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NEC Utilization Study

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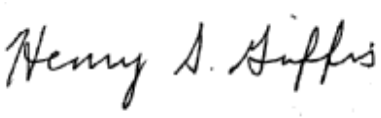

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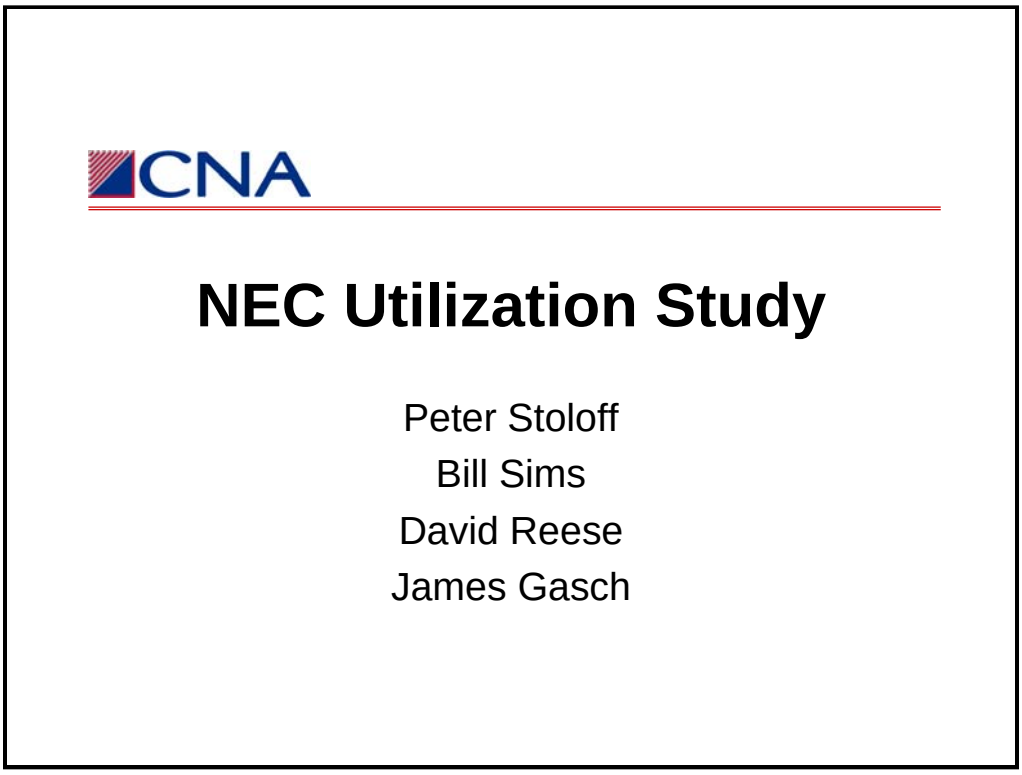


Executive Summary

Navy Detailers are responsible for assigning Sailors to Navy jobs based on their training and skills. Most jobs are specified by a rating and NEC requirement. Sailors most often earn an NEC by attending "C-school" and sometimes by on-the-job training (OJT).

The "gold standard" for job assignment is to match actual training (NEC) with the billet requirement. When this is done, the job assignment is indicated in personnel records as a "DNEC" (Detailed to the NEC). Not all job assignments, however, are based on a DNEC. Because of the similarity of jobs, a Detailer will sometimes assign a Sailor holding a related NEC to a job, despite the lack of the specific NEC training. In this study, we were asked to develop metrics, develop tools to match skills and job requirements, and identify available information technology (IT) that Detailers could use to estimate and report NEC utilization. We address the latter topic briefly here and in greater detail in a separate document.

An NEC Taxonomy. The U.S. Department of Labor funds a program for developing standards for describing job components and the skills required for performing jobs. This is the Occupational Network, or O*Net,© which provides a methodology for identifying the tasks underlying jobs. We applied this methodology to Navy NECs.

The methodology involves applying a hierarchical taxonomy to describe the tasks. We applied the taxonomy to the tasks underlying NECs, based on the job descriptions provided in the Navy's NEC manual to group NECs. We call such a grouping of NECs, or jobs, an NEC Job Family. The methodology we applied to measuring NEC reutilization does so at the Job Family level. For purposes of study, we assume that NECs within a Job Family are near substitutes for one another in measuring NEC reuse. We tested this assumption by comparing DNEC rates with O*Net Job Family reuse rates. If Detailers are assigning Sailors to jobs on the basis of O*Net Job Families, reuse rates measured on this basis should exceed DNECs.

Longitudinal Database for Measuring NEC Use. We constructed several cohorts of Sailors awarded NECs in FY 1988 through FY 1993 and tracked their job assignments for 10+ years through up to four tours. We limited our analysis to the 47 ratings where we could construct Job Families having 2 or more NECs per family. Nearly 150,000 NECs were awarded to the cohorts and Job Families we studied. We measured NEC use by DNEC and by job family, but for the purpose of presenting metrics we show use rates for ratings as a whole. This approach is consistent with the concept of the job family as a group of NECs. We measured NEC use/reuse using two metrics: assignments where the NEC matched the DNEC, and use within the Job Family (or O*Net Group).

By reusing NECs, the Navy can benefit through reuse of human capital and avoidance of training costs. We estimated training cost savings as the difference between the cost of "new" NEC training and the cost of refresher training for those reusing the NEC.

Empirical Results. The data below summarize our findings.

Initial NEC use. About 82 percent of awards are used at some time, with most use occurring during the first assignment following C-school (70%). The major reason NECs are never used is due to loss from the Navy. About 11 percent of NEC awards are never used because Sailors reach the end of obligated service (EAOS). This suggests that some Sailors received NEC training, despite a lack of opportunity for using the NEC.

About 3 percent don't use their NECs for other reasons, such as medical, or because of disciplinary problems. The loss pattern for first-termers who never use their NEC mirrors that of other Sailors. The major reason for first-termers not using their NEC is reaching EAOS in the same year that the NEC is earned. This suggests advising against providing NEC training to Sailors about to reach EAOS. Among those who do not reach EAOS shortly after an NEC award, more than 40 percent remain more than four years, suggesting that their NECs remain unused after more than one tour of duty (i.e., several assignments).

NEC reuse. To put the observed NEC reutilization in perspective, we developed a simple model to estimate the maximum rates we could observe, subject to certain constraints. We did not have sufficient data to fully parameterize the model. We lacked information about availability of a billet/job at time of assignment. Job availability is affected by billet requirements, which differ at sea and on shore. Therefore, when Sailors rotate ashore, and the NEC is one primarily used at sea, there is less likelihood of an available billet. Such circumstances can also lead to Sailors earning other NECs. These NECs, if in different job families, will affect reutilization rates for one or the other NEC. Realizing we face this lack of data, we estimated the theoretical maximum expected NEC reuse rate to be about 54 percent for those earning NECs during FY94–99.

Reuse metrics. Thirty seven percent of NECs are reused at least once. Of the 37 percent, 26 percent were direct DNEC, and the remaining 11 percent are considered reusers because the DNEC was to a linked O*Net Job Family. Eighteen percent never used their NECs. Loss to the Navy is the biggest reason for not reusing an NEC (33 percent). Promotion beyond the required paygrade is the smallest (1 percent). The remaining 11 percent is composed of the 6 percent who were still in the Navy but were not observed for a long enough time to complete a tour following their initial use of the NEC. The reasons the remaining 5 percent did not reuse their NECs are unknown.[1]

Many Sailors reuse their NECs more than once:

- 7-percent multiple reuse by DNEC method
- 9-percent multiple reuse by O*Net Job Family method.

Estimated cost savings to the Navy over 10 years. The Navy saves money through NEC reuse because placing a trained Sailor in a job avoids sending an untrained Sailor to school. This cost avoidance was estimated to be:

- Reuse by DNEC—$1.5 billion ($20K/reuse)
- Reuse by O*Net Job Families—$2.5 billion ($20K/reuse).

Return on investment. On average, NEC reuse was about 25 months per assignment. Due to multiple NEC reuse, this figure rises to 35 months for those detailed by the O*Net method, and to 28 months for the DNEC method. We examined the relationship between training costs and the amount of time Sailors reuse their NECs. Those with longer (more expensive) training tended to use their NECs slightly more (about one additional month per $14,000 of initial training cost).

[1] Other reasons would include availability of a billet for those rotating ashore (similarly for rotations to sea), assignments based on other NECs held outside the job family, and lack of funding for required refresher training.

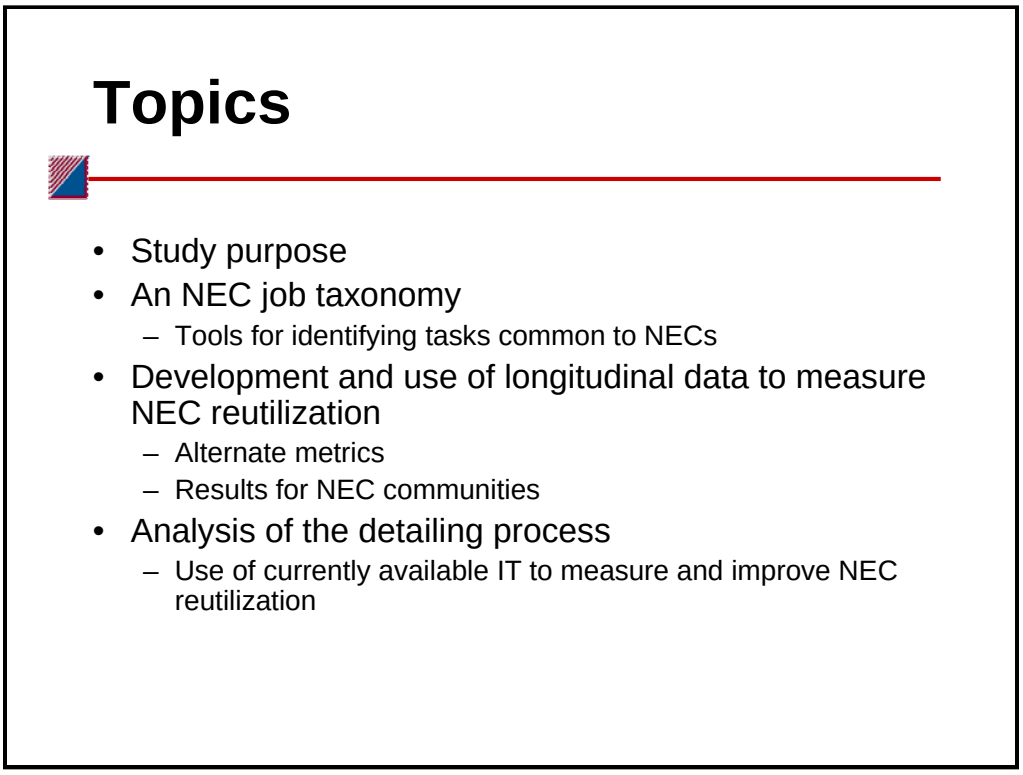
Summary. Our empirical results have shown that NECs are being reutilized, and this has produced savings to the Navy by avoiding training "new" NECs. We find that loss to the Navy is by far the biggest reason there isn't more reuse of NECs. There is a relatively small percentage of Sailors who fail to reuse an NEC for no apparent reason.

We believe that Detailers sometimes use NEC substitution in assigning NEC holders to Navy jobs. Our results suggest that much of the substitution is based on commonality of tasks associated with performing the jobs. The NEC taxonomy we developed can be used to identify the commonality of job-related tasks. It should be a useful tool for Detailers who wish to assign those with NECs that do not exactly match the requirements of the job but are similar enough to warrant substitution.

IT That Detailers Could Use To Track NEC Reutilization. The current IT system does not directly support tracking and optimization of NEC utilization. However, data are available from the Enlisted Assignment Information System (EAIS) that could be used to monitor the detailing process in near real time. This system can be used to view a cross section of the alignment of job assignments and billet requirements. We found that current month data from that system provide an estimate of an annual rate of NEC reutilization. Our reutilization estimates from the EAIS data were about 30 percent of assignments, slightly less than our estimate from the longitudinal analysis.

A Look to the Future. NECs may be replaced by some other metric in the near future. Whatever that metric is, it can be, and should be, monitored to ensure efficient utilization of the training investment using some of the same techniques used in our analyses.

If the Navy moves to Human Capital Objects as the basis of job assignments, an expansion of the O*Net taxonomy shown here could provide the basis of matching a Sailor's skills to job requirements. This will require the development of IT tools. Use of such tools that internalize the relationship of "Skill Objects" and job requirements should improve the quality of the job match, while making the process fairly transparent to the Detailer.

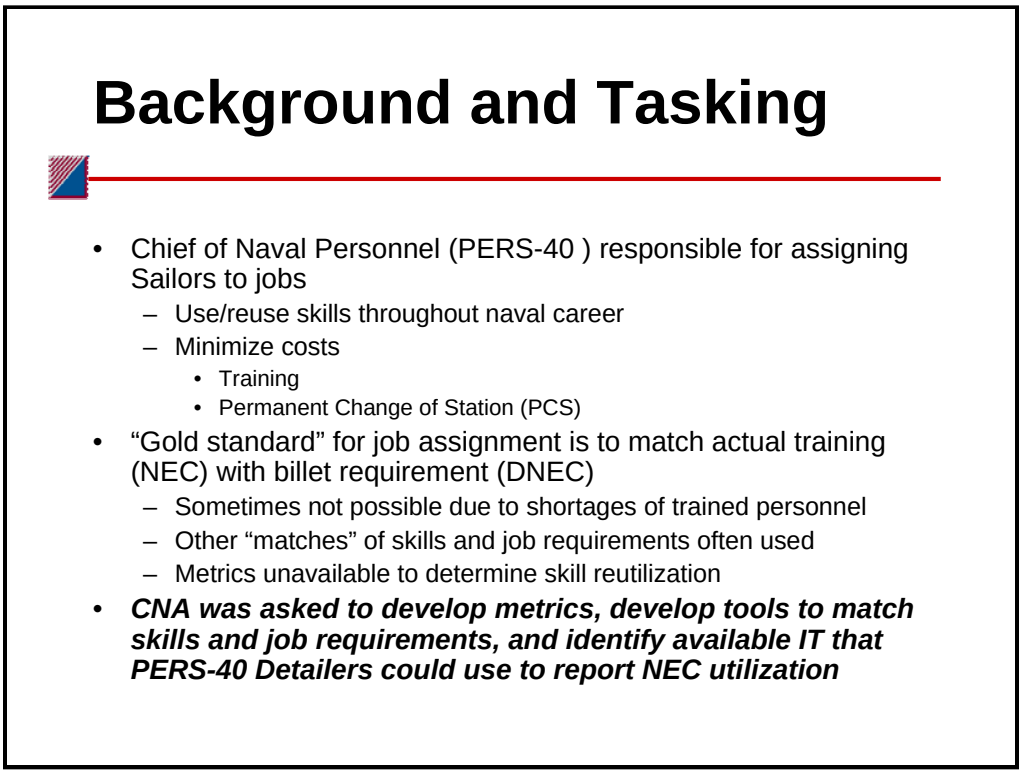


This slide outlines the topics discussed in this briefing. We begin with the purpose of the study. This includes the tasking we received from the Chief of Naval Personnel and background on the importance of NEC reutilization .

We learned that Navy Detailers attempt to utilize skills learned by Sailors in school and on the job when making new job assignments. We developed a taxonomy to assist in this process.

We then developed a longitudinal database to estimate the rate of NEC use. We used a variety of metrics to measure NEC use.

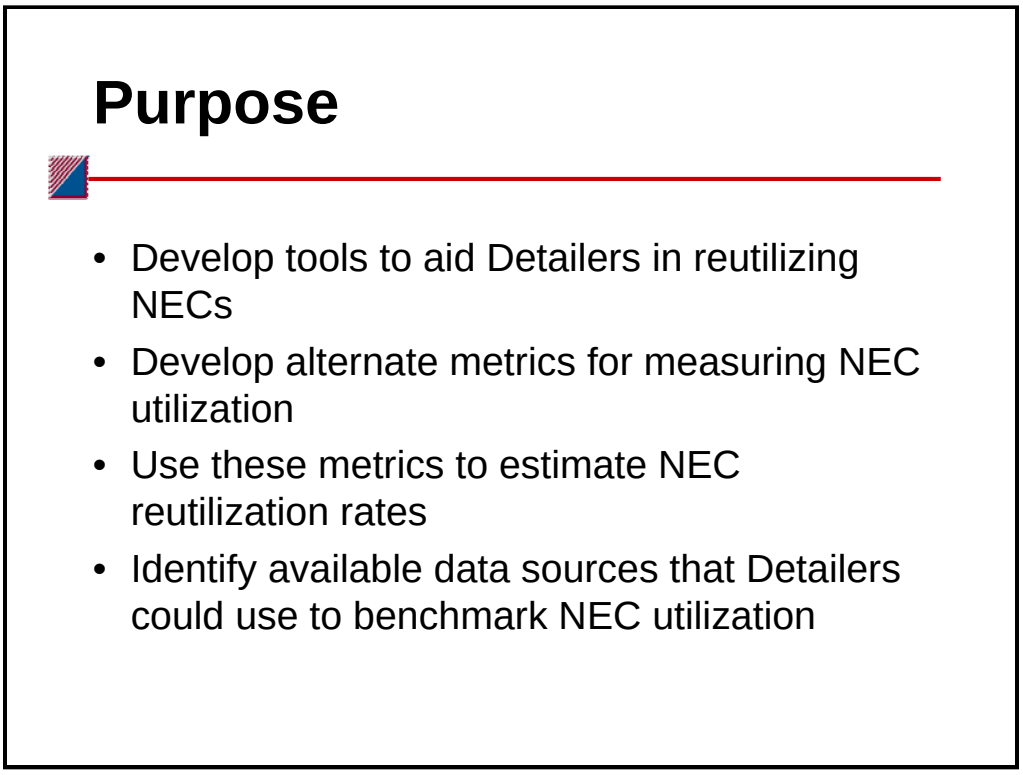
While Navy Detailers attempt to reuse NECs, they do not have the tools to develop benchmarks to measure how well they might be achieving their goals. We identify a source of data they could use for this purpose.



PERS-40 manages the detailing process. It is responsible for assigning Sailors to Navy jobs based on their training and skills. Most jobs are specified by a rating and NEC requirement. These requirements are usually satisfied by formal training. Sailors attend A-school to earning a rating, which is akin to an "occupation." NECs (Navy Enlisted Classifications) are job specific. They include such things as operating or maintaining specific kinds of equipment. Sailors earn an NEC by attending C-school. The duration of NEC training can be as long as 165 days, costing as much as $199,000 (NEC 1130, from *FY 2004 NAVEDTRACOM Cost Factors Handbook).* Given the large expense of this training, Detailers try to assign jobs requiring NEC training to those who already have the NECs.

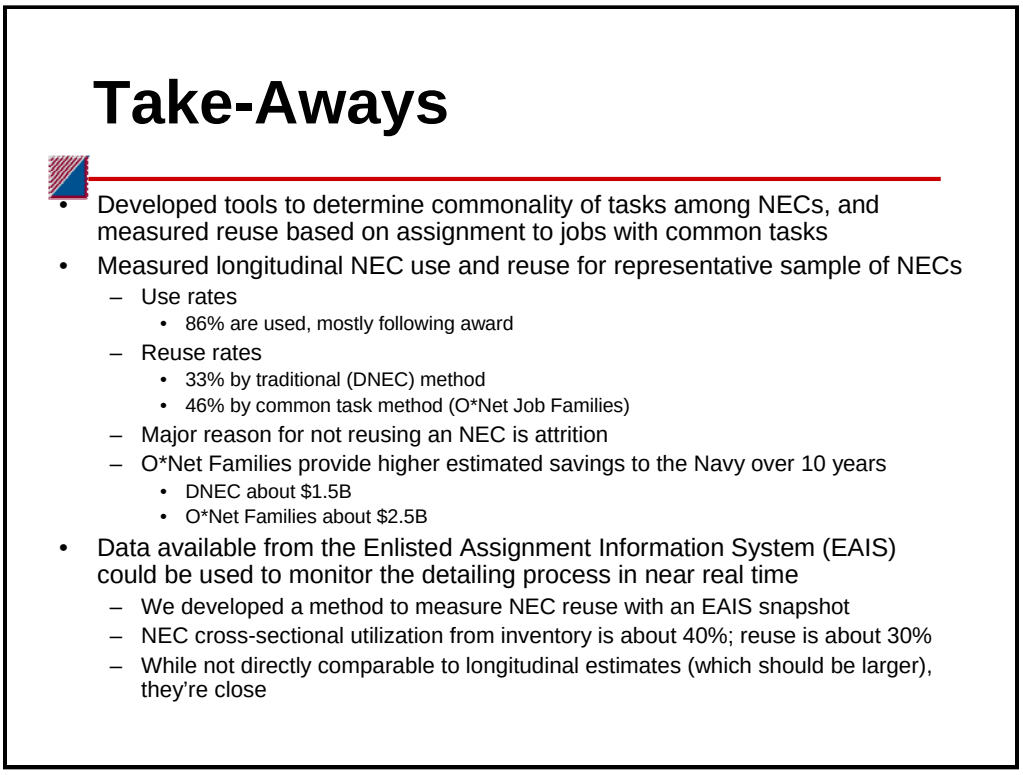
The gold standard for job assignment is to match actual training (NEC) with the billet requirement. When this is done, the job assignment is indicated in personnel records as a "DNEC" (Detailed to the NEC), but not all job assignments are based on a DNEC. This could be for a variety of reasons, such as personnel shortages, lack of training funds, and use of on-the-job training (OJT). Because of the similarity of jobs, a Detailers will sometimes assign a Sailor holding a related NEC to a job, despite the lack of the specific NEC training. This is particularly true for experienced Sailors who may have had the opportunity to learn a broad range of skills that can be applied to related NECs. For example, those who have used NECs for maintaining specific pieces of equipment are likely to have learned to operate that equipment while on the job.

A challenge for the Navy is keeping track of NEC reuse when the job assignment is not based on the DNEC. There is no formal record for the basis of these job assignments. We were asked to develop metrics, develop tools to match skills and job requirements, and identify available IT that PERS-40 Detailers could use to estimate and report NEC utilization.



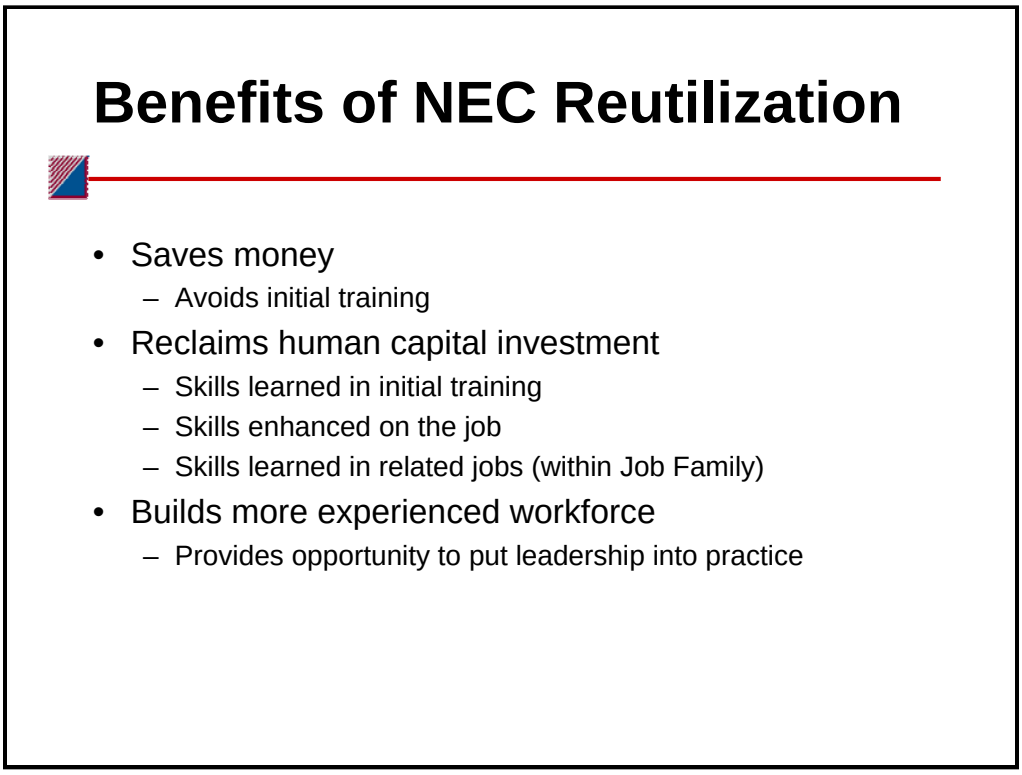
This slide shows the purpose of this study, taken from the tasking. In addition to developing metrics for measuring NEC use, we sought to develop a method for formalizing the process of identifying tasks common to NECs. This could be used by Detailers to make more flexible job assignments for experienced Sailors, thereby reusing the skills enhanced during prior NEC use. The identification of benchmarking data mentioned in the last bullet is the subject of another CNA document[1] and is only briefly summarized here.

