SURVEY OF WEAPONS DEVELOPMENT AND TECHNOLOGY

WR708

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SESSION IX

AIRCRAFT WEAPON SYSTEMS

- WEAPON SYSTEMS
- REQUIREMENTS
- NUCLEAR WEAPONS SYSTEMS FOR ENDURING STOCKPILE
- AIRCRAFT INTERFACE

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SANDIA NATIONAL LABS AIRCRAFT COMPATIBILITY DEPARTMENT

- Our charter is to ensure the Department of Energy that a capability exists between US nuclear weapons and the aircraft they are carried on throughout their life in the inventory.
- Our department was established in the early 1960's.
- We work with the military, aircraft contractor, and Sandia's weapon departments in the design of the aircraft/weapon interface.
- We define the requirements the military and contractor must comply with before final design approval can be granted.
- We conduct a wide range of electrical and mechanical tests to verify a capability exists.

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An Overview of the Evolution of Aircraft Monitor and Control (AMAC) Systems

- The AMAC acronym was created to describe the dedicated "black boxes" that monitor and control nuclear weapons.
- From 1945 to 1961, no standard weapon interface existed. Early bomb technology drove the design of the AMAC Systems.
- Little Boy (B1) and Fat Man (B2) were controlled by an AMAC known as a Flight Test Box (FTB). The FTB could measure battery voltages, turn on radars, and could verify certain components had not failed. Two manually inserted arming plugs were used to arm the weapons prior to pressurization of the cockpit at 8000ft.
- Manually inserted arming plugs were also used on the B3 (production Fat Man) and B4-0 bombs.
- 1950 saw the first bomb (B5) to incorporate a cockpit controlled inflight insertion (IFI) mechanism for enhanced nuclear safety. This device was the forerunner of the Ready/Safe switch, and it required a new AMAC to control this bomb feature.

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An Overview of the Evolution of Aircraft Monitor and Control (AMAC) Systems

- 1952 saw the first fighter-carried bomb (B7). It had an AMAC controlled retractable fin for ground clearance.
- By 1952 there were three AMAC systems for bomber aircraft and one for fighter aircraft.
- In the late '40s and early '50s AMAC systems were built around the specific needs for the bombs, not the aircraft.
- In 1954 Sandia started a program to standardize AMAC functions for new weapons under development.
- The result of this effort resulted in the T249 AMAC for bomber and fighter aircraft usage.

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An Overview of the Evolution of Aircraft Monitor and Control (AMAC) Systems

- New bombs designed during the mid to late '50s were made compatible with the T249 rather than building a unique AMAC for a specific bomb.
- AMAC design specifications, defined jointly by the DOE and DoD, first appeared in December 1961.
- AMAC specifications such as Bomber System A, Fighter System A & B, and Aero 6B were the forerunners of todays AMAC systems.
- Today's nuclear-capable aircraft, with the exception of the B-52 ALCM/ACM AMAC Systems, have what is known as a System 1 AMAC interface.
- The System 1 specification first appeared in September 1963.

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System 1 Offered Many Improved Features in Safety and Compatibility

- A current-limited Monitor State allowing weapon status to be checked without applying Safe power.
- Dedicated weapon status monitor pins for Safe, Arm, Permissive Action Link (PAL), and Weapon Present ID.
- [redacted] (3)
- Category (CAT) B PAL [6/63] and CAT D PAL [8/75] enhanced weapon security.
- Unique Signal Generator (USG) [8/75] enhanced weapon safety in abnormal environments.
- Command Disable (CD) [10/81] provided the ability to render a weapon useless from the cockpit.

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Conclusion

- All aircraft nuclear weapon interfaces built to date have been analog.
- AMAC systems have transitioned from separate to integrated designs.
- A System 2 AMAC specification, based on MIL-STD-1760, exists that defines a digital interface for possible use in future nuclear weapons.
- The number of nuclear capable aircraft has decreased considerably in recent years.

