The Third Annual Navy Workforce Research and Analysis Conference: Supporting Military Transformation
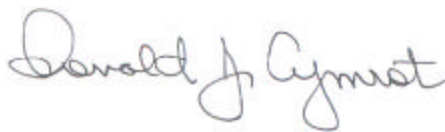
Anita U. Hattiangadi

CNA

4825 Mark Center Drive • Alexandria, Virginia 22311-1850

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Donald J. Cymrot, Director
Workforce, Education and Training Team
Resource Analysis Division

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Introduction

> Transformation is change. It's change in the way we fight, in
> the way we train, in the way we exercise, but especially it's a
> change in the way we think and how we approach our jobs.
>
> *—Defense Secretary Donald Rumsfeld [1]*

True defense transformation requires change. Assistant Secretary of
the Navy (Manpower and Reserve Affairs) William A. Navas, Jr.,
describes today's Navy as being perched atop a "burning platform"—
where inaction or maintenance of the status quo means certain
death, and change offers the only viable option. Given this construct,
the naval research community must work more closely than ever with
leadership so that it can inform, shape, and support this systemic
change.

To this end, the Center for Naval Analyses (CNA) hosted the *Third
Annual Navy Workforce Research and Analysis Conference* on March 31
and April 1, 2003. The conference was sponsored by VADM Gerald L.
Hoewing (N1/CNP), with participation from the Office of Naval
Research (ONR), the Navy Personnel Research, Studies, and Tech-
nology (NPRST) department, the Naval Postgraduate School (NPS),
and CNA. It brought together Navy's leadership and the research
community to discuss how to better integrate today's research and
development (R&D) efforts with leadership's evolving manpower,
personnel, and training vision.[1]

Key to the Navy's workforce vision is *Sea Power 21*—the Navy's opera-
tional construct for the 21st century. The CNP has issued guidance
for FY03, titled *Supporting Sea Power 21*, which provides a framework
for today's manpower, personnel, and training research efforts.

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1. The author gratefully acknowledges the assistance of the conference
   presenters in the preparation of this report.

In this document, we will relate the manpower, personnel, and training research presented by members of the research community at this year's conference to the framework presented in the CNP's FY03 guidance. Major headings and the direct quotes that follow them are elements taken directly from the CNP's FY03 guidance, and identify the Navy priority that is the focus of the research subsequently summarized.

Elements of the CNP's framework and the Navy's R&D priorities

Shaping the force

> In FY03, we have a unique opportunity to shape the force and enhance the skill mix. The result will be increased mission readiness and better advancement opportunity across all ratings. We've got the numbers right; *this year our focus is improving the skill mix, quality, and diversity*. We must do so while remaining within established fiscal constraints.
>
> —*VADM Gerald L. Hoewing (N1/CNP) [2]*

Shaping the force, which is the first element of the CNP's framework, includes properly setting accession, retention, and attrition goals, reducing gaps at sea, and developing a more diverse force. Research that develops real-time metrics and determines the effectiveness of such programs as Assignment Incentive Pay (AIP) supports force-shaping efforts.

Accessions

An important part of shaping the force is determining what accession level supports the desired force structure. Because of higher than anticipated retention, the Navy exceeded planned strength in FY02, and early indications suggest that it may do so again in FY03. Although staying above planned strength results in high personnel costs, some fear that cutting accessions too far below steady-state levels may create long-term manning problems for the Navy.

Dr. Michael Hansen (CNA) modeled determinants of continuation behavior and used data on probable changes in advancement, attrition, pay, and the economy to estimate a range of steady-state accession requirements [3]. Using this methodology, he estimated a range

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of steady-state non-prior-service accession requirements between 42,300 and 46,000. He warned, however, that while the Navy can temporarily lower accessions, it must commit to aggressively protecting the reenlistment of smaller accession cohorts.

Mr. Rick Loffredo (Computer Sciences Corporation, formerly DynCorp) noted that, in addition to accurately determining the right number of Navy personnel, it is important to establish the appropriate experience mix for the enlisted force [4]. As such, he is developing a Force Planning and Policy Development Tool Kit that (1) determines a feasible, sustainable paygrade by length of service (LOS)/experience mix that meets skill-level manpower requirement goals, (2) defines more precise LOS goals for retention goaling, (3) provides a standard methodology framework, and (4) supports what-if drills related to the transition of the current force to the desired goal. When fully developed and populated with data, the tool will support users' exploration of different force-shaping scenarios and their related recruiting and retention tradeoffs, projected manning levels and estimated costs, force profiles, advancement opportunities, training plans, and return-on-investment (ROI) decisions.

Getting the right number and type of accessions is, in part, a function of the enlistment incentives offered to new recruits. Faced with increasing difficulty in meeting recruiting goals, the Navy increased its budget for bonuses, the largest category of incentives, more than 580 percent between FY97 and FY02. Dr. Peggy Golfin (CNA) recently analyzed the effectiveness of two incentive programs, the College Loan Repayment Program (LRP) and Enlistment Bonuses (EBs), in expanding the market and channeling recruits into needed ratings [5].

The LRP offers repayment of federal college loans to those enlisting for their first terms. Recruits who accept this incentive, however, become ineligible for Montgomery GI Bill (MGIB) benefits during their first enlistments. Dr. Golfin finds that the LRP is not the best incentive for the majority of recruits considering critical ratings or the MGIB, but can be good for those who (1) aren't interested in or qualified for critical ratings and the MGIB program, and (2) are carrying large debts. From the Navy's perspective, the LRP's benefits are

less clear because it can entail a large expenditure resulting in only one new recruit.

Dr. Golfin also tried to analyze the cross-rating effects of EBs but found that lack of information on the range of ratings and incentives offered to recruits, in addition to collinearity between the value of different incentives, reciprocal causation between incentives and goals, and other issues, make it impossible to provide unbiased estimates of incentives' effects on a recruit's ultimate choice of rating and ship date. As a result, Dr. Golfin noted that more formal experiments and conjoint analyses are necessary to determine the classifiers' process for offering incentives and the role of incentives in recruits' choices.

Ensuring that recruiters perform their jobs efficiently and effectively is essential to the Services' continued recruiting success. Mr. Paul Hogan (the Lewin Group) and Ms. Janet Held (NPRST) presented work testing the effects of varying recruiter tour lengths [6]. The length of a recruiting tour is important because there is a learning curve at the tour's beginning and declining productivity at the tour's end. Extending tours for all recruiters or extending the tours of above-average recruiters (at any given experience level) while reducing the tours of below-average recruiters could result in higher productivity at a lower cost.

