



Maximization of
Maintenance and Construction
Budget for United States Navy
Bureau of Medicine and Surgery (BUMED)

ENCE 667 Project Presentation

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US Navy BUMED Budget Maximization

- Branch of Department of Defense Health Affairs
- Provides Healthcare to:
 - 700,000 Active Duty Navy & USMC service members and their families
 - 2.6 Million Retired service members and their families



US Navy BUMED Budget Maximization

- Headquarters Facilities Management and Plans (MED 33)

– Responsible for all BUMED Facilities including:

- Design
- Construction
- Maintenance
- Planning
- Programming





US Navy BUMED Budget Maximization

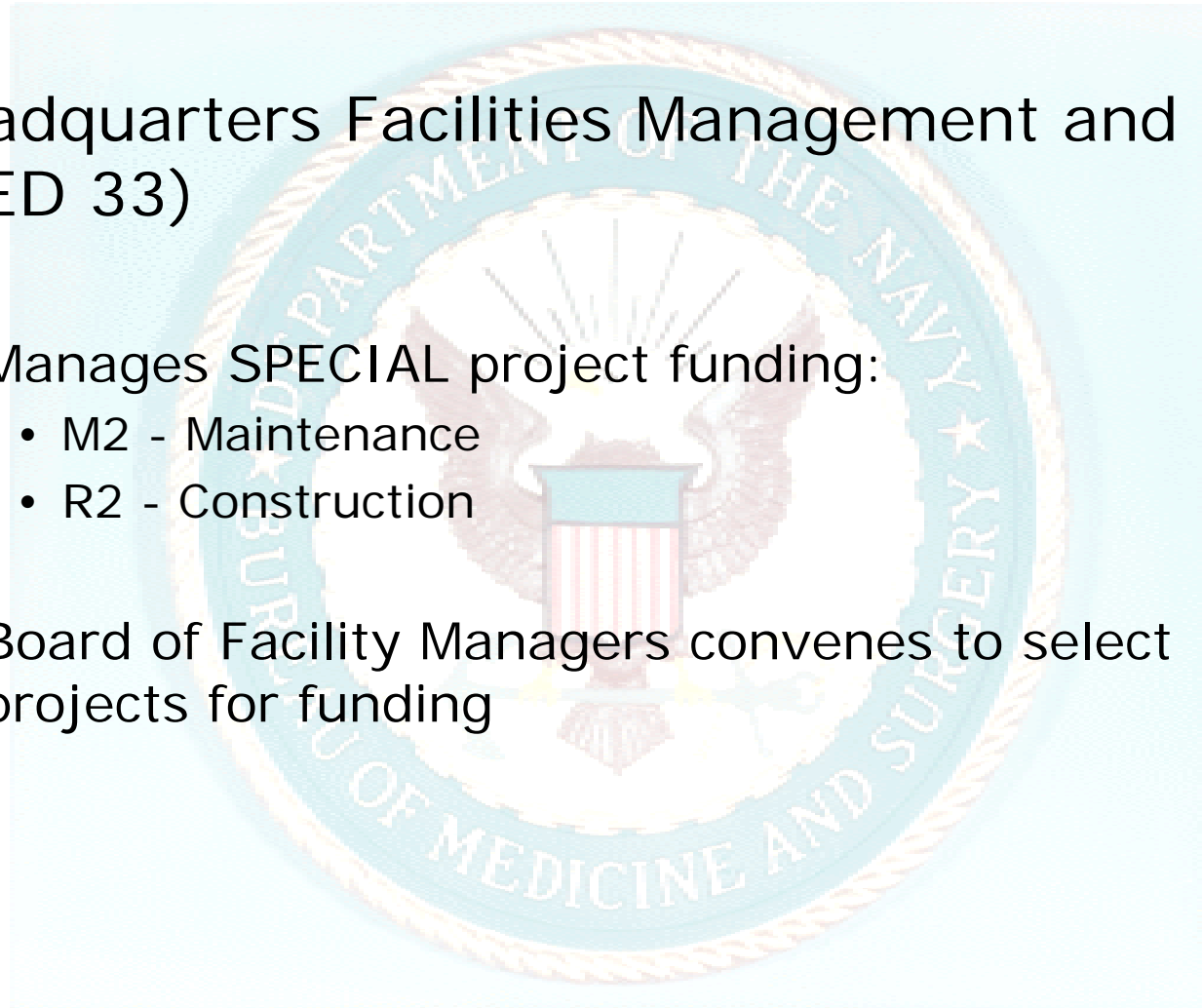
- Headquarters Facilities Management and Plans (MED 33)
 - Facilities consist of:
 - Naval Medical Centers
 - Naval Hospitals
 - Naval Medical Clinics
 - Naval Dental Clinics
 - Each Facility must have funds to perform:
 - General Maintenance (M1 Funds)
 - General Construction (R1 Funds)
 - Funds are managed at the Local Level





