Understanding the Department of Defense's Engineering Workforce

Aileen Sedmak

Office of the Deputy Assistant Secretary of Defense for Systems Engineering

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DASD, Systems Engineering Mission

Systems Engineering focuses on engineering excellence – the creative application of scientific principles:

- To design, develop, construct and operate complex systems
- To forecast their behavior under specific operating conditions
- To deliver their intended function while addressing economic efficiency, environmental stewardship and safety of life and property

DASD(SE) Mission: Develop and grow the Systems Engineering capability of the Department of Defense – through engineering policy, continuous engagement with component Systems Engineering organizations and through substantive technical engagement throughout the acquisition life cycle with major and selected acquisition programs.

A Robust Systems Engineering Capability Across the Department Requires Attention to Policy, People and Practice

- *US Department of Defense is the World's Largest Engineering Organization*

- *Over 108,000 Uniformed and Civilian Engineers*

- *Over 39,000 in the Engineering (ENG) Acquisition Workforce*

DASD, Systems Engineering

DASD, Systems Engineering
Stephen Welby
Principal Deputy Kristen Baldwin

Major Program Support
James Thompson

Supporting USD(AT&L) Decisions with Independent Engineering Expertise

- **Engineering Assessment / Mentoring of Major Defense Programs**
- **Program Support Assessments**
- **Overarching Integrated Product Team and Defense Acquisition Board Support**
- **Systems Engineering Plans**
- **Systemic Root Cause Analysis**
- **Development Planning/Early SE**
- **Program Protection**

Engineering Enterprise
Robert Gold

Leading Systems Engineering Practice in DoD and Industry

- **Systems Engineering Policy and Guidance**
- **Technical Workforce Development**
- **Specialty Engineering (System Safety, Reliability and Maintainability, Quality, Manufacturing, Producibility, Human Systems Integration)**
- **Security, Anti-Tamper, Counterfeit Prevention**
- **Standardization**
- **Engineering Tools and Environments**

Providing technical support and systems engineering leadership and oversight to USD(AT&L) in support of planned and ongoing acquisition programs

Why Engineering is Important to the DoD Mission

- **Department of Defense develops and delivers to our soldiers, sailors, marines, and airmen incredibly effective but increasingly complex weapon systems to ensure technological superiority over our adversaries**

- **Engineers play a vital role in fielding high-quality, affordable, supportable, and effective defense systems to sustain and advance America's military dominance**
  - Evolving and verifying an integrated, total life cycle balanced set of systems, people, and process solutions that satisfy the customer's needs and meet department affordability goals
  - Requires technical competency, critical and strategic thinking, knowledge of various product domains, and knowledge of other engineering disciplines to develop innovative technologies that maximize our strengths and exploit the weaknesses of potential adversaries

- **DoD Engineers**
  - Help program managers identify and mitigate risks
  - Shape DoD technical planning and management
  - Support knowledge-based decision making
  - Provide technical depth of acquisition policy and processes
  - Provide a balanced solution for affordable and capable systems

DoD at a Strategic Crossroads

Dr. Ashton Carter
FY16 Posture Statement,
Senate Armed Services
Committee, March 3

"DoD is addressing the erosion of U.S. technological superiority with the Defense Innovation Initiative (DII). The DII is an ambitious Department-wide effort to identify and invest in innovative ways to sustain and advance America's military dominance for the 21st century…the ultimate aim is to help craft 'offset strategies' that maximize our strengths and exploit the weaknesses of potential adversaries."

Building the Force of the Future

Secretary of Defense Ash Carter
Submitted Statement -- Senate Appropriations Committee-Defense (Budget Request), May 06, 2015

"We have inherited a long tradition of military excellence from those who came before us, and we must preserve it for those who will come after.

But to do so, DoD must embrace the future – and embrace change – throughout our institution. We at the Pentagon must, as I say, think outside our five-sided box, and be open to new ideas and new ways of doing business that can help us operate more efficiently and perform more effectively in an increasingly dynamic and competitive environment.

