Product Accelerator 3.0 for Functional Fabrics

from Advanced Functional Fabrics of America

GUIDEBOOK

VERSION 3.0

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SECTION 1. Introduction and Background

1.1 AFFOA's Mission

In 2016, Advanced Functional Fabrics of America (AFFOA), an independent not-for-profit organization, was founded as a DoD-sponsored Manufacturing USA Institute with the mission to rekindle the domestic textiles industry by leading a nationwide enterprise for advanced fiber & fabric technology development and manufacturing, enabling revolutionary system capabilities for national security and commercial markets. To pursue this mission, AFFOA addresses the spectrum of challenges associated with volume manufacturing of revolutionary fibers and textiles from design to end-product prototypes through various efforts, including the Product Accelerator for Functional Fabrics (PAFF) Program. These efforts aim to accelerate the development and commercialization of advanced fiber and fabric products.

Meeting AFFOA's mission starts with understanding the problem and developing key collaborations. AFFOA actively leverages capabilities within our Fabric Innovation Network (membership consortium) of domestic academic institutions, startups, manufacturers, and large industry partners in conjunction with our agile capabilities for advanced fiber and fabric prototyping and process improvement to foster innovation and manufacturing maturation for national security and commercial products.

More information on AFFOA's mission, impact, and the Fabric Innovation Network can be found on our website at: www.affoa.org.

SECTION 2. Product Accelerator for Functional Fabrics Scope & Information

2.1 Product Accelerator for Functional Fabrics (PAFF) Scope

The PAFF program enables organizations to utilize AFFOA's capabilities and expertise to increase the speed to market of advanced functional fiber and fabric products for commercial and national security applications. AFFOA uses the PAFF program to develop and foster product and/or process development collaborations with our Fabric Innovation Network. This guidebook outlines the process to apply for the PAFF program.

The Problem Being Solved. Commercializing advanced functional fabric-based products requires companies to fill many roles and capabilities, given the multidisciplinary nature of manufacturing processes embedded in these products. Specific equipment and specialized staff expertise may arise as a gap, where additional investment is either impossible, not yet justified, or will simply not be available in time. This program is designed to help US companies close the gap(s) in product and technology development. To improve the time to market for advanced functional fabric products, companies can use the PAFF program to leverage AFFOA's established specialized capabilities to close these critical technical gaps. The PAFF program targets companies with a product near commercialization (MRL >5 *https://www.dodmrl.com/*) or a process with a targeted improvement need that can be completed over a performance period of up to 12 months.

The PAFF Solution. Since its establishment, AFFOA has fostered the development of a broad set of technical expertise and specialized equipment for product development and testing. AFFOA has a team of experts ranging from textile designers and engineers to materials scientists and electrical system engineers. Collectively, the AFFOA team has gained extensive system integration and process engineering expertise necessary to mature a broad range of textile-based products and processes for product commercialization. Further, AFFOA has assembled a patent aggregate of existing US university intellectual property that may be leveraged through IP licensing. Beyond prototype and process development, the team is also skilled at landscaping and translating across disciplines, with the ability to facilitate supply chain and partnership identification across the Fabric Innovation Network.

PAFF 3.0 Topic Areas

The PAFF 3.0 program will focus on the following topics:

- Digital Engineering / Manufacturing
- Textile Manufacturing Automation
- Manufacturing Scale-Up
- Progressing TRL/MRL of Advanced Fibers and Fabrics

AFFOA ‘s Available Expertise and Capabilities for PAFF 3.0

The PAFF program provides access to AFFOA’s staff expertise and capabilities for your commercialization efforts, including:

- Textile and electronic product design
- Design for Manufacturing
- Digital engineering support
- Application of thermally drawn fiber*
- Electronics system design, development and analysis
- Prototyping – fiber, textiles, integrated systems
- Testing and evaluation, failure analysis
- Process engineering and automated manufacturing support
- Supply chain identification support
- Workforce training support

Appendix B provides a detailed description of AFFOA’s technical capabilities, equipment, and tools. If equipment and tools needed for project execution are not included in Appendix B, the proposer will work with AFFOA to identify available resources.

**No new fiber development will be funded*

SECTION 3. Proposal Submission Process

3.1 Product Accelerator for Functional Fabrics (PAFF) 3.0 Process & Timeline

The PAFF Program will utilize a two-step proposal process. First, Proposers are expected to submit a pre-proposal. Prior to submitting a pre-proposal, interested proposers may schedule an optional call with the AFFOA team between January 1st, 2026 and February 1st, 2026, to answer questions about the PAFF program scope and get feedback on proposed project concepts. Pre-proposal submissions will be evaluated according to the rubric in Appendix A, including technical and financial components.

Down-selected finalists will be notified to submit a final proposal. At this stage, finalists will work with AFFOA's technical team members to define AFFOA's Scope of Work, required internal resourcing, and proposed project deliverables. Please use the directions provided in Section 5 for contacting AFFOA with questions and to request a consultation.

AFFOA staff and US Government Stakeholders will evaluate final proposal submissions following the rubric in Appendix A. Successful proposers will be notified. Awardees will be expected to complete contracting with AFFOA within 30 days of award notification. All materials or samples required for project completion must be provided to AFFOA prior to the start of the project.

Feedback on proposals not selected for the PAFF program can be provided upon request.

Pre-proposals are due via email: proposals@affoa.org by 8:00 PM ET on February 15th, 2026.

Final proposals are due via email: proposals@affoa.org by 8:00 PM ET on April 15th, 2026.

The expected start date of the PAFF program effort will be June 1st 2026, with a period of performance of up to 12 months.

