



*Institutional Strain and Precarious Values
in Meeting Future Nuclear Challenges*

Los Alamos
NATIONAL LABORATORY

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*Todd R. La Porte**

Preface by

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PREFACE

The Nuclear Materials Technology (NMT) Division initiated a unique experiment last year; we invited a social scientist—Todd La Porte—to use NMT programs and operations as an experiment. La Porte worked at the division’s TA-55 plutonium facility off and on for approximately one year, spending the majority of his time observing our preparedness to meet future challenges in stockpile stewardship and nuclear materials management missions.

Determining how best to address future requirements necessitates objectivity, and this can only come from an independent source. La Porte’s breadth of experience with “high-reliability organizations” gives him a unique background to comment on our upcoming mission changes in the demanding world of nuclear operations. However, the institution asking for assistance must reciprocate by granting such individuals with the openness and academic freedom to conduct the experiment. The following report, **Institutional Strain and Precarious Values in Meeting Future Nuclear Challenges**, summarizes La Porte’s independent observations during his sojourn at TA-55.

Throwing a social scientist into the rigorous world of actinide science, nuclear weapons, and nuclear facilities operations provided me with some valuable insight for setting directions for NMT’s future. In the rush to meet today’s challenges, it is easy to forget that we are establishing the future directions of nuclear materials technologies for generations to come. Planning for the long-term future is an awesome obligation to which NMT and the Laboratory have paid insufficient attention, and the La Porte experiment forced me to stop and think about future directions and the importance of developing and sustaining public trust.

La Porte introduced the concept of “institutional constancy,” as “the faithful adherence to an organization’s mission and its operational imperatives in the face of institutional changes.” As I understand it, institutional constancy provides the elements of a sustaining foundation to enable scientists and engineers to manage nuclear materials regardless of political, social, and institutional changes affecting that mission. The basis for that mission is simple: the high-energy content, long half-life, and radioactive properties of plutonium simply cannot be ignored; the limited-term applications and goals may change, but the mission to manage plutonium will outlive us all. The assurance of institutional constancy is made all the more difficult by the vagaries of the political, social, and institutional world that constantly challenge the basis of our need for an unchanging foundation.

Having read this report, I began to think about what the NMT of the future should look like. As you read through this report, consider the points below.

In terms of NMT Division, I believe that our constancy-ensuring capabilities and activities include the following five key elements; the future vision is described under each element.

- 1. Skilled people:** A new generation of scientists and engineers is running NMT Division. The knowledge of the previous generations is passed on through formal mentoring programs. Universities are graduating actinide scientists, nuclear facility engineers, and trained nuclear material handlers. The NMT work force is highly qualified, skilled, compensated, and diverse.
- 2. Excellence in actinide science:** The Seaborg Institute is an internationally recognized center for excellence in actinide science. Numerous publications from NMT Division clearly demonstrate our profound knowledge in the fundamental properties and behavior of actinide metals, solutions, compounds, and ceramics. Plutonium manufacturing practices are based on fundamental metallurgy principles, advances in actinide molecular science

have defined new separation and waste minimization technologies, alloy theory has defined the aging mechanisms of plutonium, and performance of mixed-oxide fuels is predictable from first principles.

3. **Safe and compliant operations:** The Nuclear Regulatory Commission has licensed TA-55, the Nuclear Materials Storage Facility is operational, construction of a new nuclear chemistry and materials building is nearing completion, external auditors accept NMT's self-assessments to find and correct operational deficiencies, and NMT's safety record exceeds the best in class. Waste minimization has become an integral part of all ongoing and potential activities in the plutonium facility and radioactive effluents have dropped to near zero.
4. **Solid record of delivery:** All project commitments are met on-schedule and in-budget. Today's projects in surveillance, manufacturing, dismantlement, disposition, residue stabilization and nuclear materials storage programs are at steady state. New programs have started in fuels for space and terrestrial nuclear energy, accelerator transmutation of wastes, stabilization and storage of residues at facilities in the Former Soviet Union, decontamination and environmental restoration of weapons complex sites, modeling of actinide materials in storage sites, and advanced reprocessing of spent fuels.
5. **Stakeholder involvement:** Local stakeholders—and by this I mean the public, particularly the Northern New Mexico public—are involved in helping define NMT practices and missions. A process for developing mutual understanding of diverse opinions is established. Communications are frequent and positive, and the consensus opinion of both local and national stakeholders is supportive of NMT's management of nuclear materials.

The next question is: Are we preparing for that future vision? We in NMT Division are striving vigorously to become fit for the future. We have initiatives in most areas, but success requires continued diligence and additional and sustained effort. If the current initiatives continue and are successful and if we continue to introduce new activities and initiatives in these areas, the future vision for skilled people, excellence in actinide science, safer and compliant operations, and solid record of delivery will be achieved. My greatest concern lies in the challenge of gaining public trust and confidence through formal activities in stakeholder involvement. Los Alamos National Laboratory must understand the broader and future issues—those beyond the technical challenges—as new missions in pit manufacturing, environmental cleanup, and nuclear materials disposition evolve.

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Institutional Strain and Precarious Values in Meeting Future Nuclear Challenges

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Abstract. This paper explores the implications of moderately expanding plutonium “pit” production capability within the strongly R&D culture of Los Alamos National Laboratory, especially in terms of the lab’s current capacity or “fitness for the future” in which institutional stewardship of the nation’s nuclear deterrent capability becomes a primary objective. The institutional properties needed to assure “future fitness” includes the organizational requisites highly reliable operations and sustained institutional constancy in a manner that evokes deep public trust and confidence. Estimates are made of the degree to which the key Division and most relevant Program office in this evolution already exhibits them.

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Institutional Strain and Precarious Values in Meeting Future Nuclear Challenges¹

Todd R. La Porte

The continuing evolution of the U.S. nuclear enterprise poses some of the most demanding and troubling challenges faced by today's public and private institutions. These include the viable operations of nuclear power generation in a manner that evokes public trust and confidence, continuing "battlefield cleanup," i.e., cleaning up the toxic residues that accumulated during the Cold War, managing the growing store of radioactive wastes, and meeting the requirements for confidently managing excess weapons plutonium and maintaining a "de minimus" nuclear deterrent capability for the foreseeable future. Each of these domains pose remarkable operating and public demands on technical and regulatory institutions, many press for changes that stretch our analytical capacities to the fullest. The first three of this set have drawn considerable comment in the recent past. The challenges of managing the nation's store of Post-Cold War plutonium — the focus of this paper — are only beginning to be recognized.

Los Alamos National Laboratory (LANL) has accepted an expanded role in this domain. This will involve a central part both in preparing excess plutonium for international inspection and subsequent use or disposal, and in assuring that the US will maintain an effective, credible, if significantly scaled down, nuclear deterrent capability. The lab has committed itself to carry on, not only the tradition of highest quality research and development, but to add the skills and operational capacities required to produce - re-manufacture - the components necessary for the reliable detonation of the remain weapons in the nuclear stockpile. While the technical issues associated with these missions are demanding enough, the institutional challenges assume extraordinary proportions; they involve institutional patterns and processes for which there are now only the slimmest of analytical bases for designing wisely and whose operational failures could result in potentially serious environmental, social and political harm.

The overall requirement of the expanded mission would be to develop and assure a continued capacity to disassemble excess plutonium "pits," and, in separate activities, to re-manufacture up to 50 plutonium "pit" assemblies per year. This number was derived in part on the basis of estimates of the necessary re-furbishing rate, given recent arm limitation agreements, and the operational requirements of assuring an institutional capacity to continue high quality research and development.

¹From Todd R. La Porte, *Evolving High Reliability Organizations and Institutional Strain in Elements of the U.S. Nuclear Future*, Final report LA-UR 97-3227, UCB Contract LANL-C14550017-3Y-LAPORT-06/97, A Campus-Laboratory Cooperation (CLC) Experiment, Center for Nuclear and Toxic Waste Management and Department of Political Science University of California, Berkeley, California, July 31, 1997. This project included an intensive "field experiment" bringing an institutionally oriented, social scientist together with several technical communities at LANL, winter/spring, 1997. It was supported by LANL's Nuclear Materials Technology (NMT) Division, Nuclear Materials and Stockpile Management (NMSM) Program augmented by funds from Government Affairs, and the LANL CLC program with administrative support from the Technology Safety and Assessment Division, and the Department of Nuclear Engineering, UCB. My thanks to the many LANL staff who became my teachers. They were, without exception, skilled, gracious and generous with their time and insight. My thanks also to K.C. Kim, Bruce Matthews, Warren Miller, and Heidi Hahn for careful reading and commentary on earlier drafts.

The most significant aspect of these challenges arise, especially, from the indeterminate but very likely long term need to continue demonstrating such capacities. Accordingly, our frame of reference here is more oriented toward matters of the *fitness for the future* than examining the Lab's accomplishments of the past. These have been quite considerable. They give some basis for confidence that future challenges may evoke similar accomplishments. What gives pause is the fact that they would have to be as much institutional as technical in domains the laboratory, its contractor and sponsors have in the past needed only a modest innovative capacity.

In taking on this expanded role, LANL has joined with the Department of Energy (DOE) in using the metaphor of stewardship to orient its relationships to these responsibilities and to public service. The language of "stockpile stewardship" and "environmental stewardship" is sprinkled through a variety of LANL and DOE documents and media releases. In the context of managing nuclear materials, generally, or weapons grade plutonium and radioactive waste, specifically, the reach of stewardship is extraordinary for it suggests a range of public expectations that, while perhaps quite apt, opens the laboratory, the University of California, Office of the President (UC-OP) its prime overseer, and the DOE to subsequent evaluations of promised institutional behaviors which are *very* demanding, but about which we have only a limited analytical basis for confident execution.²

I take at face value the resolve of the weapons labs and DOE seriously to assume a nuclear stewardship role in the U.S.³ In consequence, this discussion reflects my understanding of what this role's successful exercise would entail. I begin by explicating a broad perspective to the challenge, then outline a number of important changes in LANL's external and internal environments and the "second order" tensions they occasion which bear on the "steward's" role. With these as a way of framing the questions, I outline the institutional properties needed to assure "future fitness," that is, the array of institutional requisites we can say, with some confidence, are expressions of **high reliability organizations** (HROs), sustaining **institutional constancy** in a manner that evokes deep **public trust and confidence**...all characteristics of effective institutional stewardship. Finally, I turn to estimates of the degree to which the Nuclear Materials Technology Division (NMT) with its management of plutonium handling facilities (dubbed TA-55)⁴ along with the Nuclear Materials and Stockpile

²For an exploratory discussion of these implications see, T. R. La Porte, "Institutional Elements for Long Term Stewardship in a Nuclear Age: Views from a "Stewardee," Proceeding of Workshop on Land Use and DOE Sites: The Implications for Long Term Stewardship, sponsored by the Resources for the Future and Environmental Management, DOE, Washington, D.C. Jan. 16-17, 1997. In general terms, **stewardship** involves a relationship between two or more parties such that one, the steward, "is entrusted (by another) with the management of property, finances or other affairs not his/her own", (that is, in the interest of someone or a corporate entity that is not capable of carrying on independently, as someone yet unborn, *my addition*.) Funk and Wagnell, 661.

