

**U.S. DEPARTMENT OF ENERGY
OFFICE OF CIVILIAN RADIOACTIVE WASTE MANAGEMENT**

**PRESENTATION TO
THE NUCLEAR WASTE TECHNICAL REVIEW BOARD**

**SUBJECT: SYSTEMS SYSTEMS ENGINEERING APPROACH &
TRANSPORTATION CASK SUBSYSTEM**

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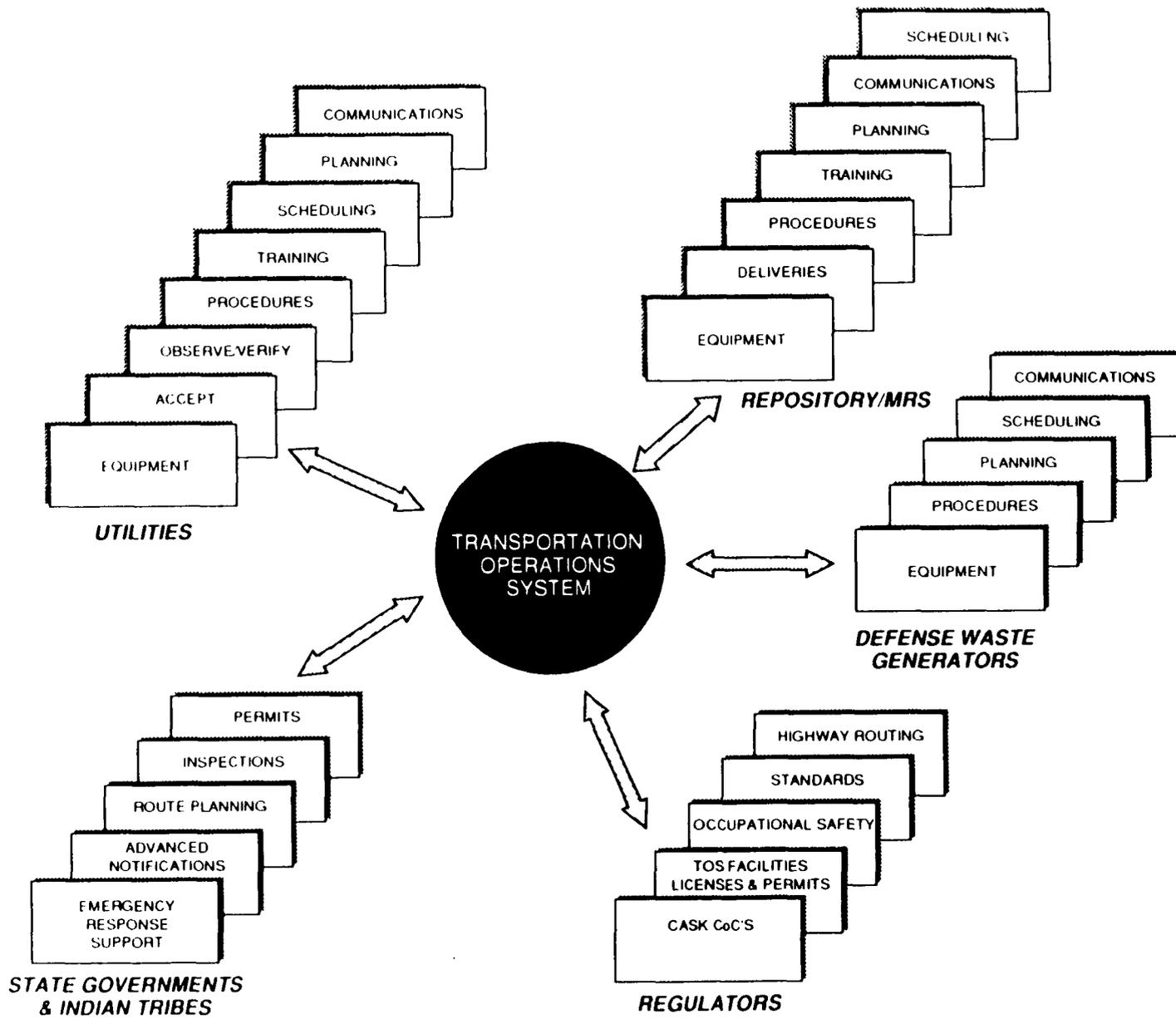
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TRANSPORTATION OPERATIONAL PLANNING

