



**Reliability Science Symposium**  
**Spring 2025**  
**March 27, 2025**

**calce**

# **Center for Advanced Life Cycle Engineering (CALCE)**

## **FY26 Research Planning Meeting**

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# CALCE EPS Consortium

The CALCE EPS Consortium provides a forum for *defining* fundamental research needs, *conducting* research, and *sharing* research findings among participating organizations. The research focus for the CALCE EPS Consortium includes risk assessment, mitigation, and management of electronic products and systems. Output from the consortium activities includes

- design and manufacturing methods,
- simulation techniques,
- models,
- experimental methods,
- guidelines,
- instructional information, and
- future engineers and technical leaders.

# FY26 Project Development Schedule

<http://www.calce.umd.edu/members/projects/2026/>

- Provide project ideas to CALCE staff ( February )
- Present Proposal at CALCE Consortium Spring Planning Meeting
- Solicit and review feedback from interest survey (March)
- Update project proposals on CALCE Web Site (May)
- Post projects on website (September)
- Present Next Year Projects for the Fall Meeting (October)

# CALCE Life Cycle Reliability and Safety

## Design for Reliability and Safety

- Parts selection
- Failure modes and mechanisms
- Derating
- Multiphysics analysis
- Materials metrology
- AI-assisted design

## Manufacturing

- Process modeling and yield mgmt.
- Process monitoring and control
- Process metrology
- Industrial AI
- Screening and burn-in strategies
- Manufacturing metrology

## Testing and Verification

- AI - physics of failure based accelerated test planning
- Failure metrology
- Uncertainty assessment
- Safety evaluation
- RUL assessment
- Security assessment

## Deployment

- Performance metrology
- Anomaly detection
- Diagnostics and classification
- Health monitoring
- Warranty analysis

## Maintenance

- Fault diagnostics
- Root cause analysis
- Prognostics
- Predictive and condition-based maintenance
- Sustainment

## End-of-Life

- Recycle
- Reuse
- Repurpose
- Disposal

Supply-chain and life cycle cost management

Disruption management

(Supply chain risk, Allocation, Security)

Compromise management

(Obsolescence, Counterfeit)

# CALCE Research Areas

A. Reliability Physics (failure mechanisms, modeling, testing, standards, metrology and characterization):

1. Substrates/Printed Boards/Interposers
  - Traces and pads
  - Dielectrics
  - Vias
  - Interfaces
  - Embedded components & interfaces
2. Interconnects
  - Permanent
  - Separable
3. Active devices and packaging
4. Passive devices
5. Batteries
6. Additively manufactured electronics
7. Cooling systems and thermal management

B. System level assessment (co-design for heterogeneous integration, cooling design, reliability assessment, safety assessment, RUL prognostics):

- Reduced order models
- data-based models
- fusion models

C. Accelerated qualification

- Test methods
- Failure analysis and reliability metrology
- Physics-based and data-based approaches for acceleration factors

D. Supply-chain management

- Counterfeit avoidance and detection
- Security
- Blockchains and machine learning
- Agent-based modeling

E. Life cycle cost and affordability

- Obsolescence
- Sustainment cost

## CALCE EPSC FY2026 Project Feedback Form

Welcome, Opening Presentation

Name (required):

Email (required):

### P26-A1: Coating Durability in Electronic Products

- High Interest
- Interest
- No Interest
- Abstain (i.e. not qualified to comment)

Comments and Suggestions:

### P26-A2: Microstructure-sensitive Grain-scale Model for Cyclic Fatigue in Oligocrystalline SAC Interconnects

- High Interest
- Interest
- No Interest
- Abstain (i.e. not qualified to comment)

Comments and Suggestions: