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Title: Engineering Sciences Strategic Leadership Plan

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Los Alamos National Laboratory

Engineering Sciences Strategic Leadership Plan

February 12, 2014

Engineering Sciences Strategic Leadership Plan

EXECUTIVE SUMMARY

Imperative:

Engineers envision, design and build the tools, instruments and systems for scientists to explore, experiment and discover. Engineering's obligation at the Laboratory is to be an involved and desired partner to enable and facilitate science success.

Vision:

A vibrant, multi-disciplinary engineering enterprise adept at delivering reliable solutions for effectively transitioning scientific advancements into tools that impact mission and programs.

Challenges:

- Retention and attraction of staff with appropriate skill sets and levels to match ongoing and future programmatic realities and needs
- Evolution of technology and tools for relevance and use
- Investment in infrastructure

Strategy:

Promote the three key elements of engineering capabilities, staff and engagement in coordination with an R&D investment cycle. Establish an Engineering Steering Council to own and guide this leadership plan.

Focus Areas:

1. Staff Capabilities (employees and collaborators)
2. Pipeline/Recruitment
3. Professional Development/Retention
4. Equipment and Facilities
5. Tools/Processes (institutional practices/standards/policies)
6. Use tools for engagement, program development/influence, outreach

Engineering Sciences Strategic Leadership Plan

1.0 The Engineering Obligation

Engineers across the Laboratory provide engineering expertise that is conversant in the Laboratory's science and that can satisfy science requirements with engineered systems. Engineering leadership's broader responsibility is to guide and challenge the Laboratory's engineering community entrusted to deliver the tools enabling science.

The engineering community resident across the Laboratory will strive to establish a recognized leadership position by delivering quality products for its customers and expand its capabilities by applying cutting-edge science and technology. Hence, our **engineering strategy for the future** is twofold; first and foremost, spark an enthusiasm for appreciating and promoting engineering science by doing new things in new ways, and second, meld together the engineering peer community which is currently dispersed across the Laboratory. There is excitement in the challenge to come together as a profession and apply scientific creativity to satisfy bounding constraints and realize "the widgets" that will solve urgent national security problems.

Relative to the first strategy, the engineering community will lead by doing; specifically, we will deliver on existing mission responsibilities and commitments, own and champion the engineering R&D agenda which will include leveraging LDRD and the Engineering Institute, and attract the future work force by establishing visible career paths for professional growth and dynamic R&D collaborations with our scientific colleagues. We will enhance our reputation and visibility through research publication and involvement in international professional communities focused on emerging topics and tools in engineering and the skills necessary for engineers going forward. Relative to the second strategy, the Engineering Steering Council will lead the dialog connecting the Laboratory's engineering peer community to identify and nurture the key competencies and specialized skill sets for ongoing professional development.

The Laboratory needs an engineering fabric to bond together its engineering science capabilities to enable scientific discovery. This engineering strategy will endeavor to lead and guide the realization of such a fabric into the future.

2.0 The Engineering Steering Council

An Engineering Steering Council was established in December 2011 comprised of individuals representing a cross-section of the R&D engineering community from across the Laboratory including both line and program representation (see the Attachment 1 for membership). The Engineering Steering Council is chartered to:

- Provide Guidance/Advocacy relative to an Engineering R&D Agenda

- Nurture existing and emerging Engineering Capabilities at LANL
- Determine requirements for sustaining and growing these capabilities
- Strengthen Engineering Line-Program-Customer relationships
- Foster Lab-wide engineering collaborations

3.0 Activities

Specific activities were identified and defined by the Engineering Steering Council with the intention of accomplishing a focus area objective. The activities, listed in Section 6.0 below, are described in more detail Attachment 2. The current status of progress for the activities is summarized in Attachment 3. Because progress is assessed and reported monthly going forward, consider Attachment 3 as an example which will not be updated unless this entire document is revised.

The activity descriptions provided in Attachment 2 were developed by answering the questions put forward in Heilmeier's Catechism in an attempt to provide a "value proposition" format to describe all activities consistently.

Heilmeier's Catechism (aka Bankers' Questions)

A set of questions credited to George H. Heilmeier that anyone proposing a research project or product development effort should be able to answer.

- **What are you trying to do?** Articulate your objectives using no jargon.
- **How is it done today?** What are the limitations of current practice?
- **What is new in your approach?** Why do you think it will be successful?
- **Who cares?** If you are successful, what difference will it make?
- **What are the risks and the payoffs?**
- **How much will it cost? How long will it take?**

4.0 Relationship Between Elements, Focus Areas, and Activities

Three key elements of an overall strategy were identified: promote engineering capabilities, staff and engagement.

Within the engineering capabilities and staff elements, there are subgroupings of related focus areas. All focus areas have supporting activities (listed below); some activities apply to more than one element.

Each focus area will have a lead and a team, assigned from the membership of the Engineering Steering Council (see Attachment 1), to address the supporting activities. The individual teams prioritize the activities supporting the focus areas and determine whether the Engineering Steering Council's role is ownership or advocacy.

Coordination of the activities of related teams will be managed by the leads and facilitated through cross-membership.

5.0 Elements, Focus Areas, and Focus Area Leads (Team Kernels)

Promote Engineering Capabilities

1) Staff Capabilities (employees and collaborators) – **Hahn lead**
4) Equipment and Facilities (bricks and mortar) – **Guffee lead** (Rees, Baker, Thoma)
5) Tools/Processes (institutional standards/policies) – **Black lead** (Barraza, Hahn, Mann)

Promote Staff

2) Pipeline/Recruitment – **Saeger lead** (Hahn)
3) Professional Development/Retention – **Prestridge lead** (Hahn)

Promote Engagement

6) Engagement using strategies, partnerships, program development/influence, outreach – **Szymanski lead** (Nicholas, Nath)

6.0 Activity Listing - Lead Assignments by Focus Area

Capabilities

LEAD	Activity
1	Capabilities and Workforce profile to include a dynamic catalog and competency and demographics assessments (1, 3)
4	Consolidation of key facilities and infrastructure to enhance reinvestment (4, 5)
4	Transformative approaches to performing work that integrates/leverages a facility to achieve fundamentally different ways of doing work, e.g., "Room as a glovebox" (4, 5, 6)
4	Institutional investments in specific equipment/facilities/infrastructure to support specific projects (4, 5)
4	Future of prototype fabrication (1, 4, 5)
5	Tools/structure for systems engineering/project management for R&D (5)
5	R&D Engineering Primer (5)
5	Social media/networking to support engineering (5, 6)

Engineering Sciences Strategic Leadership Plan

Staff

LEAD	**Activity**
2	Pipeline for Engineering Technologist via local/regional academic partnerships, e.g., NMSU non-calculus 4 year engineering degree (2)
2	Framework for Masters pipeline that leverages the GRA program (2)
2	Institutional technician pipeline effort (2)
2	Engineering “named” fellowship (Postdoc or non-Postdoc) (2)
2	Postgraduate internships, i. e., Post-Master’s Program under P509, *Postgraduate Professional Internships* (2)
2	Assimilation of engineering postdocs (2)
3	Standardized metrics and process for promotions of R&D Engineering professionals (3)
3	Professional development and retention – appropriate job level descriptors (3)

Engagement

LEAD	**Activity**
6	Academic/industry collaborations (1, 2, 6)
6	Communicating engineering capability needs across organizations (1, 6)
6	NNSA Roadmap on advanced manufacturing (6)
6	Engage w/ National Academy of Engineering grand challenges on evolving the engineering enterprise (e.g., cyber-physical systems) (6)
6	Strategic outcomes technical exchanges (6)
ADE	Engineering Society Engagement (6) **ACTIVITY COMPLETED**
ADE	LDRD engagement (1, 3, 6) (Robinson, Crone, Girrens)
ADE	Institutional capability reviews (1, 6) (Gibbs, Girrens)
ADE	Program Engagement - applied science to prototypes, i.e., a framework/methodology to incorporate/integrate earlier in projects more engagement of applied expertise/resources. (6) (Black, McBranch, Pesiri, Girrens)

Engineering Sciences Strategic Leadership Plan

Attachment 1

Engineering Steering Council

Name	Role	Org
Steve Girrens	Chair	ADE
John Benner	Deputy Chair	ADW
Andy Erickson	Deputy Chair	GS-SO
Randy Erickson	AD Leadership	ADTIR
Kevin Saeger	Division Leadership	ISR
Joysree Aubrey	Division Leadership	IAT
Steve Black	Division Leadership	AET
Subrata Nath	Division Leadership	AOT
Juan Barraza	Division Leadership	WX
Mike Baker	Division Leadership	NEN
Dave Costa	Division Leadership	MET
Ray Guffee	Division Leadership	DSA
Derrick Montoya	Division Leadership	W
Dave Teter/Dan Thoma	Division Leadership	MST
Duncan McBranch	Program Leadership	GS-SO, CTO
Nancy Jo Nicholas	Program Leadership	GS-SO
Kerry Habiger /Brian Bluhm	Program Leadership	GS-IDC
David Pesiri	Program Leadership	FCI
Chuck Farrar	Engineering Institute	NSEC-Eng Inst
Roberta Klisiewicz	Line/Program Interface	ISR
John Szymanski	Line/Program Interface	DSA
Gene Peterson	Science of Signatures	ADCLES
Jeanne Robinson	LDRD Dep Prgm Director	SRO-LDRD
Kevin Hase	LDRD ER ENG Lead	NEN
Curtt Ammerman	Technologist at Large	AET
Tom Tierney	Technologist at Large	IAT
David Zerkle	Technologist at Large	DSA
Anthony Puckett	Technologist at Large	W
Don Quintana	Technologist at Large	AET
Doug Kautz	Technologist at Large	MET
Dan Rees	Technologist at Large	AOT
Nate Mara	Technologist at Large	MPA
Kim Katko	Technologist at Large	ISR
Tim Foley	Technologist at Large	WX
Kathy Prestridge	Technologist at Large	P
Bill Ward	Technologist at Large	AET
DV Rao	Technologist at Large	ADTIR
Pat McClure	Technologist at Large	NEN

Membership: January 28, 2013

Attachment 2

Engineering Steering Council

Activity Descriptions

December 17, 2013

Engineering Sciences Strategic Leadership Plan

Attachment 2

Area 1. Engineering Capabilities and Workforce

Heilmeier's Catechism

What are you trying to do?

The goals of this initiative are three-fold:

- Develop and maintain a dynamic catalog of Lab-wide R&D engineering capabilities
- Assess and monitor the Laboratory's competency in delivering each capability, the extent to which the capability exists at the Laboratory, and the impact that we have
- Understand the workforce demographics relative to the various capabilities and use that information to enable strategic workforce planning

How is it done today?

The ESC had developed and rated an initial list of engineering capabilities, but the list has not been monitored/reevaluated. Organizations monitor their workforce demographics, and some do map workforce against capabilities, but there is no consistent method for doing this.

What is new in your approach?

Workforce demographics to include not only the "standard" ones of age and degree, but also discipline, level, and self-reported primary competency, will be used to characterize the workforce relative to the capabilities identified by the ESC. Mapping and analysis will be institutionally consistent.

Who cares?

Managers of engineering organizations need to understand both the institutional engineering capabilities profile (i.e., the vector of the various capabilities) and the demographics of their workforce supporting the capabilities to do a better job of developing programs that build/enhance key capabilities and of strategically planning for future workforce needs.

What are the risks and payoffs?

Risks: There is a risk that we would invest in doing the initial work to identify capabilities and map workforce profiles onto them, but that the information would be used or updated effectively.

Payoffs: A better understanding of how the workforce is used in support of institutional engineering capability will enable better workforce planning to ensure that the Laboratory can continue to support our most critical capabilities.

How much will it cost?

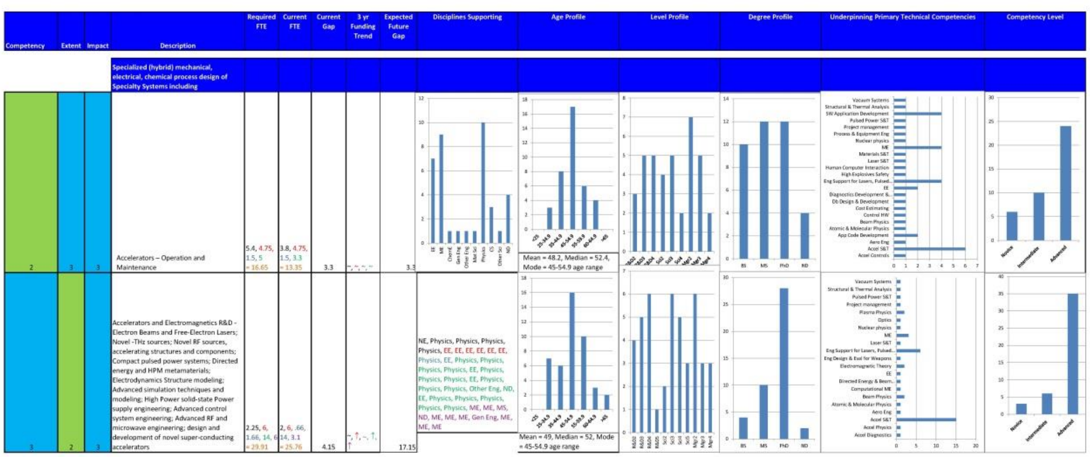
Managers will have to spend the time to map their technical staff (by name) to the engineering capabilities listing, and to estimate, for their organization, the total FTE supporting the capability and whether the capability is growing, shrinking or holding steady. Staff time will then be needed to collate and chart demographic information for the identified staff from the HR database. Cost estimates have not been prepared.

What are the midterm and final "exams" to check for success?

The most immediate metrics will be completion of the first set of workforce demographic analyses (ADE orgs plus one "volunteer" each from GS and Weapons). The final exam (3-5 years) will be dynamically maintained and consistently used capability and workforce profile.

Action Plan

1. Review capability workforce profile methodology with ESC to determine if modifications are required
2. Have managers of ADE organizations update the mapping of their employees
3. Obtain updated data from HR and revise/complete ADE capability workforce profiles
4. Solicit volunteers from GS and Weapons for capability workforce profiling exercise and execute exercise with them
5. Roll up individual organizations' data, and analyze (validate capability ratings, look for workforce trends)
6. Extend to other engineering organizations
7. Perform annual update/maintenance



70 YEARS OF CREATING TOMORROW

Los Alamos
NATIONAL LABORATORY

Engineering Steering Committee

Build & Maintain Engineering Capabilities Element

Equipment & Facilities Focus Area

November 18, 2013

Equipment and Facilities Focus Area

- Three assigned activities:
  - Key facilities and infrastructure, consolidate to enhance reinvestment
  - Investigate/postulate transformative approaches to performing work that integrates/leverages a facility to achieve fundamentally different ways of doing work, eg “room as a glovebox”
  - Institutional investments in facilities/infrastructure to support specific projects

Equipment and Facilities Focus Area

- Describe the intent of each activity thru the appropriate application of Heilmeier's questions:
  - What are you trying to do?
  - How is it done today?
  - What is new in your approach?
  - Who cares?
  - If you're successful, what difference will it make?
  - What are the risks and the payoffs?
  - How much will it cost?
  - How long will it take?
  - What are the midterm and final exams to check for success?

Application of Heilmeier Questions

- Key facilities and infrastructure, consolidate to enhance reinvestment
  - What are you trying to do?
    - Enable further reinvestment in key facilities and infrastructure through the identification and consolidation if duplicative capability
      - Can be driven from various levels, institutional to individual. What is the ESC's role?
  - How is it done today?
    - Requires some kind of initiator, like an infrastructure element or facility that is run to failure. In the absence of obvious money for repairs, consolidation options are investigated. New program starts are often faced with hunting around for available, mostly suitable space. Not clear how to effectively engage/influence institutional initiatives.
  - What is new in your approach?
    - Move away from a reactionary position to one of strategic prioritization and investment. Must bring significant number of stakeholders together for engagement. ESC is obvious starting point. Develop initial listing of 'key facilities and infrastructure' and characterize their current sources of funding. Identify opportunities for consolidation. Question is at what level do/can we engage.
  - Who cares?
    - Individuals at all levels, however project-level staff facing loss of capability tend to realize the direct consequences
  - If you're successful, what difference will it make?
    - Provide modern facilities and infrastructures to enable the Laboratory to maintain/develop core capabilities for executing mission
  - What are the risks and the payoffs?
    - Consolidation tends to result in loss of availability, loss of integration and colocation with program/project teams, loss of depth, requires completed projects to cleanup and disposition equipment/materials
  - How much will it cost?
    - Unknown
  - How long will it take?
    - Unknown
  - What are the midterm and final exams to check for success?
    - Not defined at this time

Application of Heilmeier Questions

- Investigate/postulate transformative approaches to performing work that integrates/leverages a facility to achieve fundamentally different ways of doing work, eg "room as a glovebox"
  - What are you trying to do?
    - Use innovative thinking and engineering capability to transform traditional facility/infrastructure design
  - How is it done today?
  - What is new in your approach?
    - Requires flexible facility configurations, not process/project specific
  - Who cares?
  - If you're successful, what difference will it make?
  - What are the risks and the payoffs?
  - How much will it cost?
  - How long will it take?
  - What are the midterm and final exams to check for success?

Application of Heilmeier Questions

- Institutional investments in facilities/infrastructure to support specific projects
  - What are you trying to do?
    - Focus institutional investments around specific strategic capabilities which enable new program opportunities. If you build it, they will come. Marie and Navy FEL illustrate the need and the result of having facilities.
  - How is it done today?
    - Unsure
  - What is new in your approach?
    - Direct institutional money toward stratetic facilities/infrastructure
  - Who cares?
    - The Laboratory and those working to identify and realize new strategic opportunities
  - If you're successful, what difference will it make?
    - Increase the program opportunity at the Laboratory; allow for a strategic and structured process to direct investment money
  - What are the risks and the payoffs?
  - How much will it cost?
    - Unknown
  - How long will it take?
    - Unknown
  - What are the midterm and final exams to check for success?
    - Undefined

Engineering Tools / Processes
(An evaluation utilizing Heilmeier's Catechism)

Subteam Members:

Juan Barazza
Heidi Hahn
John Bernardin
Raj Vaidya
Don Quintana
Steve Black
David Mann

Engineering Tools / Processes (Institutional Standards / Policies)

What are you trying to do? Articulate your objectives using absolutely no jargon.

- Create basic tools that will facilitate industry standard system engineering… especially for non system engineers
- Tools that can be used across the Laboratory using a graded approach
- Improved success rates

How is it done today, and what are the limits of current practice?

- There are limited examples of application at LANL (forced fit approaches).
- Most LANL projects do not incorporate system engineering

Engineering Tools / Processes (Institutional Standards / Policies)

What's new in your approach and why do you think it will be successful?