[1] *The Detailing Process, Information Technology, and NEC Utilization*, Bill Sims (CNA Annotated Briefing D0014518, Sep 2006).



This slide summarizes the major findings of the study. We found that Detailers do substitute closely related NECs when assigning Sailors to jobs. This increases NEC reutilization, and has saved the Navy about $1 billion in avoided training costs over a 10-year period. The NEC taxonomy developed in this study should be adopted by Navy Detailers as a guide for matching Sailors to jobs based on the commonality of job-task requirements, training, and on-the-job experience.

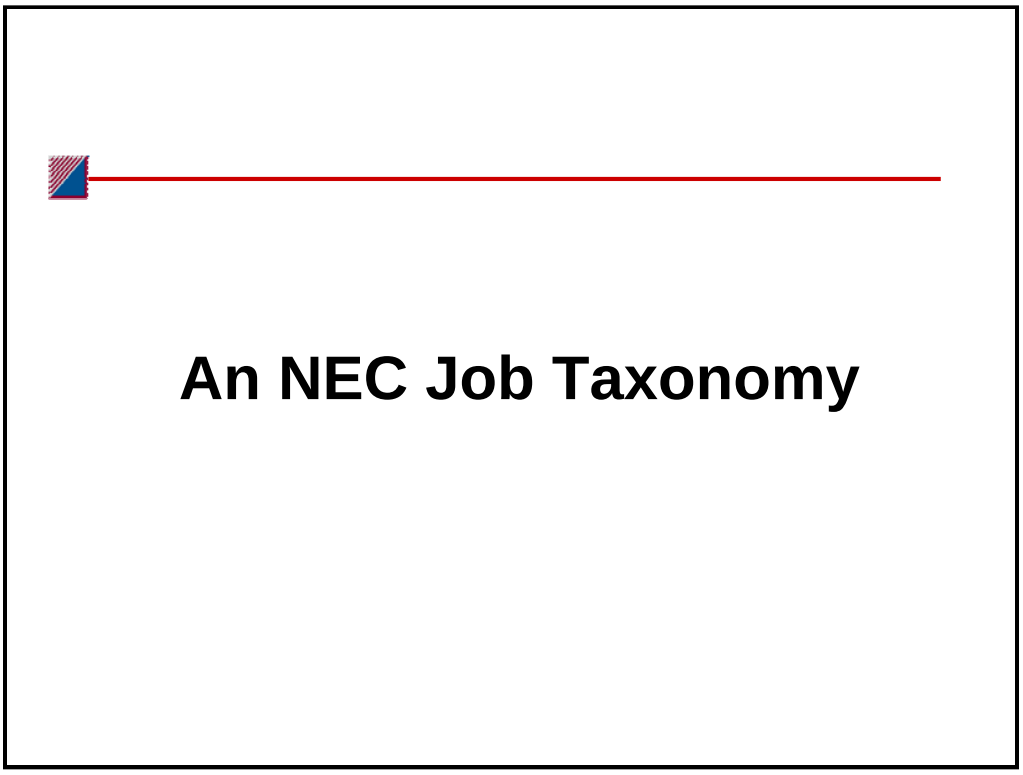
While Detailers do not have easy access to the longitudinal data we used to measure NEC reuse, they can monitor point-in-time reuse through their Enlisted Assignment Information System using the method described in this report—and should do so to ensure that NECs are being reused at a satisfactory rate.



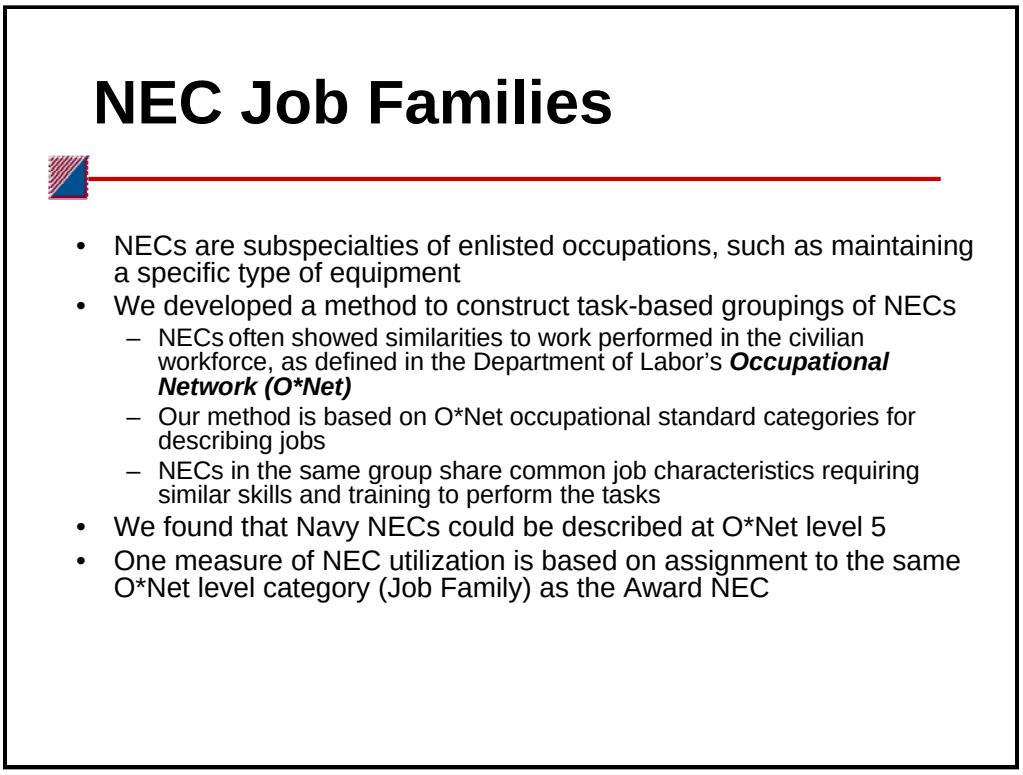
As discussed earlier, NEC training can be expensive. Assigning a Sailor who already has the required NEC to a job will save money. However, while such NEC reuse should avoid the costs of sending the experienced Sailor through the entire training pipeline for the NEC, some refresher training may be required. We have estimated that these costs are significantly less than the total training cost.

In addition to saving money, reusing NECs can reclaim the human capital investment made in the Sailor while on the job. (The earlier example applies of a Sailor originally training to maintain equipment and learning how to operate it.)

As the trained Sailor gains experience and is promoted, he/she has leadership potential. Reusing an NEC provides the opportunity to lead others on the job.



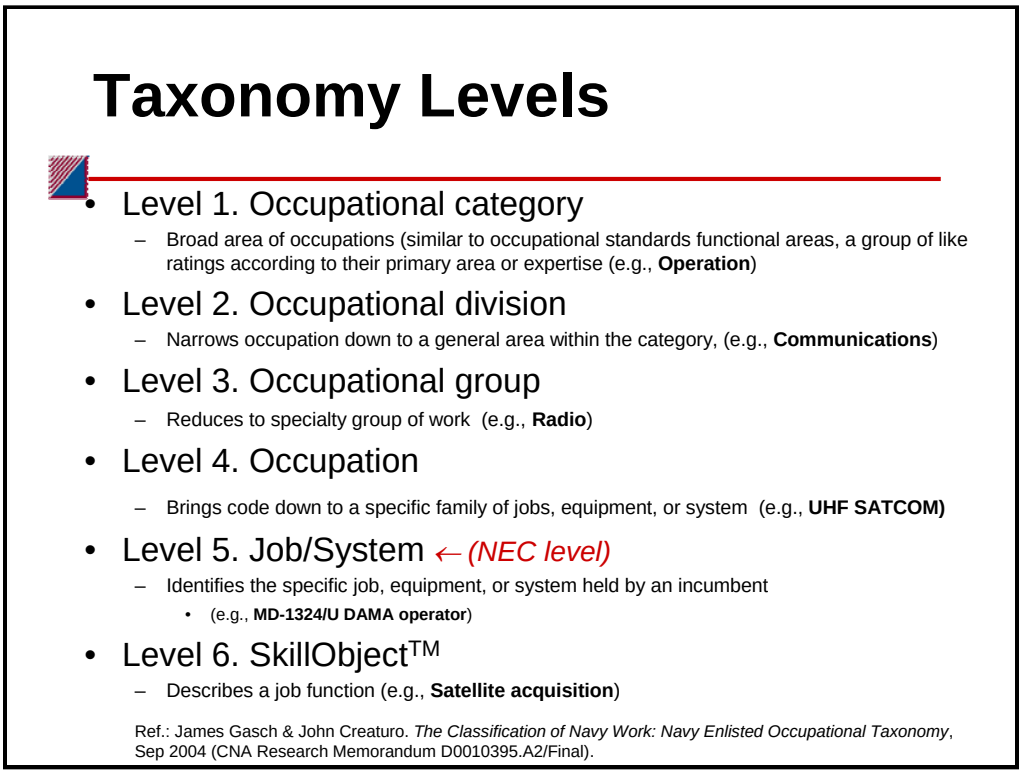
This section describes the use and development of a taxonomy that can be used to identify the similarity of tasks performed in Navy jobs.



Navy jobs involve applying a set of skills to performing a set of tasks. NECs are occupational subspecialties, such as operating and maintaining specific kinds of equipment. Navy jobs and NECs should not be viewed in isolation. Just as different kinds of equipment are linked as systems, so are jobs/NECs interlinked through common tasks and skill requirements.

As the Navy becomes more technical and complex, the need to understand the work has become increasingly important. The study of job structure and task similarity has been a focus in the civilian world. The U.S. Department of Labor funds a program for developing standards for describing job components and the skills required for performing jobs. This is the Occupational Network, or O*Net.© O*Net provides a methodology for identifying the tasks underlying jobs. We applied this methodology to Navy NECs.

The methodology involves applying a hierarchical taxonomy (described later) to describe the tasks. We applied the taxonomy to the tasks underlying NECs, based on the job descriptions provided in the Navy's NEC manual. We were able to categorize all NECs in this manner. While we found that NECs could be described at level 5 of the taxonomy, when Detailers do assign Sailors to jobs "outside" their NEC, the jobs to which they were assigned could be described at a more general (less specific) level of the taxonomy. We call this grouping of NECs, or jobs, an *NEC Job Family*. The methodology we applied to measuring NEC reutilization does so at the Job Family level. For purposes of study, we assume that NECs within a Job Family are substitutes for one another in measuring NEC reuse. We test this assumption by comparing DNEC rates with O*Net Job Family reuse rates. If Detailers are assigning Sailors to jobs on the basis of O*Net Job Families, reuse rates measured on this basis should exceed DNEC rates.



We collected data for the civilian O*NET database from job analysts who evaluated jobs based on the information contained in the Dictionary of Occupational Titles (DOT). The database relies on information collected through surveys completed by people working in various occupations. Data are gathered on about 200 occupations each year, with the goal of replenishing the database every five years. A taxonomy was developed as the result of relationships identified in the database.

The levels of the O*Net taxonomy, as applied to Navy jobs, are shown here. The taxonomy is hierarchical, proceeding from the general (level 1) to the very specific (level 6).

FC-1121 Description and Categorization

Job Description (NEC manual)

CIWS MK 15 BLOCK 11 14

Technician performs preventive and corrective maintenance on assigned equipment at the organizational and/or intermediate level using ordnance publications, circuit diagrams, and other appropriate documentation. Performs casualty analysis and fault isolation, and operates, tests, aligns, and repairs individual equipment, the system, and the interface with other systems. Operates the directors, computers, radar consoles, and associated equipment as applicable in support of the ship's weapons system in a tactical situation and during test and evaluation.

Taxonomy (to 4th level)

1. E (engineering)
2. E (electro-mechanical)
3. G (guns)
4. C (close-in weapon system)

Shown here is the categorization of the tasks inherent in NEC FC-1121, the Close-In Weapon System MK 15 Corrective Maintenance Technician.

FC-1122 Description and Categorization

Job Description (NEC manual)

Phalanx Close-In Weapon System MK 15 MOD 21, 22, and 25 BLOCK IB Technician operates the directors, computers, radar consoles, and associated equipment as applicable in support of the ship's weapons system in a tactical situation and during test and evaluation. Performs preventive and corrective maintenance on assigned equipment at the organizational and/or intermediate level using ordnance publications, circuit diagrams, and other appropriate documentation. Performs casualty analysis and fault isolation and operates, tests, aligns, and repairs individual equipment, system, and associated interfaces. Performs search, threat evaluation, acquisition, tracking, engagement, and kill assessment of assigned targets. Operates Local Control Station (LCS), computer, Remote Control Station (RCS) and associated loading equipment as applicable in support of the ship's weapon system.

Taxonomy (to 4th level)

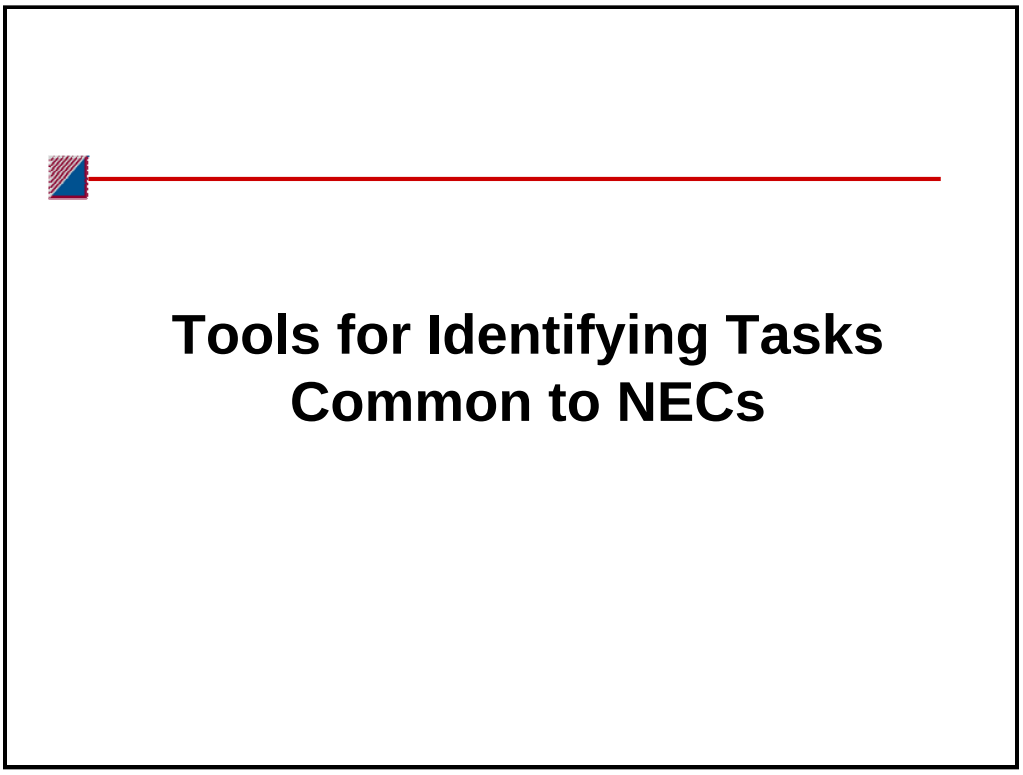
1. E (engineering)
2. E (electro-mechanical)
3. G (guns)
4. C (close-in weapon system)

Shown here is the categorization of the tasks inherent in NEC FC-1122, the Phalanx Close-In Weapon System MK 15 Operator. Note the similarity to NEC FC-1121. Both NECs are grouped together at the fourth level of the taxonomy. The task similarity suggests that they are part of the same Job Family and could substitute for one another for purposes of NEC reutilization.

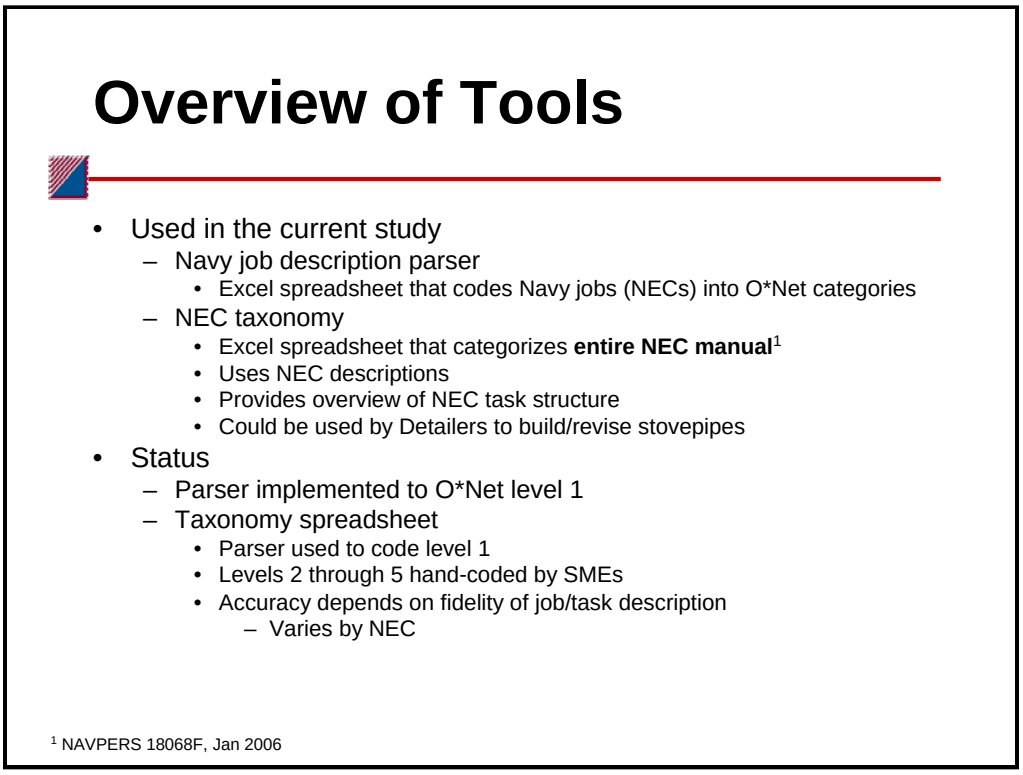
O*Net2 Groups for IC Rating

O*Net2 Group	O*Net2 Description	NEC	#Awards	NEC Title
13	DP-Design, Arts, Entertainment, Sports, & Media: Electrical	4746	378	Closed Circuit TV Technician
		4747	61	Broadcast Engineering Technician
14	EE-Engineering & Architecture: Electro-Mechanical	746	138	Advanced Undersea MK-46 Maintenance Weaponsman
		4777	104	MK6 MOD 4D Digital Dead Reckoning Trace (DDRT) Technician
16	ET-Engineering & Architecture: Testing and Calibration	4782	13	Standards Maintenance And Repair Technician
34	MA-Maintenance, Repair, Installation, & Production: Aviation	4743	103	Integrated Launch and Recovery Television Surveillance (ILARTS) System Maintenance Technician
		4758	845	Stabilized Glide Slope Indicator System Maintenance
36	ME-Maintenance, Repair, Installation, & Production: Electro-Mechanical	4745	112	Optical Landing System Technician
36		4749	177	Physical Security Equipment Maintenance Technician
		4779	6	Vertical Short Take-off and Landing Optical Lens System (VSTOL OLS)
39	MI-Engineering & Architecture: Computers and Communications	4738	119	AN/USQ-82(V) Data Multiplex System Technician
		4778	3	Fiber Optic Data Multiplex System (FODMS)
42	MV-Maintenance, Repair, Installation, & Production: Electronics	4703	110	FFG-7 Class Interior Communications Subsystem Technician
		4709	74	Mission Briefing System AN/SXQ-8 Maintenance Technician
		4711	27	Interior Voice Communications System Maintenance Technician
		4712	119	Integrated Voice Communications Technician
		4716	248	Ship's Service Telephone System (Dimension 2000) PBX Repairman
		4718	79	IC Journeyman
		4720	82	Gyrocompass Maintenance
		4721	154	MK 19 Gyrocompass Systems Maintenance Technician
		4723	123	MK 23 Gyrocompass Systems Maintenance Technician
		4727	313	WSN-2 Stabilized Gyrocompass Technician
		4728	306	WSN-5 Inertial Navigation Set Technician
		4755	89	LSD 41 Console Maintenance
		4756	120	AO 177 Console Maintenance
		4757	58	ARS 50 Console Maintenance
		4775	159	MK 9 MOD 4 DRAI/MK 6 MOD 4B DRT Technician
		4776	235	MK 9 MOD 4/MK 10 MOD 0 DRAI and MK 6 MOD 4B DRT Technician
		4781	3	NAMTS Interior Communication Repair Technician
		4783	5	MHC-51CL Console Maintenance

This is an illustration of the O*Net Job Families underlying the IC rating. Twelve Job Families encompass the 36 NECs associated with the IC rating.



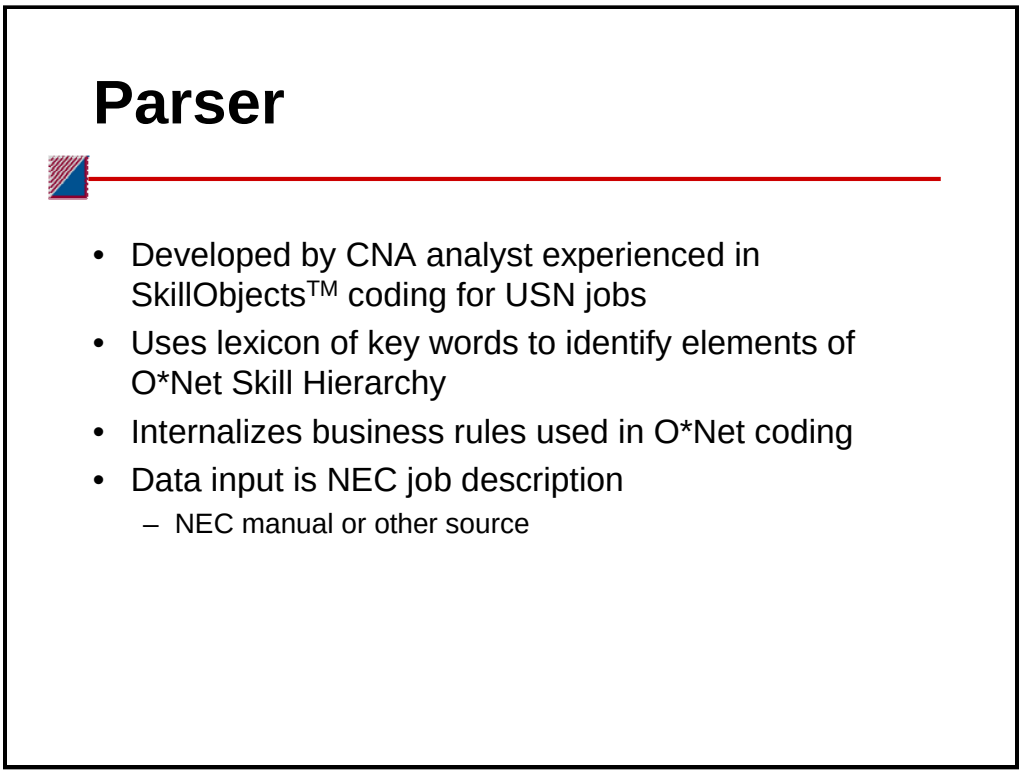
Here we describe tools developed for PERS-40 to aid Detailers in building Job Families and for measuring NEC use/reuse.