- **SYSTEM ENGINEERING**
- **PLANNING AND CONTROL SUBSYSTEM**

OPERATIONS INTERFACE WITH CASK SYSTEM DEVELOPMENT

- **TRANSPORTATION CASK SUBSYSTEM**
- **CARRIAGE SUBSYSTEM**



**TRANSPORTATION OPERATIONS INTERACTS AT DEPTH
WITH OTHER AUTHORITIES**

SYSTEMS ENGINEERING APPROACH IDENTIFICATION, DESCRIPTION, ALLOCATION OF FUNCTIONS

FUNCTIONAL REQUIREMENTS

- OPERATIONAL EXPERIENCE ASSESSMENTS
- FUNCTIONAL REQUIREMENTS AND DESCRIPTIONS

REQUIREMENTS ALLOCATION

- MANAGEMENT STRUCTURE
- FEASIBILITY STUDIES
- ISSUES RESOLUTION

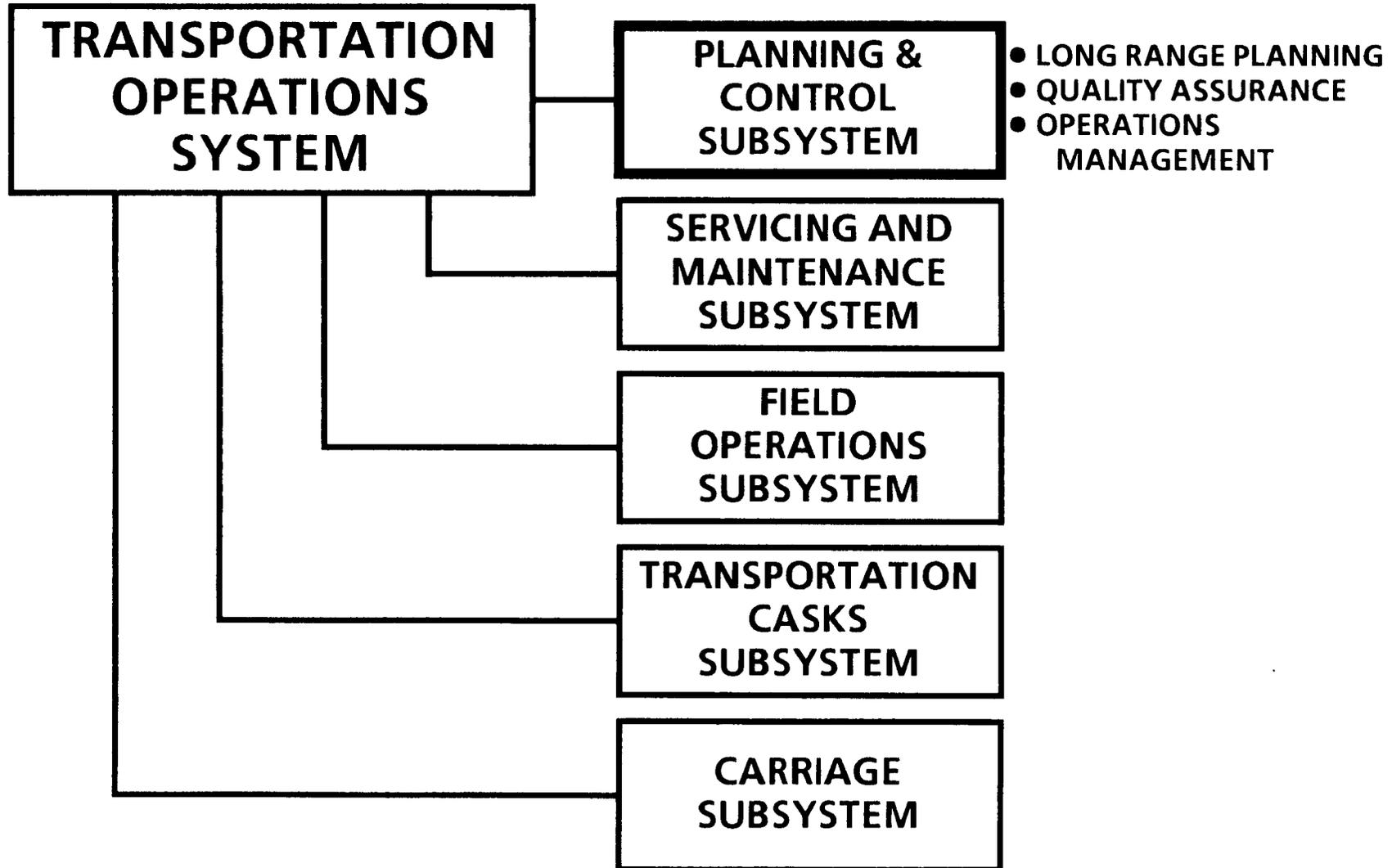
TECHNICAL REQUIREMENTS

- FLEET COMPOSITION
- FLEET SIZE
- FLEET MAINTENANCE REQUIREMENTS
- RELIABILITY, AVAILABILITY, MAINTAINABILITY
- CASK MAINTENANCE REQUIREMENTS

RESULTS OF OPERATIONS SYSTEM ENGINEERING

- **IDENTIFIED AND DESCRIBED TOP LEVEL FUNCTIONS**
 - **ACCEPT**
 - **TRANSPORT**
 - **SUPPORT**
- **DEFINED LOWER LEVEL SUBFUNCTIONS AND INTERRELATIONSHIPS**
- **IDENTIFIED SET OF SUBSYSTEMS**
- **INITIATED PROCESS TO IDENTIFY ISSUES**

THE TRANSPORTATION OPERATIONS SYSTEM ELEMENTS