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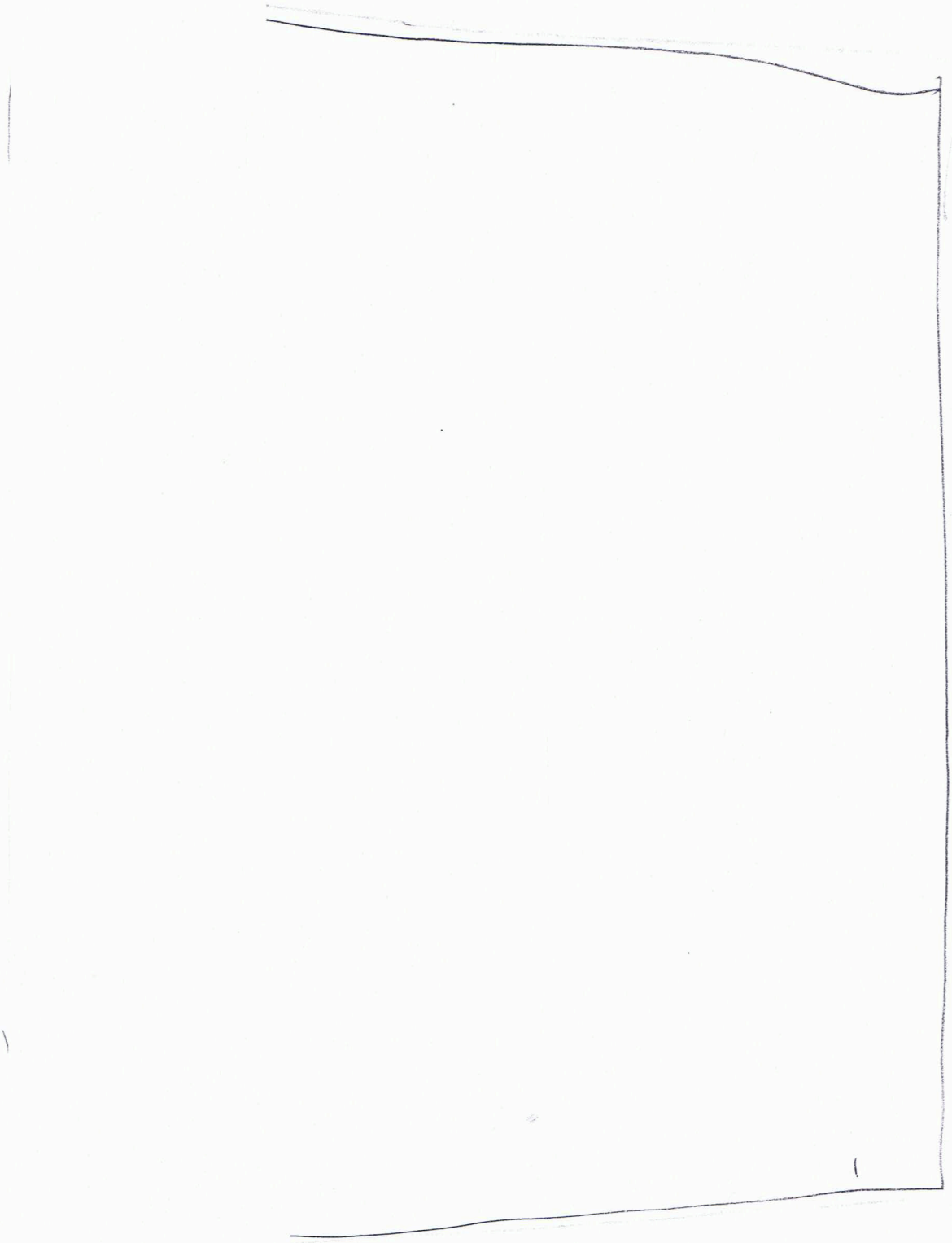

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SURVEY OF WEAPONS DEVELOPMENT AND TECHNOLOGY

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SESSION X

- Nuclear Weapons Dismantlement

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Dismantlement Topics

- Process
- Magnitude
- DOE/Labs Organiztion
- Technology Applications
- Laboratories Increased Presence at Pantex
- Lab-to-Lab Interchanges with Russians

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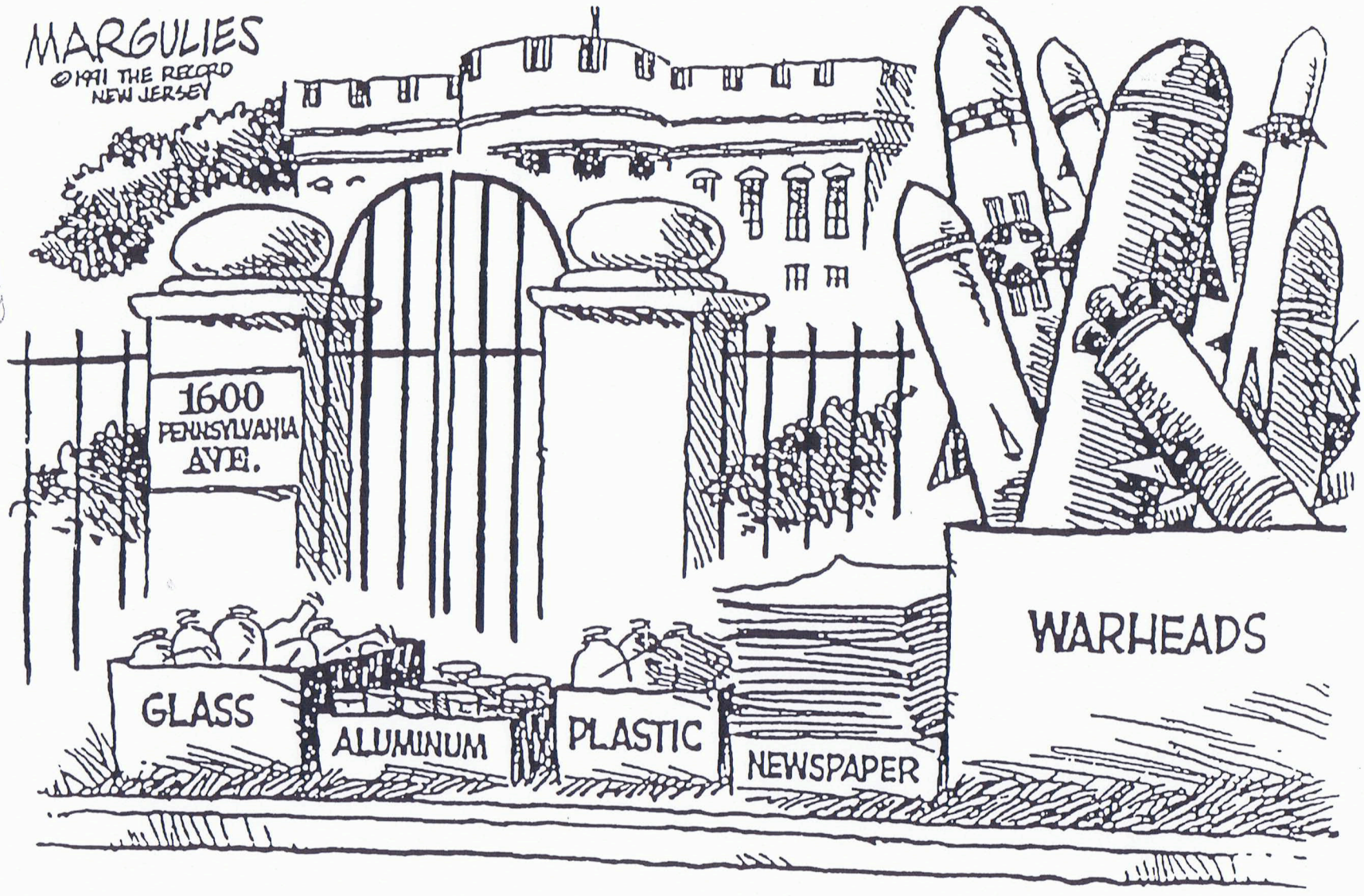