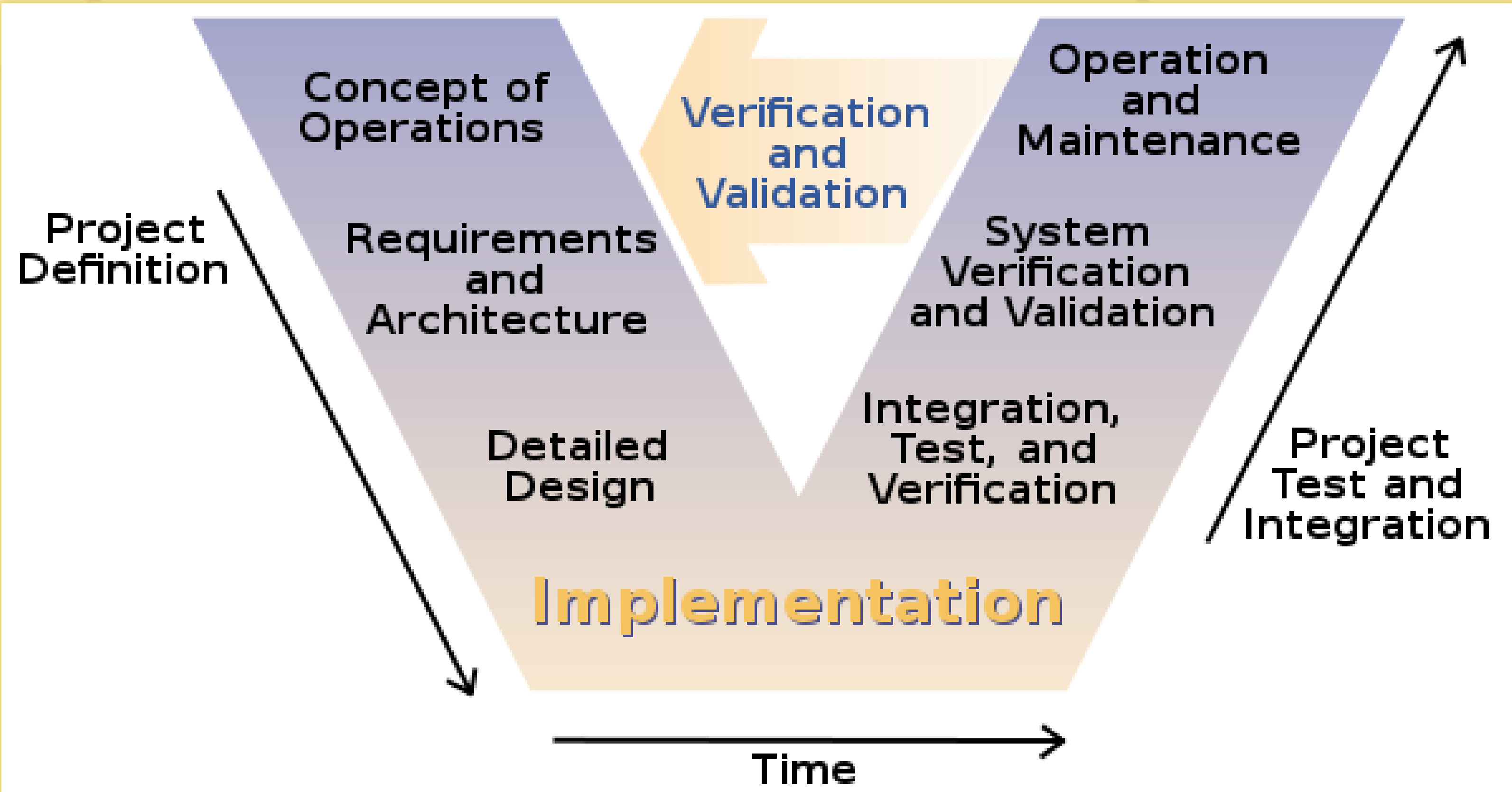
- Providing **tools** rather than simply additional policies/procedures

- Focus is on execution of R&D projects rather than other “Conduct of”s”….eg nuclear facilities or capital line items

Who cares?

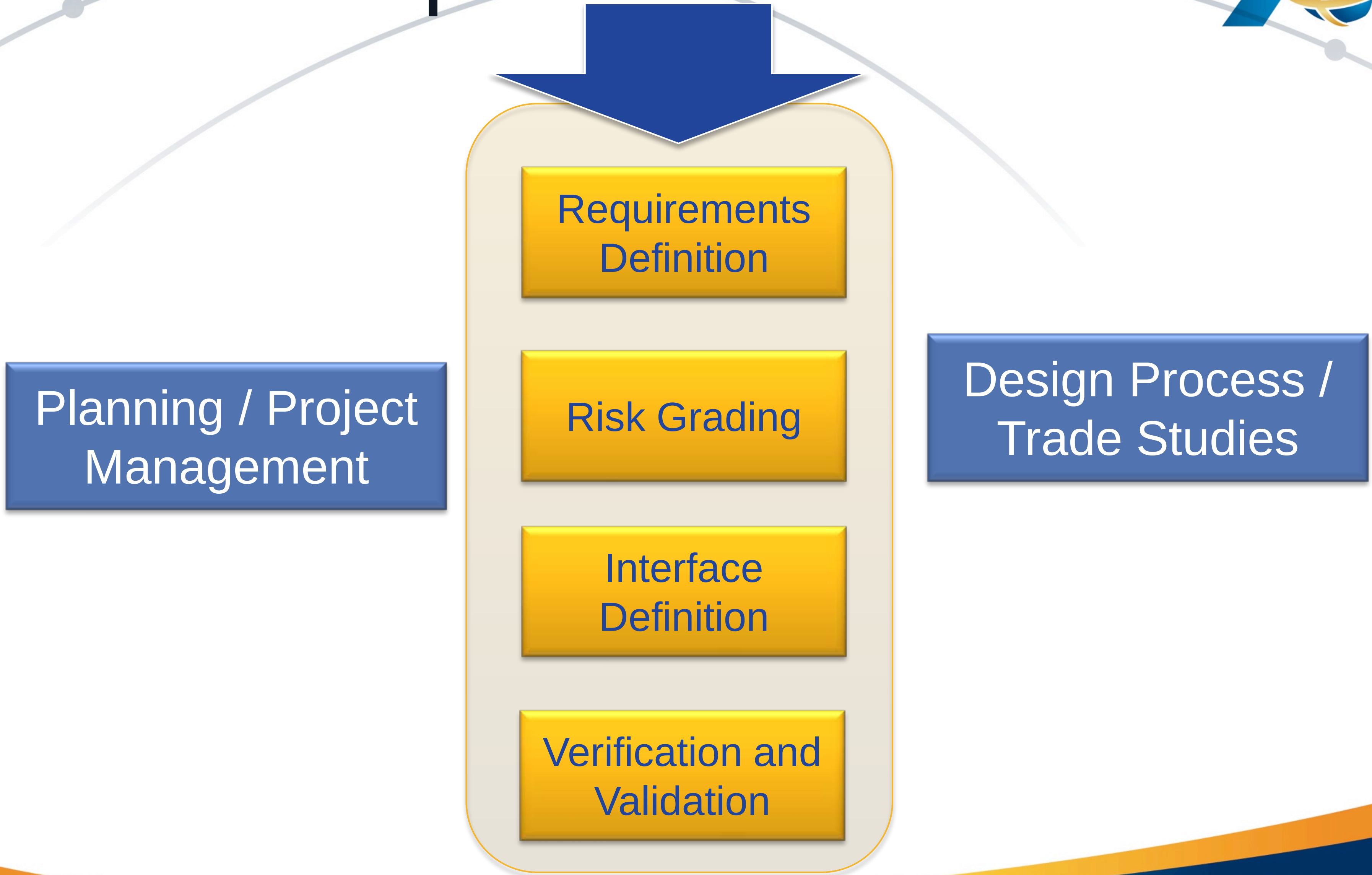
- Our customers
- Our engineering staff

System Development Lifecycle



Phase	Phase 1.0 Program Planning			Phase 2.0 Design & Development		Phase 3.0 Fabrication & Assembly		Phase 4.0 Execution & Close-Out	
Gates			G1		G2		G3		G4
Stage	1.1 - Experiment Justification	1.2 - Requirements and Feasibility	1.3 - Project Planning & Conceptual Design	2.1- Preliminary Design	2.2 - Final Design	3.1 -Fabrication	3.2 - Assembly	4.1 - Fielding and Testing	4.2 - Post Test Analysis/Doc.
Reviews		EPR	RR	CDR	PDR	FDR	ARR	AAR / TRR	close
Activities	• Experiment Intent Release (EIR)	• Issue EIR to distribution	• Baseline scope, schedule, budget	• "Make or Buy" decisions	• Assess project baseline based on Final Design and identify any critical path drivers	• Complete final safety analysis	• Complete safety analysis/reviews	• Complete Timing and Firing FDR	• Produce Quick Look Report
	• Grade project & map review process	• Scoping Document (needs, goals, objectives, R&Rs, etc)	• Support Requests (PF, W-5, W-11, W13, W-14, etc.)	• Submit/update support requests as required	• Refine Risk Assessment	• Parts acceptance of components/sub assemblies	• Assemble test article	• Ship and setup test article, fixtures and instrumentation	• Analyze test data
	• Preliminary Risk Assessment (High, Medium, Low)	• Initial Work Package - Stages 1.2 & 1.3	• Work Packages	• Draft Interface agreements (firing site, pit, CSA, hazmat)	• Finalize Interface Agreements	• Inspect or "pre-test" components/test equipment	• Inspect assembly (dimensional, radiography, etc.)	• Acquire calibration reports for test instrumentation	• Complete Waste disposition
	• Funding discussions with management and sponsors	• Define quality requirements	• Project grading and define quality requirements	• Determine instrumentation diagnostic locations	• Initiate Safety Review	• Conduct a Parts Acceptance Review	• Instrument test article and provide diagnostic locations	• Ensure Test Plans and Test Technical Procedures are updated and approved	• Disposition test components
	• Experimental Proposal Review (EPR)	• Requirements Document	• Risk mitigation plan		• Firing Site and Shot Layout Drawings and Documents	• Interface with fabrication and inspection	• Calibration reports for assembly equipment	• Conduct the TRR	• Complete post-testing of components if necessary
		• Involve manufacturing and inspection for methods, long leads, etc	• Resource/funding allocation matrix		• Conduct Firing Site Drawing Review		• Document red-lines		• Complete disassembly if required
		• Conduct the CDR	• Experiment Product Structure (drawing layout) and team in PDMLink		• Assess critical manufacturing issues		• Conduct an "As-Built" Review		• Develop and release (REL) "As Built" Drawing Package
			• Preliminary engineering analysis	• Interrogate design with analysis and calculations	• Test Technical Procedure development (30%)	• Test Technical Procedures to 60%	• Finalize Test Technical Procedure		• Produce Assembly Engineering Report
			• Begin Test Plan (30%)	• Develop Test Plan (60%)	• Complete Test Plan	• Assembly sequence models for procedure 100%	• Accept test article		• Produce System Engineering Report
				• Assembly Technical Procedures (30%)	• Assembly Technical Procedures (60%)	• Finalize Assembly Technical Procedure	• Package Assembly for transport to test site		• Produce Physics Report
			• DFMA integration	• DFMA assessment with detailed manufacturing review	• Verify assembly issues are addressed	• Assembly Step "Walk-Down" per W-AD-0096	• Complete Pre-delivery agreement		• Document Lessons Learned
			• Begin Shipping & Transportation Plan (30%)		• Complete Shipping & Transportation Plan	• Shipping & Transportation Plan	• Complete Record of Build		• Management Report of performance
			• Concept Models, Top Assembly Drawing - major components, prelim. BOM	• Models/drawings of main test article (60%)	• Final Detailed Design drawings (stand, components, interfaces, tooling, etc.) near 100%	• Peer reviewed Design Safety Record (DSR)	• Complete Waste Disposition Plan		• Compile Test Record
			• Compare alternate designs, and collect body of evidence for proposed concept	• Models/drawings of test tooling/fixturing, vessel interface, or firing stand models to 60%	• Evaluate current tool path programming for reuse	• Pre-assembly Checklist	• Conduct the AAR		• Archive Test Record
			• Begin development of Design Safety Record (DSR)	• Conduct the PDR	• Product Definition Approvals (in PDMLink)	• Radiography memo			• Complete Final Test Report
			• Conduct the CDR		• Conduct the FDR	• Conduct the ARR			• Conduct Close-out Review
Exit Criteria	• All listed activities have been completed	• All listed activities have been completed	• All listed activities have been completed	• All listed activities have been completed	• All listed activities have been completed	• All listed activities have been completed	• Assembled article has been accepted by all stakeholders	• Assembled article has been accepted by all stakeholders	• Assembled article has been accepted by all stakeholders
	• Preliminary funding/schedule issues addressed	• Scoping document created/released listing needs, goals, objectives, R&Rs, interfaces, risks, stakeholders, top level schedule	• Baseline schedule and budget approved	• Models and drawings of main article/test setup 60%	• Released Product Definition/detailed product baseline	• Parts/assembly acceptance documentation completed	• "As-built" diagnostic locations provided	• Engineering drawings, requirements, procedures, test plans complete/approved	• Data and results satisfy original requirements and are approved by customer
	• Customer provided EIR or project overview	• Work Packages Released for Stages 1.2 and 1.3	• Refined risk assessment completed, based on conceptual design	• DFMA incorporated into the design (manufacturable within schedule and budget)	• Review of Firing Site/Shot Layout Drawings/Documents completed	• NCRs have been dispositioned	• Red-lines approved at as-built review	• Experiment layout drawings are complete	• Quick Look Report released
	• High-level risks identified	• Released Requirements Document	• Design alternatives defined and addressed	• engineering analysis completed	• Configuration file of the Final Product Structure created	• Parts Acceptance Review has been completed	• A Shipping and Transportation Plan is in place	• Calibration reports gathered , and instrumentation is within specifications	• All additional functional group Final Reports archived
	• Initial funding secured, approval to proceed granted	• RR has been documented and comments resolved	• Concept models generated with top level assembly drawing	• "Make or Buy" decisions made	• Revised risk assessment based on Final Design	• Assembly Technical Procedures approved utilizing Assembly Step "Walk-Down"	• Test Technical Procedures are complete	• FOD paperwork complete	• Waste has been properly dispositioned
	• EPR has been documented and comments resolved		• Procurement for long lead items has begun	• Interface agreements (firing site, pit, CSA, hazmat) drafted	• Project baseline reassessed (Final Design), critical path drivers identified	• Safety Review has been completed	• A Waste Disposition Plan is in place	• TRR has been documented and comments resolved	• Lessons Learned have been documented and archived
			• Test plan started	• Test plans (60%) and Assembly Technical Procedures (30%)	• Engineering orders released	• Shipping and Transportation Plan in progress	• AAR has been documented and comments resolved		• A management assessment has been completed
			• Shipping & Transportation Plan started	• PDR has been documented and comments resolved	• Interface agreements completed	• Required assembly tooling is complete			• Quality control documentation archived (requirements, inspection reports, NCRs, calibration records, compliance matrix, etc)
			• CDR has been documented and comments resolved		• Safety Review initiated	• Test Technical Procedures at 60%			
					• Evaluation of manufacturing methods and existing tool path programming completed	• ARR has been documented and comments resolved			• Appendix A Records are completed and archived
					• Assembly issues addressed				• Final Test Report completed
					• Test plan has been completed				• Test Record has been archived
					• Technical procedures (60% assembly, 30% test)				
					• FDR has been documented and comments resolved				

