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Decision model for forecasting projected Naval Enlisted Reserve attainments

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NAVAL POSTGRADUATE SCHOOL

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MBA PROFESSIONAL REPORT

Decision Model for Forecasting Projected Naval Enlisted Reserve Attainments

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December 2008

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13. ABSTRACT (maximum 200 words)

The intent of this MBA Project is to forecast naval enlisted reserve attainments for a given fiscal year, so Commander, Navy Recruiting Command (CNRC) can adequately establish goals. Forecasting is based on historical data from various sources. Three levels of data are examined. These levels include CNRC data broken down by total yearly accessions, CNRC data sorted by accessions and ratings, and Defense Manpower Data Center (DMDC) data sorted by accession source (Naval Veteran, Other Service Veteran, Non-Prior Service) and ratings.

We compare all three sets of data to each other as well as previous research to ensure that data is accurate and to try to determine if there are trends. We use moving average, weighted moving average, and exponential smoothing on all data to determine which method is best in forecasting future attainments. In addition, a regression model is developed for the CNRC yearly accession data and compared to the other models to determine if it is a better forecasting model.

We use DMDC data to try and determine where specific reserve attainments are coming from and forecast future attainments. We use this model to forecast the possibility of a Naval Veteran (NAVET) or Non-Prior Service (NPS) individual in joining the Naval Reserve and use this data to help Navy Recruiting Command establish more accurate reserve recruiting goals.

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DECISION MODEL FOR FORECASTING PROJECTED NAVAL ENLISTED RESERVE ATTAINMENTS

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Submitted in partial fulfillment of the requirements for the degree of

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DECISION MODEL FOR FORECASTING PROJECTED NAVAL ENLISTED RESERVE ATTAINMENTS

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The intent of this MBA Project is to forecast naval enlisted reserve attainments for a given fiscal year, so Commander, Navy Recruiting Command (CNRC) can adequately establish goals. Forecasting is based on historical data from various sources. Three levels of data are examined. These levels include CNRC data broken down by total yearly accessions, CNRC data sorted by accessions and ratings, and Defense Manpower Data Center (DMDC) data sorted by accession source (Naval Veteran, Other Service Veteran, Non-Prior Service) and ratings.

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LIST OF ABBREVIATIONS AND ACRONYMS

ABE	Aviation Boatwain's Mate - Equipment
ABF	Aviation Boatwain's Mate - Fuels
ABH	Aviation Boatwain's Mate - Handling
AC	Air Traffic Controller
AD	Aviation Machinist's Mate
AE	Aviation Electrician's Mate
AFSC	Air Force Specialty Code
AG	Aerographer’s Mate
AM	Aviation Structural Mechanic
AME	Aviation Structural Mechanic - Equipment
AN	Airman
AO	Aviation Ordnanceman
AS	Aviation Support Equipment Technician
AT	Aviation Electronics Technician
AV	Avionics Technician
AW	Aviation Warfare Systems Operator
AZ	Aviation Maintenance Administration
BM	Boatswain's Mate
BU	Builder
CBO	Congressional Budget Office
CE	Construction Electrician
CNRC	Commander, Navy Recruiting Command
CM	Construction Mechanic
CS	Culinary Specialist
CTA	Cryptologic Technician - Administrative
CTI	Cryptologic Technician - Interpretive
CTM	Cryptologic Technician - Maintenance
CTO	Cryptologic Technician - Communications
CTR	Cryptologic Technician - Collective
CTT	Cryptologic Technician - Technical
DC	Damage Controlman
DK	Disbursing Clerk
DMDC	Defense Manpower Data Center
DoD	Department of Defense
DPEP	Direct Procurement Enlistment Program
DT	Dental Technician
EA	Engineering Aid
EM	Electrician's Mate
EN	Engineman
EO	Equipment Operator
ES	Exponential Smoothing

ET	Electronics Technician
FC	Fire Controlman
FN	Fireman
FTS	Full Time Support
FYDP	Future Years Defense Program
GM	Gunner's Mate
GSE	Gas Turbine Systems Technician - Electrical
GSM	Gas Turbine Systems Technician - Mechanical
GWOT	Global War on Terror
HM	Hospital Corpsman
HT	Hull Maintenance Technician
IA	Individual Augmentation
IADT	Initial Active Duty for Training
IC	Interior Communications Electrician
IDT	Inactive Duty Training
IRR	Individual Ready Reserve
IS	Intelligence Specialist
IT	Information Systems Technician
JO	Journalist
LCDR	Lieutenant Commander
LI	Lithographer
LN	Legalman
MA	Moving Average
MA	Master-at-Arms
MAD	Mean Absolute Deviation
MAPE	Mean Absolute Percent Error
MM	Machinist's Mate
MN	Mineman
MOS	Military Occupational Specialty
MR	Machinery Repairman
MSE	Mean Squared Error
MSO	Military Service Obligation
MT	Missile Technician
NAT	New Accession Training Program
NAVET	Naval Veteran
NC	Navy Counselor
NOSC	Navy Operational Support Center
NPS	Non-Prior Service
OSVET	Other Service Veteran
PC	Postal Clerk
PH	Photographer's Mate
PN	Personnelman
PR	Polynomial Regression
PR	Aircrew Survival Equipmentman
PS	Prior Service

QM	Quartermaster
RESCORE	Recruiting Selective Conversion and Reenlistment Program
RP	Religious Program Specialist
SELRES	Selected Reserve
SH	Ship's Serviceman
SK	Storekeeper
STG	Sonar Technician - Surface
SW	Steelworker
TM	Torpedoman's Mate
USAR	United States Army Reserve
UT	Utilitiesman
WMA	Weighted Moving Average
YN	Yeoman

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EXECUTIVE SUMMARY

Several events, including the consolidation of active and reserve recruiting and the Global War on Terror (GWOT), have affected the rate at which the United States Navy Reserve recruits enlisted service members. Because of these events, it has become difficult for CNRC to accurately forecast its recruiting requirements. According to Lieutenant Commander (LCDR) Fink at CNRC, the navy recruiting function does not currently have an accurate way of forecasting reserve enlisted attainments.

This thesis describes the different techniques that can be utilized to forecast attainments for the enlisted Navy Reserve including moving average (MA), weighted moving average (WMA), exponential smoothing (ES), and polynomial regression (PR). We make different forecasts based on these techniques and the data we received. Additionally, we discuss studies that have been done on recruiting, including trends and the reasons why recruiting may be having difficulties.

Finally, we discuss problems with data collection in the Department of Defense (DoD) including DMDC. DMDC maintains the largest repository of personnel and financial data in the defense department and receives their gain and loss reports directly from all military services. However, there are very large discrepancies between what CNRC and DMDC reports for yearly naval reserve accessions. Forecasting is critical in establishing realistic goals for CNRC and districts. With the methods we discuss in this report, plus more accurate, detailed data, we believe CNRC will have the analytical foundation for establishing better recruiting goals.

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I. INTRODUCTION

A. BACKGROUND

The mission of the Navy Reserve is to provide capable units and individuals to the Navy's active duty component for operations during both peacetime and war. The Navy Reserve represents 20 percent of the Navy's total personnel strength. The Navy Reserve Force consists of the Ready Reserve, the Standby Reserve, and the Retired Reserve. Currently, there are approximately 700,000 men and women in the Navy Reserve Force.

1. Ready Reserve

The Ready Reserve is composed of the Selected Reserve Forces and the Individual Ready Reserve.

a. Selected Reserve Forces

The Selected Reserve (SELRES) is the Navy's primary source of immediate mobilization manpower. The SELRES are paid either as weekend drillers or who serve as Full Time Support (FTS) on active duty status in the training and administration of the Navy Reserve Force program. Drilling reservist commitment requires service of one weekend per month plus an additional two weeks of training during the year. This schedule is flexible depending on individual member commitments. This thesis focuses on drilling reservists.

b. Individual Ready Reserve

Limitation of available pay billets, absence of drilling units within a reasonable commuting distance, and conflicting employment prevent some Reservists from participating in the Selected Reserve. The Individual Ready Reserve (IRR) consists of those members of the Ready Reserve who are not in the Selected Reserve. IRR members are in a non-paid status.

2. Standby Reserve

The Standby Reserve consists of individuals who have transferred from the Ready Reserve after fulfilling specific requirements established by law.

3. Retired Reserve

The Retired Reserve consists of Reservists who are drawing retired pay or are qualified for retired pay upon reaching the age of 60.

B. NAVY SAILOR CHARACTERIZATION

1. Navy Reserve Service Characterization

Sailors joining the Navy Reserve are characterized as prior service (PS) or non-prior service (NPS). To join the Navy Reserve, an individual must be "accessed" into the Reserve. Accession means that the end-strength of the Navy Reserve is increased by adding a new individual to the Navy Reserve.

2. Navy Reserve Rate and Pay Grade

An individual can join the Navy Reserve as either an officer or an enlisted member. To be an officer in the Navy Reserve, one must have a college degree. To be enlisted, one must have at least a high school diploma. This thesis focuses specifically on enlisted drilling reservists.

Pay grades for enlisted Navy Reserve personnel are the same as their active component counterparts. These are illustrated in Table 1.

Table 1. Navy Enlisted Rates and Pay Grades

Rate	Pay Grade
Seaman Recruit	E-1
Seaman Apprentice	E-2
Seaman	E-3
Petty Officer Third Class	E-4
Petty Officer Second Class	E-5
Petty Officer First Class	E-6
Chief Petty Officer	E-7
Senior Chief Petty Officer	E-8
Master Chief Petty Officer	E-9

Source: From www.navy.mil's "Rate Insignia of Navy Enlisted Personnel," 2008

3. Enlisted Rating Categories

Each sailor within the Navy Reserve has a specific job, or rating (the Navy's term for job is rating). The Navy Reserve has grouped similar ratings into 14 different categories. Table 2 lists these 14 categories along with the ratings included in each category.

Table 2. Enlisted Rating Categories

Category	Rating	
Arts and Photography	Journalist (JO)	Photographer's Mate (PH)
	Lithographer (LI)	
Aviation	Aerographer's Mate (AG)	Aviation Electronics Technician (AT)
	Airman (AN)	Aviation Boatwain's Mate - Equipment (ABE)
	Aviation Ordnanceman (AO)	Aviation Boatwain's Mate - Fuels (ABF)
	Aviation Machinist's Mate (AD)	Aviation Maintenance Administration (AZ)
	Aviation Structural Mechanic (AM)	Aviation Boatwain's Mate - Handling (ABH)
	Aviation Electrician's Mate (AE)	Aviation Support Equipment Technician (AS)
	Air Traffic Controller (AC)	Aviation Structural Mechanic - Equipment (AME)
	Aircrew Survival Equipmentman (PR)	Aviation Warfare Systems Operator (AW)
	Avionics Technician (AV)	
Business Management	Disbursing Clerk (DK)	Ship's Serviceman (SH)
	Storekeeper (SK)	
Computers, Electronics, and Information Technology	Electrician's Mate (EM)	Electronics Technician (ET)
	Sonar Technician - Surface (STG)	Information Systems Technician (IT)
	Missile Technician (MT)	Interior Communications Electrician (IC)
	Fire Controlman (FC)	Gas Turbine Systems Technician - Electrical (GSE)
Construction and Building	Builder (BU)	Construction Electrician (CE)
	Construction Mechanic (CM)	Equipment Operator (EO)
	Engineering Aid (EA)	Steelworker (SW)
	Utilitiesman (UT)	
Emergency, Fire, and Rescue Engineering, Mechanical, and Industrial	Damage Controlman (DC)	Fireman (FN)
	Boatswain's Mate (BM)	Engineering Aid (EA)
	Engineman (EN)	Gas Turbine Systems Technician - Mechanical (GSM)
	Gunner's Mate (GM)	Hull Maintenance Technician (HT)
	Machinery Repairman (MR)	Machinist's Mate (MM)
	Mineman (MN)	Torpedoman's Mate (TM)
Food, Restaurant, and Lodging	Culinary Specialist (CS)	
Human Resources	Navy Counselor (NC)	Personnelman (PN)
Intelligence and Communications	Cryptologic Technician - Collective (CTR)	Cryptologic Technician - Communications (CTO)
	Cryptologic Technician - Interpretive (CTI)	Cryptologic Technician - Maintenance (CTM)
	Cryptologic Technician - Technical (CTT)	Cryptologic Technician - Administrative (CTA)
	Intelligence Specialist (IS)	
Legal, Law Enforcement, and Security	Legalman (LN)	Master-at-Arms (MA)
Medical and Dental	Dental Technician (DT)	Hospital Corpsman (HM)
Office and Administrative Support	Disbursing Clerk (DK)	Postal Clerk (PC)
	Quartermaster (QM)	Yeoman (YN)
Religion	Religious Program Specialist (RP)	

Source: From www.navyreserve.com's "Enlisted Opportunities," 2008

C. DMDC

DMDC is responsible for collecting and maintaining an archive of automated manpower, personnel, training, and financial databases. They also operate personnel programs and conduct research and analysis. DMDC maintains the largest repository of personnel and financial data in the defense department. According to Colin Rogers, a civilian employee with DMDC, gain and loss reports received directly from all military services are utilized to compile databases of active duty and reserve accession and loss

data. DMDC has the ability to combine and cross-analyze these reports utilizing common information such as name and social security number.

While analyzing the DMDC data, we noticed large discrepancies between DMDC accession data and CNRC accession data. When we confronted DMDC about these discrepancies, Colin Rogers stated:

> DMDC data, compiled from Gain and Loss reports from the services, reflects the complexities of Reserve transactions. CNRC data reflects (as I understand it), the finalized reality. As you have discovered, there are significant differences between the two. An "update" would not resolve the fundamental differences between our two databases; they are measuring opposite ends of the same process.

D. SCOPE OF THESIS

LCDR Nancy Fink, Director, Operational Analysis Division (N51), Navy Recruiting Command, requested help in developing an enlisted reserve goaling model to forecast future reserve attainments. These are based on rating, which, in turn, are due to losses from all active duty services, and accessions from NPS sources. Using statistical modeling techniques, we assist CNRC in forecasting enlisted reserve accessions based on losses from all services and accessions from civilians (NPS). In doing so, we discuss the best techniques to use for forecasting attainments in these goaling models, problem areas (ratings) that need to be addressed, possible problems with the data, and how CNRC can possibly better manage data acquisition.

Three sources of data were obtained and are utilized to forecast future attainments at different levels. These data sets are discussed below.

1. CNRC Web Data

Data was retrieved directly from the CNRC website, www.cnrc.navy.mil, which included CNRC's reporting of reserve enlisted goals and accessions for fiscal years 1999-2007. This data was utilized to forecast future (total) accessions by CNRC standards.

2. CNRC Data Received From LCDR Fink

Data was received electronically from LCDR Fink on 28 May 2008. The data was separated by ratings and included fiscal years 2004-2006. For each fiscal year, the number of losses from the active component and accessions into the Navy Reserve (by rating) were included. This data was utilized to project future attainments based on rating.

3. DMDC Data

Data was received electronically from Colin Rogers at DMDC on 17 July 2008. This data was utilized to project future attainments while taking NPS individuals, NAVET, and Other Service Veterans (OSVET) into account. DMDC data included year and month of birth, service, grade (active), secondary DoD occupation (active), duty DoD occupation (active), date of separation (active), primary service occupation (active), duty service occupation (active), secondary service occupation (active), reserve initial entry date (Navy Reserve), reserve initial entry date (armed forces), grade (Navy Reserve), primary service occupation (Navy Reserve), duty service occupation (Navy Reserve), secondary service occupation (Navy Reserve), primary DoD occupation (Navy Reserve), duty DoD occupation (Navy Reserve), and secondary DoD occupation (Navy Reserve).

E. THESIS OUTLINE

This thesis is arranged as follows: Chapter II is a review of previous results of the existing literature. Chapter III discusses the recruiting process, including the available enlisted reserve market and programs. Chapter IV describes the methodology and formulation of the models. Chapter V discusses our forecasting models and results for each data set. Chapter VI provides conclusions and recommendations based on the analysis and results.

II. LITERATURE REVIEW

A. A RAND CORPORATION MONOGRAPH (2008)

A literature review of relevant manpower studies revealed a RAND Corporation monograph developed in 2008 entitled, "Fiscally Informed Total Force Manpower." The monograph communicates the results of how selected DoD components currently review and analyze manpower needs in particular organizations or personnel communities. The RAND monograph was utilized to draw conclusions from the data we received based on similarities in the RAND study.

Key highlights from the study include the following:

- DoD components should plan for Total Force workforces that enable key capabilities, deliver readiness, are cost-effective, and balance risk. Use minimum manpower to provide maximum effectiveness.
- DoD must not spend more than is necessary to match the capability levels and associated degrees of risk the leadership is willing to accept. Maintain the lowest practicable level of manpower in support functions.
- Rigorous analytical modeling approaches to manpower requirements have a long-standing place in the literature. The complexities of manning a force as large and diverse as the U.S. military have often required technically sophisticated analyses.
- From 2001 to 2005, there was a temporary increase in manpower requirements due to GWOT. A permanent increase is not deemed to be in the nation's best interest because of the increasingly high costs of military personnel.
- The budgeted end-strength for the reserve across DoD has decreased between fiscal years 1989-2005. This is clearly indicated in Table 3.

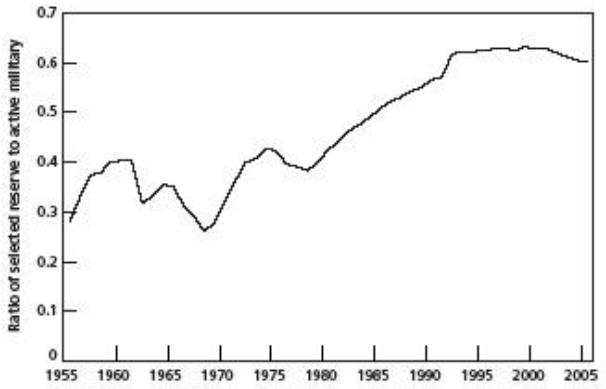
Table 3. DoD Budgeted End-Strength For Fiscal Years 1989-2005 (Fiscally Informed Total Force Manpower, 2008)

Budgeted End-Strength	FY 1989	FY 1995	FY 1997	FY 2001	FY 2005
AC	2,174,200	1,525,700	1,457,000	1,381,000	1,389,300
RC[a]	1,150,900	979,000	900,900	865,700	820,800
Civilian	1,075,400	831,800	749,500	671,600	661,200

[a] Includes Selected Reserve (reserve and National Guard), full-time active guard and reserve members, and individual mobilization augmentees.

- The ratio of SELRES to active duty military rose steadily from fiscal year 1980-1990 before leveling out to its current ratio of approximately 0.6:1. This trend is illustrated in Figure 1.

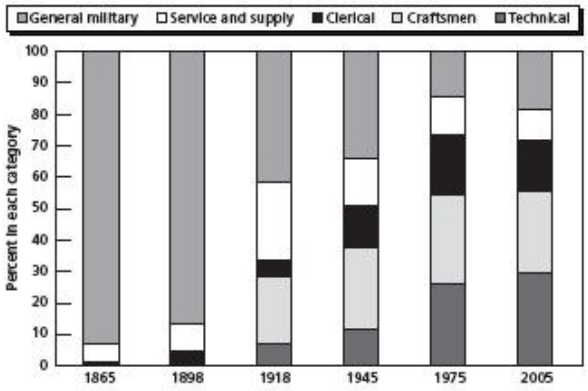
Figure 1. Ratio of SELRES to Active Military (Fiscally Informed Total Force Manpower, 2008)



According to the RAND monograph, DoD must maintain the minimum level of manpower in support functions and not spend more than is necessary to match capability levels and degree of risk leadership is willing to risk. With the ongoing GWOT, DoD and the Navy have utilized reserve forces to augment active duty forces where needed. However, the budgeted end-strength for reserves has decreased significantly since the late 1980s within DoD. In addition, DoD is in search of more technical servicemen to be a part of the work force. This has put a strain on recruiting efforts.

- The distribution of the enlisted force has become increasingly more technical. This is illustrated in Figure 2.

Figure 2. Occupational Distribution of the Enlisted Force (Fiscally Informed Total Force Manpower, 2008)



B. CONGRESSIONAL BUDGET OFFICE (CBO) STUDY (OCTOBER 2006)

A CBO study was conducted in October 2006 on "Recruiting, Retention, and Future Levels of Military Personnel." Key highlights from the study include the following research:

- The Navy's end-strength, for both the active and reserve component, is in decline. Table 4 illustrates the decline in end-strength.

Table 4. The Navy's End-Strength Fiscal Years 2000-2006 (Recruiting, Retention, and Future Levels of Military Personnel, October 2006)

	Active Navy				Navy Reserve			
		Actual				Actual		
Fiscal Year	Authorized	Enlisted Personnel	Officers	Total[a]	Authorized	Enlisted Personnel	Officers	Total
2000	372,037	315,471	53,550	373,193	90,288	67,999	18,934	86,933
2001	372,642	319,601	53,908	377,810	88,900	68,872	19,041	87,913
2002	376,000	324,351	54,476	383,108	87,000	69,692	18,266	87,958
2003	375,700	322,915	55,022	382,235	87,800	69,370	18,786	88,156
2004	373,800	314,681	54,208	373,197	85,900	64,359	18,199	82,558
2005	365,900	305,735	52,826	362,941	83,400	59,471	16,995	76,466
2006	352,700	n.a.	n.a.	n.a.	73,100	n.a.	n.a.	n.a.

- In 2005, the Navy Reserve fell short of its goal of 11,500 by 15% (approximately 1,700 recruits). During 2006, the Navy Reserve again fell short with only 8,811 accessions on a goal of 10,276 (86%). The Navy has attributed these shortfalls to several factors, including more frequent recalls to active duty status to support GWOT, more attractive civilian opportunities available to those in the target market, and the consolidation of the reserve and active recruiting commands beginning in 2003. Table 5 indicates recent accession trends.

Table 5. The Navy's Total Accessions of Enlisted Personnel for Fiscal Years 2000-2006 (Recruiting, Retention, and Future Levels of Military Personnel, October 2006)

The Navy's Total Accessions of Enlisted Personnel

	Active Navy				Navy Reserve		
Fiscal Year	Initial Objective	Final Objective	Actual Accessions	Percentage of Objective	Objective	Actual Accessions	Percentage of Objective
2000	57,370	55,000	55,147	100	18,410	14,911	81
2001	56,348	53,520	53,690	100	15,250	15,344	101
2002	53,000	46,150	46,155	100	15,000	15,355	102
2003	46,137	41,065	41,076	100	11,893	12,772	107
2004	39,672	39,834	39,677	100	10,101	11,246	111
2005	41,556	37,635	37,703	100	11,491	9,788	85
2006	37,456	n.a.	n.a.	n.a.	11,180	n.a.	n.a.
Average, 2000–2004	50,505	47,114	47,149	n.a.	14,131	13,926	n.a.

- The Navy Reserve's end-strength, according to the Future Years Defense Program (FYDP), will decline from fiscal year 2005-2009, and then remain steady. This trend is indicated in Table 6.

Table 6. Plan for the Navy Reserve's End Strength, as Specified in the Future Years Defense Program (Recruiting, Retention, and Future Levels of Military Personnel, October 2006)

	Actual 2005	2006	2007	2008	2009	2010	2011
Enlisted Personnel	59,471	54,927	53,592	53,012	52,663	52,788	52,760
Officers	16,995	16,317	15,778	15,558	15,407	15,282	15,310
Total	**76,466**	**71,244**	**69,370**	**68,570**	**68,070**	**68,070**	**68,070**

- The average number of Navy recruiters decreased from approximately 4,900 in 2000 to about 3,400 in 2005. The number of full-time Navy Reserve recruiters and recruiting support personnel was stable between 2000 and 2005, averaging about 1,100. However, the consolidation of active and reserve recruiting allows for all recruiters to recruit for both components. Specifics are included in Table 7.

Table 7. The Navy's Recruiting Resources Fiscal Years 2000-2005 (Recruiting, Retention, and Future Levels of Military Personnel, October 2006)

	Active Navy			Navy Reserve[a]		
Fiscal Year	Recruiters[b]	Recruiter Support (Millions of dollars)	Advertising (Millions of dollars)	Recruiters[b]	Recruiter Support (Millions of dollars)	Advertising (Millions of dollars)
2000	4,863	70.9	63.7	1,014	n.a.	n.a.
2001	4,934	71.6	71.5	1,104	n.a.	n.a.
2002	4,714	68.1	78.1	1,162	n.a.	n.a.
2003	4,617	75.4	90.9	1,120	n.a.	n.a.
2004	3,767	67.1	78.4	1,122	n.a.	n.a.
2005[c]	3,365	75.9	112.3	1,124	n.a.	n.a.

Note: n.a.= not available.