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Nuclear Stockpile Dismantlement Process

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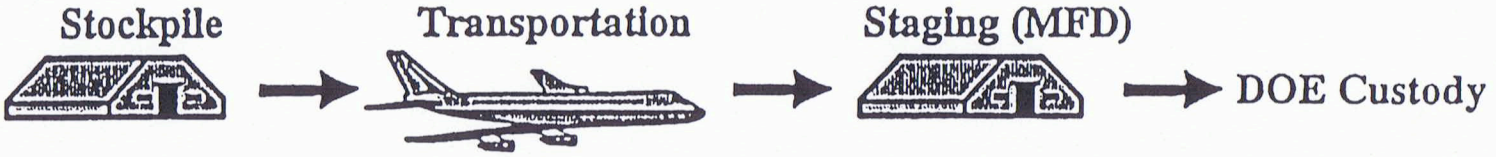
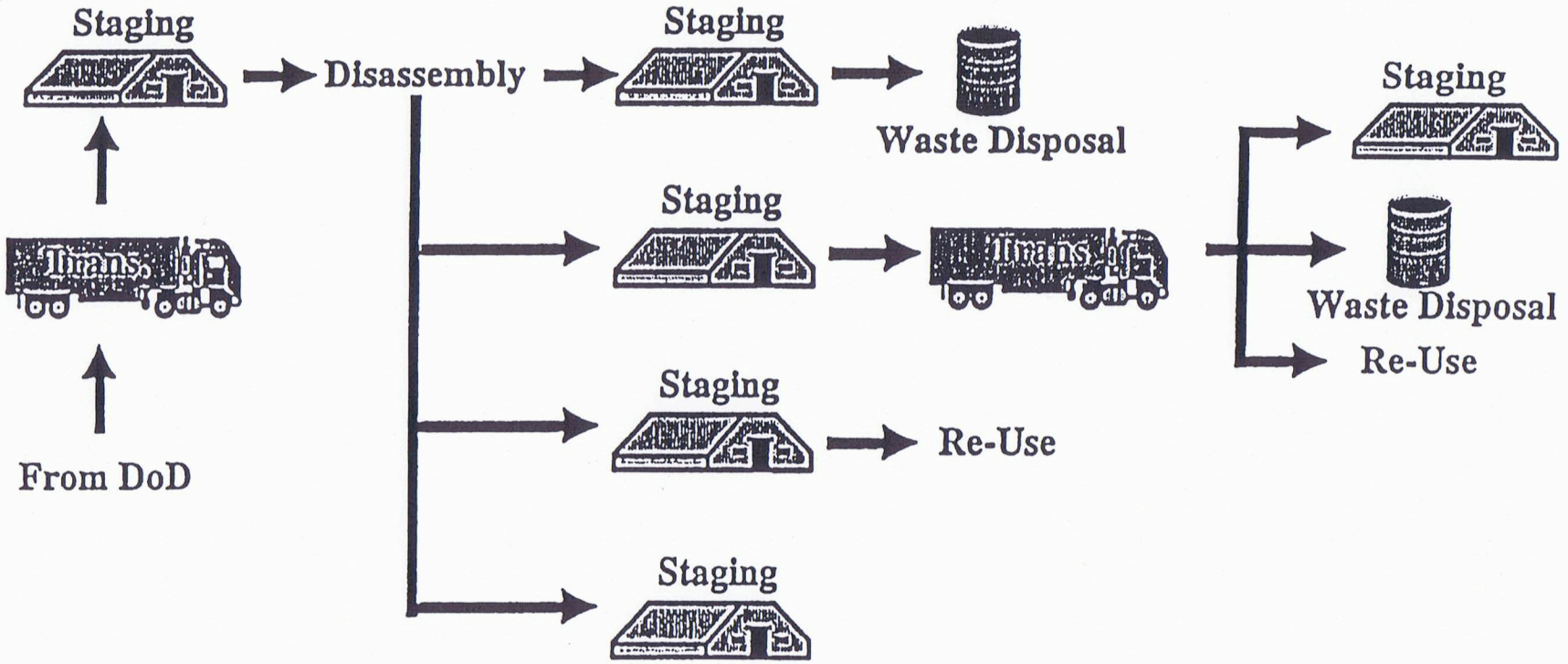
DoD Custody