Key stages and dates	
Date	**Stage**
11/24/2025	PAFF 3.0 announcement
12/17/2025 at 12:00pm ET	PAFF 3.0 Webinar
01/01/2026 - 02/01/2026	Pre-Proposal Office Hours (Optional)
02/15/2026 by 8:00 PM ET	Pre-Proposal Deadline
03/01/2026	Finalist Notification
03/01/2026 – 04/01/2026	Proposer Scope, Budget and T&Cs Consultations
04/15/2026 by 8:00 PM ET	Final Proposal Deadline
04/30/2026	Notification of Awardees

06/01/2026	Contract Award*

*Note: Awardees are given 30 days after notification of the award for contract negotiation. If contract T&Cs cannot be aligned and the contract is not signed by June 1st, 2026, the award may be withdrawn.

3.2 Pre-Proposal and Final Proposal Format Guidelines

To maintain consistency through submission, review, and approval processes, please follow these guidelines:

Submission. Each Proposer shall submit a compiled document (PDF preferred) of their proposal(s).

Figures, Graphs, Images, and Pictures. Figures and tables must be numbered and referenced in the text by that number. They should be of a size that is easily readable and may be in landscape orientation.

Font. Proposals must be prepared with either Times New Roman or Arial font, 11-point size minimum, and single-spaced. A 10-point font size may be used in figures and tables.

Page Layout. The proposal document must be in portrait orientation except for larger figures, tables, graphs, images, and pictures, in which a landscape orientation improves legibility. Pages shall be single-spaced, 8.5 inches x 11 inches, with at least one-inch margins.

Page Limit. The main body of the pre-proposal is limited to three (3) pages, not including the Cover Page and Appendices. The main body of the final proposal is limited to ten (10) pages, not including the Cover Page and Appendices. Pages that exceed these guidelines may not be reviewed.

Page Numbering. Page numbers are requested, starting with the cover page.

Summary Slide. For internal and external communication purposes, each Proposer is required to provide a single slide following the template provided. The summary slide template can be found on the PAFF 3.0 website page under Resources at:
https://affoa.org/home/product-accelerator-for-functional-fabrics-3-0/#resources
This summary slide should not contain any proprietary information and should be approved by your organization for public release.

3.3 Pre-Proposal Content

This section provides pre-proposal content guidelines. For formatting and other requirements, please follow the instructions listed in Section 3.2. The pre-proposal is limited to 3 pages, excluding the Cover Page and Appendices. Any text beyond the 3-page limit may not be reviewed during evaluation.

Pre-proposals will be evaluated based on the rubric provided in Appendix A. It is imperative that pre-proposals:

- Show the market demand for the product. Along with the market analysis, it is

recommended to include any letters of support or interest from stakeholders, and potential customers (e.g. commercial, state government, federal government).
- The proposed concept falls within the scope of PAFF 3.0 and relates to one or more of the PAFF 3.0 Topic Areas.
- Outline the IP management plan and acknowledge Government Purpose Rights to outputs under the PAFF Program.
- Outline the Proposer's financial dedication to bringing the product to market and commitment to building a long-term relationship with AFFOA and other FIN members.

The pre-proposal template can be found on the PAFF 3.0 website page under Resources at: https://affoa.org/home/product-accelerator-for-functional-fabrics-3-0/#resources

The pre-proposal should include:

Frontmatter - Not included in page count	
Page 1	Cover Page (Included in Pre-Proposal Template)

Pre-Proposal Content	
Maximum 3 pages	Include the following items in the pre-proposal: Market analysis to demonstrate demand signal for product; Benchmark summary, including IP positioning of product, description of process or underlying technology; Product commercialization timeline; Current stage of product commercialization; Brief description of key challenges in product commercialization; Plan of use of AFFOA technical capabilities; Expected project outcome; Financial commitment (see Section 4.4)

Appendices – Not included in page count	
Excluded from Page Count	Appendix A. Acknowledgment of Government Purpose Rights (GPR)
	Appendix B. IP management plan: explain how intellectual property will be identified, protected, shared, and used in the collaboration with AFFOA via PAFF 3.0 program.
	Appendix C. Biosketches of key personnel (executive, technical, commercialization)
	Appendix D. Summary Slide: Provide a single slide following the template provided on the PAFF 3.0 website page under Resources at: https://affoa.org/home/product-accelerator-for-functional-fabrics-3-0/#resources
	Appendix E (Optional). Letter(s) of Interest (LOI) from potential commercial and/or government customers. Demonstrate demand signal for output of PAFF program.

Pre-proposals should be submitted via email: proposals@affoa.org by 8:00 PM ET on February 15th, 2026.

3.4 Final Proposal Content

This section provides the final proposal content guidelines. Please follow the instructions in Section 3.2 for formatting and other requirements. The final proposal is limited to 10 pages, excluding the Cover Page and Appendices. Any text beyond the 10-page limit

may not be reviewed during evaluation.

Final proposals will be evaluated based on the rubric provided in Appendix A. It is imperative that proposals:

- Clearly identify the current capability and the quantitative target specifications to determine the project's success.
- Define development milestones that are tangible, measurable, and demonstrable. The specifications of each milestone achievement should be clearly defined based on the goal of improving manufacturing and technology readiness. Examples of tangible milestones may include physical samples, written reports containing collected data, or live demonstrations of functionality.
- Define the financial commitment of the Proposer to product commercialization and its commitment toward a long-term relationship with AFFOA and other FIN members.

The final proposal template can be found on the PAFF 3.0 website page under Resources at: https://affoa.org/home/product-accelerator-for-functional-fabrics-3-0/#resources

The final proposal should include:

Frontmatter - Not included in page count	
1 page	Cover Page (Included Final Proposal Template)
	Table of Contents
1 page	Executive Summary: A succinct summary of no more than one (1) page clearly articulating the problem being addressed, product/process concept(s), key challenges of product/process development, how use of AFFOA technical capabilities will accelerate commercialization, expected outcomes, and financial commitment.