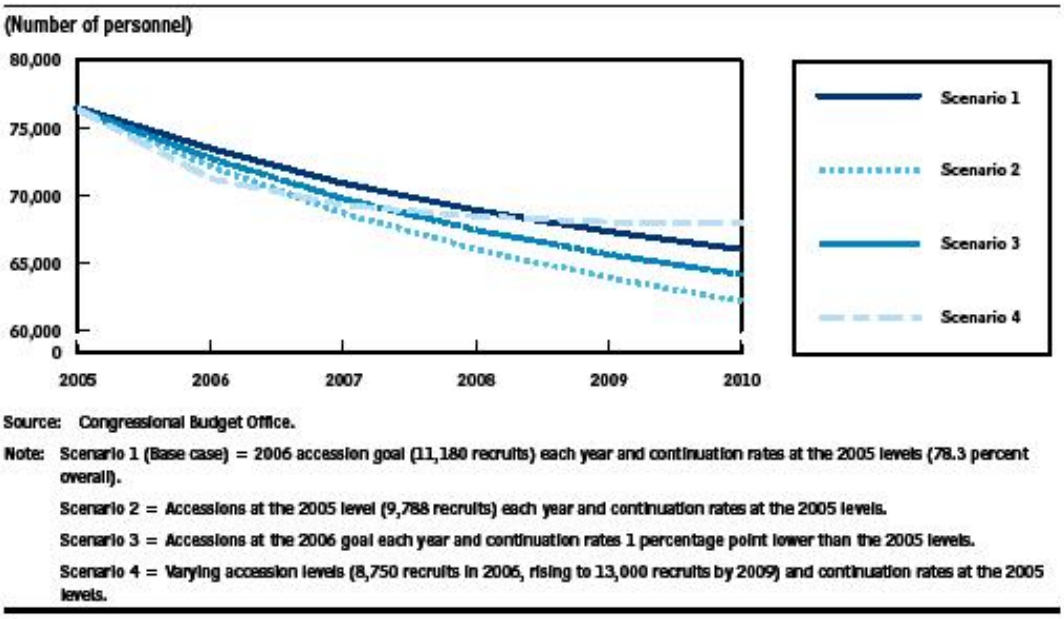
a. For 2000 to 2004, CBO was unable to separate the expenditures for recruiter support and advertising from other budgetary items in the operation and maintenance accounts.

b. For the active Navy, statistics reflect the average number of recruiters for each year. For the Navy Reserve, they reflect the number of full-time reservists filling positions as recruiters or recruiter support personnel as of the end of the year.

c. The active Navy and the Navy Reserve had a consolidated recruiting command. Resources for both components are reflected in the statistics for the active Navy.

- CBO examined four scenarios, which all produced declining end-strength for the Navy Reserve except for one scenario. With the current accession rate, as well as continuation rate (the percentage of those who continue after an enlistment period is up), the current trend is not positive. These scenarios are illustrated in Figure 3.

Figure 3. Effects of Recruiting and Retention Scenarios on the Navy Reserve's End Strength (Recruiting, Retention, and Future Levels of Military Personnel, October 2006)



Source: Congressional Budget Office.

Note: Scenario 1 (Base case) = 2006 accession goal (11,180 recruits) each year and continuation rates at the 2005 levels (78.3 percent overall).

Scenario 2 = Accessions at the 2005 level (9,788 recruits) each year and continuation rates at the 2005 levels.

Scenario 3 = Accessions at the 2006 goal each year and continuation rates 1 percentage point lower than the 2005 levels.

Scenario 4 = Varying accession levels (8,750 recruits in 2006, rising to 13,000 recruits by 2009) and continuation rates at the 2005 levels.

While conducting our analysis, we looked for similarities between these trends and our data. It appears that there should be a downturn in recruiting over the next few years with the main reasons being the active/reserve recruiting consolidation beginning in 2003, Individual Augmentations (IA) to support GWOT, and more attractive civilian opportunities.

C. UNITED STATES ARMY RESERVE (USAR) ENLISTED AGGREGATE FLOW MODEL (JUNE 2006)

A Naval Postgraduate School thesis was written in June 2006 which describes a statistical model and includes a software package which forecasts aggregate USAR enlisted personnel trends based on accession, retention, and attrition rates. The aggregate flow model uses a Markov Growth Model and is standardized using three fiscal years of data (FY01–FY03). The flow model is intended to be utilized in forecasting the number of enlisted accessions to achieve USAR end-strength. This research is somewhat similar to what we are trying to accomplish in that the model is being utilized to forecast reserve enlisted personnel trends based on historical data.

D. NAVY RECRUITING MANUAL-ENLISTED: COMNAVCRUITCOMINST 1130.8H

A Navy Recruiting Manual, written in 2008, describes recruiting operations, eligibility requirements, recruiting programs, and classifications for enlisted reserve personnel. This manual is widely utilized to understand the Navy Reserve recruiting process and programs in reserve enlisted recruiting including NAVET, OSVET and NPS programs that we used in our thesis.

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III. RECRUITING PROCESS

As described in the introduction, the objective of this project is to forecast the number of future attainments for the Navy Reserve. However, it is important to understand the recruiting market (programs available to enlist in the Navy Reserve) before analyzing the data. In this chapter, the basic reserve enlisted recruiting process is explained for all recruiting markets. Specific emphasis is placed on Naval Veteran (NAVET), Non-Prior Service (NPS), and Other Service Veteran (OSVET) markets as they are the primary sources for Navy Reserve accessions.

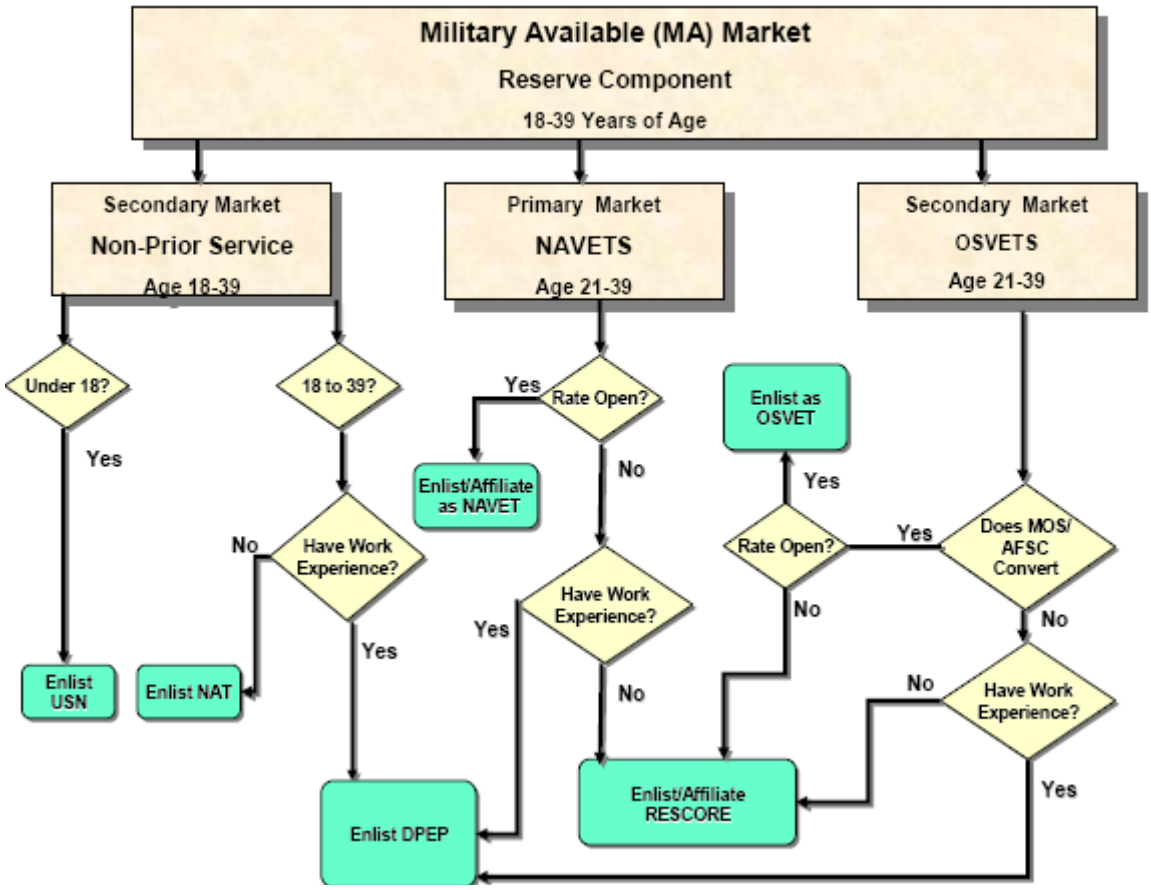
A. NAVY RESERVE RECRUITING MARKET

The Navy Reserve has three main markets from which to recruit. The primary recruiting market is NAVET. Navy or Navy Reserve veterans can apply to the Navy Reserve through the NAVET program. Auxiliary markets for the Navy Reserve are OSVET and NPS. NPS individuals are enlisted through various programs, including NAT (New Accession Training Program) and FTS. Figure 4 summarizes the available markets and entrance programs. The Navy Reserve currently has five basic "Target Markets" to consider:

- NAVET
- OSVET
- Recruiting Selective Conversion and Reenlistment Program (RESCORE)
- Direct Procurement Enlistment Program (DPEP)
- NPS

The RESCORE and DPEP programs are not completely independent programs. Both fall within the scope of the NAVET or OSVET program. Figure 4 demonstrates this fact and illustrates the reserve markets and basic requirements for each program. Each specific market is discussed in further detail in section B.

Figure 4. Available Markets for the Navy Reserve (Navy Recruiting Manual-Enlisted, 2008)



NAVETs can be enlisted directly into the Reserve if their ratings are open on the Reserve side. If the rating is not open, a NAVET has two ways to enlist. Individuals with a civilian-acquired technical school or significant work experience may join under the DPEP Program. Individuals without experience may be affiliated through the RESCORE_R program. In order to enlist in the Navy Reserve, an OSVET must go through a similar process. However, OSVETs must have their prior service ratings converted to a current open Navy rating to affiliate. NPS applicants can enlist in the Navy Reserve through available programs (NAT, FTS) even if they do not have civilian-acquired work experience. If they have work experience, they can join the Reserve in the DPEP.

B. NAVY RESERVE ENTRANCE PROGRAMS

1. NAVET Program

The NAVET program will allow personnel who have had prior active or inactive Navy/Navy Reserve service to enlist into the Navy Reserve (as a SELRES). Applicants must meet all basic enlistment and rating-specific eligibility requirements. Those who currently hold a commission in the IRR may also affiliate with the Navy Reserve through the NAVET program.

For individuals discharged from the Navy or Navy Reserve more than four years previously, the pay grade and rank/rate may be changed according to Navy Reserve needs in ratings and based on the length of time since discharge. Table 8 summarizes the ways to determine pay grades for a person who is enlisted in the same rate.

Table 8. NAVET Program Enlisted Pay Grade Options (Navy Recruiting Manual-Enlisted, 2008)

NAVET Matrix

Years since Discharge	PAYGRADE	Minimum Term of Enlistment
Six or less	Same as held at discharge	Two Years
Over six less than ten	One paygrade less than held at discharge (not less than E3 designated striker (e.g., MASN, ENFN))	Three Years
Over ten less than twelve	Two paygrades less than held at discharge (not less than E3 designated striker (e.g., MASN, ENFN))	Three years
Elapsed Time Waiver	**PAYGRADE**	**Minimum Term of Enlistment**
Over six less than twelve	Refer to Article 020307 for paygrade determination (Note: Refer to exhibit Volume II for waiver authority)	Three years

2. OSVET Program

The OSVET program allows personnel who have prior active or inactive service in military branches other than the Navy (Army, Air Force, Coast Guard, or Marine Corps), or who are presently serving in other Reserve Components, to enlist into the Navy Reserve. In determination of a rating for the Navy Reserve, the applicant's primary Military Occupational Specialty (MOS), Air Force Specialty Code (AFSC), or Coast Guard rating previously held becomes the main consideration.

The Navy Recruiting District Commanding Officer has authority to convert primary MOS/AFSC ratings. For secondary ratings conversion, CNRC authorization and some additional forms documenting the applicant's work experience are needed. Applicants can be enlisted in a lower pay grade when the eligible pay grade does not exist at the time of request. Applicants cannot be enlisted in a pay grade higher than currently held if an applicant is already under a Ready Reserve contract. Table 9 includes all OSVET program enlisted pay grade options.

Table 9. OSVET Program Enlisted Pay Grade Options (Navy Recruiting Manual-Enlisted, 2008)

Years Since Discharge	Permanent Paygrade	Temporary Paygrade	Minimum Enlistment Term	Applicable Notes
Less than Four	E3	Same as held at discharge	Three years	1, 2, 3, 4
Four to six	E3	One paygrade less than held at discharge (not less than E3 designated striker)	Three years	1, 2, 3, 4
Six to ten	E3	Two paygrades less than held at discharge (not less than E3 designated striker)	Three years	1, 2, 3, 4
Over ten	E3	Not authorized	N/A	N/A

Applicants can normally retain their previous rank/rate. Applicants who enlist within four years of discharge can usually join the Navy Reserve in the same pay grade at which they were discharged. When four to six years have passed since discharge,

however, the individual's new pay grade would be one grade less. When six to eight years have passed since discharge, the individual's pay grade would be two pay grades less than when originally discharged.

3. Non-Prior Service (NPS) Programs

NPS applicants are described as the following in Navy Recruiting Manual-Enlisted:

> Applicants that either have no military experience or have been discharged from any branch of service and have not completed the below listed requirements are considered NPS applicants and are required to complete Navy Recruit Training.
>
> a. Recruit Basic Military Training; or
>
> b. Completed 84 calendar days of Inactive Duty Training (IDT)
>
> c. Other Service Recruit Basic Military Training

NPS applicants can join the Navy Reserve either through the FTS or NAT Programs.

a. FTS Program

The FTS program is an opportunity for those to be enlisted in the Navy Reserve for the first time. It is not authorized for prior-service veterans or member of any Reserve Component. Enlistment for the program requires an eight-year military service obligation (MSO). A part of this eight-year obligation should be performed as active duty. Duration of active duty depends on the rating in which the applicant enlisted. The remainder of the eight-year MSO is served in the IRR. Applicants are usually enlisted in pay grade E1.

b. NAT Program

The NAT program is designed to reduce critical SELRES manning shortfalls. An NPS individual who joined this program completes basic training and rating-specific Class A School and is affiliated as a SELRES with the Navy Operational Support Center (NOSC) closest to his/her permanent residence. This is not a program authorized for prior-service veterans. NAT-specific ratings are identified and revised regularly based on current goaling directives. An enlisted service member has an eight-year MSO. For an individual in the NAT program, the first six years are in a SELRES status and the final two years are in an IRR status.

4. Recruiting Selective Conversion for Reenlistment Reserve (RESCORE_R) Program

The RESCORE_R program is designed for NAVETs and OSVETs who have been separated or discharged in closed ratings. The program allows these individuals to join new open ratings by changing their previous ratings. Applicants must be a NAVET or OSVET who had Initial Active Duty for Training (IADT), basic training, or the equivalent amount of training for at least 12 weeks. They must have served in the SELRES at least four years from the date of enlistment or affiliation. Those applicants who have a break in service of more than 10 years are not eligible for this program. Applicants to this program enlist with a permanent and temporary pay grade based on the length of time since discharge. Table 10 includes RESCORE_R program enlisted paygrade options for NAVETs and OSVETs.

Table 10. RESCORE_R Program Enlisted Pay Grade Options (Navy Recruiting Manual- Enlisted, 2008)

Rescore-R NAVET Matrix

Years Since Discharge	Permanent Paygrade	Temporary Paygrade	Minimum Term of Enlistment
Six or less	Same as held at discharge	Same as held at discharge	Four years
Over six to ten	One paygrade less than held at discharge (not less than E3)	One paygrade less than held at discharge	Four years

OSVET Matrix

Years Since Discharge	Permanent Paygrade	Temporary Paygrade	Minimum Term of Enlistment
Six or less	E3	Same as held at discharge	Four years
Over six to eight	E3	One paygrade less than held at discharge (not less than E-3)	Four years
Over eight to ten	E3	Two paygrades less than held at discharge(not less than E-3)	Four years

RESCORE_R applicants have two options. They can either enlist in a rating without a Class A School guarantee or with a Class A School guarantee. Individuals who enlist without a Class A school guarantee must complete lateral conversion prerequisites within 18 months from the date of enlistment. Individuals who enlist with a Class A school guarantee must begin Class A School within 12 months of accession to meet lateral conversion prerequisites.

5. DPEP

DPEP allows applicants to enlist in the Navy Reserve based on their civilian-acquired technical training or significant work experience. It is open for both prior-service and NPS applicants. However, prior service NAVET or OSVET personnel whose previous military rating converts to a Navy rating are not eligible for enlistment under DPEP unless they have been discharged for more than two years. Applicants may be enlisted in pay grades E-3 through E-6 in critically undermanned ratings based on their

civilian vocational/technical training (must be accredited) or one or more years of significant work experience in a civilian field. Table 11 includes the various DPEP enlisted paygrade options.

Table 11. DPEP Enlisted Pay Grade Options (Navy Recruiting Manual- Enlisted, 2008)

Paygrade	Minimum Years Work Experience	Minimum Supervisory Experience	Minimum Vocational or Technical Training Hours
E3	1	0	1,080
E4	2	0	1,080
E5	4	2	2,160
E6	7	4	2,160

For NPS DPEP enlistees, an eight-year MSO with a six-year SELRES commitment (via NAT Program) is required. NPS DPEP individuals are not considered for other rating conversion programs until they complete their SELRES obligation. Prior-service applicants must complete a minimum three-year commitment.

IV. METHODOLOGY – TIME-SERIES MODELS

Forecasting models can be classified into three main categories. These are qualitative models, casual models, and time-series models. Qualitative models are used in cases where more judgmental and subjective factors are involved. They are useful when subjective factors become very important and quantitative data is difficult to obtain. They are also useful for long-term forecasting. Casual models depend on quantitative data rather than qualitative data. These models are related, with the factors or variables that might affect the quantity being forecasted in the model.

Time-series models also rely on quantitative data. While casual (sometimes called explanatory) models assume that the variable to be forecasted exhibits an explanatory relationship with one or more independent variables, time-series forecasting makes no attempt to discover the factors affecting its behavior and treats the system as a black box. Therefore, prediction of the future is based on past values, but not explanatory variables which may affect the system (Makridakis, S., Wheelwright, S. C., Hyndman R. J. 1998). Time-series models make the assumption that what happens in the future is a function of what happened in the past. For this project, we forecasted future accessions based on the historical data obtained. All time-series models use a form of weighted average of past observations to smooth up-and-down movements and suppress short-term fluctuations (Keating, B., Wilson, J. H. 1990).

For each type of data, we used three types of time-series models. These models are moving average (MA), weighted moving average (WMA), and exponential smoothing (ES). In our project, we explain how to measure forecasting error, and examine each model in detail. Notation used in our methodology is listed in Table 12.

Table 12. Notation Used in Methodology

Notation	
A_t	Actual data for the year t
F_t	Forecasted data for the year t
F_{t+1}	Forecasted data for the year t+1
T	Number of the last year
W_t	Weight for the year t
a	Alpha (smoothing constant)
n	Number of periods

A. MEASURING FORECAST ERROR

The forecasting error in a model can be determined by comparing the actual results with forecasted results.

Forecast error =Actual value - Forecast value

$$= A_t - F_t$$

This measure can be used to compare different forecasting models or determine if a forecasting model works well. Three main measures—mean absolute deviation, mean squared error, and mean absolute percent error—are described below.

1. Mean Absolute Deviation (MAD)

MAD is the average of the absolute values of the individual forecast errors. It is calculated as:

$$MAD = \sum_{t=1}^{T} \left| A_t - F_t \right| / T$$

2. Mean Squared Error (MSE)

MSE is the average of the squared values of the individual forecast errors. Because errors are squared, large deviations from the average may seem unreasonable. It is calculated as:

$$MSE = \sum_{t=1}^{T} (A_t - F_t)^2 / T$$

3. Mean Absolute Percent Error (MAPE)

MAPE is the average of the absolute values of forecast errors, expressed as a percentage of the actual values. The formula for MAPE is:

$$MAPE = 100 \sum_{t=1}^{T} \left[\left| A_t - F_t \right| / A_t \right] / T$$

B. MOVING AVERAGE (MA)

A moving average (MA) is especially useful when the data remains fairly steady over time. MA smoothes out the fluctuations, sometimes referred to as the hash, of the time series (Mcgee, M., Yaffee, R. A., 2000). To calculate one period's forecast, one must find the average of the last "n" period's actual values. The mathematical formulation is as follows:

$$\text{n-period moving average} = \sum \left(\text{Actual values in previous n periods} \right) / n$$

C. WEIGHTED MOVING AVERAGE (WMA)

In some cases, past periods' actual data may not be equally important. In such cases, we use weights to add more emphasis on some periods and less emphasis on others. The choice of weights is somewhat arbitrary (Balakrishnan, N., Render, B., Stair, R. M. 2007). The mathematic formulation for WMA is:

$$WMA = \frac{\sum_{t=1}^{n}(W_t)\times(A_t)}{\sum_{t=1}^{n}(W_t)}$$

Where $\sum_{t=1}^{n}(W_t) = 1$

Therefore, the formula reduces to:

$$WMA = \sum_{t=1}^{n}(W_t)\times(A_t)$$

After applying the formula to the data, we can use an optimization program to find the optimum values for the weights. Any optimization program needs three components to define a problem. The objective function is the component we are trying to maximize or minimize. Decision variable(s) are unknown value(s) that the optimization program is going to try and determine. Finally, the third component consists of constraints which restrict the value(s) of the decision variable(s).

In our model, MAD or MAPE is the objective function that is to be minimized. Weights are decision variables and there are two constraints restricting the weights. One constraint is that all weights are non-negative and the other is that all weights add up to 1.

D. EXPONENTIAL SMOOTHING (ES)

Exponential smoothing is a type of WMA model where the weighted average of the actual and forecasted value of the previous period is calculated. However, while MA or WMA models require extensive records of data to smooth out fluctuations, ES requires fewer records. As one travels back along the historical time path, data has less influence on the forecast. In other words, the effect of the observations is expected to decline

exponentially over time. To represent this geometric decline in influence, an exponential weighting scheme is applied in a procedure referred to as ES (Mcgee, M., Yaffee, R. A., 2000). The formula is:

$$F_{t+1} = F_t + a \times (A_t - F_t) \text{ or } F_{t+1} = a \times A_t + (1-a)F_t$$

a is a weight (smoothing constant) that has a value between 0 and 1. If more weight is given to recent periods, a should be high; if more weight is given to past periods, a is relatively low. We may want to use a high a value when the data has low variability, or vice versa.

We can use an optimization program to find the optimum value of a in a similar manner as that described in a previous section. We again define MAD and MAPE as the objective function that is to be minimized. Weights are decision variables and there is only one constraint, which ensures the value of a is less than or equal to 1. Establishing a model in this way, we can calculate the optimum value of a, which minimizes error.

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V. FORECASTING

In this chapter, we describe the implementation of all time-series forecasting models (MA, WMA, and ES) that are applied to the available data. The model providing the least forecasting error was accepted as the best fit for the data. Forecasting models were implemented based on the three different data sets and the results were analyzed. Excel was used for all modeling.

A. CNRC WEBSITE DATA

1. Moving Average (MA) Model

Goal and accessions data (1999–2007) were retrieved from CNRC's website. This data gives a high-level picture of Navy Reserve enlistment goals and accessions. We have forecasted affiliation percentages based on this data. This is shown in Table 13. In the third column, accessions were calculated as a percentage of goals. This column forms the actual data. Based on the actual data, we applied an MA model in Excel.

Table 13. MA Applied CNRC Web Data

Moving Average Forecasting									
	Goal	Accessions	Actual Percentage	Forecast k=3	Error	% Error	Forecast k=7	Error	% Error
1999	20455	15240	74.51%						
2000	18410	14907	80.97%						
2001	15250	15344	100.62%						
2002	15000	15355	102.37%	85.36%	17.00%	16.61%			
2003	12000	12772	106.43%	94.65%	11.78%	11.07%			
2004	11000	11246	102.24%	103.14%	0.90%	0.88%			
2005	11491	9788	85.18%	103.68%	18.50%	21.72%			
2006	11180	9722	86.96%	97.95%	10.99%	12.64%	93.19%	6.23%	7.16%
2007	10602	10627	100.24%	91.46%	8.78%	8.76%	94.97%	5.27%	5.26%
2008	9122			90.79%			97.72%		
MAD					**11.33%**			**5.75%**	
MAPE						**11.95%**			**5.26%**

MA models with periods 3 to 8 were applied. As can be seen in Table 14, a 7-period MA provides the least MAD and MAPE. Therefore, we chose a 7-period model as the basis for analysis.

The table additionally shows forecasting differences (from 100% of attained goal) from the actual value according to number of periods used in the MA model. All percentages in the second column are the forecasts for 2008 for the different number of periods. A 7-period MA, which has the smallest MAD, estimates a shortfall of only 209 accessions from the 2008 goal. In reality, this may not always occur. Sometimes a model may have the greatest difference in forecast from the goal while it has the smallest MAD. We do not choose a model just because the model gives us the closest results to the goals. We need to compare models based on their MAD or MAPE values, which show us the reliability of the model.

Table 14. Estimated Accessions Based on Number of Periods

2008	Moving Average Percentage	Goal	Estimated Accessions	Difference
n=3	90.79%	9122	8281	-841
n=4	93.65%	9122	8542	-580
n=5	96.21%	9122	8776	-346
n=6	97.24%	9122	8869	-253
n=7	**97.72%**	**9122**	**8913**	**-209**
n=8	95.62%	9122	8722	-400

2. Weighted Moving Average (WMA) Model

As we mentioned in the previous chapter, weights are arbitrarily assigned. We wanted last year's value to have more emphasis on forecasting. Therefore, we assigned 0.95 and 0.94 as the last year weights for 2-period and 3-period WMA models, respectively. The least MAD occurred for the 3-period WMA model. According to forecasting based on this model, 99.54% of the goal will be met, which translates to 9,079 accessions. When we compare this with the other two models, we can see that

their estimated values for 2008 are closer to the goal. However, their MADs are higher than the 3-period model. We need to take the reliability of the model into consideration. Therefore, we selected the 3-period model as the basis for our analysis. Comparisons of these models can be seen in Table 15.