DOE Custody



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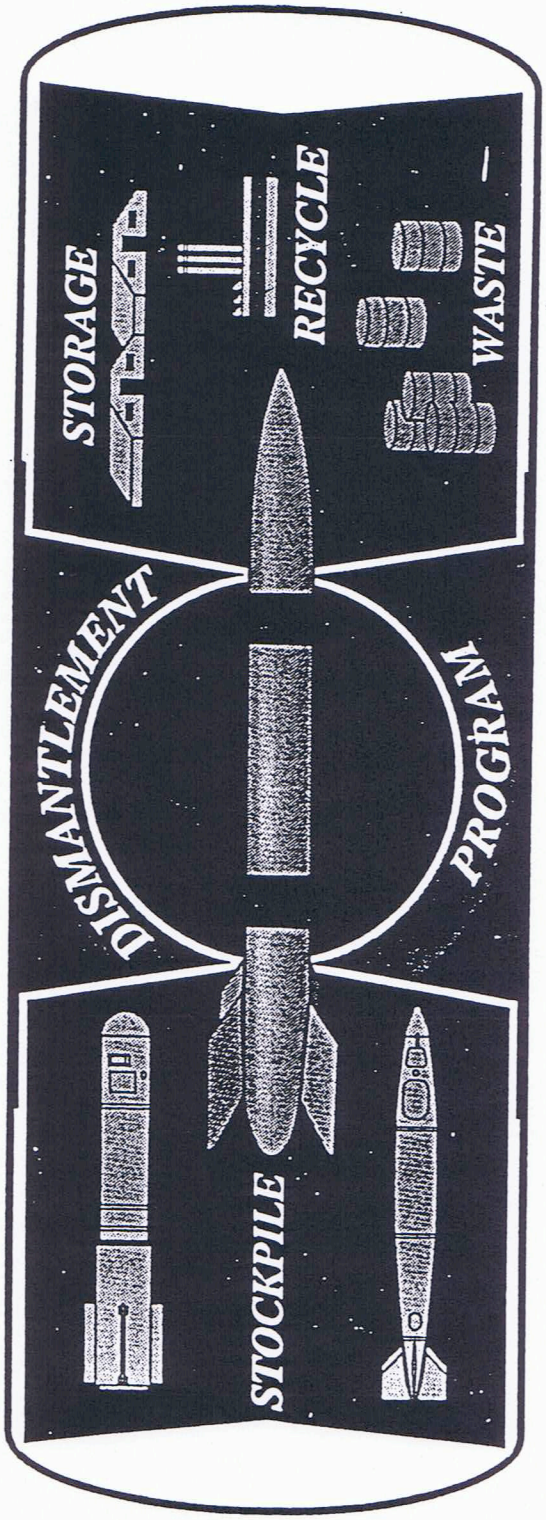

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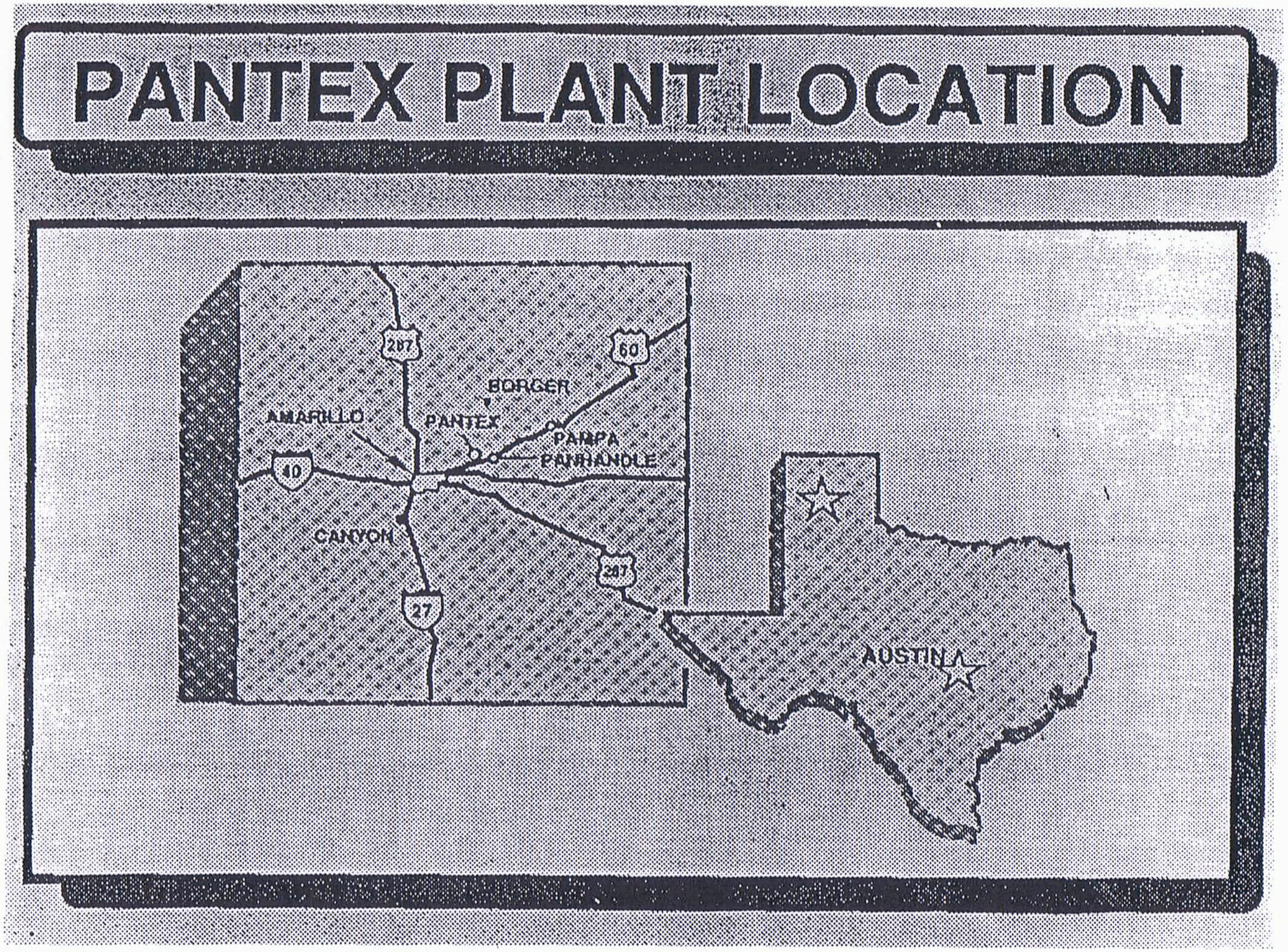