³A measure of LANL's resolve is found in LANL's Strategic Overview, 1996-2015, in which Science-based Stockpile Stewardship and Management is one of 10 central tactical goals. Recently, this emphasis has been reinforced by DOE's Assistant Secretary for Defense Programs, Vic Reis, who pointed out that LANL "is the 'mother' of stockpile stewardship" at a December, 1997, Director's Colloquium.

⁴This is the local short hand for Technical Area 55, a highly secure complex of facilities designed and operated to safeguard the weapons grade plutonium stored and handled on-site and assure the safety of its technical and administrative staff in the process. One of its primary resources, Plutonium Facility 4 (PF-4), designed as a research and development facility to reduce the risk to workers of plutonium and to assure its utterly safe keeping, is now the only place in the U.S. which can be used to handle and fabricate plutonium components at any scale.

Management (NMSM) program office, *already* exhibits them.⁵ To the degree these are not now present, it suggests the direction and scale of the institutional challenges today's managers and tomorrow's stewards face.

I. A Perspective Toward Managing Nuclear Materials

Considering the institutional aspects of managing nuclear materials is invariably influenced by assumptions that shape one's questions, analysis and evaluations. The following four assumptions shape mine, they parallel a view shared, I think, by many of those with whom I have talked.

- * Nuclear materials are potentially beneficial but also poses significant political, economic and environmental risk except under the most rigorous of organizational conditions.
- * These benefits, hazards and organizational imperatives are likely to be associated with these materials, due to their long-lived nature, for an indefinite future stretching perhaps hundreds of years into the future.
- * Due to the unique historical role the U.S. has played in the development and use of nuclear materials, both for national security and commercial purposes, the U.S. shall, as a matter of policy, continue to accept the burden of global leadership in managing nuclear weapons materials for the foreseeable future.⁶
- * These obligations lead to considering both the technical, and especially the organizational and institutional, requisites for managing these materials in a highly reliable manner, for many work, management and political generations, and doing so in a political context that demands a high degree of public trust and confidence.

⁵The descriptions and judgments outlined below derive from efforts to understand those units and programs within LANL appropriate to the execution of this expanded mission. The reader may be aware that the NMSM/NMT portions of the lab represent only about 10 to 15 per cent of the whole. In that sense, these units do not represent a typical sweep of the lab's remarkably heterogeneous divisions or programs. What draws one's attention to them is that this activity of limited scale may in the future set in train unusual and unsettling dynamics in LANL's evolution. In course of this work, over 110 people were interviewed, many several times, in positions scattered throughout the DOE-[UC-OP]-LANL-NMSM-NMT matrix from glove box operators, radiation control technicians (RATS) and operations center personnel, middle and upper level lab managers and staff people, to university officials and several DOE officials. I have also become a somewhat qualified "Radiation Worker (II)", observed work operations in the plutonium facility and labs, and attended various types of lab and public meetings, and talked with so-called "concerned citizens" and participated in several "public sentiment" sensing activities. In consequence, my descriptions and attributions of effects and characteristics derive from a variegated but truncated sample and refer only to those units and lab relationships that pertain to them. These descriptions may not be so faithful a description of other areas within LANL; if they are, then many of dynamics I explore are likely to be exhibited there as well. *The reader should also be aware that several changes in program structure have occurred since the data collection phase of this work, this included a distribution of the programs administered by NMSM between the newly established Associate Directorships of Nuclear Weapons Programs and of Threat Reduction.*

⁶ Due, in part, to the intrinsic connection between the nuclear production of energy and an increase in the world's store of plutonium, there is a vigorous debate about the degree to which the U.S. should also strive to maintain a technological and industrial "position" such that it would remain a player in commercial power reactor developments and the management of nuclear wastes in the discharge of its stewardship role.

In a sense, these qualities are the essence of institutional stewardship — a matter I will return to in closing.⁷ They are also very demanding organizational properties to achieve and sustain. If one accepts this perspective, it means, to repeat, attending to the design and operating requisites of high reliability organizations, of assuring institutional constancy for multiple generations,⁸ and of sustaining the properties in the relevant institutions that re-enforce the public's trust and confidence in them. But however earnestly these properties may be sought, there is only a meager analytical basis for assuring their development, especially in the types of organizations and institutions likely to be necessary for managing the society's growing store of nuclear materials.

Another way of framing these challenges is to demand that the U.S. agencies, programs, contractors and labs involved with the various aspects of managing nuclear materials should aspire to:

- * Take up their obligations in the spirit of sustained institutional stewardship;
- * Being the best of their kind in the world, demonstrating, by example, to citizens and to other nuclear powers the properties of highest quality operations and management;
- * Especially in the absence of nuclear weapons field testing, to equip technical and operational professionals to demonstrate, through their interactions with the professionals and opinion leaders of the US and other countries, that the US retains both technical and operational capacities to manage nuclear materials rigorously and to maintain an effective nuclear weapons deterrent capacity for the indefinite future.
- * Achieving those conditions that will assure the infrastructure and organizational qualities that encourage the evolution of honorable and honored institutional stewardship — a necessary condition in a democratic society for institutional continuity across many generations.

A cautionary note on institutional development. The institutions involved in the society's management and oversight of nuclear materials are in the midst of a major transformation. This is certainly the case for the nuclear weapons complex. Such transformations occasion the disaggregation, disordering and re-crystallization of the institutions directly involved (and often others that are on the periphery.) Experience and research has shown that the forms which emerge are likely to persist for many years, resisting changes that may in subsequent times become clearly needed at least as perceived by outsiders. One implication in terms of a long term, multi-generational challenge is that decisions taken

⁷ See especially T. R. La Porte. "Institutional Elements for Long Term Stewardship in a Nuclear Age: Views from a "Stewardee", paper presented to the Workshop on Land Use and DOE Sites: The Implications for Long Term Stewardship, sponsored by the Resources for the Future and Environmental Management, DOE, Washington, D.C. Jan. 16-17, 1997.

⁸ "Institutional constancy", a concept recently introduced into organizational studies, refers to "the faithful adherence to a mission and its operational imperatives in the face of a variety of social and institutional environmental changes". It is not intended to signal rigidify or static inertia, rather commitment to a mission and, if necessary, adaptation to technology and structure in order to accomplish it in the spirit of the institutional original commitment; in the case of public organizations, commitment to the public interest. See T.R. La Porte, and A. Keller. "Assuring Institutional Constancy: Requisite for Managing Long-Lived Hazard," Public Administration Review , 56, 6 (November/December, 1996), 535-544.

in the next five years could set in train developments that would unintendedly, greatly increase the difficulties for the third, fourth and successive generations to manage the legacy and security obligations we have assigned to them — at the level of effectiveness we are now demonstrating. This, of course, might not be the case. But we have no credible basis for confidently selecting out those organizational solutions that are apparently suitable on the basis of short term managerial, economic or political considerations, but would be potentially erosive for future generations. In effect, we could *start out wrong* in all good-hearted earnestness, not to mention others who might be motivated to use this challenge for other less sanguine purposes.

But while firm resolve and alertness to the need for considering the longer term consequences of short term institutional and technical problem solving may be necessary for meeting the challenges of nuclear stewardship, effecting these conditions also depends on the patterns of institutional relationships that exist now. A clearer view of these suggest the hurdles ahead and the effort potentially needed to assure sufficient conditions for success.

Before estimating the current match of the conditions within LANL and NMT/NMSM to those associated with *future* challenges of high reliability, institutional constancy and public trust and confidence, I review the *current* patterns of internal and external relationships that could effect achieve them. They are offered as an “in progress reality check” not as firmly documented conclusions.

.....
.....

II. Changes in LANL’s external and internal patterns: Challenges to its evolution as a prime national analytical resource.

LANL (and its UC overseer) are operating in an environment that is in the midst of remarkable and unsettling change. I indicate a number of changes in Table 1, along with what might be termed their “first order” implications, especially these that pose challenges to organizational leaders. There are some nineteen (19), to which others might be added. A number are, in a sense, imposed on the lab from pressures external to it. Other internally evoked changes often are introduced to provide certain benefits, though they also incur costs in terms of the additional management demands they occasion. These changes appear to be happening to LANL more or less simultaneously, though, of course, their force and intensity varies across the various program offices and divisions in the lab. I list them here with no discussion, though we should all welcome disconfirming evidence.

For organizations and institutions that confront, say only three and four of these changes, there is little basis for comment — most organizations must deal with such things from time to time. However, as the list of simultaneous changes grows, each prompting subsequent changes, the overall effect can be quite formidable. To the degree these changes and their associated implications actually characterize the present situation for LANL and UC, without direct attention, the evolution of the Lab and its relationships to UC could become increasingly problematic. Yet there is only a slim analytical basis upon which to consul response. A number of LANL units confront many of the nineteen (19) and are likely to be increasingly puzzled, indeed, confounded, perhaps, beleaguered by the situations they face.

The set of “first order” implications usually follow from the ensemble of changes noted in Table 1. These range across the whole spectrum of lab relationships from those with Congress and DOE, to interactions with regional and local officials, reaching all the way to the most crucial working groups.

As these are experienced, they result in a series of “second order” tensions that color much of the every-day operations and certainly the relations between the lab, DOE and, increasingly, the University

Table 1. Factors and Changes Re: LANL and its “Fitness for the Future”.**

.....

External factors.

Implications (First Order)

National:

- | | |
|---|---|
| <ul style="list-style-type: none"> * Increased policy ambiguity vis-a-vis scale, extent of nuclear weapons. * Reduced funding for defense missions. * Increased Congressional and Agency scrutiny. * Opening to civilian environmental/safety regulations, politics. * Test ban regime w/science based stockpile stewardship. * Increasingly bearing brunt of DOE radioactive waste management history. | <ul style="list-style-type: none"> # Declining policy resolve to provide funds, coherent policy direction. # Increased concentration of weapons function and professional, managerial anxiety. # Increased pressure to demonstrate efficient “performance.” # More stringent environmental, safety, health standards and public visibility. # Increased basic research in material sciences and advanced computation/simulation. # Increasing “watcher” suspicion of local lab and UC management. |
|---|---|

Regional/local:

- | | |
|--|---|
| <ul style="list-style-type: none"> * Increasing skepticism from regional political figures (Santa Fe, ABQ, and WIPP) * Increasing local hostility re:economic,diversity. | <ul style="list-style-type: none"> # Reduced harmony in relations with formal, informal elites, media, legislature, etc. # Increased media criticism, local resentment. |
|--|---|

Internal factors.

