Driving American Advanced Manufacturing Into the Future

Advancing ICME for U.S. Casting & Forging Industries

A Department of War National Asset

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The National Advanced Materials and Manufacturing Innovation Institute

DEPARTMENT OF WAR · UNITED STATES OF AMERICA

DEPARTMENT OF DEFENSE · MANUFACTURING INNOVATION INSTITUTES

Instructions

- Read all slides in this project call carefully
- Respond to every section/request herein clearly and succinctly to submit your project (see Appendix to determine TRL/MRL levels)
- There are multiple topic areas proposers may submit against (see following slides and Appendix)
- Include proposed budget (Maximum $450,000 from LIFT, with minimum cost share = LIFT funding*(1/3))
- Include project timeline for proposed task area (PoP must be 12 months or less. Follow-on phases up to an additional 12 months may be considered, but initial award must deliver value on its own)
- Open to all LIFT members
- Project consortium members must be a LIFT member in good standing for award and project duration
- Non-members may submit; if selected, awardee must onboard as a LIFT Silver Member or higher tier
- Submit completed forms to https://lift.technology/project-calls/
- Participants must have a U.S.-based division and all individuals working on the project must be U.S. persons

Project Call Summary

- This project call is seeking innovative approaches from industry and academia to advance the current state of Integrated Computational Materials Engineering (ICME) for the domestic casting and forging industries.
- The high-level intention of the project is to address key areas and challenges identified in the road map and transition solutions developed back to the defense industrial base for broader adoption. The topic areas supporting this effort are described in the following slides – **Additional Topic and Roadmap Information May Be Requested Here.**
- Proposers may submit against any number of topic areas. Funding breakdowns by task item and deliverable are required, and LIFT reserves the right to select any set (e.g. zero, some, or all) of the task items/deliverables proposed for each submission.
- Collaboration is encouraged between casting & forging producers, consumers, ICME software providers and academia.
- Data rights/storage:
  - LIFT shall own and have unlimited access to all data and source code produced within the scope of this project, including raw and processed data.
    - Source code developed under proposed work that will be implemented and made available by a commercial software provider is acceptable in lieu of providing source code to LIFT.
  - Subcontractors agree to provide all data generated under the scope of this project call to LIFT.
- Draft general terms and conditions for the awarded projects
  - The submission form requires acknowledgement whether the Draft T&Cs are acceptable as is. Participants who agree to accept T&Cs as-is will be prioritized. No negotiations of terms will occur prior to awardees being selected (indicate Yes or No only at this time). A formal copy will be provided once winners are selected, LIFT reserves the right to make changes.

Topic Areas – Cross-Cutting

ID	Problem statement	ICME-solvable technical challenge	Project-call lineage	Target production outcome
G1	Quality is inspected after production rather than predicted and controlled during production.	Validated process-to-quality models connect chemistry, process history, defects, microstructure, and properties to support earlier quality decisions.	Round 1: R1-C Round 2: R2-B	Move quality evidence earlier in the process; improve first-pass yield and acceptance confidence.
G2	Qualification and certification do not efficiently scale from first article to volume production or alternate suppliers.	Evidence packages, verification & validation (V&V) methods, and uncertainty-aware model-confidence frameworks support qualification, requalification, and source transition.	Round 1: R1-B Round 2: R2-B	Reduce avoidable requalification friction and accelerate insertion of qualified domestic capacity.
G3	Manufacturing data is fragmented and does not form a persistent material/process digital thread.	Interoperable data schemas, provenance rules, and shop-floor data pipelines link product definition, processing, inspection, and test results.	Round 1: R1-A Round 2: R2-D	Create reusable production knowledge across programs, suppliers, and future model-calibration efforts.
G4	Process-structure-property models are not validated or trusted sufficiently for production decision-making.	Common V&V protocols, calibration datasets, uncertainty methods, and model-to-measurement comparisons are established across relevant scales.	Round 1: R1-B Round 2: R2-A	Enable validated model chains to support production planning and risk-informed decisions.

