Robust Decision Making

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Abstract. The Idaho National Laboratory is funded through the U.S. Department of Energy Office of Nuclear Energy and other customers who have direct contracts with the Laboratory. The people, equipment, facilities, and other infrastructure at the laboratory require continual investment to maintain and improve the laboratory's capabilities. With ever tightening federal and customer budgets, the ability to direct investments into the people, equipment, facilities, and other infrastructure that are most closely aligned with the laboratory's mission and customers' goals grows increasingly important. The ability to justify those investment decisions based on objective criteria that can withstand political, managerial, and technical criticism also becomes increasingly important. The Systems Engineering tools of decision analysis, risk management and roadmapping, when properly applied to such problems, can provide defensible decisions.

Introduction

The Project Managers responsible for some of the Idaho National Laboratory (INL) investment decisions turned to INL's Systems Engineering Department (SED) for support in evaluating a broad range of disparate investment requests in the hope that better investment decisions could be derived using Systems Engineering tools. SED developed objective criteria against which the investment requests could be measured, organized a team of stakeholders to evaluate the requests, managed the process of scoring and prioritizing requests, and collected feedback to improve the process in subsequent years. Because SED strives for continuous improvement and integrated decisions, this process has evolved significantly over the past three years and continues to improve.

Objective Criteria. The first generation of objective criteria was based on those things that appeared to be important to the success of the INL and its customers. Before the second generation of criteria was developed, the INL published an updated Strategic Plan, which formally documented those things that are important to the success of the INL and its customers. So the second generation of criteria was based on these documened strategic objectives, but added criteria to cover issues critical to the INL that were not discussed in the strategic objectives. As the Strategic Plan evolves, so will the criteria.

Team of Stakeholders. The first generation team of stakeholders involved people from the organizations affected by the investment decisions. The second generation team of stakeholders added people from affected organizations that were not initially recognized as affected

organizations. Future teams of stakeholders will continue to adjust based on the lessons learned and improve how organizations and people are involved.

Process. The first generation process used an early MS Excel tool based on utility theory to score and evaluate the proposed investments. The second generation process adapted a more refined version of the tool that accepted more inputs and added several new output options that inspired discussion and collaboration between the stakeholders. It was able to present the affect of the team's decisions in real time during the coordination meetings further enhancing the value of those meetings. Another improvement initiated during this second generation of the process was the gathering and documenting of the reationale for any changes in priorities that were made anywhere in the process, whether during the stakeholder meetings, executive management review, or project management implementation. The next generation process will expand to accept inputs from more investment plans and synchonize those plans to get more consistency across the INL. Future generations of the process will continue to expand the scope of investments considered by including investment opportunities that could be funded through sources that are not currently included in the process. Future generations of the process will also incorporate new tools that can link investments to each other and to the INL's capabilities that they support. These future tools are being prototyped and will be able to model how the investments in people, equipment, facilities, and other infrastructure affect each other and the INL's capabilities. They will also provide status indicators that will clearly show how individual investments affect the state of each INL capability.

Feedback. One sure way to sink a process such as this is to imagine you have all the answers and ignore the cumulative intelligence brought to bear on the problem. Many of the meetings that supported this decision making process were facilitated by SED personnel other than the SED personnel directly involved in managing the process. These independent sets of eyes and ears provided useful feedback in assessing the strengths and weaknesses of the process and the personalities involved in it. In addition, as phases of the process were completed, the facilitators formally requested and received feedback from the participants and affected organizations that was used in subsequent generations of the process.

This paper will focus on the second generation of the process, but provide ties to what was learned from the first generation and how the lessons learned to date are influencing future plans.

Scope

This process was initiated on behalf of the project management organization responsible for the laboratory infrastructure. Their budget includes:

- Reactor and Nonreactor Nuclear Research Reactor Operations and Maintenance
- Engineering and Support Facility Operations and Maintenance
- National Scientific User Facility
- Radiological and Environmental Sciences Laboratory
- Research Reactor Infrastructure
- Idaho Facilities and Infrastructure Revitalization Program (IFIRP) including General Purpose Capital Equipment (GPCE)

- Line Item Capital Projects

The focus of this decision support process was just the last two bullets, which have an annual budget ranging from an approximate low of $16M to an approximate high of just over $26M in the next several years. As discussed in the introduction, as the process matures, it will encompass larger portions of the investment decisions and other funding sources currently outside this scope.