As DoD counters the very real dangers we face in the world, we will also grab hold of the bright opportunities before us – opportunities to be more competitive and re-forge our nation's military and defense establishment into a future force that harnesses and develops the latest, cutting-edge technology, and that remains superior to any potential adversary; one that is efficient and accountable to the taxpayers who support it; and one that competes and succeeds in attracting the next generation of talented Americans to fill its ranks."
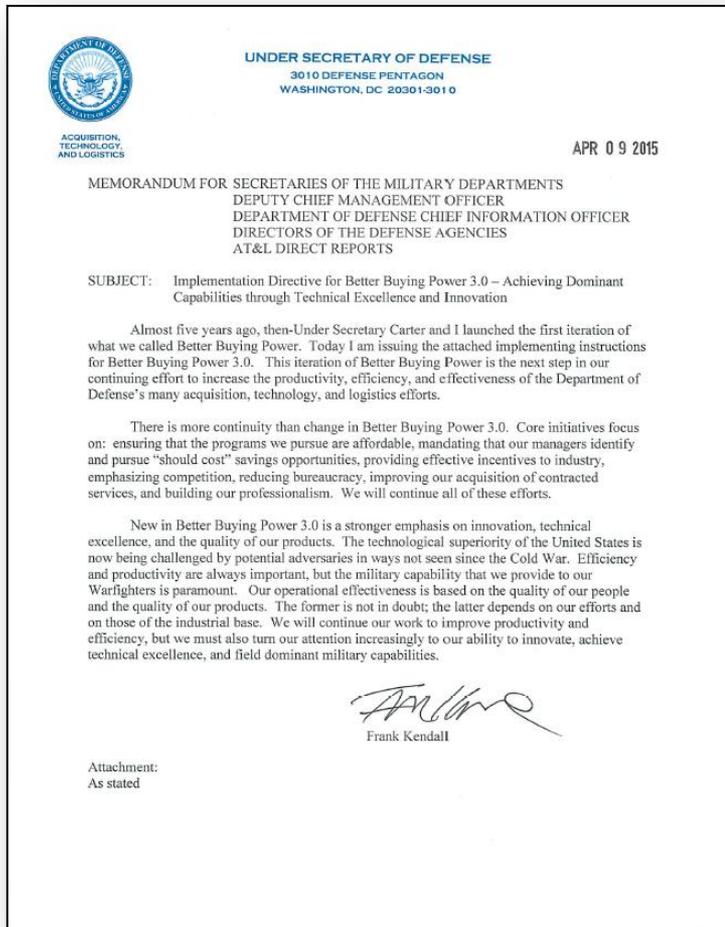

#ForceoftheFuture Be a part of it.

http://www.defense.gov/home/features/2015/0315_force-of-the-future/

USD(AT&L) Released BBP 3.0
Achieving Dominant Capabilities through Technical Excellence and Innovation

USD(AT&L), BBP 3.0 Implementation Guidance, April 3

"**Potential adversaries are challenging the U.S lead in conventional military capability in ways not seen since the Cold War. Our technological superiority is based on the effectiveness of our research and development efforts. These efforts span science and technology, component development, early prototyping, full-scale development, and technology insertion into fielded products.**"

Better Buying Power 3.0
Achieving Dominant Capabilities through Technical Excellence and Innovation

Achieve Affordable Programs
- Continue to set and enforce affordability caps

Achieve Dominant Capabilities While Controlling Lifecycle Costs
- Strengthen and expand "should cost" based cost management
- Anticipate and plan for responsive and emerging threats by building stronger partnerships of acquisition, requirements and intelligence communities
- Institutionalize stronger DoD level Long Range R&D Program Plans
- Strengthen cybersecurity throughout the product lifecycle

Incentivize Productivity in Industry and Government
- Align profitability more tightly with Department goals
- Employ appropriate contract types, but increase the use of incentive type contracts
- Expand the superior supplier incentive program
- Increase effective use of Performance-Based Logistics
- Remove barriers to commercial technology utilization
- Improve the return on investment in DoD laboratories
- Increase the productivity of corporate IRAD

Incentivize Innovation in Industry and Government
- Increase the use of prototyping and experimentation
- Emphasize technology insertion and refresh in program planning
- Use Modular Open Systems Architecture to stimulate innovation
- Increase the return on and access to small business research and development
- Provide draft technical requirements to industry early and engage industry in funded concept definition
- Provide clear and objective "best value" definitions to industry

Eliminate Unproductive Processes and Bureaucracy
- Emphasize acquisition chain of command responsibility, authority and accountability
- Reduce cycle times while ensuring sound investments
- Streamline documentation requirements and staff reviews
- Remove unproductive requirements imposed on industry

Promote Effective Competition
- Create and maintain competitive environments
- Improve DoD outreach for technology and products from global markets
- Increase small business participation, including more effective use of market research

Improve Tradecraft in Acquisition of Services
- Strengthen contract management outside the normal acquisition chain — installations, etc.
- Improve requirements definition for services
- Improve the effectiveness and productivity of contracted engineering and technical services

Improve the Professionalism of the Total Acquisition Workforce
- Establish higher standards for key leadership positions
- Establish stronger professional qualification requirements for all acquisition specialties
- Strengthen organic engineering capabilities
- Ensure development program leadership is technically qualified to manage R&D activities
- Improve our leaders' ability to understand and mitigate technical risk
- Increase DoD support for STEM education

Continue Strengthening Our Culture of Cost Consciousness, Professionalism, and Technical Excellence

Utilizing Data to Identify Engineering Workforce Trends

Objective: Provide Insight into DoD Workforce Challenges in Order to Foster Dialogue with Industry

