CCEFP Operating Procedure (COP)

COP No: 005 Rev 02
Title: CCEFP Project Selection

	NAME	TITLE	SIGNATURE	DATE
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READ AND COMMENTED BY			
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various	CCEFP Industrial Advisory Board	N/A	07-17-2014

PURPOSE

The purpose of this CCEFP Operating Procedure is to define the criteria and overall process for the selection of the CCEFP research project proposals that are funded through the NFPA Foundation.

INTRODUCTION

A balanced research portfolio that addresses the pre-competitive needs of the fluid power industry is the most important feature in helping the CCEFP achieve its goals of developing fundamental knowledge about fluid power and the education of the next generation of scientific and engineering leaders in the field. A well balanced portfolio will support both hydraulic and pneumatic projects and will span the risk/reward spectrum from fundamental research representative of technology and manufacturing readiness levels TRL/MRL 1 to nearer term technology and manufacturing efforts of a TRL/MRL 4 or 5. Industry participation in the selection of projects is paramount to ensuring that the CCEFP is responsive to meeting industry needs. Academic perspective is critical to pushing the boundaries of new ideas and concepts.

All projects should have a beginning and an end and not continue indefinitely. CCEFP projects are typically authorized funding for a 2-year time period, although the second year of funding is not awarded until the next fiscal year, at which point it is guaranteed. At the end of this 2-year time period it is acceptable to submit a new proposal to continue the research. However this new project must still be recommended for funding by the CCEFP Industry Engagement Committee and approved by the CCEFP Director to receive funding. Projects that are not selected for renewal are sun-set. The CCEFP

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Management Team strives to be as supportive as possible during the transition phase, especially with regard to any affected students.

SCOPE

The criteria and process for selection of project proposals funded through the NFPA Foundation are within the scope of this COP.

DEFINITIONS

Project selection criteria descriptions for Strategic Alignment, Risk, Reward and Weight are shown in the CCEFP Research Project Proposal Assessment Rubric template. (Link provided below.) Alignment is an indication of how well the proposal fits the CCEFP Research Strategy. Risk is an indication of how likely the project will achieve the stated results. Reward is an indication of how impactful the project will be should it succeed. Weight factor is an optional feature used to apply added importance to the particular assessment criteria.

TRL – Technology readiness level. A measurement of the maturity of a technology developed by the US Department of Defense (DoD). TRL values range from TRL 1 to TRL 9. Corresponding CCEFP definitions are provided in the table below.

Technology Readiness Level	DoD Description	CCEFP Description
TRL 1: Basic principles observed and reported	Lowest level of technology readiness. Scientific research begins to be translated into applied research and development. Example might include paper studies of a technology's basic properties.	Basic fundamental research that could lead to future improvements in many different areas which have yet to be defined. (Ex: nano particles or texturing that reduces friction)
TRL 2: Technology concept and/or application formulated	Invention begins. Once basic principles are observed, practical applications can be invented. The application is speculative and there is no proof or detailed analysis to support the assumption. Examples are still limited to paper studies.	Next logical step from fundamental research. Typically this would include early stage investigation of the optimal application for the fundamental insight gained in a TRL 1 project. The goal is to determine which specific fluid power challenge or barrier on which to focus.
TRL 3: Analytical and experimental critical function and/or characteristic proof of concept	Active research and development is initiated. This includes analytical studies and laboratory studies to physically validate analytical predictions of separate elements of the technology. Examples include components that are not yet integrated or representative.	The mathematical analysis, modeling and/or early experimental verification associated with the focused TRL 2 effort above. Most likely to include an associated bench prototype.
TRL 4: Component and/or breadboard validation in laboratory environment	Basic technological components are integrated to establish that the pieces will work together. This is "low fidelity" compared to the eventual system.	Concept has been demonstrated in a lab environment. Case can be made for improvement over existing approaches. Industry input for an on-purpose design is