Prioritization and Decision Criteria

Problem Statement and Analysis Approach. INL must periodically assess its needs for various facilities and infrastructure investments to maintain existing capabilities and meet future needs of the laboratory. Through this assessment, near-term needs are relatively well defined; however, less rigor is expended on needs further into the future because various conditions can significantly alter the future direction of the laboratory. Even the near-term needs are in a state of flux as customer funding ebbs and flows, costs change, the scope of a repair or modification changes, or another priority enters the mix. A standard systems engineering analysis of alternatives approach is used for these evaluations (as shown in Figure 1).

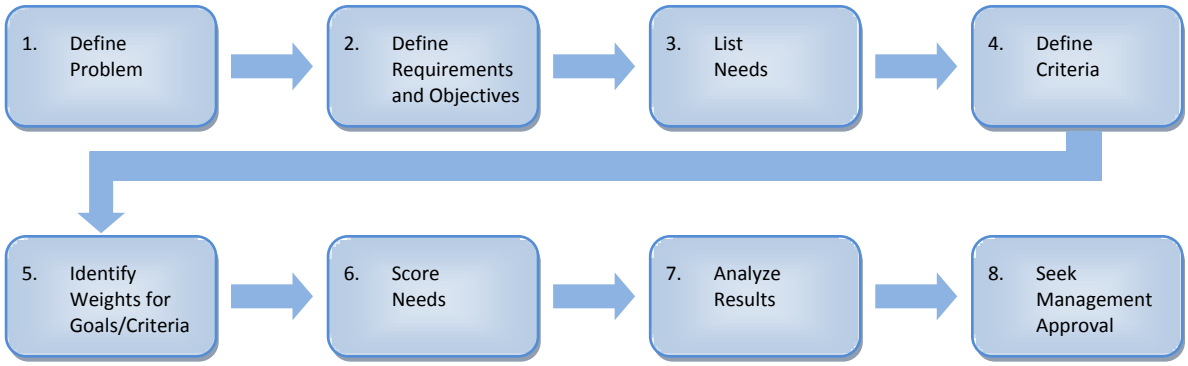

Figure 1. System engineering standard analysis of alternatives process.

Define Requirements and Objectives. The overall purpose of this investment prioritization process is to support the vision of INL being the preeminent nuclear laboratory. The comprehensive objectives of this facilities and equipment prioritization process are to provide proper facilities and equipment for INL's programs (assuming sufficient funding), optimize cost effectiveness, manage risks, and use a valid decision support process to guide investments. The defined process provides for a balance of site maintenance, nuclear programs, National and Homeland Security programs, and clean energy programs. INL's strategic objectives, as documented in the INL Strategic Plan, were used as the guiding requirements and objectives.

Define Alternatives. Each of the organizations requesting investments assigned a point of contact (POC) who acted as their representative through the remainder of the process. INL Management was briefed on the process. The POCs were trained on the process and given the previous, as yet unfulfilled, facility and equipment investment requests from their organizations. The POCs updated those requests, cancelled the requests that were no longer required, and initiated new requests for needs not previously submitted. Funding determinations and estimates were initiated or updated.

Criteria Definition. To support the vision and objectives, SED developed a set of decision criteria derived from the strategic objectives and risks associated with the business. The criteria were established to minimize the chance that any proposed investments could garner extra consideration or undue advantage by taking credit for the same benefits to the laboratory under multiple criteria. The criteria were developed, vetted by various management teams, and used by the analysis team to evaluate investment needs. Despite the diligence taken in developing the criteria, interpretations by the members of the analysis team varied and a couple of the criteria were identified as not being reasonable discriminators. The ambiguities were corrected and the nondiscriminating criteria eliminated. Table 1 explains the criteria used to evaluate the needs during a recent fiscal year.