Proposed SE Toolkit



Engineering Tools / Processes (Institutional Standards / Policies)

If you're successful, what difference will it make?

- Improved project execution
  - Better product, including product definition
- Consistent process/metrics for all LANL R&D projects
- Facilitates program development

What are the risks and the payoffs?

- Implementation and training
- If tools are not useful, they won't be used, and we create cynicism.
- Institutional support (System Engineering Center)

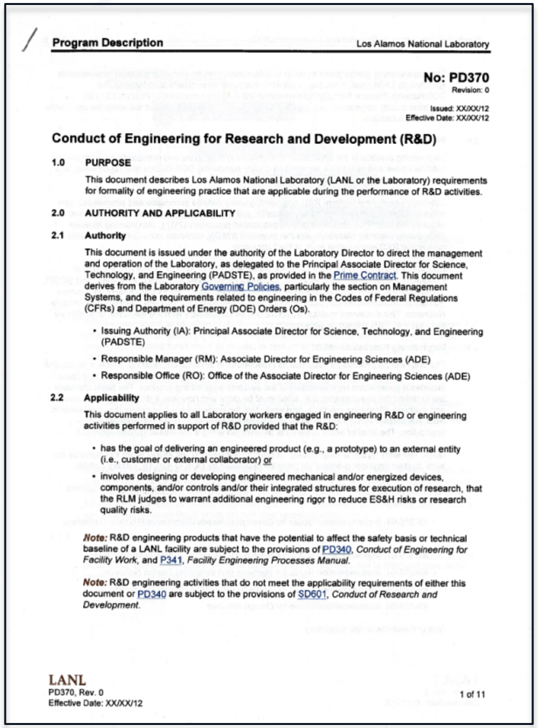
Engineering Tools / Processes (Institutional Standards / Policies)

What are the midterm and final "exams" to check for success?

- The first few projects to use these tools will be monitored for success (Midterm Exam)
- The degree to which these tools are adopted over the long term (Final Exam)
- Improved R&D project execution
- Delighted customers

Engineering Tools / Processes (Institutional Standards / Policies)

Proposed System Engineering Framework for LANL



Program Description — Los Alamos National Laboratory

No: PD370
Revision: 0

Issued: XX/XX/12
Effective Date: XX/XX/12

Conduct of Engineering for Research and Development (R&D)

1.0 PURPOSE

This document describes Los Alamos National Laboratory (LANL or the Laboratory) requirements for formality of engineering practice that are applicable during the performance of R&D activities.

2.0 AUTHORITY AND APPLICABILITY

2.1 Authority

This document is issued under the authority of the Laboratory Director to direct the management and operation of the Laboratory, as delegated to the Principal Associate Director for Science, Technology, and Engineering (PADSTE), as provided in the Prime Contract. This document derives from the Laboratory Governing Policies, particularly the section on Management Systems, and the requirements related to engineering in the Codes of Federal Regulations (CFRs) and Department of Energy (DOE) Orders (Os).

- Issuing Authority (IA): Principal Associate Director for Science, Technology, and Engineering (PADSTE)
- Responsible Manager (RM): Associate Director for Engineering Sciences (ADE)
- Responsible Office (RO): Office of the Associate Director for Engineering Sciences (ADE)

2.2 Applicability

This document applies to all Laboratory workers engaged in engineering R&D or engineering activities performed in support of R&D provided that the R&D:

- has the goal of delivering an engineered product (e.g., a prototype) to an external entity (i.e., customer or external collaborator) or
- involves designing or developing engineered mechanical and/or energized devices, components, and/or controls and/or their integrated structures for execution of research, that the RLM judges to warrant additional engineering rigor to reduce ES&H risks or research quality risks.

Note: R&D engineering products that have the potential to affect the safety basis or technical baseline of a LANL facility are subject to the provisions of PD340, *Conduct of Engineering for Facility Work*, and P341, *Facility Engineering Processes Manual*.

Note: R&D engineering activities that do not meet the applicability requirements of either this document or PD340 are subject to the provisions of SD601, *Conduct of Research and Development*.

LANL
PD370, Rev. 0
Effective Date: XX/XX/12
1 of 11

PD370

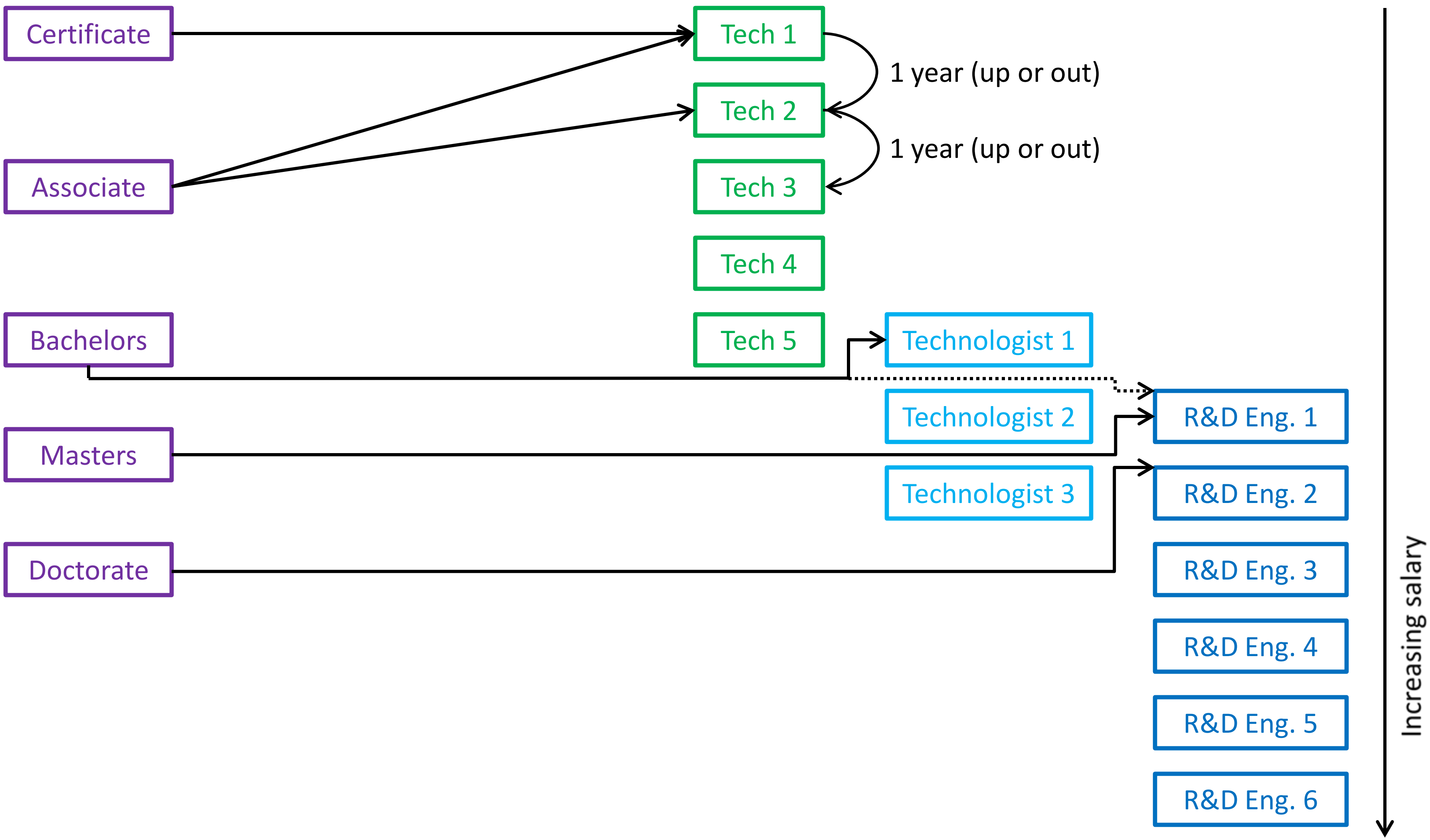
SE Primer (New)

