more predictable maintenance
- Increased use of integrated data and connected intelligence
- Autonomous functions and operation
- Weight reductions and increased power density

Capability Improvements

The Committee then reviewed the eight Capability Improvements that were identified in the 2019 NFPA Technology Roadmap as those of highest importance for the fluid power industry to pursue in order to meet or better meet the customer needs described by the Customer Drivers.

Capability Improvements

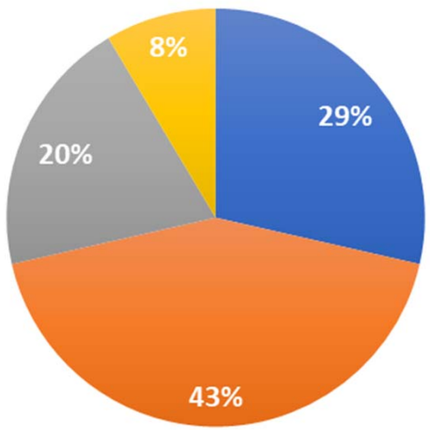
In order to better meet the needs of our customers, fluid power should seek to:

- Improve fluid power control systems (including through electrification)
- Monitor, gather and use data generated from working fluid power products to add value
- Provide greater fluid power expertise
- Improve fluid power's reliability and durability
- Increase fluid power's energy efficiency
- Increase fluid power's power density
- Reduce the environmental impact of fluid power components and systems
- Reduce lead time for fluid power components and their control elements

Survey on Customer Drivers and Capability Improvements

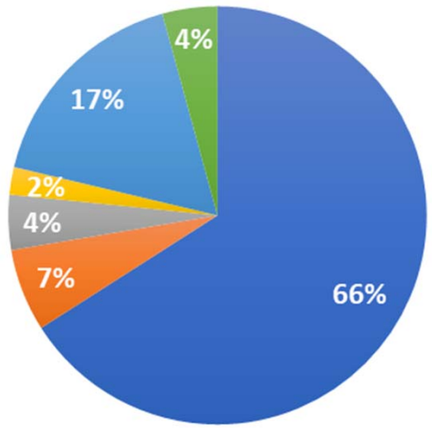
The Committee next reviewed the results of a February 2021 survey conducted by NFPA to rank the importance of these Customer Drivers, to determine fluid power's current ability to meet the customer needs represented by them, to assess the usefulness of these Capability Improvements in helping fluid power meet them, and to determine if any new Capability Improvements had emerged since the time of the 2019 NFPA Technology Roadmap. The survey received responses from 70 individuals across the fluid power supply chain, including a large percentage from the NFPA Roadmap Committee.

Supply Chain Representation



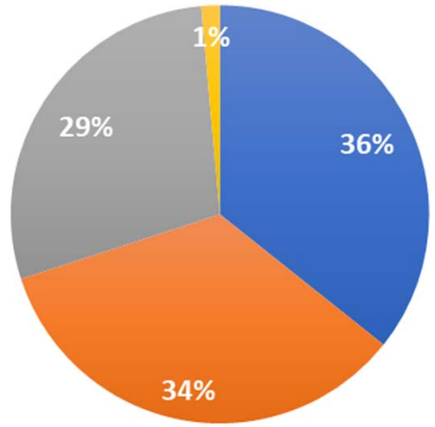
- SUPPLIER to the fluid power industry
- MANUFACTURER of fluid power components
- Fluid power DISTRIBUTOR or system integrator
- MACHINE BUILDER that uses fluid power technology

Associations Representation



- National Fluid Power Association
- Association for High Technology Distribution
- Power Transmission Distributors Association
- Packaging Machinery Manufacturers Institute
- Association of Equipment Manufacturers
- Association for Manufacturing Technology