The model, which is based on actual recruiter productivity data and observed variation in recruiter productivity at a given experience level, simulates productivity or output effects in terms of the number of A-cell recruits and the cost of policies (including recruiter pay, allowances, and PCS costs). Of the policies simulated, the most efficient appears to be one offering a voluntary extension of 12 months to recruiters who rank in the top 20 by productivity—which could reduce required recruiters by 5 percent and save $0.5 million per month in PCS and recruiter costs.

Although much of the research presented at the conference dealt with enlisted accessions, officer accessions—particularly in the relatively expensive medical and dental corps—are also of great interest. Dr. Eric Christensen and Ms. Shayne Brannman (CNA) computed the life-cycle cost (1) to attract health care professionals into the active component of the Armed Forces, (2) to train those commissioned to

be fully qualified duty specialists, and (3) to maintain fully qualified specialists in staff utilization tours [7]. These costs were used to compute the cost per year of practice (YOP) as a fully trained specialist by Service and accession source with particular emphasis on the cost per YOP at the completion of the initial active duty obligation and at the expected YOP. Accounting for training costs substantially increases costs above compensation costs—by 8 to 49 percent for physicians and 11 to 27 percent for dentists, depending on the specialty and accession source.

Using the life-cycle cost information, Dr. Christensen and Ms. Brannman developed a model to determine the optimal mix of accessions needed to fill future active duty billet requirements. Constraints, which included the required experience profile, in-house training requirements, and accession constraints, affected the optimum significantly. The required experience profile most affected the optimum for physicians, whereas in-house training requirements most affected the optimum for dentists. In exploring how the model responded to changes in bonuses and special pays, they found that (1) special pays are less effective if the predominant career path is "long," (2) special pays become more cost effective if a younger clinician force can be effectively used, and (3) targeted special pays are more cost-effective than across-the-board special pays.

Ensuring that new officers are sufficiently trained is also important in recruiting. Dr. Stephen Mehay (NPS) and Dr. William (Buzz) Bowman (USNA) examined the technical academic preparation of newly commissioned unrestricted line junior officers (JOs) to determine whether their technical skill base has been eroding over time, as some have feared [8]. They used two measures of technical background: one based on having a technical major (specific technical skills); the other based on a code signifying academic performance in undergraduate math and science core classes (general technical skills). The requirement for technically educated JOs was assessed in terms of the impact of technical background on career outcomes, including completion of nuclear power training; retention; promotion; fitness report scores; warfare qualification; completion of a technical graduate degree; and transfers into engineering duty and the civil engineering corps.

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They found that, in fact, the share of JOs with general technical skills rose slightly over the last 30 years, whereas the share with specific technical skills rose from 1978 to 1989, but fell slightly from 1989 to 2001. JOs with strong general technical skills were more likely to choose nuclear power and to earn a technical graduate degree, and had higher fitness report scores and promotion rates to O-4. JOs with specific technical skills were more likely to acquire a technical graduate degree, to laterally transfer to the (aviation) engineering duty officer community or the civil engineering corps, and to earn SWO qualification quickly. Surprisingly, JOs with general technical skills were slightly less likely to stay to year 10. To increase the number of JOs with technical skills, they recommended special recruiting efforts to attract individuals from more selective colleges, especially minorities and females. They also suggested providing bonuses to OCS graduates with technical skills, providing Grad-Ed briefings to all USNA seniors and NROTC graduates, and offering technical remediation courses.

Retention and attrition

In an effort to improve the way the Navy shapes and plans its officer force, Mr. Rodney Myers (NPRST) has developed a model that blends near-term data with historical loss rate projections to forecast officer losses for a 12-month period [9]. The model provides candidate loss plans for each community, which the Navy officer strength planner and community managers can use to baseline expected losses.

Properly forecasting future behavior is also important in determining the cost of retention programs. The ROGER model predicts needed SRB levels by estimating the percentage of SRB-eligible Sailors who will reenlist, the number of SRB takers, the overall reenlistment rate, and SRB program costs. Forecast errors have increased over time, which means that reprogramming or temporary program suspensions must occur to ensure that the SRB budget is not overspent. Mr. Hogan discussed the errors' origins and how the model could be improved.

Mr. Hogan reported that the model's assumptions about SRB eligibility do not reflect recent Navy policy—resulting in an underestimate of both the eligible pool and total enlistment [10]. Second, the model

does not do as good a job of matching takers to eligibles in later reenlistment zones. Both of these problems can be remedied through improvements in the model. Finally, the model should be validated annually to determine how well it is working and whether improvements can be made for the next programming cycle.

Determining ways to reduce attrition and increase retention are integral to force-shaping strategies. Dr. Jacqueline Mottern (NPRST) described 1st Watch—an R&D project designed to help the Navy better understand the transformation of civilians into Sailors that occurs during the first enlistment term [11]. Through 1st Watch, the Navy will develop comprehensive questionnaires and will use a longitudinal design to monitor the entire first enlistment term for a complete one-year cohort of 50,000 recruits. Developed questionnaires will include some unique measures that will allow the Navy to link attrition to levels of person/organization fit, commitment, stress coping skills, perceived social support, expectations of the Navy, or training experiences and will help to identify those who might benefit from an early intervention. The hope is that using this type of detailed information to target interventions will reduce unwanted attrition, increase reenlistment, and reduce first-term costs.

The Naval Reserve Force collects information about personnel retention and attrition decisions through the Career Decision Survey (CDS)—a web-based survey of 235 branching questions administered at career decision points that examines why drilling reservists remain in or leave the Selected Reserve (SELRES). NCCM (SW/AW) David Flake (Naval Reserve Force) described CDS data on relevant factors, such as working conditions, assignments, military culture, mobilization, leadership, recognition, training, pay and benefits, advancement, promotion, education, and personal and family life [12].

CDS results for the December 2000-April 2002 period showed pay and benefits to be the most important influence for both stayers and leavers. Stayers additionally found job assignments, senior leadership, drill site location, and unit morale to be important reasons to stay, whereas leavers found outside demands on the job, work/family balance, opportunity to work in primary rate/designator, and quality of training at the drill site to be important factors influencing their

decisions to leave. The Naval Reserve Force used the CDS data as the basis for modifying relevant policies and procedures, including improving the timeliness of pay, developing an Enhanced Change of Rate program to encourage Sailors to fill undermanned ratings, and improving computer accessibility at training sites.