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Pantex Organization Responsibilities

- Government owned facility
- DOE Amarillo Area Office (reports to AL)
  - Administers operating contract
- Mason & Hanger - Silas Mason Co., Inc.
  - Management and operating (M&O) contractor
- Battelle Memorial Institute
  - Subcontractor for Environment, Safety, and Health (ES&H)
- Sandia National Laboratories
  - Operates Weapons Evaluation Test Laboratory (WETL)

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Pantex Plant Statistics

- $190M operating budget
- 2945 employees
  - 2600 M&H
  - 250 Battelle
  - 78 AAO
  - 17 Sandia
- 16,000 acres
- 2.5M sq. ft. buildings (425 units)

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Size of Dismantlement

- Pantex capability approximately 2000 per year
- Backlog of weapons
- Retirements continue
- [redacted]
- Taper off to support retirements as they occur

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Stockpile (P&PD 93-2)

SRD Viewgraph

Shows
Stockple, Reserves, and Retiring

(Not included herein)

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Department of Energy
Executive Mangement Team for Dismantlement

- Formed by DASMA
- Covers all aspects of retirement, return, disassembly, waste characterization, and disposal
- Develop integrated departmental positions and strategies for dismantlement
  - Internal to DOE
  - With DoD
- Membership with DoD
  - DOE/AL, DOE/HQ, LANL, SNL, LLNL
  - Reports to DASMA weapons panel

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Department of Energy
Executive Management for Dismantlement

DOE/AL	Deborah Monette	Chair
DOE/HQ	Karen Lombardo	Exec Sec
LANL	Mike Kelly	
LLNL	Jerry Dow	
SNL	Paul Longmire	

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Dismantlement Priorities

- Weapons Shipment Planning
  - Priority based on risk analysis
- Material Destination - Disposal
  - Identification
  - Characterization
  - Obey Laws
- Storage of SNM
  - Keep at Pantex until better solution found

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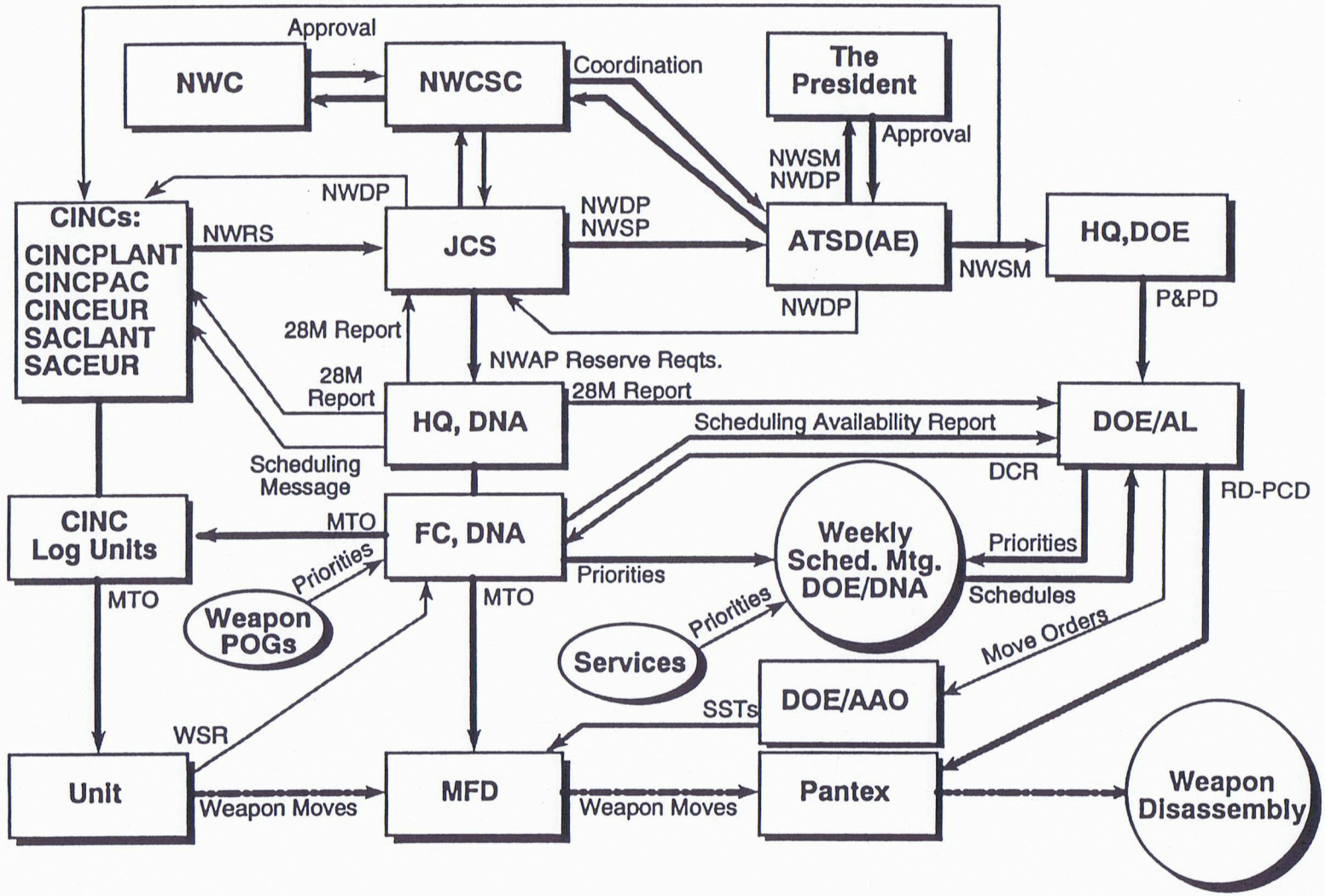
DISMANTLEMENT PRIORITIZATION PROCESS



