



CNA's Dynamic Decision Model For Servicemember Retention

CNA's retention models have helped the Department of War make personnel policy choices for more than half a century. This work has culminated in a retention model with the flexibility to evaluate the widest possible range of policy options: the **Dynamic Decision Model (DDM)**.

CNA's DDM gives personnel leaders a decision-making edge through its four key attributes :

- **Comprehensive:** It quantifies retention impacts of monetary, non-monetary, and even unobservable factors.
- **Dynamic:** It considers how servicemembers react not only to the most immediate incentive package but also to the prospect of incentives at multiple points along a career path.
- **Structural:** It more successfully isolates the impact of a policy option than other, "predictive" models.
- **Reusable:** It uses a flexible framework that can incorporate new retention incentives quickly rather than the months required to develop a traditional, one-off policy analysis model.

The DDM is a dynamic discrete choice model developed by CNA to estimate how servicemembers change retention behavior with respect to a variety of military and civilian benefits. The model is dynamic in the sense that sailors consider both the immediate and long-term benefits when choosing to remain in the military or exit to become a civilian. These benefits may be monetary or nonmonetary in nature and may include financial incentives, career expectations, economic conditions, and their inherent taste for military service.



The DDM informs policy analysis that accounts for changes in servicemember expectations about the future benefits of service.

The DDM can be used to address vital questions for meeting endstrength and manning requirements, including:

- What numbers will be retained under the status quo?
- Which policy changes will influence retention, and by how much?
- How will retention changes affect future manning and endstrength?

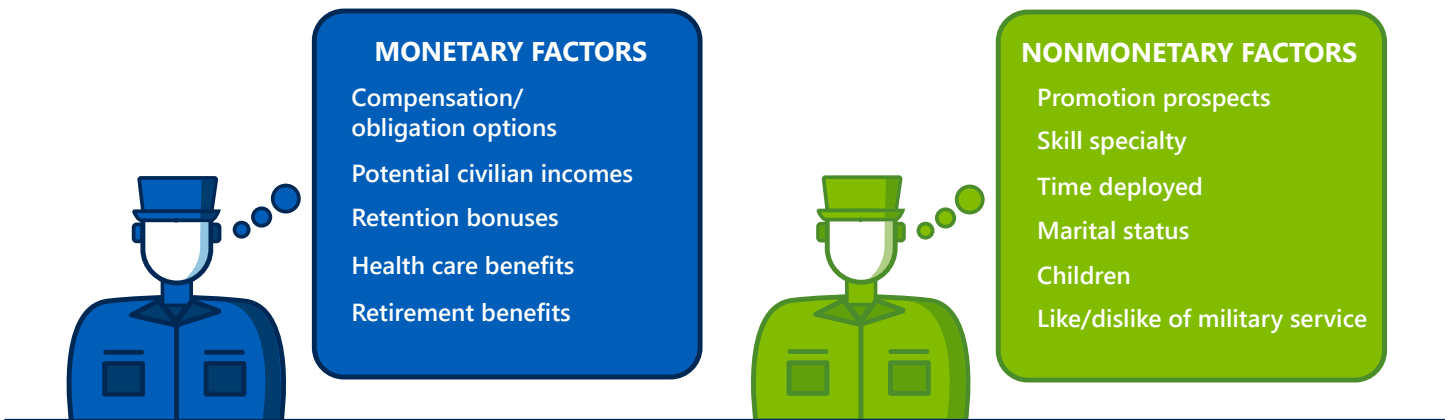
The Case for Dynamic Modeling

Servicemembers facing reenlistment decisions consider far more than the options in front of them at that moment. They look ahead to future bonuses or retirement benefits that might entice them to stay. A dynamic model can consider not only the direct impact of policies on the incentives of servicemembers

but also how they affect the incentives of more junior servicemembers through their expectations about the future. Traditional, “static” models may struggle to estimate these relationships. Dynamic models can also exploit repeated decisions by the same servicemembers to recover estimates of unobserved preferences for military service.

Elements of the Dynamic Decision Model

CNA’s DDM models how individual servicemembers decide to stay in or leave the military given the following factors:



Monetary Factors

The DDM comprehensively models the financial incentives that servicemembers are offered for each obligation length. We link military occupations to their civilian equivalents, using large civilian census and labor datasets and economic projections to estimate the civilian income that servicemembers can expect if they leave the military. These are combined to approximate the total household financial advantage or disadvantage that remaining in the military presents over the next several years. The model has distinct advantages by incorporating factors beyond current military compensation and bonuses: It can independently estimate the retention impact of changes in other factors, such as health care and retirement benefits or future bonus opportunities.

Nonmonetary Factors

The DDM also incorporates a wide variety of nonmonetary factors, using historical data to identify the likelihood that servicemembers will, for example, deploy or be promoted. The DDM’s probability-simulation approach allows the model to estimate the impact of new nonmonetary policies. For example, if a service wants to try a novel deployment schedule with no historical precedent, the event probabilities can be adjusted to represent the policy’s expected “new reality.”

One special, “unobservable” nonmonetary factor is the degree to which a servicemember likes or dislikes military service, which may influence of the effectiveness of retention incentives. The DDM uses repeated observations of servicemembers over time to recover an estimated distribution of unobserved preferences for military service. These estimates allow the model to disentangle the degree to which senior servicemembers stay because of an innate preference versus incentives such as higher compensation or expected pension benefits.

CNA's prior DDM work

CNA has used different versions of the DDM for a variety of retention studies and quick-turn analyses, including:

- Effects of enlistment and reenlistment incentives on sailor retention
- Effects of Navy Medicine retention bonuses on specialist retention
- Factors that affect naval aviator reenlistment
- Effects of Blended Retirement System reform on enlisted Navy retention along the career path

Further Reading

Evaluating the Effects of the Blended Retirement System on Navy Recruitment and Retention. Jacob Spratt, Ray Wang, and Elizabeth Clelan. 2025.

Targeted Incentives System for Retention. Elizabeth Clelan, Mehmet Berat Aydemir, Lauren Malone, Ray Wang, Sarah Wilson, Heather Wolters, and Tom Woo. 2022.

Evaluating Navy Medicine's Accession and Retention Incentives for Officers in Critical Readiness Specialties. Levy, Robert, Jacklyn Kambic, Jessica Oi, and Mikhail Smirnov. 2020.

Aviation Retention Decision Support Tool Development: Navy Aviator Dynamic Decision Model Estimates. Griffin, Jennifer, Mikhail Smirnov, Jackie Kambic, and Jared Huff. 2020.

In or Out: What Drives Sailors' Reenlistment Decisions? Jared Huff, Mikhail Smirnov, Jacklyn Kambic, Hayley Welsh, and Victor Wu. 2019.

Estimating the Retention Effects of Continuation Pay. Jared Huff, Mikhail Smirnov, Gregory Schell, and James Grefer. 2018.



About CNA

CNA is a not-for-profit analytical organization dedicated to the safety and security of the nation. With nearly 700 scientists, analysts, and professional staff across the world, CNA's mission is to provide data-driven, innovative solutions to our nation's toughest problems. It operates the Center for Naval Analyses—the Department of the Navy's federally funded research and development center (FFRDC)—as well as the Institute for Public Research. The Center for Naval Analyses provides objective analytics to inform the decision-making by military leaders and ultimately improve the lethality and effectiveness of the joint force. The Institute for Public Research leverages data analytics and innovative methods to support federal, state, and local government officials as they work to advance national and homeland security.

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