US Navy BUMED Budget Maximization

- Headquarters Facilities Management and Plans (MED 33)
 - Manages SPECIAL project funding:
 - M2 - Maintenance
 - R2 - Construction
 - Board of Facility Managers convenes to select projects for funding





US Navy BUMED Budget Maximization

– Project information includes:

- Description of project
- Costs
- Reasoning
- Urgency
- Category
 - Life Safety
 - Quality of Life
 - Mission
 - Deferrable

– Votes are Cast to prioritize and determine funding

ENCE 667 Applications

- Course Learned Techniques used in this project:
 - Integer programming
 - Goal programming
 - Holt's method
 - Exponential smoothing method

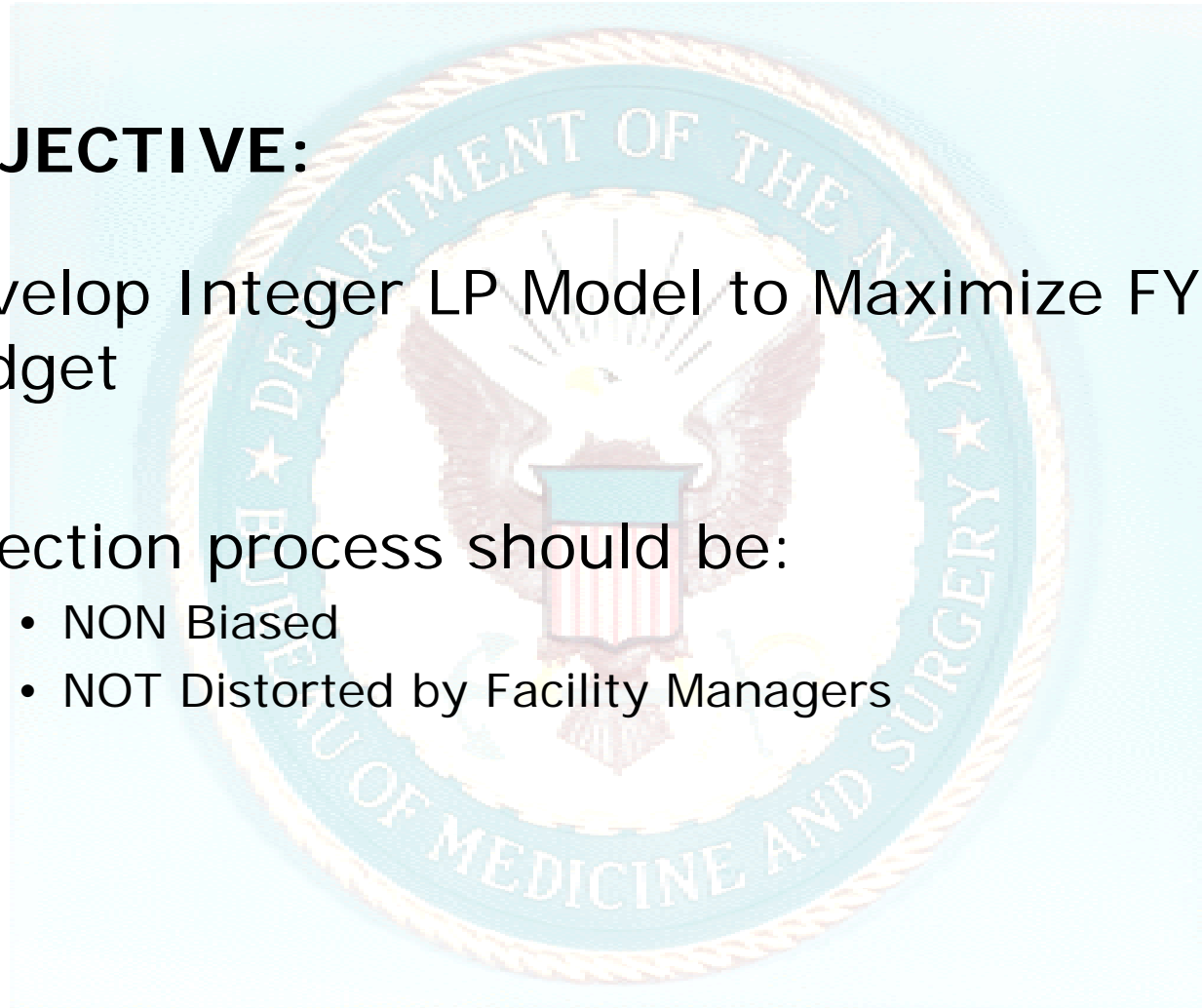


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US Navy BUMED Budget Maximization

- **OBJECTIVE:**
- Develop Integer LP Model to Maximize FY Budget
- Selection process should be:
 - NON Biased
 - NOT Distorted by Facility Managers





US Navy BUMED Budget Maximization

- **Subject To:**

- Automatically funding previously flagged projects
- Funding projects categorized by the following:
 - M2 or R2
 - Life Safety, Mission, Quality of Life, Deferrable
 - Age of facility (<20 or >20)
 - Size of facility
 - Naval Clinics = Small
 - Naval Hospitals = Medium
 - Naval Medical Centers = Large



US Navy BUMED Budget Maximization

- Develop Integer LP Model to Maximize FY Budget

- Let X_i = proposed projects for the current FY, where i = total number of projects
- Let C_i = programmed cost associated with each project

Maximize $C_1X_1 + C_2X_2 + C_3X_3 + \dots + C_nX_n$

Subject to:

$C_1X_1 + C_2X_2 + C_3X_3 + \dots + C_nX_n \leq$ **Budget** - flagged proj.

Constraints for M2, R2, QOL, M, LS, D, Age; based on following ex:

Total of all M2 projects funded for the current FY \leq % of M2 projects
Total of all current FY projects funded previously funded +10%

Total of all M2 projects funded for the current FY \geq % of M2 projects
Total of all current FY projects funded previously funded - 10%