The March 2003 CDS found that among those not mobilized, advancement opportunities were the top reason to stay and to leave. Nonmobilized stayers additionally found pay and benefits, unit morale, senior leadership, and the opportunity to work in primary rating/designator to be important reasons to stay, whereas leavers found recognition, impact on civilian job, time away from home, and time to receive benefits (age 60) to be important factors influencing their decisions to leave. Mobilized stayers found pay, Basic Allowance for Housing, per diem, and medical care while mobilized to be important reasons to stay, whereas mobilized leavers found additional stress of mobilization on spouse, leaving family, effect on children, inability to move family, and time given to report as primary reasons to leave. The CDS includes a query system, and a reporting system is being developed.

Improving the selection and classification of new recruits is an important aspect of force shaping. Better selection and classification not only lowers attrition and promotes reenlistment, but also improves job satisfaction and performance and reduces disciplinary problems. Ms. Janet Held (NPRST) discussed the impact of selection criteria by describing the validation of aptitude standards for two ratings that perform intelligence activities: Intelligence Specialists (IS) and Cryptologic Technician Interpreters (CTI) [13]. The findings resulted in an increase of aptitude requirements for both ratings and the development of a new language predictor test. Additionally, her work finds that classification using more aptitude areas increased recruit qualification rates more than when only general ability (Armed Forces Qualifications Test) was used.

Two presenters, Dr. Stephen Watson (N13) and Dr. William Farmer (NPRST), described newly developed classification tools that can be used to better match recruits to ratings: the Ratings Identification Engine (RIDE) and the Jobs and Occupational Interests in the Navy

(JOIN) [14, 15]. Under the current system, the influence of short-term recruiting quotas may result in a match that does not suit the recruit's interests. RIDE produces a limited set of ratings for which a recruit qualifies and for which there is a Navy need. JOIN presents applicants with verbal and pictorial presentations of job activities and working environments and produces a preferential rank ordering of Navy jobs that is related to their responses. In practice, JOIN filters RIDE ratings to select those in which a person reports an interest. Recent data show that RIDE outperforms traditional classification methods, saving the Navy money and improving outcomes. It still remains to be seen whether these tools will result in lower attrition and higher retention once recruits reach the fleet.

The Perform to Serve (PTS) program is a force-shaping tool that can be used to retain high-quality enlisted Sailors in overmanned ratings by allowing them to convert to undermanned or adequately manned ratings. Dr. Stephen Watson (N13) described the new program, which allows the Navy to retain high-quality Sailors while meeting its personnel needs and giving Sailors better advancement and career opportunities [14]. During PTS selection, program candidates are compared to other Sailors in their rating and compete for monthly quotas determined by Enlisted Community Managers. Sailors either receive approval to reenlist in their current rating, are offered a conversion to an undermanned or adequately manned rating, or are not given a reenlistment option.

Converting to another rating may require Sailors to retake the Armed Services Vocational Aptitude Battery (ASVAB) test. Dr. Lisa Mills (N13) described the results of an empirical study of 106 Sailors to determine whether re-testing increased their ASVAB scores [16]. Contrary to standard theory anticipating score consistency, Sailors' ASVAB scores (on all subtests) did increase significantly with re-testing. Score increases for some Sailors were dramatic—perhaps because of the development of better language skills for those who initially had limited fluency. Data on whether basic verbal and math skill courses resulted in higher re-test scores were inconclusive. There was also a significant relationship between testing interval and score increase, suggesting that Sailors continue to develop relevant skills and knowledge over their careers. Simulating the effect of score

increases on rating conversion options, Dr. Mills found that the average Sailor qualified for 75 percent more jobs based on his/her new ASVAB score. This suggests that re-tests will become increasingly important as new Navy force-shaping and career management initiatives are implemented.

The retirement system plays an important role in the retention behavior of both officer and enlisted servicemembers. Dr. Stuart Rakoff (Consultant to ASN—Manpower & Reserve Affairs) described how the current military retirement system has evolved over time, and how it might need to change to meet the Services' future needs [17]. Current retirement rules encourage those with 9 or more years of service to stay and those with 20 years of service to leave—irrespective of the military's need. As technology has allowed the need for experience to outweigh the need for "youth and vigor" and the quality of the force has improved, Dr. Rakoff argued that the retirement system should change to allow for longer careers. Such a move would give the military more flexibility in force management and would free up resources.

Reducing sea/shore gaps

As women continue to enter nontraditional, more sea-intensive ratings, making sure that their numbers can be accommodated aboard ships is important to ensuring that sea billets are filled. Mr. Gary Grice (RCI) presented a model that estimates the number of female Sailors who will be on, or scheduled to rotate to, shipboard duty each year between FY03 and FY09 [18]. The model compares this estimate to the number of projected female bunks on all Navy ships at the end of each fiscal year, to determine if there will be enough (or too many) female bunks for women rotating to sea. The model accounts for different continuation rates, lengths of service, and sea/shore rotation patterns by using gender and Enlisted Management Codes. Changing the model's parameters allows the Navy to anticipate the effects of changes in bunk availability, female accessions, or type 3 billet availability.

Mr. Rodney Myers (NPRST) noted that assignment gaps (early or late) may result from detailers' strict adherence to projected rotation dates (PRDs) [19]. Under current practice, Sailors often are assigned to a

follow-on assignment early (creating a costly personnel overlap) or late (creating a gap that affects readiness). Mr. Myers and his team developed a computer model simulating Navy distribution policy that allowed them to determine how assignment gaps could be reduced if detailers were allowed to adjust Sailors' PRDs. Currently, detailers are authorized to adjust PRDs 3 months early or 4 months late, but this option is not used often. The model, a continuous time-based, closed-loop simulation, includes stochastic inputs for producing random behavior. The model shows that making use of the rotation window, rather than a hard PRD, will result in increased opportunity for on-time assignments—improving readiness and lowering the cost of redundant personnel.

Diversity

One important goal of force-shaping efforts is to achieve a high quality, diverse force. Fostering force diversity is a particular concern in the officer corps, which is less diverse than both the enlisted force and the total population. CAPT Syd Abernethy (Special Assistant to the Chief of Naval Personnel) described his team's development of a Strategic Diversity Plan and a business case and communications plan that supports its implementation [20]. When fully developed, this plan—which will leverage public- and private-sector best practices—will align the Navy's diversity efforts with the Navy's strategic direction, assess diversity trends, and suggest ways to increase minority applications to the *Seaman to Admiral* and officer programs.

