Maine EPSCoR FY24-29 NSF EPSCoR RII Track-1
Proposal Development Process
Phase I – Research Concept Papers

To prepare for the next round of NSF EPSCoR RII Track-1 funding, Maine EPSCoR is executing a formal proposal development process.

For Phase 1, researchers from Maine are invited to submit a concept paper that describes a current research problem/need for the state that might be applicable for the next Maine NSF EPSCoR RII Track-1 project.

The Track-1 grant is required to address a comprehensive, integrated, transdisciplinary, statewide focus that creates a substantial academic research infrastructure and includes strong intellectual engagement of diverse participants from institutions of higher education across the submitting EPSCoR jurisdiction, as well as productive partnerships between the jurisdiction's academic institutions and organizations in its governmental, nonprofit, and commercial or industrial sectors.

<ins>**INSTRUCTIONS:**</ins>
Please fill in the template below, using standard NSF font size requirements and margins. The allowable maximum is three pages. If you require additional space, you may delete unused lines in the Senior Personnel section, blank lines, or instructions in the document.
Sections:
1) Indicate the general focus area of the research that you are proposing.
2) Indicate the contact person for this concept.
3) Indicate potential key personnel who could be part of the effort to address this research concept. (only include individuals who have granted permission to be listed)
4) Intellectual Merit – provide a brief description in each of the sections, relating to the research focus that you have identified as a current problem/need in Maine.
5) Broader Impacts – provide a brief description in each of the sections describing the likely impacts and outcomes that can be achieved.

Due by:	**January 7, 2022**
Submit to:	shane.moeykens@maine.edu (as pdf or Word doc)

By submitting this concept paper, you are giving Maine EPSCoR permission to post this document on a public website to encourage statewide discussions and collaborative engagements prior to the next phase of the RII Track-1 project development process.

For more information see: https://umaine.edu/epscor/track-1-rii-development-process/
https://www.nsf.gov/pubs/2021/nsf21586/nsf21586.htm

1) Proposed Research Focus:	Intelligent Collaboration: Using data science and social science to develop a multiscale collaboration capacity for Maine to improve lab-to-livelihood convergence and reduce polarization.

2) Primary Contact Person:

Name:	Institution:	Title:	Dept.	E-mail:	Phone:
G. Peter van Walsum	UMaine	Professor	CBE	Peter.vanwalsum@maine.edu	207-581-2226

3) Suggested/Potential Key Senior Personnel:

Name:	Institution:	Title:	Dept.	E-mail:	Phone:
Mohamad Musavi	UMaine	Professor and associate Dean	ECE, College of Engineering	musavi@maine.edu	207-581-2218
Linda Silka	UMaine	Senior Fellow	Mitchell Center	Silka@maine.edu	207-956-3092
Hemant Pendse	UMaine	Professor, Chair and Director	CBE, FBRI	pendse@maine.edu	207-581-2290
Ali Abedi	UMaine	Professor, Chair	ECE, UMaine AI	Ali.Abedi@Maine.edu	207-581-2231
Jonathan Rubin	UMaine	Professor, Director	ECO, MCSPC	rubinj@maine.edu	207-581-3150
Debbie Bouchard	UMaine	Director	ARI	Deborah.bouchard@maine.edu	207-581-2767
Teresa Johnson	UMaine	Assoc. Prof	SMS	teresa.johnson@maine.edu	207-581-4362
Jason Bolton	UMaine	Assoc. Ext'n Professor Director	Food Safety Foster Center for innovation	Jason.Bolton@maine.edu	207-581-1366
TBD	UMaine		SCIS		
TBD	UNE		Marine Sciences		
Katrina Pugh	UMaine, Columbia U.	Ph.D. candidate, Lecturer, Former. Director	EES, Columbia School of Professional Studies	Katrina.Pugh@maine.edu	617-967-3910

4) Intellectual Merit:

A. *Need*:

The last ten years have brought unprecedented polarization in the US. In a 2020 study[1], 57% of US citizens stated that the inability to engage in respectful dialogue with people with different views was a "major problem." Maine is no exception, with conflicts arising in climate equity, offshore wind, land use, and aquaculture, to name a few. Meanwhile, reducing the lag between the lab and livelihoods is an opportunity to enhance economic development in Maine. To address both civic and commercial concerns, we need more effective ways of collaborating across differences and disciplines.