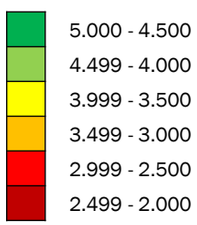
Job Function of Responders



- Executive Management
- Sales or Marketing
- Engineering
- Human Resources

Ranked Importance of Customer Drivers

CUSTOMER DRIVERS	WEIGHTED AVERAGE	IN MARKETS SERVED BY HYDRAULICS	IN MARKETS SERVED BY PNEUMATICS
Increased availability and up-time	4.54	4.60	4.25
Increased productivity and performance	4.51	4.56	4.23
On-time delivery of the machine	4.21	4.23	4.09
Lower capital and operating costs	4.09	4.10	4.02
Compliance with environmental and safety regulations and machine directives	4.04	4.06	3.93
Easier and more predictable maintenance	3.90	3.89	3.93
Increased energy efficiency	3.78	3.80	3.70
Increased use of integrated data and connected intelligence	3.72	3.72	3.70
Decreased lead time in getting the machine	3.65	3.63	3.75
Weight reductions and increased power density	3.32	3.39	2.93
Autonomous functions and operation	3.23	3.23	3.23



Survey participants were first asked to rank how important each of the customer drivers are for machine builders in markets typically served by hydraulics and in markets typically served by pneumatics.

The scoring scale was: 5 = Extremely important; 4 = Very important; 3 = Somewhat important; 2 = Not so important; 1 = Not at all important.

The weighted average reflects that, according to NFPA's latest data, hydraulics represent 84% and pneumatics represent 16% of all fluid power component sales.

When asked to identify additional customer drivers that would have ranked as extremely important or very important, survey participants had two concrete suggestions: (1) Easier implementation of new technologies; and (2) Reduced noise.

Based on these results, it was agreed that all these customer drivers were at least somewhat important in markets served by fluid power.

Hierarchy of Customer Drivers

Survey participants were then asked to identify when efforts to address one customer driver could also serve as a method for addressing the needs represented by other drivers. A summary of the percentages of participants identifying such a relationship for each pair of drivers is shown at right.

Focusing on instances where 81% or more of participants responded, it was decided that it would be more appropriate to classify:

- Autonomous functions and operations as a method for delivering increased productivity and performance;
- Weight reductions and increased power density as a method for delivering increased energy efficiency;
- Decreased lead time in getting the machine as a method for ensuring the on-time delivery of the machine; and
- Increased use of integrated data and connected intelligence as a method for delivering increased productivity and performance and for delivering easier and more predictable maintenance.

In making these changes, the Committee noted that it is more clearly separating “what the user wants” from “how the OEM is going to deliver it to them.”

	...ARE AN EFFECTIVE METHOD FOR ACHIEVING THESE CUSTOMER DRIVERS										
THESE CUSTOMER DRIVERS...	Increased availability and up-time	Increased productivity and performance	On-time delivery of the machine	Lower capital and operating costs	Compliance with environmental and safety regulations and machine directives	Easier and more predictable maintenance	Increased energy efficiency	Increased use of integrated data and connected intelligence	Decreased lead time in getting the machine	Weight reductions and increased power density	Autonomous functions and operation
Increased availability and up-time		72%	26%	61%	9%	54%	22%	30%	26%	4%	7%
Increased productivity and performance	41%		0%	71%	17%	43%	65%	26%	0%	15%	13%
On-time delivery of the machine	54%	26%		41%	3%	13%	13%	5%	56%	0%	3%
Lower capital and operating costs	32%	77%	13%		6%	32%	61%	26%	10%	16%	10%
Compliance with environmental and safety regulations and machine directives	20%	26%	6%	46%		17%	63%	23%	3%	11%	9%
Easier and more predictable maintenance	87%	76%	2%	76%	20%		37%	39%	2%	2%	9%
Increased energy efficiency	24%	63%	0%	76%	61%	9%		15%	2%	28%	7%
Increased use of integrated data and connected intelligence	67%	89%	4%	52%	37%	85%	70%		4%	7%	65%
Decreased lead time in getting the machine	36%	19%	83%	36%	2%	2%	7%	5%		2%	0%
Weight reductions and increased power density	5%	62%	2%	57%	19%	5%	86%	0%	0%		2%
Autonomous functions and operation	50%	88%	0%	62%	29%	31%	57%	64%	0%	10%	

100-81%
80-61%
60-41%
40-21%
20-0%

Final Customer Drivers

The Committee then reviewed and approved this final list of Customer Drivers for the 2021 NFPA Technology Roadmap, prioritized in order of importance.