Final Proposal Content – Maximum 10 pages for sections 1-5, page counts for each section provided as a guide only.	
1 page	Section 1. Background: • Describe your organization's mission and commercialization motivation for applying to this program and the expected outcome(s) of this program. Your approach to commercialization should include a market analysis.
1 page	Section 2. Benchmarking: • Provide, in a table format, a comparison of the product to the current State-Of-The-Art or available commercial products. Summarize the innovation of your organization's product or process. • Clearly articulate how involvement in this program will establish product differentiation or improvement in the product or process being supported.

~3 pages	Section 3. Commercialization Strategy: • Detailed description of product/process capability today and effort made to date on commercialization. • List of key product specifications, including metrics/standards used for evaluation of the product or process. • List of developed intellectual property related to product and process, with a concise layman summary of the uniqueness of the intellectual property to your product or process. • Key challenges/technical gaps of product development. • Detailed development strategy for the product or use of process, including potential funding mechanisms that will be leveraged for additional advancement to commercialization. • Timeline of key milestones / product roadmap.
~2 pages	Section 4. Work Plan*: • Detailed description of the use of AFFOA's technical capabilities outlining the impact on product or process development. The description should include details on the scale of effort needed, quantity of materials/prototypes developed, quantity of samples tested, and personnel time requirements, etc. • Related activity that will be led by your organization in support of the program efforts at AFFOA (including materials, effort, etc. & funding that is supporting your organization's effort toward commercialization (venture capital investment, government funding, company internal funds, etc.)). • Work plan timeline as defined by tasks, milestones and the corresponding deliverable(s). • Risk assessment analysis with risk mitigations. • List, within reason, potential areas of intellectual property development through this program, if anticipated. **This section should be drafted after consultation with AFFOA's technical team.*
~1 page	Section 5. Manufacturing Impact: • How does your organization support domestic manufacturing? • How will this program affect your organization's domestic manufacturing goals? • How will IP in this program be made available to domestic manufacturers (through a contract manufacturing model, licensing, etc.)?

Appendices – Not included in page count	
Excluded from Page Count	Appendix A. Terms & Conditions Modifications Requests, IP Management Plan: AFFOA will share the standard PAFF T&Cs with finalists. Finalists should review the document and list requested T&C modifications as part of the final proposal here. In addition, please define your IP management plan (e.g. explain how IP will be identified, protected, shared and used in collaboration with AFFOA via the PAFF 3.0 program). Changes requested after award selection will be considered only on a very limited basis
	Appendix B. Letters of Support and Letters of Interest: Provide copies of Letters of Support and/or Letters of Interest from collaborators/ stakeholders and/or potential customers (e.g. industry, state, and federal government) demonstrating demand signal for output of the PAFF program.

	Appendix C. Financial Letter of Commitment: • Statement acknowledging the proposal budget that will be provided by AFFOA. • Detailed narrative of related activities that will be led by your organization in support of AFFOA's PAFF scope (including materials, effort, etc.). **1:1 federal cost share reported via SF425 is the target.** • Organization's financial commitment, including but not limited to: o Support and commitment to AFFOA from revenue received through product commercialization, or commitment to share in licensing or product sales revenue of covered methods or products. • Examples include profit sharing, royalty (for licensed IP), company equity, etc. o Potential for future collaboration efforts with AFFOA that may be sought through internal or external funding and/or future planned engagement with AFFOA towards product commercialization (on a fee-for-service basis), o Potential for licensing of AFFOA/member IP or the intention to partner in licensing or other equity-related relationships with AFFOA (particularly for start-up organizations), Letter should be on your organization's letterhead and signed by an organization representative. Additional information provided in Section 4.4.
	Appendix D. Biosketches of Key Personnel: Biosketches of key personnel from organization's executive team, business development team, and technical team that will be leading the engagement with AFFOA.
	Appendix E. Technical References: Include published journal articles, market research reports, or other documents to support your background technology and product benchmarking information.
	Appendix F. Summary Slide: Provide a single slide following the template provided on the PAFF 3.0 website page under Resources at: https://affoa.org/home/product-accelerator-for-functional-fabrics-3-0/#resources

Final proposals should be submitted via email: proposals@affoa.org by 8:00 PM ET on April 15th, 2026.

SECTION 4. Administrative Topics

4.1 Confidential Information

AFFOA understands that it may be desirable to include information considered confidential and proprietary by the Proposers to convey the technical merits of the proposal fully and effectively. All submitted proposals will be distributed for review to a select group of AFFOA staff member evaluators and U.S. Government stakeholders. AFFOA staff member evaluators are bound to customary confidentiality provisions under their employment agreements (no less than reasonable care standard). AFFOA reserves the right to engage other persons or entities as part of the proposal review & evaluation process (e.g., third-party SMEs), in which case AFFOA will require such evaluators to enter into a non-disclosure agreement with customary confidentiality provisions. AFFOA encourages Proposers to include publicly available information and content when available. Please be advised that the summary slide submitted as part of the Pre-Proposal and Final Proposal submission may be made public and should not be confidential.

Any information the Proposer deems "proprietary" should be clearly and conspicuously marked as such in the proposal and be limited to the minimum necessary to convey the highlights of the technical approach. Additionally, Proposers should refrain from including Export Controlled or trade secret information in their submissions. If a Proposer believes that the inclusion of Export Controlled or trade secret information is required to respond to the technical topic fully or to convey the merits of their proposal fully, they should discuss and confirm the need via an office hour meeting during the pre-proposal stage. An office hour meeting can be scheduled by filling out this form, also found on the PAFF 3.0 website page: https://www.surveymonkey.com/r/P3KFJVW.

4.2 Intellectual Property

AFFOA recognizes that companies protect intellectual property ("IP") through various mechanisms, including patents, copyrights, and trade secrets. Proposers shall retain their rights to background IP; however, proposals are expected to address and detail each Proposer's (or joint Proposer's) willingness to share background IP or make background IP available to third parties upon reasonable business terms. Proposers should highlight any background IP unavailable for licensing or transferring to third parties upon reasonable business terms. Protection of background IP and know-how does not exclude a Proposer from participating in a project.