Our proposed transdisciplinary initiative, "Intelligent Collaboration," would apply data science (Natural Language Processing [NLP], Machine Learning [ML]), behavioral insights, human ecology and game theory to test and build the capacity for interpersonal, inter-organizational, and international collaboration. Intelligent Collaboration would help: improve convergence research, get life-enhancing technologies to market faster, and dissolve polarization on issues of sustainability, equity, and politics. As well, it would advance Maine's convergence research capacity, one of NSF's 10 Big Ideas for Future Investments.[2] Two main products of Intelligent Collaboration are data driven collaboration models and practical implementations that accelerate and strengthen tech transfer, startups, policy making, and civic action.

[1] Feldman, B., & McCorkindale, T. (2020). The Dialogue Divide Research Report. https://www.dialogueproject.study/research
[2] https://www.nsf.gov/od/oia/convergence/index.jsp

B. ***Research Goal & Objectives:***
- Advance Artificial Intelligence (AI), Natural Language Processing (NLP), Machine Learning (ML), Social Network Analysis (SNA), and related (big) data research for profiling and detecting productive conversation[3] and collaboration (especially across cognitive, identity, and industry difference).
- Develop and test conversation/dialogue models for working across different ways of knowing.
- Update behavioral insight models[4] and network design frameworks[5] for convergence research, commercialization, economic development and policy making.
- Establish transdisciplinary/convergence collaborations with industry as proofs of concept.[6]
- Recruit and graduate a cohort of 20 graduate students (mostly Ph.D.)
- Create and implement a curriculum design for Intelligent Collaboration (grad, UG, HS, middle school)
- Conduct proofs of concept applying the above for collaborative learning in hybrid/online education

C. ***Research Actions:***
Primary research (quantitative and qualitative)
- Developing AI/ML/NLP conversation analytics (Similar to the https://cortico.ai), and determine statistically significant relationships between Intelligent Collaboration practices and outcomes such as productive relationships, options-generation, and accountability of the collaborating team members.
- Determining behavioral insights is convergence (natural/social science with stakeholders). Includes qualitative study of conversation, negotiation, teaming, partnerships, network collaboration scales.
- Determining network influences (via SNA) and knowledge network design effectiveness

Testing, piloting and implementation (quantitative and qualitative assessment)
- Proof of concept, to piloting, to scaling up of models of Intelligent Collaboration (e.g., using randomized control trials). Partners could include FBRI, Mitchell Center, Native American Programs, MCSPC, Aquaculture Research Institute [ARI], Maine Climate Council, Maine Aquaculture Association [MAA], FocusMaine and Maine Sea Grant.
- Proofs of concept at the state and national level for breaking gridlock (including Intelligent Collaboration for policy makers, regulators, or public safety).

Capacity-building (academic, industry, government)
- Designing targeted Intelligent Collaboration curricula and assessment models (e.g., NLP, SNA, dialogue, facilitation, network design, knowledge-transfer, and bridging ways of knowing, especially with industry foci) (grad, UG, HS, middle school).
- Designing scalable Intelligent Collaboration practices into hybrid/online education (e.g., online/social media based discussion effectiveness).

D. ***Priority:***
- From the US Whitehouse: " 'Invent it here; make it here.' Federally funded R&D investments should … promote domestic manufacturing, job creation, and economic prosperity in the United States." This proposal will **facilitate and amplify an R+D culture of technical innovation and transfer.**
- Intelligent Collaboration include the four sectors identified by the Maine Economic Development Strategy as globally competitive: Food/Marine and Forest Products. It will also create productive collaborations with environmentalists, landowners, traditional farmers and fishers, and regulators. (continued next page)

[3] Skifstad, S., & Pugh, K. (2014). Beyond Netiquette: Discussion Discipline Drives Innovation (Chapter 8). In Pugh, K., Smarter Innovation: Using Interactive Processes to Drive Better Business Results. Ark Group.