This workforce is mainly comprised of civilian employees, so we anticipate that Industry is seeing similar trends within their engineering workforce
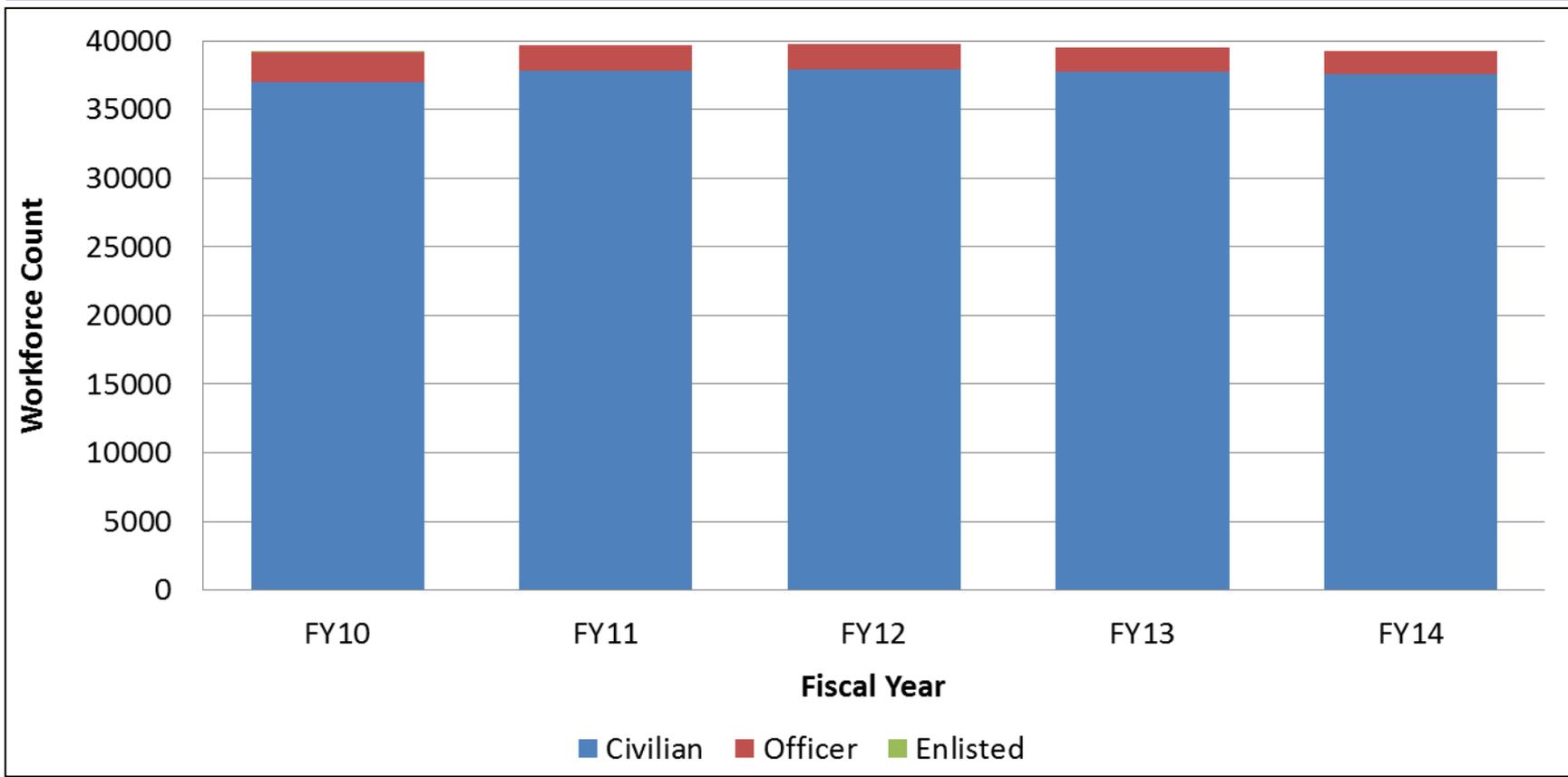
Data Source: USD(AT&L) Defense Acquisition Workforce Data Mart