Dr. Ann Parcell (CNA) described her work to identify factors observable at time of officer accession that can predict career success [21]. These factors can be used to set officer accession policies that achieve the Navy's personnel planning goals—including its diversity goals. For the aviation, surface warfare (SW), and submarine unrestricted line communities, the study estimated the following: (1) the effect of accession source on the probability of achieving various career milestones (promotion to O-3, O-4, and O-5, screening for command at sea, and promotion to O-6), holding constant other officer characteristics (e.g., undergraduate major and performance, school selectivity, race/ethnicity, and gender) and (2) the effect of other officer characteristics on the probability of achieving career milestones, holding

accession source constant. Dr. Parcell found that accession source is associated with early career success: OCS accessions had the lowest estimated probability of promotion to O-3, and USNA graduates had the highest. Her work also found that higher undergraduate grades positively affect the probability of achieving career milestones. Third, she found that attending a Historically Black College or University (HBCU) negatively affected the probability of promotion to O-4 in the SW community. Finally, Dr. Parcell found that certain factors (competitiveness of the undergraduate school attended, undergraduate major, and technical proficiency) did not consistently affect the probability of promotion. She recommended examining policies to make OCS recruits more successful, maintaining minimum grade standards, emphasizing undergraduate grades in accession decisions, and further examining the HBCU effect on probability of SW promotion to O-4.

Dr. Paul Rosenfeld (NPRST) and Dr. Jacqueline Mottern (NPRST) reported results from Navy surveys on gender and racial/ethnic diversity [22, 23]. The Navy Equal Opportunity/Sexual Harassment (NEOSH) Survey, administered biennially since 1989, measures Equal Opportunity (EO) and Sexual Harassment (SH) perceptions of Navy officers and enlisted personnel using a large, weighted sample. Argus is a web-based survey administered at transition points in a servicemember's career that monitors the reasons people leave or stay in the Navy, attitudes about Navy work, life, careers, and leadership, and intentions to leave or stay at the next decision point. Dr. Mottern presented Argus survey data from July 2001 to December 2002.

The NEOSH Survey finds that white male officers consistently have the most positive perceptions of the Navy EO climate, whereas black enlisted women have the least positive perceptions. Men are more positive about the EO climate than women, with the gap in perception being larger between male and female officers than between male and female enlisted. The survey finds that "negative comments" and "offensive jokes" are the most common forms of discrimination. Although rates of SH for enlisted women have dropped by 50 percent since 1991, gender discrimination is still commonly reported. Not

surprisingly, those who experience discrimination or harassment are less satisfied with the Navy and indicate increased intentions to leave.

To better support the Navy's diversity initiatives, the NEOSH Survey is being reengineered to shift its focus from EO to diversity. It will be combined into the 2003 Officer Career Progression Issues Survey—a comprehensive survey on diversity and career issues, including mentoring, retention, diversity, professional development, and career satisfaction. The new survey will establish baseline metrics through which the success of future diversity efforts can be measured and will allow for testing and reengineering of survey items.

Dr. Mottern described Argus data on Navy officer and enlisted career intentions by gender. She noted that a smaller share of women than men say they will stay in the Navy until retirement (42 percent vs. 49 percent for officers; 33 percent vs. 50 percent for enlisted), and a higher share of women than men say they will leave the Navy as soon as possible. In summarizing stay/leave influences, Dr. Mottern reported that—for both enlisted men and women—personnel benefits, job characteristics, and family were strong reasons to stay, whereas job characteristics, pay, and command climate were leading reasons to leave. For officers, both men and women thought family and job characteristics were important reasons to stay, but differed on their relative importance. Additionally, women cited personnel benefits as an important reason to stay, whereas men cited leadership. Both male and female officers thought job characteristics and leadership were reasons to leave (although their relative rankings differed), but women also cited command climate whereas men cited family.

The way in which the Navy measures racial/ethnic diversity has recently changed. CDR Leanne Braddock (Navy Equal Opportunity Office) described the Navy's efforts to shift to new OMB-required race codes (first used in the 2000 Census) [24]. The race codes differ from previous ones in three primary ways: (1) the Asian/Pacific Islander category has been divided into two categories—Asian and Native Hawaiian/Other Pacific Islander; (2) personnel are allowed to choose a combination of race codes to depict their heritage, and (3) personnel are asked to declare whether they are Hispanic. When one or more race codes are selected, the combination must reach 1 percent

before it will be reported separately. By January 2003, the Navy Equal Opportunity Office converted race information in all active duty and reserve personnel databases to the new codes. These databases affect information in training, personnel, promotion board, and a variety of other reports, which slowly are being converted to the new codes. A crosswalk between previous years' racial compositions and the new categories has been developed, but historic records would have to be converted manually.

Identifying real-time metrics

Identifying and tracking real-time metrics is important to guiding force-shaping efforts and the development of personnel policy. CDR Steven Vincent (N-132), Mr. Jim Bouzios (NETC N-81), Mr. Ed Bres (N-13), and Ms. Kristie Thomas (CNRF Deputy Chief of Staff for Manpower & Personnel) described current efforts to develop useful manpower metrics [25, 26, 27, 28].

The CNP requires metrics on the number of personnel, accessions, gains and losses, and reenlistments. The Navy has always collected these data, but they are not always useful guides for management action. Data may be only historical, measures may be out of CNP's control, or data may be unavailable for analysis. The current data reside on numerous legacy systems and are not readily accessible or timely (most available data are at least a month old).

Through the CNP Scorecard project, CDR Vincent and others are working to produce more useful management data that will allow for better forecasting. They are, however, encountering problems with data availability and accuracy due to differences between mainframe sources and their data's level of detail. Some progress is being made— for example, EPMAC and N-13 have recently incorporated enlisted and officer manning information into an Oracle data warehouse. Among Balanced Scorecard software packages, the team's challenge is to identify software that meets the CNP's requirements, including a web-based application, query-driven structure updates, security with varying access, and the ability to show information in many modes, handle large databases with many data dimensions, export information, and perform mathematical and statistical analysis.