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Dismantlement Prioritization Working Group

- Joint DOE/DoD group chaired by Sandia
- Initial phase identified and ranked weapons based on weapon features
- Dismantlement process from initial retirements to disposal was defined
- Influences that determine priorities were identified
- DOE issues such as staging requirements and transportation assets were examined
- Software written to process data
- Group continues for information exchange and planning assistance

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Information Systems

- Developing database for material identification and characterization
- Compatible with each DOE design agency and production agency
- Allows Pantex to receive information electronically
- Allows each DA and PA to enter their desired data
- Replaces old scrapbook system at Pantex

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DOE Dismantlement Policy
Component Retention, Reuse, or Evaluation

- For each weapon in the dismantlement process, a laboratory study will be conducted to determine if any of the major assemblies, components, or their subcomponents should be:
  - (1) Retained for reuse
  - (2) Salvaged for their strategic or economic value
  - (3) Retained for safety and use-control effectiveness evaluations
  - (4) Evaluated to provide further statistical data regarding the quality and reliability of comparable hardware in the enduring stockpile

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Non-Nuclear Hardware From Dismantled Weapons

- All hardware scheduled for disposal unless otherwise requested
- Sandia plans to request designated hardware to be returned for evaluation
- Possible storage of Sandia hardware for future use when a direct replacement in the enduring stockpile, e.g., mods of B61
- Los Alamos plans no storage of hardware except for Detonators
- LLNL plans no storage of hardware
- Evaluation units for LANL and LLNL will be requested as needed

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Component Commonality Matrix, A Few Examples

Dismantled Weapons	Enduring Stockpile			
	B61	W78	B83	W76,W80,W87,W80
B57	Solder Conn		Para chute	
W68	Trig Ckt	Trig Ckt	Trig Ckt	
W70	LAC	LAC N.G.	LAC	

W56, B61-0, W69, W71, W79

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DOE Dismantlement Policy
Component Retention, Reuse, or Evaluation

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DSD Manual

The Demilitarization and Sanitization for Disposition (DSD) Manual defines the process to be utilized in the nuclear weapons complex for applying the general guidelines to define and document a demilitarization, sanitization, and/or render-safe process. The process description covers the use of the Demilitarization/Sanitization Table, the Weapon Component Data Sheets, and the issue resolution process.

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MMSC Demilitarization/Sanitization

Part Nomenclature	*Demilitarization*	*Sanitization*	*Render Safe*	*Method*
Actuators/Squibs	Yes	No/Yes	Yes	Fire or explosive disposal (some use control items may require sanitization)
Connectors	No	No/Yes	No	None (unless rad hardening potting used, then sanitization required)
Detonators and Cable Assemblies	Yes	Yes	Yes	Fire - shred cable/crush header or explosive disposal (protect# info.)
Foams, cushions compression pads, desiccants, plastics, etc.	No	No/Yes	No	None (shred, melt, or burn if show classified contours or shock mitigation info.)
Mechanical Hardware (O-rings, brackets, bolts, cover plates, rings, etc.	No	No	No	None (part identifier removed if association makes classified)
Neutron Generator, Electronic	Yes	Yes	Yes	Crush (remove rad tube?)
Neutron Generator, Explosive	Yes	Yes	Yes	Fire (mixed waste) or timer driver to explosive disposal/tube to rad waste
Reservoir	Yes	Yes	Yes	Bury (remove rad material if appropriate)
Thermal Battery	Yes	No	Yes	Fire
Timers	No	No	No/Yes	None (fire - remove explosives if appropriate)
Use Control, PAL, CD Hardware	Yes	Yes	Yes	Expend, crush, shred, bury as appropriate

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Nuclear Material Storage/Disposal

- All pits put in interim storage
  - Yet to determine ultimate fate of plutonium
- Secondaries under study
  - Portion to be stored
  - Portion to be disassembled into basic materials

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SNM Storage Problem

- Present Storage Magazines
  - Containers stored vertically in planar array
  - At present rate magazines full in March 1994
- Proposed Changes
  - Containers stored horizontally in multi-layers
  - Activate additional magazines
  - Problem Created
    - High radiation levels
    - Worker could receive yearly allowable dose in approximately one day
- Solution
  - Use machines to load, retrieve, and inventory

