

# TMO

## Technology Management Optimization

### Highlights

#### What does TMO Enable?

TMO aids in optimal technology management (TM) planning for high-valued, long-lived, technologically sophisticated systems. TM is the process by which the maintenance, replacement, and/or upgrade of a technology is executed. Planning such operations in advance can help ensure that a proper number of mitigation alternatives are considered and can save time and money while improving overall system performance. In addition to TM, TMO can be used to address decision support problems and system-level trade studies involving the selection from among multiple choices to achieve optimal outcomes.

#### Why is TMO Important?

- Creates optimal technology roadmaps:
  - Specifies the best course of action
- Handles extremely large problems
- Provides defensible justification for decisions

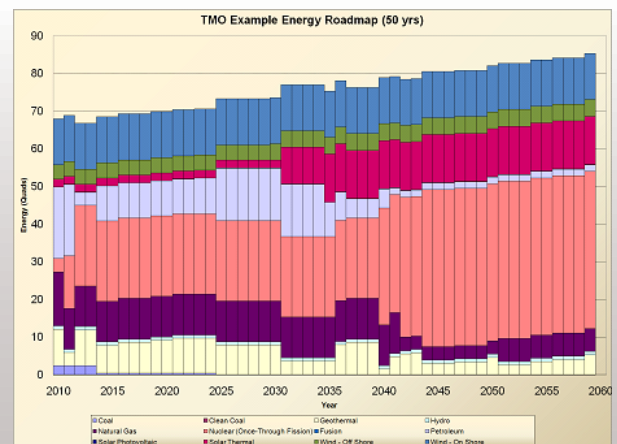
#### Example Applications

- Technology management and system-level trade studies:
  - Military platforms
  - Energy installations
  - Security systems
- Optimal design:
  - Power generation and distribution systems
- Decision support:
  - Optimal investment strategy
  - Informed policy decisions



### TMO Overview

TMO is an application that builds optimal roadmaps specifying what technologies should be in use and when they should be in use. TMO was developed to allow proactive maintenance and update of technologies for high-valued, long-lived, technologically sophisticated systems. With TMO, all components can be considered as a system and their lifecycles can be evaluated based on user-defined system metrics. For instance, cost, weight, and performance can be considered together in developing the best technology management plan for the entire system. TMO has proven flexible enough to address trade studies and decision problems. Because TMO runs quickly, it provides rapid, quantitative consideration of “what ifs.” Thus, TMO can be used to plan contingencies—what if the budget changes? What if the power requirement changes? In this manner, TMO can help reach the best plan forward, with defensible results.



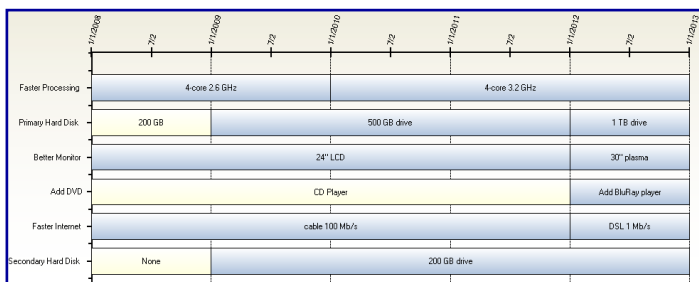
**TMO energy-planning roadmap:**  
Left axis is the amount of energy (in Quads),  
Lower axis is years.

# TMO

## Key Features

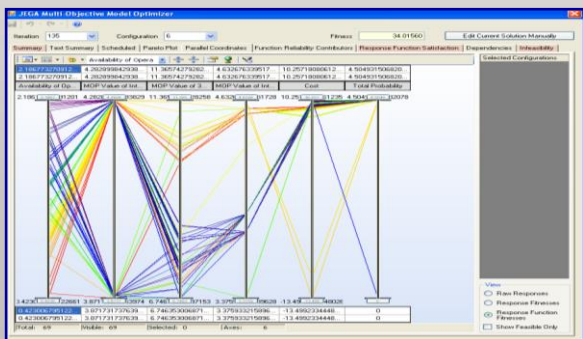
### TMO Builds Optimal Roadmaps

- Optimizes over time
- Considers user-defined, time-based objectives and constraints, including reliability measures
- Considers dependencies between alternatives:
  - Requires (A requires B)
  - Obviates (A obviates B)
- Considers schedule risk
- Incorporates both a DLL interface and an XML interface for linking to external models



## Features

- Graphical user interface
- Performs both single and multi-objective optimization
- Advanced visualization of results:
  - Satisfaction of objectives, constraints, dependencies
  - Pareto plot (right)
  - Parallel-axed plot (below)



## Key Benefits

### Problem Structure

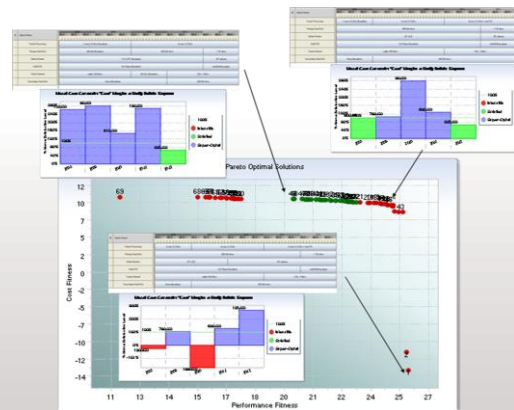
- Provides the framework for rigorous decomposition of the problem
- Step-by-step data entry

### Professional Quality

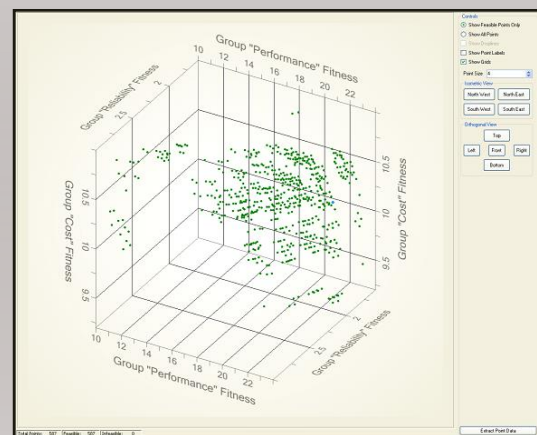
- Fast run time
- Handles large problems—a virtually unlimited number of objectives and constraints and technology alternatives

### Defensible Decisions

- Allows use of both qualitative and quantitative data
- Provides mathematically traceable results
- Multi-objective optimization allows decision makers the opportunity to examine the differences between the non-dominated optimal solutions



**TMO multi-objective optimization results showing the Pareto frontier. Blue dots indicate fully feasible solutions, red dots indicate partially infeasible.**



**Contact Us**  
**Bruce Thompson**  
 CSR Program Lead, Manager  
 Tel: (505) 284-4949  
 bmthomp@sandia.gov