Mr. Bouzios described how new training and education metrics are examining outcome rather than output. Most old metrics were mission-related and quantitative, whereas today's metrics are qualitative and quantitative efficiency and effectiveness measures in key areas. Strategic measures, following Human Performance System and 5 Vector Models, include improving combat readiness, establishing an agile and responsive organization, ensuring the most effective allocation and use of resources, and establishing a lifelong learning continuum. Mission measures use these models to provide a qualitative framework for evaluating the impact of training and education. Feedback measures are performance-based metrics that are linked to mission, individual tasks, and Sailor performance. Special interest/ emphasis measures are being developed to support a Balanced Metrics Model and gauge progress toward stretch goals. NETC is still in the process of developing metrics, and metrics software has not yet been determined.

The Navy has a wide variety of enlisted and officer retention measures. But no one set of measures has met disparate stakeholder requirements, so adaptation of measures has resulted in incompatible and confusing data. N-13 hopes to redefine these metrics so that they will be more useful. To this end, it held summit meetings for enlisted and officer retention stakeholders to develop new retention definitions and a robust information support system (PerSMART).

Mr. Bres noted that old enlisted retention measures relied on 1964 DoD instructions for outside reporting and used transactions instead of inventory. New measures capture retention though separate reenlistment and attrition measures, focus on populations "at risk" for decisions (only those who survive to the reenlistment point, for example) as well as on observed decisions, report behavior by length of service rather than number of enlistments, and include active-duty Sailors under short initial contracts.

The developed reenlistment measure is consistent with regulations and historical loss patterns. It counts all reenlistments and long-term extensions not tied to the initial enlistment decision. The current duty assignment unit gets credit for the reenlistment. The developed attrition measure, which is cross-sectional and focuses on those who

attrite more than 90 days before their End of Active Duty Obligated Service, will be linked to the individual's last full-duty station to identify where attrition is occurring. One disadvantage is that this may not be appropriate for pre-Fleet (training) activities, particularly boot camp, where assignments are much shorter and a significant portion of early attrition occurs.

New enlisted retention measures have been used for official Navy-wide reporting for the last 2 years, as work continues on providing access for Fleets and subordinate units. N-13 is working on developing new officer retention measures, which is complicated by officers' more diverse career paths and lack of a fixed-length service contract.

Ms. Thomas discussed metrics used by the Naval Reserve's HR management to achieve force structure requirements and support Navy's needs, while also ensuring that personnel have advancement and career opportunities that foster retention. She noted that goals must be achieved while recognizing that the Reserves face several unique challenges—those in the SELRES can quit and can live wherever they want, and the Commander of the Naval Reserve Force does not have input in other Claimants' requirements determination process.

Metrics described included those on executable requirements (a requirement that can be filled and trained to, resulting in a qualified Reservist to the Claimant when needed), accessions, unit structure/placement (determining the optimal structure and placement of units to maximize local fill, taking into account the SELRES population, its demographics, and its proximity to the gaining command), community management (the management of rate and designator community health and personnel life-cycles to best meet requirements), assignments, retention, and attrition. Ms. Thomas described the data sources used to develop metrics and how the metrics are used.

The Assignment Incentive Pay (AIP) program

In recent years, the Navy has faced increasing difficulty in assigning and distributing personnel. Many sea billets and some shore billets, such as those in recruiting and some undesirable overseas and U.S. locations, have chronic manning problems. The current system of

assigning Sailors to jobs relies heavily on labor-intensive, telephone negotiations with imperfect information in which the detailer serves as the matchmaker. As a result, some billets remain gapped for significant periods of time. Dr. Wesley Nimon (NPRST) noted, for example, that the average number of gapped billets per 2-week requisition cycle varied from 53 percent to 72 percent between July 2001 and August 2002 [29].

The Navy historically has relied on nonmonetary incentives, such as granting sea duty credit for an undesirable shore billet, to alleviate these shortages. But such incentives can constrain the distribution system and further exacerbate other manning shortages. Alternatively, the Navy uses a "share-the-pain" approach—with frequent moves between desirable and undesirable duty stations. This reliance on involuntary assignments to fill gaps ultimately lowers retention, fleet readiness, and productivity and increases PCS and training costs.

One possible solution to manning shortfalls is the development of Assignment Incentive Pay (AIP). Mr. Anthony Cunningham (NPRST) described AIP, a new flexible, market-based pay to attract personnel to difficult-to-fill locations or jobs [30]. The 2003 National Defense Authorization Act gave the services authority to use AIP, which is capped at $1,500 per month. The Navy will implement AIP in early June 2003 using an auction-like approach, in which interested Sailors "bid" on an assignment (in $50 increments) in the Sea Warrior/Job Advertising and Selection System (JASS). At the end of a 2-week bidding cycle, the assignment authority reviews candidates and their bids. The qualified Sailor with the lowest bid is selected for the assignment, taking total costs (AIP, PCS, and retraining costs) into account. If no bids are received or the match quality is poor, the job can be relisted repeatedly until it hits its "must-fill" date.

Initially, the Navy will pay AIP only to enlisted personnel who volunteer for jobs in Naples, Italy; Sigonella, Sicily; and Misawa, Japan—locations that historically have been difficult to fill with qualified volunteers. Use of AIP will eliminate the current sea duty credit, which gives Sailors who take these shore assignments sea duty credit. If successful, the program slowly will be expanded and fully implemented by FY06.

Dr. Bill Gates (NPS) emphasized the importance of choosing the right algorithm for matching Sailors to AIP billets [31]. He compared two matching algorithms: (1) Deferred Acceptance (DA), which ensures stable matches and prevents "off-the-site" trades between parties, and (2) Linear Programming (LP), which optimizes Command and Sailor effectiveness and promotes a balanced approach to meeting both parties' preferences, but does not guarantee stable matches. Using Aviation Support Equipment Technician data, Dr. Gates developed a simulation program that matches Sailors using both DA and LP and calculates resulting quantity (number of matches over all Sailors or Commands) and quality (utility scores and the number of unstable matches) performance measures. He found that LP generates better, but more unstable matches. Furthermore, he determined that LP matching's advantages may depend on the Navy's tradeoff between quantity and quality performance measures and may diminish if only information about rank-order, rather than relative utility, is available.