We developed two tools: a parser for NEC job descriptions and an NEC taxonomy, incorporating the results of applying the parser to the job descriptions in the current (2006) NEC manual (NAPVERS 18068F).

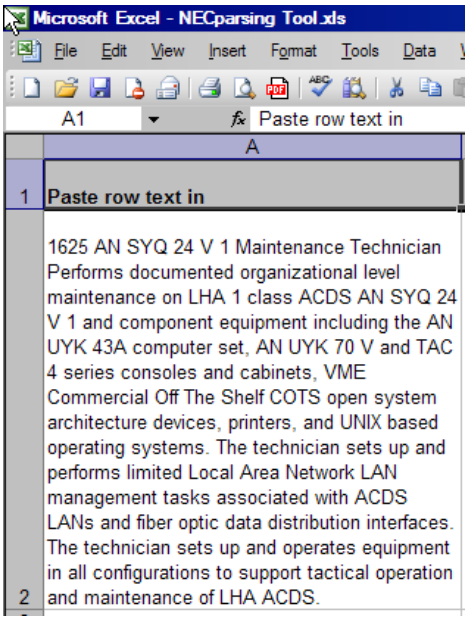
Both tools are provided in the form of Microsoft Excel spreadsheets. The end product is the NEC taxonomy spreadsheet. It can be used to describe the job structure of most NECs. This is useful for determining which NECs require the performance of similar tasks for purposes of Job Family construction. We used the spreadsheet data for determining which NECs Detailers might be substituting for one another when assigning Sailors to Navy jobs.

Because of limited resources, we were only able to automate the parser to codify NECs to level 1 of the taxonomy. Subject-matter experts (SMEs) hand-coded the NECs to level 5. The SMEs found some of the NECs difficult to code because of the limited job descriptions found in the NEC manual. Accuracy of the coding could be improved with better job descriptions or by using SMEs with a broader knowledge of the NECs.



The parser was developed by a CNA analyst having considerable experience using O*Net procedures and 25+ years of Navy personnel experience. It uses a lexicon of terms (key words) incorporated in the Department of Labor O*Net database. It also internalizes business rules recommended by the O*Net process. An example of the results of applying the parser to an NEC description follows.

Parser Example: FC 1625 AN SQY 24 V1 Maintenance Technician



- User cuts/pastes job description into spreadsheet
- Excel formulas, using built-in lexicon, categorize tasks

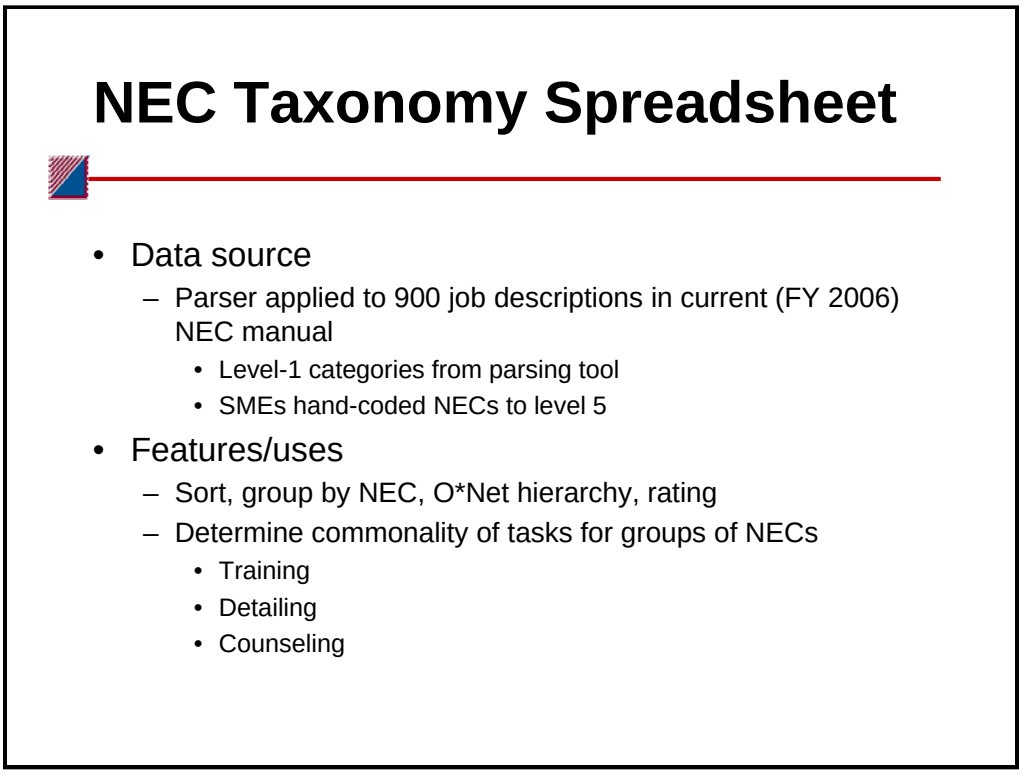
To use the parser, one simply enters the job description into the spreadsheet. In the example, we copied (cut/paste) the description for FC 1625, from the NEC manual, into the spreadsheet. Excel formulas are automatically applied to produce the result shown on the next slide.

Screen shot of parser output for FC 1625 NEC (AN/SYQ-24 Maintenance Technician)

word pos	word	word cleaned of punctuation	word cleaned of punctuation	Exclusion list	Exclusions removed	Contextualized	Unique	Key Words	Position 1 candidate	Differentiator	Distribution	Dist. Count
											Z	0
1				about							Y	0
6	1625	1625	1625	above	1625			maintain	M		X	1
9	AN	an	an	accepts	an			technician	M		W	3
13	SYQ	syq	syq	accomplisl	syq			document	A		T	0
16	24	24	24	accomplisl	24			organizational		O	S	1
18	V	v	v	accomplisl				level			P	0
20	1	1	1	accordanc				sensor	W		O	2
32	Maintenance	maintenance	maintenance	according	maintenance	maintain	maintain	equipment	M	E	M	4
43	Technician	technician	technician	according	technician	technician	technician	computer	I		L	0
52	Performs	performs	performs	achieve				series		S	I	8
63	documented	documented	documented	achieving	documented	document	document	console	W		H	0
78	organizational	organizational	organizational	across	organizational	organizational	organizational	rack	M		G	0
84	level	level	level	action	level	level	level	commercial		C	F	0
96	maintenance	maintenance	maintenance	actions	maintenance	maintain		off			E	0
99	on	on	on	activities	on			shelf			D	0
103	LHA	lha	lha	activity				open		O	C	0
105	1	1	1	acts				system	I	S	B	0
111	class	class	class	adhering				architect			A	2
116	ACDS	acds	acds	affect	acds	sensor	sensor	device				
119	AN	an	an	affected	an			print	S			
123	SYQ	syq	syq	affecting	syq			operating-system				
126	24	24	24	after	24			operate	O	O		
128	V	v	v	again				adjust				
130	1	1	1	airman				limit				
134	and	and	and	aka				local		L		
144	component	component	component	akin				area				
154	equipment	equipment	equipment	al.	equipment	equipment	equipment	network	I			
164	including	including	including	all				manage	X			
168	the	the	the	almost				task				
171	AN	an	an	along	an			fiber	I			
175	UYK	uyk	uyk	already				optic	I			
179	43A	43a	43a	also	43a			data	I			
188	computer	computer	computer	although	computer	computer	computer	distribute				
193	set,	set	set	america				interface	I			
196	AN	an	an	american	an			configuration	I			
200	UYK	uyk	uyk	americans				support	A			
203	70	70	70	amid	70			tactical	W	T		
205	V	v	v	among				operation	O	O		

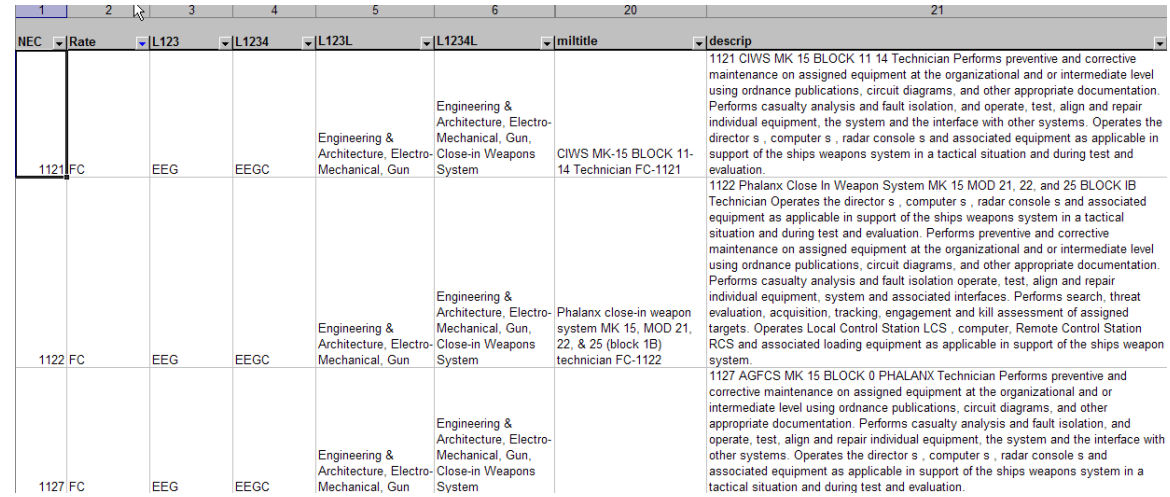
I = Information systems and communications

The output from running the parser on the FC 1625 job description is shown here. The significant information produced is shown in the columns labeled “Key Words,” “Distribution,” and “Dist. Count.” Each key word is linked to the O*Net database, which has a differentiator associated with the corresponding level-1 code. The frequency distributions of the level-1 key word codes are shown in the rightmost columns. The differentiator with the greatest frequency is used as the level-1 code—in this case, “I” (information systems and communications, circled in red).



The NEC taxonomy spreadsheet contains the taxonomy coding for 900 NECs. The codes are shown down to level 4, for purposes of forming potential Job Families. We envision the use of the taxonomy for management of training, detailing, and career counseling.

NECs in the FC CWIS Family
(from NECtaxonomy.xls)

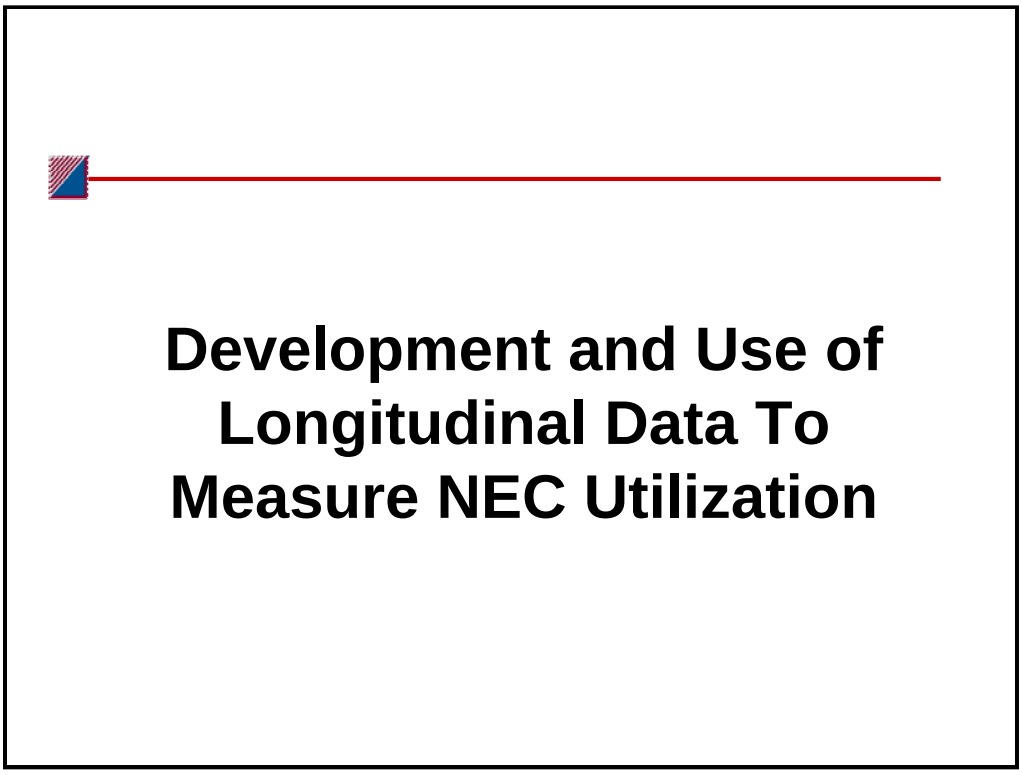


1	2	3	4	5	6	20	21
NEC	Rate	L123	L1234	L123L	L1234L	miltitle	descrip
1121	FC	EEG	EEGC	Engineering & Architecture, Electro-Mechanical, Gun	Engineering & Architecture, Electro-Mechanical, Gun, Close-in Weapons System	CIWS MK-15 BLOCK 11-14 Technician FC-1121	1121 CIWS MK 15 BLOCK 11 14 Technician Performs preventive and corrective maintenance on assigned equipment at the organizational and or intermediate level using ordnance publications, circuit diagrams, and other appropriate documentation. Performs casualty analysis and fault isolation, and operate, test, align and repair individual equipment, the system and the interface with other systems. Operates the director s , computer s , radar console s and associated equipment as applicable in support of the ships weapons system in a tactical situation and during test and evaluation.
1122	FC	EEG	EEGC	Engineering & Architecture, Electro-Mechanical, Gun	Engineering & Architecture, Electro-Mechanical, Gun, Close-in Weapons System	Phalanx close-in weapon system MK 15, MOD 21, 22, & 25 (block 1B) technician FC-1122	1122 Phalanx Close In Weapon System MK 15 MOD 21, 22, and 25 BLOCK IB Technician Operates the director s , computer s , radar console s and associated equipment as applicable in support of the ships weapons system in a tactical situation and during test and evaluation. Performs preventive and corrective maintenance on assigned equipment at the organizational and or intermediate level using ordnance publications, circuit diagrams, and other appropriate documentation. Performs casualty analysis and fault isolation operate, test, align and repair individual equipment, system and associated interfaces. Performs search, threat evaluation, acquisition, tracking, engagement and kill assessment of assigned targets. Operates Local Control Station LCS , computer, Remote Control Station RCS and associated loading equipment as applicable in support of the ships weapon system.
1127	FC	EEG	EEGC	Engineering & Architecture, Electro-Mechanical, Gun	Engineering & Architecture, Electro-Mechanical, Gun, Close-in Weapons System		1127 AGFCS MK 15 BLOCK 0 PHALANX Technician Performs preventive and corrective maintenance on assigned equipment at the organizational and or intermediate level using ordnance publications, circuit diagrams, and other appropriate documentation. Performs casualty analysis and fault isolation, and operate, test, align and repair individual equipment, the system and the interface with other systems. Operates the director s , computer s , radar console s and associated equipment as applicable in support of the ships weapons system in a tactical situation and during test and evaluation.

Procedure to Identify O*Net Job Families

- Select “FC” rate (col. 2).
- Sort on 4-level code, “L1234” (col.6)

Shown on this slide is a grouping of Fire Controller NECs to level 4. To use the spreadsheet to group NECs into Job Families, one first selects the rate (here, FC). All FC NECs will be shown. Job Families can be grouped by then sorting on column 6, “L1234L.”



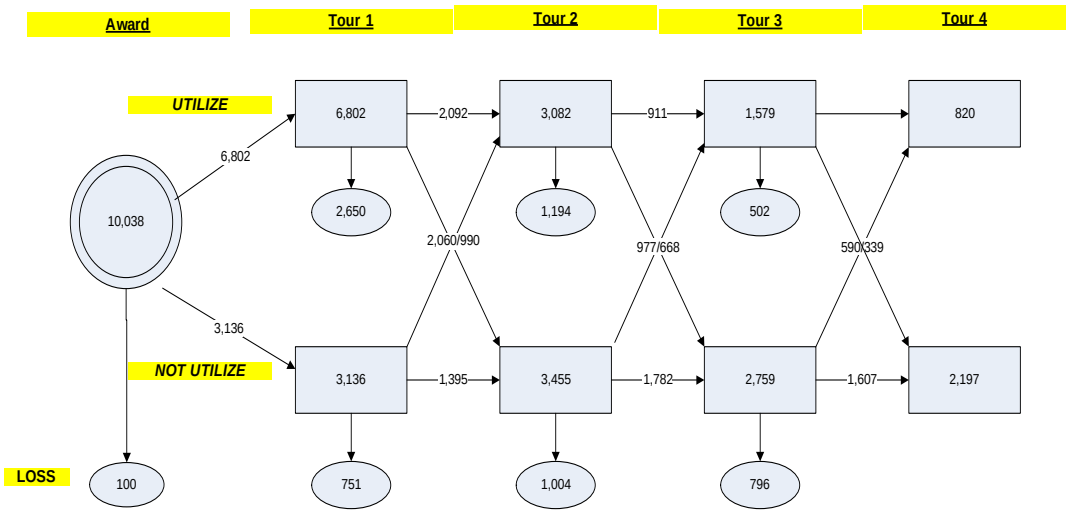
In this section, we describe the construction and use of a longitudinal database of naval enlisted personnel awarded NECs during the period of 1983 to 1999. We track the job assignments of these Sailors for 10+ years, through as many as four duty assignments. We measure various training costs and NEC utilization.

Job Assignment Paths

- We tracked Sailors awarded NECs for 10+ years for up to four tours (job assignments)
  - Determined DNEC, from administrative data, for each tour
- Possible paths for NEC uses during a particular tour
  - Utilize: NEC = DNEC (or in O*Net Job Family)
  - Not utilize: DNEC, or O*Net Job Family, unrelated to NEC
  - Leave Navy
- Flow diagram constructed for FY 1988–93 cohorts, as illustrated
  - Most (68%) use NEC on 1st tour following award
  - Some Sailors may not "use" NEC until 4th tour

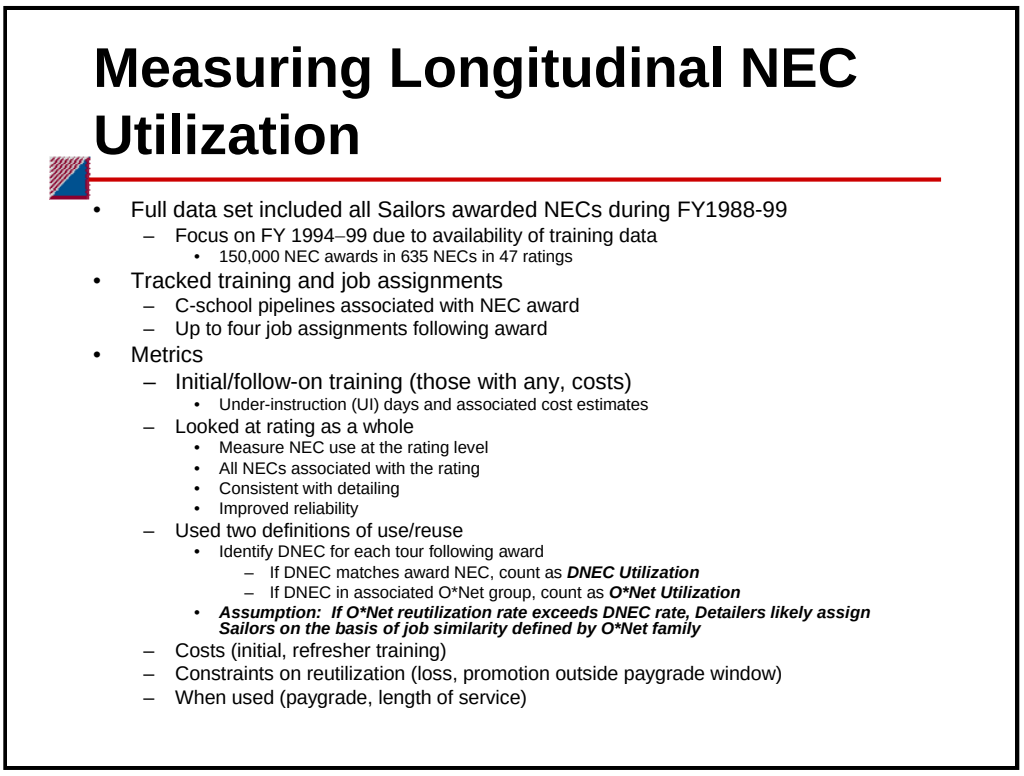
We constructed several cohorts made up of Sailors awarded NECs from FY 1988 through FY 1993, and we tracked their job assignments for 10+ years through as many as four tours. There are many possible paths from tour to tour for NEC use. Typically, about 68 percent use their NECs (DNEC) on the tour following C-school, where the NEC is awarded. As shown on the next slide, NEC use/non-use can take several paths during subsequent tours. We found that a small percentage of Sailors did not use (DNEC) their NECs until four tours following C-school (about 10 years later).

FC NEC Utilization Paths



FY 1988–93 cohorts (DNEC method)

This slide tracks the FY 1988–93 composite cohort of those awarded FC NECs. About 10,000 Sailors were awarded FC NECs during that period. Possible "paths" between tours include utilize NEC, not utilize, or loss to the Navy (numbers shown in ovals). Possible reasons for not utilizing an NEC past a given tour are ineligibility due to promotion, the Sailor not having reached the tour, and loss. We will examine these flows in subsequent analyses.



Although we had duty assignment data for Sailors awarded NECs in FY 1988 through FY 1999, we limited our analysis to the use of the FY 1994–99 cohorts due to the availability of training data. We further limited our analysis to the 47 ratings where we could construct Job Families having two or more NECs per family. Nearly 150,000 NECs were awarded to the cohorts and Job Families we studied. We combined the data from the individual cohorts because there were too few NEC awards for some NECs in a single year.

Our metrics are based on NEC use for the rating as a whole, rather than a specific NEC. This approach is consistent with the concept of the Job Family, which consists of a group of NECs. We measured NEC use/reuse using two metrics: assignments where the NEC matched the DNEC, and use within the Job Family (or O*Net Group). The DNEC use/reuse rate, at the rating level of aggregation, is a subset of the O*Net rate because all DNECs for NECs associated with a given rating are represented in one (and only one) of the O*Net groups. So, when comparing the DNEC use metric with the O*Net metric, the O*Net value is a measure of the extent of NEC substitution, or "stove piping," practiced by Detailers. Our empirical results are used to test this assumption. If the O*Net reutilization rate exceeds the DNEC rate, Detailers likely assign Sailors on the basis of job similarity as defined by O*Net Job Families.

We consider both the initial training cost of an NEC award and the cost of "refresher" training associated with reuse of an NEC. We estimated these costs using the Navy Integrated Training System (NITRAS) to determine the number of days under instruction (UI) and awaiting instruction (AI) at the schoolhouse. Schoolhouse training costs were obtained from the Chief of Naval Education and Training (CNET) and are based on FY 2004 data. Cost data reflect the direct and indirect costs of instructors, support

personnel, curriculum and material development, supplies, contracts, equipment, and equipment maintenance costs incurred by the CNET claimancy. These are the *fixed costs* of training. The Navy Military Pay and Allowances (instructors, support personnel, students) incurred for training are also included; these are the variable costs. The variable costs depend on the length of the courses and the AI time.