US Navy BUMED Budget Maximization

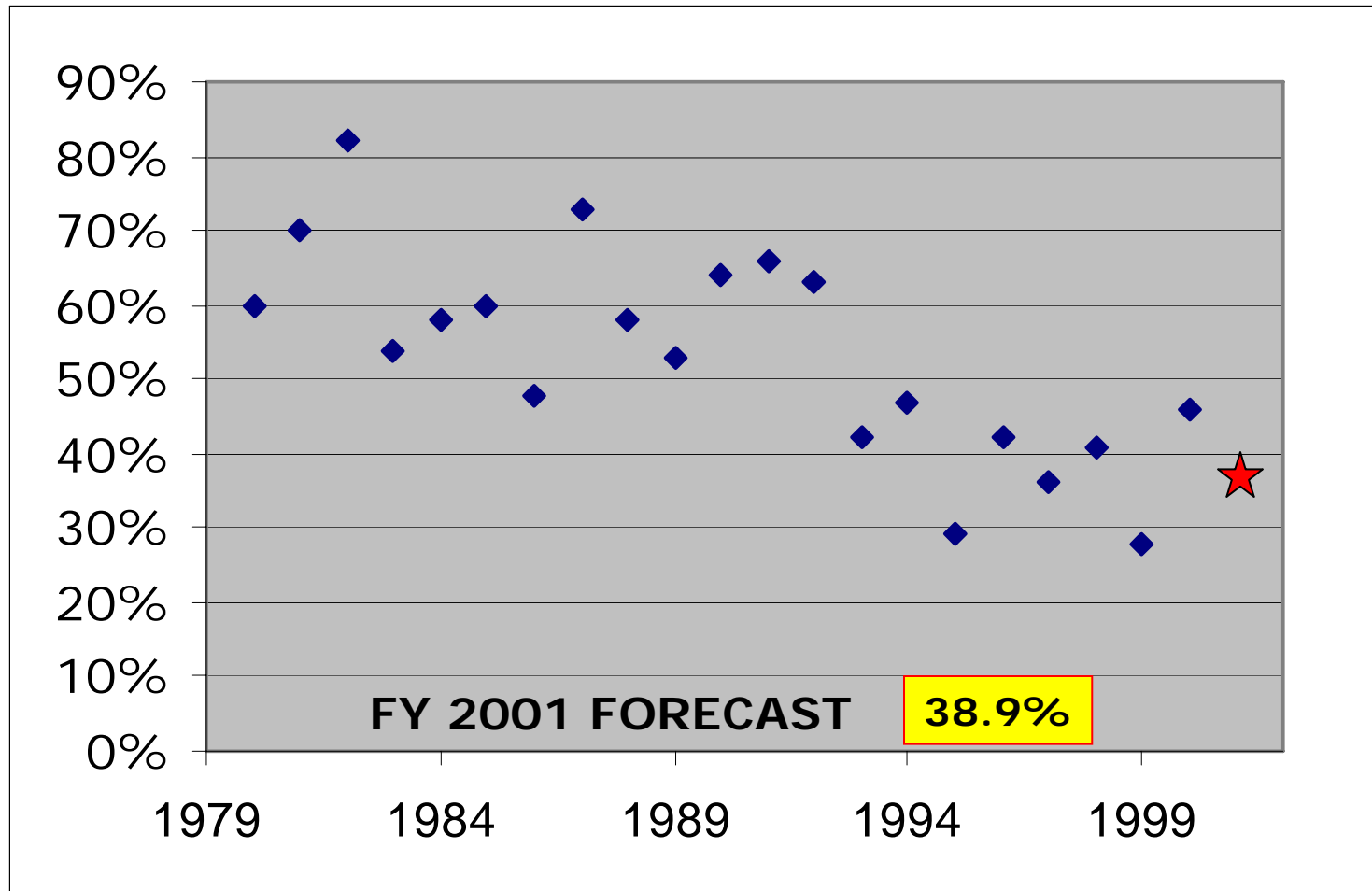
- Constraint Forecasting
 - BUMED has no idea of percentage amounts
 - Percentages forecasted with historical data
 - Plotted the percentages for years 1980-2000
 - Analyzed the plots to determine appropriate forecasting technique.
 - Holt's Method – Linear Trends
 - M2, R2, Life Safety, Mission, Deferrable, <20, and >20
 - Exponential Smoothing – No apparent trends
 - Quality of Life, Small, Medium, Large



M2 PROJECTS

Data

1980	0.600
1981	0.700
1982	0.820
1983	0.540
1984	0.580
1985	0.600
1986	0.480
1987	0.730
1988	0.580
1989	0.530
1990	0.640
1991	0.660
1992	0.630
1993	0.420
1994	0.470
1995	0.290
1996	0.420
1997	0.360
1998	0.410
1999	0.280
2000	0.460
2001	0.389