Topic Areas – Cross-Cutting

ID	Problem statement	ICME-solvable technical challenge	Project-call lineage	Target production outcome
G5	Manufacturing variation is detected late rather than sensed and controlled in process.	Sensor-selection frameworks, process signatures, data assimilation, and feedback logic enable monitored or adaptive processing.	Round 1: R1-D Round 2: R2-C	Shift from fixed recipes toward measured process state and controlled response.
G6	Installed capacity overstates effective capacity because yield, rework, secondary processes, and inspection constrain delivered parts.	Bottleneck-aware digital manufacturing models link process capability, yield, post-processing, NDE, and schedule outcomes.	Round 1: R1-C Round 2: R2-A	Translate nominal capacity into qualified delivered capacity and surge-relevant decision support.
G7	Legacy technical data packages and nonstandard data formats inhibit modernization and source transfer.	Model-ready TDP translation, standards mapping, minimum digital-record requirements, and supplier-readable ICME data packages are established.	Round 1: R1-A Round 2: R2-D	Make legacy parts easier to modernize, source, transfer, and digitally support.
G8	Workforce readiness and unclear business cases slow practical shop-floor ICME adoption.	Deployment playbooks, training content, ROI metrics, and case-study templates support supplier-deployable implementation.	Round 1: R1-E Round 2: R2-D	Make ICME an adoptable production capability rather than a bespoke research activity.

Topic Areas – Casting Specific

ID	Problem statement	ICME-solvable technical challenge	Project-call lineage	Target production outcome
C1	Casting defect formation during filling and solidification cannot be predicted with sufficient production reliability.	Coupled filling, solidification, thermodynamics, and defect-prediction methods are calibrated against production-relevant inspection data.	Round 1: R1-C Round 2: R2-A	Reduce empirical iteration and improve confidence in defect-sensitive cast components.
C2	Melt quality, cleanliness, and melt-state history are insufficiently characterized for predictive process control.	Data and model approaches treat melt state – not only nominal chemistry – as an input to casting quality prediction.	Round 1: R1-D Round 2: R2-C	Observe, model, and where practical compensate melt-state variation before defects are locked into the casting.
C3	Location-specific microstructure and properties within castings are difficult to predict and verify.	Local thermal history, segregation, phase, defect, and property prediction are linked to geometry and local performance requirements.	Round 1: R1-C Round 2: R2-B	Improve part-specific property evidence and confidence in quality assessment and qualification.
C4	Mold, core, tooling, and dimensional variation are weakly coupled to casting ICME workflows.	Models and measurements connect mold/core/tooling condition to filling, solidification, residual stress, distortion, and dimensional conformance.	Round 1: R1-A Round 2: R2-C	Treat mold, core, and tooling variation as manageable contributors to dimensional yield and casting quality.

Topic Areas – Forging Specific

ID	Problem statement	ICME-solvable technical challenge	Project-call lineage	Target production outcome
F1	Forging thermomechanical histories are inadequately connected to final properties.	Through-process models link billet condition, temperature, strain, strain rate, recrystallization, heat treatment, and final properties.	Round 1: R1-C Round 2: R2-A	Make forging recipes increasingly property-informed rather than solely experience- or specification-driven.
F2	Forging defects, grain flow, and local microstructure are difficult to predict and assure.	Defect and grain-flow prediction methods combine material flow, thermal history, microstructure evolution, and NDE/test validation.	Round 1: R1-C Round 2: R2-B	Support internal-quality and property assurance with measured and modeled process history.
F3	Die condition, tooling life, and equipment constraints introduce uncontrolled production variability.	Digital approaches monitor tooling condition, estimate die/tool life, and connect equipment state to part quality and schedule risk.	Round 1: R1-D Round 2: R2-C	Make tooling condition a managed process variable that improves repeatability and uptime.
F4	Heat treatment, residual stress, and machining distortion are not sufficiently integrated with forging ICME.	Through-chain models connect forging, cooling, heat treatment, residual stress, machining, dimensional conformance, and final property margins.	Round 1: R1-C Round 2: R2-A	Reduce late-stage distortion and rework through through-process planning and risk prediction.

Submission and Project Timing

- Project Call launch Wednesday Sept 9th 2026.
- If LIFT Support is required, a **Request for Quote is required to be submitted NLT Sept 28th, 2026**
- Proposal Deadline: Oct 16th, 2026
- Initial Project Selection: Nov 2026
- Subawards contracting starts: Dec 2026
- **Projects must be finished within the proposed topic's period of performance (PoP), starting from the project award date, or as outlined in the contracted project duration**
- Debrief to non-awardees: Jan 2027

Project Funding Details

- **Maximum $450,000 LIFT Funding (LF) per project**
- **Minimum industry Cost-Share** (CS) is LIFT funding*(1/3). i.e. cost share ends up as **25% of Total Project Value** (TPV).
  TPV = LF + CS, which is equivalent to CS = LF/3
  Percent cost share is calculated as follows: %CS = 100%*[CS/(CS+LF)]
  - i.e., if TPV = $600k, LIFT contribution is $450k with the minimum cost share of $150k
- Cost-share is required and strongly considered in project selection (recommended 1:1)
- "Best value" will also be considered in the selection process
- Award will be **cost reimbursable, no fee** allowed
  - Not to exceed amount of LIFT award
  - To be billed on a monthly basis as costs are incurred
- Fully-burdened cost proposal required at submission deadline
- Any equipment provided as cost share becomes LIFT property