SE Toolbox

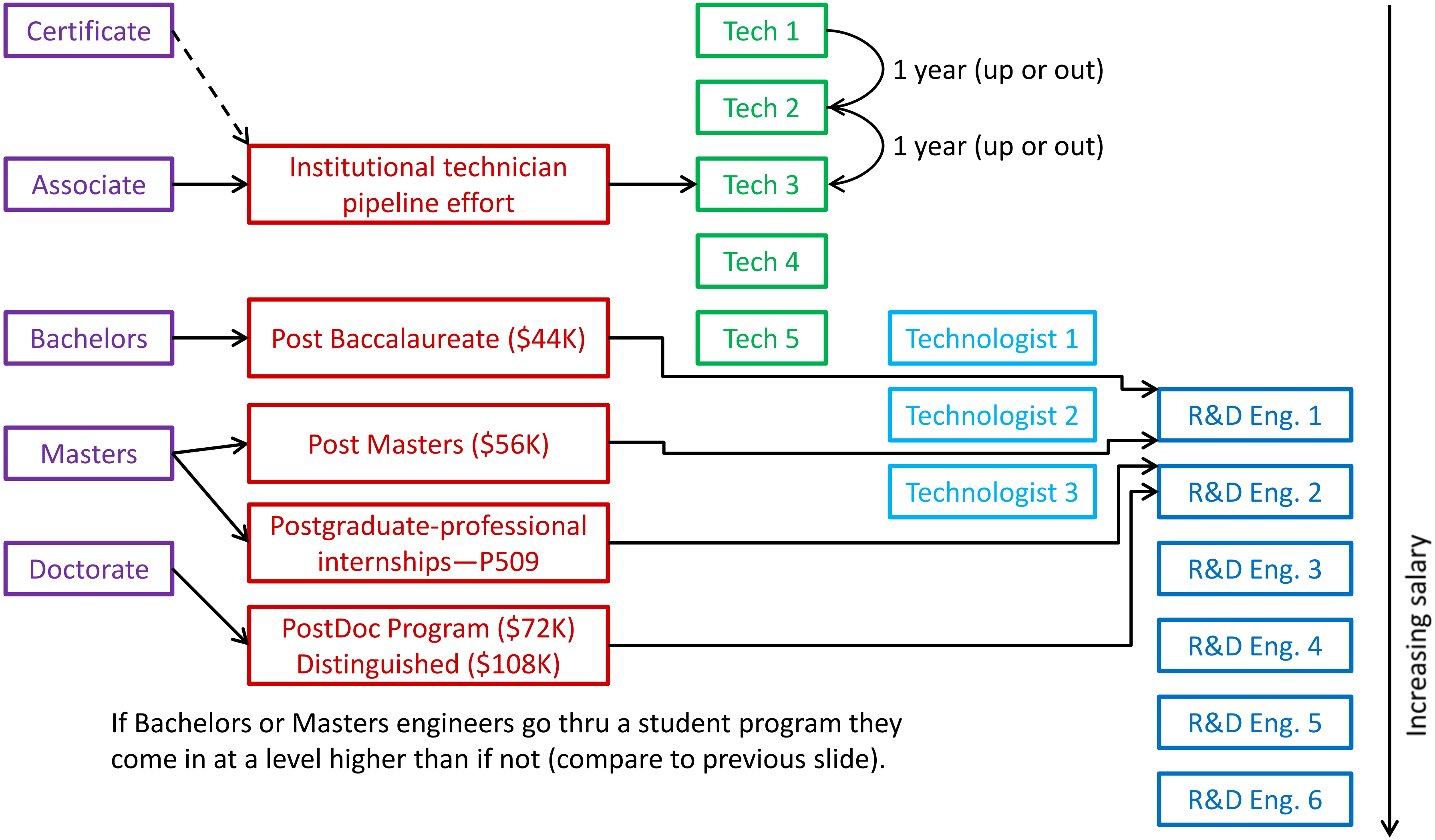
Pipeline and Recruitment

Curtt Ammerman, Mike Baker, Brian Crone, Heidi Hahn, Kim Katko, Nathan Mara, Derrick Montoya, Don Quintana, Kevin Saeger, Michael Steinzig, Tom Tierney

Coming Straight Out of School, No Student Program at LANL (direct hire)