Foreground IP shall be retained by the Inventor; however, foreground IP shall be subject to the PAFF IP Terms and Conditions, which shall include government-purpose rights, at a minimum. When the assistance through the PAFF program supports a component product, AFFOA appreciates the willingness to make foreground IP (and background IP to the extent necessary) available to AFFOA's Membership either in the form of a license to practice or in product form, under commercially reasonable terms.

Joint Proposers are expected to negotiate and agree on IP ownership terms with the partnering parties before submitting the final proposal.

The Product Accelerator for Functional Fabrics IP Terms and Conditions also specify that the Proposer agrees to the "Made in America" terms and conditions and the Data

Reporting requirements as outlined. As detailed in Section 5, AFFOA will initiate a discussion of these Terms and Conditions with Finalists as part of the Finalist Proposal Consultations.

For proposals of equal merit in all other evaluation criteria, support will be provided to Proposers most favorably willing to share information supporting the domestic manufacturing mission.

4.3 Membership Requirements

Non-AFFOA members may submit proposals in response to the Product Accelerator for Functional Fabrics opportunity. However, to qualify for project support, the Proposer selected to move forward must be a member in good standing or become members of the Fabric Innovation Network consortium before project inception. Potential members are encouraged to visit www.affoa.org and/or contact membership@affoa.org to learn more about AFFOA's membership benefits and how to join.

4.4 PAFF Reporting Outputs

The following outputs are contractually required for each PAFF program and will be presented to AFFOA's US Government Stakeholders:

- Kickoff Meeting
- Quarterly Progress Reports
- Final Prototype/Process Report

AFFOA will take the lead on these outputs, however proposers are expected to participate.

4.5 Financial Commitment

The Product Accelerator for Functional Fabrics is a partnership with industry members, start-ups, and established manufacturers to work toward market readiness for an advanced functional fabric-based product. This program is designed to bring the expertise needed to fill gaps in existing development teams. AFFOA realizes that financial needs may extend beyond the funding available as part of this program and seeks to build long-term relationships with member companies. For this reason, an evaluation factor in the PAFF selection process will be the financial commitment of the Proposer to the product commercialization and its commitment toward a long-term relationship with AFFOA and other FIN members.

This can be outlined in the Pre-Proposal (See Section 3.3) and more formally detailed in the Financial Letter of Commitment in the Final Proposal (See Section 3.4). Within the Financial Letter of Commitment, the proposer should include:

- Related activities that will be led by your organization in support of AFFOA's program efforts (including materials, effort, etc.). **1:1 Federal cost share reported via SF425 is the target.**
- Support and commitment to AFFOA not-for-profit from revenue received through product commercialization, or commitment to share in licensing or product sales revenue of covered methods or products. Examples include profit sharing, royalty (for licensed IP), company equity, etc.

- Potential for future collaboration efforts with AFFOA that may be sought through internal or external funding and/or future planned engagement with AFFOA towards product commercialization (on a fee-for-service basis),
- Potential for licensing of AFFOA/member IP
- The intention to partner in licensing or other equity-related relationships with AFFOA (particularly for start-up organizations)

SECTION 5. Proposal Communication Processes

5.1 Optional Pre-Proposal Office Hours and General Questions

AFFOA's Product Accelerator for Functional Fabrics is a two-stage proposal process. During the pre-proposal stage, interested proposers may schedule an optional call with the AFFOA team between January 1st, 2026 and February 1st, 2026 to answer additional questions about the PAFF Program and get feedback on proposed project concepts.

The optional pre-proposal office hour calls can be scheduled via this form: https://www.surveymonkey.com/r/P3KFJVW

General questions can be submitted throughout the proposal process via this form: https://www.surveymonkey.com/r/VBRNKQF

5.2 Final Proposal Consultation with AFFOA

AFFOA will evaluate and downselect pre-proposals to move forward to the final proposal stage. Once selected as a finalist, Proposers are required to meet with AFFOA's technical team to review the scope of the proposed effort and ensure that it is within the available capabilities and budget of the program. Note the Final Proposal budget will be provided by AFFOA in line with the scope of work determined in collaboration with the proposer, and not the responsibility of the proposer. Discussions are expected at this stage regarding requested changes to the sample terms and conditions document. If there are provisions for intellectual property assignments, planning with AFFOA and other partners should occur at this stage.

Final Proposal Consultations will be scheduled by AFFOA personnel with each finalist and should occur between March 1st, 2026 and April 1st, 2026. While not necessary, it may be beneficial for the consultation to occur at AFFOA's headquarters (Bedford, MA) to facilitate a better understanding of AFFOA's capability offerings. *Finalists who submit a proposal without having these discussions will not be evaluated or accepted.*

Proposals will be evaluated based on the criteria outlined in the table provided in Appendix A.

5.3 Award Process

Upon notification of selection for award, Proposers and AFFOA will finalize the schedule, budget, intellectual property, and/or other relevant factors contained in the proposal. Upon approval by AFFOA, the effort will be executed through an agreement between the parties. In the case that the Proposer is not already a member of AFFOA or is not a

member in good standing, the Proposer must officially become an AFFOA member or renew membership prior to PAFF contract execution. Awardees are given 30 days after notification of the award for contract negotiation. If contract T&Cs cannot be aligned and the contract is not signed by June 1st, 2026, the award may be withdrawn.

Note that the number of proposals selected in response to this PAFF program is contingent upon the current and continued availability of US federal government funding.

5.4 Proposal Feedback

Feedback on the Pre-Proposal and Final Proposal will be available upon request. Based on the number of Pre-Proposal submissions, it may not be possible to provide pointed feedback to all Proposers.