Decision Criteria

- Technical Merit
  - Aligned with project topic area(s) and has high probability of success (intent is development and transition, not research)
  - Applicable for DoW and dual-use applications
- Technology Readiness Level / Manufacturing Readiness Level
  - Solution starting MRL and/or TRL = 4-7 (below 4 disqualified)
  - Advances MRL and/or TRL by 1-2 points, targeting minimum MRL/TRL of 8 by the end of project (or 2nd phase project call, if a phased approach)
- Project Timing Alignment with LIFT Parent Project and Task Area Requirements
- Funding Request Level ("best value") (Maximum $450,000 from LIFT)
- Cost Share (CS) Commitment Level (<u>CS= minimum 25% of the total project value is required (CS = LIFT funding/3))</u>
  - Including services, materials etc.
- Willingness to agree to T&Cs as-is (Yes or No)
- LIFT Member Engagement and Network Involvement

Appendix A – MRL Criteria Examples

For more information reference the Manufacturing Readiness Level (MRL) Deskbook, Version 2025, available at https://dodmrl.org/

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MRLs for the Technology and Industrial Base Thread

Acquisition Phase		Pre-Materiel Development Decision (Pre-MDD)			Materiel Solution Analysis (MSA)	Technology Maturation and Risk Reduction (TMRR)		Engineering & Manufacturing Development (EMD)		Low-Rate Initial Production (LRIP)	Full-Rate Production (FRP)
Technical Reviews					MDD ASR A	SRR/SFR	PDR B	CDR	PRR/SVR C	PCA FRP	
Thread	Sub-Thread	MRL 1	MRL 2	MRL 3	MRL 4	MRL 5	MRL 6	MRL 7	MRL 8	MRL 9	MRL 10
	Recommended Technology Maturity (TRL)	Basic principles observed and reported.	Technology concept and/or applications formulated.	Analytical and experimental function and/or characteristic proof of concept.	Component and/or breadboard validation in a laboratory environment.	Component and/or breadboard validation in a relevant environment.	System/subsystem model or prototype demonstration in a relevant environment.	System prototype demonstrated in an operational environment.	Actual system completed and qualified through test and demonstration.	Actual system proven through successful mission operations.	Actual system proven through successful mission operations.
A - Technology and Industrial Base	A.1 Industrial Base	Global trends in emerging industrial base capabilities identified.	Potential industrial base capability gaps identified.	Industrial base capabilities for potential sources identified for system concepts.	Industrial base including capacities and capabilities surveyed for preferred materiel solution, key technologies, components, and/or key processes. Industrial base considerations included in AoA with capability risks and issues documented in the AS.	Industrial base analysis initiated to identify potential manufacturing sources. Sole/single/FOCI sources identified and planning initiated to minimize risks.	Industrial base (IB) analysis including capacity and capability for MS B completed. Industrial capability in place to support manufacturing of development articles. Plans to avoid or justification of sole/single/FOCI IB sources complete.	Industrial base capacity and capability to support production analyzed. Justified Sole/single/FOCI industrial base sources assessed and monitored.	Industrial base capacity and capability analysis for MS C completed. Industrial capability is in place to support LRIP.	Industrial base capacity and capability analysis for FRP has been completed and capability is in place to support start of FRP.	Industrial base analysis capacity and capability supports FRP and includes support for modifications, upgrades, surge and other potential manufacturing requirements.
	A.2 Manufacturing Technology Development	Global trends in manufacturing science and technology identified (i.e., concepts, capabilities).	Potential manufacturing science and technology gaps identified.	Manufacturing technology requirements identified to address potential capability gaps for system concepts.	Manufacturing technology development initiatives defined for preferred materiel solution. Manufacturing technology development requirements considered in the AoA.	Required manufacturing technology development efforts initiated.	Manufacturing technology efforts continuing. Required manufacturing technology development solutions demonstrated in a production relevant environment.	Manufacturing technology efforts continuing. Required manufacturing technology development solutions demonstrated in a production representative environment.	Primary manufacturing technology efforts concluding. Improvement efforts continuing. Required manufacturing technology solutions validated on a pilot line.	Manufacturing technology process improvements efforts initiated for FRP.	Manufacturing technology continuous process improvements ongoing.