Table 1. Criteria used to evaluate needs

Strategic Goal Title	Strategic Goal	Criteria	Description
1. Nuclear Reactors and Fuels	Lead advanced nuclear reactor and fuel cycle research, development, and demonstration (RD&D)	1-1: Applicability to advancing the nuclear energy mission	Define how this investment advances nuclear reactor and fuel cycle programs/ projects
2. Nuclear Energy Partnerships	Develop, demonstrate, and promote nuclear energy technology through public-private partnerships	2: Nuclear energy partnerships	Included in Criterion 7
3. National and Homeland Security	National and Homeland Security – build leading roles in nuclear nonproliferation and critical infrastructure protection	3-1: Applicability to advancing the national security missions	Define how this investment advances national security programs/projects
4. Clean Energy	Energy and Environment – become a leading clean energy laboratory valued as a regional resource	4-1: Applicability to advancing the clean energy RD&D missions	Define how this investment advances clean energy RD&D
5. Existing Assets	Build and equip facilities that advance our nuclear energy and other programmatic missions using innovative approaches and maximizing existing assets	5: Existing assets	Included in Criteria 1, 3, and 4
6. Multiproject Research	Focus investments in distinctive areas to advance nuclear and multi-program research	6: Multiproject research	Included in Criteria 1, 3, and 4
7. Strategic Partnerships	Build strategic partnerships and leverage their influence and market knowledge	7-1: Growth in improving our strategic partnerships and leveraging our technologies into the market	Define how this investment advances strategic partnerships, improves communications with those partners, and enables technology transfer and commercialization
8. Strategic Hires and Retention	Build an organization that attracts and retains key nuclear and other scientific researchers/engineers, enabling INL to reach high levels of laboratory performance	8-1: Employee working conditions and services	Metric to define effect of investment on increasing employee morale

9. Business Efficiency	Implement business and operational practices that reduce bureaucracy and promote safe, efficient, and secure mission accomplishment	9-1: Return on investment	Each score includes three parts. If your situation is reflected in multiple scores, choose the highest score you can justify. In this context, payback period is estimated annual revenue gain divided by total cost.
10. Public Trust	Develop public trust and confidence in INL and nuclear energy	10-1: Growth in improving effective communications with the public and INL employees	Metric to define the level of support investment has toward improving our ability to effectively communicate with the public and our employees
11. Risks:		11-1: Program/ project critical facility operational impact	Define the level of risk if the investment is not funded this year
		11-2: Safety impacts	The amount of safety risk mitigated by the investment
		11-3: Compliance impacts	The amount of compliance risk mitigated by the investment
		11-4: Security impacts	The amount of security risk mitigated by the investment
		11-5: Environmental impacts	The amount of environmental risk mitigated by the investment
	NOTE - This criteria required considerable clarification and care to be consistently interpreted.	11-6: Annual business impact	Metric to define the total annual dollar value of the program(s)/project(s) impacted by this investment (this is not saving)
	NOTE - This criteria was cancelled.	12-1: Creates risk to meeting 2015 and beyond outcome	Define the level of risk if the investment is not funded this year, … how soon is a needed investment deferred.
	NOTE - This criteria was cancelled.	12-2: Degree to which the 2015 and beyond vision is affected	Define the level of risk if the investment is not funded this year, … how many investment threads are affected.

Identify Weights for Goals/Criteria. INL has four councils which help to manage the laboratory. One of those councils is composed of the most senior leaders and accepts the recommendations from the other councils as their input. Representatives from the other three

councils were surveyed to gather their interpretations about the relative importance of the criteria. The representative from each counsel had a slightly different interpretation of the relative importance of the criteria, but each set of weights was entered into the analysis tool, along with the criteria. Several other weighting schemes were also entered into the tool to assess what combinations of criteria weights might pose contrasting priorities. In the end, the weighting schemes proposed by each of the counsel representatives and the risk weighting scheme were shown side by side for comparison (see Table 2). This approach worked well to inspire positive discussion among the decision makers which focussed on whether the options were correctly prioritized and why. After having done this several times, we've discovered that while our councils do not agree on the weights, the results yielded the same few options at the top of the list and the same several options at the bottom. Alternately, we could have forced them to agree on one set of weights, but when this approach yields unexpected results, the decision makers are more likely to dismiss the process than when multiple scenarios yield discussion inspiring similar or contrasting priorities.