Managerial:

- | | |
|---|---|
| <ul style="list-style-type: none"> * Elimination of formal upper middle management. (<i>Reinstated 6/98</i>) * Substantial acceptance of UC early retirement. * Ten percent reduction in force (mainly staff). * Continued tension between program offices and divisions. | <ul style="list-style-type: none"> # Decline in formal integrative processes, leadership capacity. # Decline in institutional memory, elan. # Decline in support activity skill availability. # Increased energy needed for coordination internally and with DOE offices. |
|---|---|

Technical:

- | | |
|---|--|
| <ul style="list-style-type: none"> * Increasing salience of material sciences (vs physics). * Increasing diversity of non-defense technical work. * Entering period of sustained infra-structure up-grade. * Approaching requirement of moderate scale Pu “pit re-build”. | <ul style="list-style-type: none"> # Increased pressure on past, stable status relations among technical professions. # Decline in technical/substantive problem as an integrating factor. # Relative decline in resources for technical project operations. # Increase in “specialty production” processes as defining characteristic (vs R&D). |
|---|--|

Operational:

- | | |
|---|---|
| <ul style="list-style-type: none"> * Relative decline in work force competence. * Increasing emphasis on integrated safety analysis and efforts. * Increasing requirement in Pu handling for | <ul style="list-style-type: none"> # Erosion of confident work/supervisory relations. # Increase in formal procedures, attention to “safety culture”. # Relative increase in attention to highly |
|---|---|

sustained, multi-generational operations.

reliable operations now and in future.

** I remind readers who depend on skimming tabular information that these observations are tentative, not firm conclusions.

of California. The pattern of such tensions I have observed, (see Table 2) are discussed briefly below. While they are not as easily compartmentalized as it appears in the list, they are arranged with those tensions associated, first, with external lab relations, followed by those that bedevil internal dynamics, ending with two that are related importantly to the farther future as well.

Second Order Tensions.

A general point: as LANL confronts a decline in resources and policy coherence, unexpected and novel second order tensions emerge among the formerly harmonious relations between technical operators (acting as contracting agents, i.e., LANL), contractors (UC) and sponsors (DOE, DOD). A suite of such tensions includes at LANL:

Table 2. Second Order Tensions

1. Distribution of sensitive operations.
2. Scale of hazardous materials on-site.
3. Continued effects of high security requirements.
4. Production/regulatory interactions.
5. Balancing pressures on Program Offices with demands on line Divisions.
6. Balance between infrastructure and production costs/benefits.
7. Balance between highest quality research and development and “speciality production”.
8. Becoming “Fit for the Future”
9. Contractor (UC-OP) — operator (LANL) relationships.

-
1. Distribution of sensitive operations. (Both as hazards and national security risks)

The national nuclear weapons complex is undergoing very substantial down scaling. Plans for gradually concentrating important elements of nuclear weapons component fabrication on-site at LANL among the several facilities included in the Capability Maintenance & Improvement Project (CMIP) — TA-55 including the Nuclear Materials Storage Facility, TA-50, TA-54, the CMR and Sigma facilities, the Shops and possibly TA-8. This raises explicitly for LANL (and UC) the national challenges, obligations and severe costs associated with meeting the requisites for very high levels of operational reliability, safety and stewardship. In so doing, both the responsibilities and the national visibility of these activities will be concentrated at LANL. It is also likely to prompt increasing anxiety for attentive publics in northern New Mexico and beyond. Unanticipated, this is very likely to add considerably to the burden of lab and program managers, e.g., in NMSM, and division leaders in NMT and other units involved.

2. Scale of Hazardous Materials On-site.

The volume of hazardous materials on-site is likely to increase substantially as Pu related work goes into

a specialty production mode. One consequence, especially in a new era of civil openness and possible Nuclear Regulatory Commission (NRC) assumption of regulatory functions, is that the pressure on Pu accountability, environmental and safety processes are likely to increase as function of steadily increasing handling requirements. Unless this is well analyzed (quantitatively) and supported with sufficient FTE in advance of the scale up, significant operational troubles can result, morale problems develop, and public confidence threatened.

This calls for anticipating the challenge by ferreting out quantitative bases for estimating these demands as a function of increasing volume of materials, and the subsequent increase in regulatory watchfulness that would add to the workload pressures and increasing professional/citizen dissatisfaction. Short falls in these areas, when discovered by outsiders (regulators, professional communities, media, interested members of the public) could undercut management efforts to demonstrate the qualities of trustworthiness and constancy as stewards of the nation's nuclear materials.

3. Continued effects of high security requirements.

The nuclear weapons mission intrinsically involves activities, materials and technical information that are likely to be highly classified in the interest of national security. In so far as these activities increase on-site hazards (due either to the absolute magnitude of hazardous materials or by widening the scope and number of highly hazardous activities), the tacit (publically unacknowledgeable) pressures on management and operations grow. These are likely to stimulate institutional actions which are incomprehensible (and inexplicable) to "outsiders" and subject to perverse interpretations by media and suspicious public leaders. Again, this is likely to prompt increasing anxiety in attentive publics in northern New Mexico and beyond. Developing a strategy that afford the lab and UC the means to develop a surplus of institutional trust — the basis for public forbearance — will undoubtedly add to the burden of lab and NMSM/NMT management, and suggests a range of institutional skills and capacities that are not now much in evidence at LANL, in the UC-OP, or in DOE.

4. Production/regulatory interactions.

The continued pressures from DOE to maintain highly functional cooperation and partnership conflict with increased demand to attend to DOE mandated safety and regulatory constraints. At the same time, there appears to be an increasing scope, range of regulations and oversight activities/requirements due, in part, to opening the lab's work to "civilian" regulation, e.g., EPA/OSHA, interested public officials, etc., as well as DOE/DOD activities such as EM activities and the Defense Nuclear Facilities Review Board. These legitimate activities are taking greater proportions of the time of working level technical staff as well as middle level technical managers. This is seen as eroding both their effectiveness and their morale. If this impression (held by a wide variety of LANL staff) is accurate, it is one of the most serious impediments to future fitness, that is, the attractiveness of LANL/NMT as a locus of professional work, and would contribute to a decline in the perception that weapons related work as both a professionally rewarding and a honorable career.

From the lab's point of view, this calls, first, for an immediate systematic review and development of proposals for safety paper work assistance, and for ways of freeing staff time for core technical work. At the same time, much better more accurate data should be developed regarding the proportion of work distraction and overload originating in regulatory procedures and, as importantly, from the uncoordinated and, perhaps unyielding, presence of regulators from different federal and state agencies.

This would join the array of data that should be used in more vigorous “push back” from LANL and the UC President’s Office, and be complemented within LANL and UC-OP by efforts to fully understand the pressures and perspectives of sponsors and regulators. (See discussion of Lab-[UC-OP] relations, p.11.)

5. Balancing/equalizing the pressures on Program Offices and Line Divisions.

LANL employs a Program-Line (Division) matrix as a key mechanism for relating client/sponsor objectives to technical work. Such matrices, while generally appropriate for highly technical work related to large scale technical systems, are intrinsically conflictual, especially in times of budget decline, and require increased senior management attention to avoid dysfunctional tensions. This is particularly the case when DOE and DOD program offices find themselves under strong pressure to change substantive directions and/or scale back the level of resources. This often necessitates significant changes in technical and professional areas of expertise in order to effect economizing measures in technical domains with high degrees of intrinsic uncertainty. These changes may come in the face of budgetary turbulence and abrupt reductions. LANL program offices are confronting all these factors and are pressed to commit technical divisions to work and time schedules — in the interest of keeping capabilities in tact — that can tend to over commit division capabilities. This general problem has been recognized at LANL. Indeed, the Program-Line Committee, a sub-group of the Technical Working Group, one of the several main coordinating bodies for the Laboratory Leadership Council (LLC), has attempted an initial effort to address it explicitly via activities designed to improve communications and consultation among the various program and division players as the annual planning and budgetary processes go on apace. *(These dynamics may change due to the reorganization of NMSM program activities under the Associate Directorships of Nuclear Weapons and of Threat Reduction (3/98).*

These are certainly important interactions, but they do not attend to the external pressures that are often the source of internal tensions in the first place. Resolution at the Division-Program levels can only go so far without strenuous attention from other superordinate actors. This is likely to require a combination of individual efforts among the program and division leaders as they negotiate with DOE DP, EM, NE, etc., and, as importantly, increased efforts from the Lab Director and UC-OP in developing a realistic set of “rules of engagement” within the lab and in relationships between the lab(s) and DOE. I have seen little laboratory leadership in this regard, nor much attention to these problems from the UC-OP or the Albuquerque DOE regional office. (See discussion of Lab-UC-OP relations, p. 11.)

6. Balance between infrastructure and production costs/benefits.

The clash between national weapons policy objectives and Congressional single mindedness in budget cutting is producing within LANL enveloping pressures to balance infrastructure modernization requirements (in face of the modified Pu handling mission), on the one hand, and, on the other, programmatic uses of these facilities for R&D, and for specialized manufacture requirements. The extraordinarily high costs of facilities renovation and up-grade for production purposes, after often twenty to thirty years of scantily maintained use, is absorbing enough of the total budgets that the relative capacity to use these facilities is diminished. Put another way, strong facilities upgrade pressures tend to escape specific infrastructure managing units and increase the budget vulnerability of “adjacent” science and technology producing units. This situation calls for the development of rigorous data explicating the consequence in the potential for eroding the professional and technical capacity to use

the refurbished facilities once they are ready to inhabit. Again, these data and analyzes should be added to the array of “push back” analyzes (see Tension 3 above). Without these kinds of data supporting the intuitions of LANL and UC-OP leaders, DOE officials are in no position to counter aggressive Congressional or Executive pressures, even if they were convinced of LANL’s veracity and accuracy about consequences.

7. Balance between highest quality research and development and “speciality production”, i.e., especially “pit rebuild”.

This tension is by far the item of most pervasive concern within the lab — and to a large degree for the UC contract overseers as well. An integral aspect of LANL’s increased “speciality production” mission, especially those activities involving intrinsically hazardous materials and operations, is the potential introduction of social processes and external interests that conflict with the openness and flexibility associated with effective research and development culture and dynamics. There is grave apprehensiveness about this risk among LANL staff. Indeed, the on-set of planning and the early preparation for engaging in relatively more routine, substantially understood processes of specialty production raises questions among high skilled technical professionals concerning the organization’s seriousness and capability to continue a vibrant research and development capacity as it takes on, as well, a “specialty production” mission of equal technical challenge, hazard and national importance. As production missions take up proportionally more of LANL’s total budgetary and personnel resources, pressures on the present, predominantly “university” style processes and reward criteria are likely. To the degree this situation obtains, motivating younger people in successive generations to join in with the level of desired commitment and intensity may become more and more difficult under present incentives and expressions of mission. (Avoid eating the seed corn, swamping the fields, and losing a sense of mission.)

