



Workforce Planning System (WPS)

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1. THE CHALLENGE

NASA's challenge is to develop and maintain a workforce that meets the Agency's current mission requirements, while remaining flexible to adapt to changing demographics and shifts in programmatic and mission objectives. NASA must respond to an increasingly dynamic environment in which multiple policies and programs are under review, creating a high degree of technical and financial uncertainty. In parallel, NASA faces significant workforce planning and demographic challenges which add increased uncertainty to management's decisions. The Agency needs tools and methodologies which enable rapid and agile decision making in the critical arena of workforce planning and leverage NASA's existing Human Capital Management insight, data and systems to enhance the Agency's overall agility and responsiveness in the context of evolving policies and programs.

This paper describes an adaptation to NASA of a Workforce Planning System (WPS) and analytical methodology which has been successfully applied by Regional Workforce Transformation Consortium (RWTC) members in the Dayton, Ohio region to help its members analyze impacts of Base Closure and Realignment Commission (BRAC) decisions on:

- Current/future supply of workers
- Current/future demand for workers
- Alignment of supply and demand for workers
- Strategies to mitigate supply and demand mismatches

Planning decisions made in the near term will dramatically affect NASA's overall programmatic and technical capability for years to come. Increasing management's ability to make decisions towards this end is best done on the basis of a systematic and comprehensive ability to understand and analyze the multiple elements involved in workforce planning environment.

2. THE CONTEXT

NASA is currently in the midst of planning and executing a major change in the nature of its programmatic activities as it prepares for the retirement of the Space Shuttle Program in FY2010 (according to policy as of September 2009); shifts focus from construction to utilization of the International Space Station; and transitions to the development and operations of a new manned Exploration program, currently in the form of the Constellation Program pursuant to the U.S Space Exploration Policy (formerly known as the Vision for the Space Exploration). The exact nature and structure of the Exploration Program faces uncertainty, awaiting Presidential response to the options presented in the October 2009 report of the Review of U.S. Human Space Flight Plans Committee. Programmatic changes and uncertainty have created an environment at NASA where multiple projects, programs and priorities act to create competing demand for a limited skilled technical civil servant workforce. Accordingly NASA workforce planners have placed emphasis on: retaining the necessary skills to safely execute the remaining Space Shuttle Program manifest; managing the transition of Shuttle workforce and skills into Constellation Program development activities; and planning to retain the skills necessary to successfully execute the Constellation program in its operational phase.

Challenges posed by programmatic changes and uncertainties are complicated by demographic trends ongoing within NASA's civil servant workforce. The average age of NASA's workforce, at 46.8 years¹, is similar to the government wide average of 46.0²; however when compared to the U.S. workforce at large there is a significant gap in employment in the NASA civil service between the ages of 20 and 40.

¹ As of September 8, 2009. NASA Office of Human Capital.

² Office of Personnel Management, FedSource data. September 2006

While 65.9% of NASA's civil servant workforce is between the ages of 41-59, only 25.0% of that workforce is below the age of 40³ (compared to 44.3% of the U.S workforce as a whole⁴). NASA's civil servant workforce is an aging one- which represents a generational set of skills and experience. Furthermore, NASA has a low attrition rate, at 4.6%, considerably lower than both the private sector and other federal government agencies⁵. Taken together these two demographic factors mean that NASA is likely facing a retirement wave in the near future, as a large portion of its skilled workforce reaches retirement eligibility. This wave is likely to coincide with the initial operational phases of the Lunar portion of the new Exploration program (as currently planned) in the early 2020s. NASA's extant pool of younger civil servants upon which it can draw to replace the skills and knowledge of those expected to retire is small. Similar retirement trends are expected in the private sector, although the generational gap is less pronounced.

The impacts of NASA's programmatic changes reach beyond the Agency's civil servants. As the Space Shuttle Program is retired NASA expects a decline of approximately 4200 in the number of contractors working on the Shuttle and Constellation Programs⁶, a number that represents 19.8% percent of the current contractor workforce associated with those programs. This contractor workforce corresponds to a skill and knowledge base separate to that represented by the civil servant workforce. As the new Exploration program matures, elements of this skill base will be required, and the available workforce will need to be matched with programmatic requirements.