	Examples include integration of "ad hoc" hardware in a laboratory.	highly desirable before continued any further development.
TRL 5: Component and/or breadboard validation in relevant environment	Fidelity of breadboard technology increases significantly. The basic technological components are integrated with reasonably realistic supporting elements so that the technology can be tested in a simulated environment. Examples include 'high fidelity' laboratory integration of components.	On purpose prototype has demonstrated the desired product feature or benefit in the lab or on a test bed. An industry partner has been involved in developing the test plan. Next step is to begin commercialization.
TRL 6: System/subsystem model or prototype demonstration in a relevant environment	Representative model or prototype system, which is well beyond the breadboard tested for TRL 5, is tested in a relevant environment. Represents a major step up in a technology's demonstrated readiness. Examples include testing a prototype in a high fidelity laboratory environment or in simulated operational environment.	A CCEFP project or test bed at this level would be nearing the end of Center support. An industry partner is likely to have assumed the lead role for further efforts (as a sponsored project) or the project is in the final stages of graduating as a Center-funded project.
TRL 7: System prototype demonstration in an operational environment	Prototype near or at planned operational system. Represents a major step up from TRL 6, requiring the demonstration of an actual system prototype in an operational environment, such as in an aircraft, vehicle or space. Examples include testing the prototype in a test bed aircraft.	Possible CCEFP involvement, but only as an associated/sponsored project and not a Center-funded project. An industry partner or start-up is now leading the effort.
TRL 8: Actual system completed and qualified through test and demonstration	Technology has been proven to work in its final form and under expected conditions. In almost all cases, this TRL represents the end of true system development. Examples include developmental test and evaluation of the system in its intended weapon system to determine if it meets design specifications.	Not applicable to CCEFP. Technologies at this level would normally fall under industry development programs. CCEFP may play a supportive role.
TRL 9: Actual system proven through successful mission operations	Actual application of the technology in its final form and under mission conditions, such as those encountered in operational test and evaluation. In almost all cases, this is the end of the last "bug fixing" aspects of true system development. Examples include using the system under operational mission conditions.	Not applicable to CCEFP. Technologies at this level would normally fall under industry development programs. CCEFP may play a supportive role.

MRL – Manufacturing readiness level. A quantitative measure used to assess the maturity of a given technology, component or system from a manufacturing perspective. MRL values range from MRL 1 to 9. Corresponding CCEFP definitions are provided in the table below.

Manufacturing Readiness Level	DoD Description	CCEFP Description
MRL 1: Basic manufacturing implications identified	Basic research expands scientific principles that may have manufacturing implications.	Basic fundamental research that could lead to future improvements in many different

	The focus is on a high level assessment of manufacturing opportunities. The research is unfettered.	areas which have yet to be defined. (Ex: surface science research to better understand nano coating properties at a molecular level)
MRL 2: Manufacturing concepts identified	Invention begins. Manufacturing science and/or concept described in application context. Identification of material and process approaches are limited to paper studies and analysis. Initial manufacturing feasibility and issues are emerging.	Next logical step from fundamental research. Typically this would include early stage investigation of the optimal application for the fundamental insight gained in a MRL 1 project. The goal is to determine which specific fluid power manufacturing challenge or barrier on which to focus.
MRL 3: Manufacturing proof of concept developed	Conduct analytical or laboratory experiments to validate paper studies. Experimental hardware or processes have been created, but are not yet integrated or representative. Materials and/or processes have been characterized for manufacturability and availability but further evaluation and demonstration is required.	The mathematical analysis, modeling and/or early experimental verification associated with the focused MRL 2 effort above. Most likely to include an associated early stage manufacturing prototype process.
MRL 4: Capability to produce the technology in a laboratory environment.	Required investments, such as manufacturing technology development identified. Processes to ensure manufacturability, producibility and quality are in place and are sufficient to produce technology demonstrators. Manufacturing risks identified for prototype build. Manufacturing cost drivers identified. Producibility assessments of design concepts have been completed. Key design performance parameters identified. Special needs identified for tooling, facilities, material handling and skills.	Process has been demonstrated in a lab environment. Case can be made for improvement over existing manufacturing methods. Industry input for a targeted production intent process is highly desirable before continued any further development.
MRL 5: Capability to produce prototype components in a production relevant environment.	Manufacturing strategy refined and integrated with Risk Management Plan. Identification of enabling/critical technologies and components is complete. Prototype materials, tooling and test equipment, as well as personnel skills, have been demonstrated on components in a production relevant environment, but many manufacturing processes and procedures are still in development. Manufacturing technology development efforts initiated or ongoing. Producibility assessments of key technologies and components ongoing. Cost model based upon detailed end-to-end value stream map.	Production intent process has demonstrated the desired benefit in the lab or on actual manufacturing equipment. An industry partner has been involved in developing the process evaluation plan. Next step is to begin commercialization.
MRL 6: Capability to produce a prototype system or subsystem in a production relevant environment.	Initial manufacturing approach developed. Majority of manufacturing processes have been defined and characterized, but there are still significant engineering/design changes. Preliminary design of critical components completed. Producibility	A CCEFP manufacturing process research project at this level would be nearing the end of Center support. An industry partner is likely to have assumed the lead role for further efforts (as a sponsored project) or