Constraints limiting the potential reuse of NECs include promotion, expiration of NEC certification (usually after 5 years), and leaving the Navy. Because NEC use could occur beyond our variable period of observation of job assignments, there is a potential bias in measuring NEC reuse. That is, those earning NECs in 1994 could be observed for up to 11 years, but those earning NECs in the later cohorts (1999) could only be observed through 2005 (6 years). This would increase the likelihood of observing reuse for those in the earlier years and underestimate potential use for more recent NEC awards.

To round out our descriptive statistics concerning NEC use/reuse, we indicate “when” use occurs, in terms of the average paygrade of the users and their length of service.

Example: Sailor Awarded NEC "A"

Arbitrary O*Net Job Families

O*Net Family	1st NEC	2nd NEC	3rd NEC
1	A	B	C
2	D		

Detailed DNEC x Tour

Tour	1	2	3	4
DNEC	A	C	B	A

RESULTS

Method	Tour1	Tour2	Tour3	Tour4	Utilization Rate
DNEC	1	0	0	1	2/4
O*Net	1	1	1	1	4/4

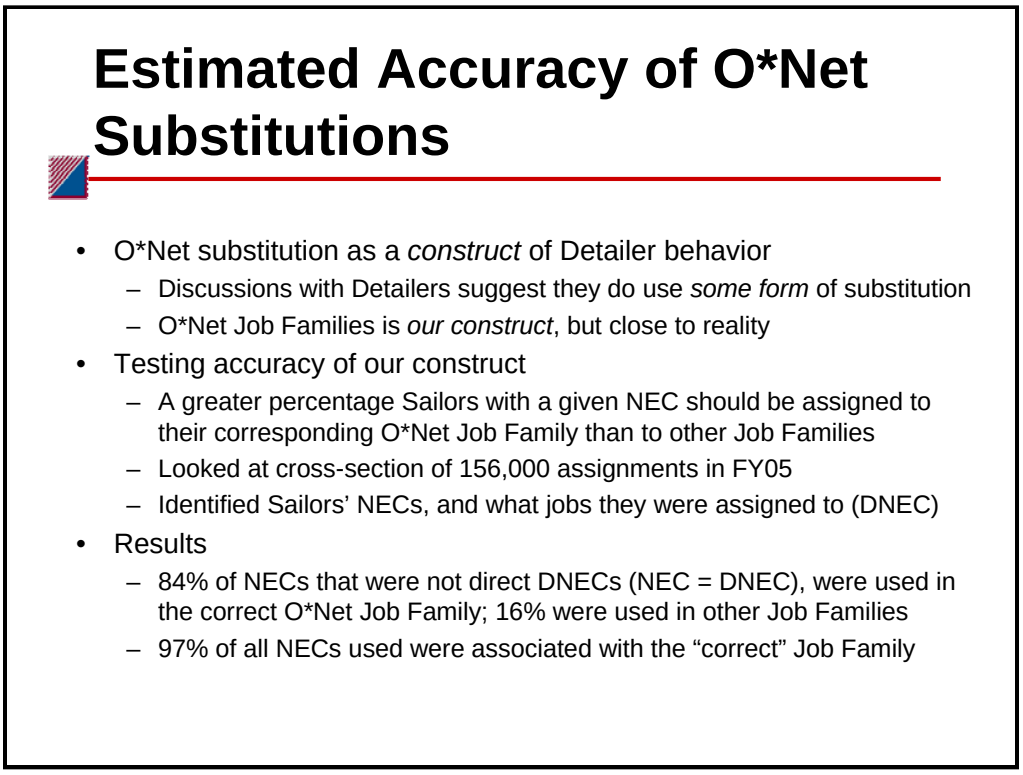
This is an example of how NEC use/reuse would be measured. We consider a rating with four associated NECs (A, B, C, and D). We suppose the job requires NEC A.

The top panel shows two O*Net Job Families that were constructed for the NECs. The middle panel shows the DNECs to the billet (requiring NEC A). The bottom panel shows whether the NECs were utilized, given our two metrics.

Tour1. Since the NEC A meets the requirement, and the NEC is equal to the DNEC, we consider this NEC as having been used, under the DNEC definition. We also credit this assignment as O*Net use because NEC A belongs to O*Net Family 1.

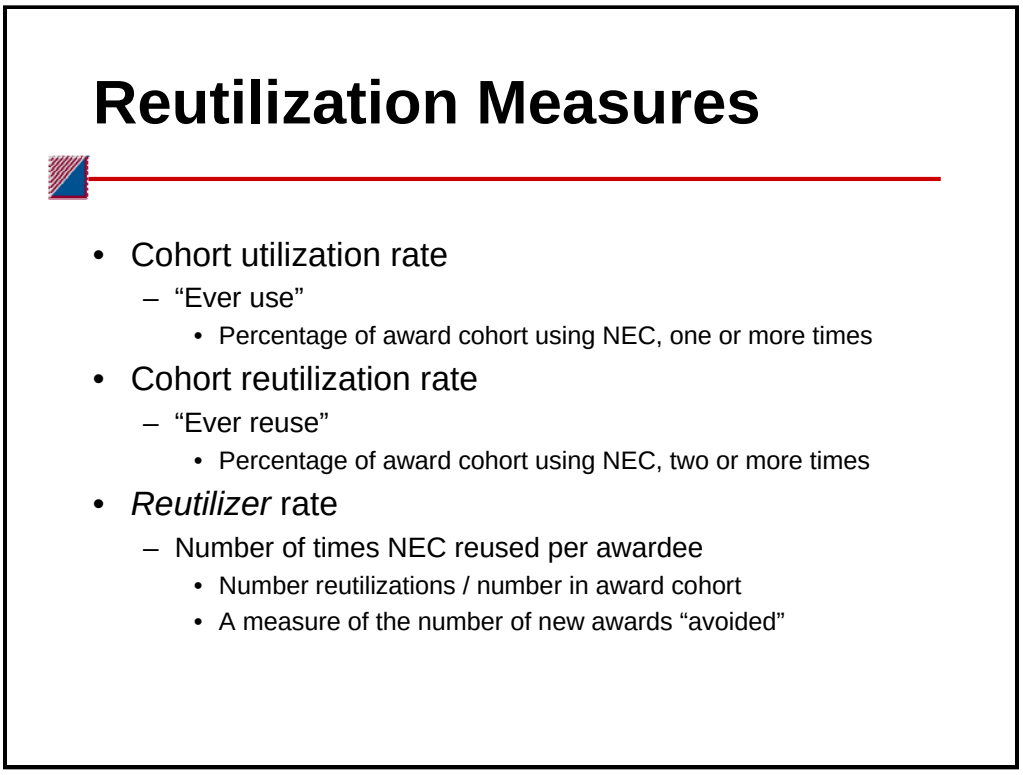
Tour2. A Sailor with NEC C is detailed to the billet. Since the DNEC is not equal to the billet requirement, we do not consider this NEC as having been utilized under the DNEC metric. However, since NEC C is included in the same O*Net Job Family as NEC A, we consider the NEC to have been utilized under the rule for the O*Net metric.

The utilization rates shown in the last column are the result of adding utilizations across tours.



We developed the NEC taxonomy as a tool for describing the tasks associated with Navy jobs. Our discussions with a limited number of Detailers suggested that they do assign Sailors to jobs based on commonality of tasks to some extent. But this is not likely done universally, or in a consistent manner, because there are no official guidelines on NEC substitution.

As a way of testing the consistency this substitution process, we compared the number of substitutions that occurred within the framework of our taxonomy with the number that were inconsistent with the taxonomy (i.e., to unrelated job families). We found that 84 percent of substitutions were to the same job family as the awarded NEC. This result indicates that Detailers do not assign Sailors "at random" to jobs. Rather, they mostly use a scheme consistent with our NEC taxonomy.

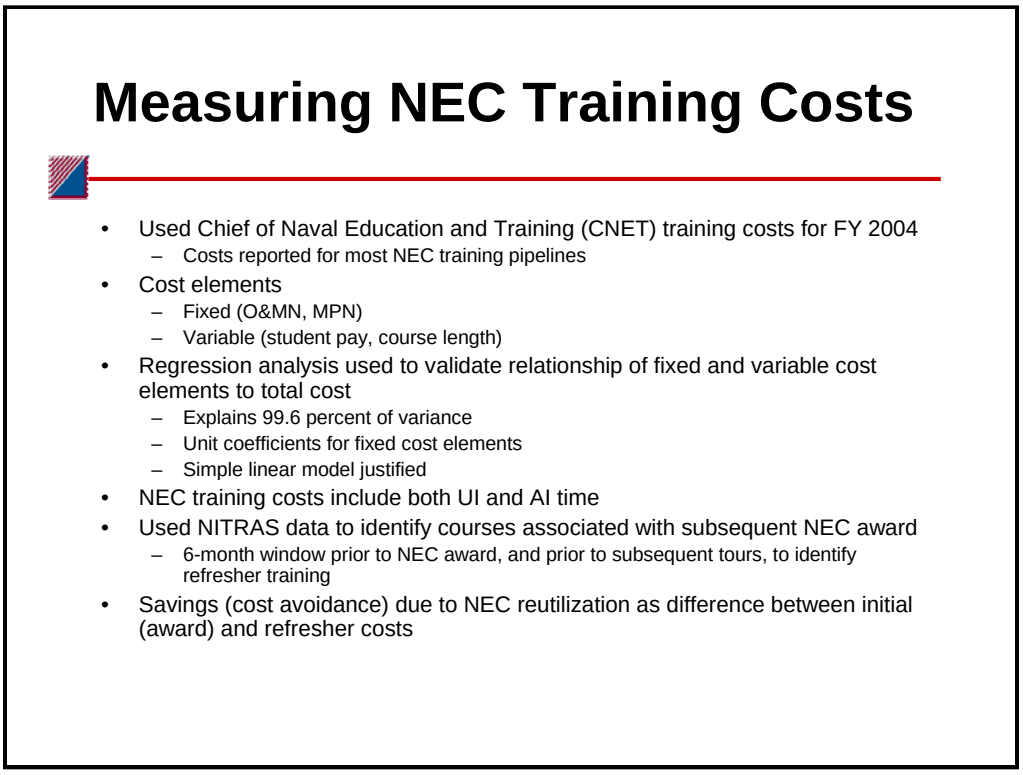


Developing metrics for NEC reutilization is complicated by the fact that a person may use a given NEC several times during a career. Consider the case where an NEC is awarded to ten Sailors. Suppose one Sailor used it once, four of these Sailors each used the NEC twice, and one Sailor used it three times. Such a circumstance led to development of three metrics.

Cohort utilization rate (those who ever used the NEC). This is the percentage of NECs awarded used one or more times. In the above example, this would be 6/10, or 60 percent.

Cohort reutilization rate (those who ever reused the NEC). This is the percentage of NECs awarded used two or more times. In the above example, this would be 5/10, or 50 percent.

Reutilizer rate. This is based on the number of times an NEC is reused per awardee. This accounts for the possibility that an NEC could be used several times by the same person, thereby avoiding initial NEC training for new awards. In the above example, the reutilizer rate would be [(2 reuses x 1 Sailor) + (1 reuse x 4 Sailors)]/10, or 60 percent. This reuse pattern suggests that six fewer new NEC awards would be needed to fill the NEC trained inventory.



The cost of NEC training involves several elements, including the expense of getting the Sailor to and from the school (PCS) and the cost of training at the school. While data on PCS costs were not available, we were able to estimate the schoolhouse portion of the training cost. The key elements of schoolhouse training are the fixed costs of running the schoolhouse (instructors, facilities, equipment, etc.), and the variable costs associated with student pay and allowances.

The Chief of Naval Education and Training reports schoolhouse training costs in a Training Cost Factors manual. We used the data in the FY 2004 manual to estimate parts of NEC training costs.

For each course comprising an NEC pipeline, CNET reports three cost elements: fixed costs, composed of O&MN and MPN, and variable costs, composed of student pay and allowances. Fixed costs are independent of the variable costs—a function of the course length (under instruction, or UI, time).

There is another cost associated with training that should be considered. Often, Sailors will not begin training immediately upon arriving at a training facility. Because they are still receiving pay and allowances, these costs (awaiting instruction, or AI, time) should be included.

We estimated the variable cost components using NITRAS data. This data source maintains longitudinal information on Sailors, such as UI and AI. We developed a simple regression model to identify the daily UI costs inherent in the CNET reports, so we could apply it to the AI days extracted from NITRAS. This seemed reasonable since Sailors' pay and allowances are the same whether they are UI or AI. We developed separate models at the

rating level. The fit of the data was a good one, accounting for 99 percent of the variation, implying that the CNET cost factors and NITRAS data were consistent.

The NITRAS data were used to estimate the training costs associated with both the initial NEC award and subsequent follow-on training that Sailors received before reuse of their NECs later in their careers. We used a 6-month window before an assignment to determine if any training related to the NEC had been received. We used the training costs before NEC reuse in determining net savings, which is the difference between initial and follow-on (refresher) training costs.

Reutilization Benefit/Cost Calculation
ILLUSTRATION

- Assumes reutilizing NEC avoids training another Sailor
- Reutilization benefit
  - Example: 10 Sailors use once, 5 use twice from cohort of 25
    - 5/25 = 20 percent
    - Avoids training 5 Sailors
- Reutilization cost avoidance[1]
  - Additional UI days ("refresher") after first use reduce savings
  - Net savings due to training avoidance
    - Cost of initial NEC award less refresher cost[2]
    - Per reuse (subtracting UI days[3]) : $51,000 - $31,000= $20,000

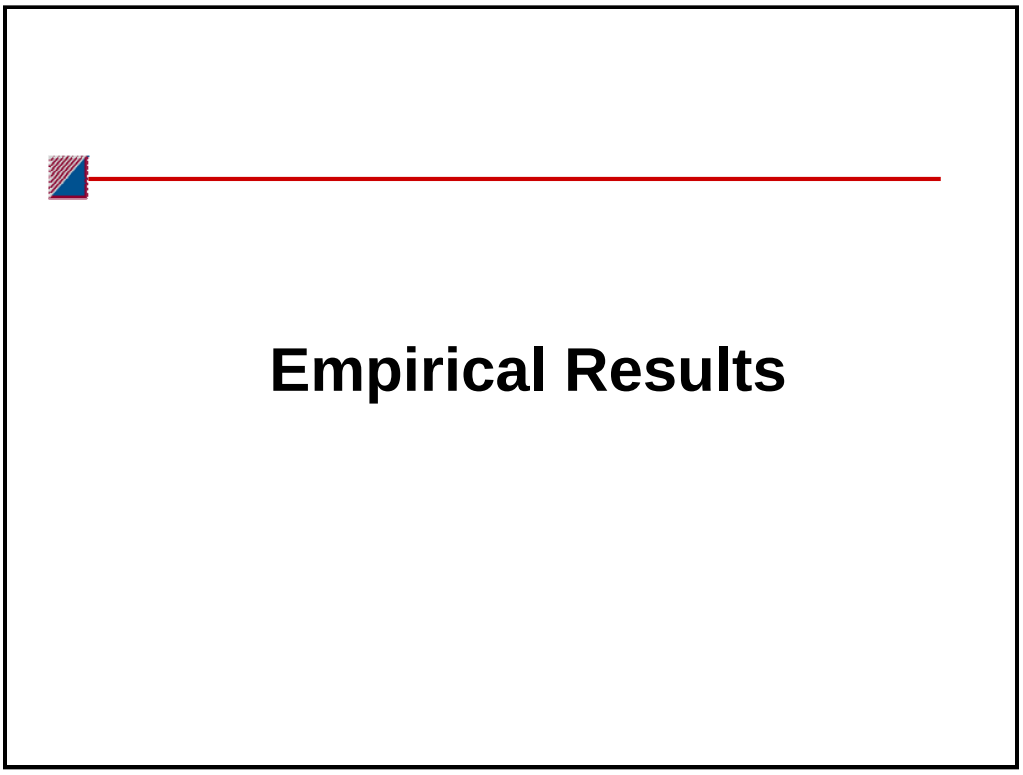
[1] Illustration is for an NEC related to Fire Controller (FC).

[2] Training costs estimated from CNET FY2004 Cost Factors manual. The (simplified) regression equation estimated was: $30,123 + 138 * # UI days. The constant incorporates O&MN and MPN dollars (instructors and facilities) set to means of FC NECs in CNET cost manual. The variable cost incorporates student pay and per diem, which depends on UI days from cohort data.

[3] Forty percent of those reutilizing their NECs had additional UI days. Average UI days per reuser, with identifiable formal training, was about 5.

This slide is an example of how we calculated net savings due to NEC reuse. We assume that reutilizing an NEC avoids putting another Sailor through the full training NEC pipeline. Our example uses data for those in the FC rating.

In the example, 5 Sailors of an initial cohort of 25 reuse their NEC once, for a 20-percent reutilization rate. The initial training cost for the NEC was estimated, as shown in the footnote, at $51,000 for a pipeline length of 151 days. This is in contrast to the 5 days of refresher training identified for reusers at a cost of about $31,000. The difference (net savings) is $20,000.



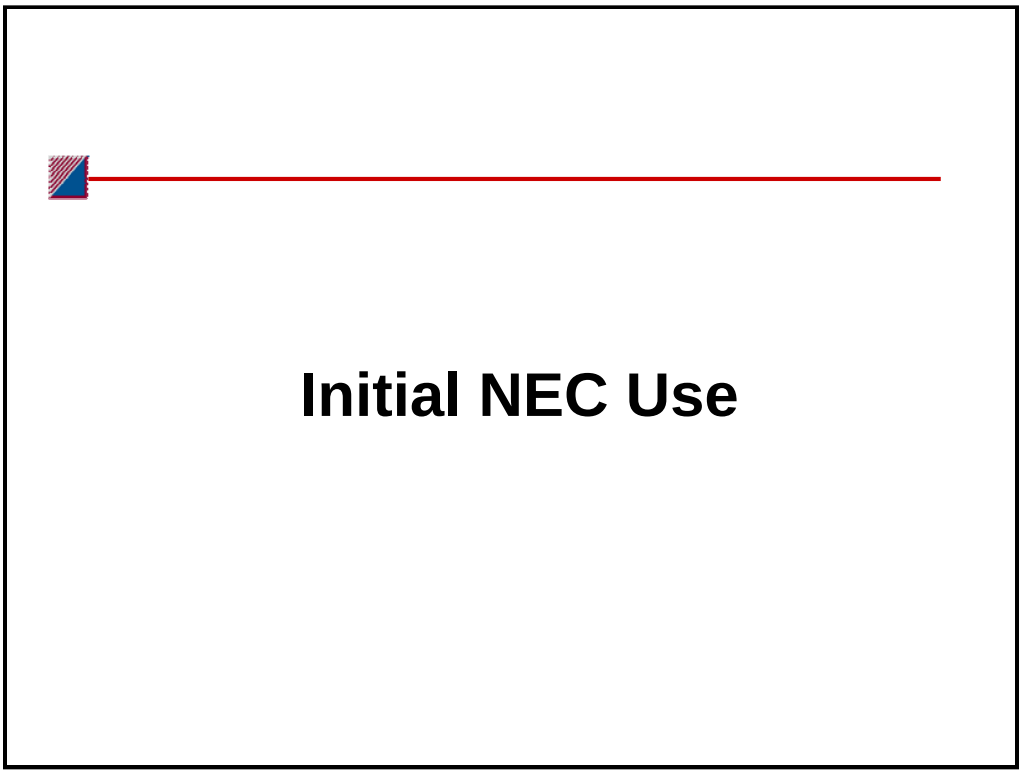
In this section, we show estimates of NEC use/reuse from the FY 1994–99 cohorts.

O*Net Level-2 Rating Groups

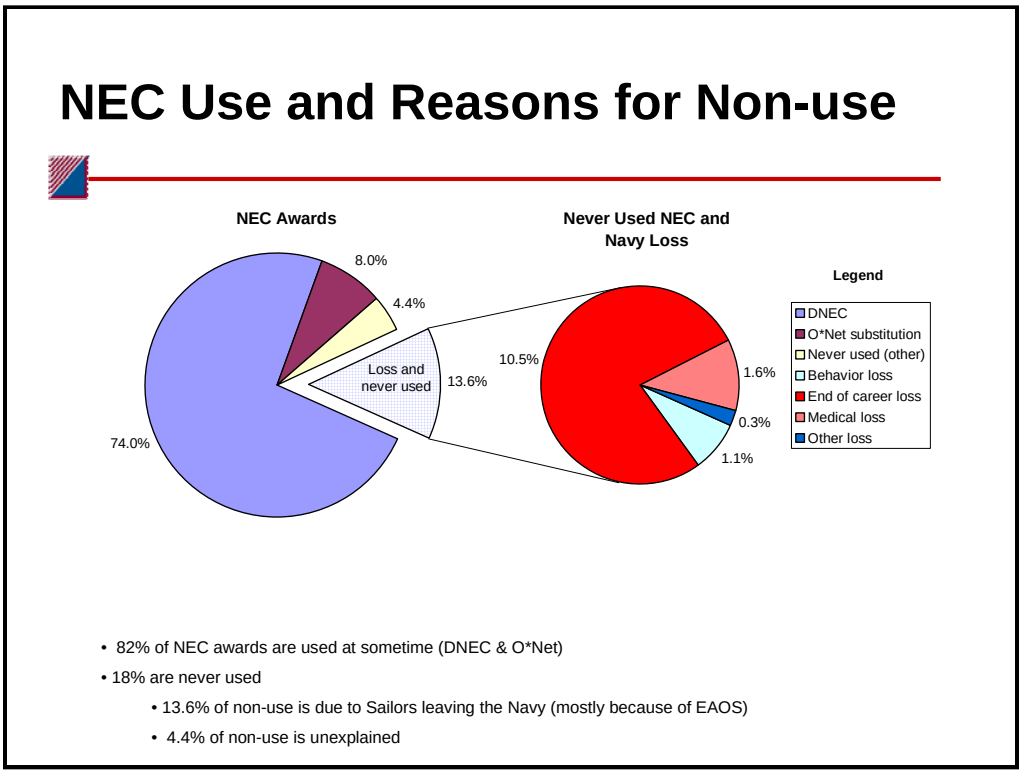
Rating	#Awards	# NECs	#Onet2 Groups
AB	2528	8	3
AC	1327	3	1
AD	2423	14	3
AE	1289	12	2
AM	2004	7	3
AO	1225	4	1
AS	2313	11	2
AT	6186	56	5
AW	3520	10	5
AZ	538	4	1
BM	921	6	2
BU	793	4	3
CS	4105	5	2
CT	5305	21	7
CTI	1158	24	1
CTM	1187	14	2
CTO	978	2	1
CTR	1302	3	2
CTT	1985	8	2
DC	4201	4	1
DT	1742	9	3
EM	2708	14	6
EN	4302	17	2

Rating	#Awards	# NECs	#Onet2 Groups
EO	512	5	3
ET	18870	83	9
FC	9284	44	6
FT	1128	11	2
GM	2101	6	1
GS	1638	9	3
HM	19016	41	7
HT	1188	6	2
IC	4363	30	7
IT	2199	18	3
MM	11999	20	4
MN	168	5	3
MR	358	2	1
MT	1314	4	1
MU	347	18	1
OS	5497	12	6
PH	207	7	3
PR	564	3	2
SK	4297	10	3
STG	9149	30	3
STS	635	8	2
TM	339	2	1

This slide shows the number of NEC awards during FY 1994–99 associated with each of the 47 ratings studied. We also show the number of O*Net Job Families (Groups) and the number of NECs subsumed in the groups for each rating.