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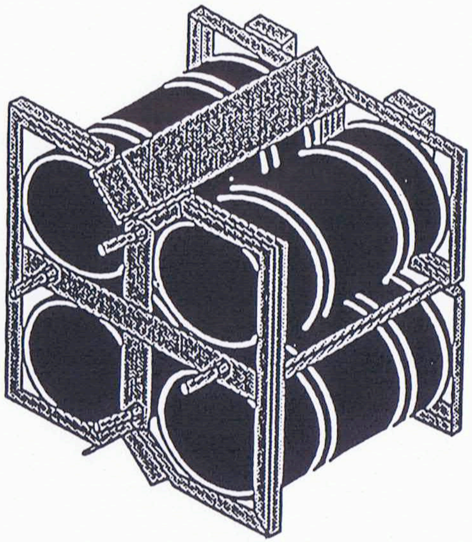
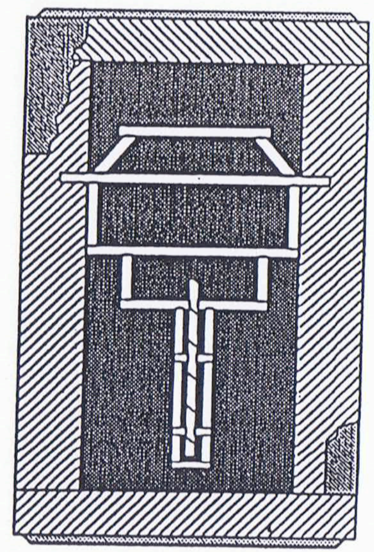
Project Stage Right Storage





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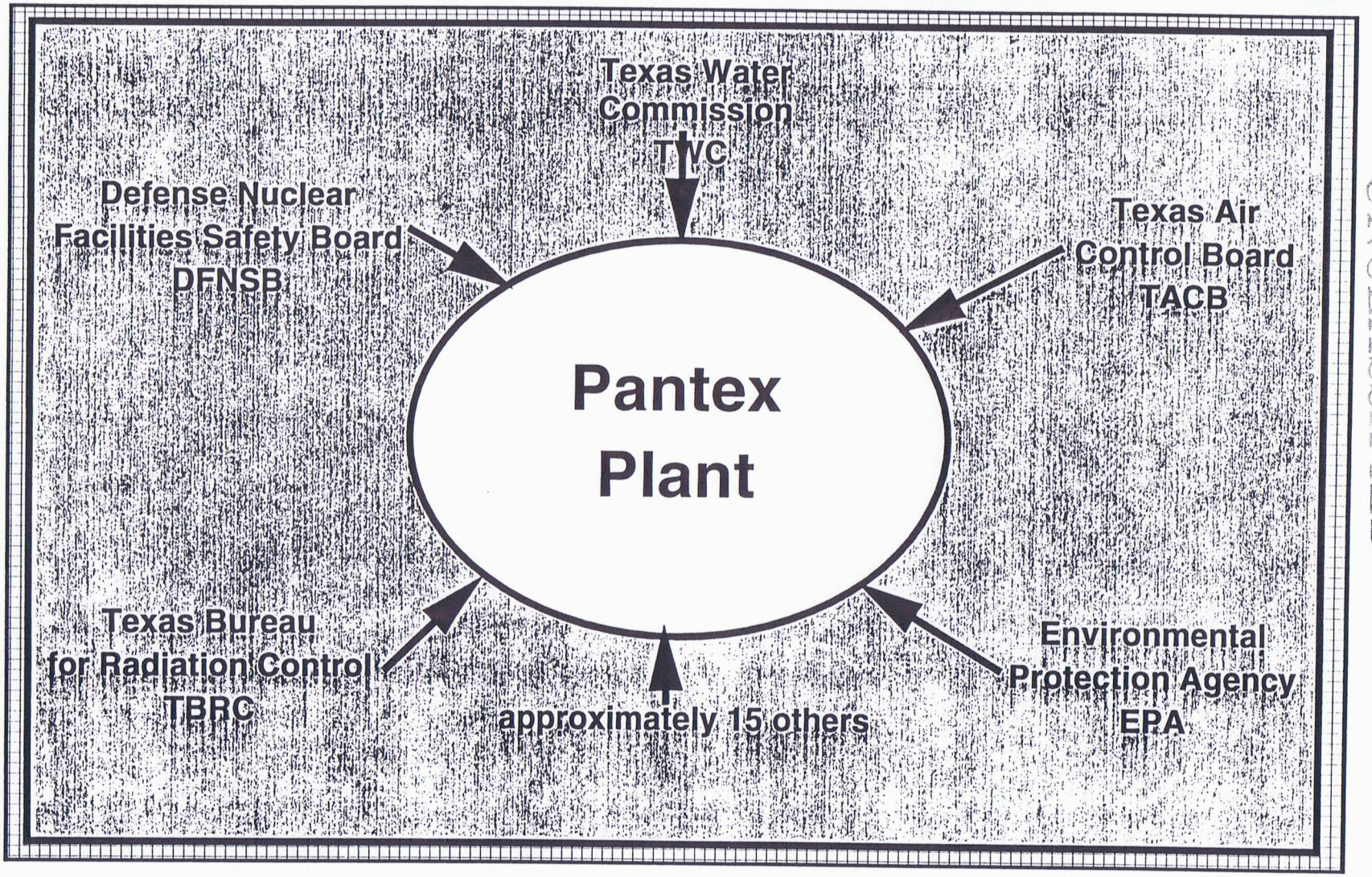
External Oversight



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Sandia/Pantex Robotics

- Weighing and Leak Checking System (WALS)
- Disassembly
- System Studies

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Quality Evaluation for Dismantlement (QED)

- Concept originated in DOE Policy
  - Generated by EMTD and approved by DP-20
- Labs assess dismantlement process
- Level 1-Weapon receipt through disassembly
- Level 2-Subassembly and component preparation for disposal
- Joint Lab team effort to provide the best technical advice
- M&H-Battelle retains overall responsibility
- Defense Nuclear Facility Safety Board values to process
- Level 1 evaluations performed on W48, B57, W68, and W70
- Official Laboratory Quality Releases in December 1992
- Planning for Level 2 underway