ENG Career Field Civilian Workforce FY10-14

Budget Driven Downsizing Continues
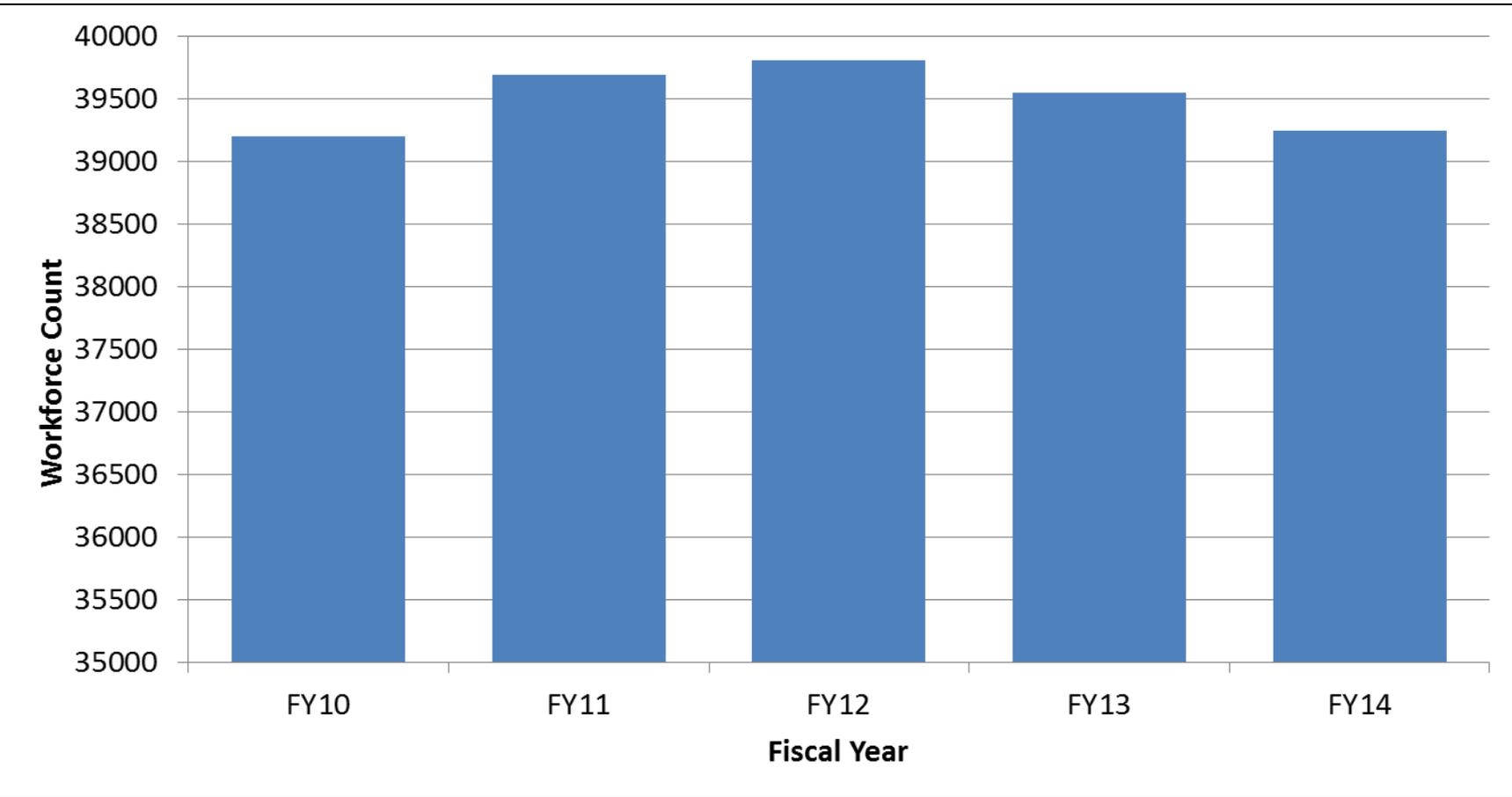
Actual Total Data Source: USD(AT&L) Defense Acquisition Workforce Data Mart
Projection Data Source: President's FY16 Budget PB23 Projection – OSD CAPE SNAP Database

Engineering Workforce Trends

- **Recruiting/maintaining the talent pipeline**

- **Potential untapped resources**

- **Age Demographics – Generational Motivators**

Engineering Civilian Distribution by Years to Retirement Eligibility

This is still an aging workforce

Defense Acquisition Workforce - Engineering

Distribution by Years to Retirement Eligibility (Civilians)(FY2014)

12,364 or 33% of the civilian members of the Engineering workforce will become eligible to retire with full benefits within 10 years.

Retirement Eligible

5,549 or 15% of the civilian members of the Engineering workforce are eligible to retire with full benefits.

5 Years

5 Years

5,055 - 14%

7,309 - 20%

FERS

CSRS

Years to Becoming Retirement Eligible

Retirement Eligible
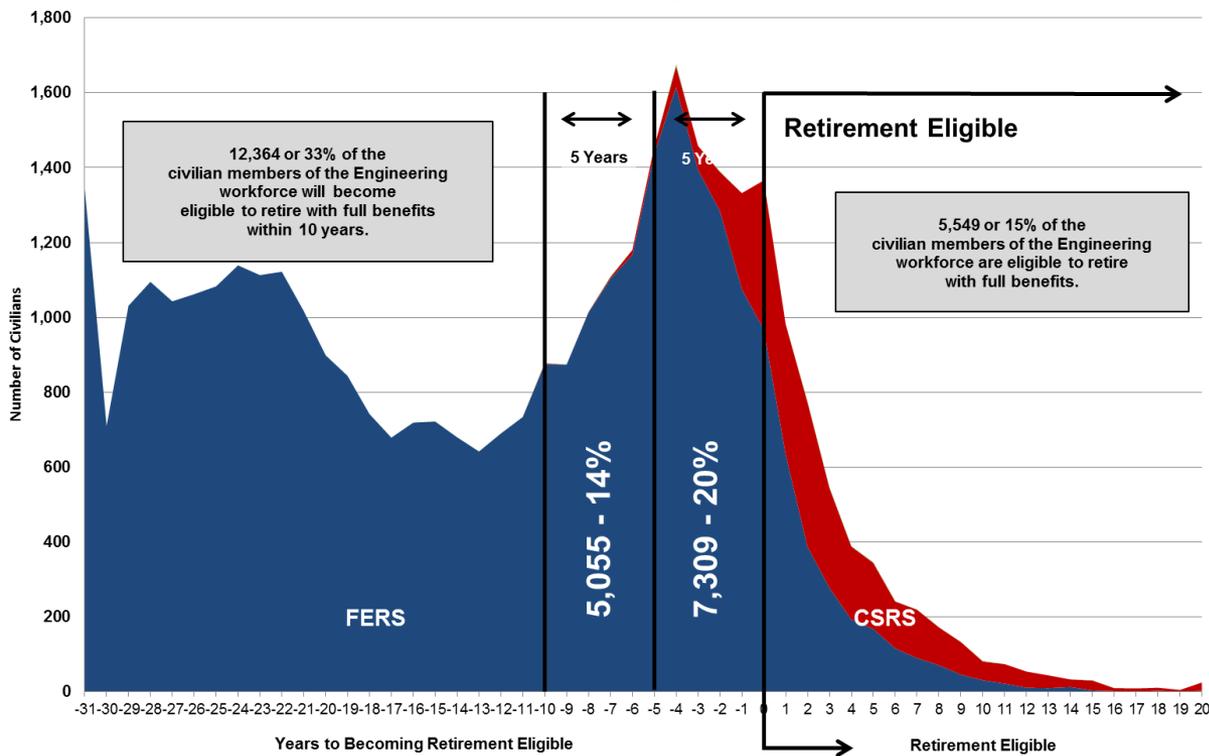
Data Source: RAND NDRI Forces and Resources Policy Center