Customer Drivers

Fluid power's machine builders want to provide their customers with machines that offer:

1. **Increased availability and up-time**
2. **Increased productivity and performance**, including through efforts to provide autonomous functions and operations, and to use integrated data and intelligence
3. **On-time delivery of the machine**, including through efforts to decrease lead time in getting the machine
4. **Lower capital and operating costs**
5. **Compliance with environmental and safety regulations and machine directives**
6. **Easier and more predictable maintenance**, including through efforts to use integrated data and intelligence
7. **Increased energy efficiency**, including though efforts to reduce weight and increase power density

Alignment with Fluid Power

CUSTOMER DRIVERS	WEIGHTED AVERAGE	FREQUENCY **HYDRAULICS** IS USED TO DELIVER BENEFITS	FREQUENCY **PNEUMATICS** IS USED TO DELIVER BENEFITS
Increased availability and up-time	**3.84**	**3.88**	**3.62**
Increased productivity and performance	**4.29**	**4.38**	**3.79**
On-time delivery of the machine	**3.38**	**3.38**	**3.38**
Lower capital and operating costs	**3.65**	**3.66**	**3.62**
Compliance with environmental and safety regulations and machine directives	**3.47**	**3.44**	**3.65**
Easier and more predictable maintenance	**3.49**	**3.48**	**3.56**
Increased energy efficiency	**3.71**	**3.76**	**3.44**
Increased use of integrated data and connected intelligence	**3.12**	**3.12**	**3.12**
Decreased lead time in getting the machine	**3.16**	**3.14**	**3.24**
Weight reductions and increased power density	**3.60**	**3.66**	**3.29**
Autonomous functions and operation	**3.06**	**3.06**	**3.03**

- 4.00 or higher
- 3.75-3.99
- 3.50-3.74
- 3.25-3.51
- 3.00-3.24
- Below 3.00

Survey participants were next asked how often hydraulic and pneumatic technologies are used by machine builders when delivering each of the benefits described by the Customer Drivers to the buyers and users of their machines.

The scoring scale was: 5 = Always; 4 = Usually; 3 = Sometimes; 2 = Rarely; 1 = Never.

The Committee focused its analysis on the seven most important Customer Drivers. The weighted average reflects that, according to NFPA's latest data, hydraulics represent 84% and pneumatics represent 16% of all fluid power component sales.

It was noted that fluid power is generally aligned with the needs expressed by the Customer Drivers. Fluid power appears most often used to help machine builders deliver increased productivity & performance and increased availability & up-time, and least often used to help machine builders ensure on-time delivery of the machine and compliance with environmental and safety regulations.

Gap Between Importance and Alignment

It is often helpful to look at the gap between the importance of a customer driver and the frequency with which fluid power is used by machine builders to deliver its benefits to their customers.

The Committee focused its analysis on the seven most important Customer Drivers. The weighted average reflects that, according to NFPA's latest data, hydraulics represent 84% and pneumatics represent 16% of all fluid power component sales.

For all seven, the gaps between importance and use of fluid power are positive numbers, meaning that the frequency of fluid power use scored lower than the importance of the driver. The Customer Drivers can be ordered from largest to smallest gap like this:

1. On-time delivery of the machine (0.83)
2. Increased availability and up-time (0.71)
3. Compliance with environmental and safety regulations and machine directives (0.57)
4. Lower capital and operating costs (0.43)
5. Easier and more predictable maintenance (0.40)
6. Increased productivity and performance (0.22)
7. Increased energy efficiency (0.08)

This suggests that fluid power should focus on Capability Improvements that would help address the top drivers on this list.