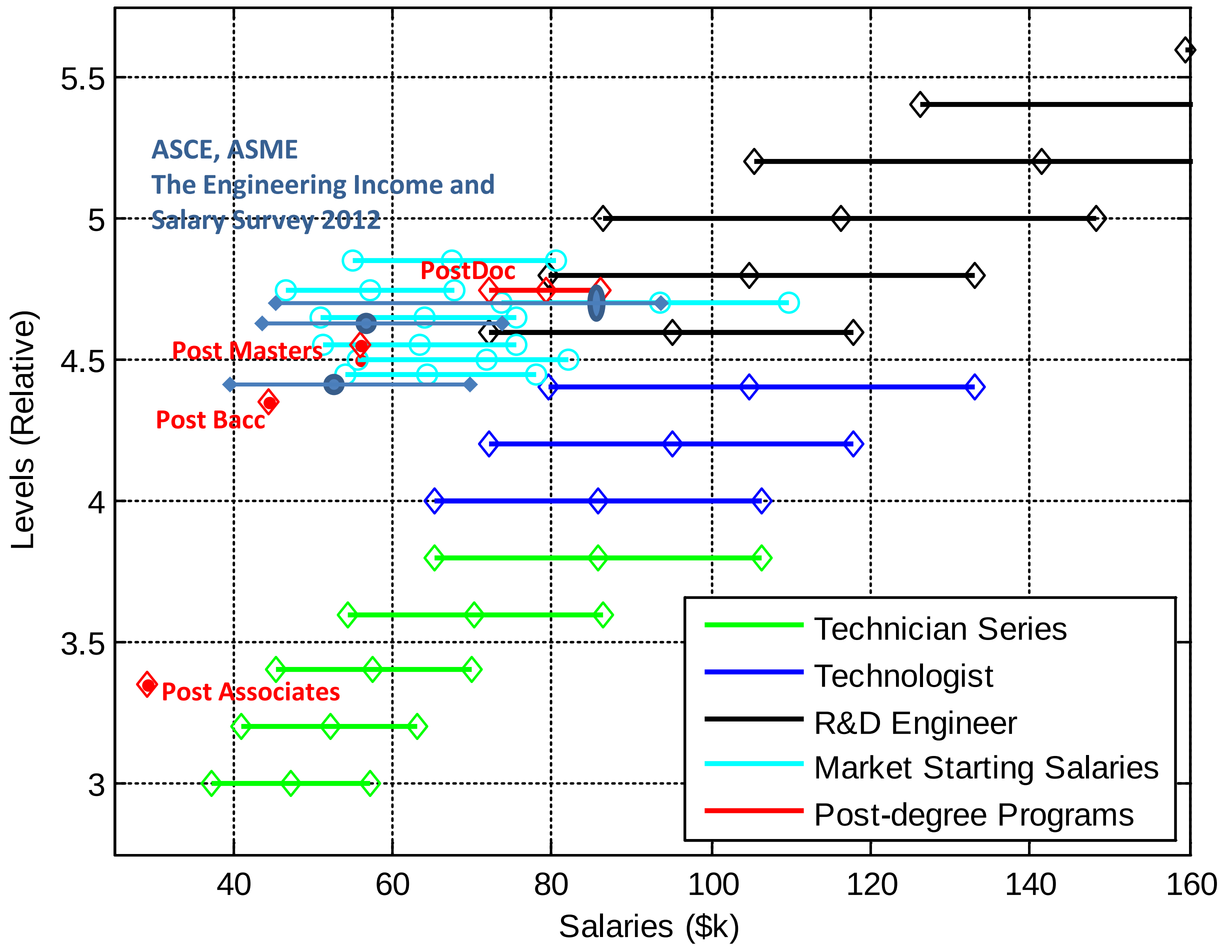


Coming Straight Out of School, to a Student Program at LANL

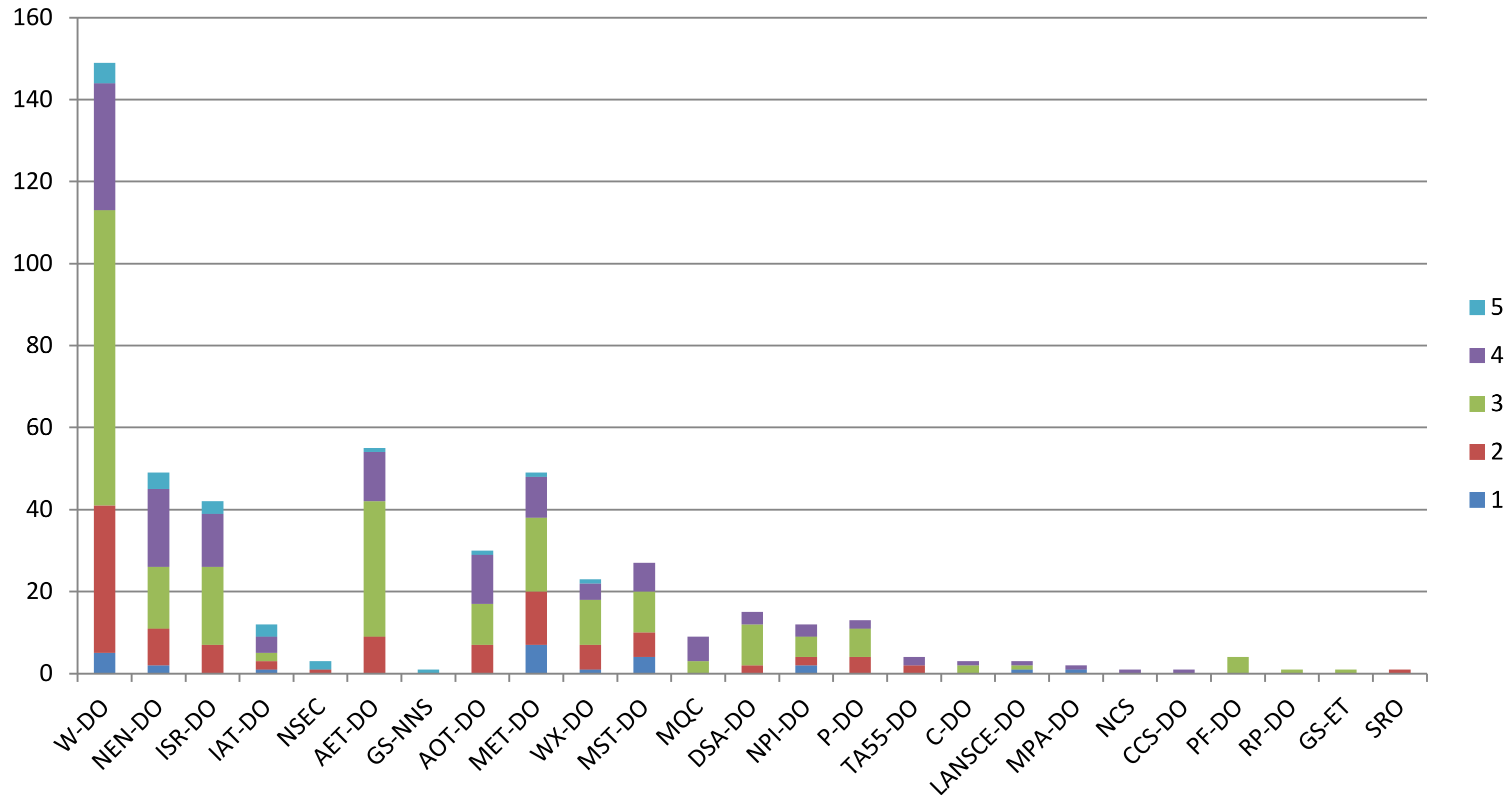


If Bachelors or Masters engineers go thru a student program they come in at a level higher than if not (compare to previous slide).

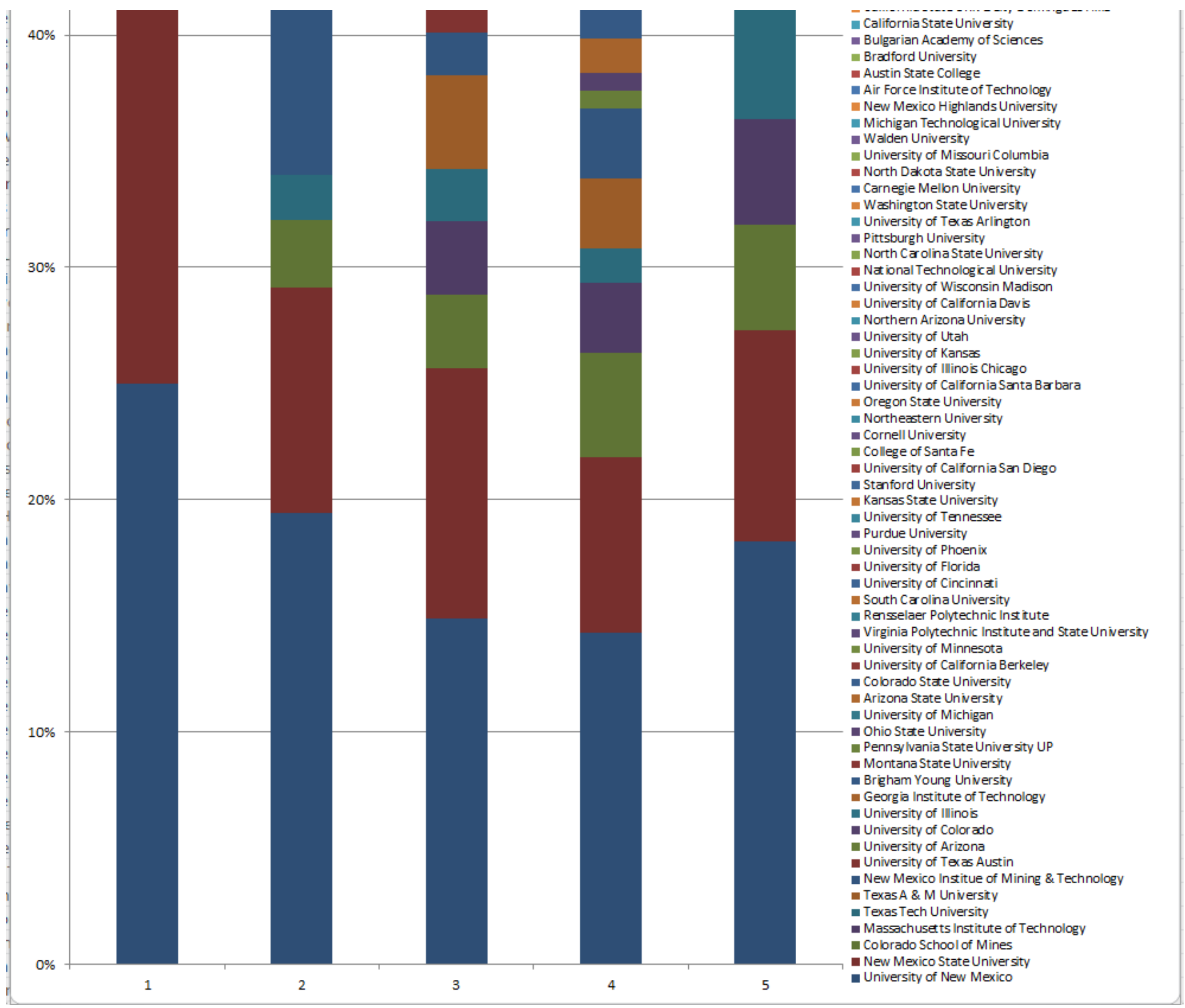
Salary Bands, Student Pay, Market Value



Engineers-Where Are They



Engineers—Where'd They Come From?



Technician Pipeline Effort

- What are Your Trying To Do?
  - Create a pipeline to Level 3 Engineering Technicians that includes a validated competency framework
- How is it Done Today?
  - No formal pipeline
  - Hiring restrictions limit ability to refill vacancies
- What is New in Your Approach?
  - Candidates will demonstrate performance in a series of validated competencies in order to be promoted
  - Institutional consistency in promotion criteria
- Who Cares?
  - Engineering Technicians are key to the Laboratory's ability to develop, fabricate, and field innovative solutions.
  - Level 1 (0), Level 2 (3), and Level 3 (13) are disappearing

Technician Pipeline Effort (cont)

- What are the Risks and Payoffs?
  - Risks
    - Building a pipeline that managers won't use
    - Failure to progress through program
  - Payoffs
    - Rejuvenated technician pipeline
- How Much Will It Cost?
  - $180K - $300K per year (assuming 3 selected candidates per year)
- What are the Midterm and Final Exams to Check for Success
  - Number of applicants and program completion rate
  - Improved demographics of technician ranks

Pipeline for MS Engineers

- What Are You Trying to Do?
  - Improve effectiveness of pipeline for MS-degreed Engineers
    - Leverage existing GRA Programs
    - Examine use of Postgraduate Professional Internships (PPI)
- How Is It Done Today?
  - Direct Hire
  - Conversion of GRA following degree completion
  - Conversion following 1-year Post Masters
  - Conversion following 2-3 year PPI
- What is New in Your Approach?
  - Extending Post Masters Program to 2 years
  - Allow Post Masters to Compete as Internal Candidates
  - ***Establish Clear Metrics for Evaluating Conversion Candidates***

Pipeline for MS Engineers (cont)

- Who Cares?
  - To be successful in executing the Laboratory's varied missions, a vibrant, creative cadre of engineers is an essential and equal partner with our strong fundamental science programs.
- What are the Risks and Payoffs?
  - Risks
    - Little Risk
    - Status quo has been marginally effective
    - Risks of inaction difficult to define
  - Payoffs
    - Establish engineering on equal footing with science programs
    - Improve Laboratory's ability to accomplish mission
- How Much Will it Cost? How Long Will It Take?
  - Minimal implementation costs—mostly policy changes.
  - Less than 6 months.
- What Are the Midterm and Final Exams to Check for Success?
  - ***Metric for improved caliber of entry level engineering staff?***
  - Five-year retention rate of high-caliber early career engineers.
  - Improved processes for recruitment of masters level engineers.

Engineering Named Fellowship

- What Are You Trying To Do?
  - Create a named fellowship that selects candidates based on engineering-centric criterion.
- How is it Done Today?
  - Engineering PostDocs are evaluated by criteria that are more applicable to the hard sciences.
- What is New in Your Approach?
  - Successful candidates would be selected based on extraordinary engineering characteristics.
- Who Cares
  - The laboratory cannot afford to have an imbalance in the caliber of its scientists and engineers. Without engineer's ability to create, new ideas and discoveries will languish and fail to make an impact.