MRLs for the Design Thread

Acquisition Phase		Pre-Materiel Development Decision (Pre-MDD)			Materiel Solution Analysis (MSA)	Technology Maturation and Risk Reduction (TMRR)		Engineering & Manufacturing Development (EMD)		Low-Rate Initial Production (LRIP)	Full-Rate Production (FRP)
Technical Reviews					MDD ASR	A SRR/SFR	PDR	B CDR	PRR/SVR	C PCA	FRP
Thread	Sub-Thread	MRL 1	MRL 2	MRL 3	MRL 4	MRL 5	MRL 6	MRL 7	MRL 8	MRL 9	MRL 10
B - Design	B.1 Producibility Program	Hypotheses developed for cause-effect relationships between technology variables and producibility.	Studies performed to test hypotheses regarding cause-effect relationships between technology variables and producibility. Elements identified which have a potential impact to producibility (i.e., materials, processes, capabilities, limitations).	System concept elements evaluated for manufacturability and producibility using experiments and modeling, and simulation.	Initial producibility assessments of preferred materiel solution complete. Results considered in AoA and documented in AS key components/technologies.	Producibility and manufacturability assessments of key technologies and components initiated. Ongoing design trades consider manufacturing processes and industrial base capability constraints. Manufacturing processes assessed for capability to be tested and verified in production. Manufacturing processes assessed for influence on O&S.	Producibility assessments and producibility trade studies (performance vs. producibility) of key technologies/components completed. Results used to shape AS, SEP, manufacturing and producibility plans, and planning for EMD or technology insertion programs. Preliminary design choices assessed against manufacturing processes and industrial base capability constraints. Producibility enhancement efforts (i.e., DFM, DFA, etc.) initiated.	Detailed producibility trade studies using knowledge of key design characteristics and related manufacturing process capability completed. Producibility enhancement efforts (i.e., DFM, DFA, etc.) ongoing for optimized integrated system. Manufacturing processes re-assessed as needed for capability to be tested and verified. Manufacturing processes re-assessed as needed for potential influence on O&S.	Producibility improvements implemented on system. Known producibility risks and issues managed for LRIP.	Prior producibility improvements analyzed for effectiveness during LRIP. Producibility risks and issues discovered in LRIP managed for FRP.	Design producibility improvements demonstrated in FRP. Process producibility improvements ongoing. All modifications, upgrades, DMSMS and other changes assessed for producibility.
	B.2 Design Maturity	Current capability deficiencies and gaps identified.	Analyses performed to evaluate the feasibility of potential solutions to address capability gaps.	High-level performance, lifecycle, and technical requirements defined and evaluated for system concepts. Trade-offs in design options assessed based on experiments and initial MOEs.	Form, fit, and function constraints identified for preferred materiel solution. SEP and T&E Strategy recognize the need for the establishment and validation of manufacturing capability and management of manufacturing risk for the product life cycle. Initial KPPs identified for preferred materiel solution. System technical requirements and measures to support required capabilities identified.	Lower level performance requirements sufficient to proceed to preliminary design. All enabling/critical technologies and components identified and the product lifecycle considered. Evaluation of the design for KCs initiated. Product data required for prototype component manufacturing released.	System allocated baseline established. Product requirements and features are well enough defined to support PDR. Product data essential for subsystem/ system prototyping has been released, and all enabling/critical components have been prototyped. Preliminary KCs for the design identified and mitigation plans initiated.	Product design and features are well enough defined to support CDR, even though design change traffic may be significant. All product data essential for component manufacturing released. Potential KC risks and issues identified with mitigation plans in place.	Detailed design of product features and interfaces completed. All product data essential for system manufacturing released. Design change traffic does not significantly impact LRIP. KCs are attainable based upon pilot line demonstrations.	Major product design features and configuration are stable. System design has been validated through operational testing of LRIP items. PCA or equivalent complete as necessary. Design change traffic is limited. All KCs are controlled in LRIP to appropriate quality levels.	Product design is stable. Design changes are few and generally limited to those required for continuous improvement or in reaction to obsolescence. All KCs are controlled in FRP to appropriate quality levels.