$\alpha =$	0.3
$\beta =$	0.1

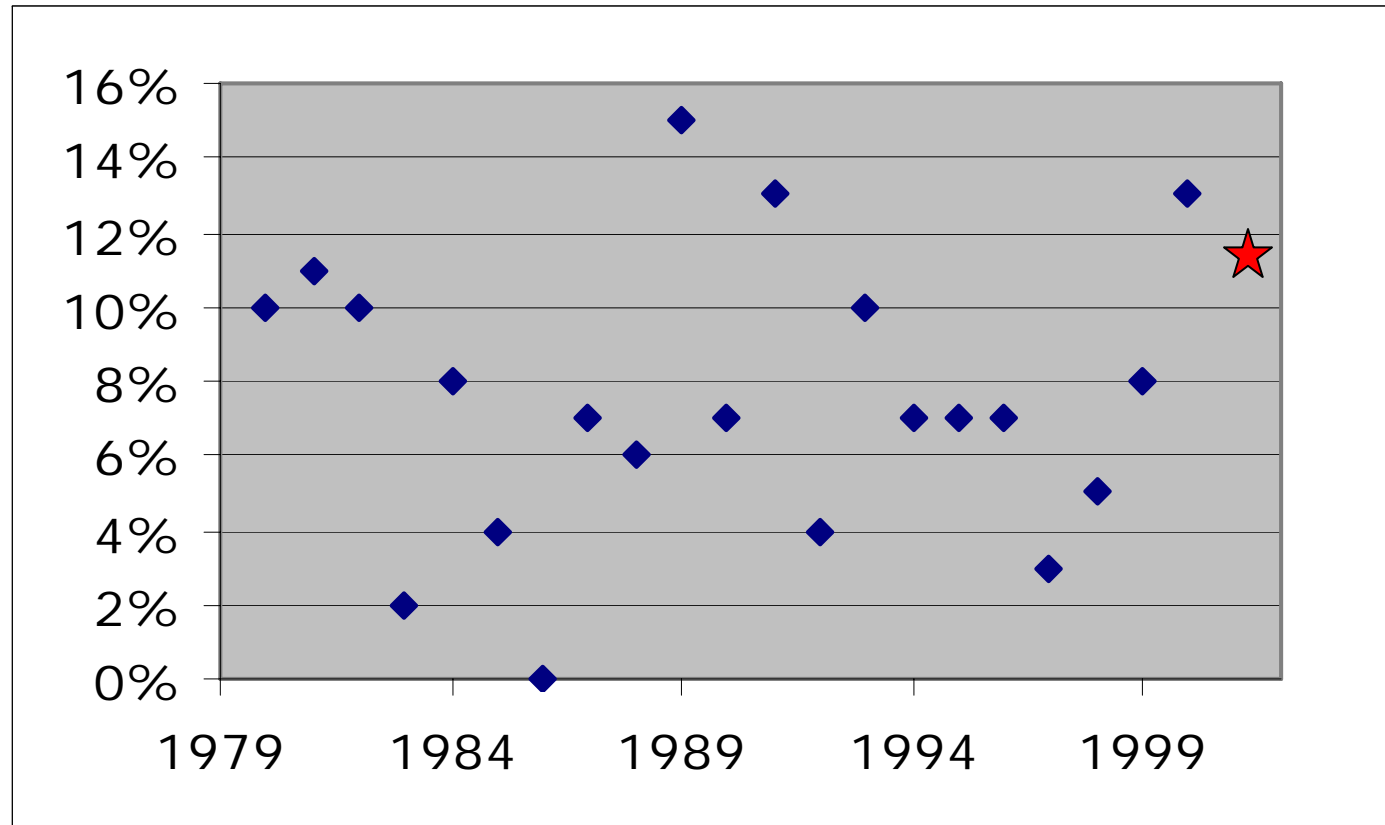
HOLT'S Method



Data

1980	0.100
1981	0.110
1982	0.100
1983	0.020
1984	0.080
1985	0.040
1986	0.000
1987	0.070
1988	0.060
1989	0.150
1990	0.070
1991	0.130
1992	0.040
1993	0.100
1994	0.070
1995	0.070
1996	0.070
1997	0.030
1998	0.050
1999	0.080
2000	0.130
2001	0.115