To avoid this type of techno-cultural conflict, much greater attention should be paid now to careful considering how (indeed whether) professional and managerial rewards (especially for younger people) should be re-aligned, perhaps bifurcated, in terms of the expanded production (applied engineering) emphases. This should be coupled with analysis of the consequences for neglecting this aspect of demanding technical work and hazardous operations; and what the consequences for such a re-alignments would mean for the quality of nuclear stewardship.

8. The Dynamics of “Fitness for the Future”.

One of the most demanding aspects of the nuclear management mission, especially when taking a stewardship orientation to it, is the prospect of attending to this function for many generations. This lays an unusual requirement upon “institutional stewards” for it obliges them much more explicitly to take future generations of operators, professionals, managers and citizens into account far earlier in the deployment process than is currently the case. In effect, the deployment of programs now is likely to have strong impacts on numerous work and political generations. This means that current technical and institutional designers are designing not only for the present generation, but for, say, the fourth or fifth generation as well, an imperative that is quite recent and relatively novel with unusual analytical and staffing problems.

I am struck by the degree to which the present distribution of scarce resources are limiting activities needed to be prepared for future developments in at least three aspects.

** Maintaining and broadening core competencies in a) developing very skilled young people and fostering their work at early stage of career, and b) support facilities for new types of work.

** Assuring facilities adequacy in terms of both the quality and quantity of work spaces and safety features anticipating the activities needed to meet changes in mission (though the CMIP activity may be able to attend to some safety matters.)

** Avoiding foreshortening the capacity to plan for the near term (2-4 years) future, much less the farther future (10-20 years). This is not yet a serious, ongoing problem, but it is likely to result in inattention to assuring the foundation in activities and rewards that avoid difficulties over the next ten years in recruiting, and highly reliable operations as well as in publics' perceptions.

9. Contractor (UC-OP) — Operator (LANL) relationships.

Finally, in a different vein, the formerly distant, “absentee ownership” relationships of the University of California, Office of the President — the primary institutional locus of oversight — to the weapons labs are tending to move somewhat toward more “hands-on” oversight. This a response to pressures from DOE in the interests of improved economy, assuring safety (see # 8 above) and concentration on the expanded production mission. This is in the context of much more direct, uncoordinated involvement of DOE program offices, Defense Programs, Environmental Management, and Environmental Safety and Health, with LANL operations at all levels. Indeed, increased UC-OP presence is expressed formally in the UC evaluation requirements summarized in the so-called “Appendix F” pressed on the university by DOE in the last contact negotiations five years ago. The increased intensity of what some would call DOE’s micro-management, combined with UC’s insistent application of Appendix F with explicitly related management rewards and punishments, both significantly increases the role of the university as “corporate enforcer” and suggests a stronger overall management presence. One result is a growing “push-back” from the operator (LANL) seeking more aggressive contractor (UC-OP) behavior in LANL’s defense in interactions with sponsors (DOE and DOD). This introduces often new negotiating requirements and conditions for the contractor which may be at odds with the institutions primary suite of educational values and academic culture. At the same time, in LANL managers daily consideration of their interactions with DOE program offices and other external entities, the University remains almost completely absent, invisible really, in their perceptions.

This is a chastening array of tensions suffusing the managerial and technical work dynamics of the whole lab. Attending to them is both essential and will pose very substantial management challenges, but they have particular force in the context of the divisions and programs associated with the expanded weapons mission. I narrow my focus a bit to two of the units most involved.

III. Present Patterns and the Elements of Institutional Stewardship: NMSM and NMT at the Edge or “out in front”.

The NMT Division and its Program symbionts are embarking on an extraordinary organizational evolution as they take up the challenges of expanding the lab’s “pit” surveillance and rebuild capacity. This will mean a substantial increase in NMT’s speciality production capability relative to its present R&D capacity. Due to the intrinsically hazardous nature of handling radioactive materials, both these functions demand very reliable, safe performance. At the same time, on the basis of work done in other technical areas, we have come to expect that the work processes and operating cultures of these

functions are quite different and at times the source of sustained internal tension. One familiar solution has been formal organizational separation, not only in authority structure, but with significant geographical separation as well. Another is the emergence of an organizational culture and processes in which the values and interests of one function strongly predominates the other. Neither of solutions are seen as acceptable to LANL management and some of the tensions noted above arise due the objective of retaining the capability of highest quality research and development and, at the same time, becoming the world's leader in stock pile and nuclear materials management.

This is a formidable challenge. A measure of its magnitude is found, in part, in terms of the goals or reach of the enterprise. In this case, the benchmark is set by the frame of reference I outlined above (p. 6) Recall it includes:

- * An emphasis on a self conscious spirit of sustained institutional stewardship;
- * Aiming to be the best of its kind in the world — not only within the lab, or in the U.S.;
- * Equipping technical and operational professionals to demonstrate, via their interactions with professionals communities throughout the world, that the US retains an effective nuclear weapons deterrent capacity for the indefinite future; and
- * Achieving the conditions that encourages the evolution of honored institutional stewardship across many generations.

This way of putting the matter is, at once, unusual for technical organizations and programs, and as demanding a set of goals as ever to be proposed for the units involved. It is also completely apt for their evolving missions.

The challenge is also measured in the degree to which the existing organization *already* meets the most salient properties of institutional nuclear stewardship: **high reliability** in operations, and qualities that assure **institutional constancy**, and deepen **public trust and confidence** for many years to come, that is, already “fit for the future”. I turn to this task below outlining rough estimates for each of these three areas — *set against the goals noted above*.⁹ In a sense, this elevates the demand by shifting attention away from the qualities of past performance to those appropriate in the face of an uncertain, indefinitely long future. The salient properties for that future are unevenly evident within the lab (or any DOE/DOD facility, for that matter), indeed, many of these properties have not been imagined as important in the past nor was there warrant for doing so.

In this regard, estimates (not evaluations) of NMSM's and NMT's standings in relation to these future oriented properties must be understood not only in terms of their present manifestations but in the degree to which they are seen as necessary for the units' past missions. Most of properties were *not* obviously involved in mission accomplishment, nor were they characteristics that sponsors, overseers or regulators sought or for which support, and sometime authorization, was forthcoming. They are only made salient now due to the character of mission expansion. And the estimates — based on extensive

⁹ NOTE: Including “estimates” is not intended as a grading exercise. Grades, so to say, might be appropriate if there were some sorts of changes expected, i.e., something to be achieved with a marker against which to judge them. This is not the case, indeed until very recently, the notion that LANL or one of its prime Divisions ought to be worrying these questions, except for the challenges of high reliability, simply were was not a matter of interest either to DOE or to UC.

interviewing and observation — are subjective and should be taken as hypotheses. I am not yet in a position to document them, but in so far as my impressions are confirmed, our work suggests the need for review, and very likely substantial change. If this turns out to be the case, and changes seems appropriate, consider them in the context of the patterns of conditions (Table 1) and tensions (Table 2) outlined above.

NOTE: In the discussion that follows, organizational properties are treated at a somewhat abstract level. Each one can be expressed by a range of organizational mechanisms, SOP's, and specific measures that satisfy the condition. These are specific to the organization and evolve from its particular requirements and institutional setting.¹⁰ I occasionally refer to specific processes and circumstances within NMT to illustrate a more general point. Much more thorough review of the many means of managing hazardous materials, insuring safety, and reliable operations is appropriate but must await more detailed understanding and warrants a paper in its own right.

High Reliability Operation

One objective of this paper is to gauge the degree to which NMT now exhibits the properties of other High Reliability Organizations (HRO), and to explore the implications of the expanded specialty production mission for maintaining and enhancing highly reliable, safe and productive operations — that can be sustained for a number of generations. Table 3 lists the properties we have observed in a variety of HROs.¹¹ They include a cluster of internal characteristics and, importantly for future development, external relationships as well. I also include a cryptic estimate of the extent to which these seem evident thus far in the NMT context.

In sum, NMT is doing reasonably well with a number of internal relationships— matters for which they have been held directly accountable. Emphasis on external relationships — matters currently assigned to LANL-wide unit's — is limited. Rather than develop an even-handed discussion of the characteristics, I will comment mainly on those that are not particularly evident. It should be clear that to reach the goals of world leadership and sustained stewardship in the future these qualities should be “clearly evident” across the board.

Three operational properties call for comment. NMT's work structure is reasonably flexible; there is a willingness for both formal and informal cooperation, quickly, sometimes on the fly, e.g., as seen in the ready cross-group responses to the “incident in Rm 113,” summer 1997 (where a Post-Doctoral staff member accidentally lost momentary control of a glove box repair job and both he and the working area were exposed to potentially serious contamination), and the area's subsequent clean-up. At the same

¹⁰ For an example of the specific measures that have been recommended to DOE for its own management of radioactive wastes, see the list of 70 detailed changes recommended in Department of Energy. Earning Public Trust and Confidence: Requisite for Managing Radioactive Wastes. Final Report. Task Force on Radioactive Waste Management, Secretary of Energy Advisory Board. Washington, D.C. November 1993.

¹¹ There is a growing literature related to these properties, see especially the special issue of the Journal of Crisis and Contingency Management, 4, 2 (June 1996) on the topic edited by Gene I. Rochlin. T.R. La Porte, “High Reliability Organizations: Unlikely, Demanding and At Risk”, Journal of Crisis and Contingency Management, 4, 2 (June 1996), 60-71, provides a rough summary of the overall findings.

Table 3. Characteristics of Highly Reliable Organizations.#

<u>Characteristics</u>	<u>NMT status</u>	[5-1]
<u>Internal Processes</u> (NMT's direct responsibility)		
** Strong sense of mission and operational goals, commitment to highly reliable operations, both in production and safety.	Clearly Evident	[5]
** Reliability enhancing operations.		
* Extraordinary technical competence.	Evident	[4]
* Sustained, high technical performance.	Evident	[4]
* Structural flexibility and redundance.	Somewhat evident	[3]
* Allowable collegial, de-centralized authority patterns in the face of intense, high tempo operational demands.	Evident	[4]
* Flexible decision-making processes involving operating teams.	Evident	[4]
* Processes intended to forward continual search for improvement.	Becoming Evident	[2]
* Processes that reward the discovery & reporting of error, <u>even one's own</u> .	Becoming Evident	[2]
** Organizational culture of reliability, including norms that stress the equal value of reliable production and operational safety.	Evident	[4]
<u>External Relationships</u> (NMT with limited responsibility)		
** External "watching" elements.		
* Strong superordinate institutional visibility in parent organization.	Evident	[4]
* Strong presence of stake holding groups.	Not Evident	[1]
** Mechanisms for "boundary spanning" processes between the unit & these "watchers."	Not Evident	[1]
** Venues for credible, current operational information available on a timely basis.	Becoming evident	[2]

From: T.R. La Porte, "High Reliability Organizations: Unlikely, Demanding and At Risk", Journal of Crisis and Contingency Management, 4, 2 (June 1996), 60-71.