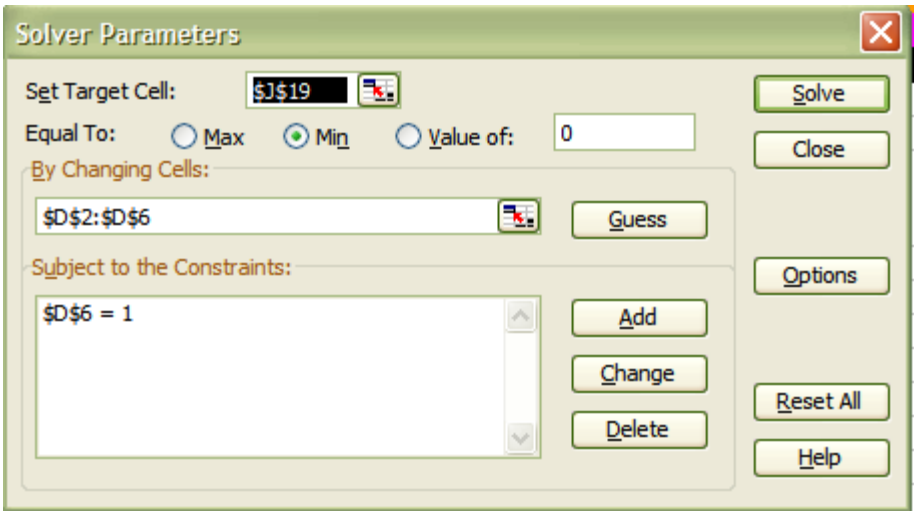
Table 15. WMA Applied to CNRC Web Data

	wma (1)	wma (2)	wma (3)
weight 1	0.05	0.02	0.01
weight 2	0.95	0.03	0.02
weight 3		0.95	0.03
weight 4			0.94
sum	1	1	1

Weighted Moving Average										
Year	Actual Percentage	wma (1)	error	% error	wma (2)	error	%error	wma (3)	error	%error
1999	74.51%									
2000	80.97%									
2001	100.62%	80.65%	19.97%	19.85%						
2002	102.37%	99.63%	2.73%	2.67%	99.50%	2.86%	2.88%			
2003	106.43%	102.28%	4.15%	3.90%	101.89%	4.55%	4.46%	101.61%	4.83%	4.75%
2004	102.24%	106.23%	3.99%	3.91%	106.19%	3.96%	3.73%	105.94%	3.70%	3.50%
2005	85.18%	102.45%	17.27%	20.27%	102.36%	17.19%	16.79%	102.35%	17.17%	16.77%
2006	86.96%	86.03%	0.93%	1.07%	86.12%	0.84%	0.98%	86.29%	0.67%	0.78%
2007	100.24%	86.87%	13.37%	13.33%	87.21%	13.02%	14.93%	87.41%	12.83%	14.68%
2008		99.57%			99.54%			99.56%		
MAD			**8.92%**			**7.07%**			**7.84%**	
MAPE				**9.28%**			**7.29%**			**8.10%**

Another way to assign weights is by using an optimization program. By using Excel solver, we can find the optimum weights. Figure 5 shows how to use solver. J19 is the target cell, which is the MAD cell for a 4-period model, D2–D6 (weight cells) are decision variables. A constraint of 1 is established for the sum of the weights. Solver gives us the optimum weights for the minimum MAD.

Figure 5. Using Solver for Optimum Weights



As an example, optimum weight values and minimum MAD for a 4-period model was 7.43. Table 16 shows all possible minimum MAD and MAPE values with appropriate weight values. In some cases, solver does not give very reasonable results. It calculates 0 for the first two years and 1 for the third year. However, we would like to include a weight for every year. Because of this, we chose not to use these optimized weights in our evaluations. Rather, the weights we used were arbitrary, as discussed earlier.

Table 16. Optimized Weights based on MAD and MAPE

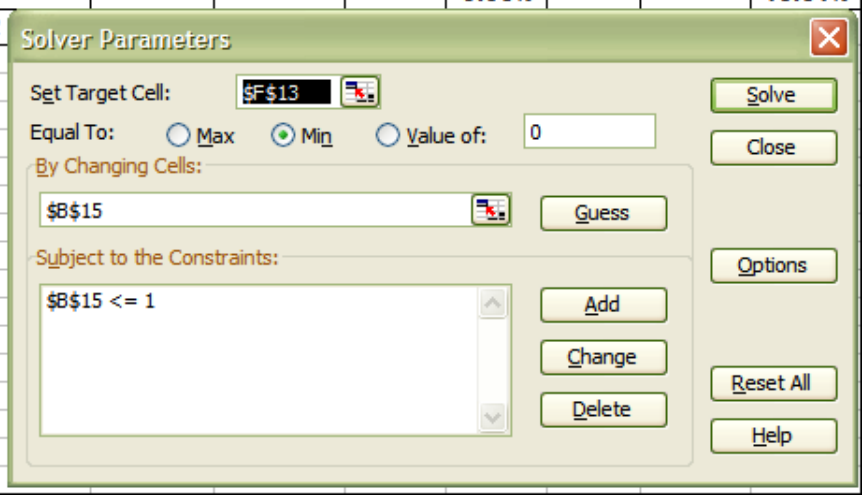
	wma (3)	wma (2)	wma (1)		wma (3)	wma (2)	wma (1)
weight 1	0.080884	0	0	**weight 1**	0.057178	0.064864	0
weight 2	0.007588	0	1	**weight 2**	0.005588	0	1
weight 3	0	1		**weight 3**	0	0.935136	
weight 4	0.914202			**weight 4**	0.945189		
sum	1	1	1	**sum**	1	1	1
MAD	**7.43%**	**7.02%**	**8.82%**	**MAPE**	**7.67%**	**7.27%**	**9.21%**

3. Exponential Smoothing (ES) Model

As mentioned in the previous chapter, a should be high if it is desirable to assign more weight to recent periods.

Table 17. ES Applied to Data

	A	B	C	D	E	F	G	H	I	J
1	Exponential Smoothing									
2	Year	Goal	Accessions	Actual Percentage	α=optimum forecast.	error	%error	α=0.2 forecast	error	%error
3	1999	20455	15240	74.51%	74.51%	0.00%	0.00%	74.51%	0.00%	0.00%
4	2000	18410	14907	80.97%	74.51%	6.47%	7.99%	74.51%	6.47%	7.99%
5	2001	15250	15344	100.62%	80.97%	19.64%	19.52%	75.80%	24.82%	24.67%
6	2002	15000	15355	102.37%	100.62%	1.75%	1.71%	80.76%	21.60%	21.11%
7	2003	12000	12772	106.43%	102.37%	4.07%	3.82%	85.08%	21.35%	20.06%
8	2004	11000	11246	102.24%	106.43%	4.20%	4.11%	89.35%	12.88%	12.60%
9	2005	11491	9788	85.18%	102.24%	17.06%	20.02%	91.93%	6.75%	7.92%
10	2006	11180	9722	86.96%	85.18%	1.78%	2.05%	90.58%	3.62%	4.16%
11	2007	10602	10627	100.24%	86.96%	13.28%	13.25%	89.86%	10.38%	10.36%
12	2008	9122			100.24%			91.93%		
13	MAD					7.58%			11.99%	
14	MAPE						9.06%			13.61%
15	Alpha	1	0.2							



Initially, we tried 0.1 and 0.2 for a. The model gave high values for MAD in both cases (more than 10). Next, we used Excel solver to find the optimum a, which would minimize MAD. However, solver indicated that a should be 1 whereas MAD was 7.58. This is indicated in Table 17. When alpha is 1, the model does not take the previous forecasts into account. This can be seen when examining the formula for ES,

($F_{t+1} = a \times A_t + (1-a)F_t$), (1-a)*Ft becomes zero. Therefore, we opted again not to include the solver results in our evaluation. Calculations based on arbitrarily assigned alpha values are shown in Table 18.

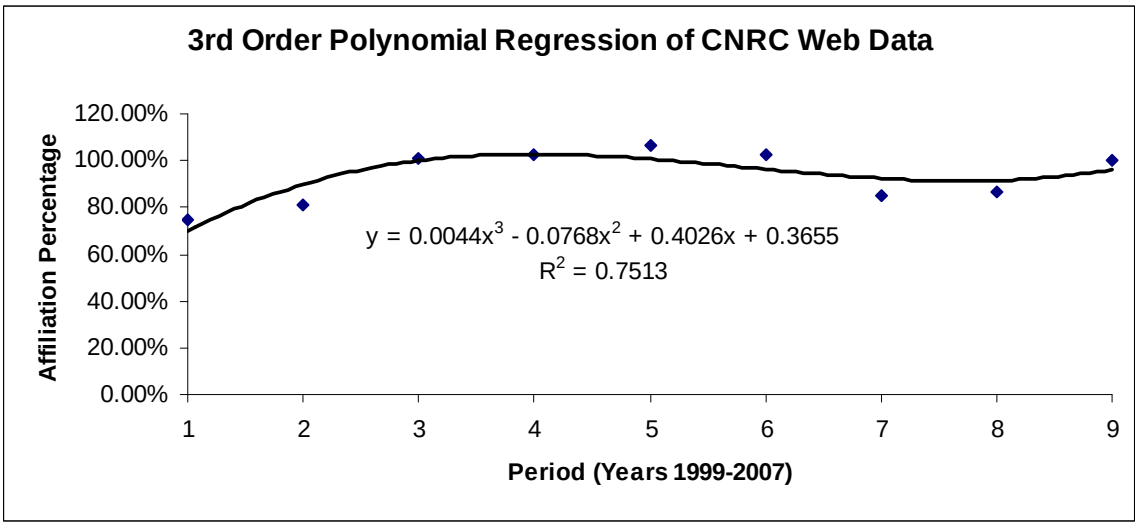
Table 18. ES Results for CNRC Web Data

2008	MAD	MAPE	est. percent.	goal	estimated accessions	difference
a=0.1	**13.35%**	**14.92%**	86.52%	9122	7892	-1230
a=0,2	**11.99%**	**13.61%**	91.93%	9122	8385	***-737***

4. Regression Model

Regression was run on the CNRC data using Excel to try and determine if there were additional models which may forecast the data more accurately. R^2, or the coefficient of determination, is the proportion of variability in a data set that is accounted for by a statistical model. R^2 is a statistical measure of how well a regression line approximates the real data points. The closer the R^2 is to 1, the closer the approximation. Using 3rd-order polynomial regression (PR), we analyzed the CNRC web data and discovered an R^2 value of .7513. The data is represented by the equation 0.0044 * X^3 - 0.0768 * X^2 + 0.4026 * X + 0.3655, where X is the year (1999=1). The slope of the curve turns slightly upward after 2007 and forecasts a 111.15% accession rate for 2008. The graph of the 3rd-order polynomial regression can be seen in Figure 6. Using the 3rd-order polynomial accession rate, for a goal of 9,122 in 2008, CNRC will attain 10,139. This projection, however, seems unlikely as CNRC has not seen more than a 106% accession rate in the recent past.

Figure 6. 3rd-Order PR of CNRC Web Data



A 2nd-order polynomial equation produces a lower R^2 value (0.4904) and the slope of the curve turns downward after 2007. This equation is more likely, producing an 80.35% accession rate for 2008 (7330 accessions on a goal of 9122), but the R^2 value is much lower (0.4904). The graph of the 2nd-order polynomial regression can be seen in Figure 7.

Figure 7. 2nd-Order PR of CNRC Web Data

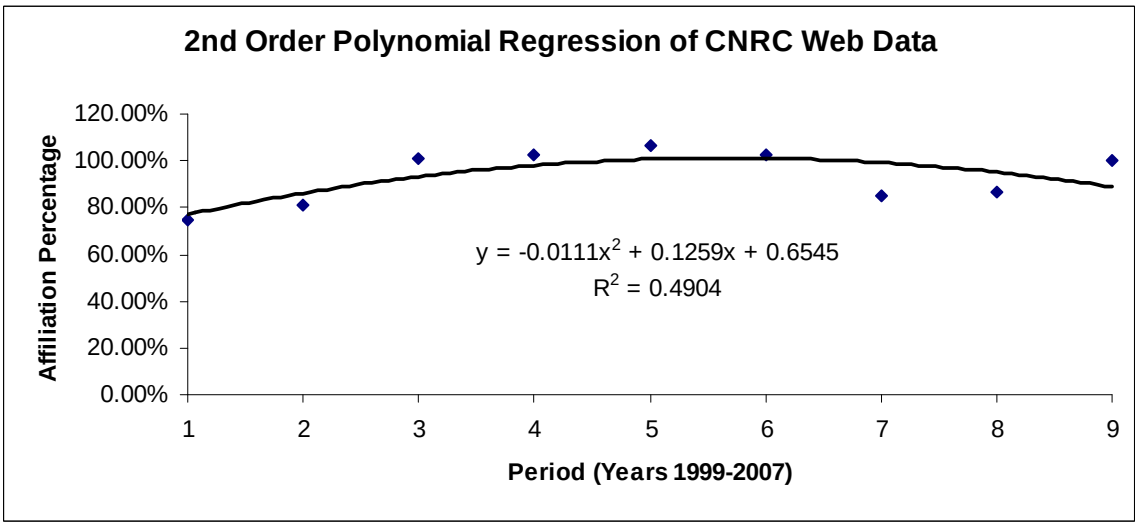


Table 19. Regression Applied to CNRC Data

Regression Forecasting							
Years	Actual Percentage	2nd Order Polynomial			3rd Order Polynomial		
		Forecast	Error	% Error	Forecast	Error	% Error
1999	74.51%	76.93%	2.42%	3.25%	0.6957	4.94%	6.62%
2000	80.97%	86.19%	5.22%	6.44%	0.8987	8.90%	10.99%
2001	100.62%	93.23%	7.39%	7.34%	1.0009	0.53%	0.52%
2002	102.37%	98.05%	4.32%	4.22%	102.87%	0.50%	0.49%
2003	106.43%	100.65%	5.78%	5.43%	100.85%	5.58%	5.25%
2004	102.24%	101.03%	1.21%	1.18%	96.67%	5.57%	5.44%
2005	85.18%	99.19%	14.01%	16.45%	92.97%	7.79%	9.15%
2006	86.96%	95.13%	8.17%	9.40%	92.39%	5.43%	6.25%
2007	100.24%	88.85%	11.39%	11.36%	97.57%	2.67%	2.66%
2008		**80.35%**			**111.15%**		
MAD			**6.66%**			**4.66%**	
MAPE				**7.23%**			**5.26%**

Higher polynomial equations produce a higher R^2 value, but they also produce improbably high accession percentages due to the steep incline of the curve after 2007 (X=9). Although 3rd-order regression provides the smallest MAD and MAPE values compared to other models, regression models were excluded from consideration because we think the forecasts are unreasonable. This is exemplified in Table 19.

5. Selecting the Best Model

Table 20 compares the models we examined for the CNRC web data. All models are compared to each other by means of MAD and MAPE.

Table 20. Comparison Between Models (CNRC Web Data)

Comparisons Between Models		
Models	**MAD**	**MAPE**
Moving Average (n=7)	**5.76**	**5.26**
Weighted Moving Average	7.07	7.29
Exponential Smoothing (α=0.1)	13.35	14.92
Exponential Smoothing (α=0.2)	11.99	13.61
Regression 2nd Order	6.66	7.23
Regression 3rd Order	4.66	5.26

As mentioned earlier, we excluded regression models because of the steep incline of the curve after 2007, although they have the smallest MAD and MAPE values. Among the other models, the 7-period MA model is the best, with a 5.76 MAD and 5.26 MAPE. This model will be used in our final analysis.

B. CNRC DATA FORECASTING

LCDR Nancy Fink, Director, Operational Analysis Division (N51), Navy Recruiting Command, provided three years of CNRC reserve accession data and active-duty loss data electronically on 28 May 2008. The data was separated by ratings and included fiscal years 2004–2006. For each fiscal year, the number of losses from the active component and accessions into the Navy Reserve (by rating) were included.

Using the data, we have forecast overall affiliations, as well as affiliations by rating and category, based on the best forecasting model using MAPE. As discussed earlier, the forecasting models used were MA, ES (alpha=0.1), ES (alpha=0.2), and WMA (w1=.05, w2=.95). Since only three years of data was available, we were forced to apply an MA and WMA of period 2.

1. MA Model

Table 21 includes the computations of the categories for MA and Table 22 is a sample for how an individual rating was calculated. As we only had three years of data, we had to utilize a 2-period MA, which is not ideal. More data would provide a more accurate forecast. We need to consider the reliability of this model in our analysis due to the lack of data.

Table 21. MA Applied CNRC Data - Categories

Moving Average Forecasting			
Category	**2007 Forecast**	**MAD**	**MAPE**
Arts and Photography	16	7.0	50.0
Aviation	708	221.5	33.4
Business Management	109	81.0	96.4
Computers, Electronics, and Information Technology	482	247.5	62.0
Construction and Building	44	39.5	109.7
Emergency, Fire, and Rescue	75	48.5	85.1
Engineering, Mechanical, and Industrial	424	299.0	94.0
Food, Restaurant, and Lodging	67	39.0	78.0
Human Resources	48	6.5	14.1
Intelligence and Communications	108	104.5	145.1
Legal, Law Enforcement, and Security	54	22.0	36.1
Medical and Dental	203	119.0	64.3
Office and Administrative Support	114	80.5	93.6
Religion	7	1.0	16.7
Total	**2459**		

Table 22. MA Applied CNRC Data - AE Rating Sample

Moving Average AE Rating Forecasting				
Reserve Accessions	AE	n=2	error	%error
2004	62			
2005	49			
2006	60	55.5	4.5	7.5
2007		**54.5**		
MAD			**4.5**	
MAPE				**7.5**

2. WMA Model

We again wanted last year's affiliations to have more of an emphasis on forecasting because of the effects that GWOT, political changes, and other localized changes have on recruiting efforts. Therefore, we assigned 0.95 for the most recent year's data, and .05 for the previous year. As we only had three years of data, we had to

utilize a 2-period WMA, which is not ideal. Again, we need to consider the reliability of this model in our analysis due to lack of ample data. Table 23 includes the computations of the categories for the WMA model and Table 24 is a sample for how an individual rating was calculated.

Table 23. WMA Applied CNRC Data – Categories

Weighted Moving Average Forecasting			
Category	**2007 Forecast**	**MAD**	**MAPE**
Arts and Photography	14	4.3	30.7
Aviation	668	100.5	15.1
Business Management	87	53.1	63.2
Computers, Electronics, and Information Technology	407	173.3	43.4
Construction and Building	37	18.4	51.0
Emergency, Fire, and Rescue	59	36.4	63.8
Engineering, Mechanical, and Industrial	329	219.8	69.1
Food, Restaurant, and Lodging	52	34.5	69.0
Human Resources	46	4.3	9.2
Intelligence and Communications	76	74.4	103.3
Legal, Law Enforcement, and Security	60	15.7	25.7
Medical and Dental	187	44.3	23.9
Office and Administrative Support	89	57.6	66.9
Religion	6	1.0	16.7
Total	**2117**		

Table 24. WMA Applied CNRC Data – AE Rating Sample

Weighted Moving Average AE Rating Forecasting				
Reserve Accessions	AE	estimate	error	%error
2004	62			
2005	49			
2006	60	50	10.4	17.3
2007		**59**		
MAD			**10.4**	
MAPE				**17.3**

3. ES Model

In exponential smoothing (ES), when a is close to 1, dampening is quick; when a is close to 0, dampening is slow. Since an a value of 1 is unrealistic to use (the current forecast would be the same as the previous forecast), we chose to use more realistic a values of 0.1 and 0.2 for forecasting for this data. Table 25 and Table 26 include the computations of the categories for ES (alpha=0.1/0.2) and Table 27 is a sample for how an individual rating was calculated.

Table 25. ES (Alpha=0.1) Applied CNRC Data – Categories

Exponential Smoothing Forecasting (Alpha=0.1)			
Category	**2007 Forecast**	**MAD**	**MAPE**
Arts and Photography	22	5.1	33.5
Aviation	960	199.4	28.5
Business Management	179	55.9	57.4
Computers, Electronics, and Information Technology	681	159.5	35.9
Construction and Building	88	35.1	84.1
Emergency, Fire, and Rescue	110	28.8	44.5
Engineering, Mechanical, and Industrial	650	181.8	49.8
Food, Restaurant, and Lodging	89	17.7	32.6
Human Resources	54	4.5	9.5
Intelligence and Communications	190	66.1	76.4
Legal, Law Enforcement, and Security	36	13.9	25.2
Medical and Dental	352	117.1	58.4
Office and Administrative Support	177	50.6	51.2
Religion	7	0.3	5.6
Total	**3595**		

Table 26. ES (Alpha=0.2) Applied CNRC Data – Categories

Exponential Smoothing Forecasting (Alpha=0.2)			
Category	**2007 Forecast**	**MAD**	**MAPE**
Arts and Photography	21	4.9	32.1
Aviation	906	190.4	27.1
Business Management	164	53.9	54.9
Computers, Electronics, and Information Technology	637	154.0	34.6
Construction and Building	79	33.5	79.8
Emergency, Fire, and Rescue	102	27.9	42.9
Engineering, Mechanical, and Industrial	599	175.9	48.0
Food, Restaurant, and Lodging	84	17.3	32.0
Human Resources	52	4.3	9.1
Intelligence and Communications	172	63.9	73.3
Legal, Law Enforcement, and Security	40	13.4	24.5
Medical and Dental	320	111.6	55.5
Office and Administrative Support	163	48.9	49.2
Religion	7	0.3	5.6
Total	**3346**		

Table 27. ES Applied CNRC Data - AE Rating Sample

Exponential Smoothing AE Rating Forecasting							
Reserve Accessions	AE	es1 (Alpha=0.1)	error	%error	es2 (Alpha=0.2)	error	%error
2004	62	62	0.0	0.0	62	0.0	0.0
2005	49	62	13.0	26.5	62	13.0	26.5
2006	60	61	0.7	1.2	59	0.6	1.0
2007		**61**			**60**		
MAD			**4.6**			**4.5**	
MAPE				**9.2**			**9.2**

4. Comparison of Models and Chosen Forecast

Using the models, the chosen forecasts for both categories and individual ratings were obtained using MAPE. ES (Alpha=0.2) was the overwhelming choice for forecasting categories (chosen 9 times out of 14), while WMA was second (chosen 4 times). For individual ratings, WMA was chosen 31 times (out of 99), while ES

(Alpha=0.2) was chosen 27 times. Table 28 includes the chosen forecast for CNRC data based on categories. Table 29 includes the chosen forecast for CNRC data based on ratings. Figure 8 graphically compares all forecasting models for the CNRC data by categories. Figure 9 graphically compares the projected affiliation totals for the different forecasting models using the CNRC data.