SECTION 6. Reference Documents and Resources

The following reference documents are in the Product Accelerator for Functional Fabrics Reference Documents section of the Product Accelerator for Functional Fabrics Member Portal Opportunity Posting and the Product Accelerator for Functional Fabrics section of AFFOA's website:

1. Product Accelerator for Functional Fabrics Guidebook, with AFFOA Technical Expertise and Capability list in the appendix
2. Webinar Slide Decks and Video Recordings
3. Proposal Summary Slide Template
4. Pre-Proposal Template
5. Full Proposal Template
6. Online Forms for General Questions and Pre-Proposal Office Hours
7. Frequently Asked Questions & Answers Document (updated as necessary)

PAFF 3.0 Member Portal Opportunity Page: https://portal.affoa.org/opportunity-detail?sid=10136931a6a2617fe299

PAFF 3.0 Website Page: https://affoa.org/home/product-accelerator-for-functional-fabrics-3-0/

For additional membership information, please visit go.affoa.org and/or contact membership@affoa.org.

APPENDICES

Appendix A. Proposal Evaluation Criteria

Scoring (5 points is the highest score; 1 point is the lowest score)	
Criteria	
Background & Benchmarking	
There is a clear commercial motivation provided in the proposal with a clear differentiation of the product vs. the current market options. The resulting product or process provide advantage to both the commercial and military markets.	5 pts: Strongly Agree 4 pts: Agree 3 pts: Neither Agree nor Disagree 2 pts: Disagree 1 pts: Strongly Disagree
Current Product/Process Status	
The current product or process maturity is near commercialization. There is a high impact that the use of AFFOA's capabilities on the achievement of commercialization.	5 pts: Strongly Agree 4 pts: Agree 3 pts: Neither Agree nor Disagree 2 pts: Disagree 1 pts: Strongly Disagree
Demand Signal & Relevancy to AFFOA mission	
Proposal demonstrates product / technology demand from customers, end users, industry partners, or government stakeholders. The proposer provides evidence of demand, which may include letters of interest from customers, industry and/or government stakeholders. The proposed solution clearly aligns to DoD needs, industry adoption pathways, or defined end-user requirements. The project addresses a validated gap that is currently unmet.	5 pts: Strong demand signal and strong alignment 4 pts: Good demand signal or moderate alignment 3 pts: Limited demand signal but some relevance 2 pts: Weak demand signal and minimal relevance 1 pts: No demand signal demonstrated
Plan of Work	
The technical scope of the proposed work matches the capabilities of AFFOA's staff and available equipment. The proposed work is feasible within the period of performance provided. The risk level of successful use of AFFOA's capabilities is low.	5 pts: Very Likely 4 pts: Likely 3 pts: Neutral 2 pts: Unlikely 1 pts: Very Unlikely
Manufacturing Impact	
The organization demonstrates a clear motivation to support domestic manufacturing. The strategy to enable domestic manufacturing leveraging this program (including related intellectual property) is strongly stated.	5 pts: Strongly Agree 4 pts: Agree 3 pts: Neither Agree nor Disagree 2 pts: Disagree 1 pts: Strongly Disagree
Pathway to Commercialization	
The proposer's commercialization strategy activity beyond this effort has a high likelihood of success within 2 yrs. The PAFF program provides a meaningful step along that commercialization pathway.	5 pts: Very Likely 4 pts: Likely 3 pts: Neutral 2 pts: Unlikely 1 pts: Very Unlikely
IP Management Plan	
The proposer clearly identifies background IP and anticipated project-generated IP. The plan addresses protection, ownership, licensing approach, and pathways to support domestic manufacturing. Roles and responsibilities for IP management between AFFOA and the proposer are well defined.	5 pts: Excellent IP plan with clear structure and low risk 4 pts: Good IP plan with minor gaps 3 pts: Adequate but limited detail 2 pts: Weak IP plan with unclear provisions 1 pts: No meaningful IP plan provided
PAFF Program Financial Commitment	
The proposer has provided a satisfactory financial commitment to AFFOA to support future PAFF program efforts, assuming successful commercialization and has met the cost share target obligation.	5 pts: Strongly Agree 4 pts: Agree 3 pts: Neither Agree nor Disagree 2 pts: Disagree 1 pts: Strongly Disagree
Total Score: (Maximum Score of 40)	

Appendix B. AFFOA HQ Technical Capabilities

AFFOA headquarters Fabric Discovery Center in Bedford, MA, includes end-to-end advanced fiber and fabric prototyping and testing capabilities. AFFOA's HQ FDC has 12,000 sq ft of state-of-the-art research & manufacturing equipment serving industry and government agencies. Technical teams led by experienced engineering leaders are capable of:

1) Textile and electronic product design
2) Design for manufacturing
3) Digital engineering support
4) Thermally drawn fiber development & low-rate initial production manufacturing
5) Electronics system design, development, and analysis
6) Prototyping fiber, yarn, textiles and integrated systems
7) Component & product testing, evaluation and failure analysis.
8) Process engineering and automated manufacturing support
9) Supply chain identification support
10) Workforce training support

Textile and Electronic System and Product Design

Custom garment, electronic, and hardware design and modeling through various computer-aided design tools.

- Custom pattern development for textile and e-textile integration.
- 3D garment modeling and simulation.
- Custom PCB and enclosure design, including AFFOA Universal Development Platform (UDP)
- E-textile system architecture design and rapid prototyping.
- Technical Data Package (TDP) development.