I remind readers who depend mainly on skimming tabular information that these estimates are with regard to the presence of future requirements, not grades for past expected accomplishments. In interpreting these estimates one might be tempted to translate the ordinal numbers included in the tables into percentages, e.g., a 2 equals say 40% of something, as in a grade. But shifting from the ordinal 1-5 for "degrees of evidentness" to more quantitative "percentages" of something does not convey what is indicated. The estimate is more in the way of reporting how evident a phenomenon, e.g., a deer population, was present or evident in some valley. The percentages suggest that we know what the full 100% looks like ... as in grading.

time, one gets the sense, more generally, of thinly staffed capabilities that reduce the redundance, robustness and flexibility in important areas, e.g., the near scarcity of Radiation Control Technicians (RCT's) in some labs, and the limited staffing in materials sciences. Care should be taken as NMT staffs up for its increased production mission that what is merely thin coverage now does not edge close to becoming important gaps later on.

One signal feature of HROs is the consistent presence of rigorous processes that support the continual search for improvement. These come in a wide variety of forms, small groups formally charged with the review and correction of procedures, periodic evaluation of lessons learned, extensive and transparent data bases on operations, safety performance, work processes, etc. The intent is to improve the overall knowledge of the technical operations, distribute this learning widely, and keep it updated. There is a beginning trend toward the development of such processes, and an increased sense of their importance within the management team. This can be seen in the emphasis on "management walk arounds" and a recent "productivity" survey. Strong efforts here should continue, certainly to improve the bases for more widely available means to deepen an understanding of the dynamics of production (and to protect the arenas of R&D), but especially in the face of pressures from DOE/DOD to make decisions and allocate resources that in NMT's opinion will cripple the Division's capability to meet its mission requirements. Much better data upon which to base "push-back" initiatives is essential in an environment where sponsors may neither be sufficiently competent to understand the consequences of their decisions nor in a political environment that will give them incentives to find out.

The last comment on internal patterns has to do at once with formal incentives encouraging processes of discovery, which are quite limited, and norms of reliability which are quite evident. These related elements are central to sustained high reliability operations (and, I think, to the foundations of an honorable and honored activity.) A key component of reliable operations are incentives which systematically encourage, not only learning lessons from errors, but seeking to discover errors, reporting them, and taking charge of mitigating or ventilating their potential consequences. At present, there appears to be mainly informal, highly placed encouragement to seek out the potentials for failures, with no clearly recognized rewards for doing so, or for proposing means to mitigate or avoid such potentials.

A critical element of this process, which seasons the culture of reliability, are clear rewards for reporting errors *even when they are one's own*. This process and/or norm runs counter to most organizational experience which teaches participants that they will be "hammered" if they err, and that they are foolhardy to reveal their own mistakes. Far better, runs most folklore, to cover-up or ignore errors; lest upper management chose to act punitively, exert sanctions and otherwise make the "culprit" miserable. In highly hazardous operations, the identification of error, potential problems, etc., before they occur, and thus prevent a possibly much more consequential failure, obviously, is a highly desirable thing. But rewarding such behavior also seems counter intuitive to middle and upper level managers, to regulators, and to legislators. And, indeed, punishing this type of response now seems predictable within T-55, a perception that is augmented by tales of upper management, University, and DOE responses to problems.

But, in more general terms, one finds evidence at TA-55 of an emerging organizational culture of reliability that stresses the equal value of reliable production and operational safety. This is evident in management's explicit and repeated stress on safety, the role of safety comments early in the daily "stand up meetings," briefings in weekly "management team meetings", and in NMT's recent response to the lab wide efforts to give "integrated safety management" top billing as an important issue. This latter

emphasis began in early January and has become more and more explicit throughout the lab. Initially received with some skepticism by NMT management, they have taken the program up with a will. At the same time, they have reserved final judgment on its formal applicability until they see to what degree this notion take its rightful place not just in formal pronouncements, but in the daily mind set of all those engaged in potentially hazardous activities.

While a wide array of internal characteristics form the behavioral basis for highly reliable operations, they are costly, and often require substantial changes in managerial behavior. They are not likely to be sustained simply on the basis for internal resolve and management dedication. Re-enforcing external relationships are intrinsic to long term HRO achievement. Establishing and maintaining the external relationships, listed in Table 3, are often the province of top unit management, in this case the Lab Director's office, and cannot flourish without at least tacit acceptance of Division and/or Program office efforts to effect them for their own situations. Such re-enforcing "superordinate institutional visibility" regarding HRO performance is quite evident, especially regarding recent DOE and University California attention, though thus far this has taken a predominantly punitive cast.

Another source of external reenforcement, indeed support, for a division's HRO efforts comes from "stake holding groups."¹² While there are a number of external "stake holders," and some group actively opposing LANL's programs, most of them are oriented broadly toward LANL's overall mission, with some attention from the State of New Mexico regarding environmental effects. There is little, if any, local or regional stake holder notice of the weapons production function per se. That is, TA-55 currently operates almost wholly within the image and reputation of the Lab as a whole, with no evident presence of stake holding groups explicitly attending to matters of expanded production capabilities. It is no surprise than that, in the absence of explicit stake holding "watching" groups, neither are there institutional mechanisms employed by NMT or other TA-55 units for "boundary spanning" activities regarding "watching" groups.

This situation is likely to continue for some time, especially during the early phases of developing production capabilities. Without explicit attention, it is unlikely that TA-55/CMIP related units (and, in the near future, whatever a potentially more integrated weapons production organization becomes) will gain experience in managing relationships with external groups that could, under the right circumstance, re-enforce the politically perceived needs for sufficient resources to maintain HRO activities, or, for that matter, buttress the political backbone needed to avoid pressures that could erode hard won HRO capacities. Remediating this situation will, I suspect, require a different orientation and relationships between the Division and the lab's community and public affairs functions.

The remaining externally oriented characteristic — "venues for credible, current operational information available (to watching groups) on a timely basis" — seems on the verge of developing. TA-55's emerging emphasis on "issue management" has this potential. This initiative assigns explicitly to a person or small group the responsibility of coordinating formal responses to regulatory issues flagged by

¹² These are groups that feel they have a stake in what an organization does in its effects on economic, environmental or policy matters of concern to them. These include groups who represent technical and professional interests, as well, and with whom NMT has quite good relations and reflects NMT's technical standing; indirectly indicated in their evident "extraordinary technical competence", and "sustained, high technical performance" items in Table 3.

various overseeing and auditing groups. This function holds the promise of also developing skills in candidly providing other forms of information to sponsors, overseers, and potentially to stake holding groups, about TA-55 operations and organizational trends as well. Issue management, now mainly responding to outsiders' oversight interests, could as importantly become a venue or mechanism through which stakeholders become assured that their interests could be addressed. In the most effective version of the "issue management," outsiders, including opinion leaders, learn they can expect to be alerted to developments related to their interests before such development become overtly obvious on the basis of organizational performance, formal sponsor or regulatory decision making, or media attention.

Were NMT and LANL to demonstrate the properties I outlined above, it would go some distance in establishing the conditions that encourage and sustain highly reliable performance in daily operations. To do so would be a demanding and signal accomplishment. In addition, to develop an organization that has the capability to do this for more than one, perhaps a number of work generations is both rare and remarkable. It is also a necessary challenge for the organizations, agencies and sponsors involved in assuring the American people that the U.S. is able to provide credible nuclear deterrents and manage nuclear materials for the time periods of relevance — *into the indefinite future*. I turn now to the current promise of NMT and LANL in this regard.

Assuring Institutional Constancy.

Effective stewardship in managing nuclear materials should be expected to continue for at least 50 to 100 years, perhaps for centuries. This implies a long period of **institutional constancy**, i.e., the faithful adherence to a mission and its operational imperatives in the face of a variety of social and institutional environmental changes.¹³ What little systematic examination of this remarkable intention has been done suggests that institutional constancy requires steadfast political will, and what one might call the organizational infrastructure of constancy. The elements that express these overall qualities are listed in Table 4.

A quick scan of the table shows them to be as demanding as the HRO characteristics noted above, and more complex as a frame of reference for estimating these aspects of the LANL/NMSM/NMT combine's "fitness for the future". Institutional constancy must be seen in terms of the missions or goals animating the institution. In this case, LANL and NMT have traditionally had seen themselves as pursuing research and development goals. As Table 4 indicates, there are a number of more or less evident constancy enhancing characteristics related to these goals. Aside from the quite explicit formal statements and utterances of top LANL and UC leaders, the expression of these qualities remains often at the informal level with processes of recruitment, norms of apprenticeship-like relationships among senior and more junior professionals, and rewards worked out in a manner any researcher who has been involved in academic and/or highly sophisticated technical laboratory culture would find familiar. Recently, the weapons design divisions have begun teaching activities (the Titans program) to formalize

¹³ Recall this refers to "the faithful adherence to a mission and its operational imperatives in the face of a variety of social and institutional environmental changes". It includes, if necessary, organizational adaptation to technology and structure in order to accomplish it in the spirit of the institutional original commitment. See T.R. La Porte, and A. Keller. "Assuring Institutional Constancy: Requisite for Managing Long-Lived Hazard," Public Administration Review , 56, 6 (November -December, 1996), 535-544.

Table 4. Characteristics Associated with Institutional Constancy #

<u>Characteristics</u>	<u>NMT status</u> [5-1]	
	R&D	“Re-build”
** Assurance of Steadfast Political Will. This is enhanced by:		
* Formal goal of unswerving adherence to the spirit of the initial agreement.	Evident [4]	Becoming Evident [2]
* Strong articulation of commitments by high-status agency leaders calling on staff & labor’s role in achieving constancy.	Somewhat Evident [3]	Not Evident [1]
* Clear evidence of institutional norms that nurture the persist across many generations.	Somewhat Evident [3]	Not Evident [1]
* Vigorous external reinforcement from regulatory agencies and public “watching” groups.	Somewhat Evident [3]	Somewhat Evident [3]
** Organizational Infrastructure of Constancy. This includes:		
* Administrative & technical capacity to carry out constancy assurance activities re-enforced by agency rewards for their pursuit.	Somewhat Evident [3]	Absent [0]
* Adequate resources & activities to assure the “transfer”of requisite technical and institutional knowledge from one work & management generation to the next.	Becoming Evident [2]	Absent [0]
* Analytical & resource support for “future impact analyzes”.	Somewhat Evident [3]	Absent [0]
* Capacity to detect and remedy the early onset of likely failure related to processes that threaten the future, as well as assurance of remediation if failures actually occur.	Not Evident [1]	Becoming Evident [2]

Adapted from T.R. La Porte and A. Keller, “ Assuring Institutional Constancy: Requisite for Managing Long-Lived Hazard”, Public Administration Review , 56, 6 (November -December, 1996), 535-544.