Table 28. Chosen Forecast for Applied CNRC Data – Categories

Chosen Forecast			
Category	**Best Model Using MAPE**	**2007 Forecast**	**MAPE**
Arts and Photography	Weighted Moving Average	14	30.7
Aviation	Weighted Moving Average	668	15.1
Business Management	Exponential Smoothing (Alpha =0.2)	164	54.9
Computers, Electronics, and Information Technology	Exponential Smoothing (Alpha =0.2)	637	34.6
Construction and Building	Weighted Moving Average	37	51.0
Emergency, Fire, and Rescue	Exponential Smoothing (Alpha =0.2)	102	42.9
Engineering, Mechanical, and Industrial	Exponential Smoothing (Alpha =0.2)	599	48.0
Food, Restaurant, and Lodging	Exponential Smoothing (Alpha =0.2)	84	32.0
Human Resources	Exponential Smoothing (Alpha =0.2)	52	9.1
Intelligence and Communications	Exponential Smoothing (Alpha =0.2)	172	73.3
Legal, Law Enforcement, and Security	Exponential Smoothing (Alpha =0.2)	40	24.5
Medical and Dental	Weighted Moving Average	187	23.9
Office and Administrative Support	Exponential Smoothing (Alpha =0.2)	163	49.2
Religion	Exponential Smoothing (Alpha =0.1/0.2)	7	5.6
Projected Total		**2926**	

Table 29. Chosen Forecast for Applied CNRC Data – Ratings

Chosen Forecast			
Rating	**Best Model Using MAPE**	**2007 Forecast**	**MAPE**
ABE	Weighted Moving Average	34	15.0
ABF	Weighted Moving Average	32	16.4
ABH	Weighted Moving Average	60	29.6
AC	Exponential Smoothing (Alpha=0.2)	29	8.8
AD	Weighted Moving Average	77	32.4
AE	Moving Average	55	7.5
AF	All Models	0	0.0
AG	Weighted Moving Average	13	25.8
AM	Weighted Moving Average	72	7.8
AME	Weighted Moving Average	19	12.4
AN	Weighted Moving Average	28	73.1
AO	Weighted Moving Average	63	16.1
AS	Weighted Moving Average	24	11.9
AT	Exponential Smoothing (Alpha=0.2)	126	29.2
AV	All Models	0	0.0
AW	Exponential Smoothing (Alpha=0.2)	14	30.3
AZ	Moving Average	37	3.8
BM	Weighted Moving Average	104	3.1
BU	Weighted Moving Average	10	51.0
CE	Exponential Smoothing (Alpha=0.1)	9	16.5
CM	Weighted Moving Average	5	89.0
CMC	All Models	0	0.0
CN	All Models	0	0.0
CT	All Models	0	0.0
CTA	Exponential Smoothing (Alpha=0.1)	7	19.9
CTI	Exponential Smoothing (Alpha=0.1)	13	52.7
CTM	Exponential Smoothing (Alpha=0.1)	7	19.4
CTO	Exponential Smoothing (Alpha=0.1)	14	99.7
CTR	Moving Average	23	11.5
CTT	Exponential Smoothing (Alpha=0.1/0.2)	24	50.0
DC	Exponential Smoothing (Alpha=0.2)	68	34.3
DIV	Weighted Moving Average	2	2.5
DK	Exponential Smoothing (Alpha=0.2)	22	861.3
DM	No Good Model (Used W.M.A. Forecast)	0	N/A
DT	Weighted Moving Average	32	49.0
EA	Exponential Smoothing (Alpha=0.1/0.2)	3	66.7
EM	Exponential Smoothing (Alpha=0.2)	86	46.8
EM (NUC)	Exponential Smoothing (Alpha=0.1/0.2)	4	6.7
EM (SS-NUC)	Exponential Smoothing (Alpha=0.2)	11	90.0
EN	Exponential Smoothing (Alpha=0.2)	78	72.0
EO	Exponential Smoothing (Alpha=0.2)	10	70.0
EOD	Weighted Moving Average	1	5.0
ET	Exponential Smoothing (Alpha=0.2)	77	5.0
ET (NUC)	Weighted Moving Average	1	30.0
ET (SS)	Exponential Smoothing (Alpha=0.1)	19	5.8
ET (SS-NUC)	Weighted Moving Average	2	125.0
FC	Weighted Moving Average	49	5.3
FN	Exponential Smoothing (Alpha=0.2)	15	62.1
FN (SS)	All Models	0	0.0
FT	Exponential Smoothing (Alpha=0.1)	4	25.9
GM	Exponential Smoothing (Alpha=0.2)	92	153.3

Rating	Best Model Using MAPE	2007 Forecast	MAPE
GS	All Models	0	0.0
GSE	Exponential Smoothing (Alpha=0.2)	21	90.3
GSM	Exponential Smoothing (Alpha=0.2)	46	64.9
HM	Weighted Moving Average	155	18.9
HT	Exponential Smoothing (Alpha=0.2)	26	45.8
IC	Weighted Moving Average	19	61.4
IS	Exponential Smoothing (Alpha=0.2)	25	40.0
IT	Weighted Moving Average	90	30.6
JO	Exponential Smoothing (Alpha=0.1)	7	8.4
LI	Moving Average	2	0.0
LN	Weighted Moving Average	2	5.0
MA	Weighted Moving Average	58	26.8
MM	Exponential Smoothing (Alpha=0.2)	128	53.0
MM (NUC)	Exponential Smoothing (Alpha=0.1)	11	29.8
MM (SS)	Exponential Smoothing (Alpha=0.2)	11	42.7
MM (SS-NUC)	Weighted Moving Average	11	12.7
MN	Exponential Smoothing (Alpha=0.1)	4	25.8
MR	Exponential Smoothing (Alpha=0.2)	10	420.0
MS	Exponential Smoothing (Alpha=0.2)	78	31.9
MS (SS)	Exponential Smoothing (Alpha=0.1/0.2)	6	33.3
MT	Moving Average	7	28.6
MU	No Good Model (Used W.M.A. Forecast)	0	N/A
NC	No Good Model (Used W.M.A. Forecast)	0	N/A
OS	Exponential Smoothing (Alpha=0.2)	140	48.5
PC	Moving Average	16	5.9
PH	Weighted Moving Average	5	46.0
PN	Weighted Moving Average	46	7.2
PR	Weighted Moving Average	14	1.1
QM	Exponential Smoothing (Alpha=0.2)	53	60.5
RP	Exponential Smoothing (Alpha=0.1/0.2)	7	5.6
SEAL	Weighted Moving Average	3	153.3
SH	Exponential Smoothing (Alpha=0.2)	54	84.9
SK	Exponential Smoothing (Alpha=0.2)	109	45.5
SK (SS)	Exponential Smoothing (Alpha=0.1)	1	20.0
SM	No Good Model (Used W.M.A. Forecast)	1	N/A
SN	Exponential Smoothing (Alpha=0.2)	32	40.4
SN (NUC)	All Models	0	0.0
SN (SS)	No Good Model (Used W.M.A. Forecast)	0	N/A
STG	Exponential Smoothing (Alpha=0.2)	22	45.2
STS	Exponential Smoothing (Alpha=0.2)	11	50.6
SW	Moving Average	4	25.0
SWCC	Exponential Smoothing (Alpha=0.1)	2	28.9
TEMAC	All Models	0	0.0
TM	Moving Average	9	0.0
UT	Weighted Moving Average	3	13.3
YN	Weighted Moving Average	43	31.8
YN (SS)	No Good Model (Used W.M.A. Forecast)	0	N/A
Projected Total		**2767**	

Figure 8. Comparison of Forecasting Models for Applied CNRC Data – Categories

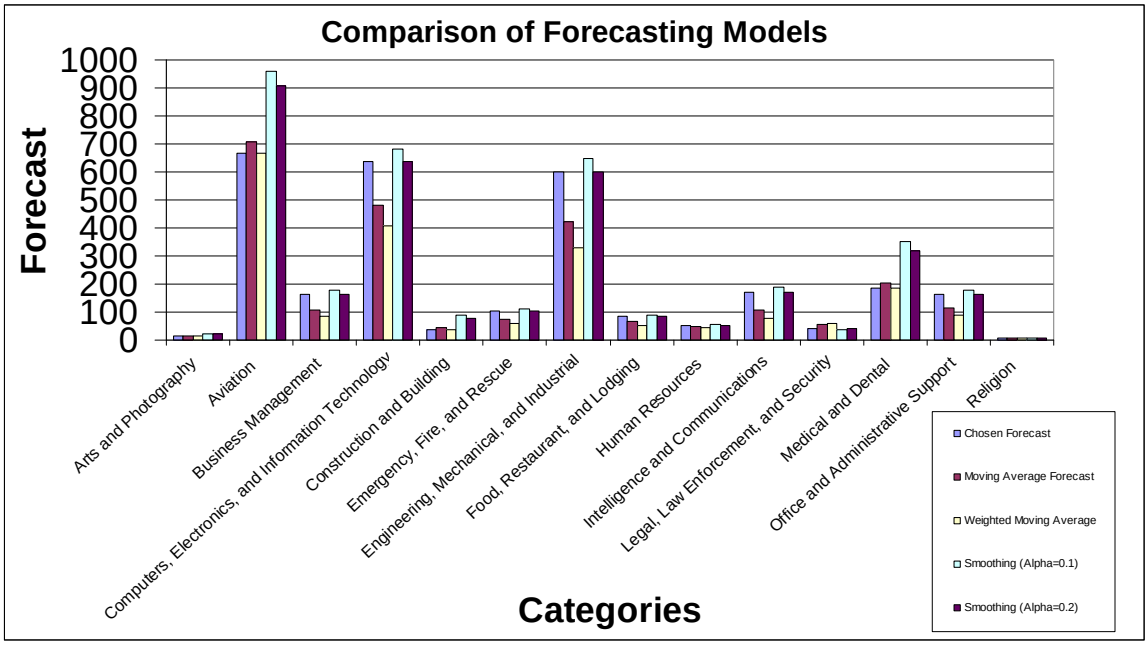
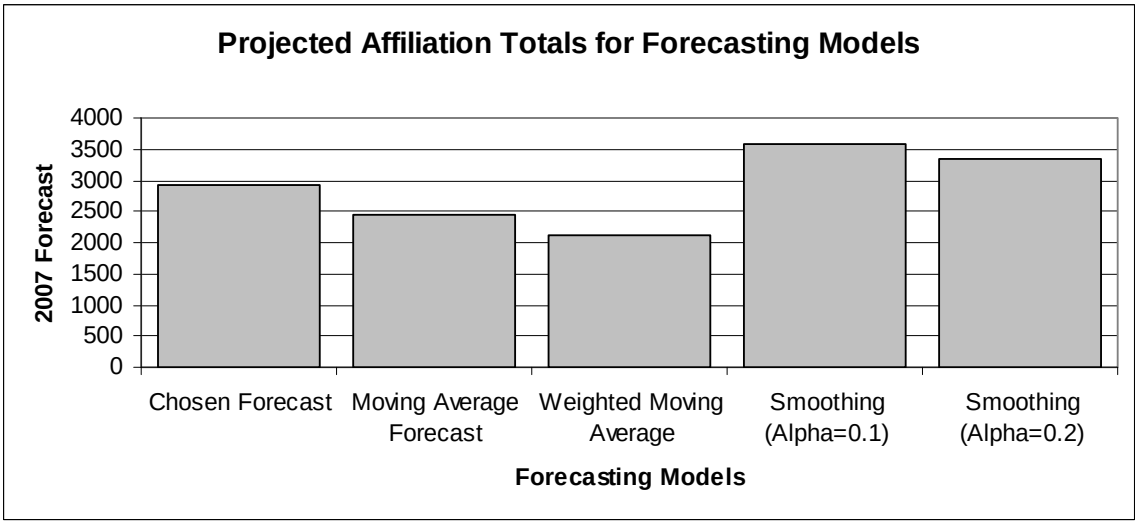


Figure 9. Comparison of Forecasting Models for Applied CNRC Data – Projected Affiliation Totals for Forecasting Models



C. DMDC DATA FORECASTING

Navy Reserve recruits in 14 different categories, as discussed earlier. In this section, we apply forecasting models to the five-year reserve data and forecast the number of accessions to each category. DMDC data includes almost no OSVET data. Therefore, we will only be able to forecast for the NAVET and NPS markets. In the end, we will choose the best-fit model for the data based on MAD and MAPE. For each section of modeling, we will show how we applied the techniques and then present the overall results.

1. NAVET Accessions Forecasting

Modeling results will be demonstrated using the business management category data. Excel results for the MA are shown in Table 30. Forecasted accessions for 2008 are 9 and the MAD is 5.3; MAPE is 66% for the model. We applied a 3-period MA model, because only five years of data was available.

Table 30. MA for Business Management (NAVET)

Moving Average for Business Management				
Year	**Accessions**	**Forecast**	**Error**	**% Error**
2003	13			
2004	20			
2005	10			
2006	10	14.33	4.33	43.33
2007	7	13.33	6.33	90.48
2008		9.00		
MAD			**5.33**	
MAPE				**66.90**

For the WMA model, a value of 0.95 was used as the last year's weight, since more emphasis was desired for the previous year. The estimated value for 2008 is 7.15; MAD and MAPE are 1.78 and 24%, respectively. These results are much better than the MA results and are shown in Table 31.

Table 31. WMA for Business Management (NAVET)

WMA for Business Management					
Year	**Accessions**	**Forecast**	**Error**	**% Error**	**Weight**
2003	13				k1=0.02
2004	20				k2=0.03
2005	10				k3=0.95
2006	10	10.36	0.36	3.60	
2007	7	10.20	3.20	45.71	
2008		7.15			
MAD			**1.78**		
MAPE				**24.66**	

ES has been applied for two different alpha values, a=0.1 and a=0.2. For a=0.1, the forecasted accessions for 2008 are 12.3; MAD and MAPE are 5 and 47.7%, respectively. For a=0.2, the forecasted accessions for 2008 are 11.65; MAD and MAPE are 5.2 and 49.3%, respectively. More specific details are listed in Table 32.

Table 32. ES for Business Management (NAVET)

Exponential Smoothing for Business Management							
		α=0.1			**α=0.2**		
Year	**Accessions**	**Forecast**	**Error**	**% Error**	**Forecast**	**Error**	**% Error**
2003	13	13.00	0.00	0.00	13.00	0.00	0.00
2004	20	13.00	7.00	35.00	13.00	7.00	35.00
2005	10	13.70	3.70	37.00	14.40	4.40	44.00
2006	10	13.33	3.33	33.30	13.52	3.52	35.20
2007	7	13.00	6.00	85.67	12.82	5.82	83.09
2008		12.40			11.65		
MAD			**5.01**			**5.18**	
MAPE				**47.74**			**49.32**

Finally, a comparison was made between the three forecasting techniques in terms of reliability (MAD and MAPE). Table 33 shows the MAD and MAPE values for each technique.

Table 33. Comparison Between Models (NAVET)

Comparison Between Models		
Models	**MAD**	**MAPE**
Moving Average	5.33	66.90
Weighted Moving Average	**1.78**	**24.66**
Exponential Smoothing(α=0.1)	5.01	47.74
Exponential Smoothing(α=0.2)	5.18	49.32

With a MAD of 1.78 and MAPE of 24%, WMA has the smallest forecasting error. Therefore, for the business management category, the WMA model results will be utilized for our analysis.

In the third section of this chapter, we show a comparison of all Navy Reserve categories and decide the best-fit model for each category so that we can make the most reliable analysis based on the data we have.

2. NPS Accessions Forecasting

In this section, forecasting NPS accessions was completed in the same manner as it was for NAVET accessions in section A. As an example, we will examine the Law Enforcement and Security category. We will apply all previously discussed forecasting techniques to this data. Table 34 shows the MA results.

Table 34. MA for Law Enforcement (NPS)

Moving Average for Law Enforcement				
Year	**Accessions**	**Forecast**	**Error**	**% Error**
2003	79			
2004	74			
2005	61			
2006	105	71.33	33.67	32.06
2007	127	80.00	47.00	37.01
2008		97.67		
MAD			**40.33**	
MAPE				**34.54**

By applying a 3-period MA model to the law enforcement data, we get a 97.6 forecast for 2008, with a MAD of 40.3 and MAPE of 34.5%.

The same weight values as the previous section were used in the WMA model (.95 was used for the previous year). Again, we wanted the recent years to have more emphasis on our calculations. Results for the WMA model for law enforcement are listed in Table 35.

Table 35. WMA for Law Enforcement (NPS)

WMA for Law Enforcement					
Year	**Accessions**	**Forecast**	**Error**	**% Error**	**Weight**
2003	79				n1=0.02
2004	74				n2=0.03
2005	61				n3=0.95
2006	105	61.75	43.25	41.19	
2007	127	103.06	23.94	18.85	
2008		125.02			
MAD			**33.60**		
MAPE				**30.02**	

The WMA results are better than the MA model. As can be seen in the table, the forecast for 2008 is 125, MAD and MAPE values are 33.6 and 30% respectively.

The Excel results for ES are shown in Table 36 for two different alpha values.

Table 36. ES for Law Enforcement (NPS)

Exponential Smoothing for Business Management							
		α=0.1			**α=0.2**		
Year	**Accessions**	**Forecast**	**Error**	**% Error**	**Forecast**	**Error**	**% Error**
2003	79	79.00	0.00	0.00	79.00	0.00	0.00
2004	74	79.00	5.00	6.76	79.00	5.00	6.76
2005	61	78.50	17.50	28.69	78.00	17.00	27.87
2006	105	76.75	28.25	26.90	74.60	30.40	28.95
2007	127	79.58	47.43	37.34	80.68	46.32	36.47
2008		84.32			89.94		
MAD			**24.54**			**24.68**	
MAPE				**24.92**			**25.01**

ES gives the best results in terms of both MAD and MAPE. Table 37 provides results of the three different models.

Table 37. Comparison Between Models (NPS)

Comparison Between Models		
Models	**MAD**	**MAPE**
Moving Average	40.33	34.54
Weighted Moving Average	33.60	30.02
Exponential Smoothing(a=0.1)	**24.54**	**24.92**
Exponential Smoothing(a=0.2)	24.68	25.01

The ES model with a=0.1 is the best-fit model for the law enforcement data. It has the smallest forecasting error. Therefore, we will use this model as a basis for analysis for the law enforcement category.

3. Determining Appropriate Models for Categories

As stated earlier, the Navy Reserve has 14 different categories for recruiting. We have applied forecasting techniques for each category as well as for NAVET and NPS accessions. Based on the smallest MAD and MAPE values, we determined the best models for each category. Table 38 indicates the best models based on MAD or MAPE values for NAVETs for the DMDC data. Table 39 indicates the best models based on MAD or MAPE values for NPS for the DMDC data. In chapter VI, we will analyze the models developed and make recommendations based on prior research.

Table 38. MAD, MAPE Values for Categories (NAVET)

Best Models for Each Category Based on MAD, MAPE values (NAVET Data)										
	Moving Average		WMA		Exp. Smoth. a=0.1		Exp. Smoth. a=0.2		Best	2008
RATING	MAD	MAPE	MAD	MAPE	MAD	MAPE	MAD	MAPE	Model	Foreca
Arts and Photography	2	-	***1.07***	-	1.26	***19.16***	1.272	21.66	WMA	0
Aviation	29.83	102.22	***17.99***	57.27	20.37	***48.64***	20.73	50.86	WMA	26
Business Management	5.33	66.9	***1.78***	***24.65***	5	47.74	5.18	49.32	WMA	7
Computers / Elect. / Info. Technology	25.5	141.11	20.89	107.67	***15.41***	***70.1***	15.63	71.27	ES1	46
Construction and Building	5.33	116.66	***1.79***	39.45	4.63	***37.08***	4.7	41.4	WMA	4
Emegency, Fire, and Rescue	4.66	350	***2.2***	***141.3***	3.26	160.75	3.46	166	WMA	1
Engineering / Mech. and Indust.	23	112.31	16.55	73.81	***15.13***	***54.81***	15.46	56.98	ES1	38
Food, Rest, and Lg	0	-	0	-	0	-	0	-		
Human Resources	1.83	-	***1.06***	-	1.8	47.5	1.63	***45***	WMA	0
Intel. and Comm.	5.5	123.33	3.65	76.4	3.54	***63.85***	***3.54***	64.48	ES1	9
Legal / Law Enforc. and Security	5.83	81.31	7.83	163.1	4.19	84.47	***3.68***	***70.1***	ES2	2
Medical and Dental	4.66	33.98	***2.86***	***22.98***	10.12	61.23	8.5	50	WMA	12
Office and Admin. Support	5.83	100.37	***2.4***	45.52	4.97	***42.17***	5.75	53.06	WMA	5
Religion	***0.5***	***66.66***	0.96	97	0.5	95.5	0.51	92	MA	1

Table 39. MAD, MAPE Values for Categories (NPS Data)

Best Models for Each Category Based on MAD, MAPE values (NPS Data)										
	Moving Average		WMA		Exp. Smoth. a=0.1		Exp. Smoth. a=0.2		Best	2008
RATING	MAD	MAPE	MAD	MAPE	MAD	MAPE	MAD	MAPE	Model	Forecast
Arts and Photography	1.33	-	***0.08***	-	6.88	-	5.9	-	WMA	0
Aviation	35	44.19	***26.5***	***33.6***	90.52	110.26	78.26	96.37	WMA	81
Business Management	37.5	128.99	***22***	***73.7***	90.44	260.37	78.67	222.09	WMA	25
Computers / Elect. / Info. Technology	36.17	65.47	***25.6***	***49.6***	97.27	160.1	84.55	138.21	WMA	45
Construction and Building	112.17	44.52	76.07	***31***	***74.13***	45.37	74.8	44.88	WMA	260
Emegency, Fire, and Rescue	12	400	***3.67***	***122***	10.33	202.05	10.72	206.84	WMA	3
Engineering / Mech. and Indust.	79.83	95.69	***49.8***	***56.5***	65.28	71.55	60.25	65.36	WMA	74
Food, Rest., and Lodg.	0	-	0	-	0	-	0	-		0
Human Resources	9	-	***5.27***	-	15.8	185.33	13.87	***177.33***	WMA	0
Intel. and Comm.	9.17	24.56	***6.43***	***17***	57.58	195.31	49.01	169.74	WMA	36
Legal / Law Enforc. and Security	40.33	34.54	33.6	30.02	***24.54***	***24.92***	24.68	25.01	ES1	84
Medical and Dental	21.17	70.55	***7.98***	***27.4***	31.48	93.07	28.1	81.65	WMA	27
Office and Admin. Support	17.83	76.03	***12.8***	***53.2***	34.71	131.52	30.34	114.37	WMA	22
Religion	***1.83***	***62.5***	***1.5***	***49.9***	3.96	115.94	3.29	84.09	WMA	4

Determining the best model was based on which one demonstrated the smallest MAD and MAPE. However, in the case that a model has the smallest MAD and another model has the smallest MAPE, we looked at scope of the numbers. When the data has

small values, MAPE tends to be more deceptive. In this case we based our analysis on MAD. Additionally, if it wasn't possible to calculate MAPE values due to values of zero in the data set, we used MAD for our analysis. In several cases we also were required to take the pattern of the data into consideration.

4. Comparison of Models

Using the models, the chosen forecasts for both categories and individual ratings were obtained using MAD and MAPE. Figure 10 graphically compares NAVET forecasting models by category for the DMDC data. Figure 11 graphically compares NAVET projected affiliation totals for the DMDC data. Figure 12 graphically compares NPS forecasting models by category for the DMDC data. Figure 13 graphically compares NPS projected affiliation totals for the DMDC data.

Figure 10. Comparison of Forecasting Models for DMDC Data – Categories (NAVET)

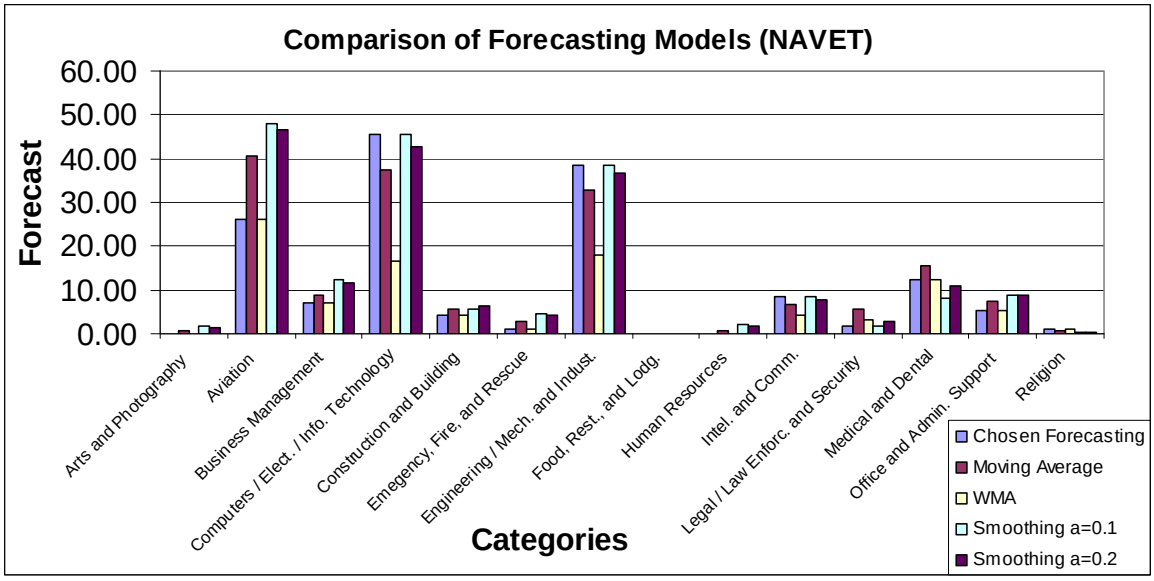


Figure 11. Comparison of Forecasting Models for Applied DMDC Data (NAVET) – Projected Affiliation Totals for Forecasting Models

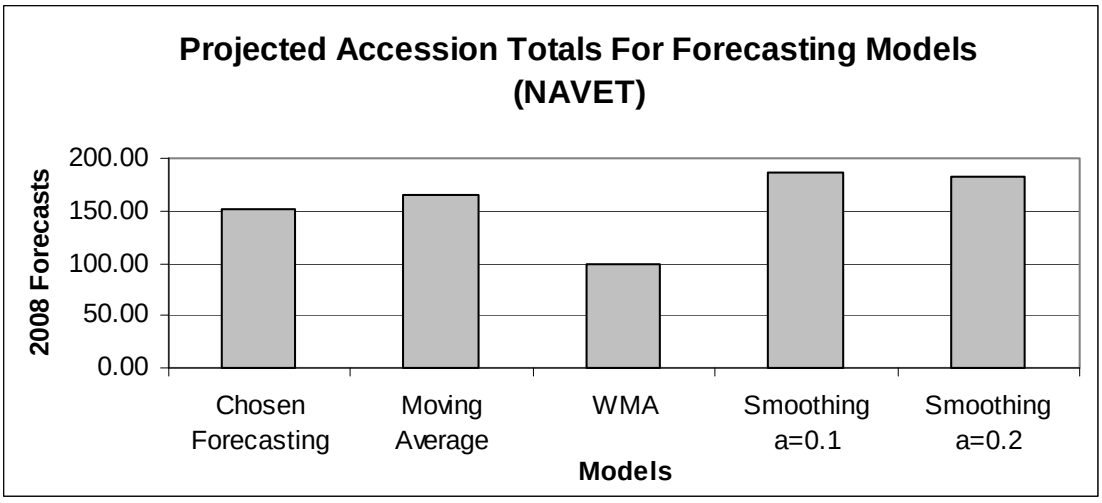


Figure 12. Comparison of Forecasting Models for DMDC Data – Categories (NPS)

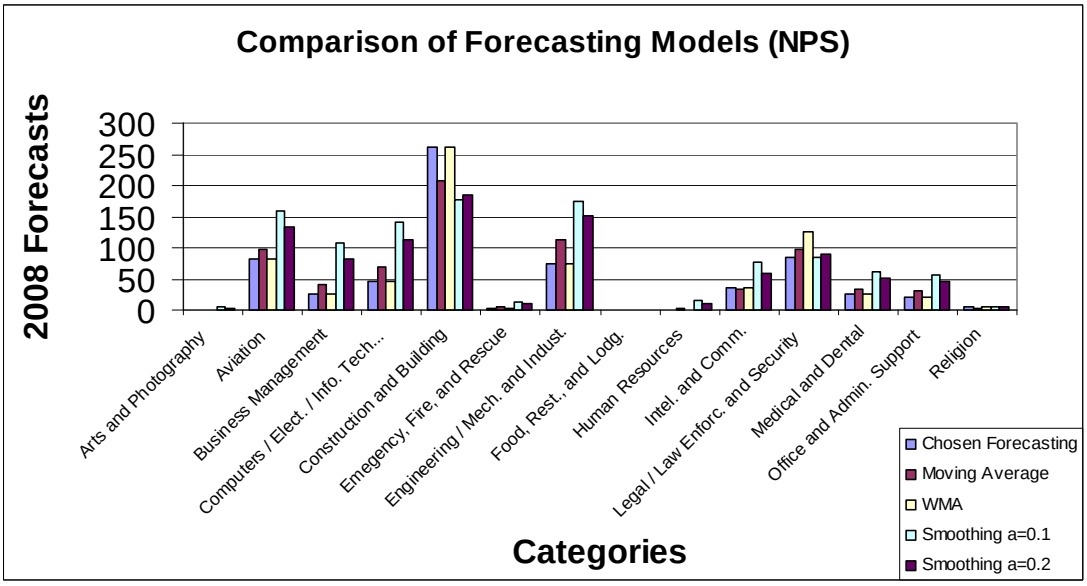
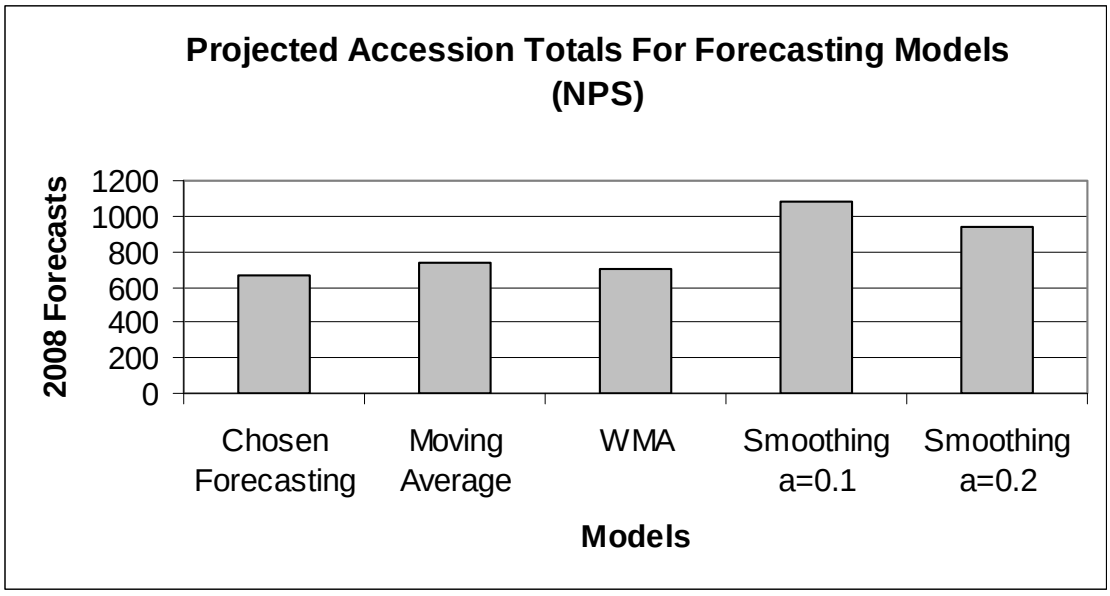


Figure 13. Comparison of Forecasting Models for Applied DMDC Data (NPS) – Projected Affiliation Totals for Forecasting Models



VI. ANALYSIS

A. CNRC WEBSITE DATA ANALYSIS

Based on the chosen forecast for the CNRC website data, MA produced a forecast of 8,914 accessions for 2008 (97.72% of goal). This is a projected shortfall of 208 accessions for 2008. The trend will continue to get worse as our forecast for total affiliations based on the CNRC web data indicates in Figure 14.