3. THE SOLUTION & METHODOLOGY

To address these issues, Futron Corporation and Edaptive Computing, Inc. are working together to deliver a workforce planning and analysis system specifically targeted to the needs of NASA. This system will help NASA understand the current and future state of the supply of new and experienced workers, the current and future state of the demand for these workers, and what strategies can be employed to manage any gaps that exist or are projected. The WPS utilizes comprehensive models for workforce supply, workforce demand, and mechanisms to match supply and demand.

First, the supply model captures the current workforce, educational output, current unemployment, and the impact of relocation. Multiple classification methods are used, including Classification of Instructional Program (CIP) and Standard Occupational Classification (SOC) codes. This allows users to analyze the aspects of supply using classifications consistent with current reporting. One of the keys to the supply model is a customization component for selecting analysis codes. This allows the user to select the codes of interest to analyze at either a broad or detailed level.

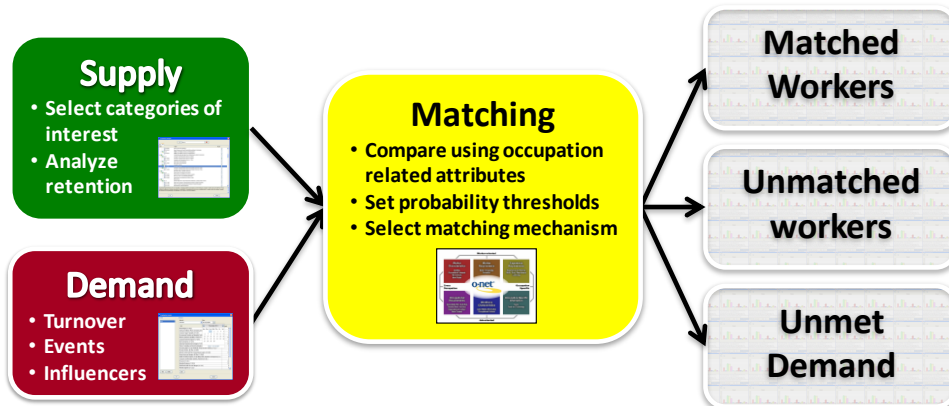
Next, the demand component of the model utilizes a flexible, user-driven approach. To facilitate the modeling of different demand scenarios, the demand model consists of two major aspects. The first is the use of demand events, which model specific instances of demand for a given set of occupations. The second aspect is that of demand influencers, which are algorithms based on specific variables or elements of current demand. Combined, the use of events and influencers allows the user to model a wide range of complex demand interactions.

³ Calculated from Office of Personnel Management, FedSource data. Federal Civilian Employment Distribution Within Selected Age Groups. September 2006.

⁴ Calculated from Bureau of Labor Statistics data. Civilian Labor Force Level, Unadjusted. 4th Quarter 2008.

⁵ Henning and Leshner. "The State of the Next Generation of Explorers." 2008.

⁶ NASA Space Shuttle Workforce Transition Strategy. July 2009 Update.



Finally, a matching engine is used to compare the supply and demand and determine gaps. This matching engine uses data on worker attributes to determine the probability that a worker in the supply could fill the demand for an occupation. To provide flexibility in the matching process, the modeling framework allows a user to select from multiple matching algorithms. These algorithms use attributes such as skills, knowledge, and job experience to determine a matching probability. As a result of this matching process, the user can determine the amount of unmet demand or the number of unmatched workers for each occupation being analyzed.

The analysis enabled by the System begins with a detailed characterization of NASA’s workforce supply by mapping workers available by the detailed occupational skill set in which they fall. This can be done on a regional basis- i.e. according to the NASA Center at which the employees are resident. The tool is then able to model changes and trends in workforce skills (and demographics) available as demand conditions change (e.g. programmatic or budget changes; or major shifts in project work location). The tool compares the known workforce supply to the expected demand conditions to identify likely future skills and demographic gaps- areas where projected workforce needs necessary for mission execution will not be met under existing workforce supply conditions. The tool outputs projections, over time, of the number of workers available by skill set classification. As a result the Agency’s future workforce availability and needs can be analyzed in terms of workers matched to requirements; workers not matched to requirements; and requirements (demand) not matched to workers.