I remind readers who depend mainly on skimming tabular information that these estimates are with regard to the presence of future requirements, not grades for past expected accomplishments.

the training of a new generation of designers...a good example of "resources and activities explicitly devoted to 'transferring' of technical and institutional knowledge from one work and management generation to the next." Another constancy assuring characteristic that require more formal institutional commitments — dedicated "capacity to detect and remedy the early onset of likely failure related to processes that threaten the future..." — is not apparent.

When turning to the speciality production mission, what some observers judge as competing goals to R&D, many of the properties are in limited evidence within NMT — a "finding" that obtains equally for NMSM, the rest of LANL, and, as far as I can tell, within DOE as well. This should not be a surprise.

Much in the evolution of DOE, LANL, and other actors in the nuclear enterprise — save for those who worry specifically about radioactive wastes — has led to a close focus on the immediate, sometimes proximate, demands of operational and technical problems. "Building for the ages" has seemed far too long-sighted, costly, and, indeed, irrational given the pace of technical change and the aggressive capabilities of a capable adversary. But as the international, post cold war frames of reference change and national strategies are altered, the requirements self consciously to build for the long term becomes more imperative. When viewed now in terms of NMT and LANL, this suggests a considerable analytical and resource investment in developing the skills and the workways that increase the public's assurance that constancy will be achieved — certainly a matter in considering "fitness for the future."¹⁴

Of the eight characteristics related to the speciality production mission listed in Table 4, NMT and LANL showed any evidence of only three. But before I go on, let me remind the reader of the context. Recall these properties have, in my view, become important in terms of an expanded mission and a quite different international security situation. They have not been sought, authorize or supported by sponsors in the past, nor are they particularly honored by political, media or economic leaders in our political culture. In a sense, it would be odd to observe them in a laboratory that evolved in that context and is now re-orienting itself toward change.

Two characteristics are associated with articulating and sustaining the politically difficult goal of constancy: an appreciation of the need for steadfastness as a goal is beginning to suffuse across some management domains; and long term trustworthiness is an important demand voiced by a widening range of stake holders and regulatory agencies. These characteristics, in rather greater measures, are certainly necessary (and modestly evident at LANL), but two crucial characteristics are missing almost altogether: strong public and internal articulation by high-status agency leaders calling on staff, workers and the public in achieving constancy, and the institutional norms that nurture and support the resolve to persist in a speciality production mode across many generations. These are, of course, matters that are central responsibilities for lab wide and DOE leadership, but NMT and NMSM need not (indeed, should not) wait for leadership from these quarters to begin developing the skills and arguments to effect the conditions of steadfastness in the face of an uncertain future.

¹⁴ For a discussion of the consequences of neglecting this challenge, see T.R. La Porte, "Large Technical Systems, Institutional Surprise and Challenges to Political Legitimacy," in Hans-Ulrich Derlien, Uta Gerhardt and Fritz Scharpf, eds. *Systemrationalität und Partialinteresse*. (Systems Rationality and Partial Interests.) Festschrift für Renate Mayntz. Baden-Baden: Nomos Verlagsgesellschaft, 1994, 433-452. Slightly revised version in *Technology in Society*. 16, 3, (Dec., 1994), 269-288.

The only other somewhat evident characteristic pertains to the infrastructure of constancy: the beginning and potential emergence of a “capacity to detect and remedy the early onset of likely failure related to processes that threaten the future.” The initial developments within NMT to establish much more finely grained indicators of operational states, the trends in safety data and improving “issue management” analysis and skills are (or could be) early stages in laying the foundation for a rigorous “future failure” identifying capability. These are precarious beginnings that risk suffering from arrested development at ineffectual stages without vigorous top management support. This is especially the case if the other characteristics of constancy infrastructure are missing — as is the case at LANL and NMT. There are no administrative and technical capacities or institutional rewards for carrying out constancy assurance activities in specialty production arenas; nor are there resources or activities to assure the “transfer” of requisite technical and institutional knowledge from one work and management generation to the next. Neither is there explicit analytical and resource support from LANL or DOE for “future impact analyzes, nor ready assurance of remediation if potential failures become evident or that they actually occur”. These characteristics are also limited in the domains of research and development though this absence is not likely to be seen as worrisome to interested publics.

To reiterate, the absence of these capacities are not surprising; indeed, their presence should not be expected, given the history of LANL and the NMT Division. But its future will be little like its past. As the lineaments of LANL’s expanded (and concentrated) mission emerge, NMT is likely to be pushed further into the mine fields of suspicion. Making one’s way through them will be much more demanding, possibly impossible. Beginning to develop constancy enabling processes now has the aura and actuality of legitimate prudence and high stewardship in the face of expanded missions with demanding properties.

Sustained operations of hazardous, beneficial technical systems intrinsically puts strain on the managing and sponsoring organizations due both to the perceived levels of hazards involved and to the inevitable differentials in knowledge between technical operators and attentive members of the public. The public is almost certainly to feel vulnerable in the face of these differences. The current generalized social propensity to be suspicious of large institutions simply adds to the nutrients for distrust in the operator’s environment. At the same time, if harm to the public due to operational missteps or mismanagement may potentially extend far into the future (so that issues of constancy become salient), the demands for trustworthiness are likely to be greatly increased. This is an institutional challenge that has come to bedevil a number of organizations and agencies that operate and/or regulate demanding technical systems. The challenge is growing for LANL and will, I think, become a continuing responsibility for the NMT Division, and other units that become identified with nuclear weapons production and/or the associated planning and supporting programs. It is a matter to which I now turn.

Institutional Trust and Confidence (Trustworthiness)

A key element of effective institutional stewardship is the capacity of an organization to evince organizational properties and comport itself so that it is seen as worthy of the public’s trust. This is the case for managing nuclear materials, especially if the institutions involved have volunteered (as they have), in effect, for the remarkable mission of watching out for the welfare of the public (stewardees, if you will). What are these properties and to what degree do NMT and LANL more generally seem to realize them?

Before we turn to this directly, it is useful to examine the institutional meaning of trust. A concept subject to considerable rhetorical ambiguity (e.g., trust and confidence, legitimacy), La Porte and Metlay propose the following definitions:¹⁵

1. Trust is the belief that those with whom one interacts (agencies, firms) will take your interests into account, even in situations where you are not in a position to recognize, evaluate and/or thwart a potentially negative course of action by “those trusted”.

2. Confidence exists when the party trusted (agencies, firms) is seen to be able to empathize with (know of) your interests, is competent to act on that knowledge, and will go to considerable lengths to keep her/his word.

3. Trustworthiness is a combination of trust and confidence.¹⁶

To the degree **institutional trustworthiness** is a prime requisite for successful stewardship (and the more complex and hazardous the technology and the longer it presents the hazard, the more it is), the following institutional design characteristics and processes are crucial.¹⁷ I list them, first, for relationships with external bodies (Table 5), then, for the design of internal relationships (Table 6).

It is worth noting that these characteristics were derived from a situation in which the agencies involved were in a state of considerable public *distrust*, or deep deficit of trust.¹⁸ Indeed, only the first two of each list need be considered if the organization is merely attempting to maintain a high level of public trust and confidence rather than to recover it. The other conditions could be thought of either remedial, that is, needed if one has to dig out of a hole, or preventative, if the work and history of the organization is such that it operates near the edge, with the ready potential for losing public trust and confidence. NMT and

¹⁵ T. R. La Porte and D. Metlay, "Facing a Deficit of Trust: Hazards and Institutional Trustworthiness," Public Administration Review. 56, 4 (July-Aug. 1996), 341-347. Cf. R.M. Kramer and T.R. Tyler, eds. Trust in Organizations: Frontiers of Theory and Research. Thousand Oaks, CA: Sage, 1996, for views of trust among organizational members, i.e., within organizations rather than between an institution and its clientele or citizens.

¹⁶ Given these definitions, many members of the public and stake holding groups, especially when they feel themselves to be vulnerable, do not believe that a number of U.S. institutions (including DOE and its contractors) have either the intent to take their interests into account, or, if some of its members did, the competence/capability to act on it. This is an untenable position in advanced industrial democracy, and it presents very severe challenges for any institution that undertakes to carry on operations that have properties that put their legitimacy at risk. See T.R. La Porte, "Large Technical Systems, Institutional Surprise and Challenges to Political Legitimacy," Technology in Society. 16, 3, (Dec., 1994), 269-288.

¹⁷ The design principles to accomplish high Public Trust and Confidence (PT&C), i.e., organizational and institutional properties that increasing the likelihood that able members of the public will regard an agency as worthy of their trust, are related a) to interactions with external parties and b) to a combination of internal organizational factors that make up a matrix of re-enforcing necessary conditions.

¹⁸ Department of Energy. Earning Public Trust and Confidence: Requisite for Managing Radioactive Wastes. Final Report. Task Force on Radioactive Waste Management, Secretary of Energy Advisory Board. Washington, D.C. November 1993. T. R. La Porte was Chairman, Contributor and Editor, Daniel Metlay, Project Director and Principle Author.

LANL, more generally, seem to be moving toward that edge (or perhaps the edge is moving closer to LANL) as missions and regulatory environments change. Prevention should be a high priority.

Again, before plunging in, recall the context. Work at LANL and, especially at NMT, has gone on under the thick cloak of high security. During the Cold War, the public's trust and confidence was in a sense assumed, the protection of the nation was unambiguously at stake; professionals were on the technological front lines. Questions of maintaining the conditions of public trust and confidence were, from the view of LANL and its Divisions, in the hands, at least of the University of California, possibly tended, as well, by program sponsors and agency leaders in Washington. The need for such skills or attending to the resources and institutional processes involved were not pressed on technical working leaders. Only recently have conditions changes so much that technical institutions might need to develop such things on their own. The press of civilian regulatory regimes and demands generally for increased transparency of all large scale institutions (public or no) suggests strongly that LANL and its more potentially controversial divisions begin to complement their high technical skills and processes with equally able new processes that signal their public trustworthiness. What distant do they have to travel? How far along the path of trustworthiness do they seem to have come?