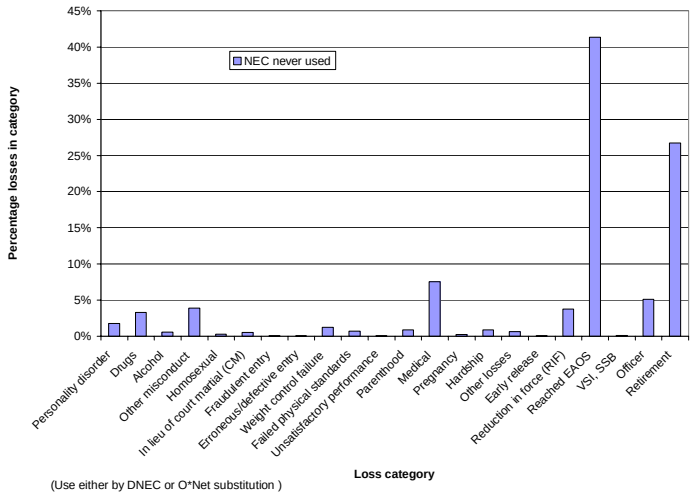
In this section, we look at initial use of NECs and why they may not be used.



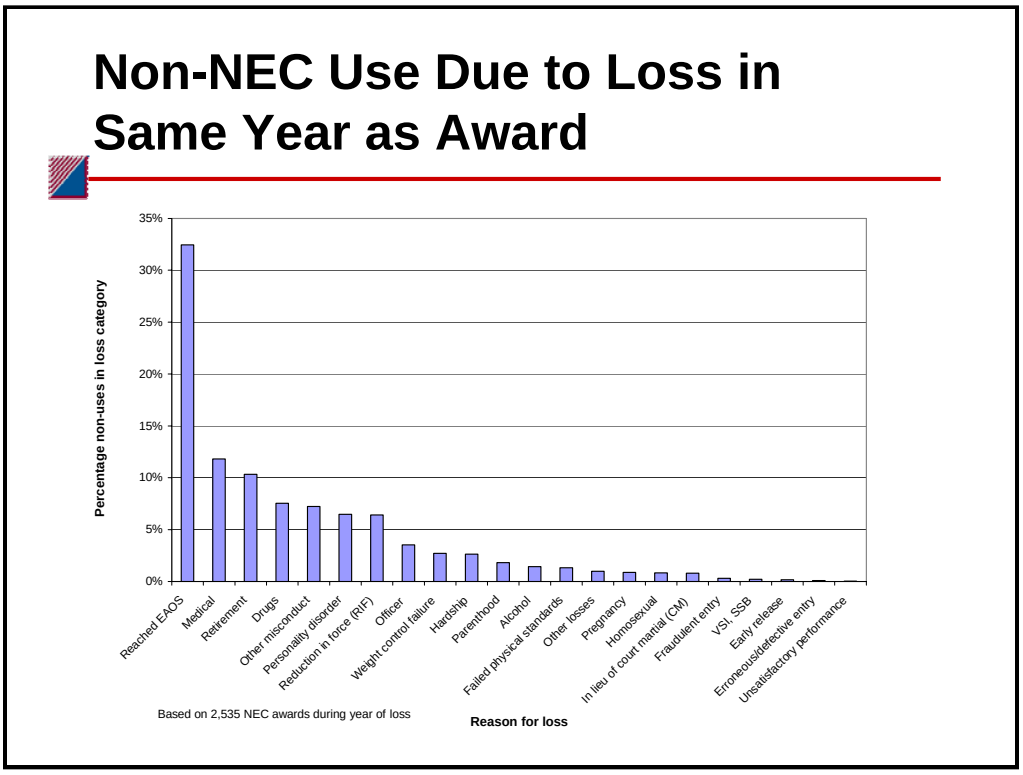
This slide is a graphical depiction on the utilization of NECs. The data suggest that the longitudinal use rate is about 82 percent, with most use occurring during the first assignment following C-school (70%). The major reason NECs are not (EVER) used is due to attrition from the Navy. About 11 percent of NEC awards are never used because Sailors reach the end of obligated service (EAOS), and about 3 percent don't use their NECs for other reasons, such as medical, or because of disciplinary problems.

The next slide provides a more detailed look at the specific reasons for NEC non-use.

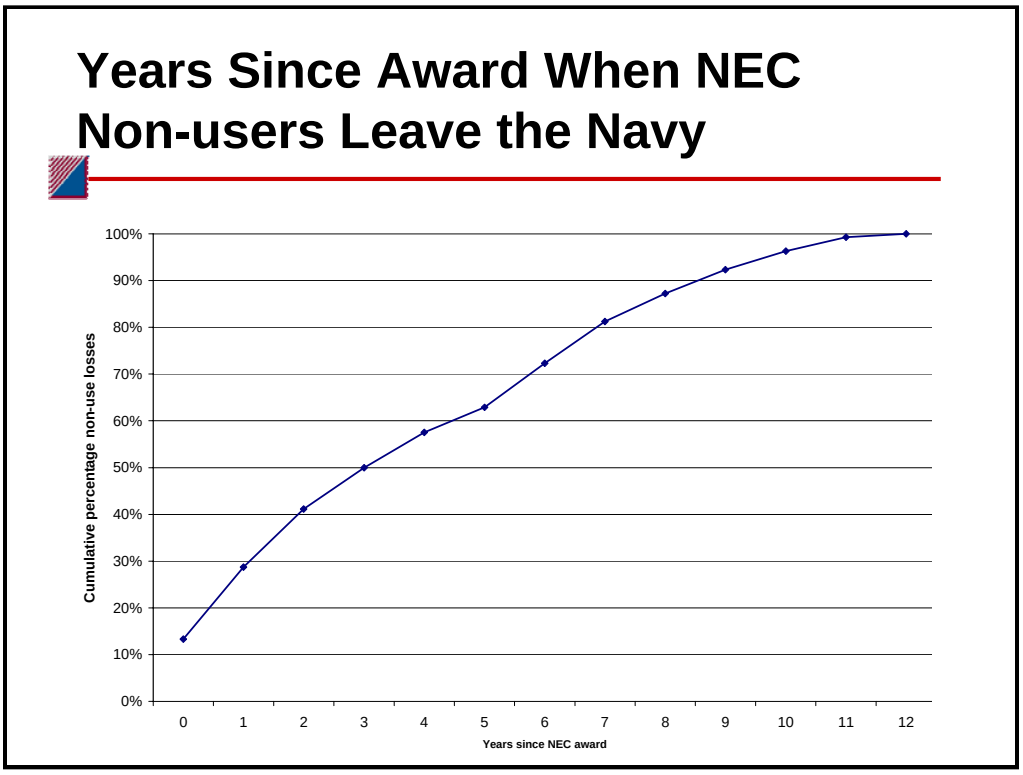
Loss Categories for NEC Non-users (Never Used NEC)



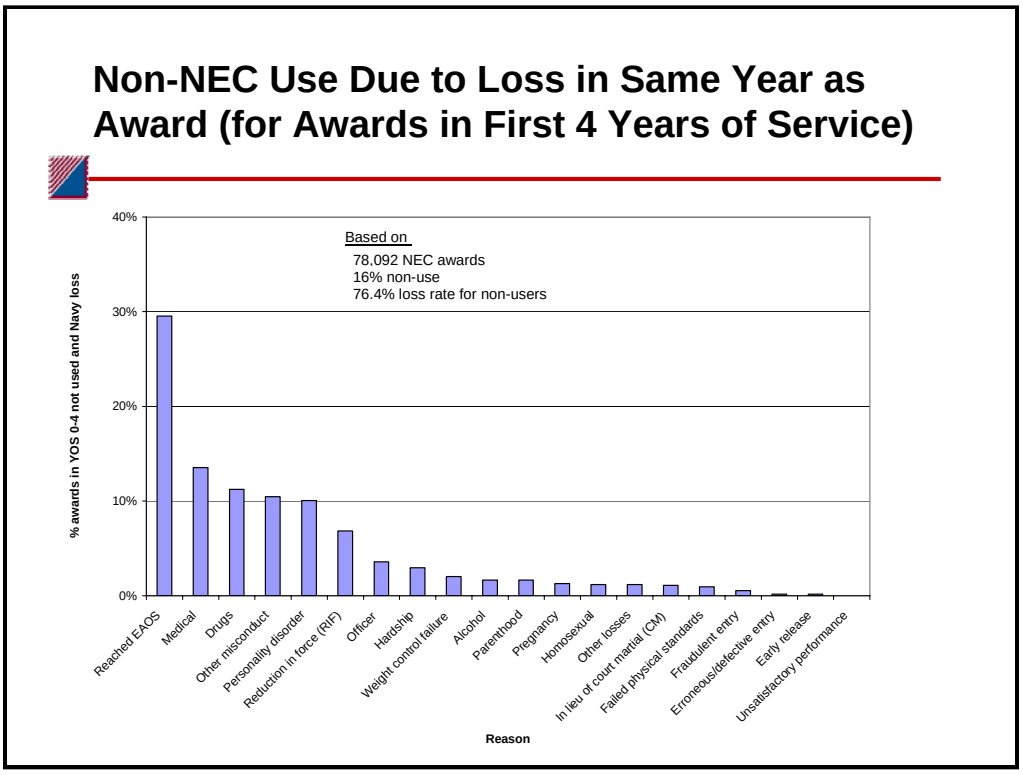
Here, we show the relative frequency of losses by reason for loss for those never using their NEC. The majority of losses are associated with Sailors reaching the end of their careers before they were able to use their NEC. About 27 percent of these losses are associated with retirement and 42 percent with reaching EAOS. We next look at the relation of when the NEC was earned, relative to when the loss occurred.



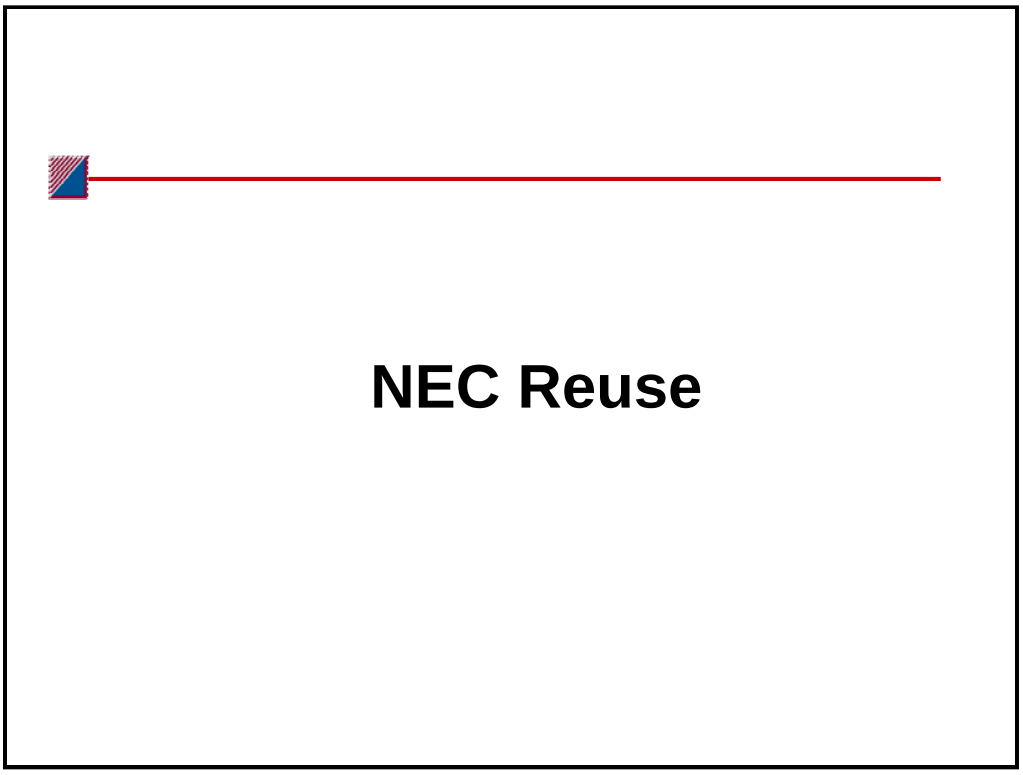
Here we look at the distribution of reasons for loss for those leaving the Navy within 12 months of earning their NEC. Reaching EAOS and retirement account for the majority of losses. This suggests that some Sailors received NEC training, despite a lack of opportunity for ever using the NEC.



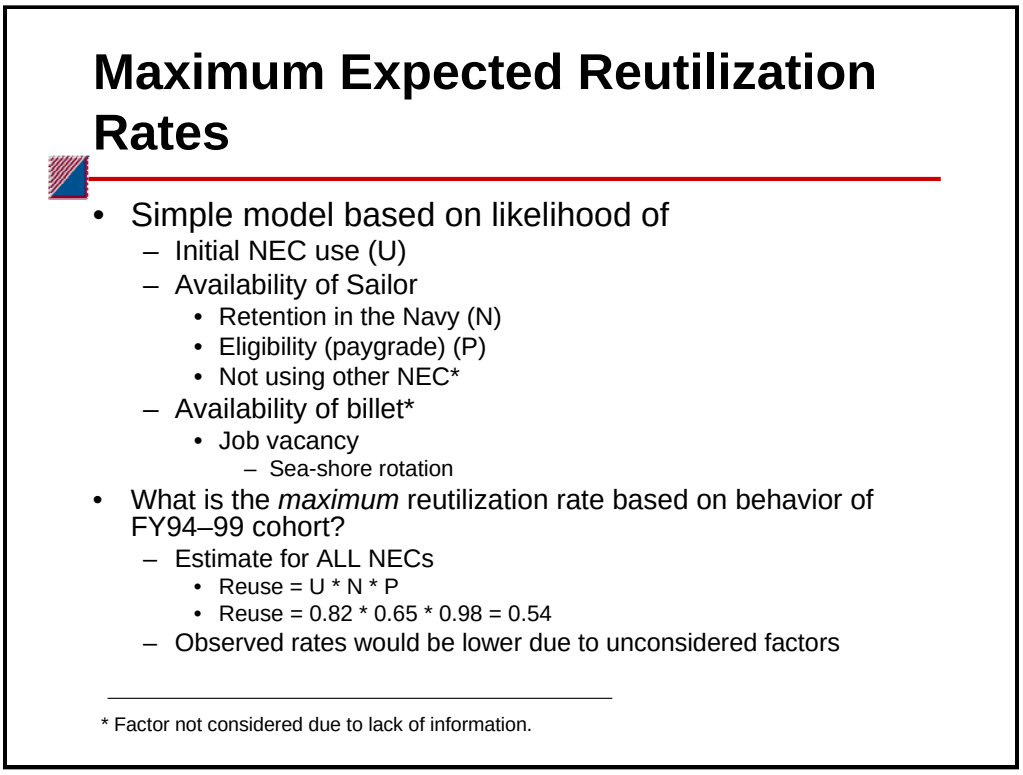
This slide shows how many years NEC non-users stay in the Navy after the NEC is awarded. More than 40 percent remain more than 4 years, suggesting that their NECs remain unused after more than one tour of duty (i.e., across several assignments).



The loss pattern for first-termers who never use their NEC mirrors that of other Sailors. The major reason for first-termers not using their NEC is reaching EAOS in the same year that the NEC is earned. This suggests advising against providing NEC training to Sailors about to reach EAOS.

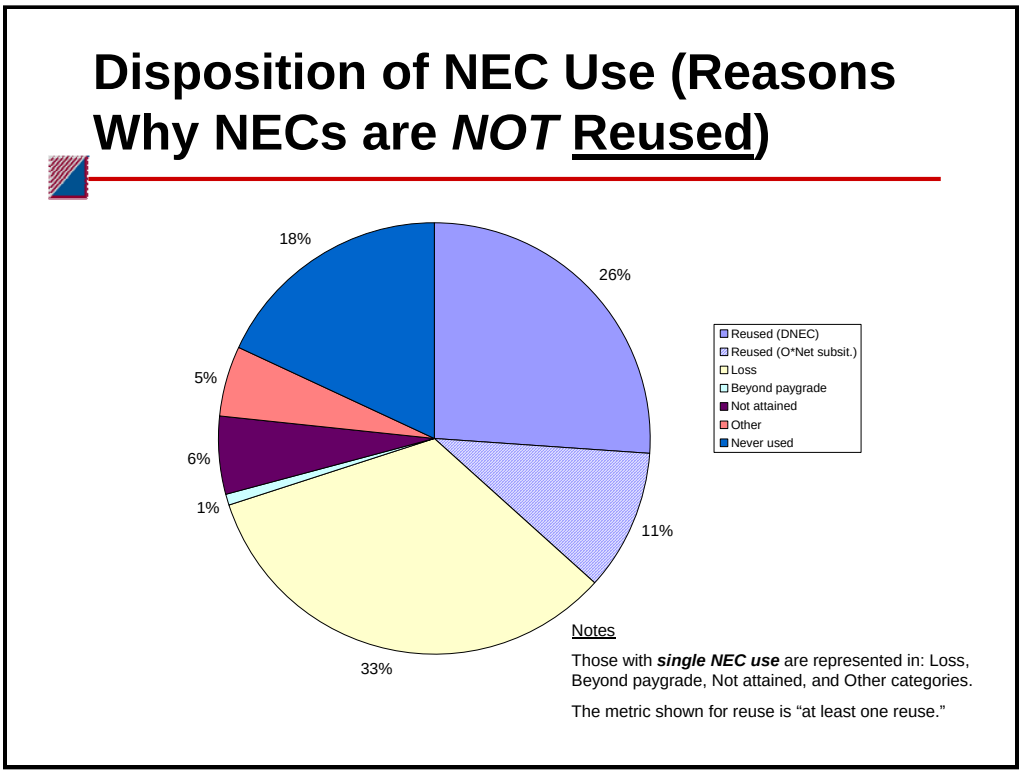


In this section, we look at NEC reutilization. We focus on the rate of reuse, cost savings associated with reuse, and reasons for not reusing NECs.



To put the observed NEC reutilization in perspective, we developed a simple model to estimate the maximum rates we could observe, subject to certain constraints. We did not have sufficient data to fully parameterize the model. We lacked information about availability of a billet/job at time of assignment. Job availability is affected by billet requirements, which differ at sea and on shore. Therefore, when Sailors rotate ashore, and the NEC is one primarily used at sea, there is less likelihood of an available billet. Such circumstances can also lead to Sailors earning other NECs. These NECs, if in different job families, will affect reutilization rates for one or the other NEC.

We estimated the maximum expected NEC reuse rate, using the equation shown in this slide. We used values observed in the reutilization behavior of the FY94–99 cohorts to estimate an overall rate of 54 percent. We also estimated maximum expected rates for individual ratings. These results are presented later in the annotated briefing.



Shown here is a breakdown of the disposition of NEC utilization for those in the FY 1994–99 cohorts. The divisions in the pie charts are as follows. Reusers make up 37 percent of the cohort. Of the 37 percent, 26 percent were direct DNEC, and the remaining 11 percent are considered reusers because the DNEC was linked to O*Net Job Family.

Eighteen percent of the cohort never used their NECs. The remaining sections are made up of those who used their NECs once (did not reuse). Loss to the Navy is the biggest reason for not reusing an NEC. Promotion beyond the required paygrade is the smallest (1 percent). The remaining 11 percent is composed of the 6 percent who were still in the Navy but were not observed for a long enough time to complete a tour following their initial use of the NEC. The reasons the remaining 5 percent did not reuse their NECs are unknown.

The next slide breaks down these data in finer detail.

Comparison of DNEC and O*NET Level-2 Reutilization Statistics

Metric		DNEC		ONET2
Number of awards		149,213		149,213
Any use		74%		82%
Number reuses				
1		27%		37%
2		9%		16%
3		3%		5%
Total reuses		79,096		126,757
Reutilizer rate		53%		85%
Re-use rate		33%		46%
Average # uses		1.17		1.46
Average # reuses		0.76		0.92
Total award cost ($M)	$	2,228	$	3,571
Total reuse cost ($M)	$	687	$	1,040
Training cost/award	$	28,170	$	28,170
Reuse training cost/reuse	$	8,691	$	8,202
Total savings ($M)	$	1,541	$	2,531
Net savings/reuse	$	19,479	$	19,968
Total Savings wrt number reuses elasticity		1.01		1.03
Reusers w. UI days		19%		18%
Initial award (training) avoidance		35%		46%
Non-reuse reasons (% Initial utilizers)				
Loss		67%		74%
Out of PG		2%		2%
Too few tours observed		16%		13%
Unknown		15%		12%

Note: Reuse rate based on multiple reuse across tours.

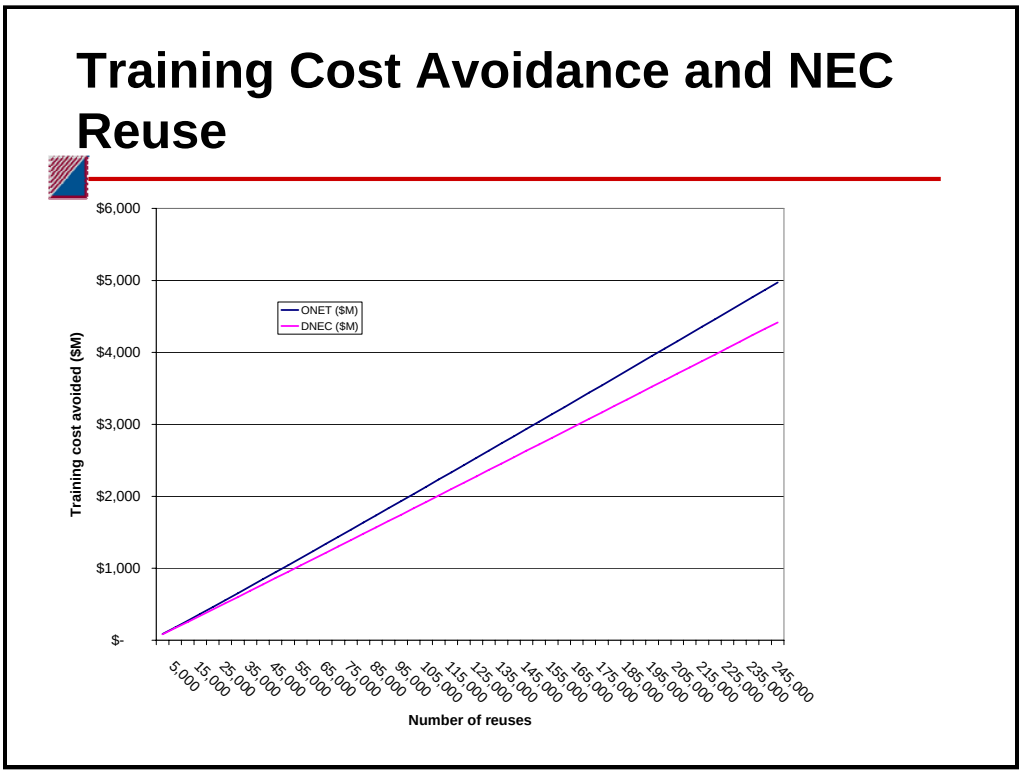
This slide compares metrics for the two methods used to measure NEC use/reuse. The results suggest that Detailers do assign Sailors to jobs using broader criteria than the DNEC, as shown by the higher use/reuse rates in the *ONET2* column. O*Net rates are higher (by 8 percent) than DNEC rates for any use of NECs. Net savings are about $20,000 per reuse. Over a 10-year period, we estimate that NEC reuse saves the Navy as much as $2.5 billion due to avoided training costs—about 46 percent of the initial cost of NEC training.

A significant proportion of Sailors—about 21 percent—reused their NECs more than once (16 percent reusing twice, and 5 percent reusing three times), under the broader O*Net definition. When this behavior is considered, the resulting DNEC and O*Net reuse rates are 33 and 46 percent, respectively.

Not all reusers receive formal refresher training. The NITRAS data indicated that about 19 percent of reusers returned to C-school to take courses associated with the NEC.