<u>Available resources that PAFF performers could leverage:</u>

- Digital Product Creation Toolsets
  - CLO 3D
    - 3D garment simulation and fabric digitalization.
    - 2D and 3D patterning making.
  - Browzwear
  - SEDDI
  - Gerber Accumark PDS
- Altium
  - PCB board design and layout.
  - Generate manufacturing documentation and BOMs.
- Fusion 360
  - 3D modeling
  - PCB enclosure design
- Adobe Suite
  - Technical garment flat development.
  - System architecture layout and renderings.
- Product Lifecycle Management system

  - Material database development.
  - Technical data package development.
- Digital design rules and material library.
  - Development of design rules for manufacturing and process control of technical textile integration. Use AFFOA-developed design rules for ZSK embroidery and Stoll knitting with conductive, non-traditional and/or novel yarns.
  - Use of fully characterized material design library for textile conductors, encapsulants, connectors, heating elements, thermal insulation.
  - Technical datasheet development for textile materials to serve as inputs for digital simulation tools and improved communication to the electronic system design community.
  - Fabric digitization files for use in DPC toolsets

Past Exemplar Projects:

- Digital product creation for design concept communications and stress analysis.
- E-textile electronic bus network design, prototyping, and testing.
- Specialized e-textile testing and testing procedure development.
- Close-to-skin layer with e-textile power and data distribution for sensing and actuation
- Handwear solution for heating, sensing, and power management at extreme temperatures.

Design for Manufacturing

AFFOA has established a rigorous Design for Manufacturing (DfM) framework to ensure that advanced functional fabric systems can be produced reliably, repeatedly, and at scale across the domestic textile industry. AFFOA has refined the process of translating functional requirements into manufacturable textile and soft-system architectures by integrating materials selection, textile processes and electronic subsystem design. This includes the development of design rules, process windows, and documentation that align novel textile-integrated technologies with pilot-scale production capabilities at AFFOA HQ and AFFOA fabric innovation network (FIN). Through early manufacturability assessment, supply-chain alignment, and iterative product–process optimization, AFFOA enables partners to transition advanced concepts into manufacturing-ready prototypes and scalable production pathways within the U.S. industrial base.

Past Exemplar Projects:

- Process refinement and manufacturability evaluation of conductive webbing structures
- Manufacturing Readiness Level assessment and opportunity reporting for commercial-off-the-shelf products for DoD hardening.
- Design of a heated handwear solution that can be reliably and affordably manufactured using standard domestic glove-making processes

Digital Engineering

AFFOA applies digital engineering and model-based design methods to accelerate the development of advanced functional fabric systems and to modernize and optimize traditional textile products. Core capabilities include creating digital technical data packages, fabric digitalization, 2D pattern digitization, and 2D-to-3D model development for digital product creation (DPC). These digital

assets enable simulation of form, fit, and function, the generation of design rules, and the creation of virtual prototypes. Through this approach, we can evaluate performance, manufacturability, and integration pathways prior to physical fabrication, reducing development time and cost while improving design precision.

Past Exemplar Projects:

- Development of digital infrastructure including material libraries, standardized data sheets, digital test methods, and process design rules to support modern textile design and manufacturing.
- End-to-end digitalization of fabrics—construction, physics, and texture—to produce accurate digital materials for virtual prototyping and garment simulation.
- Use of digital garment simulation and CLO-based modeling to design a BSL4 protective suit, evaluate range-of-motion stresses, and communicate design requirements for manufacturing and supply-chain planning.
- Application of digital tools to define e-textile layouts, communicate design rules, and select compression materials through a digital material library for soft-system prototype development.

Thermally Drawn Fiber

AFFOA has matured a unique thermal preform to fiber draw process to manufacture advanced fibers that can sense the environment, communicate information, and respond to stimuli. AFFOA has optimized the process of combining disparate materials, including conductors, insulators, and semiconductors, into composite monofilament fibers that behave as devices. This includes the introduction of conductors of various compositions, strengthening members, and optical fibers. These materials can be combined in a single process step while simultaneously engineering specific material properties. *Through this program, the thermally drawn fiber capability is provided only for this technology that has been demonstrated at Manufacturing Readiness Level 4 or higher.*

Examples for Thermal Drawn Capabilities at AFFOA:

Chips-In-Fiber

AFFOA has demonstrated and matured the production of thermally drawn fibers with embedded electronic devices such as light emitters, photodetectors, temperature sensors, radio frequency identification tags, and inertial measurement unit devices. With this enabling innovative packaging technology, we can integrate hundreds of devices at any desired device density. We have also developed extensive knowledge of integrating these fibers into textile materials or other downstream advanced fiber and fabric production processes.

Multiconductor packaging for power and data transfer / Metallic microwire arrays:

The thermal draw process allows the integration of a multitude of parallel metallic wires; all encapsulated in the polymeric cladding of the fiber that could be used for power and data transmission in a fiber. AFFOA has demonstrated kilometer-scale production of fibers with 6+ conductors embedded in the fiber.

Photonic Bandgap Fibers:

AFFOA has been producing photonic bandgap fibers with desired spectral reflectance on the fiber surface or in the fiber core, which can be used for medical and safety applications.

Polymer Optical Fibers:
AFFOA has produced at-scale polymeric optical fibers for data communications. It can produce fibers made of various polymers, including PMMA, PC, PEI, COC, and SEBS, at high tolerances and lengths.

Hollow Channel / Liquid-Filled Fibers:
AFFOA has developed and scaled the process to produce hollow channel fibers that can be filled with active materials and liquids for various applications such as color-changing fibers, microfluidics, and more.

Equipment List:
- 4 draw towers with 25mm and 50mm diameter furnaces.
- Broad, polymer-relevant temperature ranges.
- In-line diameter measurement.
- Fiber diameters from 200um to 2mm.
- Fully equipped machine shop for preform manufacturing.

Past Exemplar Projects:
- Fibers with mounted LEDs for textile-based display and data communication
- Fibers with color-changing properties
- Fibers with mounted pressure and temperature sensors for undersea monitoring.

Electronic System Design, Development & Analysis
AFFOA's Electrical and Systems Engineering (EASE) team has electrical and systems design expertise for wearables, textiles, and soft goods applications. From requirements definition and system analysis to architecture and design, the EASE team can provide advanced embedded and analog hardware design services. The available services also include access to platforms, including the Universal Development Platform and Closed Loop Heating Platform.