Interaction with External Parties. The central premise informing the design for external public trust and confidence evoking measures is:

When agencies (or firms) manage programs that could be seen as levying more potential harm than benefits upon citizens and communities, agency (or industry) leaders must give all groups of citizens and their representatives opportunities for involvement and must demonstrate fairness in negotiating the terms of their immediate relationship.

To realize these conditions and avoid grounds for distrust, agencies or firms should commit themselves to the six general conditions listed in Table 5. I include an estimate of the degree to which they seem evident in NMT/TA-55 and, by extension, to LANL as a whole. As in discussing the frames of reference above, I focus on those conditions which are least evident at NMT and LANL, though this does not help much in compressing the discussion for the overall picture does not show a robust pattern.

Notably, the two conditions (listed first) needed to maintain a secure and trustful relationship — early, continuous and open involvement with stake holders advisory groups, and timely carrying out of agreements unless modified through an open process established in advance — are only “becoming evident”. One senses that this results from external pressure rather than voluntary lab initiation. The same dynamics seem to color the presence of one condition that is “reasonably evident”: negotiated benefits to the community along with the resources to the affected host communities that might be needed to detect and respond to unexpected costs. This is due, in part, to the relatively rare circumstances of LANL's history and relationship to these communities, a matter that assures the other “very evident” condition of an unmistakable agency and program residential presence in the locality and contributions to community affairs with appropriate mechanisms to shoulder its fair share of the tax burden. At the same time, there is the sense from Lab managers that this proximity really means one cannot get away from this often irritating community closeness. And recent negotiations between the lab/DOE and communities close by are reported with an edge of suspicion and resentment.

The picture here is one in which there is a small cluster of necessary conditions with a near absence of

**Table 5. Institutional Trust Enhancing Relationships:
Interaction with External Parties #**

<u>Property</u>	<u>NMT Status</u>	[1 - 5]
* Early, continuous involvement of stake holders advisory groups characterized by freq. contact, complete candor & rapid, full response.	Becoming evident	[2]
* Timely carrying out of agreements unless modified through an open process established in advance.	Becoming evident	[2]
* Consistent and respectful reaching out to state and community leaders and general public to inform, consult and collaborate with them about technical and operational aspects of agency (or firm) activities.	Maybe becoming evident	[1.5]
* Active, periodic presence of very high agency (and firm) leaders, visible and accessible to citizens at important agency field sites.	Not evident	[1]
* Unmistakable agency (or firm) and program residential presence in the locality that contributes to community affairs and pays through appropriate mechanisms its fair share of the tax burden.	Clearly evident	[5]
* Assuring the availability of negotiated benefits to the community along with the resources to the affected host communities that might be needed to detect and respond to unexpected costs.	Evident	[4]

From T. R. La Porte and D. Metlay, "Facing a Deficit of Trust: Hazards and Institutional Trustworthiness," Public Administration Review. 56, 4 (July-Aug. 1996), 341-347.

I remind readers who depend mainly on skimming tabular information that these estimates are with regard to the presence of future requirements, not grades for past expected accomplishments.

two that make a strong difference: While there has been a low level and intermittent effort to reach out respectfully to state and community leaders and general public to inform, this has not taken on a quality of consultation or collaboration about technical and operational activities, nor is there an active, periodic presence of very high agency leaders accessible to citizens on-site. I hasten to add that there may be deep national security reasons to avoid the sort of decision-maker visibility and consultative spirit traced above. The extent of this prohibition should, of course, be tested, for to the extent these conditions cannot be met, then compensating activities should be put in place for the lab to avoid remaining in a mine field of precarious public trust.

These familiar external measures, if they are carried out faithfully, can be expected to reduce some sources of suspicion — and increase an organization's perceived "fitness for the future." But these measures go only a short distance toward stimulating or recovering trust and confidence if the agency is facing a deficit of trust, or, as is the case for NMT and LANL, are in a precarious trust maintaining

situation.¹⁹ One must considering complementing improvements in external relations with changes in internal operating culture, as well.

Internal Operations. Attending to an agency's or firm's internal operations for the maintenance or recovery of public trust and confidence is more important than is generally recognized. And its salience is greatly increased when the technical operations involved have intrinsic properties that prevent unequivocally determining its safety or benefits for many years. This is, of course, the case for radioactive waste disposal programs, the development and closing of mining operations, and for a number of operations in handling nuclear materials more generally. These are situations whose success or failure may extend far longer than the life times of the programs' initial managerial and technical leadership.

This means (as we put it in the DOE report already noted, p. 51) that "the quality of the decisions taken now or operations carried out in the near future cannot be judged on the basis of near term feedback, nor will there be any chance to reward or punish the leaders most responsible for the programs on the basis of its overall success or failure."

In our legal system, there are few ways of holding present decision makers liable for failures they may have put in train in the present but are not discovered to be failures until well into the future. In this case, one's attention is re-directed *internally*, to the activity's quality of knowledge, operations, and management -- in the present and its prospects for continuing into the future.

Taking these conditions into account, the underlying premise for designing of internal operations is that:

Tasks should be carried out in ways that, when the public gains access to programs via improvements in external relations, they discover activities within the organization that increases institutional trustworthiness rather than decreases it (DOE 1993, 55).

Put another way, the recovery or assurance of trust results, in part, when the more *members of the attentive public* know about the agency or firm, the more confident they are that hazardous processes are and will continue to be done very well. It is notable that this is the reverse of what most observers expect when they become fully familiar with large institutions, i.e., "the more you know, the worse it gets".

Estimating the degree to which trust evoking internal characteristics are "evident" shifts the perspective from describing formal properties, as in the earlier sections, to the perspective of a outsider. This involves imagining oneself as a person who is becoming increasingly knowledgeable about the organization, a stake holder say, and then (as a researcher) trying to "see" how the structure and activities that evoke trust could come to be recognized in the ways the organization presents itself to these stake

¹⁹ Indeed, the task force that first took up this problem spent over half its time (and 40 of its over 70 detailed recommendations) on matters of *internal processes* as well. See Department of Energy. Earning Public Trust and Confidence: Requisite for Managing Radioactive Wastes. Final Report. Task Force on Radioactive Waste Management, Secretary of Energy Advisory Board. Washington, D.C. November 1993. T. R. La Porte was Chairman, Contributor and Editor; Daniel Metlay, Project Director and Principle Author.

holders.²⁰ This suggests that the more attention an organization pays to making it easy for stake holders quickly to figure out what's going on, the more likely the presence of the various properties, if they are present, are likely to seem as "quite evident". This is a significant demand for success depends as much on the learning of outsiders as it does on the good intentions and resolve of managers, and/or the struggles of working groups to overcome obstacles often not of their own making. Put another way, the more opaque the characteristic, e.g., informal, masked by technical language, buried within the formal structure, the less evident it will be to outsiders, even if there is an abundance of good intention, informal delegation of trust evoking responsibilities, etc.

Internal operations then should be designed to effect the measures germane to establishing, assuring or recovering public trust and confidence. Again, I list these (Table 6) and include a estimate of the degree to which they seem evident in NMT/TA-55 and, by extension, to LANL as a whole. As we should expect, NMT and LANL generally evinces the first requisite for maintaining established public trust and confidence — high professional and managerial competence. The second requisite — discipline in meeting technically realistic schedules — while it is held in question by DOE, has not, until recently, been a matter of public concern. I suspect there is some recent erosion of confidence among the public in the guise of media hawks. Meeting and setting realistic schedules may now be "becoming evident" to the media and stake holders as a function of LANL's response to external criticism. There have been a number of efforts to address these demands; unfortunately, their effectiveness in communicating to stake holders the importance of this quality is somewhat muted for these efforts could be seen as much as potentially short term reactions to criticism as a common practice of the Lab. In a sense, NMT's efforts to be disciplined are not acknowledged by outsiders, in part, because NMT and LANL do not have activities that reveal the skills and processes that can demonstrated in this regard.

These two qualities would possibly be sufficient if the lab and NMT were operating in a climate of abundant public trust and confidence where there is likely to be forbearance and some slack in the face of missed promises, delayed schedules and overrun budgets. But insofar as this reservoir of patience and good feeling has been exhausted, additional operational qualities recommend themselves.

None of them have much visible presence at NMT or LANL today; nor have there been strong reasons to nurture them. Rather, there have been strong reasons to avoid doing so. Have both policy and environmental conditions changed so that the costly, potentially frustrating and professionally chastening efforts of realizing them become a signal matter for exercising effective nuclear stewardship? I would argue that they have and that to ignore this matter now is to put the enterprise at longer term risk and to begin falling short in the realizing the mission and spirit of nuclear stewardship in the new age. How far is there to go? Where are NMT and LANL now? These are unexpected, unfamiliar topics in most discussions of public trust and confidence, hence I expand a bit on some of them.

There is little evidence that technical options are begin pursued such that their consequences can be clearly demonstrated to broad segments of the public (via the media). While many projects and activities in NMT and within the lab are intended to serve public and certainly national security interests,

²⁰ This can be tricky to do for in initial stages one is reduced to "taking the role of an outsider" without clear verification that the researcher's views are actually shared by outsiders. This leaves room for disagreement among observers about how outsiders might actually perceive internal dynamics and functions. Such verification could, of course, be secured if enough interest were shown.

**Table 6. Institutional Trust Enhancing Relationships:
Interaction with Internal Organizational Conditions.#**

<u>Organizational Condition</u>	<u>NMT Status</u>	[1 - 5]
* High professional and managerial competence.	Evident	[4]
* Discipline in meeting technically realistic schedules.	Becoming evident	[2]
* Pursue technical options whose consequences can be most clearly demonstrable to broad segments of the public.	Not evident	[1]
* Processes of self-assessment that re-enforce activities permitting the agency to “get ahead of problems” <u>before</u> they are discovered by outsiders.	Becoming evident	[2]
* Tough internal processes of reviewing and discovering actual operating activities ... that include stake holders.	Not evident	[1]
* Clear, institutionalized assignment of responsibility for protecting the internal viability of efforts to sustain public trust and confidence throughout the organization.	Absent	[0]

From T. R. La Porte and D. Metlay, "Facing a Deficit of Trust: Hazards and Institutional Trustworthiness," Public Administration Review. 56, 4 (July-Aug. 1996), 341-347.

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from the public learning point of view, the objectives and benefits believed to justify technical programs are often masked due for security reasons, and/or when they are discussed it is often in such technical language that only those already interested are likely to comprehend. The high value of a technical project is a moot point in terms of evoking increased trust if interested publics cannot figure out what is going on and/or become skeptical that the technology’s proponents have it right with regard to expected outcomes. Those who are already skeptical or wary will sense that whatever the technology, it may not be executed well or they are not in a position to know if it were or not.