Table 2. Comparison of council weighting schemes

	Scenario 1		Scenario 2		Scenario 3		Scenario 4	
Criteria Name	**Council 1**		**Council 2**		**Council 2**		**Risk Focus**	
1-1: Applicability to advancing the nuclear energy mission	20	1	21	1	15	1	1	1
3-1: Applicability to advancing the national security missions	18	1	16	1	10	1	1	1
4-1: Applicability to advancing the clean energy RD&D missions	16	1	7	1	7	1	1	1
7-1: Growth in improving our strategic partnerships and leveraging our technologies into the market	17	1	11	1	12	1	1	1
8-1: Employee Working Conditions and Services	10	1	9	1	10	1	1	1
9-1A: Payback period for investment (expressed in years)	14	20	14	33	10	10	1	1
9-1B: Annual Cost Savings		16		28		7		1
9-1C: Life Cycle Cost Avoidance		18		39		5		1
10-1: Growth in improving effective communications with the public and INL employees	10	1	5	1	5	1	1	1
11-1: Program / Project Critical Facility Operational Impact	16	18	17	9	10	10	1000	1
11-2: Safety Impacts		16		19		5		1
11-3: Compliance Impacts		16		19		5		1
11-4: Security Impacts		20		19		5		1
11-5: Environmental Impacts		16		19		5		1
11-6: Annual Business Impact		18		15		7		1

These weights are not the actual weights used, but are representative. In general, people like using even numbers that sum to 10 or 100. Our tool is not picky about the numbers input because it automatically calculates the decimal equivalents of the individual scores in each column and group. Doing this weight normalization makes the later calculations easier to trace and having this function built into our tool helped people focus more on the relative weights and less on the sum of their weights, which is especially complicated when both criteria and sub-criteria are used such as in this example.

Scoring Alternatives. While management representatives were providing their input on criteria weighting, the organizational POCs worked with teams from their organizations, scored each of their requests against the established criteria on a scale of 1 through 5, low to high respectively, justified any scores greater than 1, and submitted their scores and justifications. To minimize confusion, ambiguities, and variation among the multiple scoring POCs, clear, concise scoring definitions were written and vetted before being presented to the POCs in a pre-scoring training session. In other applications of this method, we used a single, small team to score all projects.

It's easier to believe you have clear, concise and unambiguous wording than it is to actually achieve. However, it's critical to avoid complicated, overlapping, or multi-part scoring definitions where you can legitimately give multiple scores to a single option or gapped definitions where options legitimately fall between adjacent scores. An example is presented in Table 3 along with the scoring explanations to demonstrate this point. Because each scoring definition has multiple parts, one of the guidelines we used was that the option was always granted the higher score when it fit part of one scoring definition and part of another scoring definition.

Table 3. Sample of multi-part scoring definition

Criteria	Description	Scoring Explanation
Applicability to advancing the primary mission	Define how this investment advances the primary mission (or specific portions thereof)	Investment provides: 1. No direct or indirect maintenance of or advancement in aspect A or aspect B of the primary mission facilities, equipment, or capabilities 2. Indirect advancement in aspect A or aspect B of the primary mission facilities, equipment, or capabilities or maintenance to avoid loss of capability 4+ years away 3. Enablers needed prior to advancement in aspect A or aspect B of the primary mission facilities, equipment, or capabilities or maintenance to avoid loss of capability 1 to 3 years away 4. Maintenance of or a direct advancement in aspect A or aspect B of the primary mission facilities, equipment, or capabilities 5. Maintenance of or a direct advancement in both aspect A and aspect B of the primary mission facilities, equipment, or capabilities.