	GAP BETWEEN IMPORTANCE AND ALIGNMENT		
CUSTOMER DRIVERS	WEIGHTED AVERAGE	HYDRAULICS	PNEUMATICS
Increased availability and up-time	0.71	0.72	0.63
Increased productivity and performance	0.22	0.18	0.44
On-time delivery of the machine	0.83	0.85	0.71
Lower capital and operating costs	0.43	0.44	0.40
Compliance with environmental and safety regulations and machine directives	0.57	0.62	0.28
Easier and more predictable maintenance	0.40	0.41	0.37
Increased energy efficiency	0.08	0.04	0.26
Increased use of integrated data and connected intelligence	0.60	0.60	0.58
Decreased lead time in getting the machine	0.49	0.49	0.51
Weight reductions and increased power density	-0.28	-0.27	-0.36
Autonomous functions and operation	0.17	0.17	0.20

- Zero or less (better alignment than importance)
- 0.01-0.25
- 0.26-0.50
- 0.51-0.75
- 0.76-1.00
- 1.01-1.25

Helpfulness of Existing Capability Improvements

Survey participants were then asked to rank how helpful each of the 2019 Capability Improvements would be in improving the ability of hydraulic and pneumatic systems in allowing machine builders to provide the benefits described by each Customer Driver.

The scoring scale was: 5 = Extremely helpful; 4 = Very helpful; 3 = Somewhat helpful; 2 = Not too helpful; 1 = Not at all helpful.

The Committee focused its analysis on the seven most important Customer Drivers. The weighted average reflects that, according to NFPA's latest data, hydraulics represent 84% and pneumatics represent 16% of all fluid power component sales.

		CUSTOMER DRIVERS													
		Increased availability and up-time		Increased productivity and performance		On-time delivery of the machine		Lower capital and operating costs		Compliance with environmental and safety regulations and machine directives		Easier and more predictable maintenance		Increased energy efficiency	
CAPABILITY IMPROVEMENTS	WEIGHTED AVERAGE	HYD	PNE	HYD	PNE	HYD	PNE	HYD	PNE	HYD	PNE	HYD	PNE	HYD	PNE
Improve fluid power control systems (including through electrification)	3.65	3.96	3.53	4.38	4.21	1.95	2.12	3.85	4.03	3.55	3.38	3.75	3.87	4.15	4.03
Monitor, gather and use data generated from working fluid power products to add value	3.81	4.24	4.06	4.15	4.13	1.95	2.12	3.95	3.87	3.63	3.66	4.71	4.56	4.10	3.94
Provide greater fluid power expertise	3.52	3.80	3.67	3.90	4.06	2.85	2.97	3.51	3.50	3.33	3.47	3.78	3.87	3.43	3.38
Improve fluid power's reliability and durability	3.65	4.59	4.29	4.05	4.09	2.12	2.13	4.17	4.09	2.88	2.91	4.60	4.52	3.18	3.30
Increase fluid power's energy efficiency	3.50	3.42	3.25	3.83	3.79	1.80	1.97	4.37	4.22	3.38	3.25	2.80	2.87	4.93	4.79
Increase fluid power's power density	2.92	2.96	2.86	3.73	3.50	1.90	2.03	3.33	3.34	2.50	2.41	2.36	2.42	3.67	3.62
Reduce the environmental impact of fluid power components and systems	2.77	2.82	2.83	2.43	2.50	1.83	2.00	2.55	2.65	4.69	4.50	2.38	2.42	2.58	2.88
Reduce lead time for fluid power components and their control elements	2.58	3.40	3.42	2.23	2.41	4.17	4.26	2.30	2.29	1.56	1.68	2.53	2.65	1.75	1.88

It was determined that these results show that each Capability Improvement would be extremely or very helpful in improving fluid power's ability to help meet the customer needs expressed by at least one of the Customer Drivers.