Engineering Named Fellowship

- What are the Risks and Payoffs?
  – Risks
    - Creating a “separate-but-equal” track for engineers and reduce prestige of position
  – Payoffs
    - Establish engineering on a more equal footing with science
    - Acknowledge that engineering is distinct from science
  – How Much Will It Cost?
    - Approximately $350K per year
  – What are the Midterm and Final Exams for Success
    - Retention of high-caliber engineering junior staff
    - Improve recognition of engineers

3 Professional Development/Retention: Heilmeier's Catechism
Kathy Prestridge & Joysree Aubrey

- **What are you trying to do?**
  Ensure that R&D engineers have an understanding of the expectations of their management for not only their current positions, but also their promotion path. This is a particular problem because engineers are spread throughout PADSTE and PADWP, and there may be confusion about expectations and metrics for promotion of engineers in organizations outside ADE. Are certain behaviors, such as team building, occurring less often than management would like? These behaviors and others can be encouraged using these guidelines and expectations. One of the goals is to be inclusive and aware of multiple measures of success in a given category, e.g. recognizing multiple forms of leadership. Management must also be able to easily recognize high achievement and understand how to reward it through nominations for fellowships of professional societies and the National Academy of Engineering.
- **How is it done today? What are the limitations of current practice?**
  HR job descriptors for R&D engineers are very general. If an organization has different expectations, they are not articulated. In ADEPS, additional descriptors are written for the R&D scientist and engineer series to be more specific about expectations for these jobs. In ADEPS, the metrics for R&D scientist are relatively clear (e.g., h-index), but the engineer metrics are less mature. This is partly because there are many fewer engineers in ADEPS. Additionally, some uniformity in promotion packages is enforced via a promotion committee. The committee approach to promotion is somewhat inconsistent due to changing committee composition, leading to some objections and confusion about rejected promotion packages (from both managers and employees).
- **What is new in your approach? Why do you think it will be successful?**
  The engineering council (ADE) should take the lead in developing R&D engineer descriptors that assist managers and employees throughout PADSTE in understanding the expectations within this series. The approach to write the descriptors mimics the ADEPS approach. A new approach will be to work with PADSTE to disseminate these guidelines to organizations with R&D engineers.
- **Who cares? If you are successful, what difference will it make?**
  This will benefit employees by clarifying expectations, and managers by making it easier for them to outline performance expectations. When properly disseminated to employees, these guidelines increase dialogue with managers. Clear expectations help morale.
- **What are the risks and payoffs?**
  Not a lot of risks. Possibly some organizations will say that "our engineers are different," but the guidelines will be guidelines, not rules, and the guidelines can be customized by divisions or AD's as needed. Many benefits, including increased recognition for engineers.
- **How much will it cost? How long will it take?**
  Cost is the time of volunteers to write and others to review. Some time to socialize with PADSTE, etc. A few months to get it out of the Engineering Council and up to PADSTE, then out.
- **What are the midterm and final checks for success?**
  Writing the guidelines is one deliverable. Another is getting feedback from each AD (or different level) about implementation. Did it help group level managers in guiding employees and putting together promotion packages? Did it help the reviewers of promotion packages? What about employees?

R&D Engineer Job Descriptors & Expectations:
Supplement to HR Job Repository descriptions

All R&D Engineers are expected to maintain an accurate C.V. or resumé. The resumé should include descriptions of work experience highlighting leadership roles (PI, chief engineer, lead engineer, etc.), list of publications (e.g., LA-UR, LA-CP, reports to sponsors, milestone reports (or chapter names), proceedings, journal articles, etc.), list of awards, service to Los Alamos and/or professional societies, list of people mentored, and any other items that could be used to gauge accomplishments in rank.

Level 1: An engineer at this level will be in an assistance and support mode. The engineer will be able to apply standards and methods to ensure that solutions meet technical requirements. He or she can also assist in developing new methods and approaches to solve technical problems. She/he is expected to assist in acquiring the data or developing the intellectual property needed to prepare reports, publications, patents, etc. He/she should give presentations and possibly belong to professional societies. The focus is on continued technical development, but mentoring or other team-building skills should also be encouraged.

Level 2: This is the entry level for a PhD, or an experienced BS/MS. Relevant engineering experience consists of designs meeting requirements and supported by calculations, or similar combinations of engineering analysis and design. Work will be part of a team, but the engineer will be exhibiting more technical decision-making and will work independently. Engineer may mentor students, postdocs, technologists or others.

Level 3: A higher leadership role at this level will include acquiring funding for projects and setting scope, schedule, deliverables, etc. Engineer will be leading projects or leading engineering efforts on projects, as evidenced by lead authorship on papers, reports, patents, presentations, or other documents. Peer review can be through journals, committee service, or other work, and mentoring will be more important at this level. Evidence should be established to demonstrate that the engineer is sought after for technical advice and leadership.

Level 4: Leadership at this level extends beyond the technical to influence within the line organization, directorate, or through professional societies. Publications, papers, reports, etc. have higher impact through either audience, criticality of report, or recognition, such as invited talks at national events. Leadership is at a national level, and could possibly influence standards, policies, or other technical areas. Projects and/or teams managed are larger and high impact, and the level 4 engineer is an important mentor to others.

Level 5: At this level, the engineer is receiving national recognition and exhibiting international leadership. This can take the form of professional society fellowships, positions on standards boards, large program leadership, or other ways of influencing long-term strategic goals at LANL and nationally. The influence of the engineer's work should be well documented through awards, publications, milestone reviews, or other similar activities relevant to the programs in which he or she works. Leadership is at a strategic level, or leadership can be in directly advancing new capabilities institutionally.

Level 6: This engineer will have the highest levels of national and international influence, and will be called upon, for example, for policy guidance nationally. Leadership will be for long-term programs that will influence the future technical directions of the Laboratory. Recognition of engineering and leadership should come from multiple sources and can take many forms, such as national awards/medals, National Academy of Engineering, and other intellectual property recognition. Influence is over programs that are a significant component of the Laboratory's and/or nation's portfolio.

70 YEARS OF CREATING TOMORROW

Los Alamos NATIONAL LABORATORY

Engineering Steering Council Engagement Activities

John Szymanski, Nathan Mara, Dan Thoma, Chuck Farrar, NJ Nicholas, Subrata Nath

November 2013

UNCLASSIFIED

NNSA National Nuclear Security Administration

Context

- **2.0 Elements, Focus Areas, and Focus Area Leads (Team Kernels)**
  - **Build and Maintain Engineering Capabilities**
    - Staff Capabilities (employees and collaborators) – **Hahn lead**
    - Equipment and Facilities (bricks and mortar) – **Guffee lead** (Rees, Baker, Thoma)
    - Tools/Processes (institutional standards/policies) – **Black lead** (Barraza, Hahn, Mann)
  - **Build and Maintain People**
    - Pipeline/Recruitment – **Saeger lead** (Hahn)
    - Professional Development/Retention – **Prestridge lead** (Hahn)
  - **Build and Maintain Engagement**
    - Engagement using strategies, partnerships, program development/influence, outreach – **Szymanski lead** (Nicholas, Nath)

Context

- **3.0 Activity Listing - Lead Assignments by Focus Area**
  - **6** Academic/industry collaborations (1, 2, 6)
  - **6** Communicating engineering capability needs across organizations (1, 6)
  - **6** NNSA Roadmap on advanced manufacturing (6)
  - **ADE** Engineering Society Engagement (6)
  - **6** Engage w/ National Academy of Engineering on evolving engineering enterprise (e.g., cyber-physical systems) (6)
  - **6** Strategic outcomes technical exchanges (6)
  - **ADE** LDRD engagement (1, 3, 6) (Robinson, Crone, Girrens)
  - **ADE** Institutional capability reviews (review committee candidates) (1, 6) (Gibbs, Girrens)
  - **ADE** Applied science to prototypes, i.e., a framework/methodology to incorporate/integrate earlier in projects more engagement of applied expertise/resources. Can we address a business model and/or define characteristics to accomplish? (6) (Black, McBranch, Pesiri, Girrens)

Whom are We Engaging?

- **Lab Stakeholders**
  - PADs and ADs
  - Strategic outcomes Office
  - GS program offices
  - SC and energy program offices
  - LDRD program office
  - Science Resource Office
- **External Organizations**
  - Capability review teams
  - NNSA advanced manufacturing initiative
  - Engineering societies
  - Academia and industry
  - National Academy of Engineering

Suggested Goals and Messages

- **Lab Stakeholders**
  - Improve knowledge of LANL engineering capabilities
  - Improve understanding of the value offered by these capabilities
  - Increase support for investment in engineering capabilities
  - Annunciate the innovation inherent in engineering research in contrast to the broadly-understood science innovation the Lab supports routinely
- **External Organizations**
  - Improve recognition of LANL as a strong engineering organization
  - Seek recognition for individual LANL staff
  - Support the above by placing staff on national studies and government planning activities
  - Develop high-value collaborations
  - Stay abreast of the latest developments in research, education, and practice

Academic/Industry Collaborations

- **What are you trying to do?** Foster collaboration with academia and industry to further engineering capability, enhance recruitment opportunity, and facilitate technology transfer opportunity.
- **How is it done today?** Lack of coordination across divisions and directorates to engage academic and industrial institutions. Currently, such engagements are not formalized across LANL, and are individual funding source based. In terms of a hiring pipeline, this hinders making key hires in targeted areas for program development.
- **What is new in your approach?** Coordination across the Laboratory of engineering needs through the ESC can provide academic and industry partners with a well-defined pathway to starting collaboration.
- **Who cares?** Better, targeted collaborations can improve both our program execution and the skill sets of our engineering staff. Thus, our sponsors will benefit as well as our staff.
- **What are the risks and the payoffs?** Risks of implementing a new approach include wasted T&E if unsuccessful, and risks to IP based on enhanced collaboration with individuals and organizations outside the Laboratory.
- **How much will it cost? How long will it take?** Costs will be associated with personnel to conduct formalized outreach activities and to coordinate industry/academic collaborators across engineering-related divisions.
- **What are the midterm and final "exams" to check for success?** Objective analysis of the relative size and quality of our academic/industry collaboration portfolio. Suggest such an analysis by ADE or the Engineering Capability Review yearly.

Communicating Engineering Capability Needs Across Organizations

- **What are you trying to do?** Enhance engineering capability across organizations.
- **How is it done today?** Lack of coordination across divisions and directorates to communicate current capability and future needs. Currently, such engagements are not formalized across LANL, and are individual funding source based. This leads to duplication of resources in some cases, and in others, hinders acquisition of new facilities due to a lack of a coordinated Lab-wide vision.
- **What is new in your approach?** Coordination across the Laboratory of engineering needs through the ESC can give a unified approach to defining current and future engineering capability needs. This will further enable building a strong business case for investment in new capabilities and approaching new funding sources.
- **Who cares?** Individual R&D engineers and scientists due to improved/more efficient facilities and capabilities. Funding sponsors will be attracted to the concept of a "one-stop shop" vision of LANL for their projects.
- **What are the risks and the payoffs?** Possible payoffs include reduced footprint due to consolidation of duplicate capabilities, and reinvestment of those funds into new or upgraded capabilities. Risks can include wasted T&E to coordinate an unsuccessful attempt.
- **How much will it cost? How long will it take?** Major cost is participant's time. Major progress can be made on 3-, 6-, and 12-month intervals.
- **What are the midterm and final "exams" to check for success?** These are preliminary thoughts: perhaps a survey of staff in organizations not traditionally deeply engaged with LANL engineering organizations. Use the same or similar survey with program and line management in those organizations.