Normalizing Alternatives. This part of the process can be one or more steps depending on the volume and complexity of the data, but is critical to achieving buy-in and a valid end result. In

our examples, we've done this part of the process in either one or two steps. The first step is where the responsible systems engineer reviews the submitted scores and justifications against the other documentation available to assure they are consistent and that the POCs correctly interpreted the criteria and scoring definitions. Any improperly justified or inconsistent scores were returned to the POCs with comments for resolution. Once all the scores and justifications were evaluated individually, POCs were assembled in a facilitated working group and allowed the opportunity to review their scores and justifications with the scores and justifications of their peers. This team normalization portion of the process assured the scores and justifications were consistent among the POCs and helped the POCs to buy into the results. When a small team scores all the projects, then these steps can easily be combined. In both cases, the normalization reduces variation between scoring individuals and drift in the interpretation of the score definitions over time.

The tools used during this stage of the process allowed automatic sorting by score under each criterion. This feature allowed group review of like scored investment requests, adjustments to the scores, and real time resorting to view the results.

- Criteria 1
  - Score 5, Project H, justification …
  - Score 4, Project F, justification …
  - Score 4, Project B, justification …
  - Score 4, Project C, justification …
  - Score 3, Project D, justification …
  - Score 3, Project A, justification …
  - Score 3, Project G, justification …
  - Score 2, Project J, justification …
  - Score 2, Project I, justification …
  - Score 1, Project E, justification …

Also, as we proceeded through the steps of this process, we captured the debate over the definitions of the criteria and scores, explained the intended interpretation of the criteria and scores, facilitated the discussions as needed to reach agreement among the primary points of contact, and captured the results of their discussions as notes for future meetings to keep the evaluations consistent.

Analyze Results – Prioritization. Calculations were run using the criteria scores and weighting scenarios to generate priority-ordered lists of the facilities and equipment requests. With these ordered lists, the POCs again were assembled in a facilitated working group and allowed the opportunity to reconcile the lists and to recommend and justify changes to the prioritized lists. The POCs provided a critical review of requests by their peers to reprioritize the lists. They only accepted a few well-justified changes, such as moving up a lower priority item that was a prerequisite for a higher priority item. The rationale for the accepted changes was documented. The result was a vetted priority list that was presented to management. In this picture, Scenario 1 is now the results of the POC prioritization adjustments, Scenarios 2 – 4 are the tool generated

priority lists, and Scenario 5 is the tool generated risk priority list. The Final column in the middle of the sheet is a place to allow manual assignment of priorities in real time during a meeting.

This ability to handle manual reprioritization serves multiple purposes. First, the criteria and scoring definitions will never be complete or perfect, so allowing for some manual reprioritization allows people to interject important considerations that were not part of the criteria or scoring definitions. Second, and politically more important, is that some people will not feel valued if they are presented with a prioritized list and asked to approve it without being able to make any adjustments. Whether changes are made or not, the ability to make some adjustments yields better buy-in and better discussions. However, this step must be managed so changes are not wholesale. Documenting the rationale for the changes, especially when the individuals responsible for the change are named in the rationale will help control wholesale changes and will yield data that can be used to understand if there were any gaps in the criteria that should be addressed before the next application of the process.

Annual budgets were overlaid on the prioritized lists presented to management for their concurrence or realignment. Because of annual funding constraints, a few priorities were readjusted, the rationale for the changes documented.

Figure 2 shows the annual funding bands overlaid on the prioritized lists where several weighting scenarios are displayed side-by-side for easy comparison and contrast. The far left column displays a color code based on the anticipated funding year versus the critical need year. Green indicates on-time funding. Yellow is early funding. Red is late funding. The far right shows the rational for changes made between the tool recommendations and the prioritizations resulting from the team meetings.