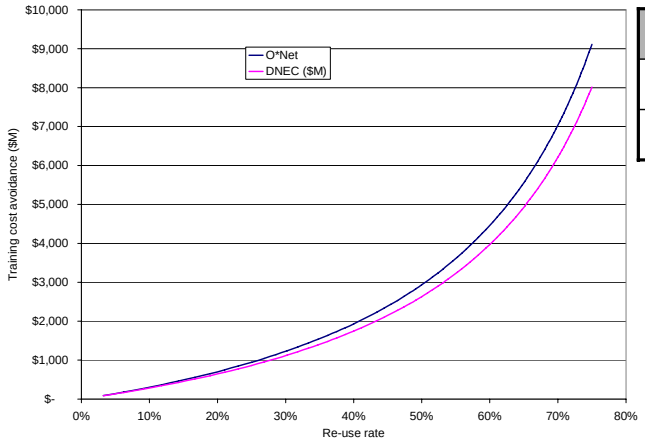
The major reason for Sailors not reusing their NECs, after initial use, is that they leave the Navy. Very few don't reuse their NECs because of promotion to higher paygrades that would disqualify them from being assigned to jobs designated for those in lower paygrades. About 13 to 16 percent were not observed to reuse their NECs because we were unable to follow them beyond their initial utilization tour.

The next group of slides provides additional metrics about NEC use at the rating level.



This slide extrapolates the savings, due to avoiding training costs, as the result of increasing the number of NEC reuses. We used separate linear regression models for DNEC and O*Net-based "assignments" to relate the cost savings and number of NEC reuses. The steeper slope for O*Net assignments suggests a greater rate of return for NEC reuses based on O*Net substitution. As we later show, this is because those in NECs that are more expensive to train are associated with O*Net substitution.

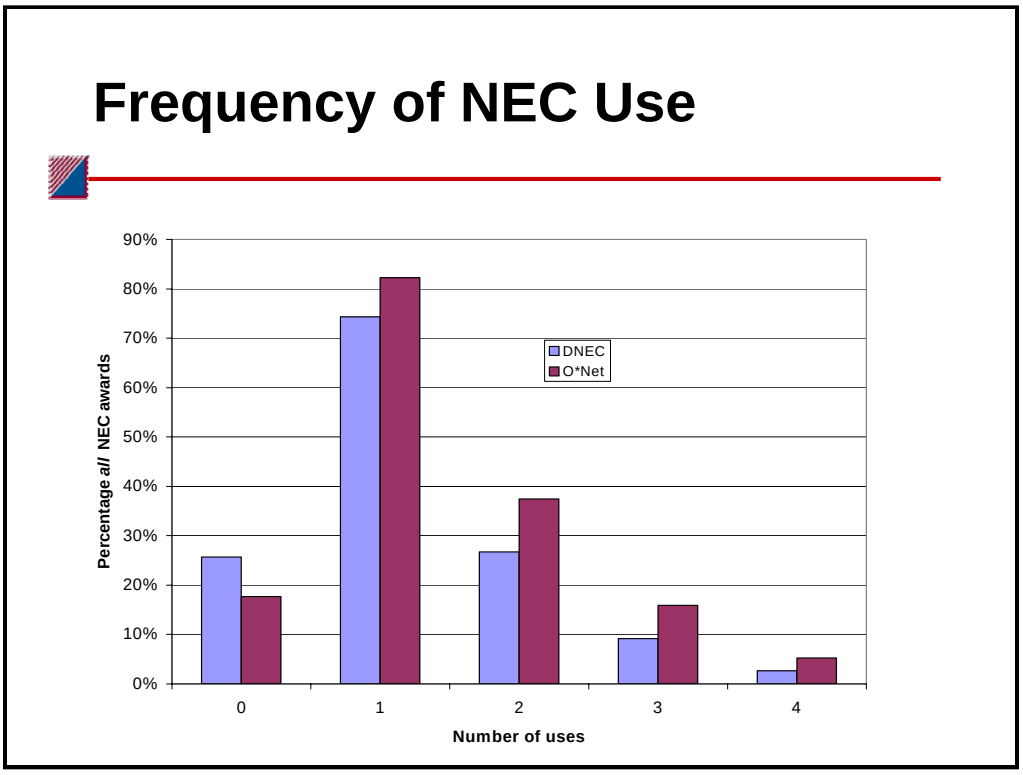
Training Cost Avoidance and NEC Reuse Rate



Method	Change in reuse rate	Additional savings
DNEC	33% to 34%	$67.3M
O*Net	46% to 47%	$98.4M

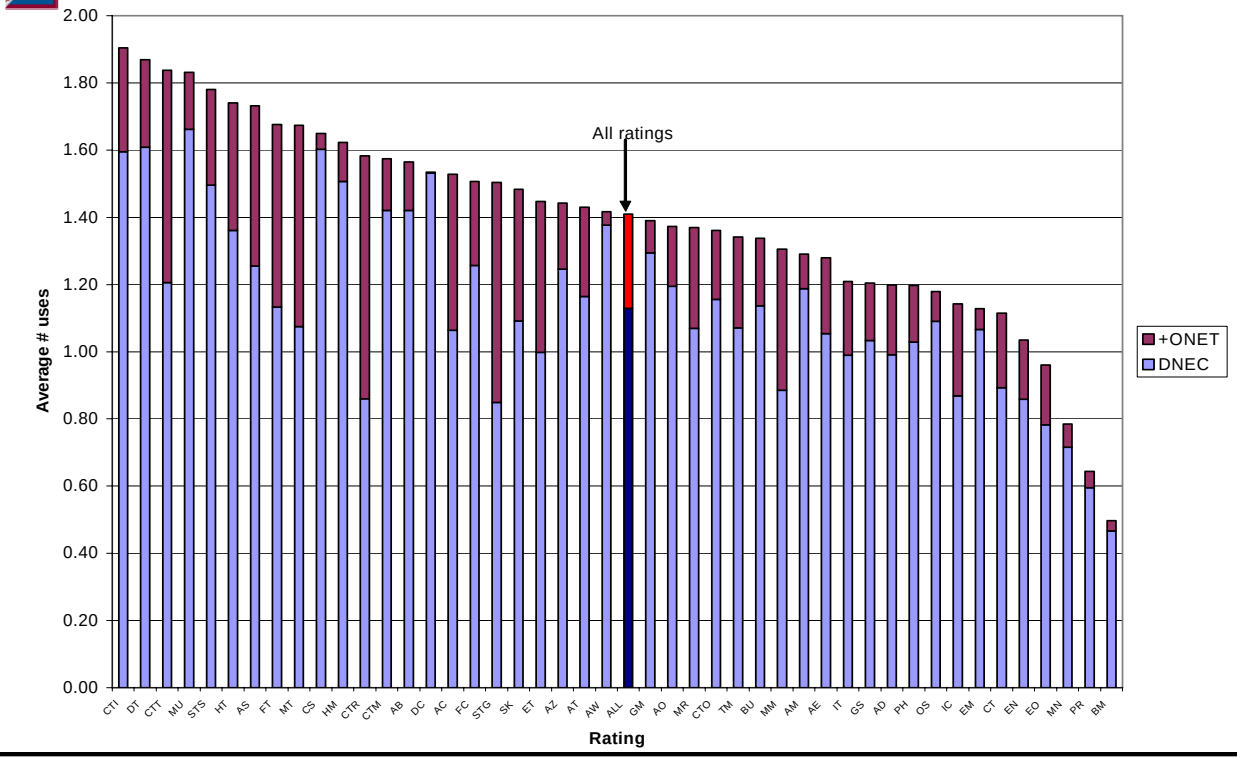
Earlier, we reported the elasticity of cost savings with respect to the number of NEC reuses. The elasticity "value" is the percentage increase in savings associated with a 1-percent increase in the number of reuses. Here we show a variant of that metric—the savings associated with a 1-percentage-point increase in the reuse rate. A 1-percent increase in the number of average DNEC reuses would increase the reuse rate by 0.33 percent (1.01 x 33%). Therefore, a 3-percent increase in DNEC reuses would be needed to raise the reuse rate by 1 percentage point. A similar extrapolation was used to convert O*Net reuses.

As this graph suggests, the relationship between savings and reuse rates is nonlinear, with higher reuse rates yielding proportionally greater savings, particularly for rates greater than the average reuse rate.



This slide shows the frequency distributions of the number of times NECs for all ratings were observed to have been used over a 10-year period following the award.

NEC Use by Detailing Method

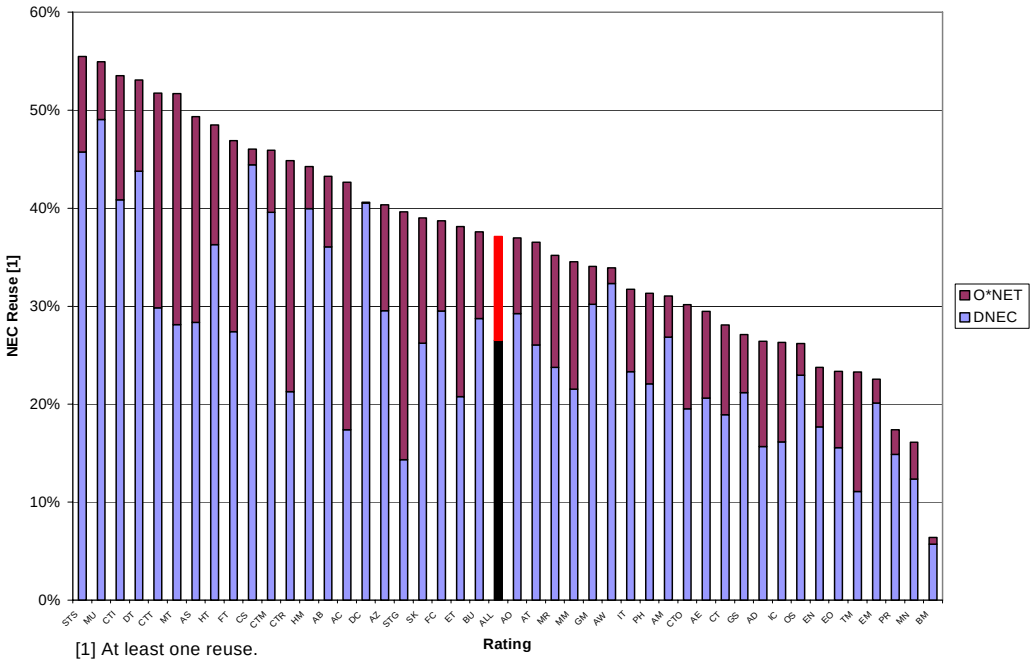


Here we compare the average number of times NECs are used at the rating level. The lower portion (in blue) of each vertical bar represents use measured by the DNEC method, and the upper part (red) is the added contribution of O*Net detailing. Values above one represent NEC reuse.

There is considerable variation among ratings. CTI NECs tend to have the highest use, whereas BMs have the lowest. (The value of about 0.5 for BMs indicate that many never use those NECs.)

We also observe large differences among ratings in the degree of NEC substitution taking place in the detailing process.

NEC Reuse by Detailing Method



[1] At least one reuse.

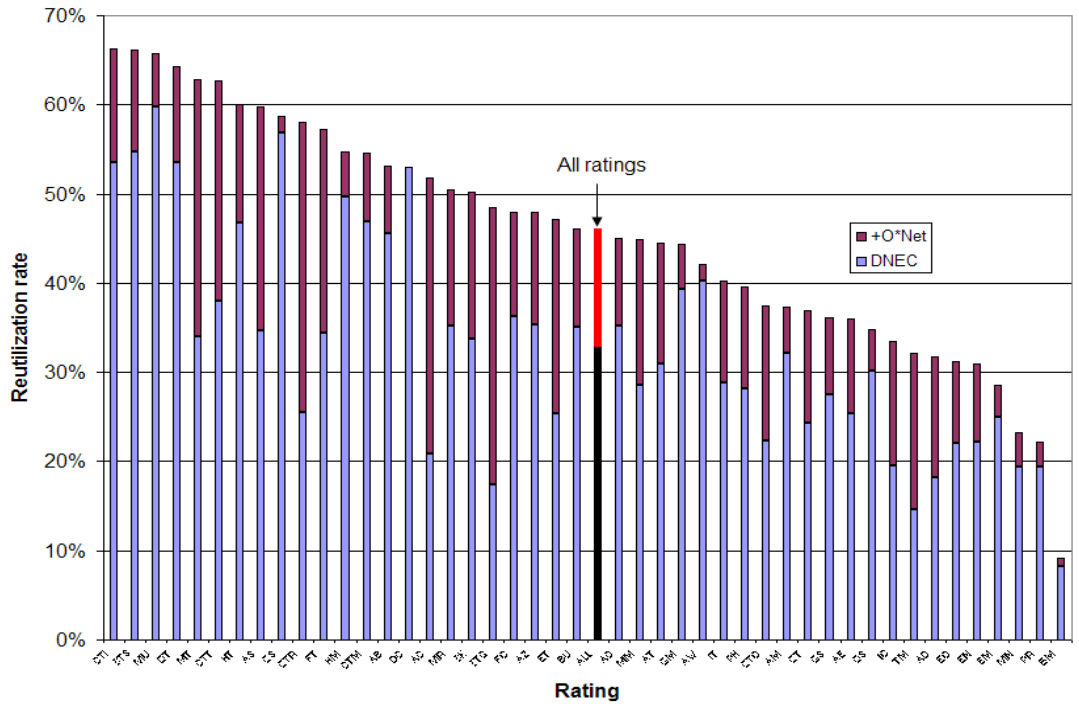
This slide shows NEC reuse rates for the ratings studied. Here we are measuring the likelihood of an NEC being reused at least once over an approximate 10-year period (life of the cohort). As in the previous slide, the top part of each bar shows the increase in reuse due to NEC substitution by O*Net detailing. The increase in reutilization due to the O*Net method varies from rating to rating. There are also large differences in reutilization rates in general from rating to rating.

The improvement in reutilization due to O*Net detailing is related to the greater choice the Detailer may have in job assignment for Sailors whose NEC is part of a large Job Family having several NECs. Differences in reuse rates between Ratings is more difficult to explain. They are likely related to such factors as:

- Availability of sea/shore billets upon rotation.[1]
- Detailer efficiency.
- Sailors' inability to recertify their NECs due to lack of training funds whose availability may differ across rating communities.

[1] We found no correlation between the number of authorized sea billets and shore billets for a current snapshot of the Navy force structure and reuse rates. However, NEC requirements associated with billets, and the number of billets do vary over the life of the cohort.

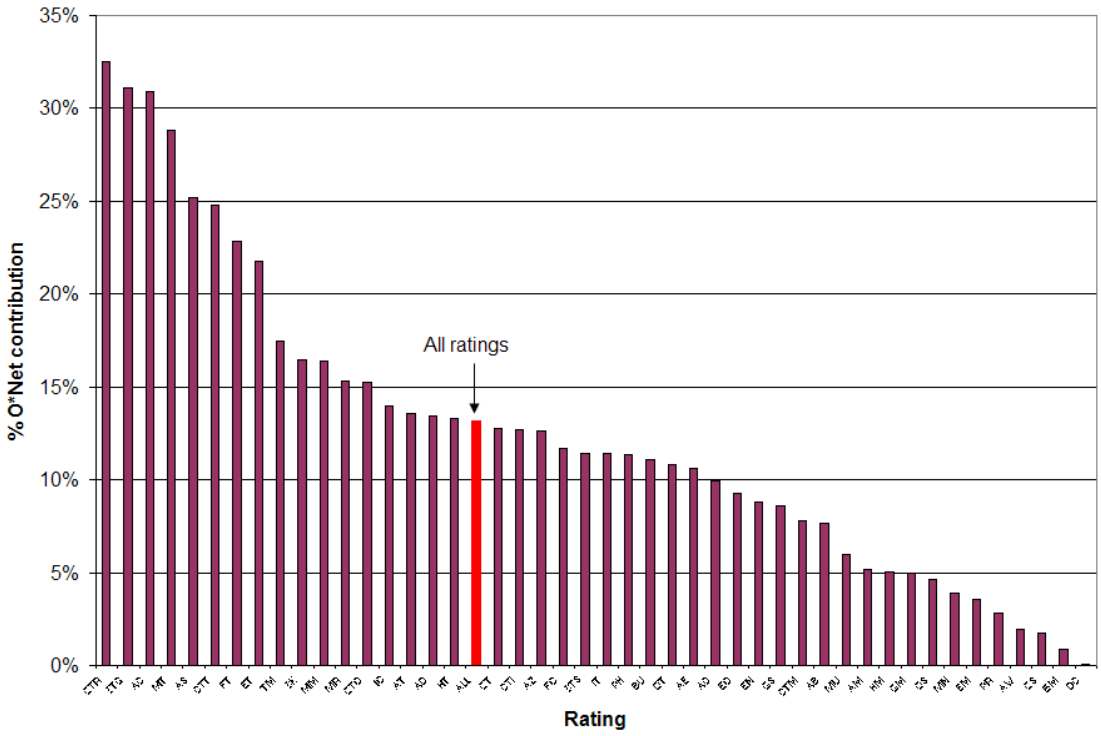
Alternate Reutilization Rates



Note: Rate based on multiple re-use across tours.

On this slide, we show an alternate metric to represent NEC reuse. The measure is based on multiple reuses of an NEC. When multiple use is considered, reuse rates for the DNEC method increase from 27 to 33 percent, and from 37 to 46 percent for the O*Net method.

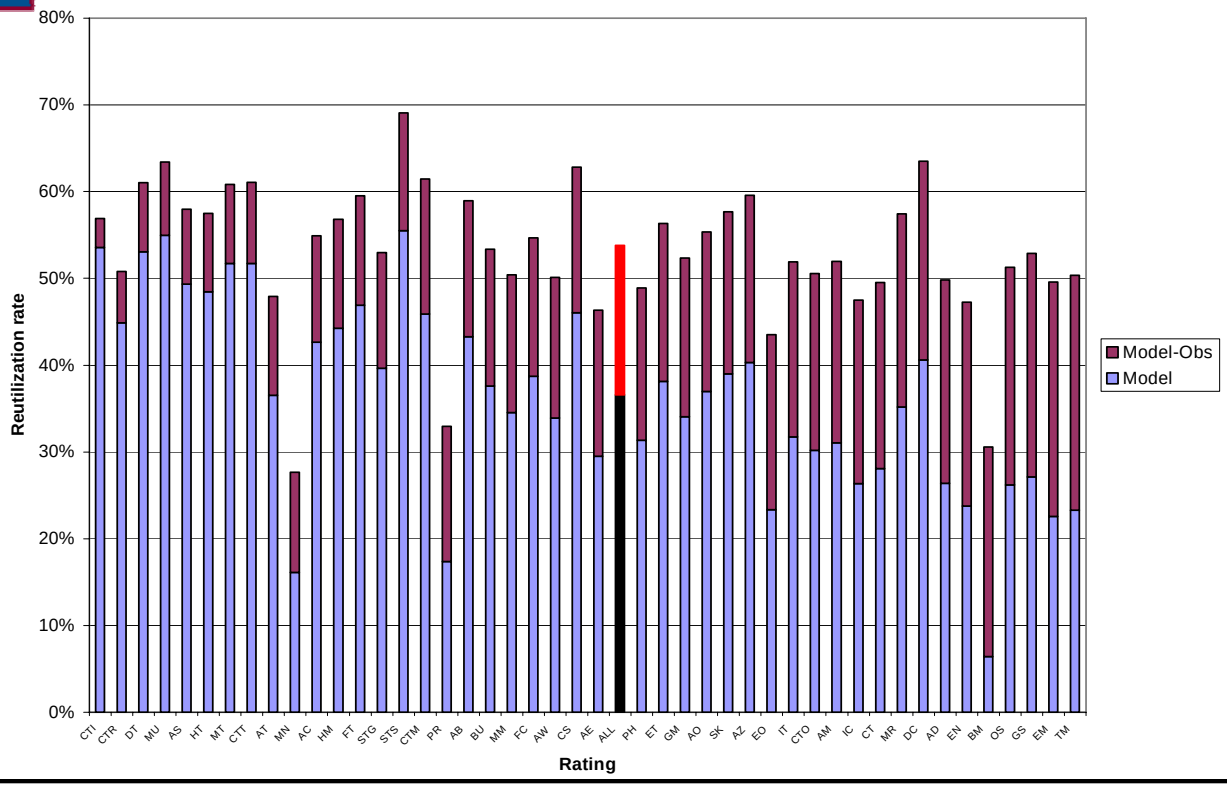
Contribution of O*Net Detailing to Reutilization



Note: Contribution to rate based on multiple reuse across tours.

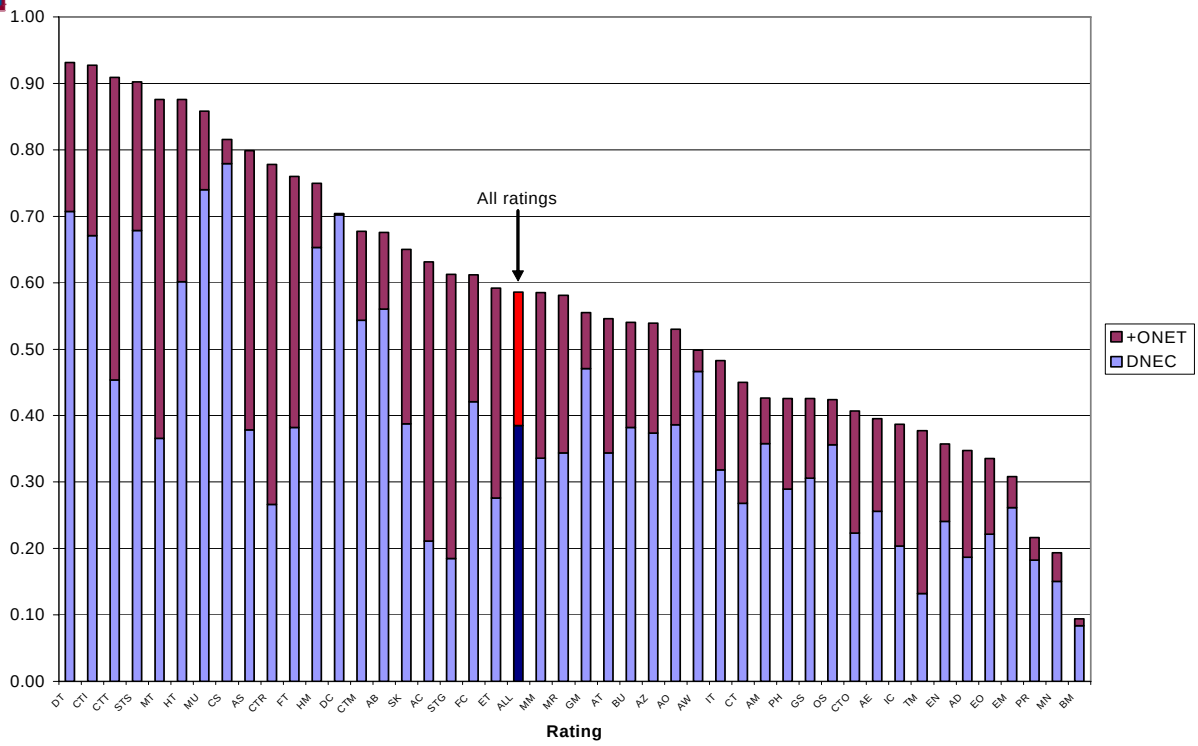
This slide is an alternate representation of the data shown on the previous slide. It illustrates the contribution of O*Net substitution to reutilization rates. On average, the contribution is about 13 percent.

Predicted Maximum Reuse vs. Observed



This slide compares the observed NEC reuse (at least one reuse by the O*Net method) rates with the maximum expected from the model presented earlier. In all cases, the observed reuse rate falls below the one predicted by the model. This suggests that the factors we did not account for in the model do have a strong influence on NEC reuse and that the influence of these factors differs by rating.