QUALITY OF LIFE



$\alpha =$ 0.3

FY 2001 FORECAST

11.5%

Exponential Smoothing Method



US Navy BUMED Budget Maximization

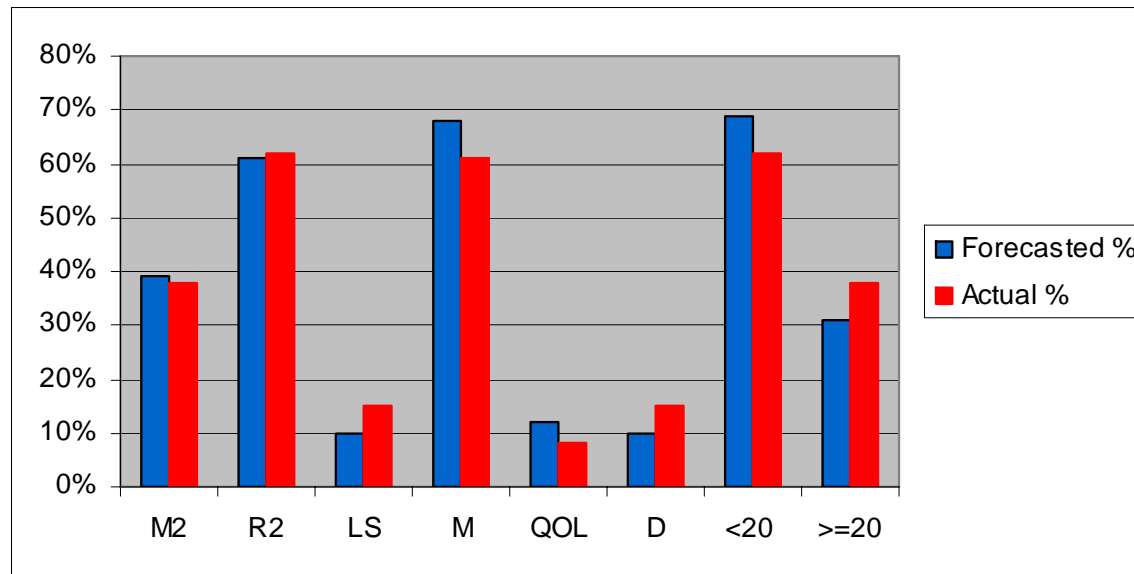
PROJ.N UM	MODEL SELECT	FUNDED BY BUMED	ACTIVITY	SIZE	TITLE	PROJECTED COST (000)	MODEL SELECT FUNDS (000)
X1		X	NNMC BETH	3	REPAIR PARKING GARAGE	1957	
X2		X	NH GLAKES	2	DUCT CLEANING	595	
X3	X	X	NMC SDIEGO	3	INSTALL ELEVATOR	335	335
X4		X	NMC PTSMH	3	INSULATE DUCTS	205	
X5		X	NH BFT	2	REPAIR MEDICAL GAS SYSTEM	297	
X6		X	NH OKI	2	REPAIR/ALTER EMERGENCY ROOM	452	
X7		X	NH GLAKES	2	ROOF REPAIRS	621	
X8		X	NH GUAM	2	RELOCATE PHYSICAL THERAPY AND MED LIBRARY	679	
X9		X	NH GUAM	2	RELOC PEDIATRIC CLINIC	1126	
X10	X	X	NH JAX	2	RENOVATE B2004	1600	1600
X11	X	X	NH CORPUS	2	FACILITY ENERGY IMPROVEMENT	852	852
X12		X	NDC NORTHEAST	1	REPAIRS TO BDC NEW LONDON	700	
X13	X		NH OKI	2	REPLACE HVAC	2447	2447
X14			NACC GROTN	1	REPAIR LIFE SAFETY	5116	
X15	X		NMC SDIEGO	3	REPAIR MOR AHU	347	347
X16			NMC PTSMH	3	REPAIR STREET GATE INTERSECTION	250	
X17			NMC PTSMH	3	INSTALL DCC CONTROLS	276	
X18			NNMC BETH	3	MILITARY FAMILY HEALTH REHAB	800	