As of the end of FY14 (30 September 2014)

We are doing a good job hiring mid-level and senior-level engineers
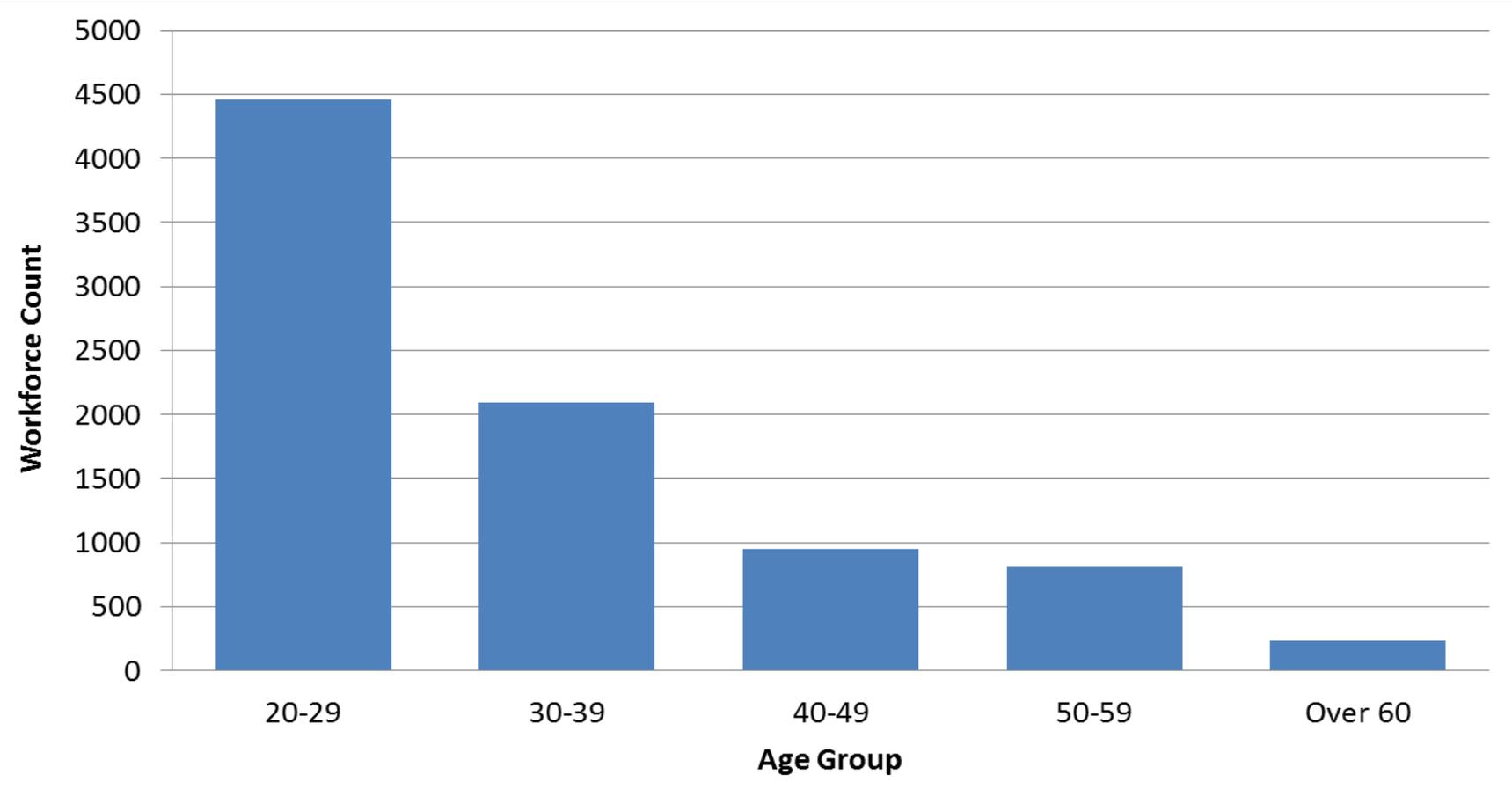
Data Source: USD(AT&L) Defense Acquisition Workforce Data Mart; excludes unknowns