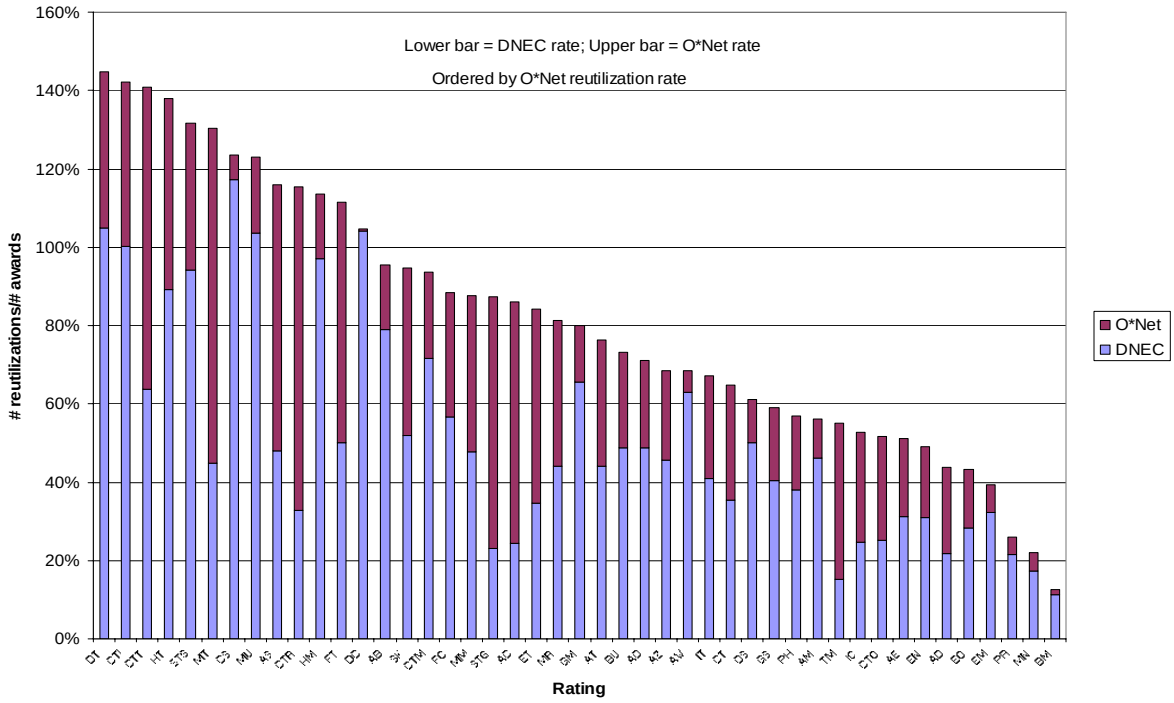
Average Number of NEC Reuses by Detailing Method



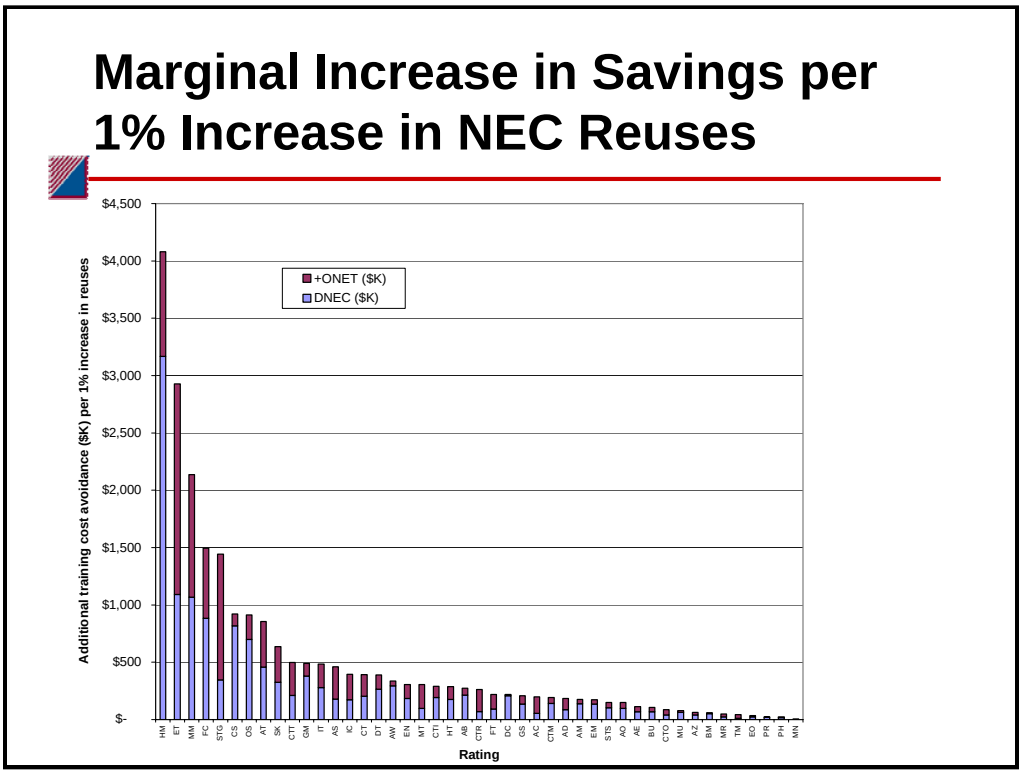
This slide focuses on NEC *reuse* by rating. The metric used to depict reuse is the average number of reuses. A value of 1.0 would indicate that NECs associated with the rating tend to be reused once, on average. No rating achieves this value.

Again we see considerable variation across ratings. High reuse for many of the ratings is due to assignments within the O*Net group, as indicated by the predominance of the red portion of the vertical bars (e.g., MT NECs).

Relative Efficiency of Detailing Method



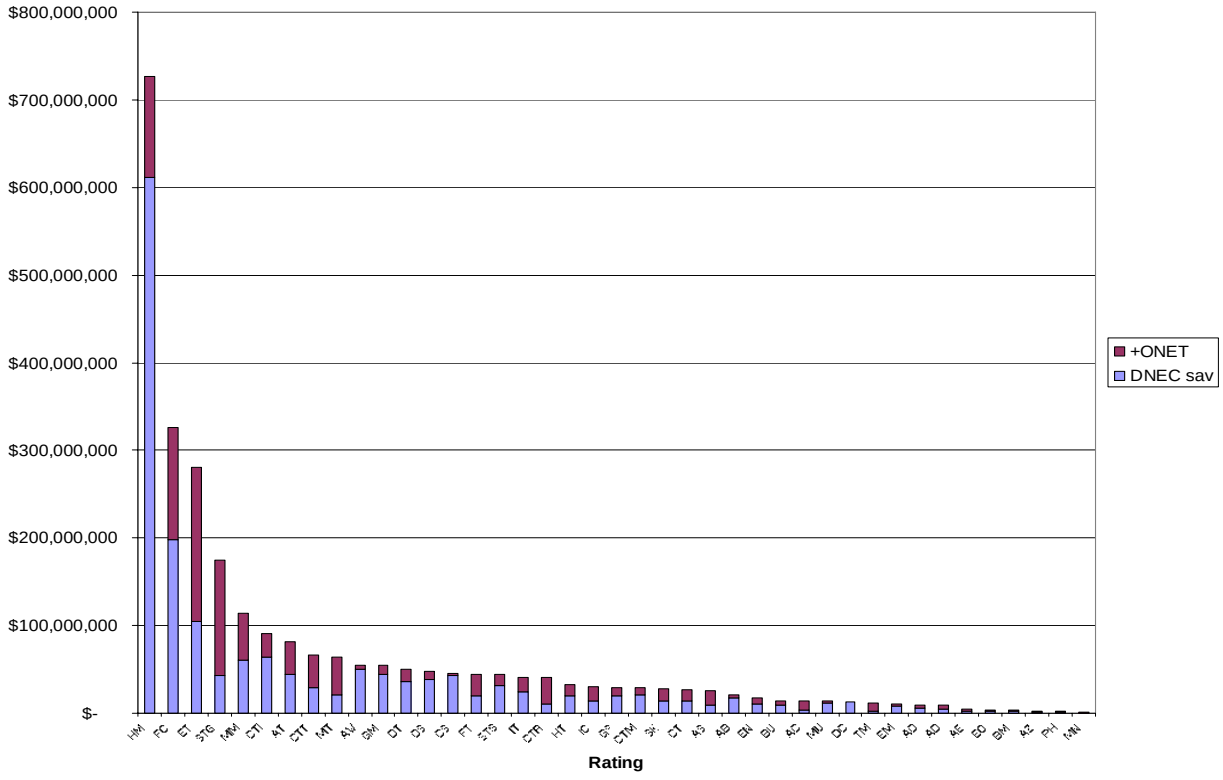
As discussed earlier, NECs can be reutilized numerous times, avoiding training for "new awards." A measure of the degree to which new training is avoided is the reutilizer rate. Values exceeding 100 percent indicate that, over time, the number of reutilizations exceeds the number of new awards. This metric could be considered a measure of detailer efficiency. This efficiency is mostly achieved by O*Net detailing. Thirteen of the ratings studied achieved reutilizer percentages above 100 percent.



Here we show the savings to the Navy due to training cost avoidance associated with NEC reuse for the ratings used in our study. Medical-related NECs are expensive to train. Because they have a high reuse rate, the greatest savings are associated with this group.

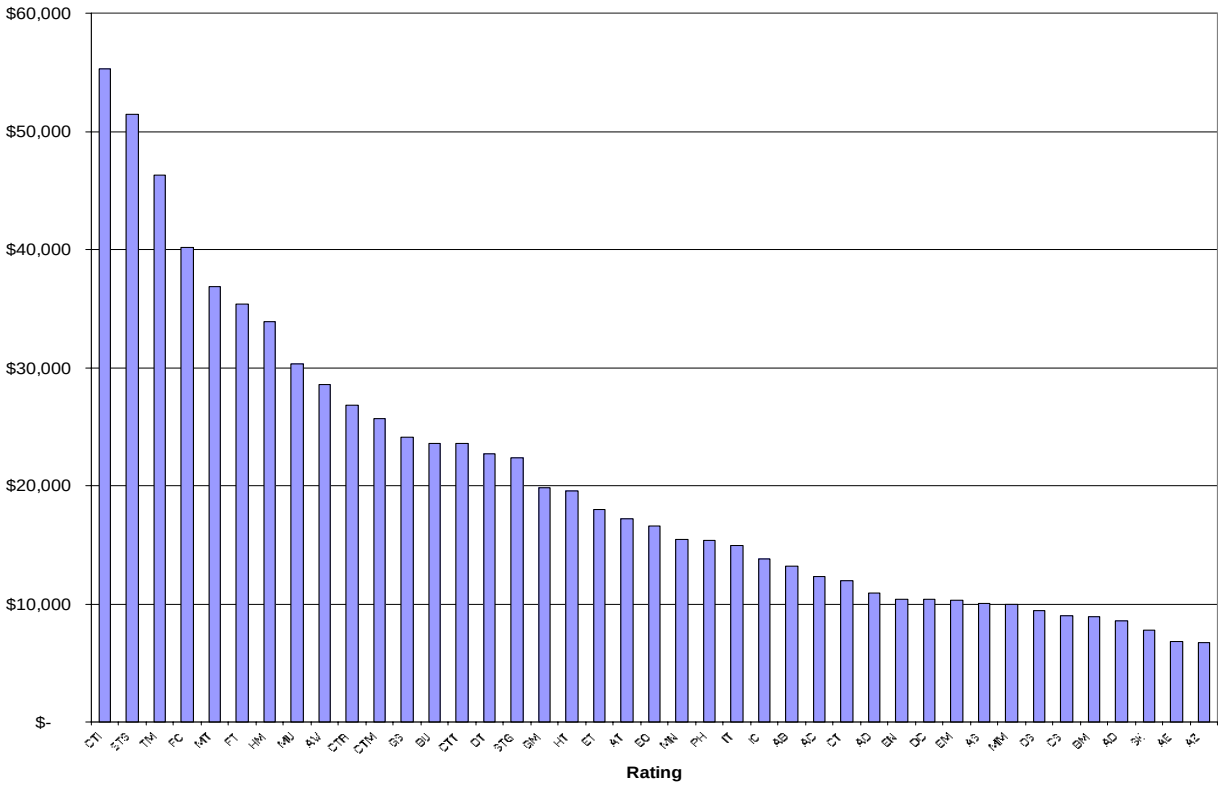
The slide also illustrates that some ratings have higher rates of NEC substitution, and their reuse results in greater cost savings per reuse (e.g., ETs).

Savings Due to NEC Reutilization (by Detailing Method)



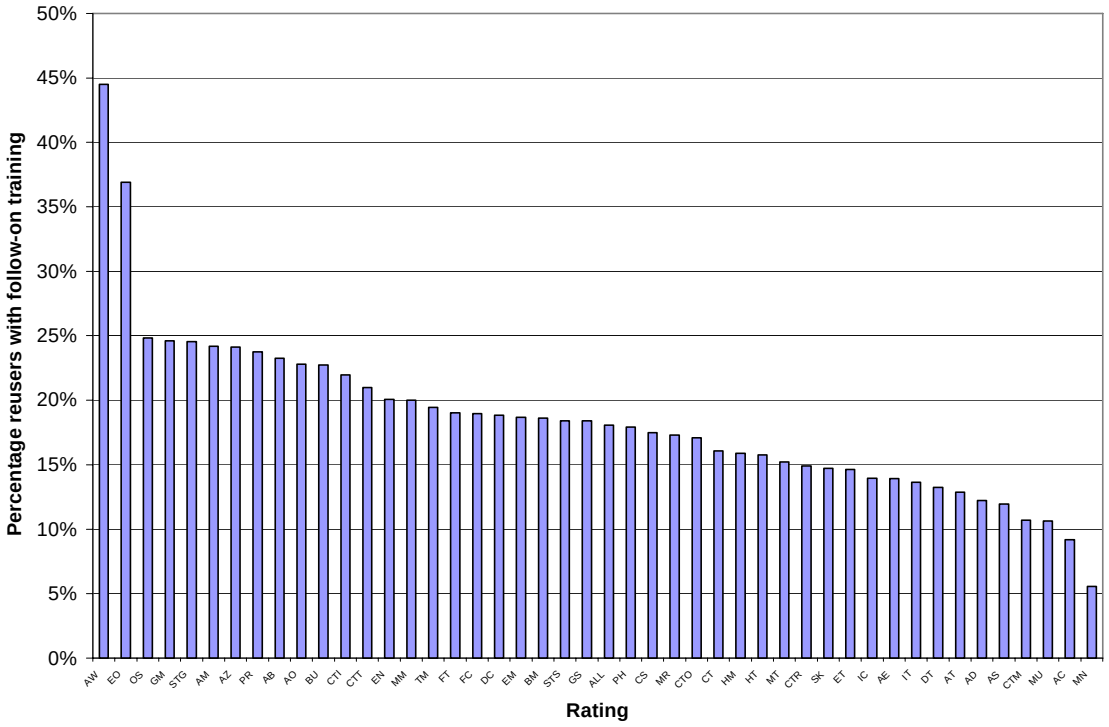
Savings due to training avoided were also seen to vary widely among ratings. NECs in the HM ratings produce the greatest savings due to the very long training pipelines, high reutilization rates, and the large number of Sailors with the NECs. This example of "closed-loop" detailing avoids large training costs.

Training Costs Avoided per Reuse (O*Net Detailing)



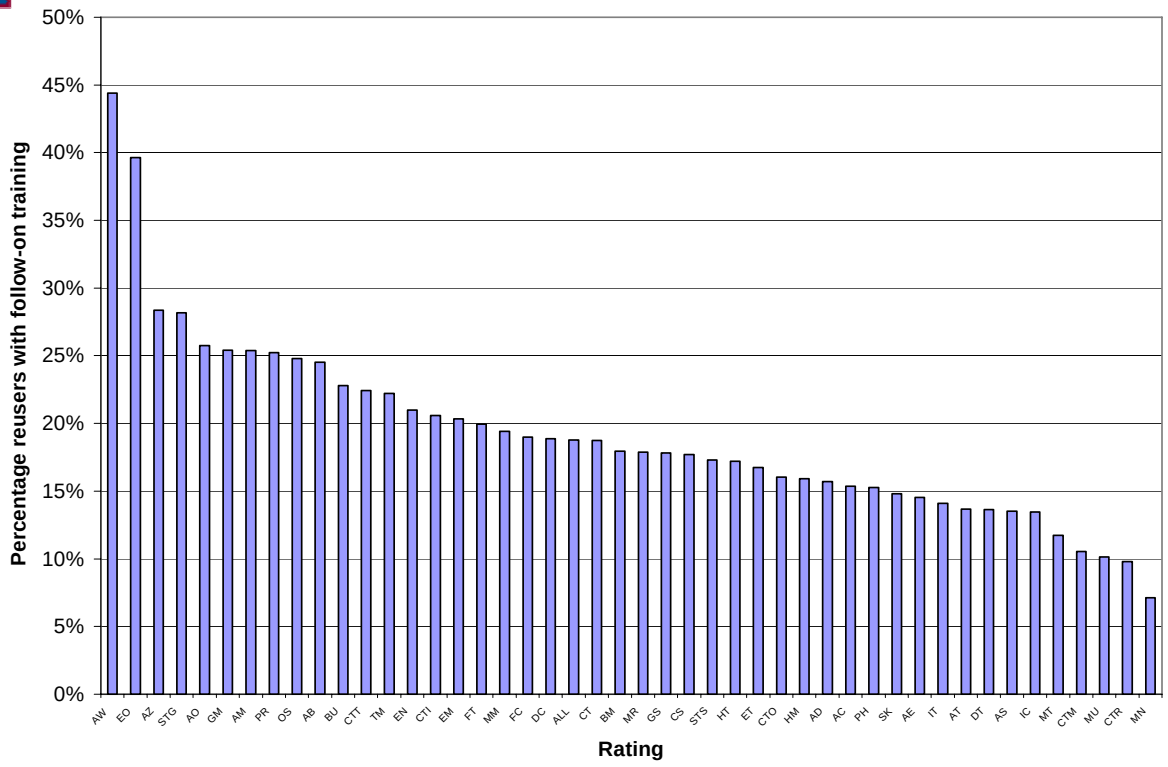
Another view of cost savings is shown here. The cost savings per NEC reuse was similar for the DNEC and O*Net Job Families, so only the latter is shown here. Savings are greatest for NECs with longer training pipelines, such as those in the CTI and FC ratings.

Follow-on Training Preceding NEC Reuse (O*Net Detailing)



NEC reusers don't always receive formal follow-on training before assignment to jobs where the NECs are presumably used. About 19 percent of reusers went to C-school for follow-on or refresher training. We observed a similar pattern for those detailed under DNEC and O*Net Job Family rules (next slide). Two ratings stand out as having higher than average levels of follow-on training: AWs and EOs. There does not seem to be a correlation between the proportion of reusers having had follow-on training and the reutilization rates.

Follow-on Training Preceding NEC Reuse (DNEC Detailing)



Here we see a similar pattern of the percentage of reusers, as defined by the DNEC method, who had formal follow-on training.

Time Spent Reusing NECs

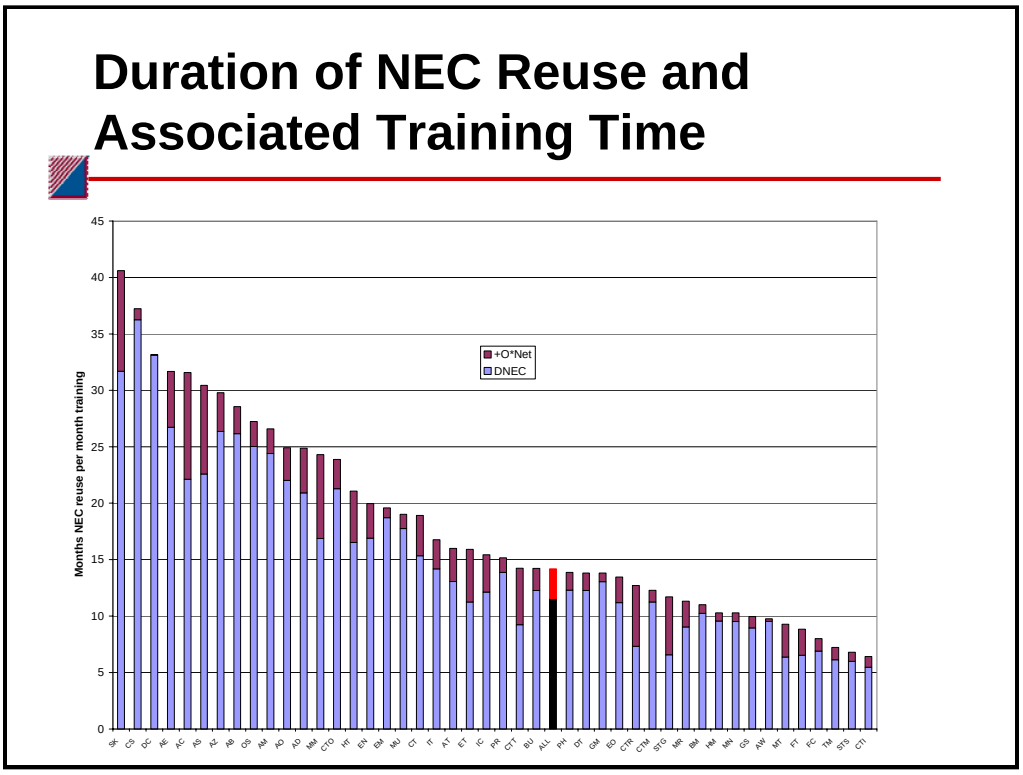
Method	Use #1	Use # 2	Use # 3	Use # 4	Average # months	Months per reutilizer
DNEC	29.3	25.9	23.0	19.7	24.8	28.0
O*Net	29.3	26.5	22.9	19.1	24.9	35.1

- Time using NEC on the job similar for DNEC and O*Net
- Cumulative time greater for O*Net assignments because Sailors more likely to reuse several times

The time a Sailor spends reusing an NEC is an indicator of the Navy's return on investment (ROI) in training the Sailor. This slide shows how much time Sailors spend on the job presumably using their NECs.

Sailors who reuse their NECs tend to spend about the same time using them on the job whether the assignment was based on a DNEC or O*Net substitution. However, we observed a greater amount of cumulative use for O*Net-based assignments because of the greater number of NEC reuses observed over the 10-year period of observation for those Sailors than for Sailors directly DNEC'd to the job who have fewer reuses.

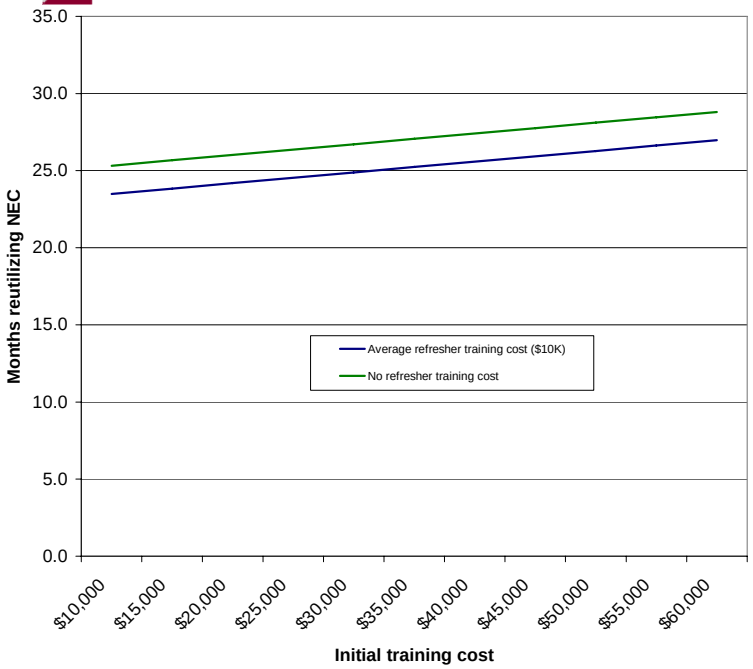
On the next slide, we show the relationship of the cost of training and months of NEC reuse.



This slide illustrates the benefit (total months of reuse) to cost (training) ratio by rating. While we see some differences between ratings, there was no significant statistical relationship[1] between payback (as defined here) and training costs. (Expensive and "inexpensive" NECs have similar payback).