X19	X		NMC SDIEGO	3	RELOCATE PICU TO WARD 2N	120	120
X20			NMC SDIEGO	3	REPLACE HVAC COIL BANKS	354	
X21			NNMC BETH	3	REPAIR CART LIFTS	322	
X22			NNMC BETH	3	OB-GYN CLINIC	800	
X23	X		NMC SDIEGO	3	REPLACE FIRE DOORS	200	200
X24			NH GLAKES	2	REPAIRS TO ELECTRICAL	3043	
X25	X		NNMC BETH	3	BQ REPAIRS	1300	1300
X26			NH GLAKES	2	REPAIR UPGRADE DISTRIBUTION FEEDERS	2035	
X27	X		NMC PTSMH	3	INSTALL AIR CONDITIONING	200	200
X28	X		NMC PTSMH	3	MALE HEAD RENOVATIONS	135	135
X29			NMC SDIEGO	3	REPLACE HVAC COIL BANKS	413	
X30			NMC PTSMH	3	RESTROOM REPAIRS BMCL BOONE	324	
X31			NMC PTSMH	3	WALKING PARTH	108	
X32			NH GLAKES	2	REPAIR SAMPSON STREET BRIDGE	287	
X33			NMC SDIEGO	3	REPLACE AIR HANDLERS	158	
X34			NH BFT	2	LIFE SAFETY IMPROVEMENTS	238	
X35	X		NMC SDIEGO	3	REPLACE INT/EXT SIGNAGE	1680	1680
X36	X		NMC SDIEGO	3	INSTALL STAIRS	123	123
X37			NMCL ANNA	1	REPLACE PIPING ASBESTOS	791	
X38			NMC SDIEGO	3	REPLACE SEISMIC JOINT COVERS	100	
X39	X		NMC SDIEGO	3	RETRO FIT LIGHTING POINT LOMA	80	80
X40			NMC PTSMH	3	RESEAL PARKING GARAGE DECKS	320	