LONG RANGE OPERATIONAL PLANNING CONSIDERATIONS

STANDARD UTILITY CONTRACT (10 CFR 961)

- **ESTABLISHES THE SHIPMENT SCHEDULE REQUIREMENT**
- **REQUIRES CASK AND SUPPORT EQUIPMENT SUITABLE FOR USE AT THE UTILITY'S SITE**
- **REQUIRES APPROPRIATE DOCUMENTATION AND TRAINING TO UTILITIES**

LONG RANGE OPERATIONAL PLANNING FRAMEWORK

PURPOSE

- **DEFINE OPERATIONAL SYSTEM REQUIREMENTS**

METHODOLOGY

- **SPECIFY ASSUMPTIONS**
- **SCREEN UTILITY PICK UP OPTIONS**
- **IDENTIFY FEASIBLE SCENARIOS**
- **ITERATE THE PROCESS**

ISSUES EMERGING FROM CURRENT WORK

- **LOGISTICAL COMPLEXITY OF OPERATIONS**
 - **OVER 80 INDIVIDUAL CUSTOMERS (DOE CONTRACTS)**
 - **OVER 75 SITE LOCATIONS NATIONWIDE**
 - **OVER 125 DIFFERENT FACILITIES**
 - **MANY INFRASTRUCTURES HAVE MODAL CONSTRAINTS**
- **VARYING REACTORS ACCESS/CASK HANDLING CAPABILITIES VARY WIDELY**
- **NO U.S. EXPERIENCE WITH LONG-TERM, CONTINUOUS, MULTIPLE SITE CAMPAIGNS FOR SPENT FUEL SHIPMENT**
- **LOGISTICAL COMPLEXITY CONSIDERATIONS AFFECT NUMBER OF SITES SHIPPING AT ANY ONE TIME**