Universal Development Platform

The Universal Development Platform (UDP) is a standardized, textile-friendly electronics development platform designed to integrate advanced technologies seamlessly into functional textiles. Emphasizing ease of integration, manufacturability, robustness, and a compact form factor, the UDP significantly streamlines the prototyping and development process, reducing time and cost. It supports the textile industry's adoption of cutting-edge technologies by providing an adaptable system tailored for soft systems, enhancing user capabilities across various applications. The UDP is "soft integration ready," offering seamless compatibility with textile applications, accelerating concept verification, and reducing the product development cycle by minimizing hardware and software development efforts. The platform is miniaturized, scalable, and configurable, supporting rapid, in-depth evaluations of soft system performance. The UDP serves as a central hub

with various plug-in front-end modules that come with SDK and API support. Additional features include USB connectivity and multiple digital and analog I/O's, supporting various sensing modalities and enhancing its adaptability and utility.

Closed Loop Heating Platform

The Closed Loop Heater (CLH) is a thermal management system designed to integrate heated garments and soft goods, utilizing the same architecture as the UDP. Its powerful processor can support advanced algorithms to address challenges like cold starts, frostbite prevention, and hypothermia management. Each CLH can support two heaters with an output of up to 50W/3A, and for more extensive heating solutions, multiple CLH units can be synchronized to operate together. The system monitors temperature through numerous sensing channels, adjusting heat output via a Proportional-Integral-Derivative (PID) control system found in modern household thermostats for efficient and stable temperature regulation. Users can control the device via a pressure button that toggles it on/off and switches between high and low heat settings, with set points adjustable through software via Bluetooth or USB. Featuring robust safety mechanisms to guard against failures from the heater or battery issues, the CLH operates from 5V to 18V DC, accommodating a variety of input power options.

Electrical Testing

AFFOA's Electrical and Systems Engineering (EASE) team has electrical and systems design expertise for textile and soft goods applications. EASE can provide a complete test solution, ranging from individual component tests to complete system-level tests.

Service List:

- Architecture definition of systems
- Detailed design and schematics (Altium)
- Custom printed circuit board (PCB) design and layout
- Design validation and reference designs
- Sensor and actuator selection and integration
- Compact and efficient designs
- Low power system design and Bluetooth
- Experience with RF, high speed, high power, low-level analog, digital, and microprocessor designs.
- Component selection, BOM cost, size, and battery life.
- Characterization of
    - Power electronics and energy consumption
    - Amplifier performance
    - Instrumentation and sensors
    - Batteries
- Embedded systems functionality troubleshooting and testing
- Thermal testing
- Firmware and software development

Equipment List:

- DDM Novastar Reflow Oven
- 6.5 digits Keysight precision multimeter
- Programmable 0.1mA to 30A electrical load
- Rhode&Shwartz LCR Meter
- CSZ MCB-1.2 Environmental chamber
- Keysight MXR104A 1GHz Oscilloscope,
- Current probes, active differential probes
- 8 Channel, 12-bit DAQ system
- Qoitech Battery Analyzer
- 9 GHz Field Fox Spectrum and Vector Network Analyzer
- FOTRIC 348A-L44-L7 thermal camera

Prototyping – Textile Yarn, Fabric Formation, Integrated Systems

PAFF participants are invited to take advantage of the subject matter expertise of the textile formation and production capabilities of AFFOA staff. The AFFOA textile design team has expertise in yarn preparation, such as yarn plying and wrapping, sizing, yarn coating, and fabric formation processes such as weaving, knitting, and embroidery.

Yarn Preparation

AFFOA staff has the knowledge and experience to design, and prototype plied and core-wrapped yarns, apply sizing, and coat yarns with water-based, solvent-based, or UV-cured coatings.

AFFOA owns an R&D-scale yarn plying and core-wrapping machine capable of manufacturing custom yarns and fibers. It also owns an R&D-scale package-to-package yarn sizing machine used in preparing yarns for weaving, knitting, or embroidery. AFFOA's custom in-line coating machine enables the coating of advanced yarns and fibers at R&D scales and speed and can be used in conjunction with AFFOA draw towers.

Equipment List:

- Agteks DirectTwist B6 "D6"
- CCi SS600 Single-End Sizing Machine
- AFFOA custom In-line coating machine

Embroidery

AFFOA team members are subject matter experts in embroidering conventional threads, conductive yarns, thermally drawn fibers, and circuit boards, as well as forming electrical connections between yarns and boards using the embroidery machine.

The ZSK JGVA is an R&D-scale industrial digital embroidery machine. This machine represents the state-of-the-art in technical embroidery capabilities, with new attachments and functions added every year. The machine's three stitching heads allow for the basic capabilities of e-textiles.

Equipment List:

- ZSK JGVA industrial digital embroidery machine with F, K, and W embroidery heads.

Knitting

AFFOA team members have expertise in programming and operating whole garment weft knitting machines. AFFOA has three knitting machines: Stoll, Shima Seiki, and Santoni. Specifically, the AFFOA team has extensive experience knitting conductive traces and thermal heaters and has developed strategies for knitting with nontraditional materials, including monofilaments, thermally drawn fibers, and conductive yarns.

The Stoll ADF and Shima Seiki mini are two state-of-the-art Industrial weft knitting machines with seamless technology and knit-to-shape output. Both machines are used to trial new materials and advanced structures. The on-demand output provides low levels of prototyping with minimum material use, advanced machine technology and accessories are developed with robotics for e-textile knit integration. The Santoni is an industrial circular knitting machine that produces fine gauge fabric with jacquard structures for cut-and-sew assembly.

Equipment List:

- Stoll ADF, weft knit wide double bed, 14gg
    - Seamless Knit & Wear®
    - M1PLUS, CREATE PLUS proprietary software
- Shima Seiki, weft knit mini double bed, 10gg
    - Seamless WHOLEGARMENT®
    - Apex proprietary software
- Santoni, circular knit single bed, 24gg

Weaving

The AFFOA team has extensive expertise in designing woven textiles, setting up warp beams, and operating looms to produce woven fabric structures. Additionally, the team is skilled in integrating nontraditional yarns and fibers into the woven structures.