Figure 14. Total Affiliations using CNRC Web Data from 1999-2008 (Using Ideal Forecast from MA)

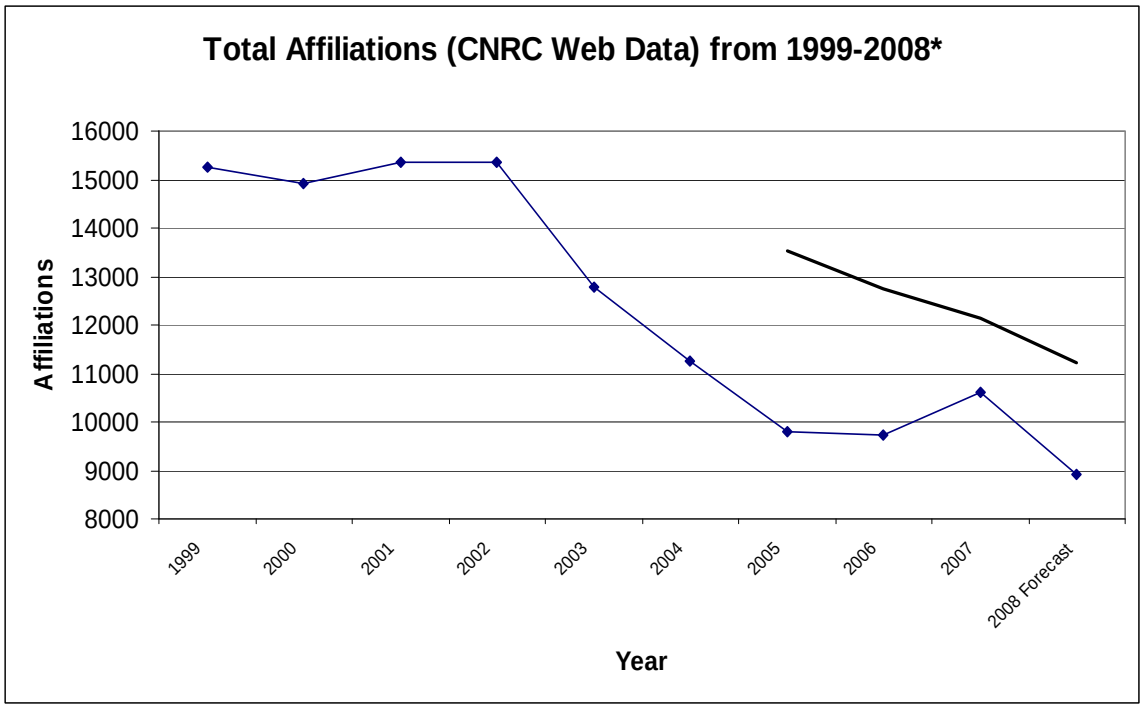
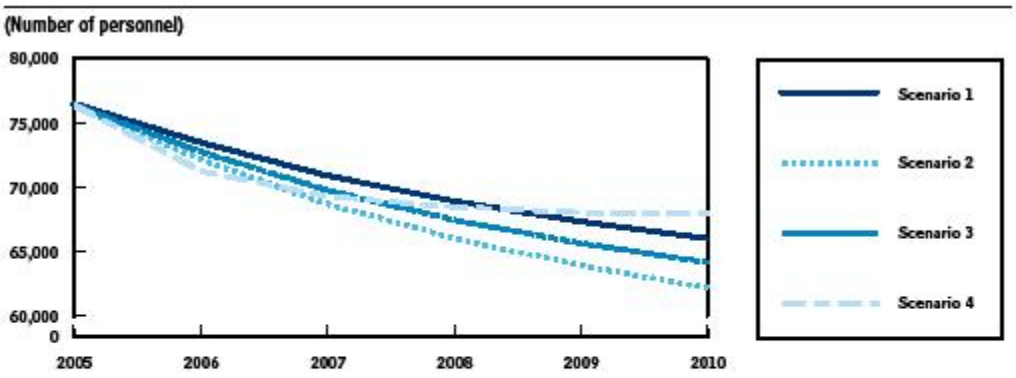


Figure 15. Effects of Recruiting and Retention Scenarios on the Navy Reserve's End Strength (Recruiting, Retention, and Future Levels of Military Personnel, October 2006)



Source: Congressional Budget Office.

Note: Scenario 1 (Base case) = 2006 accession goal (11,180 recruits) each year and continuation rates at the 2005 levels (78.3 percent overall).

Scenario 2 = Accessions at the 2005 level (9,788 recruits) each year and continuation rates at the 2005 levels.

Scenario 3 = Accessions at the 2006 goal each year and continuation rates 1 percentage point lower than the 2005 levels.

Scenario 4 = Varying accession levels (8,750 recruits in 2006, rising to 13,000 recruits by 2009) and continuation rates at the 2005 levels.

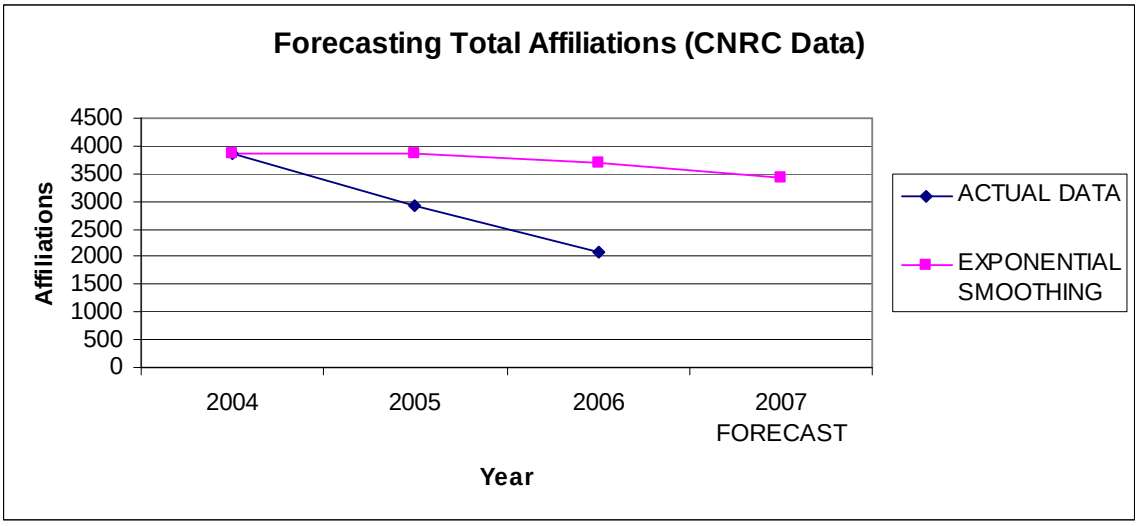
When comparing the CBO projected end-strength in Figure 15 for scenarios 1, 2, and 3 to the forecast for the CNRC website data, the downward trend is similar. Based on this trend, it appears that affiliations will continue to decrease for at least the next several years. As the CBO study states, possible reasons for this decline are the consolidation of active and reserve component recruiting beginning in 2003, GWOT, and more enticing civilian opportunities.

B. CNRC DATA ANALYSIS

The CNRC data we received included only three years of fiscal data. In statistical analysis, using only three data points will not produce accurate results when considering MA, WMA, and ES. Additionally, this data set received from CNRC did not closely match the total affiliations represented in the CNRC website data. We were unable to determine the reason for this. However, we analyzed this data to determine any possible trends.

Based on the CNRC data, ES produced a forecast of 3439 accessions for 2007. This forecast is not accurate based on the CNRC website data. However, as one can see from Figure 16, which is forecasting total affiliations based on CNRC data using exponential smoothing, this is a downward trend from previous years. This also matches with the results from the CBO study conducted in 2006.

Figure 16. Total Affiliations using CNRC Data from 2004–2007

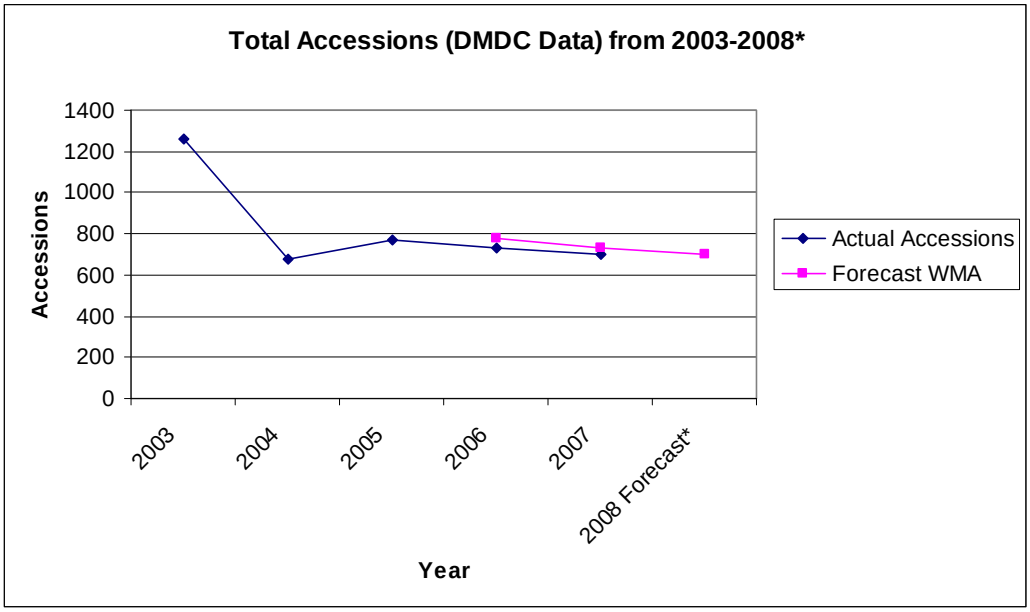


C. DMDC DATA ANALYSIS

DMDC data was also significantly different than the web-based CNRC data in regards to total numbers. We are not sure why this is the case, as DMDC receives their data directly from each respective service. However, when analyzing the data, the downward trend in the data remained the same.

Based on the ideal forecast for the DMDC data, WMA produced a forecast of 701 accessions for 2008. Figure 17 illustrates the forecasted WMA for 2006-2008 using the DMDC data. Examining the WMA trend line in Fiigure 17, recruiting will slowly get worse as our forecast indicates. This data is again similar to the CBO study conducted in 2006.

Figure 17. Total Affiliations using DMDC Data from 2003–2008



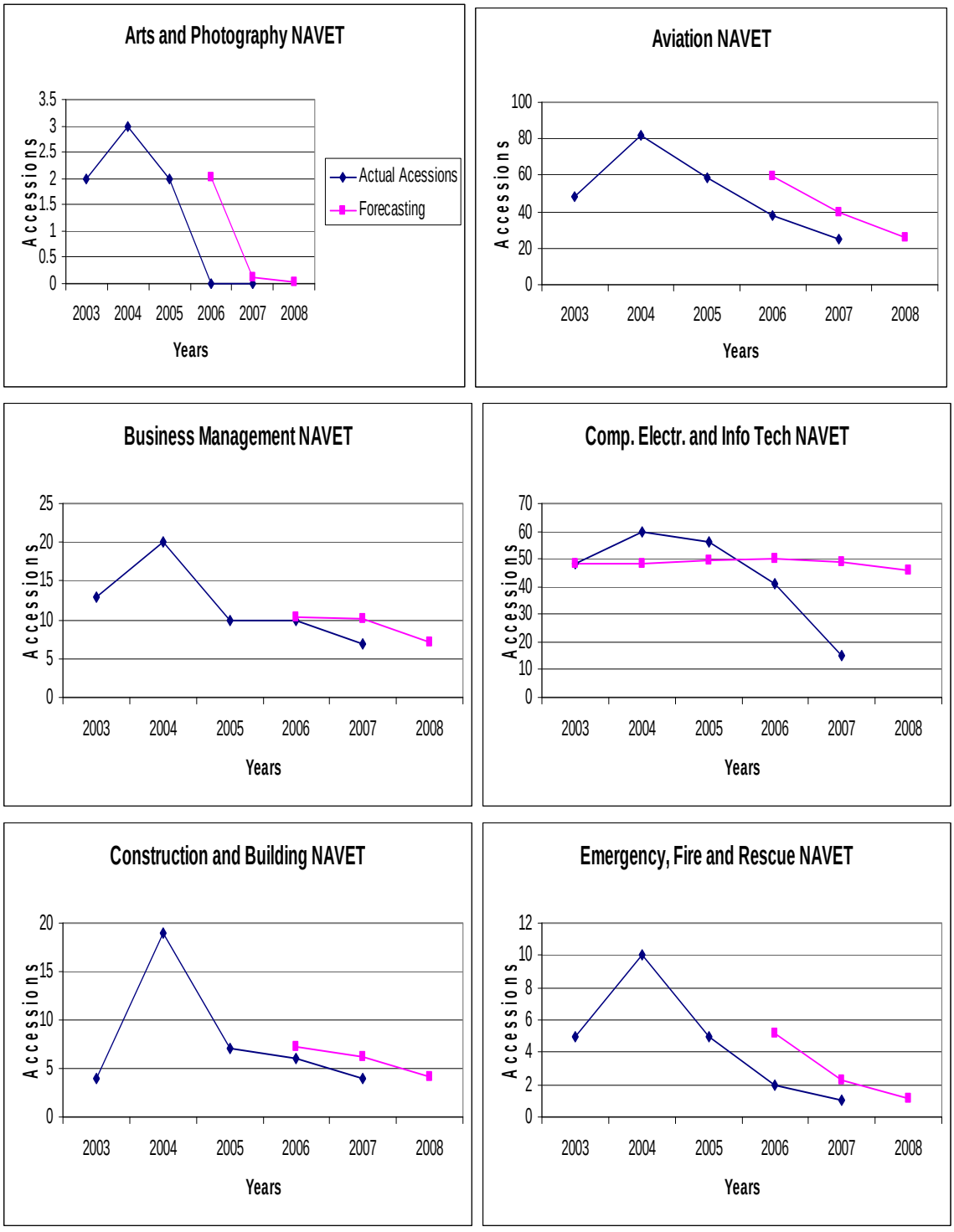
1. NAVET Accessions Analysis

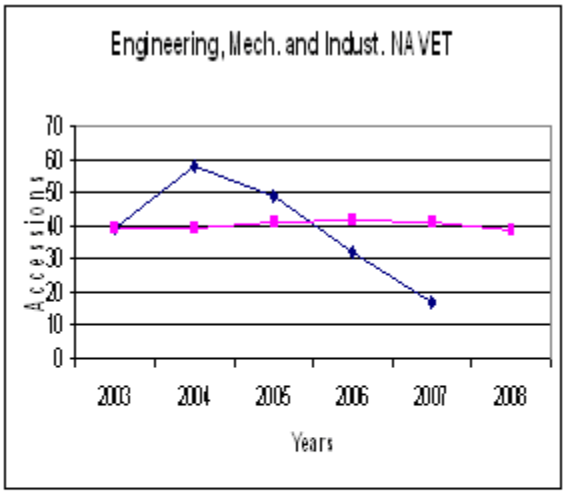
Figure 18 illustrates NAVET forecasts by category based on ideal forecasting models (DMDC data). The graphs in the figure show the actual accession pattern and forecasting for each of the 14 categories individually. Analyzing the figures, almost all NAVET accession categories show a similar pattern. Except for human resources and law enforcement, there is an obvious surge in 2004 in NAVET accessions. Later, accessions steadily decrease until 2008.

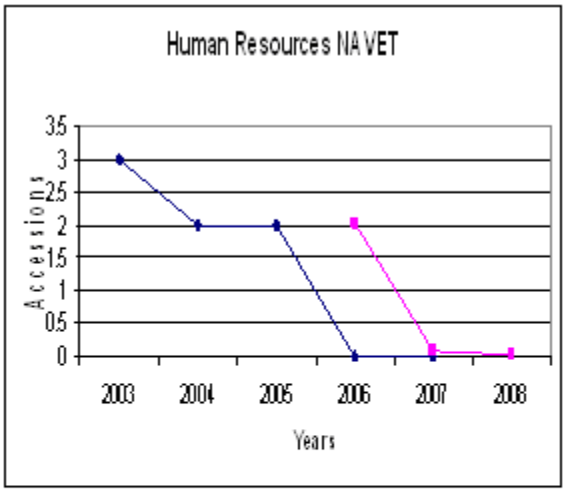
In the human resources category, there is a steady decrease in 2004, rather than an increase. In the law enforcement category there was a large surge in 2006, and then a decrease back to the 2005 level in 2007. A possible reason for this surge is a need for reserve forces to support GWOT efforts.

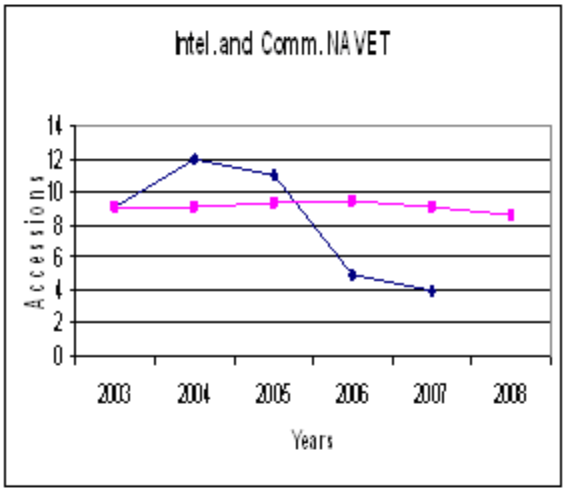
According to forecasts based on the data we have, it seems that a decrease in NAVET accessions will continue in the near future. There might be many reasons for this decrease. As stated earlier, possible reasons for this could be more lucrative civilian opportunities and the consolidation of the active and reserve recruiting components.

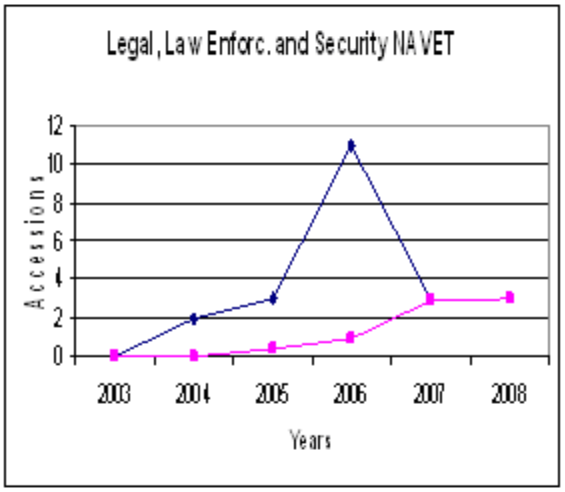
Figure 18. NAVET Accession Projections based on Ideal Forecasting Models

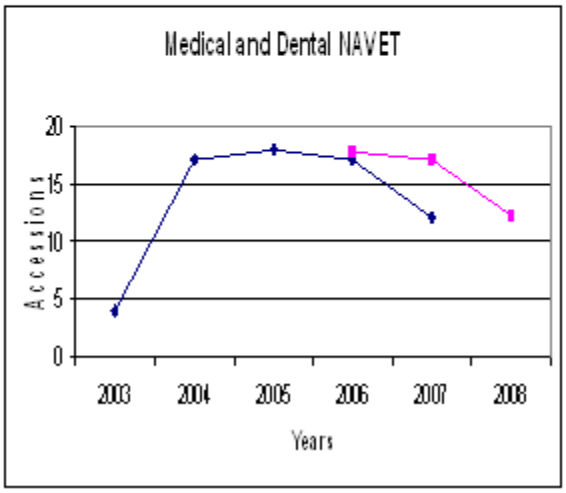


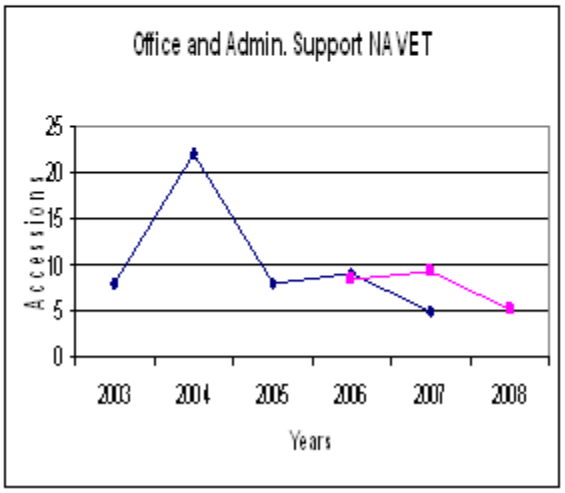

Engineering, Mech. and Indust. NAVET
Accessions
70
60
50
40
30
20
10
0
2003
2004
2005
2006
2007
2008
Years


Human Resources NAVET
Accessions
3.5
3
2.5
2
1.5
1
0.5
0
2003
2004
2005
2006
2007
2008
Years


Intel. and Comm. NAVET
Accessions
14
12
10
8
6
4
2
0
2003
2004
2005
2006
2007
2008
Years


Legal, Law Enforc. and Security NAVET
Accessions
12
10
8
6
4
2
0
2003
2004
2005
2006
2007
2008
Years


Medical and Dental NAVET
Accessions
20
15
10
5
0
2003
2004
2005
2006
2007
2008
Years


Office and Admin. Support NAVET
Accessions
25
20
15
10
5
0
2003
2004
2005
2006
2007
2008
Years

2. NPS Accessions Analysis

Figure 19 illustrates NPS forecasts by category based on ideal forecasting models (DMDC data). The graphs in the figure show the actual accession patterns and forecasting for each of the 14 categories individually between 2003 and 2008. Although not as obvious, there is also a pattern in NPS accessions. In most categories, a sharp decrease occurred in 2004 then it steadies out or continues to decrease smoothly. However, the construction and building; emergency, fire and rescue; engineering; law enforcement; and medical and dental categories do not fit this pattern exactly.

There is a possible explanation as to why there was a sudden increase in NAVET accessions in 2004, if the data is believed to be accurate. The Navy affiliated more NAVET personnel than NPS in 2004. Since a NAVET service member costs less to train than an individual with no prior service, this is an understandable course of action for the Navy.