Several software tools are being developed to support AIP's implementation. Dr. Nimon demonstrated a prototype for the Distribution Incentive System (DIS)—a system to help detailers to best select from among bidders for a particular job [29]. The system creates an aggregate fitness score that accounts for important factors, such as differences in quality and in AIP and PCS costs, and gives the user the option to weight different factors differently. Mr. Al Rouse (RCI) demonstrated a prototype for the Distribution Incentives Management System (DIMS)—a decision support system for the management of Navy distribution incentives [32]. A primary DIMS function would be to record, administer, and propose AIP levels, and the system would allow for data warehousing and the use of custom-built reporting tools. A tracking module would gather and store activity manning and JASS vacancy and application data needed to establish AIP locations, levels, and cost-effectiveness, and a forecasting module would track actual AIP expenditures and forecast future ones.

Mr. Patrick Mackin (SAG Corporation) highlighted some of AIP's limitations: AIP would not apply to deployments within an assignment, would not be payable in a wartime situation, and would not apply to a Sailor's first duty assignment [33]. He also highlighted policies and practices that could support successful AIP implementation, including

providing good information to Sailors on assignment locations and to commands on qualified candidates, guaranteeing a solid overseas Cost of Living Allowance (COLA) program, allocating sufficient money to incentives, and establishing a long-term commitment to maximizing voluntary assignments. He recommended an AIP evaluation strategy in which actual auction outcomes are compared to the "least-cost" solution and cost-benefit analyses are conducted.

AIP proponents assume that it will result in a more efficient distribution of personnel at a lower cost. Mr. Mackin presented a simple model that showed that a voluntary assignment system is, in fact, more efficient than a "random" system —assuming that both maintain the same level of retention and fill the same number of assignments. Dr. Heidi Golding (CNA) has confirmed through survey work that Sailors will volunteer for undesirable billets and stay in them for additional pay [34].

Dr. Golding estimated the relative cost of AIP using survey results and the estimated costs of using existing incentives (sea duty credit and SRBs) to encourage Sailors to fill undesirable billets. Her rough estimates indicate that existing incentives cost about as much as AIP to fill CONUS billets ($22 million annually), but may cost at least 3.5 times as much as AIP to fill OCONUS billets. Consequently, she concludes that AIP is cost-effective for OCONUS billets, but may not be for CONUS billets.

Manpower requirements

> [A]s we define our Total Force requirements, we must ensure they are the minimum necessary to deliver readiness; this will permit us to redirect funding to other compelling Navy requirements.
>
> —*VADM Gerald L. Hoewing (N1/CNP) [2]*

LCDR Phil Nowak (Coast Guard Future Force 21) described a proposal that would allow the Coast Guard to better determine manpower requirements (demand for personnel), which then could be matched to the supply of personnel [35]. He noted that, to improve manpower requirements determination (MRD), three feeder processes must be

improved —the skill and attribute framework, work measurement, and the business model/staffing logic. Analysis, the fourth leg of the proposal, would integrate the three subprocesses.

The current skill and attribute framework focuses on distributable communities (i.e., ratings), periodic occupational analysis (OA) reviews, and analyses within a single occupational area. The MRD proposal would allow the Coast Guard to shift this focus to subspecialties and knowledge, skills, and abilities—strengthening OA for the total workforce (active, Reserve, civilian). Similarly, improving work measurement means shifting from the current state, in which manpower requirements are validated at their inception and billet workload is not scalable, to one in which billet workload can be measured over time, a best-choice staffing alternative is selected, staffing is scaled to meet programmed workload, resource tradeoffs are made, and the workload expectations of commanders and employees are better managed. Improving the business model/staffing logic includes shifting from clearly defined rules that support budget inputs to using tools to determine requirements, defining the attributes and limitations of each workforce, and creating a scalable methodology. In sum, the proposal would establish an "honest broker" process in the Coast Guard—one that integrates MRD efforts and analyzes resources in the base, rather than having MRD responsibilities shared across a number of entities using "analog" methods.

LT Phil Prather (Coast Guard Future Force 21) noted that MRD relies on economically feasible and statistically valid work estimation techniques [36]. Accurately measuring work allows for the determination of manpower, knowledge, skill, and ability needs, the analysis of long-term and cyclical variations, the linkage of measurable process outputs to workload, and the improvement of working conditions. He contrasted the way work is measured, both directly and indirectly, in industry and in the military, with the way it is measured in the Coast Guard. Coast Guard direct work measures include work sampling for staffing standards, systems studies, industrial labor reporting, OA reviews, and NAVMAC validations. Indirect Coast Guard work measures include abstracts of operations, logs, logistics information systems, personnel transactions, CASREPs, and maintenance, training, and financial records. The Coast Guard plans to adapt work

measurement methodologies, expand AWPS, link SkillsNET taxonomy to both PeopleSoft and IMPRINT, and continue to develop skill-based assignments.

Initiatives to reduce or optimize manning make development of a ship's manning structure more complex. Mr. Shane Bowen (Micro Analysis and Design, Inc.) described the Total Crew Model (TCM) — a tool that uses task network models to develop a ship's manning structure and solve manning optimization issues [37]. The model determines if the assigned crew complement can accomplish all underway operations within acceptable crew fatigue levels, accounting for the combined effects of watch schedules, WQ&SB assignments, and manning requirements for special evolutions. Manning hypotheses can be adjusted with the goal of optimizing crew size, schedules, or WQ&SB. A trump matrix is established, in which each evolution and routine schedule event is compared to each other evolution for prioritization. Iterations frequently result in improvements to the simulated crew's aggregated fatigue levels and its ability to perform all required activities within the scenario.

The model's spreadsheet format allows for easy modification and quick iteration times. Output reports include records of special evolution activities, fatigue estimates for the crew, and crewmember activity and sleep time records. The TCM already has been used on several Navy and Coast Guard programs, including DD21, Aegis DDG manning reduction studies, and USCG Deepwater.

Sailor-centric system design

> We want to make Sailors the focus of what we do because
> they run the systems that make us combat ready. The design
> of new systems must include Sailors from the start.
>
> —*VADM Gerald L. Hoewing (N1/CNP) [2]*

In an environment of increased tactical and system complexity, information proliferation, rapid technology insertion, high life-cycle costs, and reduced and optimal manning initiatives, the Human Systems Integration (HSI) Directorate (NAVSEA 03) was established to design, acquire, certify, and deliver usable warfighting systems and to

support and align with Task Force EXCEL initiatives. Its top priorities and challenges are developing HSI policies/standards for NAVSEA, developing human performance metrics and evaluation techniques, developing HSI certification criteria for the Total Ship Certification process, supporting the CNO's Revolution in Training, institutionalizing HSI in systems engineering, and educating the NAVSEA workforce. In the past, hardware and software systems were developed with no regard for the type of personnel and training required. HSI reverses this emphasis; now personnel and training are determined first, and hardware and software are developed to support the Warfighter.