To put this in terms of the positive condition, I saw little at LANL, or certainly within NMT (no one pays for this) that signals the importance of including the “communicability of technical operations” as valued design criteria. Indeed, putting it that way in the LANL and most engineering environments, has an odd sound and imponderable implications. And in many technical environments design (and/or security) constraints may be so demanding that there is no point to considering the “understanding in the public” aspect. If this is so, and it may very well be so in most high tech R&D projects, the organization is confronted with having to bear this “potential for reduced trust” burden. In consequence, organizational leaders could think about engaging in, what one might call, compensating trust evoking activities to

make up for the intrinsic short fall.²¹

Two trust enhancing measures have broadly to do with self assessment. There are growing efforts in NMT and in pockets of LANL more generally to establish processes of self-assessment that re-enforce activities permitting the units to “get ahead of problems” before they are discovered by outsiders (also related to high reliability organizations). Again from the public’s vantage, these are now likely to seem fragile, somewhat distant efforts. Were a stake holder representative, for example, of a mind to learn about such processes, there is little opportunity to discover whether or not there are vigorous, well rewarded activities that signal the development of sensitivities to hidden glitches in procedures, that unearth fault tree analyzes, or systematized lessons learned from management “walk arounds.”

In another HRO related matter, there appears to be little inclination to establish tough internal processes of reviewing and discovery with regard to actual operating activities that include stake holders. Many of these processes exist, and in the past several years the UC Office of the President has established a series Division Review Committees and there is a general move to provide some backbone to credible external review processes. But these remain, on the whole, processes carried out, often quite rigorously, by members of the salient technical communities. If there is suspicion of such processes (as there is increasingly) the “insider” nature of the present system does little to give it credence to able, formerly excluded communities. From the public’s point of view, were some form of stake holder involvement to be in place, it would suggest that actual processes of review would likely be less prone to fudging, skimping on resources, and would be more transparent. Such a measure is often a response to situations of extreme distrust, it can also be a means of getting ahead of that circumstance well before a deficit of trust beings to grow. Again, the motivations of managers and overseers are less important than providing transparency and established error finding processes that seem likely to live past a particular senior manager’s tenure.

Finally, there is no evidence that LANL (or its Divisions) are inclined to provide unambiguous institutional assignments of responsibility (with commensurate rewards and sanctions) for protecting the internal viability of efforts to sustain public trust and confidence throughout the organization. In practice, this refers some sort of formal assignment or position with enough horse power (and rewards) to insist on “keeping at it” when recovering or maintain public trust and confidence is concerned. This sort of formal location of “trust assuring” functions is extremely rare in LANL or other organizations, though it may, after a fashion, be assigned informally to public affairs offices. But informal assignment does not reassure. Rather formality signals importance of intent. There is a rough parallel recently within LANL when its former Director appointed a senior person reporting to him with the formal, full time responsibility to enhance “integrated safety management.” Whether or not one thinks this was a sensible thing to do re: actually safety needs, or considers it to have made a real difference, the assignment of responsibility signaled the importance of the function. Something like this acts, in the view of outsiders, to increase the likelihood that the processes and effectiveness of maintaining public trust and confidence will not go aglimmering when the initial smoke clears. This is especially salient when stake holders perceive that the operations themselves and/or consequences of error in operations, etc., could plausibly be carried many years into the future.

²¹ In Swedish nuclear waste management community, this is termed advancing technical alternatives that demonstrate a high “ease of proof,” that is, can, by virtue of experience or analytical familiarity, be made quite plausible to broad portions of the educated stake holders.

IV. Conclusion

The organizational properties we have discussed cover a formidable range. When they are assembled as an overall set, in Table 7 below, the character of the challenge could seem daunting, especially in the context of institutional stewardship as an overarching perspective. I return to this perspective as an organizing notion for I argued that highly reliable operations, long term institutional constancy, and deepening public trust and confidence are the essence of institutional stewardship in our society. And as each of these qualities was arrayed above, I also argued that many of their requisite properties are not yet evident in LANL operations. Some twenty eight (28) different properties included, a number pertaining to two or all the stewardship qualities. This makes for a complicated summary; to simplify a bit, I have, first, included only the “re-build” aspect in the Constancy column (LANL has attended to the many of the properties that seek to assure R& D competence across generations.) I have also dichotomized the estimates into *Evident* - X (from evident to somewhat evident, 5-3) and *Not Evident* - O (from becoming evident to absent, 2-0).

For those quantitatively inclined, this results in a total of 33 possible scores. Thirteen (13) of these indicate “Evident” properties that are associated with “fitness for the future,” that is, fit to be society’s stewards for nuclear materials. By far the most “fitness” has to do with highly reliable operations (9 of 13 overall, and 9 of the 13 properties of HRO’s themselves.) These can and should be enhanced, certainly, but LANL has these skills and the challenge is to assure they are maintained.

What is arresting about this summary is the sweep of work to be done in providing for future assurances of *institutional constancy* and *public trust and confidence*. To be sure, these are new requirements, neither particularly salient in the past. But they now press insistently upon lab and UC management. Attention to establishing a “pit rebuild” organization that is designing for the “fourth,” as well as the “first generation” is now problematic; and the equally important matter of developing an institutional capacity to assure public trustworthiness seems an apt and crucial challenge. Few of the internal or externally oriented institutional properties of either of these qualities are now present.

In the context of LANL’s past, this discussion may seem unduly alarming. After all, the weapons labs, under the benign oversight of the UC system, have performed very well; repeatedly making unique and invaluable contributions both to advance basic scientific knowledge and to overcoming a vigorous adversary. Couldn’t we expect the same “world class” performance in the new era? Perhaps, but to leave it there is to miss the thrust of the emerging skepticism and ambiguity regarding technical systems generally; skepticism which has a particular edge in regard to the nuclear enterprise. Those who are technically engaged in its various aspects have not been well served either by their governmental or commercial sponsors and promoters. Recent history suggests failures of institutional competence, policy determination, and public disclosure. The steady accumulation of these failures acts to exhaust public patience, erode confidence in technical professionals (and their overseers), and accrete layers of resentment harbored in the social psyches of a distracted and anxious public.

If further analysis turns out to support these views (and I hope it does not), it would be a formidable challenge for LANL, the University of California (UC-OP), and the relevant DOE offices. While the technical parameters of “science based stockpile stewardship” may be becoming clarified, (and taking on daunting proportions), its operational lineaments remain quite opaque and its institutional imperatives illusive. This presents the current leadership with, not only demanding technical obstacles, but extraordinary institutional ones as well. The metaphor of stewardship, while levying very demanding

Table 7. Properties of Institutional Stewardship

(X=evident; O=not evident)

	<u>HRO</u>	<u>CONST</u>	<u>PT&C</u>
	(Re-build)		
<u>Internal Processes</u>			
* Strong sense of mission and operational goals, unswerving commitment.	X	O	
* Public commitments by high-status agency leaders	X	!	
* Institutional norms that nurture commitments across many generations.		O	
* Culture of reliability, w/norms according <u>equal</u> value to reliable production and operational safety.	X		
* Extraordinary technical competence.	X		X
* High managerial competence and discipline in meeting ...realistic schedules.			O
* Pursue technical options clearly demonstrable to broad segments of the public.			O
* Structural flexibility and redundance.	X		
* Collegial, de-centralized authority patterns in the face of high tempo operations.	X		
* Flexible decision.-making processes involving operating teams.	X		
* Processes enabling continual search for improvement.	X		
* Self-assessment to “get ahead of problems” <u>before</u> discovery by outsiders.			O
* Processes that reward the discovery & reporting of error, <u>even one’s own</u>	O		
* Processes of review and discovery ... that include stake holders.			O
* Institutionalized responsibility and resources to protect these efforts thru out org.		O	O
* Resources for “transferring” requisite technical/institutional knowledge across from one work & management generation to the next.		O	
* Analyt’l & resource support for “future impact analyzes”		O	
* Capacity to detect/remedy the early onset of likely failure that threatens the future, and assurance of remediation if failures occur.		O	
<u>External Relationships</u>			
* Strong superordinate institutional visibility within parent organization	X	O	!
* Strong presence of stake holding groups (watchers)	O	X	!
* Mechanisms for “boundary spanning” processes btwn the unit & these “watchers.”	O		!
* Venues for credible, current operational information available on a timely basis.	O		!
* Early, continuous involvement of stake holders advisory groups w/freq. contact, candor & rapid, full response. (Overlaps with the three immediately above.)			O
* Consistent/respectful reaching out to state and community leaders, and general public to inform, consult ... about technical/operational agency activities			X
* Timely carrying out of agreements unless modified through an open process established in advance.			O
* Active, periodic presence of very high agency leaders, visible and accessible to citizens at important agency field sites.			O
* Unmistakable agency/program residential presence locally that contributes to community affairs and pays ... its fair share of the tax burden.			X
* Negotiated benefits to the community with the resources that might be needed to detect and respond to unexpected costs.			O

! Indicates properties that are likely to be associated with these qualities as well.

charges for current leadership, *is* apt and warranted. But it is stewardship in the face of historical residues and evolving conditions that taxes our analytical understanding, our institutional capacities, and our abilities to frame perspectives that adequately take into account the political and social strain intrinsic to the technical capabilities that have been central to achieving global dominance.

The changes implied by this discussion will be marginally costly in dollars and personnel, but considerable to managers in terms of increased political anxiety, and potentially in decreased internal, short term control over institutional directions. It is possible, I suspect likely, that leadership in Washington or in Oakland (UC), finding they have neither the capacity nor fully the resolve, will be loathe to initiate stewardship enhancing changes. To the degree this is the case (and I very much hope to be wrong about it), developments in the relationships of LANL and NMT/NMSM both to the external world and changes within the weapons programs itself will require initiation from within — probably in the face of at least residual resistance from both Oakland and Washington.

If stewardship enhancing measures can established, control will return expeditiously to technical and institutional leaders who have recovered the confidence of able Americans and very likely leaders around the world. This is, it seems, a requisite to nurture a climate of understanding and honor in which each generation assumes the obligation of managing the burden of nuclear weapons and materials in such a way that their successors in the “fourth generation” will inherit a system *at least no more difficult to manage than they received*.

Without serious attention to these matters by DOE and the lab, one is haunted by the suspicion that rapid operational developments (perforce closure), based on *current* practices, rationalized on the basis of past conditions, could inadvertently propel DOE and the Lab on a track that would *increase* the difficulties for succeeding generations in executing the nuclear stewardship mission we are assigning to them — at the level of effectiveness we hope for them. If this transpires, leaders and historians of that “fourth generation” will not look kindly on our efforts.

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