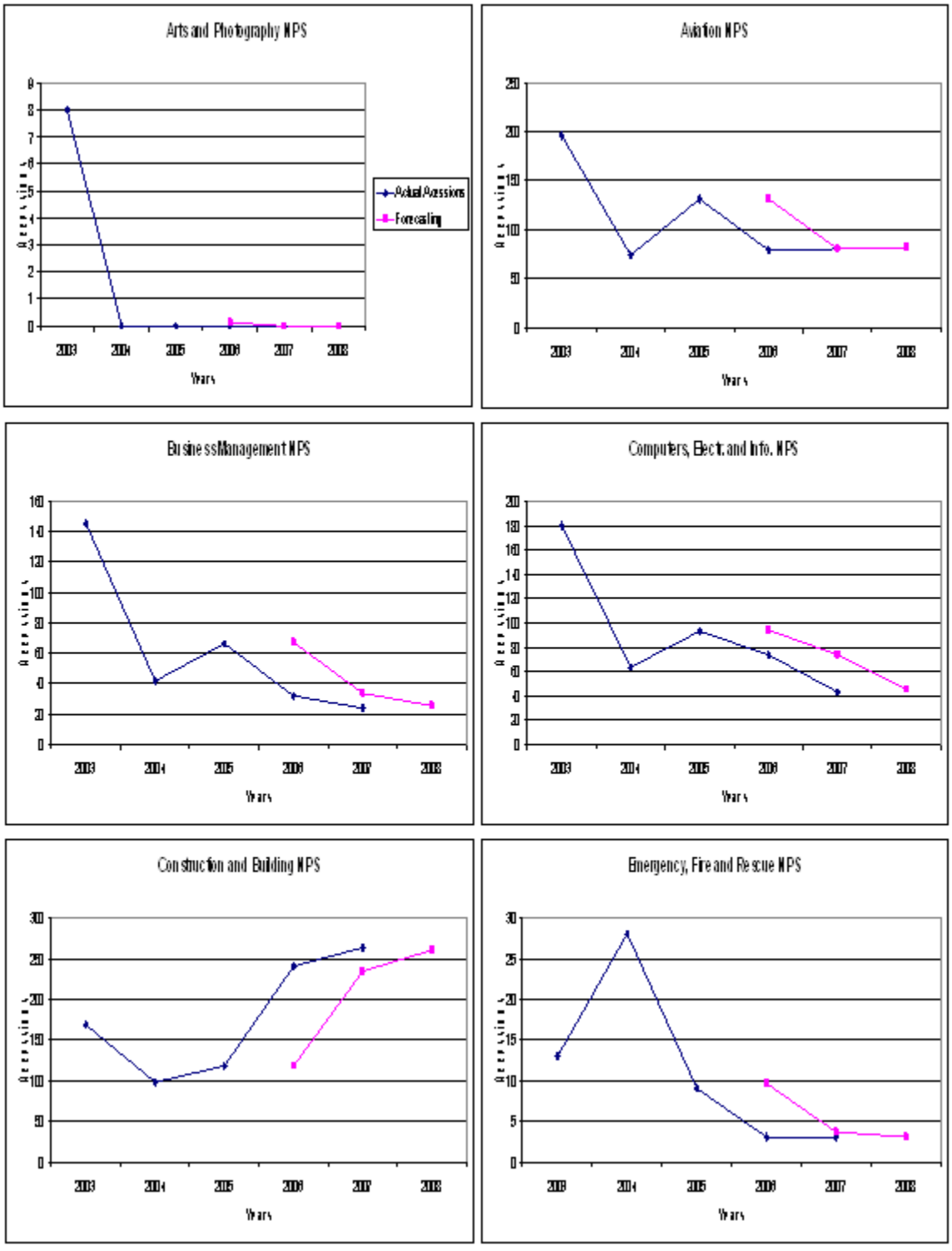
Aviation accessions dropped from 200 to 74 in 2004 and then steadied out. The 2008 forecast for aviation is 81, which indicates it should remain steady for the time being.

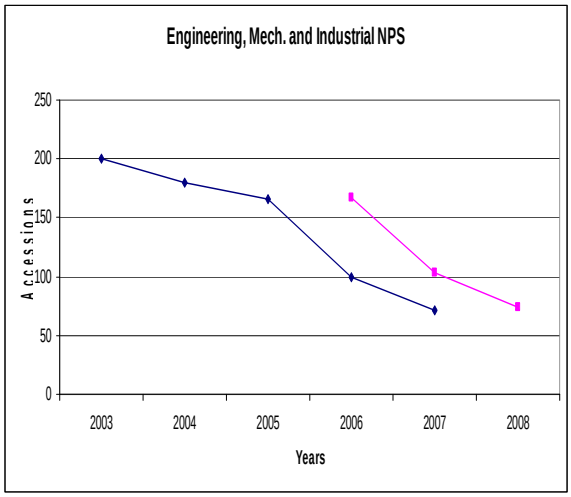
Interestingly, as opposed to other categories, the construction and building category has been steadily increasing since 2004 (from 98 to 264). The forecast for 2008 (260) indicates that there is a strong need for service members in this category. It appears that the category will continue to grow in the near future to support GWOT.

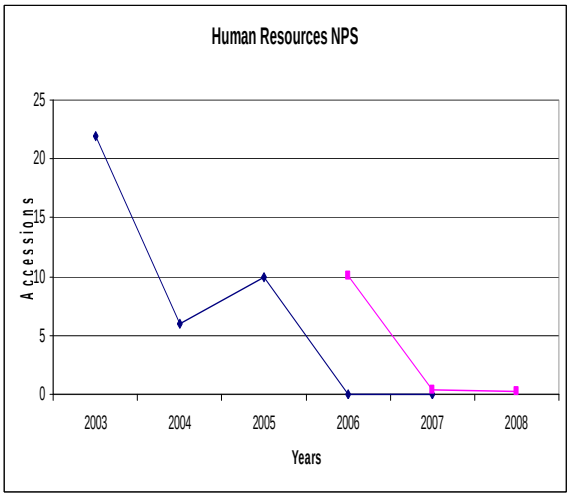
The engineering category is also different from others because there is no sudden drop in 2004; rather, it decreases steadily. Engineering dropped from 200 to a forecasted value of 74 in 2008. This seems to contradict the RAND study somewhat as the Navy seems to be losing technical service members.

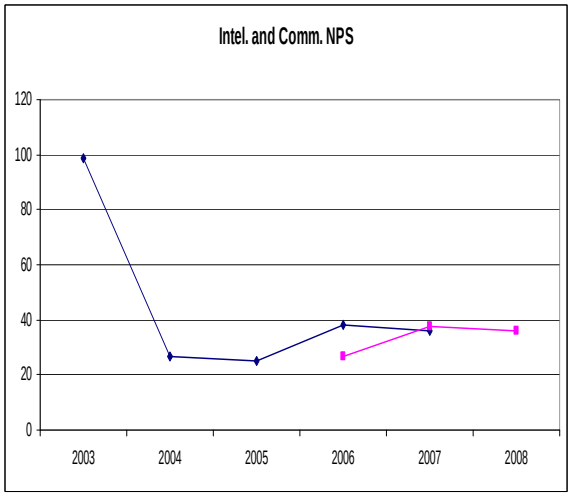
When looking at the overall picture of NPS accessions, there is an obvious decrease despite the sudden increase in 2004. The Navy Reserve's objective may have been to keep the level of accessions at a certain level and they required higher affiliation levels in 2004 to stay above this threshold.

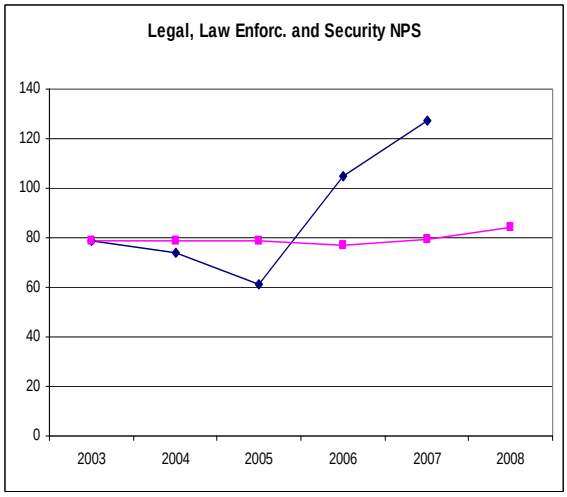
Figure 19. NPS Accession Projections based on Ideal Forecasting Models

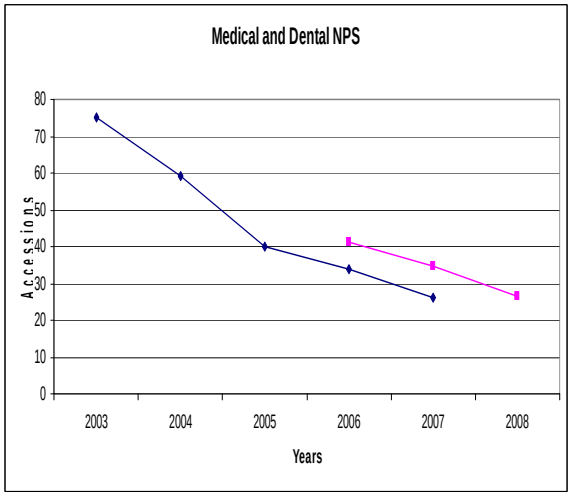


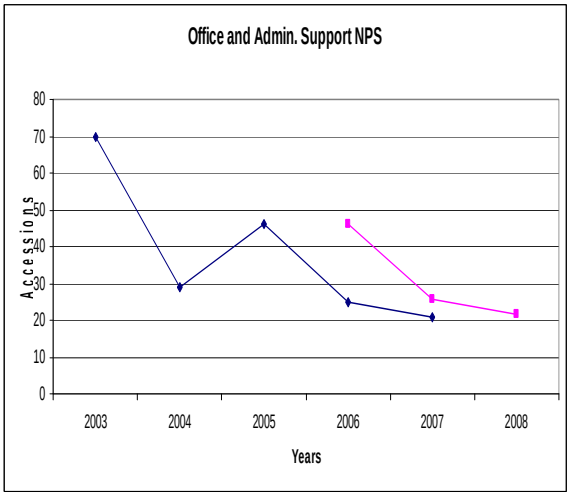

Engineering, Mech. and Industrial NPS
Accessions
250
200
150
100
50
0
2003
2004
2005
2006
2007
2008
Years


Human Resources NPS
Accessions
25
20
15
10
5
0
2003
2004
2005
2006
2007
2008
Years


Intel. and Comm. NPS
120
100
80
60
40
20
0
2003
2004
2005
2006
2007
2008


Legal, Law Enforc. and Security NPS
140
120
100
80
60
40
20
0
2003
2004
2005
2006
2007
2008


Medical and Dental NPS
Accessions
80
70
60
50
40
30
20
10
0
2003
2004
2005
2006
2007
2008
Years


Office and Admin. Support NPS
Accessions
80
70
60
50
40
30
20
10
0
2003
2004
2005
2006
2007
2008
Years

D. SUMMARY AND CONCLUSIONS

Based on our research, it has become apparent that there is a problem with data collection within Navy recruiting. The three data sets we were able to obtain varied greatly, causing the forecasting models to vary significantly in some instances. Good data is key to being able to forecast projected goals and possible shortfalls. Accurate data would also be useful in helping CNRC become more efficient by more closely forecasting funding and manpower requirements.

Even though all of the data may not be complete or accurate, it has become apparent from research and our limited data that there is a downward trend in recruiting. Based on forecasting and analysis discussed earlier, we recommend the following to CNRC in order to calculate the future number of accessions more accurately and correct the downward recruiting trend:

1. It is vital to keep robust loss and accession data from each service by rating, separation date, and other key information. It is difficult to make accurate projections when there is a lack of data or when the data does not match.

2. An analysis of all three data sets showed a downward trend in Navy Reserve enlisted accessions. CBO research shows the same. Indications for this downward trend include GWOT, civilian opportunities, and the active/reserve recruiting consolidation. CNRC may need to begin offering more incentives to potential enlistees or add more recruiters to the workforce to overcome this downward trend.

3. If more accurate data were available, it would be possible to forecast the number of accessions for each service and category by applying the forecasting models. This would provide Navy Recruiting Command with tools in the decision-making process in regards to future affiliations. Future accessions (total numbers and by rating) can be forecasted more accurately, saving time and money.

In addition, CNRC can take this process one step further by modeling individual districts to determine where more focus should be placed. One district may be better at recruiting certain ratings than others or may require more manpower to recruit the same

number of individuals. By having more accurate data and more tools to draw from, CNRC can direct manpower policies accordingly and become a more efficient organization.

4. As stated earlier, time-series models are useful in predicting a future event based on historical data. These models use a form of weighted average of past observations to smooth up-and-down movements and suppress short-term fluctuations (Keating, B., Wilson, J. H. 1990). If a data set has a "spike," a time-series model will help to smooth out or suppress the fluctuation. In recruiting, this is essential as there are usually many "spikes" seen in the data due to the small size of some of the ratings, the number of individuals leaving active duty, the current political situation, and many other factors. If better data can be obtained, it is recommended that CNRC utilize weighted moving average, moving average, exponential smoothing, and regression to (a) select which of these methods work best to forecast future attainments, and (b) use that method to more fully inform estimation of attainments.

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APPENDIX A. MAD, MAPE VALUES OF ALL MODELS APPLIED TO CNRC DATA (RATINGS)

	TOTAL	ABE	ABF	ABH	AC	AD	AE	AF	AG	AM
MOVING AVERAGE RESERVE ACCESSIONS MAD	7.00	18.00	16.50	30.50	6.00	39.50	4.50	0.00	6.50	20.00
EXPONENTIAL SMOOTHING (.1) RESERVE ACCESSIONS MAD	21.00	20.93	17.17	23.70	2.93	28.57	4.57	0.00	5.43	21.60
EXPONENTIAL SMOOTHING (.2) RESERVE ACCESSIONS MAD	31.00	19.87	16.33	22.73	2.87	27.47	4.53	0.00	5.20	20.53
W.M.A. RESERVE ACCESSIONS MAD	36.00	5.10	5.25	17.45	5.10	24.65	10.35	0.00	3.35	5.60
		ABE	ABF	ABH	AC	AD	AE	AF	AG	AM
MOVING AVERAGE RESERVE ACCESSIONS MAPE	6.00	69.23	51.56	51.69	17.65	51.97	7.50	0.00	50.00	27.78
EXPONENTIAL SMOOTHING (.1) RESERVE ACCESSIONS MAPE	13.00	118.46	82.81	71.36	20.00	69.34	1.17	0.00	71.54	45.56
EXPONENTIAL SMOOTHING (.2) RESERVE ACCESSIONS MAPE	4.00	106.15	75.00	66.44	19.41	65.00	1.00	0.00	66.15	41.11
W.M.A. RESERVE ACCESSIONS MAPE	57.00	15.00	16.41	29.58	15.00	32.43	17.25	0.00	25.77	7.78
	ABE	ABF	ABH	AC	AD	AE	AF	AG	AM	AME
2007 Projected accessions using WMA	34.00	32.00	60.00	34.00	77.00	59.00	0.00	13.00	72.00	19.00
	AME	AN	AO	AS	AT	AV	AW	AZ	BM	BU
MOVING AVERAGE RESERVE ACCESSIONS MAD	5.50	35.50	20.50	10.50	48.00	0.00	11.00	1.50	4.00	15.00
EXPONENTIAL SMOOTHING (.1) RESERVE ACCESSIONS MAD	5.10	28.17	17.57	11.43	27.20	0.00	6.47	5.63	8.80	15.27
EXPONENTIAL SMOOTHING (.2) RESERVE ACCESSIONS MAD	4.87	27.00	16.80	10.87	26.40	0.00	6.27	5.27	8.27	14.53
W.M.A. RESERVE ACCESSIONS MAD	2.35	19.75	10.15	2.85	37.20	0.00	8.30	3.45	3.20	5.10
	AME	AN	AO	AS	AT	AV	AW	AZ	BM	BU
MOVING AVERAGE RESERVE ACCESSIONS MAPE	28.95	131.48	32.54	43.75	58.54	0.00	45.83	3.85	3.85	150.00
EXPONENTIAL SMOOTHING (.1) RESERVE ACCESSIONS MAPE	43.68	183.33	47.14	72.08	70.24	0.00	55.83	15.13	10.00	238.00
EXPONENTIAL SMOOTHING (.2) RESERVE ACCESSIONS MAPE	40.00	170.37	43.49	65.00	67.32	0.00	53.33	12.31	8.46	216.00
W.M.A. RESERVE ACCESSIONS MAPE	12.37	73.15	16.11	11.88	45.37	0.00	34.58	8.85	3.08	51.00
	AN	AO	AS	AT	AV	AW	AZ	BM	BU	CE
2007 Projected accessions using WMA	28.00	63.00	24.00	84.00	0.00	24.00	39.00	104.00	10.00	7.00
	CE	CM	CMC	CN	CT	CTA	CTI	CTM	CTO	CTR
MOVING AVERAGE RESERVE ACCESSIONS MAD	3.00	8.50	0.00	0.00	0.00	3.00	10.00	2.50	12.50	3.00
EXPONENTIAL SMOOTHING (.1) RESERVE ACCESSIONS MAD	1.40	7.03	0.00	0.00	0.00	1.80	4.53	2.43	4.77	10.33
EXPONENTIAL SMOOTHING (.2) RESERVE ACCESSIONS MAD	1.47	6.73	0.00	0.00	0.00	1.93	4.73	2.47	4.87	9.67
W.M.A. RESERVE ACCESSIONS MAD	3.90	4.45	0.00	0.00	0.00	4.80	12.70	5.65	13.85	6.00
	CE	CM	CMC	CN	CT	CTA	CTI	CTM	CTO	CTR
MOVING AVERAGE RESERVE ACCESSIONS MAPE	42.86	170.00	0.00	0.00	0.00	50.00	166.67	35.71	312.50	11.54
EXPONENTIAL SMOOTHING (.1) RESERVE ACCESSIONS MAPE	31.43	242.00	0.00	0.00	0.00	23.33	126.67	4.29	282.50	42.31
EXPONENTIAL SMOOTHING (.2) RESERVE ACCESSIONS MAPE	34.29	224.00	0.00	0.00	0.00	30.00	136.67	5.71	290.00	34.62
W.M.A. RESERVE ACCESSIONS MAPE	55.71	89.00	0.00	0.00	0.00	80.00	211.67	80.71	346.25	23.08
	CM	CMC	CN	CT	CTA	CTI	CTM	CTO	CTR	CTT
2007 Projected accessions using WMA	5.00	0.00	0.00	0.00	6.00	7.00	7.00	5.00	26.00	11.00

	CTT	DC	DIV	DK	DM	DT	EA	EM	EM(NUC)	EM(SS-NUC)
MOVING AVERAGE RESERVE ACCESSIONS MAD	15.00	26.00	0.50	25.50	1.50	35.00	2.00	43.00	1.00	8.00
EXPONENTIAL SMOOTHING (.1) RESERVE ACCESSIONS MAD	5.00	17.07	0.63	8.97	1.90	32.20	0.67	25.53	0.33	4.53
EXPONENTIAL SMOOTHING (.2) RESERVE ACCESSIONS MAD	5.00	16.47	0.60	8.93	1.80	30.73	0.67	24.73	0.33	4.40
W.M.A. RESERVE ACCESSIONS MAD	15.00	17.90	0.05	25.05	0.15	15.20	2.00	32.20	1.00	6.20
	CTT	DC	DIV	DK	DM	DT	EA	EM	EM(NUC)	EM (SS-NUC)
MOVING AVERAGE RESERVE ACCESSIONS MAPE	150.00	60.47	25.00	2550.00	#DIV/0!	112.90	200.00	93.48	20.00	200.00
EXPONENTIAL SMOOTHING (.1) RESERVE ACCESSIONS MAPE	150.00	77.21	45.00	2590.00	#DIV/0!	169.68	200.00	114.35	20.00	240.00
EXPONENTIAL SMOOTHING (.2) RESERVE ACCESSIONS MAPE	150.00	73.02	40.00	2580.00	#DIV/0!	155.48	200.00	109.13	20.00	230.00
W.M.A. RESERVE ACCESSIONS MAPE	150.00	41.63	2.50	2505.00	#DIV/0!	49.03	200.00	70.00	20.00	155.00
	DC	DIV	DK	DM	DT	EA	EM	EM(NUC)	EM(SS-NUC)	EN
2007 Projected accessions using WMA	44.00	2.00	2.00	0.00	32.00	1.00	48.00	5.00	4.00	35.00
	EN	EO	EOD	ET	ET(NUC)	ET(SS)	ET(SS-NUC)	FC	FN	FN (SS)
MOVING AVERAGE RESERVE ACCESSIONS MAD	47.00	7.00	0.50	8.00	3.00	2.50	7.00	10.00	10.50	0.00
EXPONENTIAL SMOOTHING (.1) RESERVE ACCESSIONS MAD	29.67	3.27	0.63	3.60	3.80	1.03	7.00	16.40	3.97	0.00
EXPONENTIAL SMOOTHING (.2) RESERVE ACCESSIONS MAD	28.67	3.20	0.60	3.53	3.60	1.07	6.67	15.47	3.93	0.00
W.M.A. RESERVE ACCESSIONS MAD	33.50	6.10	0.05	7.10	0.30	2.95	2.50	2.60	10.05	0.00
	EN	EO	EOD	ET	ET(NUC)	ET (SS)	ET(SS-NUC)	FC	FN	FN (SS)
MOVING AVERAGE RESERVE ACCESSIONS MAPE	142.42	175.00	50.00	11.43	300.00	14.71	350.00	20.41	175.00	0.00
EXPONENTIAL SMOOTHING (.1) RESERVE ACCESSIONS MAPE	178.79	195.00	90.00	12.57	540.00	12.35	550.00	43.27	181.67	0.00
EXPONENTIAL SMOOTHING (.2) RESERVE ACCESSIONS MAPE	169.70	190.00	80.00	12.29	480.00	12.94	500.00	37.55	180.00	0.00
W.M.A. RESERVE ACCESSIONS MAPE	101.52	152.50	5.00	10.14	30.00	17.35	125.00	5.31	167.50	0.00
	EO	EOD	ET	ET(NUC)	ET(SS)	ET(SS-NUC)	FC	FN	FN (SS)	FT
2007 Projected accessions using WMA	4.00	1.00	70.00	1.00	17.00	2.00	49.00	7.00	0.00	7.00
	FT	GM	GS	GSE	GSM	HM	HT	IC	IS	IT
MOVING AVERAGE RESERVE ACCESSIONS MAD	3.50	67.00	0.00	12.50	30.50	84.00	14.00	20.50	14.00	47.00
EXPONENTIAL SMOOTHING (.1) RESERVE ACCESSIONS MAD	1.37	51.27	0.00	9.30	14.37	84.93	6.57	16.63	5.60	36.20
EXPONENTIAL SMOOTHING (.2) RESERVE ACCESSIONS MAD	1.40	49.20	0.00	8.93	14.07	80.87	6.47	15.93	5.53	34.73
W.M.A. RESERVE ACCESSIONS MAD	3.95	39.10	0.00	7.55	26.45	29.10	14.15	11.05	13.10	27.20
	FT	GM	GS	GSE	GSM	HM	HT	IC	IS	IT
MOVING AVERAGE RESERVE ACCESSIONS MAPE	50.00	279.17	0.00	156.25	160.53	54.55	107.69	113.89	107.69	52.81
EXPONENTIAL SMOOTHING (.1) RESERVE ACCESSIONS MAPE	44.29	382.50	0.00	211.25	179.47	86.23	128.46	160.56	113.85	72.58
EXPONENTIAL SMOOTHING (.2) RESERVE ACCESSIONS MAPE	45.71	356.67	0.00	197.50	174.74	78.31	126.15	148.89	112.31	67.64
W.M.A. RESERVE ACCESSIONS MAPE	56.43	162.92	0.00	94.38	139.21	18.90	108.85	61.39	100.77	30.56
	GM	GS	GSE	GSM	HM	HT	IC	IS	IT	JO
2007 Projected accessions using WMA	26.00	0.00	8.00	20.00	155.00	14.00	19.00	14.00	90.00	7.00