AFFOA has a dedicated weaving studio designed to facilitate the development of advanced woven structures for integration into small-scale product prototyping and production efforts. Capabilities and offerings include integrating e-textile components, novel material sampling to de-risk low TRL/MRL level yarns and fibers, and the development of e-textile circuits via Jacquard capability.

Equipment List:

- CCi Studio Dobby Power Loom
    - Fully automated
    - 22 harnesses + auto leno selvage
    - 19” weaving width
- TC2 Jacquard
    - Handloom
    - Jacquard capable
    - 20” weaving width
- AVL CompuDobby
    - Handloom
    - 24 harnesses

- 20” weaving width

Product and Integrated System Prototyping
AFFOA’s textile engineering team has expertise in cut & sew integration of textiles and electronics for concealment and ruggedization, rapid prototyping using 3D print printing, laser cutting, and ultrasonic welding to design and iterate on e-textile garments and soft goods, co-located with electrical engineers.

Equipment List:

- Industrial sewing equipment: Juki lockstitch, Pegasus 5 thread overlock, Pegasus 4 thread overlock, Bernina L890, Bernina B790+
  - Range of lockstitch, stretch overlock, flatlock, and chain stitch classes can be fabricated.
  - Compatible with woven, knit, and nonwoven fabrics.
- 3D printing: Stereolithography (SLA) vat polymerization printer, Fused deposition modeling (FDM) extrusion printer
- Universal laser system laser cutter (18 x 24 in bed)
  - Can cut plastics, metals, wood, and fabric with high precision
- Chase FS-90 ultrasonic welder
  - Can weld synthetic materials for waterproof seams

Past Exemplar Projects:

- Seamless integration of electronics in garments with the ability to record voice or video or to provide geo-location.
- Textile baselayer with e-textile power and data distributed sensing and actuation.
- Arctic-ready handwear solution for heating, sensing, and power management.
- Integration of electrodes and electronics for medical applications

Process Engineering and Automated Manufacturing Support
AFFOA’s process engineering team has expertise in extrusion, melt spinning, fiber drawing, winding, and characterization. Our experience ranges from the lab scale, g/min to industrial M/lbs./yr and various control schemes to ensure quality. We also have experience in roll-to-roll processing and coating/lamination in an industrial setting. Our EASE team has experience developing rapid firmware tools that enhance testing, quality monitoring, and reporting, while the product team leverages automated knitting and weaving programs with integrated defect detection, correction, and operator training. Together, the teams apply Value Stream Mapping and multimaterial expertise to identify automation opportunities, translate tech packs for automation readiness, and enable effective interdisciplinary communication.

Equipment List:

- Single-end fiber coating and encapsulation
- Keyence optical microscopy and imaging
- SEM and imaging
- Instron fiber physical testing

- Differential scanning calorimetry, DSC
- Parallel plate rheology

Past Exemplar projects:

- High Temperature Aerospace Grade Silica Fabric Manufacturing Scale-Up Support
- Nonwoven fabric development for PPE products
- Supported the development of an automated PPE mask point of need production lines
- Manufacturing process readiness enhancement of fibers, yarns, thermally drawn fibers, and other textile material production processes.
- Transition of lab and pilot scale process to limited rate and full-scale manufacturing.
- Equipment specification, installation support, and qualification for manufacturing.
- Development of process parameters to meet material and throughput requirements.
- Execution of design of experiments and failure analysis.

Component and Product Testing & Evaluation and Failure Analysis

Fiber Characterization

AFFOA has developed a range of techniques, procedures, and capabilities to characterize and test fibers based on the intended end-use applications.

Equipment List:

- Digital Microscopy (Keyence VHX-7000)
- Scanning Electron Microscopy (JEOL JSM-IT200 InTouchScope)
- Cross-sectioning grinder/polisher (Allied Tech Multiprep)
- FT-IR Spectroscopy (Bruker)
- Tensile testing (Instron 5900 series, with various grips)
- Bend fatigue testing (custom)

Fabric Testing

AFFOA can perform standardized test methods (ASTM, ISO, AATCC) or develop custom SOPs to capture key performance metrics, including tensile strength, elongation, stiffness, and friction.

Equipment List:

- Mark-10 Model F105 test frame
- Instron 5967 tensile tester
- Schap uniaxial bend stiffness tester
- JA King SASD-672 circular bend stiffness tester
- SDS Atlas Vortex M6 washing machine
- Gelbo flex tester
- Memmert HPP 110 and HPP 260 climate chambers

Product Wear Testing

AFFOA can leverage existing test protocols and has developed new item/application-specific protocols for product prototype evaluation for comfort, fit and durability.

Supply Chain Identification

AFFOA conducts comprehensive mapping and analysis of the domestic textile supply chain to match product requirements with qualified manufacturers, materials sources, and integration partners. This capability ensures that advanced functional fabric products transition smoothly from prototype to scalable U.S.-based production while identifying gaps, risks, and alternative sourcing pathways.

Past Exemplar projects:

- Supply-chain mapping and partner identification for advanced fiber and fabric scale-up production
- Supplier identification and material sourcing analysis for cold weather garments and heated handwear system components
- Supplier identification and material sourcing analysis for PPE product (nonwoven, masks, gowns and BSL-4 suite)

Workforce Training Support

AFFOA provides targeted workforce development support by creating training modules, hands-on instruction, and documentation that help manufacturers adopt new textile, e-textile, and soft-systems technologies. These efforts build operator readiness, increase process reliability, and accelerate the integration of advanced manufacturing methods into existing production environments.

Past Exemplar projects:

- Operator-level training and workflow guidance for cut-and-sew teams transitioning to e-textile cable and webbing integration
- Work Instruction development and implementation of process capability improvements resulting from Value Stream Mapping exercises.