**FY 2001
Projects**



US Navy BUMED Budget Maximization

Category	Number of Projects	Forecasted Percentage (%)	Actual (%)
M2	5	39	38
R2	8	61	62
LS	2	10	15
M	8	68	61
QOL	1	12	8
D	2	10	15
<20 Years	8	69	62
>20 Years	5	31	38





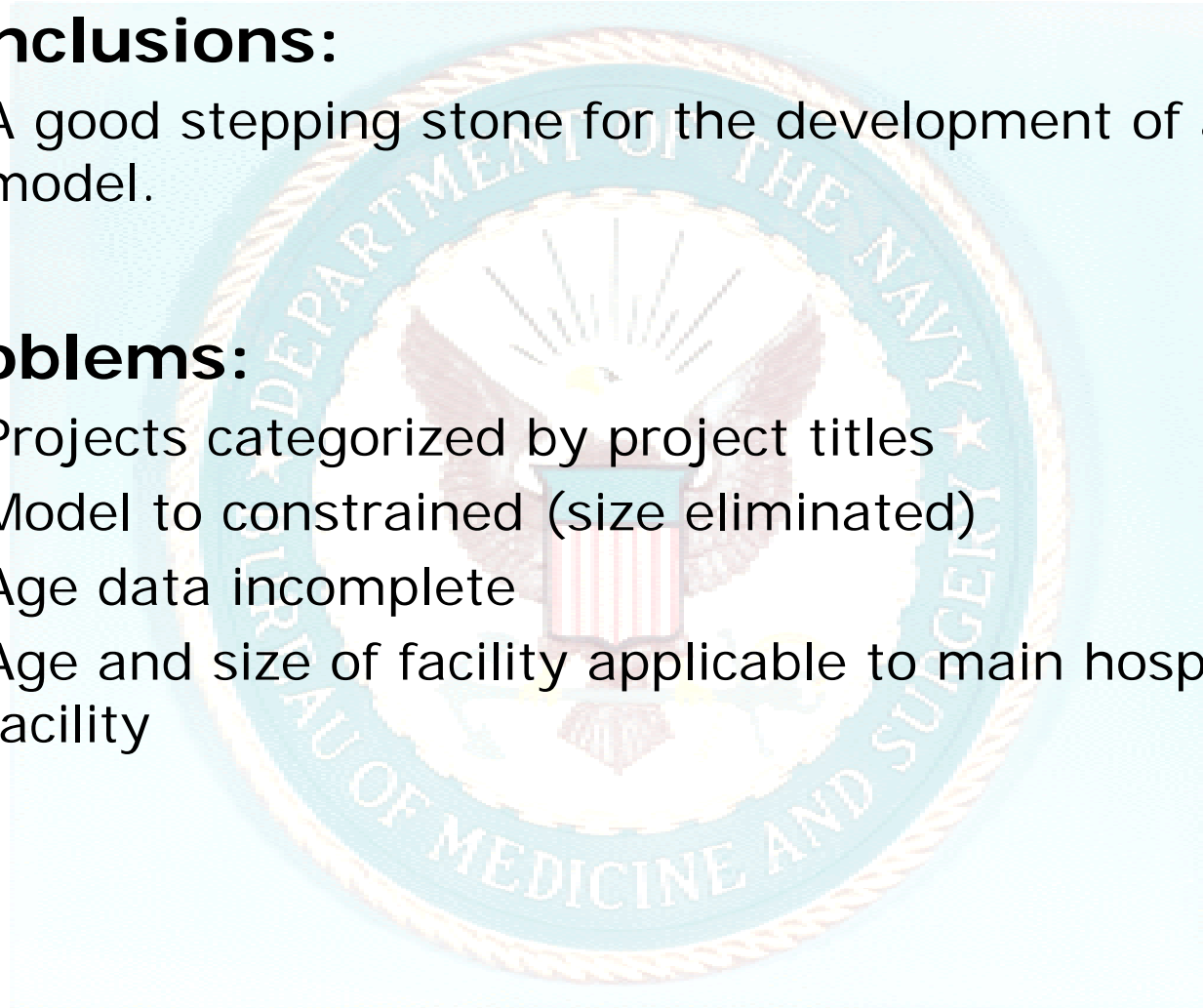
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- **Conclusions:**

- A good stepping stone for the development of a good model.