	JO	LI	LN	MA	MM	MM (NUC)	MM (SS)	MM(SS-NUC)	MN	MR
MOVING AVERAGE RESERVE ACCESSIONS MAD	1.00	0.00	1.00	23.00	77.50	6.00	6.00	4.00	2.50	9.50
EXPONENTIAL SMOOTHING (.1) RESERVE ACCESSIONS MAD	0.73	0.93	1.27	15.13	36.57	2.80	2.93	6.93	2.43	6.43
EXPONENTIAL SMOOTHING (.2) RESERVE ACCESSIONS MAD	0.80	0.87	1.20	14.60	35.80	2.93	2.87	6.53	2.47	6.20
W.M.A. RESERVE ACCESSIONS MAD	1.90	0.90	0.10	15.80	67.15	7.80	5.10	1.40	5.65	6.35
	JO	LI	LN	MA	MM	MM (NUC)	MM (SS)	MM(SS-NUC)	MN	MR
MOVING AVERAGE RESERVE ACCESSIONS MAPE	14.29	0.00	50.00	38.98	129.17	85.71	100.00	36.36	62.50	950.00
EXPONENTIAL SMOOTHING (.1) RESERVE ACCESSIONS MAPE	2.86	40.00	90.00	49.83	144.50	62.86	113.33	80.00	7.50	1230.00
EXPONENTIAL SMOOTHING (.2) RESERVE ACCESSIONS MAPE	5.71	30.00	80.00	47.12	140.67	68.57	110.00	69.09	10.00	1160.00
W.M.A. RESERVE ACCESSIONS MAPE	27.14	45.00	5.00	26.78	111.92	111.43	85.00	12.73	141.25	635.00
	LI	LN	MA	MM	MM(NUC)	MM (SS)	MM(SS-NUC)	MN	MR	MS
2007 Projected accessions using WMA	2.00	2.00	58.00	63.00	7.00	6.00	11.00	4.00	1.00	49.00
	MS	MS (SS)	MT	MU	NC	OS	PC	PH	PN	PR
MOVING AVERAGE RESERVE ACCESSIONS MAD	36.00	3.00	2.00	1.00	0.50	85.00	1.00	5.00	6.00	1.50
EXPONENTIAL SMOOTHING (.1) RESERVE ACCESSIONS MAD	16.67	1.00	2.13	0.33	0.37	36.73	1.53	4.47	4.80	1.90
EXPONENTIAL SMOOTHING (.2) RESERVE ACCESSIONS MAD	16.33	1.00	2.07	0.33	0.40	36.13	1.40	4.27	4.60	1.80
W.M.A. RESERVE ACCESSIONS MAD	31.50	3.00	4.70	1.00	0.95	76.90	2.80	2.30	3.30	0.15
	MS	MS (SS)	MT	MU	NC	OS	PC	PH	PN	PR
MOVING AVERAGE RESERVE ACCESSIONS MAPE	76.60	100.00	28.57	#DIV/0!	#DIV/0!	125.00	5.88	100.00	13.04	10.71
EXPONENTIAL SMOOTHING (.1) RESERVE ACCESSIONS MAPE	85.11	100.00	5.71	#DIV/0!	#DIV/0!	135.59	3.53	148.00	18.26	19.29
EXPONENTIAL SMOOTHING (.2) RESERVE ACCESSIONS MAPE	82.98	100.00	2.86	#DIV/0!	#DIV/0!	132.94	1.18	136.00	16.96	17.14
W.M.A. RESERVE ACCESSIONS MAPE	67.02	100.00	67.14	#DIV/0!	#DIV/0!	113.09	16.47	46.00	7.17	1.07
	MS (SS)	MT	MU	NC	OS	PC	PH	PN	PR	QM
2007 Projected accessions using WMA	3.00	7.00	0.00	0.00	72.00	17.00	5.00	46.00	14.00	27.00
	QM	RP	SEAL	SH	SK	SK (SS)	SM	SMAII	SN	SN (NUC)
MOVING AVERAGE RESERVE ACCESSIONS MAD	27.00	1.00	10.00	33.50	47.00	0.50	44.50	0.00	15.50	0.00
EXPONENTIAL SMOOTHING (.1) RESERVE ACCESSIONS MAD	19.27	0.33	8.93	22.83	33.40	0.37	45.17	0.00	8.43	0.00
EXPONENTIAL SMOOTHING (.2) RESERVE ACCESSIONS MAD	18.53	0.33	8.53	22.00	32.13	0.40	43.00	0.00	8.20	0.00
W.M.A. RESERVE ACCESSIONS MAD	17.10	1.00	4.60	22.25	29.90	0.95	15.25	0.00	12.35	0.00
	QM	RP	SEAL	SH	SK	SK (SS)	SM	SMAII	SN	SN (NUC)
MOVING AVERAGE RESERVE ACCESSIONS MAPE	103.85	16.67	333.33	159.52	75.81	50.00	#DIV/0!	0.00	86.11	0.00
EXPONENTIAL SMOOTHING (.1) RESERVE ACCESSIONS MAPE	137.69	16.67	493.33	207.14	100.32	10.00	#DIV/0!	0.00	101.67	#DIV/0!
EXPONENTIAL SMOOTHING (.2) RESERVE ACCESSIONS MAPE	129.23	16.67	453.33	195.24	94.19	20.00	#DIV/0!	0.00	97.78	#DIV/0!
W.M.A. RESERVE ACCESSIONS MAPE	65.77	16.67	153.33	105.95	48.23	95.00	#DIV/0!	0.00	68.61	0.00
	RP	SEAL	SH	SK	SK (SS)	SM	SMAII	SN	SN (NUC)	SN (SS)
2007 Projected accessions using WMA	6.00	3.00	22.00	63.00	1.00	1.00	0.00	19.00	0.00	0.00
	SN (SS)	STG	STS	SW	SWCC	TEMAC	TM	UT	YN	YN (SS)
MOVING AVERAGE RESERVE ACCESSIONS MAD	1.50	12.50	7.50	1.50	2.00	0.00	0.00	4.00	25.50	3.50
EXPONENTIAL SMOOTHING (.1) RESERVE ACCESSIONS MAD	0.97	5.57	2.70	1.83	1.47	0.00	1.87	5.07	21.10	1.77
EXPONENTIAL SMOOTHING (.2) RESERVE ACCESSIONS MAD	0.93	5.47	2.73	1.67	1.60	0.00	1.73	4.80	20.20	1.87
W.M.A. RESERVE ACCESSIONS MAD	1.05	11.15	7.95	3.75	3.80	0.00	1.80	0.40	13.35	4.85
	SN (SS)	STG	STS	SW	SWCC	TEMAC	TM	UT	YN	YN (SS)
MOVING AVERAGE RESERVE ACCESSIONS MAPE	#DIV/0!	113.64	150.00	25.00	100.00	0.00	0.00	133.33	60.71	#DIV/0!
EXPONENTIAL SMOOTHING (.1) RESERVE ACCESSIONS MAPE	#DIV/0!	124.55	142.00	8.33	20.00	0.00	16.00	240.00	86.43	#DIV/0!
EXPONENTIAL SMOOTHING (.2) RESERVE ACCESSIONS MAPE	#DIV/0!	121.82	144.00	0.00	40.00	0.00	12.00	213.33	80.00	#DIV/0!
W.M.A. RESERVE ACCESSIONS MAPE	#DIV/0!	101.36	159.00	62.50	190.00	0.00	18.00	13.33	31.79	#DIV/0!
	STG	STS	SW	SWCC	TEMAC	TM	UT	YN	YN (SS)	
2007 Projected accessions using WMA	12.00	5.00	6.00	2.00	0.00	10.00	3.00	43.00	0.00	2124.00

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APPENDIX B. MAD, MAPE VALUES OF ALL MODELS APPLIED TO DMDC DATA (CATEGORIES)

NAVET MAD	TOTAL	ARTS AND PHOTGRAPHY	AVIATION	BUSINESS MANAGEMENT	COMPUTERS / ELECTRONICS / INFORMATION TECHNOLOGY	CONSTRUCTION AND BUILDING	EMERGENCY, FIRE, AND RESCUE	ENGINEERING / MECHANICAL AND INDUSTRIAL
MOVING AVERAGE	2.00	2.00	29.83	5.33	25.50	5.33	4.67	23.00
EXPONENTIAL SMOOTHING (.1)	3.00	1.27	20.38	5.01	15.42	4.63	3.26	15.14
EXPONENTIAL SMOOTHING (.2)	3.00	1.27	20.74	5.18	15.63	4.70	3.46	15.47
W.M.A.	9.00	1.08	17.99	1.78	20.90	1.80	2.20	16.55
NPS MAD								
MOVING AVERAGE	1.00	1.33	35.00	37.50	36.17	112.17	12.00	79.83
EXPONENTIAL SMOOTHING (.1)	3.00	6.88	90.52	90.44	97.27	74.13	10.33	65.28
EXPONENTIAL SMOOTHING (.2)	1.00	5.90	78.26	78.67	84.55	74.80	10.72	60.25
W.M.A.	12.00	0.08	26.52	22.04	25.62	76.07	3.67	49.84
NAVET MAPE								
MOVING AVERAGE	1.00	#DIV/0!	102.23	66.90	141.11	116.67	350.00	112.32
EXPONENTIAL SMOOTHING (.1)	7.00	19.17	48.65	47.74	70.10	37.08	160.75	54.82
EXPONENTIAL SMOOTHING (.2)	2.00	21.67	50.86	49.32	71.27	41.40	166.00	56.98
W.M.A.	3.00	#DIV/0!	57.27	24.66	107.68	39.46	141.25	73.82
NPS MAPE								
MOVING AVERAGE	0.00	#DIV/0!	44.19	128.99	65.47	44.52	400.00	95.69
EXPONENTIAL SMOOTHING (.1)	1.00	#DIV/0!	110.26	260.37	160.10	45.37	202.05	71.55
EXPONENTIAL SMOOTHING (.2)	1.00	#DIV/0!	96.37	222.09	138.21	44.88	206.84	65.36
W.M.A.	10.00	#DIV/0!	33.56	73.68	49.62	31.03	122.17	56.49

NAVET MAD	ENGINEERING / MECHANICAL AND INDUSTRIAL	FOOD, RESTAURANT, AND LODGING	HUMAN RESOURCES	INTELLIGENCE AND COMMUNICATIONS	LEGAL / LAW ENFORCEMENT AND SECURITY	MEDICAL AND DENTAL	OFFICE AND ADMINISTRATIVE SUPPORT	RELIGION
MOVING AVERAGE	23.00	0.00	1.83	5.50	5.83	4.67	5.83	0.50
EXPONENTIAL SMOOTHING (.1)	15.14	0.00	1.81	3.55	4.20	10.13	4.97	0.50
EXPONENTIAL SMOOTHING (.2)	15.47	0.00	1.64	3.55	3.69	8.50	5.76	0.51
W.M.A.	16.55	0.00	1.06	3.66	7.84	2.86	2.41	0.96
NPS MAD								
MOVING AVERAGE	79.83	0.00	9.00	9.17	40.33	21.17	17.83	1.83
EXPONENTIAL SMOOTHING (.1)	65.28	0.00	15.80	57.58	24.54	31.48	34.71	3.96
EXPONENTIAL SMOOTHING (.2)	60.25	0.00	13.87	49.01	24.68	28.10	30.34	3.29
W.M.A.	49.84	0.00	5.27	6.43	33.60	7.98	12.84	1.50
NAVET MAPE								
MOVING AVERAGE	112.32	#DIV/0!	#DIV/0!	123.33	81.31	33.99	100.37	66.67
EXPONENTIAL SMOOTHING (.1)	54.82	#DIV/0!	47.50	63.86	84.48	61.23	42.18	95.50
EXPONENTIAL SMOOTHING (.2)	56.98	#DIV/0!	45.00	64.48	70.11	50.01	53.06	92.00
W.M.A.	73.82	#DIV/0!	#DIV/0!	76.40	163.11	22.99	45.52	97.00
NPS MAPE								
MOVING AVERAGE	95.69	#DIV/0!	#DIV/0!	24.56	34.54	70.55	76.03	62.50
EXPONENTIAL SMOOTHING (.1)	71.55	#DIV/0!	185.33	195.31	24.92	93.07	131.52	115.94
EXPONENTIAL SMOOTHING (.2)	65.36	#DIV/0!	177.33	169.74	25.01	81.65	114.37	84.09
W.M.A.	56.49	#DIV/0!	#DIV/0!	17.01	30.02	27.38	53.15	49.88

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APPENDIX C. MAD, MAPE VALUES OF ALL MODELS APPLIED TO DMDC DATA (RATINGS)

NAVET MAD	TOTAL	AA	AB	ABE	ABF	ABH	AC	AD
MOVING AVERAGE NAVET RESERVE ACCESSIONS MAD	12.00	0.00	0.00	1.17	1.17	1.17	1.67	2.67
EXPONENTIAL SMOOTHING (.1) RESERVE ACCESSIONS MAD	23.00	0.00	0.00	0.53	3.17	1.00	1.03	2.83
EXPONENTIAL SMOOTHING (.2) RESERVE ACCESSIONS MAD	8.00	0.00	0.00	0.55	2.67	1.02	1.06	2.62
W.M.A. RESERVE ACCESSIONS MAD	34.00	0.00	0.00	1.48	1.00	1.94	2.44	1.13
NPS MAD		**AA**	**AB**	**ABE**	**ABF**	**ABH**	**AC**	**AD**
MOVING AVERAGE NPS ACCESSIONS MAD	28.00	0.50	0.00	3.00	3.83	4.00	3.33	3.00
EXPONENTIAL SMOOTHING (.1) NPS ACCESSIONS MAD	10.00	0.80	0.00	6.58	8.03	4.68	2.42	12.23
EXPONENTIAL SMOOTHING (.2) NPS ACCESSIONS MAD	12.00	0.87	0.00	5.57	6.77	4.16	2.60	10.50
W.M.A. NPS ACCESSIONS MAD	43.00	0.51	0.00	2.51	3.49	4.38	3.97	2.98
NAVET MAPE		**AA**	**AB**	**ABE**	**ABF**	**ABH**	**AC**	**AD**
MOVING AVERAGE RESERVE ACCESSIONS MAPE	20.00	#DIV/0!	#DIV/0!	72.22	91.67	34.44	44.44	80.00
EXPONENTIAL SMOOTHING (.1) RESERVE ACCESSIONS MAPE	34.00	#DIV/0!	#DIV/0!	34.17	182.08	24.06	45.56	38.15
EXPONENTIAL SMOOTHING (.2) RESERVE ACCESSIONS MAPE	19.00	#DIV/0!	#DIV/0!	35.00	138.00	24.89	46.67	36.32
W.M.A. RESERVE ACCESSIONS MAPE	18.00	#DIV/0!	#DIV/0!	82.50	74.75	52.00	65.00	36.73
NPS MAPE		**AA**	**AB**	**ABE**	**ABF**	**ABH**	**AC**	**AD**
MOVING AVERAGE NPS ACCESSIONS MAPE	33.00	33.33	#DIV/0!	115.00	250.00	185.00	77.38	39.81
EXPONENTIAL SMOOTHING (.1) NPS ACCESSIONS MAPE	19.00	91.90	#DIV/0!	262.96	388.72	146.12	50.68	209.84
EXPONENTIAL SMOOTHING (.2) NPS ACCESSIONS MAPE	15.00	87.20	#DIV/0!	231.64	309.23	132.56	61.16	187.96
W.M.A. NPS ACCESSIONS MAPE	30.00	96.00	#DIV/0!	81.40	191.30	178.50	141.82	41.36
		AA	**AB**	**ABE**	**ABF**	**ABH**	**AC**	**AD**
2008 NAVET Projected Accessions Using WMA	109.4	0	0	2.92	1.97	4.94	0.11	3.1
2008 NPS Projected Accessions Using WMA	795.38	0.95	0	4.89	4.86	4.97	2.19	6.21
2008 Total Projected Accessions Using WMA	904.78	0.95	0	7.81	6.83	9.91	2.3	9.31
NAVET MAD	**AE**	**AG**	**AM**	**AME**	**AN**	**AO**	**AS**	**AR**
MOVING AVERAGE NAVET RESERVE ACCESSIONS MAD	4.50	1.83	4.67	0.50	7.83	3.17	1.67	0.00
EXPONENTIAL SMOOTHING (.1) RESERVE ACCESSIONS MAD	2.82	1.28	3.73	0.71	7.41	5.06	1.14	0.00
EXPONENTIAL SMOOTHING (.2) RESERVE ACCESSIONS MAD	2.87	1.32	4.15	0.68	7.68	4.47	1.24	0.00
W.M.A. RESERVE ACCESSIONS MAD	4.05	2.92	2.93	0.50	1.97	2.86	1.05	0.00
NPS MAD	**AE**	**AG**	**AM**	**AME**	**AN**	**AO**	**AS**	**AR**
MOVING AVERAGE NPS ACCESSIONS MAD	1.67	1.50	1.33	1.67	22.67	8.17	2.17	0.67
EXPONENTIAL SMOOTHING (.1) NPS ACCESSIONS MAD	8.96	4.34	10.98	1.56	17.38	17.00	2.28	0.55
EXPONENTIAL SMOOTHING (.2) NPS ACCESSIONS MAD	7.64	3.76	9.25	1.60	18.29	16.17	2.20	0.59
W.M.A. NPS ACCESSIONS MAD	0.09	1.03	4.21	0.59	16.10	9.86	2.46	0.97
NAVET MAPE	**AE**	**AG**	**AM**	**AME**	**AN**	**AO**	**AS**	**AR**
MOVING AVERAGE RESERVE ACCESSIONS MAPE	316.67	88.89	383.33	#DIV/0!	833.33	64.58	33.33	#DIV/0!
EXPONENTIAL SMOOTHING (.1) RESERVE ACCESSIONS MAPE	160.08	73.00	142.09	10.00	296.70	66.52	23.00	#DIV/0!
EXPONENTIAL SMOOTHING (.2) RESERVE ACCESSIONS MAPE	160.33	78.67	160.70	20.00	321.26	57.58	28.67	#DIV/0!
W.M.A. RESERVE ACCESSIONS MAPE	209.50	99.33	262.58	#DIV/0!	253.00	60.88	3.00	#DIV/0!
NPS MAPE	**AE**	**AG**	**AM**	**AME**	**AN**	**AO**	**AS**	**AR**
MOVING AVERAGE NPS ACCESSIONS MAPE	27.78	0.00	10.82	47.22	1683.33	90.74	129.17	66.67
EXPONENTIAL SMOOTHING (.1) NPS ACCESSIONS MAPE	174.37	340.87	129.05	41.77	466.91	480.56	199.93	95.50
EXPONENTIAL SMOOTHING (.2) NPS ACCESSIONS MAPE	152.27	289.60	113.23	43.80	569.68	465.59	187.95	92.00
W.M.A. NPS ACCESSIONS MAPE	1.50	93.00	32.65	15.08	868.75	109.50	135.75	97.00
	AE	**AG**	**AM**	**AME**	**AN**	**AO**	**AS**	**AR**
2008 NAVET Projected Accessions Using WMA	1.22	0.09	1.23	0.02	0.09	4.24	0.1	0
2008 NPS Projected Accessions Using WMA	6	0.97	11.03	3.95	1.65	9.4	3.89	0.03
2008 Total Projected Accessions Using WMA	7.22	1.06	12.26	3.97	1.74	13.64	3.99	0.03

NAVET MAD	AT	AW	AZ	BM	BU	CA	CE	CM
MOVING AVERAGE NAVET RESERVE ACCESSIONS MAD	5.00	0.50	2.33	6.33	1.67	0.00	0.67	1.67
EXPONENTIAL SMOOTHING (.1) RESERVE ACCESSIONS MAD	3.36	0.25	1.85	4.63	1.64	0.00	0.99	1.64
EXPONENTIAL SMOOTHING (.2) RESERVE ACCESSIONS MAD	3.43	0.25	1.90	4.88	1.50	0.00	0.97	1.50
W.M.A. RESERVE ACCESSIONS MAD	4.09	0.50	2.89	4.65	0.59	0.00	0.98	0.59
NPS MAD	**AT**	**AW**	**AZ**	**BM**	**BU**	**CA**	**CE**	**CM**
MOVING AVERAGE NPS ACCESSIONS MAD	5.50	2.17	3.00	34.50	30.50	0.83	12.83	19.33
EXPONENTIAL SMOOTHING (.1) NPS ACCESSIONS MAD	19.80	1.63	7.00	30.06	19.31	0.48	7.69	11.93
EXPONENTIAL SMOOTHING (.2) NPS ACCESSIONS MAD	16.83	1.51	6.23	27.45	18.87	0.45	8.39	11.74
W.M.A. NPS ACCESSIONS MAD	3.56	1.09	6.27	27.09	17.16	0.53	18.12	12.56
NAVET MAPE	**AT**	**AW**	**AZ**	**BM**	**BU**	**CA**	**CE**	**CM**
MOVING AVERAGE RESERVE ACCESSIONS MAPE	250.00	100.00	50.00	244.44	141.67	#DIV/0!	0.00	141.67
EXPONENTIAL SMOOTHING (.1) RESERVE ACCESSIONS MAPE	119.96	100.00	37.88	92.64	47.58	#DIV/0!	88.67	47.58
EXPONENTIAL SMOOTHING (.2) RESERVE ACCESSIONS MAPE	124.67	100.00	36.73	104.31	45.83	#DIV/0!	78.00	45.83
W.M.A. RESERVE ACCESSIONS MAPE	204.25	100.00	89.00	149.33	56.50	#DIV/0!	93.00	56.50
NPS MAPE	**AT**	**AW**	**AZ**	**BM**	**BU**	**CA**	**CE**	**CM**
MOVING AVERAGE NPS ACCESSIONS MAPE	63.64	72.22	57.22	264.12	40.04	83.33	36.61	53.97
EXPONENTIAL SMOOTHING (.1) NPS ACCESSIONS MAPE	304.74	94.56	256.31	202.31	34.35	95.00	30.03	51.07
EXPONENTIAL SMOOTHING (.2) NPS ACCESSIONS MAPE	274.90	89.33	236.00	182.69	33.32	90.00	33.16	49.73
W.M.A. NPS ACCESSIONS MAPE	39.45	36.17	140.40	170.35	22.29	52.50	65.55	36.15
	AT	**AW**	**AZ**	**BM**	**BU**	**CA**	**CE**	**CM**
2008 NAVET Projected Accessions Using WMA	2.16	0.95	1.98	2.3	1.05	0	0.07	1.05
2008 NPS Projected Accessions Using WMA	10.93	2.96	3.23	10.51	74.42	0.98	21.59	37.4
2008 Total Projected Accessions Using WMA	13.09	3.91	5.21	12.81	75.47	0.98	21.66	38.45
NAVET MAD	**CN**	**CR**	**CS**	**CTA**	**CTI**	**CTM**	**CTN**	**CTO**
MOVING AVERAGE NAVET RESERVE ACCESSIONS MAD	0.33	0.00	1.33	0.67	1.00	0.50	0.00	1.50
EXPONENTIAL SMOOTHING (.1) RESERVE ACCESSIONS MAD	0.30	0.00	3.29	0.28	0.82	0.50	0.00	1.04
EXPONENTIAL SMOOTHING (.2) RESERVE ACCESSIONS MAD	0.34	0.00	3.17	0.30	0.88	0.51	0.00	1.06
W.M.A. RESERVE ACCESSIONS MAD	0.49	0.00	1.95	0.98	1.90	0.96	0.00	1.04
NPS MAD	**CN**	**CR**	**CS**	**CTA**	**CTI**	**CTM**	**CTN**	**CTO**
MOVING AVERAGE NPS ACCESSIONS MAD	1.50	0.50	3.50	0.50	1.17	0.67	0.50	0.83
EXPONENTIAL SMOOTHING (.1) NPS ACCESSIONS MAD	1.21	0.71	5.70	2.58	1.46	1.54	0.25	2.40
EXPONENTIAL SMOOTHING (.2) NPS ACCESSIONS MAD	1.18	0.68	5.73	2.21	1.45	1.35	0.25	2.09
W.M.A. NPS ACCESSIONS MAD	1.50	0.50	5.36	0.03	1.89	0.05	0.50	0.06
NAVET MAPE	**CN**	**CR**	**CS**	**CTA**	**CTI**	**CTM**	**CTN**	**CTO**
MOVING AVERAGE RESERVE ACCESSIONS MAPE	#DIV/0!	#DIV/0!	19.05	33.33	33.33	33.33	#DIV/0!	#DIV/0!
EXPONENTIAL SMOOTHING (.1) RESERVE ACCESSIONS MAPE	100.00	#DIV/0!	45.15	3.33	24.89	5.00	#DIV/0!	47.50
EXPONENTIAL SMOOTHING (.2) RESERVE ACCESSIONS MAPE	100.00	#DIV/0!	46.21	6.67	26.22	10.00	#DIV/0!	45.00
W.M.A. RESERVE ACCESSIONS MAPE	#DIV/0!	#DIV/0!	27.86	95.00	89.00	95.00	#DIV/0!	#DIV/0!
NPS MAPE	**CN**	**CR**	**CS**	**CTA**	**CTI**	**CTM**	**CTN**	**CTO**
MOVING AVERAGE NPS ACCESSIONS MAPE	72.22	50.00	20.56	#DIV/0!	100.00	#DIV/0!	100.00	#DIV/0!
EXPONENTIAL SMOOTHING (.1) NPS ACCESSIONS MAPE	94.99	90.97	32.48	#DIV/0!	53.27	100.00	100.00	200.00
EXPONENTIAL SMOOTHING (.2) NPS ACCESSIONS MAPE	91.02	83.73	32.24	#DIV/0!	59.22	100.00	100.00	200.00
W.M.A. NPS ACCESSIONS MAPE	82.33	50.00	29.77	#DIV/0!	167.25	#DIV/0!	100.00	#DIV/0!
	CN	**CR**	**CS**	**CTA**	**CTI**	**CTM**	**CTN**	**CTO**
2008 NAVET Projected Accessions Using WMA	0.02	0	6.92	0.97	1.01	0.03	0	0.04
2008 NPS Projected Accessions Using WMA	2.88	0.98	16.31	0	2.01	0	0.95	0
2008 Total Projected Accessions Using WMA	2.9	0.98	23.23	0.97	3.02	0.03	0.95	0.04