[4] Hallsworth, M., & Kirkman, E. (2020). Behavioral Insights (The MIT Press Essential Knowledge series). MIT Press. https://amazon.com/Behavioral-Insights-Press-Essential-Knowledge/dp/0262539403/

[5] Pugh, K., & Prusak, L. (2013). Designing Effective Knowledge Networks. MIT Sloan Management Review.

[6] Johnson, T., Beard, K., Brady, D., Byron, C., Cleaver, C., Duffy, K., Keeney, N., Kimble, M., Miller, M., Moeykens, S., Teisl, M., van Walsum, G., & Yuan, J. (2019). A Social-Ecological System Framework for Marine Aquaculture Research. Sustainability, 11(9), 2522. https://doi.org/10.3390/su11092522

- The 2016 MIEAP acknowledged that we need to enhance connection and cohesion among diffuse networks and organizations within the State. **Network sustainability is a key impact of Intelligent Collaboration**. We propose developing applications of this project in the three of MIEAP's 7 areas: Forest products and agriculture, Information technology, and Marine technology and aquaculture.

5) Broader Impacts:

E. *In-state collaborations*:

Intelligent Collaboration will contribute to strengthening our partnerships with: Roux Institute (technology transfer to Maine enterprises); Maine Climate Action Council (Citizen action); University of New England (Aquaculture and other marine science, facilitation, behavioral insights); FocusMaine (innovation, convergence); Bates, Bowdoin, Colby, Husson, College of the Atlantic (Intelligent Collaboration curricula); Maine Aquaculture Association; Maine regulatory agencies, such as DMR, DEP, Public Health, etc.

F. *Regional/national collaborations*:

These institutions have been contacted: Columbia University School of Professional Studies, Information and Knowledge Strategy Program (Nancy Dixon, Katrina Pugh); MIT Center for Constructive Communication/Cortico.ai (Alex Kelly Berman); MIT Center for Applied Cooperation; Regional sustainability collaborations (e.g., Sea Grant in HI)

G. *Economic development*:

Intelligent Collaboration accelerates growth, improves partnerships, improves effectiveness of consortia and institutes, and accelerates translation of science into productive enterprise. Products could be:
1. NLP and other data science apps, game theory applications, application of ecosystems/platforms, and open data for analyzing conversation, benchmarking and engaging citizens.
2. Methodologies using the above to improve state and national level decision-making and policy-making
3. New businesses on Intelligent Collaboration (e.g., using open source, open data, methods, citizen science)
4. Scalable online education models for workforce development (e.g., data science, facilitation, management)

H. *Workforce Development*:

We propose an **Intelligent Collaboration degree-awarding academic program, Research Center**, including the quantitative and data science methods, such as NLP, SNA, game theory, and quantitative skills in transdisciplinary (convergence). **Community training and facilitation** will support science-policy-citizen collaboration, self-service tools in conversation AI, facilitation, teaming, negotiation and networks. (Emphasizes collaboration across identity, region, affiliation, industry and ways of knowing. It could be scalable to other universities, community colleges, high schools, middle schools). Graduate students (primarily Ph.D.) during the EPSCoR program will have dual affiliations with Intelligent Collaboration and UMaine centers and departments, such as ECE, SCIS, Maine AI, Mitchell Center, FBRI, Native American Programs, ARI, MAA, Maine Sea Grant, Communication and Journalism.

I. *Infrastructure*:
- A knowledge network for Intelligent Collaboration scholars and practitioners
- Compute infrastructure for running NLP, ML, game theory simulations
- GitHub (or similar) with open code, models, learning (e.g., C++, Python, BERT, Neo4j, SKLearn)
- Big (open) data (e.g., anonymized conversation transcripts) for analysis similar to Cornell's Convokit
- Collaboration platform for EPSCoR partners, pilots (e.g., Google, SharePoint, Ubuntoo.com, Slack)
- Facilitation, network design and conversation analytics methods, videos and tools
- Collaborative learning applications (e.g., on BrightSpace, with virtual reality, discussion analytics)
- Scalable learning resources/video about intelligent conversation for communities and educators