Mr. Bob Bost (NAVSEA 03) noted that by using a total system engineering process, including HSI principles, good human performance results and is a critical element of total system performance [38]. One challenge, however, is ensuring that HSI is integrated into the entire Future Naval Capability program. To do so, he noted that it must be recognized that Sailors are the most valuable shipboard system. Performance improvement can be supported by relevant technical training and integrated training architectures. Fully implementing HSI into the Navy requires that engineers, researchers, program managers, program sponsors, and the Fleet support the change in focus to systems engineering.

Mr. Tim Tate (N00T) noted that HSI, if used to design new weapon systems and to reinvent processes, could serve as the Navy's "transformation enabler" [39]. For this to occur, the Navy will have to embrace this new way of looking at its requirements, procurements, design, and evaluation processes while also finding a way to quickly procure the certified HSI professionals needed to perform this work. Dr. Paul Elliott (Saba Software) described how several large, international companies in the commercial sector have used HSI for transformation—resulting in salary savings, revenue increases, more efficient training, and improved customer service [39].

New technology

> Our HR systems and databases must be able to connect in a manner that enhances the quality of service for Sailors and their families. Interconnectivity is even more important as we join forces with Task Force Excel to move Sea Warrior forward.
>
> *—VADM Gerald L. Hoewing (N1/CNP) [2]*

Using new technologies to better distribute workforce information is an important component of the CNP's priorities. Two presenters, CDR Scott Chapman (N81) and Dr. Bernard Ulozas (SPAWARS), described programs that accomplish this end [40, 41].

CDR Chapman demonstrated the Naval Manpower, Personnel and Training (MPT) Exchange—a system that brings together the MPT studies community, allowing the exchange of MPT information and knowledge. The exchange, which is being beta and operationally tested between May and August 2003, will include references to MPT studies, information about studies' approaches, findings, and recommendations, information on study recommendations adopted, and information on the outcome of program evaluations. The developers hope that the exchange will improve productivity and effectiveness, foster collaborative work on MPT policies and programs, help to identify gaps or redundancies in a particular MPT area, and provide an overview of Navy's investment in MPT studies.

Dr. Ulozas described his team's efforts to develop a virtual workplace to meet the work, learning, career planning, and development needs of the newly created Information Professional (IP) officer community. He discussed the process of determining the nature and form of the website, assessing designs and expectations, defining the operating constructs of the site, and drawing lessons learned from the site's use. Dr. Ulozas also demonstrated the site's features, which will be improved in the future by the addition of more "push" and interactive features (e.g., webinars, community news and information alerts, and live chats).

Comprehensive career management

> Stress leadership involvement in a Sailor's professional development from the moment the Sailor walks into a recruiting office until the time that Sailor is piped ashore.
>
> —*VADM Gerald L. Hoewing (N1/CNP) [2]*

The CNP's 2003 Guidance heavily emphasizes career management, calling for the creation and development of "a web-based comprehensive Sailor-Centric Career Management System that combines the current and future products of Task Force Excel, Project Sail, and Improving Navy's Workforce." Development of such a system is needed to provide Sailors with accurate career information and make career planning more rigorous.

Mr. Anthony Cunningham (NPRST) described his team's efforts to develop Career Case Manager Technologies—tools within the Integrated Sailor/Marine Career Management System (S/MCMS) that provide a Sailor with information about future jobs, training, and education, and also with advice as to the probability of achieving his/her career goals based on a variety of factors [42]. The effort relies on the development and deployment of intelligent software agents to gather data from multiple sources and tailor them to a Sailor's traits, preferences, and goals. The agents also will serve as "sounding boards" to answer a Sailor's "what if" questions and provide career advice. The tools can be modeled using historical, stochastic information and game-theoretic, network-based structures. In developing models, probability techniques (several of which are being considered) may have to be stretched and combined. Developers are currently using historical data and data developed by Subject Matter Experts (SMEs) to assess alternative structural models, compare path and network precedence models, and integrate the SkillsNET career planning taxonomy. Models will be tested in a laboratory with SMEs and the Sailor Community.

Mr. Ricky Hall (NPRST) described the Sailor Assignment Matchmaker (SAM)—one part of the S/MCMS [43]. SAM, a decision support algorithm, will allow a Sailor to compare alternative assignment choices according to attributes of the assignments that he/she finds

important. Attributes could include whether the job is good for promotion, the type duty, skills required, school systems, climate, base housing availability, spousal employment opportunity, area entertainment, sea and shore duty availability, and incentives offered. The end product will be a command and job database structure, used by an algorithm within the Web-based Marketplace or within the cognitive agents. SAM's outputs could be used to learn about Sailors' interests and how to improve their quality of life, to help structure Sailor incentive bundles, to forecast future incentive accounts, and to help manage incentives.

Positive Navy experience

> Our Sailors and their families are part of the finest military organization in the world. This experience begins when they walk in a recruiting office and continues throughout their career. Reviewing pay data, service record information, getting the assistance they need from Fleet and Family Service Centers, and enjoying MWR opportunities are just a few examples of what we can contribute to an overall positive Navy experience.
>
> *—VADM Gerald L. Hoewing (N1/CNP) [2]*

One way in which the Navy attempts to improve servicemembers' "quality of life" is by providing family housing. However, many opt for civilian housing instead—often citing school quality as a factor in this decision. Dr. Jennie Wenger (CNA) found that the relatively low quality of public schools serving family housing units may lower the value that servicemembers place on family housing benefits [44]. She found that servicemembers at bases with few schools from which to choose were much less likely to be satisfied with their children's schools, and those in family housing were less satisfied with schools than those in civilian housing. Finally, Navy children at most bases were more likely to attend private schools than other children, and differences were larger at bases with less desirable schools. Although Dr. Wenger found a positive correlation between school quality and overall satisfaction with the Navy, there was no evidence of a retention effect.

The availability of advancement opportunities is important to service-members' perceived quality of life and to the Navy, which needs to develop a more experienced force. Dr. Aline Quester (CNA) and SgtMaj (RET) Gary Lee (CNA) argued that the creation of a new E-10 paygrade is needed [45]. In fact, the addition of new paygrades is not without precedent—enlisted paygrades were added in 1920 and 1958.