Figure 3 shows the fiscal year banding overlaid on the prioritized lists, but in place of the weighting scenarios, the display shows the overall utility score for each investment request and a horizontal stack bar chart showing how each of the criteria scores contributed to each of the utility scores. This representation is only for one weighting scenario, but is critical for knowing if two adjacent items in the priority list scored the same, such as Projects 4 and 5 below, or if there is a big difference between adjacent items such as between Projects 2 and 3. For this reason, this data is very useful to have available when reviewing the prioritized list and making manual adjustments.

After review and adjustment by the POCs and middle management, these prioritized lists were then sanctioned by senior management, recorded in a configuration controlled document and submitted to the customer for their approval.

Flag	$$ Yr	Crit Yr	Org	Project	Cost($K)	Escl($K)	Cum($K)	Final	Scen1	Scen2	Scen3	Scen4	Scen5	Notes
0	2010	2010	A	Project A	141	141	141		1	1	1	1	7	
0	2010	2010	B	Project B	472	472	613		2	6	6	5	4	Moved up because of risk
0	2010	2010	A	Project C	410	410	1,024		3	9	9	9	3	Moved up because of risk. Parts only avail thru salvage.
-2	2011	2009	C	Project D	807	819	819		4	5	4	4	2	Needed for Accredidation
-1	2011	2010	D	Project E	341	346	1,165		5	2	2	2	9	Moved down, less supportive of hard science
-2	2011	2009	C	Project F	723	734	1,898		6	4	3	3	1	Can follow TLD & still meet process accred'n needs
0	2011	2011	C	Project G	79	80	1,978		7	7	8	7	24	
2	2011	2013	ALL	Project H	200	203	2,181		8	12	10	14	11	H & I switched in order
-1	2012	2011	D	Project I	523	539	539		9	3	5	6	25	Moved down, less supportive of hard science. Related to D
1	2012	2013	ALL	Project J	911	938	1,477		10	8	7	8	8	F & J switched in order
1	2012	2013	C	Project K	0	0	1,477		11	10	11	10	5	DELETED - Lease instead of buy
1	2012	2013	C	Project L	356	367	1,844		12	11	12	12	22	Moved down because of lower risk
1	2012	2013	A	Project M	129	133	1,977		13	13	13	11	16	
-2	2013	2011	A	Project N	588	615	615		14	14	17	13	6	
-1	2013	2012	E	Project O	89	93	708		15	15	16	18	13	
0	2013	2013	F	Project P	242	253	961		16	16	14	16	15	
0	2013	2013	G	Project Q	67	70	1,031		17	17	15	17	17	
0	2013	2013	H	Project R	767	802	1,833		18	18	18	15	10	
1	2013	2014	I	Project S	73	76	1,909		19	19	19	19	18	
1	2013	2014	I	Project T	190	199	2,107		20	20	20	20	20	
1	2013	2014	A	Project U	205	214	2,322		21	21	21	21	21	
-1	2014	2013	ALL	Project V	1,513	1,606	1,606		22	22	22	22	12	
1	2014	2015	A	Project W	180	191	1,797		23	23	23	23	19	
-1	2014	2013	C	Project X	81	86	1,884		24	24	24	25	26	
-4	2014	2010	C	Project Y	151	160	2,044		25	25	25	24	14	
-2	2015	2013	C	Project Z	310	334	334		26	26	26	26	23	
-6	2015	2009	G, I	Project AA	889	958	1,292		27	27	27	27	27	