The Workforce Planning System provides the ability to analyze the trainability of the workforce to meet unmet skill set requirements. For those workers not matched to requirements, the tool provides an assessment of the comparability of their skills to those skill sets identified as areas of unmet demand. For example, both the Shuttle Program and the Constellation Program require workers with flight controller skills during the operational phases of the Programs. However, during the period between the final Shuttle flight and the first Constellation flight there will presumably be a significantly reduced requirement for flight controllers. The Workforce Planning System described here would identify and characterize the number of workers in the existing workforce with flight control skills, model the expected demand for that skill in future years, map the expected future demand with the projected availability of that skill set given demographic factors, and provide a projection of whether the expected demand for flight controllers in the future is over-matched, matched or under-matched. The tool would also provide the capability to match those flight controllers to other areas of activity where the skill set possessed is complementary, identifying areas where those skills could be put to work during the intervening years between programmatic requirements for flight controllers.

4. THE VALUE PROPOSITION

NASA's current challenge is to develop and maintain a workforce that meets the Agency's current mission requirements, while remaining flexible enough to effectively adapt to changing demographics and potentially significant shifts in programmatic and mission objectives. Workforce planners face a situation of increased decision complexity and volume due to the need to analyze alternative scenarios while recognizing that inaccuracies in staff and demographic planning can increase cost and schedule risks to mission execution. The Workforce Planning and Analysis system described here builds upon NASA's existing Human Capital Management tools and insight to provide improved planning and evaluative capabilities, leading to an enhanced workforce planning & decision capability. The system provides a comprehensive picture of workforce planning decisions and their impacts.

The Workforce Planning System would leverage and build upon existing knowledge of NASA's current workforce supply by capturing a profile of the skills within the Agency's current workforce. This workforce supply profile would support the modeling of NASA's workforce needs under various alternative scenarios of future demand for workforce skills as dictated by programmatic and budgetary conditions. NASA would gain enhanced insight into its training needs and opportunities during programmatic changes and "gap-filling" situations. The ability to model various demand alternatives and project demographic trends, on a skill categorization basis, provides the capability to evaluate and compare various complex scenarios and provide management input quickly and accurately. The tool also provides the ability to track and evaluate the impact to staff as a result of workforce planning decisions; actual decision impacts can be compared to the projections. An advanced demographic planning approach based on the use of the system described here leads to improved cost effectiveness, enhanced ability to anticipate staff training and development requirements, reduced risk and increased productiveness/effectiveness.

5. THE TEAM

Futron Corporation is a leading provider of decision management solutions for aerospace, telecommunications and other technology enterprises. The company combines business, technical, and management expertise to create solutions for improved decisions, performance, and results. Futron business and market management, safety and risk management, and technology and program management products and services are recognized and accepted as industry standards, and are influential in government, commercial and international forums. We are thought leaders responsible for innovations in the field, including methodologies, tools, and solutions. Futron skilled and talented professionals collaborate with clients to address diverse and challenging strategic and tactical issues and opportunities. Our innovative decision management solutions are at work at government, commercial and international aerospace companies routinely producing better decisions and better futures for clients.

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Edaptive Computing, Inc. (Edaptive) provides innovative software products and professional services for rapid analysis and optimization of complex systems and processes. Our military and aerospace customers include Department of Defense (DoD), National Aeronautics and Space Administration (NASA), and their Prime Contractors who design or deploy large System-of-Systems. Our commercial Fortune 500 customers like Procter & Gamble include organizations with interest in optimization of their supply chains or business processes. Edaptive has mature software and project management processes, considered at CMMI Level 3 (self assessment). Edaptive staff is highly qualified, with several members who possess advanced degrees. Edaptive was founded in 1997 and is headquartered in Dayton, Ohio. Edaptive is a small business certified as 8(a) (2005-2014) by Small Business Administration.

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