On average, E-9s retire from the military after 6 years in the grade; most leave well before regulations require it. In fact, analysis of Navy and Marine Corps historical data showed that fast trackers were leaving the earliest. Those leaving note that there are no further advancement possibilities and that longevity pay increases are small, stopping completely at 26 years of service. Dr. Quester and SgtMaj Lee proposed changing current law, which limits total E-8s and E-9s to 3.5 percent of the enlisted force and E-9s to 1 percent of the enlisted force, to allow E-8s to E-10s to be 3.7 percent of the enlisted force and E-10s to be 0.2 percent of the enlisted force. That would allow each Service to determine the number of E-10s and the allocation of E-10 positions between E-9s who serve as technical or duty experts within a specific field and those who serve as senior enlisted advisors (SEAs) to commanders. The E-10 paygrade could be used as a tool to shape and age the force, to create a more experienced top six force, to support longer careers, to ensure another quality screen for those serving longer careers, and to encourage fast-trackers to serve longer careers.

A seamless team

> We must better incorporate both the contributions and issues of our reserve and civilian shipmates. With the establishment of the Civilian Community Management Division we are off to a good start. Sailors who want to succeed have access to the career management and mentorship they need to reach their goals; we must give our civilians similar resources to excel.
>
> —*VADM Gerald L. Hoewing (N1/CNP) [2]*

The Navy employs a mix of active-duty, reserve force, civilian, and contract personnel to accomplish its missions. Some jobs are "militarily essential," requiring active-duty or Reserve personnel, whereas others are not.

Accurately estimating manpower costs is important for determining the right personnel mix, for adhering to A-76 study rules, and for determining the right mix of manpower, hardware, and technology in the acquisition process. Mr. Pat Mackin and Mr. Richard Parodi (SAG) presented the Proposed Manpower Costing Mechanism (MCM)—a web-based manpower cost tool with paygrade/skill/type-duty granularity that calculates costs (including variable indirect costs) based on the most recent fiscal year's actual outlays [46]. The mechanism could be expanded over time to link to an Activity Manpower Document (AMD) database, to allow analysts to derive annual enlisted, officer, and unit MPN costs, and to provide replacement costs for ROI tradeoff analyses. Model challenges include accurately capturing the "variability" in variable indirect costs, accounting for officer and civilian training and acquisition costs, estimating contractor costs, and making the methodology consistent with that of other Services.

The Guard and Reserve are essential components of the total force. Some fear, however, that increasing Reserve call-ups may reduce employer support of their Reservist-employees because of cost and morale problems generated by the call-ups. In turn, weak support could hinder Guard and Reserve recruiting, retention, and volunteerism. Dr. Glenn Gotz (IDA) found that there was surprisingly little evidence on whether such problems even exist—perhaps due to the paucity of systematic data connecting Reservists to their employers [47].

Dr. Gotz described five possible DoD initiatives to assist Reservists and their employers. The first would create an employer database—with mandatory reporting by Reservists—linked to Reserve personnel files. This would allow DoD to target information to employers and would facilitate statistical studies and surveys (e.g., how the costs of Reserve call-ups differ by employer characteristics). The second initiative would obtain timely information for early warning of problems—through a short, periodic telephone survey to develop leading indicators and through the tracking of the number and nature of calls to ombudsmen. The third would provide more timely information to Reservists' immediate supervisors and HR managers, including early notification of call-up, reason for deployment, and likely call-up duration. Distribution of such information could improve workload planning for employers, possibly reducing costs and resentment.

However, many noted that collecting this information also may create privacy concerns. The fourth initiative would decrease call-up uncertainty, by providing early mobilization orders, establishing "double volunteer" units, rotating mobilization risk for units, and setting definite tour/deployment lengths. Finally, DoD could offset employer costs through tax credits or by providing reimbursement for overtime payments, training costs of temporary workers, lost productivity or sales, or Reservists' retirement pay and medical insurance. Dr. Gotz noted, however, that evidence on the effects of these financial offsets on employer support and Reserve recruiting and retention should be developed before nationwide implementation.

Dr. Neil Carey (CNA) described six ways to use Navy Reservists to improve force capabilities [48]. First, Reservists could augment a carrier flight deck, ordnance, and AIMD ratings. This would require their integration into the interdeployment training cycle but would remove operational constraints that appear only in wartime (e.g., when surge/"all out" capability is needed) and could almost double a carrier's firepower. Second, he noted that using Reservists to return ships to port would remove operational constraints that limit coverage for forward deployment and increase ships' time in the area of responsibility by 50 percent. For this to work, active duty personnel would have to accept turning over the ship, forgoing the return-to-port homecoming, and leaving some personnel aboard. Third, more Reservists could staff ships during nondeployed periods. This would increase active forces' QOL and lower active forces' attrition, but it could result in Reservist dissatisfaction. Fourth, Dr. Carey noted that having EA-6B squadrons train more with Marine Expeditionary Units could increase their utilization and better prepare them for short detachments. Fifth, using technology to shift workload to Reservists on shore could reduce costs, increase shipboard space, and free active duty personnel for other duties. Finally, creating skill niches (i.e., IO, IT, linguistics, intelligence, security/force protection) could expand Reserves' usefulness and create efficiencies. However, he cautioned that it may not be feasible to recruit and retain Reservists in some lucrative private-sector fields.

Conclusion

The *Third Annual Navy Workforce Research and Analysis Conference* brought together researchers from a variety of organizations, each working toward a common goal—the support of the CNP's framework and the Navy's R&D priorities. Individual organizations' approaches and techniques may differ, but this guiding framework results in a comprehensive and coherent body of work. Although the research community's work presented at the conference addressed all six of the CNP's major framework elements, some sub-elements still warrant further examination. For example, research that helps leadership to reduce PCS costs, to better understand the Individuals Account, and to make manpower a consideration in BRAC deliberations could facilitate the CNP's efforts in these areas. By providing a forum for the exchange of ideas and information, the *Navy Workforce Research and Analysis Conference* ensures that the research community will continue to support leadership's workforce priorities for years to come.

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[45] "Senior Enlisted Personnel: Do We Need Another Grade?" presented by Dr. Aline Quester (CNA) and SgtMaj (RET) Gary Lee at the *Third Annual Navy Workforce Research and Analysis Conference*, Apr 1, 2003

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