- **Problems:**

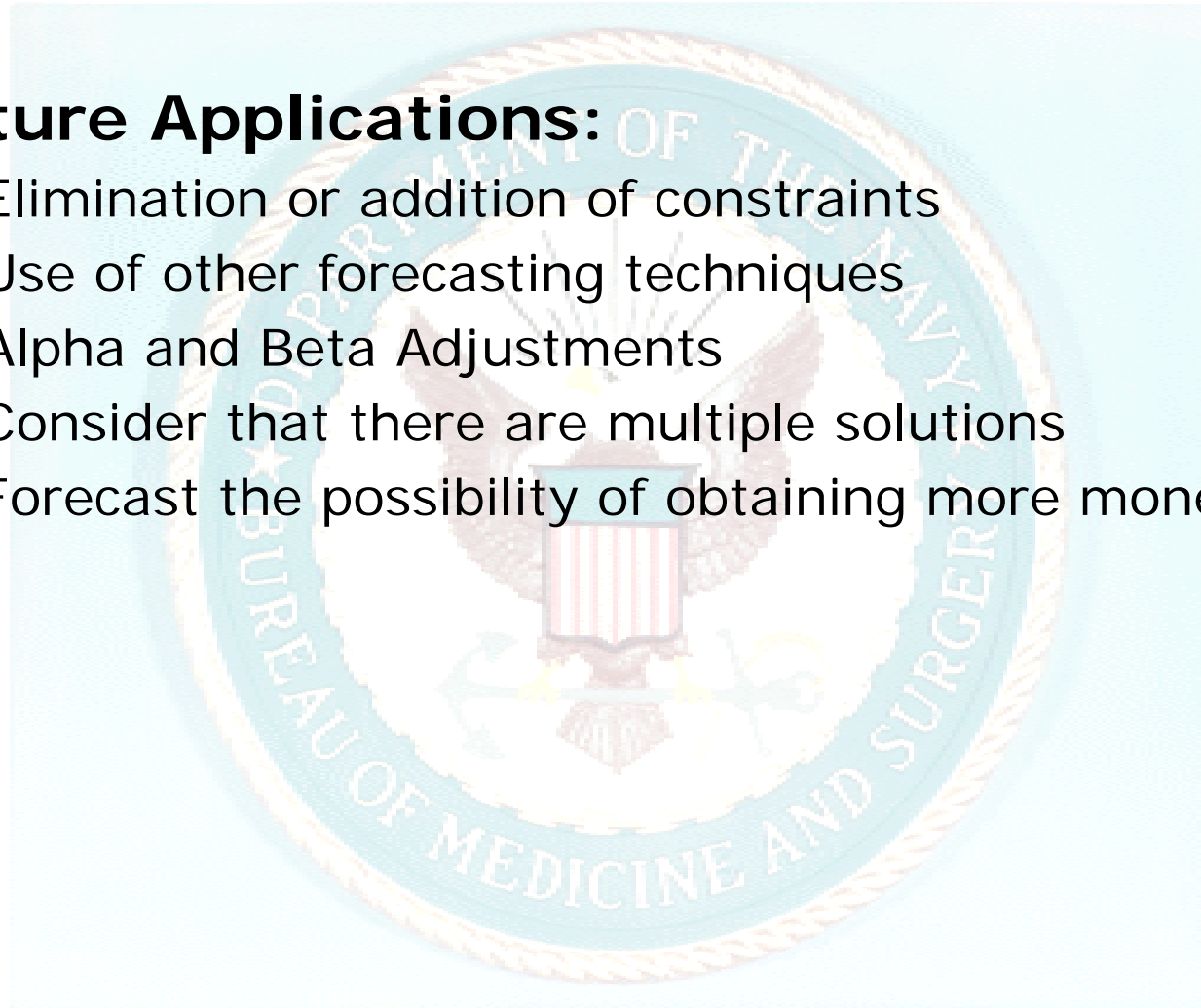
- Projects categorized by project titles
- Model to constrained (size eliminated)
- Age data incomplete
- Age and size of facility applicable to main hospital facility





US Navy BUMED Budget Maximization

- **Future Applications:**
 - Elimination or addition of constraints
 - Use of other forecasting techniques
 - Alpha and Beta Adjustments
 - Consider that there are multiple solutions
 - Forecast the possibility of obtaining more money





US Navy BUMED Budget Maximization



Any Questions ?