Increased trend in losses for new hires (employees >21 YRE) and retirement eligible employees
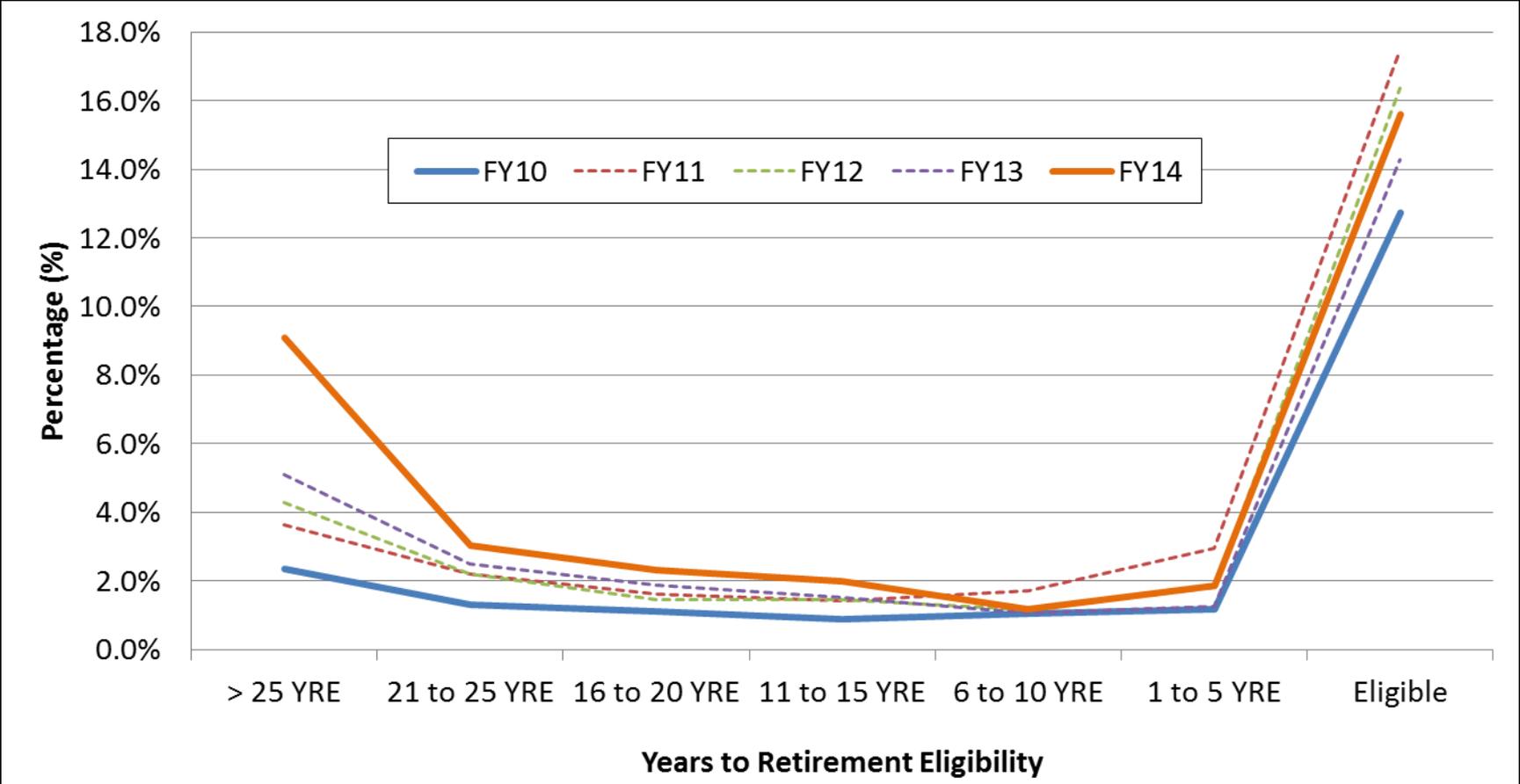
Data Source: RAND NDRI - Engineering Career Field Acquisition Workforce Data - FY09 - FY14

Recruitment / Retention Trends

- **Large portion of the workforce is still reaching retirement eligibility in the next 5 years**
  - Need to look into and understand how likely this workforce will begin to leave the workforce once they reach eligibility….?

- **Hiring mid-level / senior-level engineers**
  - Need to determine where these employees are coming from (i.e. retired military, other government agencies, industry,…)

- **Problems with retaining the new hires (>21 YRE)**
  - Need to look at additional data (i.e. by Occupational Career Codes, by Location, …)
  - Need to understand the root cause (i.e. lack of upward mobility, generational motivators, salaries, …)

Is Industry dealing with similar trends with its engineering workforce?