NAVET MAD	CTR	CTT	DC	DK	DN	DT	EA	EM
MOVING AVERAGE NAVET RESERVE ACCESSIONS MAD	1.83	1.33	2.67	3.00	0.00	1.00	0.00	2.67
EXPONENTIAL SMOOTHING (.1) RESERVE ACCESSIONS MAD	1.96	0.55	1.78	2.22	0.00	0.95	0.00	3.37
EXPONENTIAL SMOOTHING (.2) RESERVE ACCESSIONS MAD	1.95	0.60	1.78	2.39	0.00	1.12	0.00	3.04
W.M.A. RESERVE ACCESSIONS MAD	2.87	1.95	1.59	1.15	0.00	0.08	0.00	1.58
NPS MAD	**CTR**	**CTT**	**DC**	**DK**	**DN**	**DT**	**EA**	**EM**
MOVING AVERAGE NPS ACCESSIONS MAD	3.17	2.00	1.50	3.67	0.33	2.33	3.33	3.67
EXPONENTIAL SMOOTHING (.1) NPS ACCESSIONS MAD	2.06	1.25	3.91	3.09	1.72	1.59	4.05	2.86
EXPONENTIAL SMOOTHING (.2) NPS ACCESSIONS MAD	2.09	1.24	3.40	3.33	1.48	1.64	3.66	2.76
W.M.A. NPS ACCESSIONS MAD	1.63	1.54	0.57	2.60	0.02	1.10	2.56	3.05
NAVET MAPE	**CTR**	**CTT**	**DC**	**DK**	**DN**	**DT**	**EA**	**EM**
MOVING AVERAGE RESERVE ACCESSIONS MAPE	33.33	100.00	266.67	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	46.67
EXPONENTIAL SMOOTHING (.1) RESERVE ACCESSIONS MAPE	57.28	100.00	123.30	43.33	#DIV/0!	100.00	#DIV/0!	52.72
EXPONENTIAL SMOOTHING (.2) RESERVE ACCESSIONS MAPE	50.60	100.00	127.15	53.33	#DIV/0!	100.00	#DIV/0!	47.00
W.M.A. RESERVE ACCESSIONS MAPE	90.00	100.00	159.00	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	28.49
NPS MAPE	**CTR**	**CTT**	**DC**	**DK**	**DN**	**DT**	**EA**	**EM**
MOVING AVERAGE NPS ACCESSIONS MAPE	63.33	50.00	50.00	#DIV/0!	#DIV/0!	#DIV/0!	54.17	77.78
EXPONENTIAL SMOOTHING (.1) NPS ACCESSIONS MAPE	43.61	49.94	114.63	94.00	#DIV/0!	30.00	91.08	56.65
EXPONENTIAL SMOOTHING (.2) NPS ACCESSIONS MAPE	46.51	49.75	98.40	88.00	#DIV/0!	35.00	83.05	53.48
W.M.A. NPS ACCESSIONS MAPE	32.50	38.50	18.83	#DIV/0!	#DIV/0!	#DIV/0!	38.56	59.83
	CTR	**CTT**	**DC**	**DK**	**DN**	**DT**	**EA**	**EM**
2008 NAVET Projected Accessions Using WMA	1.98	0.06	1.06	0.04	0	0	0	5.12
2008 NPS Projected Accessions Using WMA	4.94	3.94	3.02	0.1	0	0.04	7.78	4.18
2008 Total Projected Accessions Using WMA	6.92	4	4.08	0.14	0	0.04	7.78	9.3
NAVET MAD	**EN**	**EO**	**ET**	**EW**	**FA**	**FC**	**FN**	**FR**
MOVING AVERAGE NAVET RESERVE ACCESSIONS MAD	2.67	0.67	7.50	0.00	0.00	3.67	2.00	0.00
EXPONENTIAL SMOOTHING (.1) RESERVE ACCESSIONS MAD	5.27	1.08	5.06	0.00	0.00	3.24	1.88	0.00
EXPONENTIAL SMOOTHING (.2) RESERVE ACCESSIONS MAD	4.64	1.16	5.28	0.00	0.00	3.26	1.98	0.00
W.M.A. RESERVE ACCESSIONS MAD	1.58	0.53	6.59	0.00	0.00	5.85	0.61	0.00
NPS MAD	**EN**	**EO**	**ET**	**EW**	**FA**	**FC**	**FN**	**FR**
MOVING AVERAGE NPS ACCESSIONS MAD	4.33	17.67	4.33	1.50	0.50	0.50	10.50	0.50
EXPONENTIAL SMOOTHING (.1) NPS ACCESSIONS MAD	15.82	16.45	11.34	7.74	0.71	3.85	8.41	0.25
EXPONENTIAL SMOOTHING (.2) NPS ACCESSIONS MAD	13.52	16.11	9.90	6.64	0.68	3.29	9.32	0.25
W.M.A. NPS ACCESSIONS MAD	4.41	20.84	10.05	0.09	0.50	1.90	3.10	0.50
NAVET MAPE	**EN**	**EO**	**ET**	**EW**	**FA**	**FC**	**FN**	**FR**
MOVING AVERAGE RESERVE ACCESSIONS MAPE	100.00	0.00	527.78	#DIV/0!	#DIV/0!	44.17	166.67	#DIV/0!
EXPONENTIAL SMOOTHING (.1) RESERVE ACCESSIONS MAPE	160.88	34.73	222.27	#DIV/0!	#DIV/0!	157.34	102.33	#DIV/0!
EXPONENTIAL SMOOTHING (.2) RESERVE ACCESSIONS MAPE	138.25	38.53	235.42	#DIV/0!	#DIV/0!	155.75	116.00	#DIV/0!
W.M.A. RESERVE ACCESSIONS MAPE	65.00	94.00	333.17	#DIV/0!	#DIV/0!	100.75	14.00	#DIV/0!
NPS MAPE	**EN**	**EO**	**ET**	**EW**	**FA**	**FC**	**FN**	**FR**
MOVING AVERAGE NPS ACCESSIONS MAPE	38.93	35.24	72.92	#DIV/0!	#DIV/0!	20.83	#DIV/0!	100.00
EXPONENTIAL SMOOTHING (.1) NPS ACCESSIONS MAPE	149.47	83.97	167.57	#DIV/0!	10.00	179.63	58.58	100.00
EXPONENTIAL SMOOTHING (.2) NPS ACCESSIONS MAPE	131.99	80.23	147.86	#DIV/0!	20.00	157.00	77.58	100.00
W.M.A. NPS ACCESSIONS MAPE	38.75	47.55	135.93	#DIV/0!	#DIV/0!	71.25	#DIV/0!	100.00
	EN	**EO**	**ET**	**EW**	**FA**	**FC**	**FN**	**FR**
2008 NAVET Projected Accessions Using WMA	2.12	0.95	1.41	0	0	4.18	0.05	0
2008 NPS Projected Accessions Using WMA	13.04	53.65	5.35	0	0.02	2.06	0.1	0.95
2008 Total Projected Accessions Using WMA	15.16	54.6	6.76	0	0.02	6.24	0.15	0.95

NAVET MAD	FT	GM	GSE	GSM	HA	HM	HN	HR
MOVING AVERAGE NAVET RESERVE ACCESSIONS MAD	0.33	5.00	2.00	1.83	0.33	4.67	2.50	0.00
EXPONENTIAL SMOOTHING (.1) RESERVE ACCESSIONS MAD	0.32	3.49	1.54	1.94	0.32	9.58	2.04	0.00
EXPONENTIAL SMOOTHING (.2) RESERVE ACCESSIONS MAD	0.37	3.66	1.57	1.90	0.37	8.12	2.06	0.00
W.M.A. RESERVE ACCESSIONS MAD	0.03	2.23	2.00	2.42	0.03	2.79	2.04	0.00
NPS MAD	**FT**	**GM**	**GSE**	**GSM**	**HA**	**HM**	**HN**	**HR**
MOVING AVERAGE NPS ACCESSIONS MAD	0.00	2.00	0.67	0.33	6.17	18.83	20.00	5.17
EXPONENTIAL SMOOTHING (.1) NPS ACCESSIONS MAD	0.00	6.80	0.55	5.09	6.10	30.89	24.67	3.48
EXPONENTIAL SMOOTHING (.2) NPS ACCESSIONS MAD	0.00	6.08	0.61	4.32	5.29	27.45	23.20	3.21
W.M.A. NPS ACCESSIONS MAD	0.00	3.79	0.98	2.36	7.85	6.88	16.22	5.82
NAVET MAPE	**FT**	**GM**	**GSE**	**GSM**	**HA**	**HM**	**HN**	**HR**
MOVING AVERAGE RESERVE ACCESSIONS MAPE	#DIV/0!	500.00	66.67	161.11	#DIV/0!	32.76	97.22	#DIV/0!
EXPONENTIAL SMOOTHING (.1) RESERVE ACCESSIONS MAPE	100.00	226.38	95.11	70.63	100.00	61.29	49.85	#DIV/0!
EXPONENTIAL SMOOTHING (.2) RESERVE ACCESSIONS MAPE	100.00	233.50	90.44	78.23	100.00	51.09	54.85	#DIV/0!
W.M.A. RESERVE ACCESSIONS MAPE	#DIV/0!	222.50	35.67	181.17	#DIV/0!	22.47	100.00	#DIV/0!
NPS MAPE	**FT**	**GM**	**GSE**	**GSM**	**HA**	**HM**	**HN**	**HR**
MOVING AVERAGE NPS ACCESSIONS MAPE	#DIV/0!	20.00	33.33	8.33	63.85	62.78	70.04	57.22
EXPONENTIAL SMOOTHING (.1) NPS ACCESSIONS MAPE	#DIV/0!	87.61	22.13	404.23	84.90	91.95	55.97	51.46
EXPONENTIAL SMOOTHING (.2) NPS ACCESSIONS MAPE	#DIV/0!	80.93	28.40	364.05	71.34	80.34	54.70	47.17
W.M.A. NPS ACCESSIONS MAPE	#DIV/0!	37.50	72.25	82.00	107.15	24.08	66.58	70.08
	FT	**GM**	**GSE**	**GSM**	**HA**	**HM**	**HN**	**HR**
2008 NAVET Projected Accessions Using WMA	0	1.08	0.13	2.96	0	12.27	2.2	0
2008 NPS Projected Accessions Using WMA	0	11.09	1.03	2.04	5.24	26.48	23.25	6.04
2008 Total Projected Accessions Using WMA	0	12.17	1.16	5	5.24	38.75	25.45	6.04
NAVET MAD	**HT**	**IC**	**IS**	**IT**	**JO**	**LI**	**LN**	**MA**
MOVING AVERAGE NAVET RESERVE ACCESSIONS MAD	1.00	2.00	1.33	8.50	0.33	0.00	0.50	6.33
EXPONENTIAL SMOOTHING (.1) RESERVE ACCESSIONS MAD	0.78	1.43	2.24	6.45	0.32	0.00	0.25	3.95
EXPONENTIAL SMOOTHING (.2) RESERVE ACCESSIONS MAD	0.81	1.36	2.01	6.57	0.37	0.00	0.25	3.90
W.M.A. RESERVE ACCESSIONS MAD	1.01	1.54	1.44	3.87	0.03	0.00	0.50	8.34
NPS MAD	**HT**	**IC**	**IS**	**IT**	**JO**	**LI**	**LN**	**MA**
MOVING AVERAGE NPS ACCESSIONS MAD	5.83	2.50	5.33	6.83	0.33	0.17	0.83	40.83
EXPONENTIAL SMOOTHING (.1) NPS ACCESSIONS MAD	9.14	9.88	39.48	19.04	1.72	0.86	1.08	24.68
EXPONENTIAL SMOOTHING (.2) NPS ACCESSIONS MAD	8.93	8.48	33.63	16.51	1.48	0.74	0.94	24.72
W.M.A. NPS ACCESSIONS MAD	6.92	0.63	5.73	7.88	0.02	0.01	0.99	33.63
NAVET MAPE	**HT**	**IC**	**IS**	**IT**	**JO**	**LI**	**LN**	**MA**
MOVING AVERAGE RESERVE ACCESSIONS MAPE	88.89	22.22	33.33	561.11	#DIV/0!	#DIV/0!	100.00	125.76
EXPONENTIAL SMOOTHING (.1) RESERVE ACCESSIONS MAPE	62.06	21.11	134.61	297.82	100.00	#DIV/0!	100.00	78.09
EXPONENTIAL SMOOTHING (.2) RESERVE ACCESSIONS MAPE	62.30	20.00	125.11	289.65	100.00	#DIV/0!	100.00	81.28
W.M.A. RESERVE ACCESSIONS MAPE	99.50	1.67	44.00	210.00	#DIV/0!	#DIV/0!	100.00	251.27
NPS MAPE	**HT**	**IC**	**IS**	**IT**	**JO**	**LI**	**LN**	**MA**
MOVING AVERAGE NPS ACCESSIONS MAPE	72.92	233.33	19.69	39.44	#DIV/0!	#DIV/0!	33.33	35.19
EXPONENTIAL SMOOTHING (.1) NPS ACCESSIONS MAPE	119.20	753.11	184.73	105.21	#DIV/0!	#DIV/0!	84.30	24.98
EXPONENTIAL SMOOTHING (.2) NPS ACCESSIONS MAPE	114.08	644.40	160.34	93.11	#DIV/0!	#DIV/0!	70.40	25.00
W.M.A. NPS ACCESSIONS MAPE	86.50	38.00	21.01	45.75	#DIV/0!	#DIV/0!	95.00	30.20
	HT	**IC**	**IS**	**IT**	**JO**	**LI**	**LN**	**MA**
2008 NAVET Projected Accessions Using WMA	1.1	0.15	0.08	1.2	0	0	0.95	2.29
2008 NPS Projected Accessions Using WMA	8.28	1.95	24.95	15.65	0	0	0.97	124.05
2008 Total Projected Accessions Using WMA	9.38	2.1	25.03	16.85	0	0	1.92	126.34

NAVET MAD	MC	MM	MN	MR	MS	MT	MU	NC
MOVING AVERAGE NAVET RESERVE ACCESSIONS MAD	0.67	5.50	0.33	0.50	0.00	0.67	0.33	0.00
EXPONENTIAL SMOOTHING (.1) RESERVE ACCESSIONS MAD	0.55	3.17	0.30	0.71	0.00	0.28	1.72	0.00
EXPONENTIAL SMOOTHING (.2) RESERVE ACCESSIONS MAD	0.59	3.09	0.34	0.68	0.00	0.30	1.48	0.00
W.M.A. RESERVE ACCESSIONS MAD	0.97	4.12	0.49	0.50	0.00	0.98	0.02	0.00
NPS MAD	**MC**	**MM**	**MN**	**MR**	**MS**	**MT**	**MU**	**NC**
MOVING AVERAGE NPS ACCESSIONS MAD	0.83	2.33	3.50	2.67	14.17	0.00	0.00	0.33
EXPONENTIAL SMOOTHING (.1) NPS ACCESSIONS MAD	0.57	7.25	3.92	5.00	71.18	0.00	0.00	0.30
EXPONENTIAL SMOOTHING (.2) NPS ACCESSIONS MAD	0.62	6.18	3.88	4.35	61.13	0.00	0.00	0.34
W.M.A. NPS ACCESSIONS MAD	0.53	5.75	5.82	3.39	0.86	0.00	0.00	0.49
NAVET MAPE	**MC**	**MM**	**MN**	**MR**	**MS**	**MT**	**MU**	**NC**
MOVING AVERAGE RESERVE ACCESSIONS MAPE	66.67	94.76	#DIV/0!	50.00	#DIV/0!	100.00	#DIV/0!	#DIV/0!
EXPONENTIAL SMOOTHING (.1) RESERVE ACCESSIONS MAPE	95.50	53.09	100.00	90.97	#DIV/0!	100.00	#DIV/0!	#DIV/0!
EXPONENTIAL SMOOTHING (.2) RESERVE ACCESSIONS MAPE	92.00	51.29	100.00	83.73	#DIV/0!	100.00	#DIV/0!	#DIV/0!
W.M.A. RESERVE ACCESSIONS MAPE	97.00	65.30	#DIV/0!	50.00	#DIV/0!	100.00	#DIV/0!	#DIV/0!
NPS MAPE	**MC**	**MM**	**MN**	**MR**	**MS**	**MT**	**MU**	**NC**
MOVING AVERAGE NPS ACCESSIONS MAPE	50.00	20.00	42.86	16.67	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
EXPONENTIAL SMOOTHING (.1) NPS ACCESSIONS MAPE	24.35	78.19	125.21	190.07	8200.00	#DIV/0!	#DIV/0!	100.00
EXPONENTIAL SMOOTHING (.2) NPS ACCESSIONS MAPE	30.80	68.22	122.25	164.53	8200.00	#DIV/0!	#DIV/0!	100.00
W.M.A. NPS ACCESSIONS MAPE	27.00	51.00	69.57	90.50	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
	MC	**MM**	**MN**	**MR**	**MS**	**MT**	**MU**	**NC**
2008 NAVET Projected Accessions Using WMA	0.03	5.22	0.02	0.98	0	0.03	0	0
2008 NPS Projected Accessions Using WMA	1.95	9.18	0.25	2	0	0	0	0.02
2008 Total Projected Accessions Using WMA	1.98	14.4	0.27	2.98	0	0.03	0	0.02
NAVET MAD	**ND**	**OS**	**PC**	**PH**	**PN**	**PR**	**PS**	**QM**
MOVING AVERAGE NAVET RESERVE ACCESSIONS MAD	0.00	6.33	0.67	1.33	1.83	0.67	4.17	2.50
EXPONENTIAL SMOOTHING (.1) RESERVE ACCESSIONS MAD	0.00	6.33	0.55	1.13	1.81	0.80	2.23	2.11
EXPONENTIAL SMOOTHING (.2) RESERVE ACCESSIONS MAD	0.00	6.07	0.59	1.22	1.64	0.85	2.33	2.12
W.M.A. RESERVE ACCESSIONS MAD	0.00	6.52	0.97	1.03	1.06	0.52	5.41	1.12
NPS MAD	**ND**	**OS**	**PC**	**PH**	**PN**	**PR**	**PS**	**QM**
MOVING AVERAGE NPS ACCESSIONS MAD	0.00	20.33	1.17	0.83	8.67	1.33	2.50	1.83
EXPONENTIAL SMOOTHING (.1) NPS ACCESSIONS MAD	0.00	44.59	2.04	4.30	16.00	2.20	4.07	6.86
EXPONENTIAL SMOOTHING (.2) NPS ACCESSIONS MAD	0.00	38.82	1.84	3.69	14.03	1.94	3.67	5.87
W.M.A. NPS ACCESSIONS MAD	0.00	13.47	1.02	0.05	4.78	1.49	2.82	6.16
NAVET MAPE	**ND**	**OS**	**PC**	**PH**	**PN**	**PR**	**PS**	**QM**
MOVING AVERAGE RESERVE ACCESSIONS MAPE	#DIV/0!	181.48	66.67	#DIV/0!	#DIV/0!	33.33	145.24	108.33
EXPONENTIAL SMOOTHING (.1) RESERVE ACCESSIONS MAPE	#DIV/0!	71.98	95.50	95.00	47.50	30.45	69.71	42.37
EXPONENTIAL SMOOTHING (.2) RESERVE ACCESSIONS MAPE	#DIV/0!	79.05	92.00	90.00	45.00	36.60	88.76	45.52
W.M.A. RESERVE ACCESSIONS MAPE	#DIV/0!	142.50	97.00	#DIV/0!	#DIV/0!	96.00	321.93	54.13
NPS MAPE	**ND**	**OS**	**PC**	**PH**	**PN**	**PR**	**PS**	**QM**
MOVING AVERAGE NPS ACCESSIONS MAPE	#DIV/0!	141.54	41.67	#DIV/0!	#DIV/0!	41.67	25.57	25.00
EXPONENTIAL SMOOTHING (.1) NPS ACCESSIONS MAPE	#DIV/0!	257.79	111.29	#DIV/0!	196.67	84.54	39.79	206.44
EXPONENTIAL SMOOTHING (.2) NPS ACCESSIONS MAPE	#DIV/0!	222.02	90.36	#DIV/0!	187.78	70.60	35.58	185.62
W.M.A. NPS ACCESSIONS MAPE	#DIV/0!	91.21	42.08	#DIV/0!	#DIV/0!	49.13	30.15	85.05
	ND	**OS**	**PC**	**PH**	**PN**	**PR**	**PS**	**QM**
2008 NAVET Projected Accessions Using WMA	0	3.44	0.03	0.04	0.04	0.95	1.2	2.1
2008 NPS Projected Accessions Using WMA	0	13.58	2.93	0	0.18	3.88	10.91	5.09
2008 Total Projected Accessions Using WMA	0	17.02	2.96	0.04	0.22	4.83	12.11	7.19

NAVET MAD	RP	SA	SH	SK	SM	SN	SO	SR
MOVING AVERAGE NAVET RESERVE ACCESSIONS MAD	0.50	0.00	3.00	2.33	0.00	2.17	0.00	0.00
EXPONENTIAL SMOOTHING (.1) RESERVE ACCESSIONS MAD	0.50	0.00	2.99	2.01	0.00	2.93	0.00	0.00
EXPONENTIAL SMOOTHING (.2) RESERVE ACCESSIONS MAD	0.51	0.00	3.18	2.00	0.00	2.82	0.00	0.00
W.M.A. RESERVE ACCESSIONS MAD	0.96	0.00	2.90	1.48	0.00	1.99	0.00	0.00
NPS MAD	**RP**	**SA**	**SH**	**SK**	**SM**	**SN**	**SO**	**SR**
MOVING AVERAGE NPS ACCESSIONS MAD	1.83	2.50	2.00	35.50	2.83	30.50	0.50	10.50
EXPONENTIAL SMOOTHING (.1) NPS ACCESSIONS MAD	3.96	3.37	3.70	86.75	14.62	24.78	0.25	8.80
EXPONENTIAL SMOOTHING (.2) NPS ACCESSIONS MAD	3.29	3.02	3.33	75.45	12.55	29.65	0.25	8.17
W.M.A. NPS ACCESSIONS MAD	1.50	0.64	2.46	19.58	0.17	6.47	0.50	6.79
NAVET MAPE	**RP**	**SA**	**SH**	**SK**	**SM**	**SN**	**SO**	**SR**
MOVING AVERAGE RESERVE ACCESSIONS MAPE	66.67	#DIV/0!	25.00	37.30	#DIV/0!	93.33	#DIV/0!	#DIV/0!
EXPONENTIAL SMOOTHING (.1) RESERVE ACCESSIONS MAPE	95.50	#DIV/0!	62.27	27.46	#DIV/0!	54.18	#DIV/0!	#DIV/0!
EXPONENTIAL SMOOTHING (.2) RESERVE ACCESSIONS MAPE	92.00	#DIV/0!	71.85	27.26	#DIV/0!	57.98	#DIV/0!	#DIV/0!
W.M.A. RESERVE ACCESSIONS MAPE	97.00	#DIV/0!	43.75	23.58	#DIV/0!	84.95	#DIV/0!	#DIV/0!
NPS MAPE	**RP**	**SA**	**SH**	**SK**	**SM**	**SN**	**SO**	**SR**
MOVING AVERAGE NPS ACCESSIONS MAPE	62.50	41.67	43.06	148.27	#DIV/0!	180.44	100.00	71.21
EXPONENTIAL SMOOTHING (.1) NPS ACCESSIONS MAPE	115.94	67.70	84.01	294.21	#DIV/0!	44.50	100.00	95.02
EXPONENTIAL SMOOTHING (.2) NPS ACCESSIONS MAPE	84.09	61.80	76.59	249.78	#DIV/0!	69.10	100.00	90.38
W.M.A. NPS ACCESSIONS MAPE	49.88	10.67	49.54	79.44	#DIV/0!	37.28	100.00	45.74
	RP	**SA**	**SH**	**SK**	**SM**	**SN**	**SO**	**SR**
2008 NAVET Projected Accessions Using WMA	0.97	0	0.16	6.99	0	2.13	0	0
2008 NPS Projected Accessions Using WMA	3.92	5.98	4.16	20.92	0	16.24	0.95	18.5
2008 Total Projected Accessions Using WMA	4.89	5.98	4.32	27.91	0	18.37	0.95	18.5
NAVET MAD	**STG**	**STS**	**SW**	**TM**	**UT**	**YN**		
MOVING AVERAGE NAVET RESERVE ACCESSIONS MAD	1.17	0.67	0.50	0.67	0.50	0.67		
EXPONENTIAL SMOOTHING (.1) RESERVE ACCESSIONS MAD	1.44	0.52	0.78	0.52	0.53	1.35		
EXPONENTIAL SMOOTHING (.2) RESERVE ACCESSIONS MAD	1.41	0.54	0.80	0.54	0.56	1.44		
W.M.A. RESERVE ACCESSIONS MAD	1.48	0.52	0.96	0.52	0.51	1.42		
NPS MAD	**STG**	**STS**	**SW**	**TM**	**UT**	**YN**		
MOVING AVERAGE NPS ACCESSIONS MAD	1.00	1.67	13.83	1.50	17.17	15.83		
EXPONENTIAL SMOOTHING (.1) NPS ACCESSIONS MAD	4.87	1.48	8.82	2.19	11.76	27.92		
EXPONENTIAL SMOOTHING (.2) NPS ACCESSIONS MAD	4.12	1.47	8.97	2.17	11.99	24.40		
W.M.A. NPS ACCESSIONS MAD	3.33	1.52	10.30	1.97	11.02	12.72		
NAVET MAPE	**STG**	**STS**	**SW**	**TM**	**UT**	**YN**		
MOVING AVERAGE RESERVE ACCESSIONS MAPE	16.67	66.67	0.00	66.67	66.67	20.83		
EXPONENTIAL SMOOTHING (.1) RESERVE ACCESSIONS MAPE	82.56	9.50	25.50	95.00	95.95	36.05		
EXPONENTIAL SMOOTHING (.2) RESERVE ACCESSIONS MAPE	82.44	18.00	27.00	90.00	93.60	40.53		
W.M.A. RESERVE ACCESSIONS MAPE	47.00	98.00	92.00	5.00	98.00	39.58		
NPS MAPE	**STG**	**STS**	**SW**	**TM**	**UT**	**YN**		
MOVING AVERAGE NPS ACCESSIONS MAPE	25.00	#DIV/0!	54.80	133.33	55.32	121.79		
EXPONENTIAL SMOOTHING (.1) NPS ACCESSIONS MAPE	397.14	68.33	80.32	107.75	137.28	188.64		
EXPONENTIAL SMOOTHING (.2) NPS ACCESSIONS MAPE	359.70	70.00	79.75	106.00	136.27	166.09		
W.M.A. NPS ACCESSIONS MAPE	108.60	#DIV/0!	43.07	286.00	37.17	97.81		
	STG	**STS**	**SW**	**TM**	**UT**	**YN**		
2008 NAVET Projected Accessions Using WMA	0.12	0.95	0.03	0.05	0.95	3.01		
2008 NPS Projected Accessions Using WMA	2.07	0.06	29.27	0.11	33.4	13.5		
2008 Total Projected Accessions Using WMA	2.19	1.01	29.3	0.16	34.35	16.51		

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