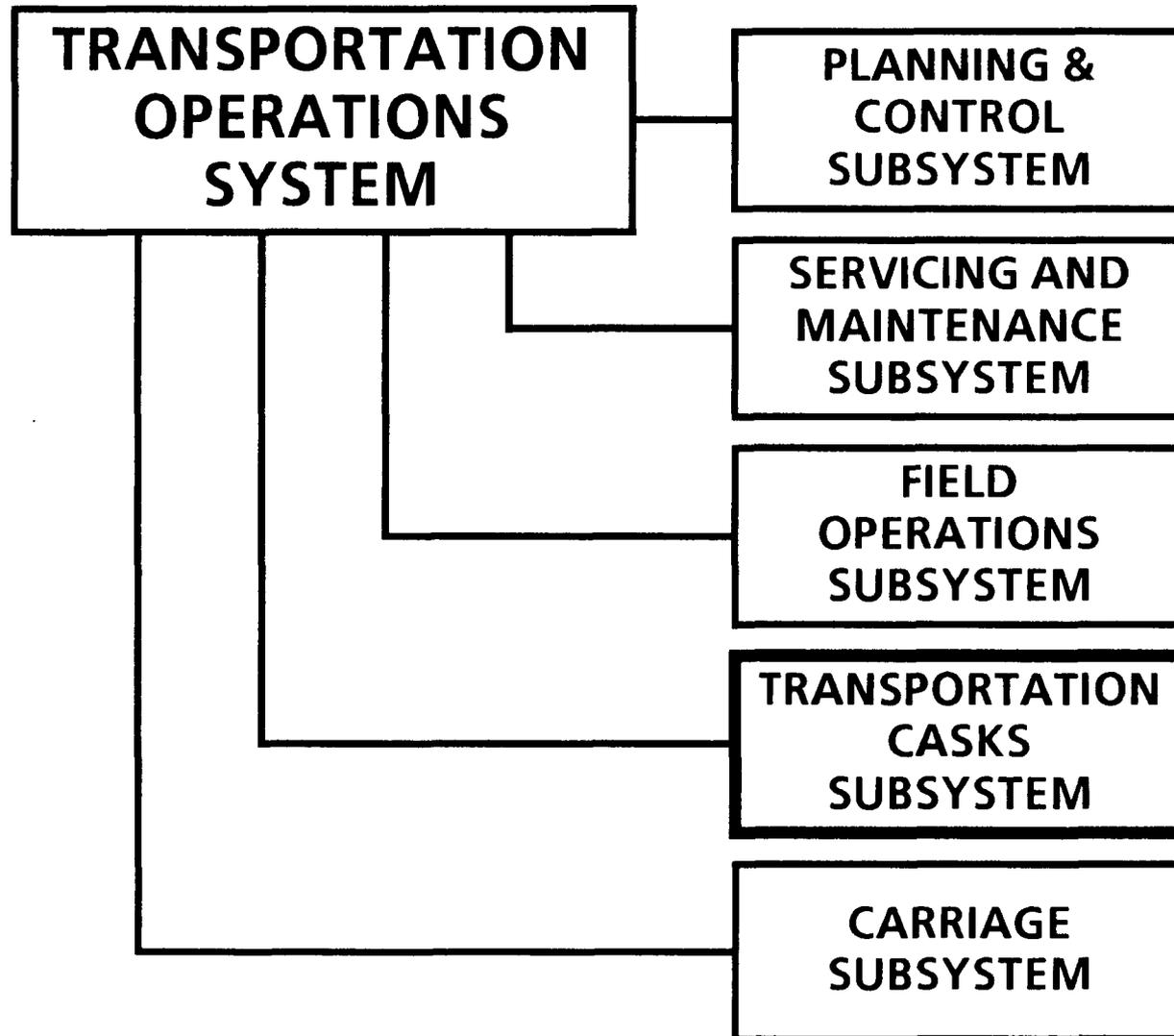
ISSUE RESOLUTION ACTIVITIES

- **DATA ACQUISITION/ANALYSIS**
- **OVERALL SYSTEM OPERATIONAL PLANNING/INTEGRATION**
- **DEFINE ALTERNATIVE OPERATIONS SCENARIOS FOR MULTI-SITE CAMPAIGNING BY TIME PERIOD**
- **USE OPERATING SCENARIOS AS BASIS FOR TOS DEVELOPMENT (EQUIPMENT, FACILITIES, SERVICES, PERSONNEL)**
- **SITE SPECIFIC REACTOR SERVICING PLANS**
- **CAMPAIGN PLANNING**