NNSA Roadmap on Advanced Manufacturing

- **What are you trying to do?** Articulate your objectives using no jargon.
  - Manufacturing at LANL has historically been driven by following a process. In other words, repeatability, consistency, reduced uncertainty, etc. has been a function of a tightly controlled process methodology that ensures identical results for each manufacturing process, including assembly. In reality, what this process-based methodology provided was the same microstructure evolution at each step. With consistent microstructures, predictable properties (and therefore engineering performance) were guaranteed.
  - Another route enabled over the past decade (through science advancements and computer speed) is the ability to directly control the microstructure. Direct control of the microstructure (through in situ sensing and diagnostics, microstructure evolution models, and processing feedback) shifts the focus from an "identical process" to an "identical product". As a result, flexibility and agility are afforded to the manufacturing routes to provide efficiencies (e.g., waste, power consumption, footprint, worker exposure, etc.). In other words, our efforts focus on manufacturing efforts that provide "process aware" product. Finally, a product-based approach minimizes final inspection (since in situ monitoring and process simulation is inherent in the product-based approach).
- **How is it done today?** What are the limitations of current practice?
  - The approach is an historical route that is expected to be translateable to other facilities. This does not account for subtle changes that are not measured or controlled that can actually affect performance (impurities, environment, etc.). Being historical, the process-based approach does not permit new technology or scientific/engineering developments for implementation.
  - The approach does not permit higher efficiencies (waste, footprint, power, worker exposure, cost, water usage, etc.) to be modified with more state of the art technologies.
  - The approach does not permit new methods with less variation.
  - The approach does not actually monitor real variables. For example, the oxygen reading in a glove-box is controlled, but the real factor is impurity content in the processed material.
  - The process relies heavily on post-production inspection, promoting costly scrap when manufacturing flaws are found at the end of production/assembly

NNSA Roadmap on Advanced Manufacturing

- **What is new in your approach?** Why do you think it will be successful?
  - A product-based approach focuses on the end product specifications, not each individual step in the process. By using better science tools, new technologies, integrated sensors and diagnostics with simulation feed-back or feed-forward control, in situ quality control on the real product eliminates the need for tightly controlled steps. Thus, multiple pathways are possible to reach the same desired specifications, allowing flexibility in cost and efficiencies.
- **Who cares?** If you are successful, what difference will it make?
  - This is a national effort to increase American competitiveness in manufacturing. There is also a NNSA Roadmap on Advanced Manufacturing. The real difference for LANL is a modernization of our manufacturing capability.
- **What are the risks and the payoffs?**
  - The major risk is the new approach requires a qualification certification process which can prove to be a challenge with sponsors and customers. With the absence of an admiral test, science-based approaches will be needed. However, LANL's ability to accomplish has been demonstrated with cast vs. wrought processing.
  - The big payoff is cost, flexibility, and a variety of efficiencies (energy, waste, worker exposure, footprint, etc.)

NNSA Roadmap on Advanced Manufacturing

- **How much will it cost? How long will it take?**
  - The cost of the effort has to be determined at an individual task level. For example, using additive manufacturing for tooling or direct cast for uranium alloys both have unique needs for advanced manufacturing and ultimate cost benefit analysis. This ibeing developed in a 100 page NNSA Roadmap on the top 10 to 20 areas.
- **What are the midterm and final "exams" to check for success?**
  - Advanced Manufacturing is a staged approach. First is the ability to demonstrate a process through a variety of means. Then there is the ability to take the concept to TRL3/4. The near final element is MRL 8 for success. The TRL and MRL levels are used as the stagegates for any advanced manufacturing effort.

Engage with NAE on Evolving Engineering Enterprise (e.g. cyber-physical systems)

- **What are you trying to do?**
  - Stay abreast of national initiatives being undertaken or championed by the National Academy of Engineering (NAE) and/or the National Science foundation (NSF) related to engineering research, education and practice that can impact and improve the engineering enterprise at LANL.
  - Provide LANL input to NAE/NSF initiatives.

- **How is it done today?** To date, engagement with the NAE or NSF is *ad hoc*. It tends to be done by individual initiative (e.g. a staff member volunteers to serve on NSF proposal review panel). Participation on NAE or NSF committees is minimal (current participation needs to be quantified).

- **What is new in your approach?** Form a committee that meets semi-annually to review current and new initiatives being undertaken by the NAE and NSF. The committee will report to the Engineering council on these activities and their relevance to the LANL engineering enterprise. The committee will identify NAE/NSF activities where LANL participation is appropriate and suggest possible participants from LANL engineering community.

- **Who cares?** In order to stay at the forefront of engineering, LANL needs to be part of the evolving national and global engineering discussions and agenda.

Engage with NAE on Evolving Engineering Enterprise (e.g. cyber-physical systems)

- **What are the risks and the payoffs?** The risks are that LANL does remain at the forefront of emerging trends in engineering research, education and practice. In addition to the converse of the previous statement, the payoffs are that LANL becomes recognized as an active participant in setting national and global engineering agenda.

- **How much will it cost? How long will it take?** Engagement with the NAE and NSF needs to be an ongoing activity for an institution that has a significant engineering enterprise. Costs are primarily associated with the committee's time to meet, review activities, report to the engineering council on these activities and to suggest ways that LANL can engage in appropriate NAE/NSF activities. Further costs will be associated with time and travel to participate on NAE/NSF workshops and committees.

- **What are the midterm and final "exams" to check for success?**
  - Midterm – initially quantify current level of participation in NAE/NSF activities and impact NAE/NSF activities have on LANL engineering enterprise. In three years reassess to track increase in participation. Also, at three years identify and quantify the impact of these interactions on the engineering enterprise at LANL. Similarly, identify and quantify impact that LANL is having on NAE/NSF activities.
  - Because the assumption is that this interaction needs to be an ongoing activity, there is not a final exam.

Strategic Outcomes Technical Exchanges

- **What are you trying to do?** Articulate the value of engaging the broad engineering community in GS programs and program development, especially system engineering. Seek support for LDRD investment in engineering capabilities.
- **How is it done today?** As an example, our sensing systems tend to be single-sensor-specific and often are not very problem-centered – engineering capabilities can help change this. Regarding LDRD, the community defining LDRD investments often does not understand well the innovation and importance of engineering to Lab mission.
- **What is new in your approach?** The SOO is eager to design highly integrated systems that will rely heavily on our engineering capabilities.
- **Who cares?** Individual engineers and program developers will benefit.
- **What are the risks and the payoffs?** Large payoff and limited risk. Biggest risk is opportunity cost for individuals contributing to this outreach.
- **How much will it cost? How long will it take?** Major cost is participant's time. Major progress can be made on 3-, 6-, and 12-month intervals.
- **What are the midterm and final "exams" to check for success?** Open discussions with the SOO members on how we can improve communications.

LDRD Engagement

- **What are we trying to do:**
  - Maximize flow of ideas and encourage risk and innovation through short fail-fast projects
  - Tailor format to enable quick use by program offices ← payoff
  - Foster program-line interactions to maximize program growth ← payoff
  - Encourage synergistic partnerships
  - Incorporate R&D investment cycle (sow, nurture, harvest, prepare) ← midterm exams
- **Who Cares:**
  - Applied researchers have a mechanism to develop ideas and capabilities
  - Fundamental researchers have a path to advance TRL and develop applied partners
  - Program and line strengthen interactions and awareness
  - Part of building sustainable Engineering capabilities and programs
- **How is it done now:**
  - The process is being implemented and optimized, and will be ongoing
  - Relies on existing LDRD funding, structured to minimize PI and reviewer effort ← reduce cost
  - Initial results are promising: ← signs of success
    - FY14: 84 quad-charts, 28 white papers, 8 ERs funded this year
    - Project stock takes (penta-chart + stoplight) showing increased program and line involvement

Program Engagement

- **What are we trying to do:**
  - Improve development of externally funded programs based on existing applied capabilities
  - Leverage existing investments such as LDRD
  - Continue to develop Engineering R&D investment strategy
- **Who Cares:**
  - Line benefits from better understanding of customer needs
  - Program benefits from better understanding of line capabilities
  - Customers benefit from exposure to broader set of Lab capabilities
- **How is it done now:**
  - Personal relationships and knowledge of the PMs and PIs
- **What is new:**
  - Build investment cycle coupling a customer (DARPA) to an existing portfolio (LDRD)
- **How long will it take:**
  - 2 years to demonstrate / optimize the process, implementation ongoing
- **How much will it cost:**
  - Leverages / integrates existing efforts to reduce cost
- **Midterm exams:**
  - Should see at least 1 DARPA project per year stemming from LDRD developed capabilities

Engineering Sciences Strategic Leadership Plan

Attachment 3

ESC Activity Status Report
(Feb 3, 2014)

Activity	Area Lead	Status	Comments
Capabilities and Workforce	**1: Hahn**		
Dynamic Catalog			Revisit status in June
Competency Assessment			Need a simpler method to track
Demographics			Refresh before March 3
Equipment and Facilities	**4: Guffee**		
Consolidation of facilities			
Transformative Approaches to Performing Work			Location for additive manufacturing equipment
Investment in specific equipment/ facilities			Better future collaboration on small equipment calls.
Future of Prototype Fabrication			Issuing RFI Collaborative Fabrication Partnership
Pipeline and Recruitment	**2: Saeger**		
Technicians			On schedule
MS Engineers			Presentation to Council Feb 3
"named" fellowship			
Assimilation of ENG PDs			pipeline identified
Professional Development and Retention	**3: Prestridge**		
Level Descriptors			Rec'd feedback from LLNL
Standardized metrics and process for promotions			Presentation to Council Feb 3 (level descriptors are the metrics)
Tools & Processes	**5: Black**		
R&D Engineering Primer			Presentation to Council Feb 3
SE/PM tools			when is first deliverable prototype?
Social media/networking			Sharepoint, blog and wiki exist
Engagement	**6: Szymanski**		making progress on a communications plan, met in Jan and identifying messages
Academic/ industry collaborations			
Communicating capability needs across organizations			
NNSA Roadmap on advanced manufacturing			Teter has presented briefing to ADs and others
Engage w/ NAE			SNL CTO Speaker at Engineer's Week activity Feb 20 is a start
Strategic outcomes exchanges			Need to schedule regular crosscut report
Engagement	**ADE**		
Program			
LDRD			ENG ER Process in 3rd cycle
Institutional capability reviews			March 17-19: Satellites, Nuclear, SHM
Engineering Societies			Memo issued Dec 23

	complete		lagging or impediment
	satisfactory progress		on hold