Engineering Workforce Trends

✓ **Recruiting/maintaining the talent pipeline**

- **Potential untapped resources**

- **Age Demographics – Generational Motivators**

ENG Career Field by Gender[1]
FY10-14
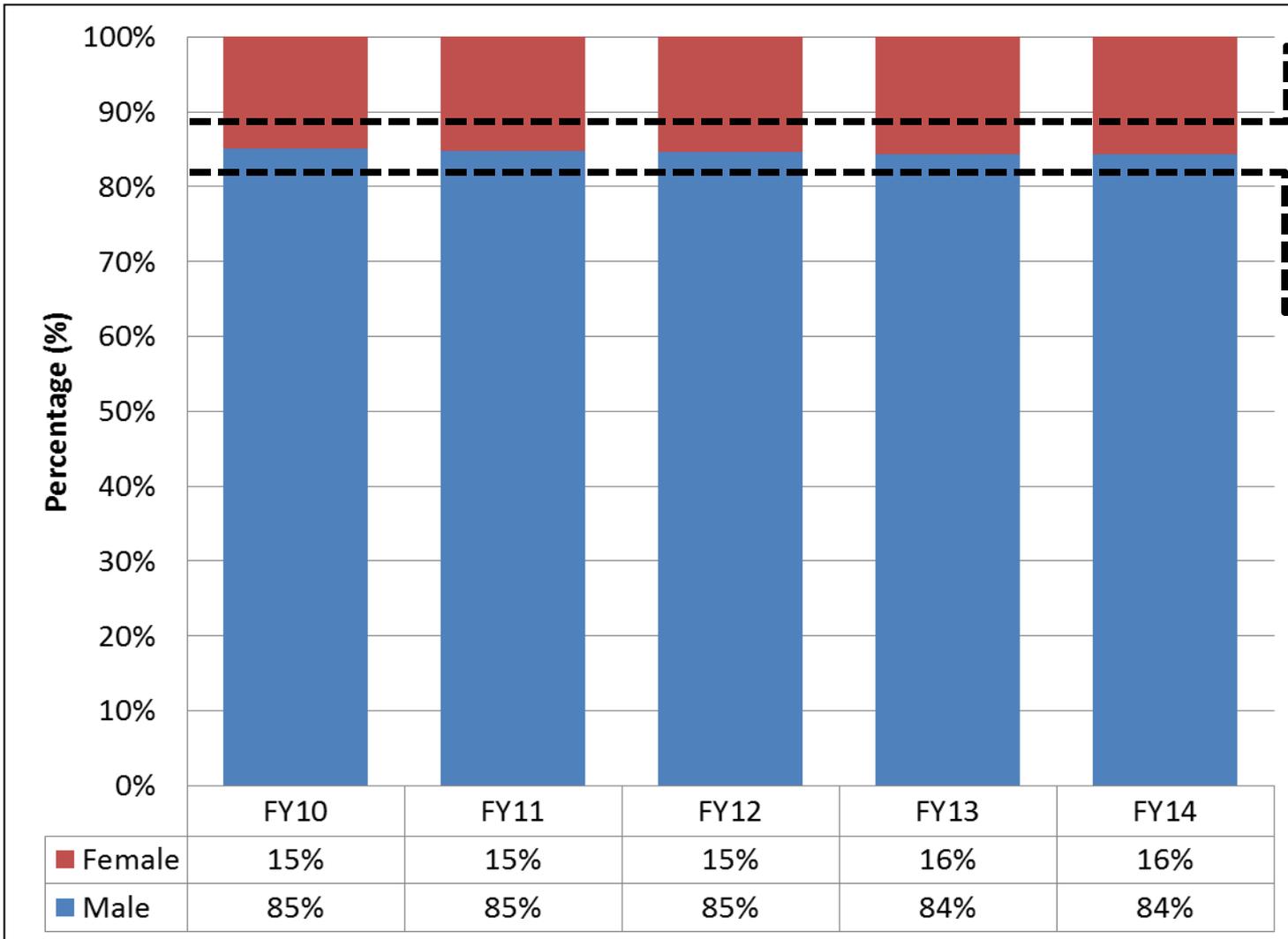
2010 US Engineering Civilian Workforce[2]
- 88% Male
- 12% Female

2012 US Engineering Degrees Obtained[3]
- 82.5% Male
- 17.5% Female

Data Sources:
1. USD(AT&L) Defense Acquisition Workforce Data Mart, 30 September 2014, excludes unknowns
2. U.S. Bureau of Labor and Statistics, http://www.bls.gov.
3. Barr, Valerie. "Women in STEM, Women in Computer Science: We're Looking At It Incorrectly." *Communications of the ACM*. 1 Dec. 2014. Web 9 Jan. 2015.