	assessments of key technologies complete. Prototype materials, tooling and test equipment, as well as personnel skills have been demonstrated on subsystems/ systems in a production relevant environment. Detailed cost analysis include design trades. Cost targets allocated. Producibility considerations shape system development plans. Long lead and key supply chain elements identified. Industrial Capabilities Assessment for Milestone B completed.	the project is in the final stages of graduating as a Center-funded project.
MRL 7: Capability to produce systems, subsystems or components in a production representative environment.	Detailed design is underway. Material specifications are approved. Materials available to meet planned pilot line build schedule. Manufacturing processes and procedures demonstrated in a production representative environment. Detailed producibility trade studies and risk assessments underway. Cost models updated with detailed designs, rolled up to system level and tracked against targets. Unit cost reduction efforts underway. Supply chain and supplier Quality Assurance assessed. Long lead procurement plans in place. Production tooling and test equipment design and development initiated.	Possible CCEFP involvement, but only as an associated/sponsored project and not a Center-funded project. An industry partner or start-up is now leading the effort.
MRL 8: Pilot line capability demonstrated. Ready to begin low rate production.	Detailed system design essentially complete and sufficiently stable to enter low rate production. All materials are available to meet planned low rate production schedule. Manufacturing and quality processes and procedures proven in a pilot line environment, under control and ready for low rate production. Known producibility risks pose no significant risk for low rate production. Engineering cost model driven by detailed design and validated. Supply chain established and stable. Industrial Capabilities Assessment for Milestone C completed.	Not applicable to CCEFP. Processes at this level would normally fall under industry development programs. CCEFP may play a supportive role.
MRL 9: Low Rate Production demonstrated. Capability in place to begin Full Rate Production.	Major system design features are stable and proven in test and evaluation. Materials are available to meet planned rate production schedules. Manufacturing processes and procedures are established and controlled to three-sigma or some other appropriate quality level to meet design key characteristic tolerances in a low rate production environment. Production risk monitoring ongoing. LRIP cost goals met, learning curve validated. Actual cost model developed for Full Rate Production environment, with impact of Continuous improvement.	Not applicable to CCEFP. Processes at this level would normally fall under industry development programs. CCEFP may play a supportive role.

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RESPONSIBILITIES

1. The CCEFP Director, or his designee, is responsible for administering the overall project selection process.
2. The CCEFP Industry Engagement Committee will be responsible for recommending which proposals are funded.
3. The CCEFP Industry Engagement Committee will identify a number of proposal review teams to provide appropriate and knowledgeable reviews of all proposals. In addition to the members of the CCEFP Industry Engagement Committee, these proposal review teams will include the members of the NFPA Roadmap Committee. The CCEFP Director has final responsibility for determining which projects will be funded.

PROCEDURE

1. Responses to the CCEFP Call for Project Proposals will be posted on a secure website to allow proposal review teams access to the proposals. Instructions will be provided to each individual review team representative.
2. Each proposal review team representative will assess and rank order project proposals based on the selection criteria per the proposal assessment rubric. Ranking results from multiple representatives will be combined and compared using appropriate statistical methods and forwarded to the CCEFP Director or his designee.
3. The CCEFP Director and CCEFP Industry Relations Director will review the project rankings to ensure proper distribution and strategic alignment, and prepare a final list of rank-ordered projects to be funded.
4. The final list of projects to be funded will be presented to the CCEFP Industry Engagement Committee. Any deviations from the received ranked order due to concerns about distribution or strategic alignment will be described and explained by the CCEFP Director.
5. Projects will be awarded in the final ranked order up to the available funding limit. Typically projects will be funded for two years unless otherwise specified.
6. PIs will be notified of the awards per the lead university Sponsored Projects Administration organization.
7. Existing CCEFP projects that are discontinued qualify for bridge funding per CCEFP guidelines.

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FORMS and TEMPLATES USED

CCEFP Research Project Proposal Assessment Rubric template can be found at:

https://drive.google.com/file/d/0B6Bw_IxcNc3AeThLa3hUQkgtMWw3blpvQmVmcHAzNHd3Rkxz/view?usp=sharing

REFERENCES

Not applicable.

REVISION CONTROL

Revision No.	Significant Changes	Release Date
0	Initial document release	09-19-2014
1	Updated procedure	05-20-2016
2	Updated procedures	11-7-2016