[1]Regression of months initial training on months of total reuse had an R-squared of .02.

Return on Training Cost



- Those with longer initial training spend slightly more time using their NECs
- Those with refresher training spend less time using their NECs
  - Difference corresponds to time in refresher training
- More significant benefit of NEC reuse is cost avoidance of initial NEC training

We examined the relationship between training costs and the amount of time Sailors reuse their NECs. On average NEC reuse was about 25 months per reuse. The data depicted here combine job assignments based on both DNEC and O*Net Job family. We used linear regression analysis[1] to estimate the relationship between training costs and NEC use.

Those with longer (more expensive) training tended to use their NECs slightly more (about 1 month per $14,000 of initial training cost) per reuse. These results could be an artifact of the nature of tour lengths for technical jobs associated with "expensive" NECs. About 40 percent of reusers returned to C-school for refresher training. These Sailors tended to spend less time using their NECs. The amount of time corresponds to the amount of time in refresher training. This suggest that refresher training was done as "TAD" from the job (vs. en route to the job).

The more significant benefit of NEC reuse is the cost avoidance associated with having to train new Sailors, and the accumulation of human capital associated with keeping experienced Sailors on the job.

[1] Similar results were obtained when DNEC and O*Net assignments were considered separately. The coefficients for initial and refresher training costs were both statistically significant ($p < .05$). While we also used a natural log specification for the model, a better fit was obtained for the linear model depicted here.

NEC Reutilization: Awards In vs. Out of Rate

- NECs associated with particular ratings can be earned by those in other ratings
  - About 10% awarded out of rating
- Reutilization higher for those in rate

		Method	
Utilization	NEC match Rating	DNEC	ONET2
Any use	No	54%	60%
	Yes	77%	85%
Reuses			
1	No	17%	22%
	Yes	28%	39%
2	No	5%	8%
	Yes	10%	17%
3	No	1%	2%
	Yes	3%	6%

NECs are linked to particular ratings. As mentioned earlier, NECs are considered to be subspecialties of the rating. However, about 10 percent of NEC awards are to those who have other ratings. For example, Fire Controllers (FCs) earn Ocean Systems (OS) NECs. The results show that NECs are more likely to be used and reused by those in the ratings linked to the NEC.

NEC Use During Naval Career (All NECs)

- NECs are awarded to those in all paygrades

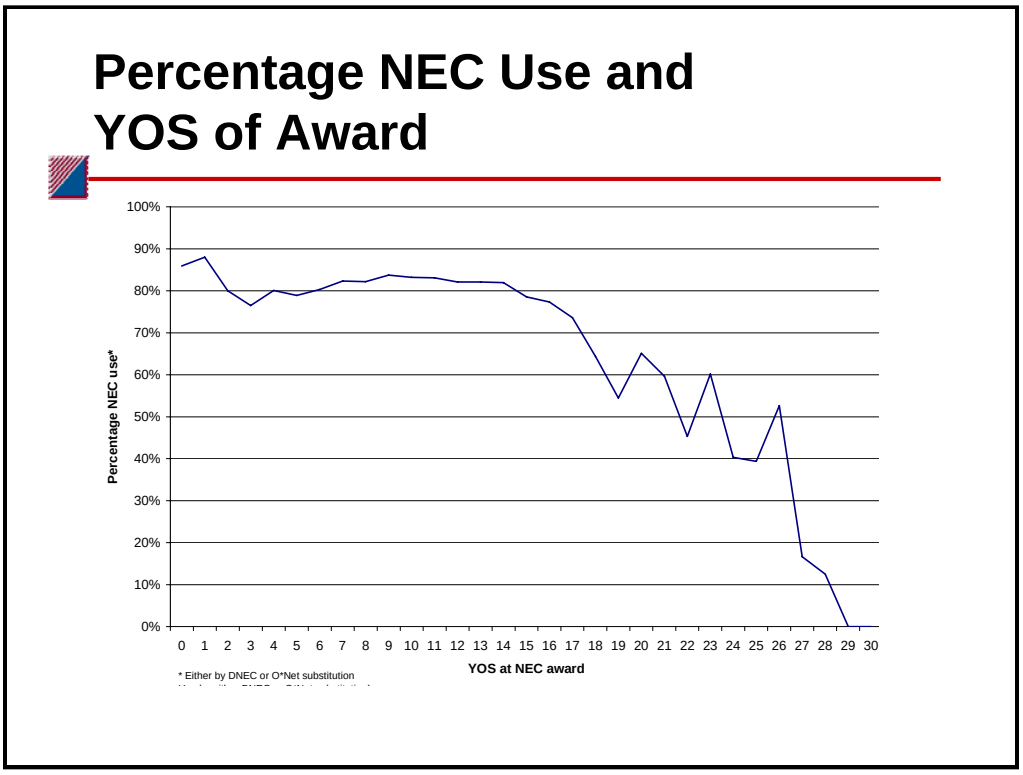
LOS	Average PG	E1-E3	E4	E5	E6	E7-E9
76	4.3	28%	26%	24%	17%	6%

- Paygrade and LOS similar for those DNEC'd and those detailed by O*Net
- Most reuse occurs during sequential tours

	Average PG at reuse #			Average LOS at reuse #		
Method	1	2	3	1	2	3
DNEC	5.3	5.7	6.0	119	148	168
O*NET	5.3	5.8	6.1	120	148	167

This slide illustrates use patterns of NECs during a naval career. NECs are awarded to Sailors in most paygrades. The pattern of the average LOS by use number shows LOS increasing by about 2 years between uses. This suggests that reuse tends to occur on sequential tours.

Paygrades are similar for those detailed on the basis of DNEC and O*Net Job Family matches.



This slide shows the likelihood of ever using an NEC and when (YOS) the award was made. Note the precipitous drop in the use rate for awards made after the 15th YOS. Also note the drop in the reuse rate after YOS 4. These are likely Sailors earning their NECs at the end of their first enlistment term and subsequently leaving the Navy.

Section Summary

- Built database capable of addressing utilization for all NECs for all ratings
- Measured NEC reuse for representative sample of NECs
  - Reuse rates[1]
    - 27% by DNEC method
    - 37% by O*Net Families method
  - O*Net Families provide higher estimated savings to the Navy over 10 years
    - DNEC about $1.5B
    - O*Net Families about $2.5B
- Developed tools to determine commonality of tasks across NECs

[1] At lease one reuse

This slide summarizes our findings.

Our empirical results have shown that NECs are being reutilized, and this has resulted in savings to the Navy by avoiding training “new” NECs.

We believe that we have confirmed the use of NEC substitution, being used by Detailers, in assigning NEC holders to Navy jobs. Our results suggests that much of the substitution is based on commonality of tasks associated with performing the jobs. The NEC taxonomy we developed can be used to identify the commonality of job-related tasks. It should be a useful tool for Detailers who wish to assign those with NECs that do not exactly match the requirements of the job but are similar enough to warrant substitution.

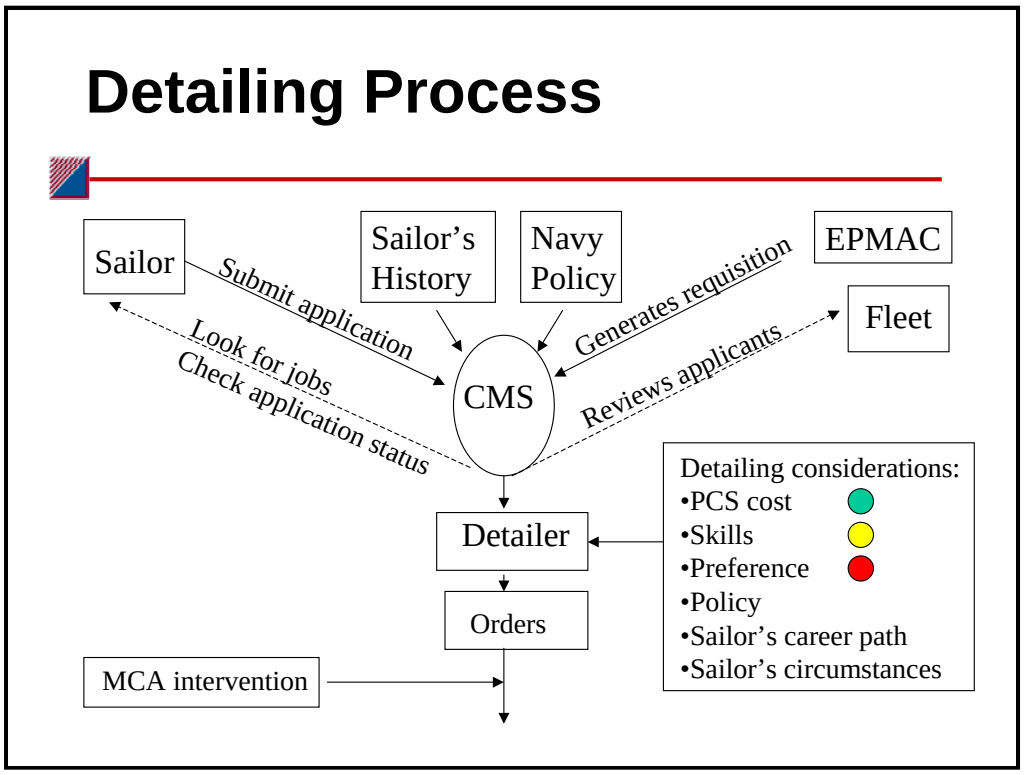
We examined information technology systems used by Detailers to see if they support NEC utilization. We propose a means of near-real-time monitoring of NEC utilization and estimate NEC use and reuse within each Navy rating. We briefly summarize the findings of our look at cross-sectional measures of NEC use, available from these systems. A more detailed report of our findings will be available as *The Detailing Process, Information Technology, and NEC Utilization* (CNA Annotated Briefing D00xxxxx, Sep 2006, by Bill Sims).

The Detailing Process, Information Technology, and NEC Utilization

- Detailing process
  - Extensive interviews with Detailers and supervisors
- Support of NEC reuse by IT systems
  - Interviews with Detailers and EPMAC personnel
- Near-real-time monitoring of NEC reuse
  - Analysis of cross-sectional data on details for FY 2005

We examined the Navy detailing process with an emphasis on whether the process encourages NEC utilization. We also examined information technology systems used by Detailers to see if they support NEC utilization. Finally, we proposed a means of near-real-time monitoring of NEC utilization and estimated NEC use and reuse within each Navy rating.

The analysis of the detailing process involved extensive interviews with Detailers and their supervisors. We formed our judgments of the IT systems based on interviews with detailers and with EPMAC. Then we conducted an extensive analysis of cross-sectional data for FY 2005 to develop and illustrate a methodology that should enable NPC to monitor NEC use and reuse in near real time.



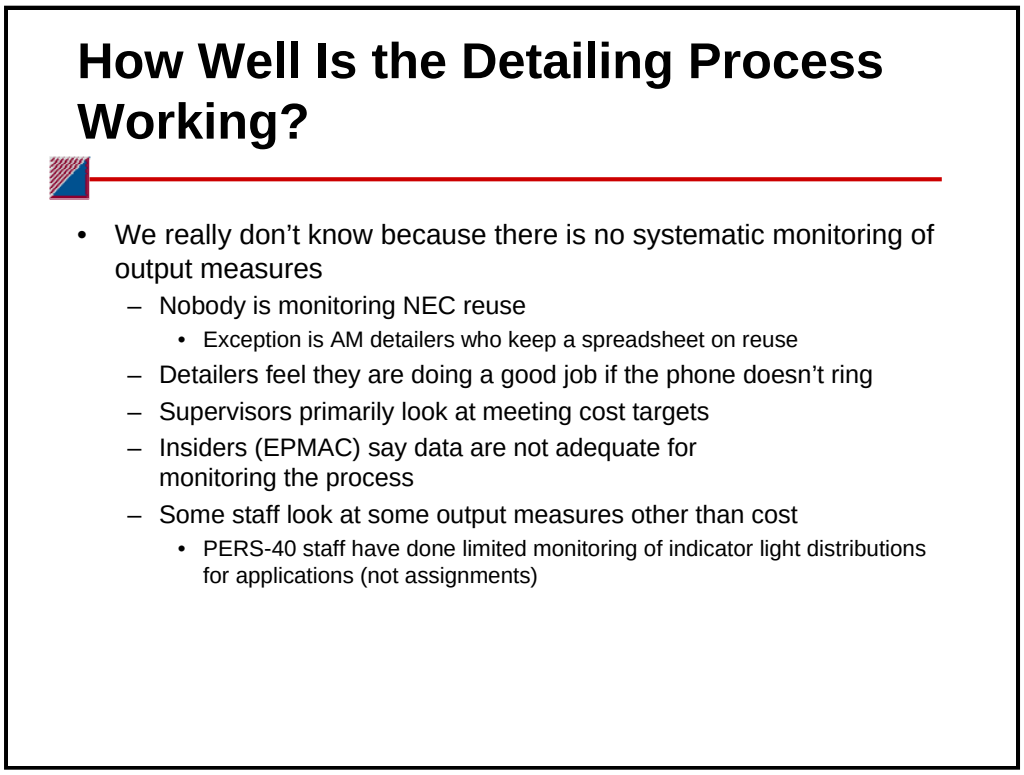
This schematic illustrates important aspects of the detailing process. The Career Management System (CMS)[1] is the hub of the detailing process. The process is started by the Enlisted Personnel Manpower Analysis Center (EPMAC), which generates a requisition to fill an expected billet vacancy. The Sailor submits an application listing his/her preferences among listed vacancies. This information, along with the Sailor's history and Navy policy guidance, is incorporated into CMS. The Sailor can also use CMS to look for new job openings and to check on the status of his/her application. The fleet can use CMS to review qualifications of applicants for a vacancy. The Major Command Authority (MCA) reviews orders and intervenes in about 1 percent of cases.

The Detailer acts as an honest broker who attempts to meld the needs of the Navy and the needs of the Sailor.

The Detailer considers PCS cost, Sailor's skills, Sailor's job preference, Navy policy, Sailor's career path, and any special circumstances, such as a family member needing special care or a spouse who also serves in the military.

The first three of the considerations are highlighted by "indicator lights" that indicate how closely the assignment meets the requirements of both the Sailor and the Navy.

[1] CMS was formerly known as JCMS.



How well does the detailing process work? The reality is that we don't really know since there is no systematic monitoring of output measures.

There is no systematic monitoring of NEC reuse. EPMAC is not. Detailers generally don't. One exception that we found was the Detailers for the AM rating, who do keep a spreadsheet on each detailing that shows cost and whether they reused an NEC. The spreadsheet is kept up manually and all detailings may not actually be recorded.

Detailers report feeling that they are doing a good job if the phone doesn't ring.

Supervisors primarily look at meeting cost targets.

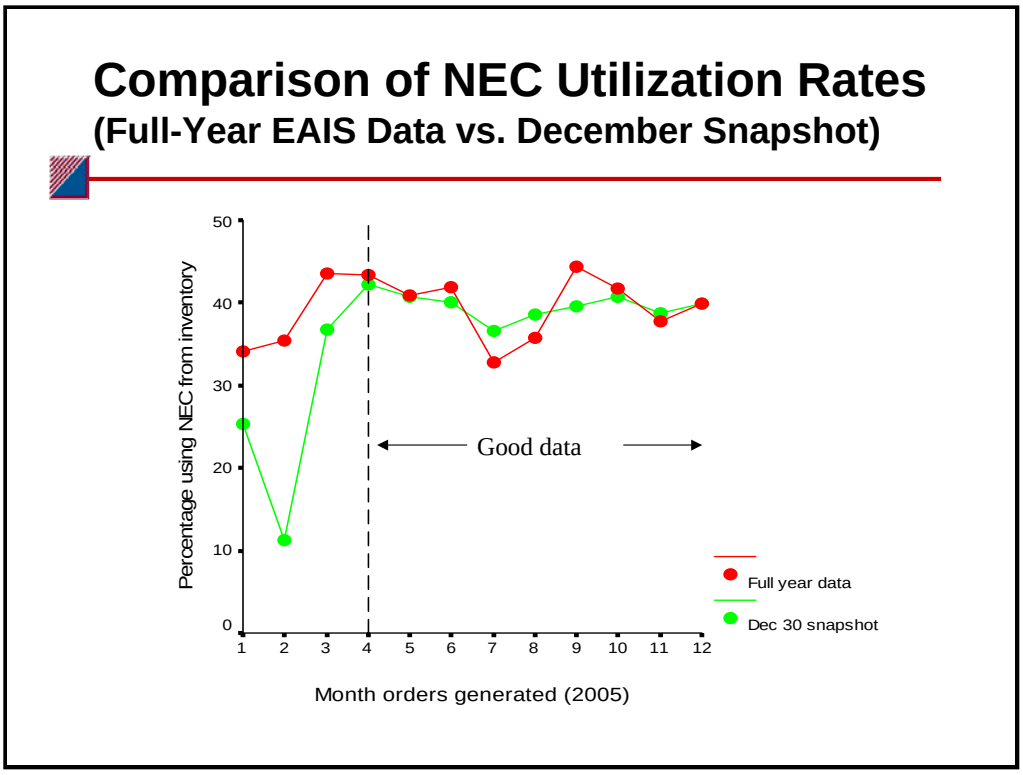
EPMAC personnel claim that current data are not adequate for monitoring the process.

There is no systematic monitoring of Sailor satisfaction with the process. An exception would be PERS-40's limited monitoring of indicator light distributions for job applications (not for job assignments).

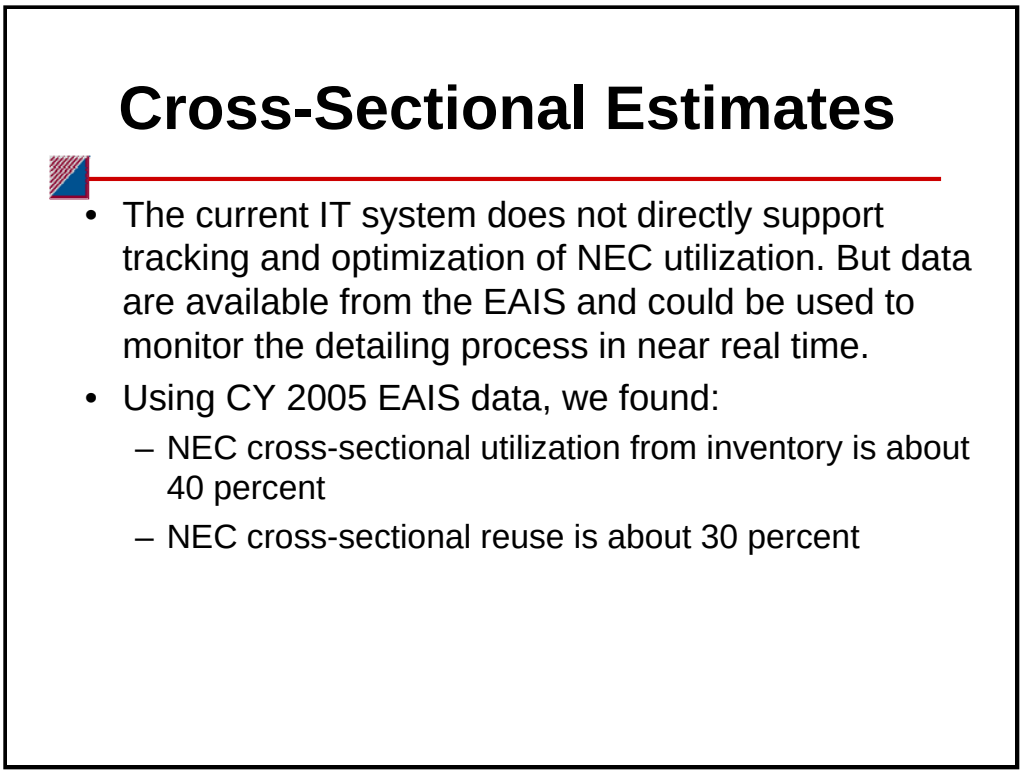
Available Data

- Detailers now use the EAIS to track order-writing process
- EAIS has Sailors' NEC inventory and job requirements
  - Basic elements for measuring NEC use/reuse

Detailers currently use the Enlisted Assignment Information System (EAIS) to monitor the order-writing process. The system captures data about Sailors' training (NEC inventory) and requirements of the jobs to which the Sailors were assigned. These are the basic elements for measuring NEC utilization.



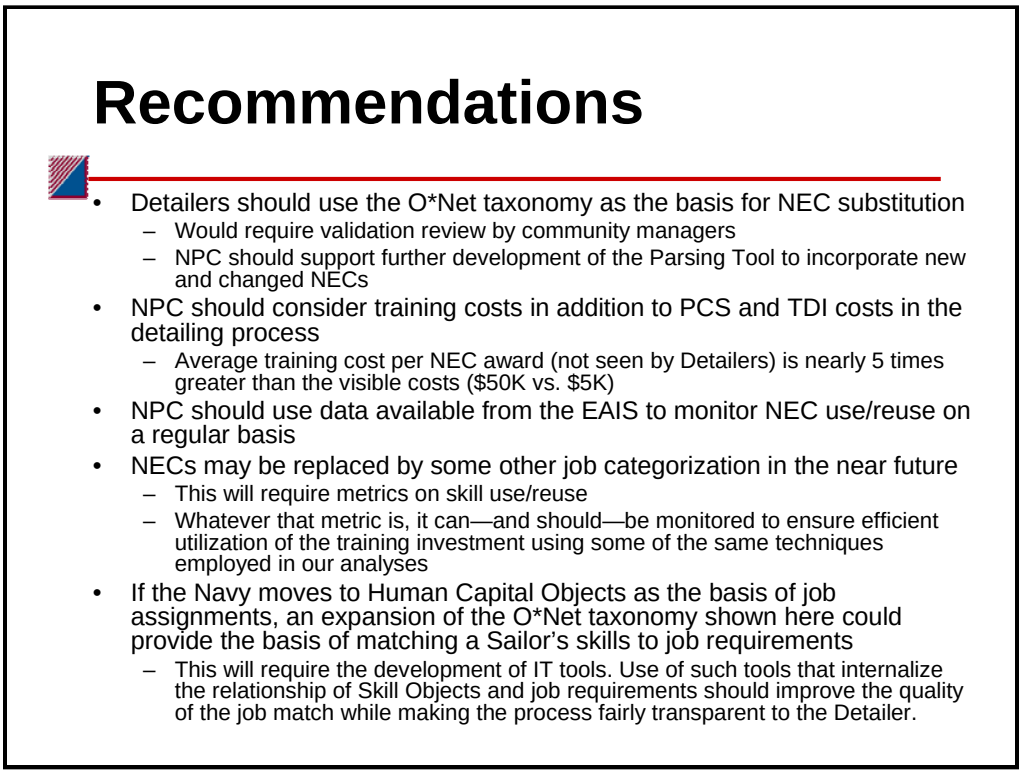
This slide compares the NEC utilization rates from a full year (2005) of EAIS data and from the December 30 snapshot. They agree very well 9 months into the past. That should be fine for monitoring NEC utilization.



The current IT system does not directly support tracking and optimization of NEC utilization. However, data are available from the EAIS that could be used to monitor the detailing process in near real time.

Examples are shown of how this could be done. We found the following:

- CY 2005 NEC utilization from inventory was about 40 percent.
- CY 2005 NEC reuse is about 30 percent.
- NEC utilization varies greatly by paygrade and rating.
- NEC reuse saves an estimated $918 per set of orders.
- About 3 percent of orders need, but do not get, NEC training; rates are much higher for some ratings.



We make several recommendations on how the Navy might better manage NEC utilization. These concern the use of the NEC taxonomy we developed for this study, the need to consider C-school training costs (in addition to PCS costs) during the detailing process, and data that Detailers might use to track NEC utilization. We also suggest that some of the techniques we used in this study be applied to manage the understanding and cataloging of Navy Enlisted personnel skill sets as the Navy moves to Human Capital Objects.

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