Figure 2. Comparison of weighting scenarios for each investment request

	Projects	Utility	Cost($K)	Escl($K)	Util/$	Cum$	Weighted Scores
1	Project 1	0.571	$141	$141	0.13	$141	
2	Project 2	0.56	$341	$341	0.05	$482	
3	Project 3	0.467	$523	$523	0.03	$1,005	
4	Project 4	0.423	$723	$723	0.02	$1,728	
5	Project 5	0.423	$807	$819	0.02	$819	
6	Project 6	0.414	$472	$479	0.03	$1,298	
7	Project 7	0.395	$79	$80	0.16	$1,378	
8	Project 8	0.395	$911	$938	0.01	$938	
9	Project 9	0.327	$230	$237	0.05	$1,175	
10	Project 10	0.31	$410	$423	0.02	$1,598	
11	Project 11	0.306	$1	$1	10.00	$1,599	
12	Project 12	0.291	$356	$367	0.03	$1,966	
13	Project 13	0.286	$200	$206	0.05	$2,172	
14	Project 14	0.28	$129	$133	0.07	$2,305	
15	Project 15	0.262	$588	$615	0.01	$615	
16	Project 16	0.242	$89	$93	0.09	$708	
17	Project 17	0.222	$242	$253	0.03	$961	
18	Project 18	0.222	$67	$70	0.11	$1,031	
19	Project 19	0.221	$767	$802	0.01	$1,833	
20	Project 20	0.172	$73	$76	0.08	$1,909	
21	Project 21	0.164	$190	$199	0.03	$2,107	
22	Project 22	0.164	$205	$218	0.03	$218	
23	Project 23	0.162	$1,513	$1,606	0.00	$1,824	
24	Project 24	0.135	$180	$191	0.02	$2,015	
25	Project 25	0.091	$81	$86	0.04	$2,101	
26	Project 26	0.086	$151	$160	0.02	$2,262	
27	Project 27	0.063	$310	$334	0.01	$334	
28	Project 28	0	$889	$958	0.00	$1,292	

- 1-1: Applicability to advancing the nuclear energy mission
- 3-1: Applicability to advancing the national security missions
- 4-1: Applicability to advancing the clean energy RD&D missions
- 7-1: Growth in improving our strategic partnerships and leveraging our technologies into the market
- 8-1: Employee Working Conditions and Services
- 9-1: Return on investment - Equipment
- 10-1: Growth in improving effective communications with the public and INL employees
- 11-1: Program / Project Critical Facility Operational Impact
- 11-2: Safety Impacts
- 11-3: Compliance Impacts
- 11-4: Security Impacts
- 11-5: Environmental Impacts
- 11-6: Annual Business Impact

Figure 3. Comparison of utility scores for each investment request

Cost Estimates and Critical Dates

Reliable cost estimates are independent of this process until fiscal year bands are added. Critical dates are more closely tied and some estimate of the need date is required to accurately score any time based criteria, such as, “what happens if this investment is not made in the year planned?” In a highly technical organization such as a National Laboratory, many of the technical people who are best at explaining how an investment are severely challenged when confronted with defensible cost and schedule estimates. When needed, engage in laying out a Systems Engineering Management Plan that helps the technical experts define their needs along with their cost, schedules, and risk management strategies. Know when to get help from Project Management and Finance personnel. At INL, SED, Project Management, and Finance have worked together to establish a minimum fidelity required for investment requests, but to avoid unnecessary expenditures estimating and re-estimating investment requests, we only hold near term requests to the estimating requirements.

References

U.S. Department of Energy. 2007. *Accounting Handbook*. DOE Office of Financial Policy. 27 April. <http://www.mbe.doe.gov/crorg/cf50.htm>

———. 2004. *Cost Estimating Guide for Program and Project Management*. DOE G 430.1-1x. DOE Office of Management, Budget, and Evaluation. April.

Idaho National Laboratory. 2008. *Strategic Plan FY 2009-2018*. INL/EXT-08-13048. Idaho Falls, ID: Idaho National Laboratory.

———. 2009. Document Change Configuration Management. INL Laboratory-wide Procedure (LWP)-1201. Revision 7. 12 June.

Disclaimer

Biography

Chris Dieckmann has been a Senior Systems Engineer at the Idaho National Laboratory since the Fall of 2007. Before joining the INL, Chris was a Quality Manager, Systems Engineer, Flight Test Management Engineer, Product Engineer, and Product Assurance Engineer for Honeywell, Analex, the US Army and the US Air Force. He has supported a wide variety of projects including energy systems, ground vehicles, air vehicles and related equipment. His career has taken to several cities and a bunch of remote locations across the country, but he grew up in Chicago and now calls Idaho Falls home.