5.00-4.01
4.00-3.01
3.00-2.01
2.00-1.01
1.00-0.01

Suggestions for New Capability Improvements

	SUGGESTIONS FOR CAPABILITY IMPROVEMENTS	
CUSTOMER DRIVERS	**HYDRAULIC SYSTEMS**	**PNEUMATIC SYSTEMS**
Increased availability and up-time	Origin of supply chain manufacturing Proper distribution strategy Real time oil monitoring Easily maintained Distributors stocking product more Availability of service parts	Origin of supply chain manufacturing Proper distribution strategy Easily maintained Distributors stocking product more Availability of service parts
Increased productivity and performance	Noise/vibrations Use of new technology like IoT or similar	Use of new technology like IoT or similar
On-time delivery of the machine	Improved fabrication capability - flexibility and throughput Better distributor involvement Local support from hydraulic suppliers	Better distributor involvement Local support from hydraulic suppliers
Lower capital and operating costs	Identify actual operating costs so they can be targeted	Identify actual operating costs so they can be targeted
Compliance with environmental and safety regulations and machine directives	Better knowledge of published directives and compliance	Better knowledge of published directives and compliance
Easier and more predictable maintenance	Clear and precise technical documentation Embrace new technology that monitors machine performance Supply chain consistency	Clear and precise technical documentation Embrace new technology that monitors machine performance Supply chain consistency
Increased energy efficiency	Better data to see how to improve efficiency	Better data to see how to improve efficiency
Increased use of integrated data and connected intelligence	Break down trust barriers to network security	Break down trust barriers to network security
Decreased lead time in getting the machine	Distribution strategy Stable or short supply chains	Distribution strategy Stable or short supply chains
Weight reductions and increased power density		
Autonomous functions and operation	Local programming support from suppliers Training necessary to support this technology	Local programming support from suppliers Training necessary to support this technology

In addition to ranking the helpfulness of the existing Capability Improvements, participants were also asked to suggest any additional Capability Improvements that they would have ranked as “Extremely Helpful” or “Very Helpful” for each Customer Driver. A summary of the responses received is shown at left.

In reviewing these suggestions, the Committee noted that many of them would require market-based rather than technology-based improvements in order to be effective, and therefore may not be appropriate for incorporation into a technology development roadmap.

Action on Suggested Capability Improvements

The Committee discussed the following list of suggested Capability Improvements, each of which being identified as a possible technology-based improvement. The table also summarizes the agreed-upon action for incorporating each suggestion into the new technology roadmap.

Related Customer Driver	Suggested Capability Improvement	Action
Increased availability and up-time	Real-time oil monitoring	Include as a possible research area under the existing Capability Improvement: "Monitor, gather and use data generated from working fluid power products to add value."
	Easily maintained	Include as a possible research area under the existing Capability Improvement: "Improve fluid power's reliability and durability."
Increased productivity and performance	Noise/vibrations	Include as a possible research area under the existing Capability Improvement: "Reduce the environmental impact of fluid power components and systems."
	Use of technology like IoT or similar	Include as a possible research area under the existing Capability Improvement: "Improve fluid power control systems (including through electrification)."
On-time delivery of the machine	Improved fabrication capability – flexibility and throughput	Include as a possible research area under the existing Capability Improvement: "Reduce lead time for fluid power components and their control elements."
Easier and more predictable maintenance	Embrace new technology that monitors machine performance	Include as a possible research area under the existing Capability Improvement: "Monitor, gather and use data generated from working fluid power products to add value."
Increased energy efficiency	Better data to see how to improve efficiency	Include as a possible research area under the existing Capability Improvement: "Increase fluid power's energy efficiency."

During the discussion, other suggestions were made for possible Research Areas, and it was noted that several of the suggestions could conceivably be Research Areas under multiple Capability Improvements. A list of these suggestions was created, and it was agreed that they would be included in the next committee survey on Research Areas and Targets.

Draft List of 2021 Capability Improvements

To summarize the discussions and actions taken by the Committee, the following represents the draft list of Capability Improvements that will be used in the further development of the 2021 NFPA Technology Roadmap (not in priority order).

In order to better meet the needs of our customers, fluid power should seek to:

- Improve fluid power control systems (including through electrification)
- Monitor, gather and use data generated from working fluid power products to add value
- Improve fluid power's reliability and durability
- Increase fluid power's energy efficiency
- Increase fluid power's power density
- Reduce the environmental impact of fluid power components and systems
- Reduce lead time for fluid power components and their control elements

Notably, “Provide greater fluid power expertise” was removed from this list. The Committee agreed that, although it represented an important area of market and student education, it is not a technology-based improvement to fluid power systems, and it is therefore an outlier in a technology-based development roadmap for fluid power.

Committee members then volunteered to serve on one of seven Working Groups, each of which will be tasked with the development of Research Areas and Targets for each Capability Improvement.

Wrap-Up and Next Steps

The Committee meeting closed with a review of the next steps on the process and timeline for the 2021 update to the NFPA Technology Roadmap.

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