MRLs for the Process Capability and Control Thread

Acquisition Phase		Pre-Materiel Development Decision (Pre-MDD)			Materiel Solution Analysis (MSA)	Technology Maturation and Risk Reduction (TMRR)		Engineering & Manufacturing Development (EMD)		Low-Rate Initial Production (LRIP)	Full-Rate Production (FRP)
Technical Reviews				MDD	ASR A	SRR/SFR	PDR B	CDR	PRR/SVR C	PCA FRP	
Thread	Sub-Thread	MRL 1	MRL 2	MRL 3	MRL 4	MRL 5	MRL 6	MRL 7	MRL 8	MRL 9	MRL 10
E - Process Capability & Control	E.1 Modeling & Simulation (Product & Process)	Modeling and simulation approaches/tools identified to support manufacturing and quality activities.	Modeling and simulation development initiated.	Manufacturing and quality gaps for system concepts identified using modeling and simulation.	Modeling and simulation tools utilized to define manufacturing and quality requirements for preferred materiel solution. Modeling and simulation results considered in the AoA."	Initial modeling & simulations (product or process) developed at the component level and used to determine constraints.	Initial modeling & simulations developed at the sub-system or system level, and used to determine system constraints.	Modeling & simulations used to determine system constraints and to identify improvement opportunities.	Modeling & simulations verified by pilot line build. Results used to improve process and demonstrate that LRIP requirements can be met.	Modeling & simulations verified by LRIP build, assist in management of LRIP, and demonstrate that FRP requirements can be met.	Modeling & simulations verified by FRP build. Production simulation models used as tools to assist in management of FRP.
	E.2 Manufacturing Process Maturity	Hypotheses developed regarding cause-effect relationships between process variables and process stability and repeatability.	Studies performed to test hypotheses regarding cause-effect relationships. Initial process approaches identified.	Cause-effect relationships between process control variables and process stability and repeatability validated through laboratory experiments. Critical process control variables identified.	Maturity of critical processes for preferred materiel solution assessed. Process capability requirements and improvement plans developed and documented in the SEP.	Process Maturity assessed on similar processes in production. Process capability requirements identified for pilot line, LRIP and FRP.	Manufacturing processes demonstrated in production relevant environment. Collection or estimation of process capability data from prototype build and refinement of process capability requirements initiated.	Manufacturing processes demonstrated in a production representative environment. Collection and/or estimation of process capability data and refinement of process capability requirements ongoing.	Manufacturing processes for LRIP verified on a pilot line. Process Capability data from pilot line meets target. Process capability requirements for LRIP and FRP refined based upon pilot line data.	Manufacturing processes are stable, adequately controlled, capable, and have achieved program LRIP objectives. Variability experiments conducted to show FRP impact and potential for continuous improvement.	Manufacturing processes are stable, adequately controlled, capable, and have achieved program FRP objectives.
	E.3 Process Yields and Rates	Hypotheses developed regarding future state manufacturing yields and rates.	Studies performed to test hypotheses regarding yields and rates.	Initial estimates of yields and rates for system concepts identified through laboratory. Yield and rate gaps for system concepts identified.	Yield and rate assessments on preferred materiel solution completed and considered in the AoA. Yield and rate gap closure strategies identified for the preferred materiel solution and documented in the SEP.	Target yields and rates established for pilot line, LRIP, and FRP. Yield and rate issues identified. Improvement plans developed/initiated.	Yields and rates from production relevant environment evaluated against targets and the results feed improvement plan.	Yields and rates from production representative environment evaluated against pilot line targets and the results feed improvement plans.	Pilot line targets achieved. Yields and rates required to begin LRIP refined using pilot line results. Improvement plans ongoing and updated.	LRIP yield and rate targets achieved. Yields and rates required to begin FRP refined using LRIP results. Yield improvements on-going.	FRP yield and rate targets achieved. Yield improvements on-going.

Appendix B – TRL Descriptions

For more information reference the Technology Readiness Assessment Guide, GAO-20-48G, 2020, available at https://www.gao.gov/products/gao-20-48g

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TRL descriptions

1	Basic principles observed and reported	Scientific research begins to be translated into applied research and development. Examples include paper studies of a technology's basic properties.
2	Technology concept and/or application formulated	Invention begins. Once basic principles are observed, practical applications can be invented. Applications are speculative, and there may be no proof or detailed analysis to support the assumptions. Examples are limited to analytic studies.
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 the analytical predictions of separate elements of the technology. Examples include components that are not yet integrated or representative.
4	Component and/or breadboard validation in laboratory environment	Basic technological components are integrated to establish that they will work together. This is relatively low fidelity compared with the eventual system. Examples include integration of ad hoc hardware in the laboratory.
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 they can be tested in a simulated environment. Examples include high fidelity laboratory integration of components.
6	System/subsystem model or prototype demonstration in a relevant environment	Representative model or prototype system, which is well beyond that of TRL 5, is tested in its 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 a simulated operational environment.
7	System prototype demonstration in an operational environment	Prototype near or at planned operational system. Represents a major step up from TRL 6 by requirement demonstration of an actual system prototype in an operational environment (e.g., in an aircraft, a vehicle, or space).
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.
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. Examples include using the system under operational mission conditions.

Thank You

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