CONCLUSION

- **OPERATING SYSTEM IS COMPLEX**
- **REQUIRE INTEGRATION OF A NUMBER OF ELEMENTS**
- **SYSTEM ENGINEERING AND PLANNING TO BUILD A LOGISTICALLY SOUND SYSTEM**

THE TRANSPORTATION OPERATIONS SYSTEM ELEMENTS



OPERATIONAL COORDINATION WITH CASK SYSTEM DEVELOPMENT

- **CHECKLIST FOR OPERATIONAL REVIEW OF CASK DESIGN**
 - **CASK DESIGN**
 - **ANCILLARY EQUIPMENT**
 - **TRANSPORTER DESIGN**
 - **INTERMODAL TRANSFER EQUIPMENT**
- **OVERALL SYSTEM ASSESSMENT**
- **INPUT FOR FINAL DESIGN PERFORMANCE EVALUATION
AND FLEET PROCUREMENT**
- **OPERATIONAL TESTING**

CARRIAGE SUBSYSTEM TRANSPORTER COORDINATION

- **TARGET WEIGHTS FOR CASK, TRAILER, AND TRACTOR**
54,000 LB- CASK (INCLUDING PAYLOAD AND IMPACT LIMITERS)
9,000 LB - TRAILER (INCLUDING TIEDOWN AND PERSONNEL BARRIER)
16,000 LB- TRACTOR (WET AND ROAD READY)
- **DEVELOPED PRELIMINARY TRACTOR PERFORMANCE CRITERIA AND WEIGHT**
- **TRADE-OFF STUDIES ON SYSTEM PERFORMANCE VERSUS WEIGHT LIMITS**
- **DEMONSTRATE SYSTEM USING DUMMY CASK, PROTOTYPE TRAILER, AND PROTOTYPE TRACTOR**

MANUFACTURER SPECIFIED BASE TRACTOR

**CAB OVER ENGINE
180" WHEEL BASE
CUMMINS 400
FULLER 12609
TRANSMISSION
46" SLEEPER
AIR SUSPENSION
ALUMINUM WHEELS
POWER STEERING
AIR CONDITIONING
ABS**

**100 GALLON FUEL TANK
– ALUMINUM
ALUMINUM BELL HOUSING
ALUMINUM REAR AXLE
CARRIER
SLIDING FIFTH WHEEL WITH
SAVING OPTION
AIR SEATS – DRIVER AND
PASSENGER
15-1/2" CERAMIC CLUTCH
DELUXE INTERIOR**

Weight – Approximately 14,500 lbs (dry)

TRACTOR WEIGHT BREAKDOWN ROAD READY

	ESTIMATED WEIGHT (LBS.)
BASE TRUCK - MINIMUM ESSENTIAL FEATURES DRY	14,500
FUEL (100 GALLONS)	700
OUTFITTING (DRIVERS, GEAR, TOOLS, ETC.)	1,000
60" SLEEPER	300
EXTRA FUEL TANK	100
206" WHEEL BASE	200
1-1/2 PERCENT VARIANCE	250
	<u>17,050</u>
ALLOWANCE FOR SNOW AND ICE BUILDUP	<u>300</u>
	17,350

SYSTEM FEATURES AND WEIGHT SAVING OPTIONS FOR TRADEOFF STUDIES

TRACTOR WEIGHT SAVINGS OPTIONS

**SMALL BLOCK ENGINE
MIDSIZE SLEEPER
FIXED FIFTH WHEEL
180" WHEEL BASE
ONE FUEL TANK**

PROCEDURAL OPTIONS

**NO ALLOWANCE FOR ICE BUILDUP
NO CHAINS**

OTHERS

**SINGLE DRIVER SCENARIOS
INTEGRATED (TRACTOR-TRAILER) TRANSPORTER**