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Lead Lab Approach

- Preserve technology at Laboratories
- Utilize limited resources supporting process and manufacturing development
- Maintain Laboratories' unique technical competence
- Enhance Laboratories' capability to provide limited backup
- Facilitate further enhancement of technology transfer
- Increases scope of Laboratories' functions and responsibilities
- Role and relationships of Labs and Production agencies will change
- Lead Lab responsible for maintaining technical excellence in production technology
  —"Cradle to grave"

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Pantex Lead Lab Assignments

- Weapon assembly/disassembly
  - Sandia, Paul Longmire
  - Nuclear subassembly
    - Los Alamos, Luis Salazar
- High Explosives
  - LLNL, Dick Hatfield
- Responsible for developing and certifying processes at plants for Complex 21
- Follow-on to Technology Assessment and Selection Panel (TASP)--currently in operation

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Tri-Lab Project Office

- 10/92 letter from Bruce Twining, MGR DOE/AL

"Laboratories play a stronger, more direct role, and well-defined role in nuclear operations, wherever they occur, with a first-step emphasis on Pantex operation"

"Establish a Joint Laboratory Technical Support Office"

- Tri-Lab Project Office in operation
  - Ribbon cutting ceremony Sept. 29, 1993
  - Four offices for each Lab
  - Three on-site residents from LLNL--Two from LANL
  - One resident from SNL--one more in process
- Full office facilities, e.g,, adm. support, repository

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Coopertive Program between US and Russian Labs

- Participants
  - US--Sandia, Los Alamos, and LLNL
  - Russia--Chelyabinsk and Arzamas-16
- Unclassified, non-sensitive information exhanges
- Four areas of activity
  - Risk assessment--Stan Spray
  - Transportation Surety--John Kane
  - Hazardous Materials--Paul Longmire
  - Communication and Translation--Patricia Newman
  - Hazardous materials includes handling, material ID, and waste management

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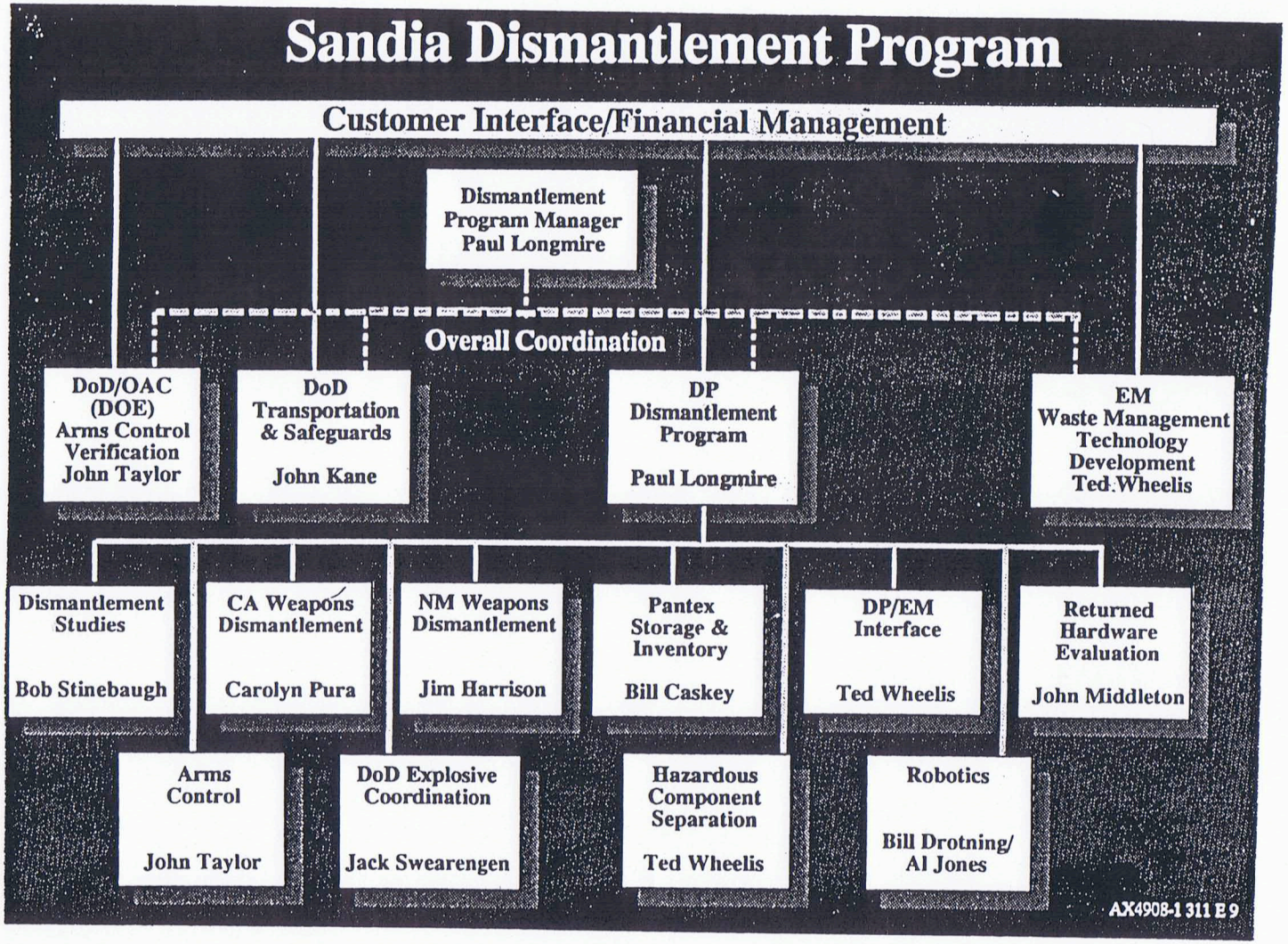

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