	FY10	FY11	FY12	FY13	FY14
■ Female	15%	15%	15%	16%	16%
■ Male	85%	85%	85%	84%	84%

ENG Career Field by Race FY10-14

	FY10	FY11	FY12	FY13	FY14
■ UNKNOWN	3.8%	3.7%	3.4%	3.3%	4.4%
■ PI	0.2%	0.2%	0.2%	0.3%	0.3%
■ AMI/AN	0.5%	0.5%	0.5%	0.5%	0.4%
■ MULTI	0.8%	0.9%	1.1%	1.3%	1.3%
■ BLACK	5.3%	5.4%	5.6%	5.8%	5.7%
■ ASIAN	10.2%	10.8%	10.8%	10.7%	10.6%
■ WHITE	79.2%	78.4%	78.4%	78.1%	77.2%
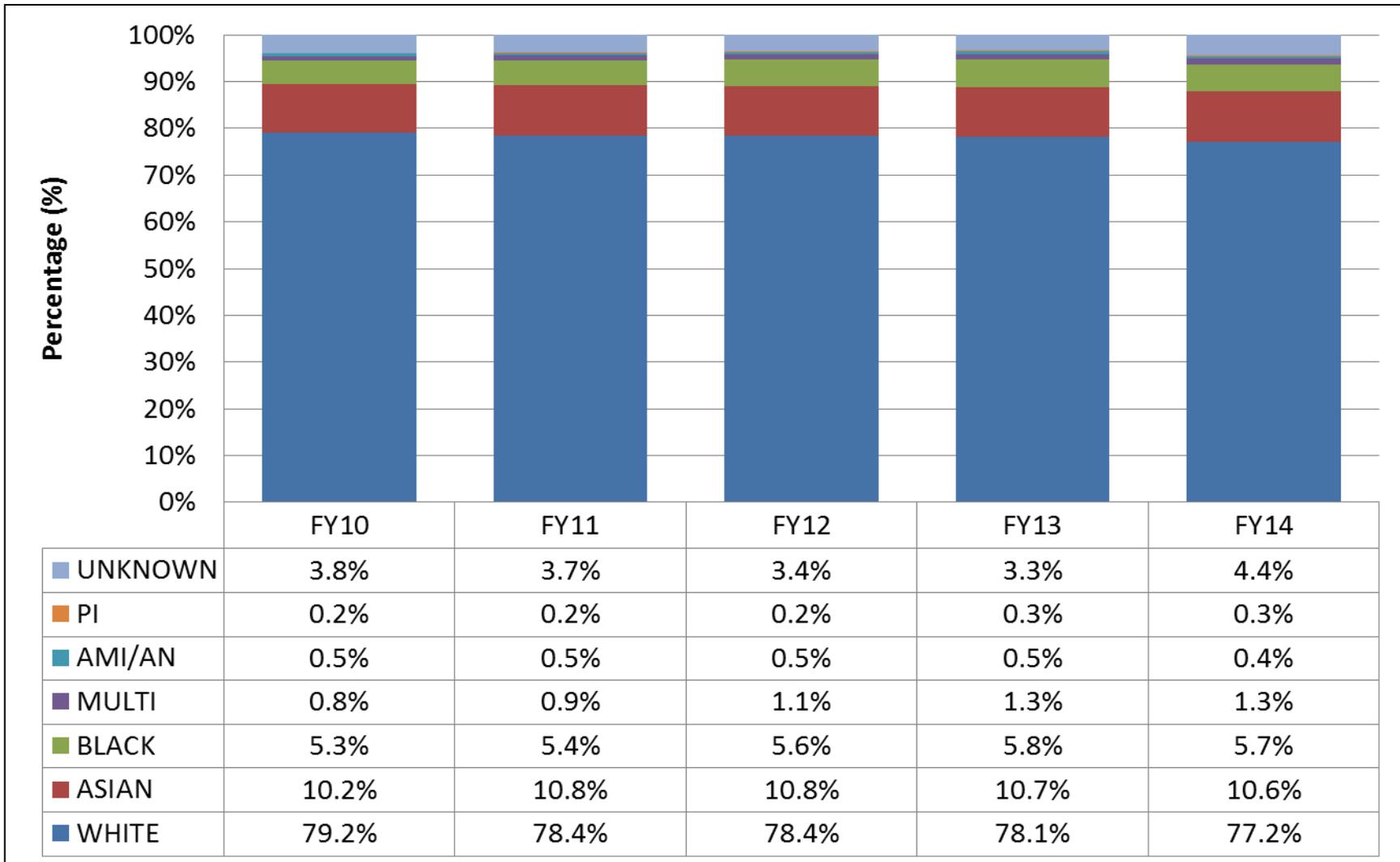
Data Source: USD(AT&L) Defense Acquisition Workforce Data Mart

Untapped Resources to Fill the Talent Pipeline

- **Women and minorities are untapped resources to help build the Nation's requisite engineering capability**
  - **84%** of the ENG Career Field engineers are men
  - Women make up ~**50%** of the country's college-educated workforce, but only make up **17.5%** of US engineering degrees obtained
  - African Americans, Hispanics, American Indians, and Alaska Natives accounted for only **~10%** of the ENG Career Field

Need to get our women and under served communities STEM interested, STEM college ready, and STEM educated

Engineering Workforce Trends

✓ **Recruiting/maintaining the talent pipeline**

✓ **Potential untapped resources**

• **Age Demographics – Generational Motivators**

Diminishing bathtub curve; this workforce is a very diverse age group with different motivators
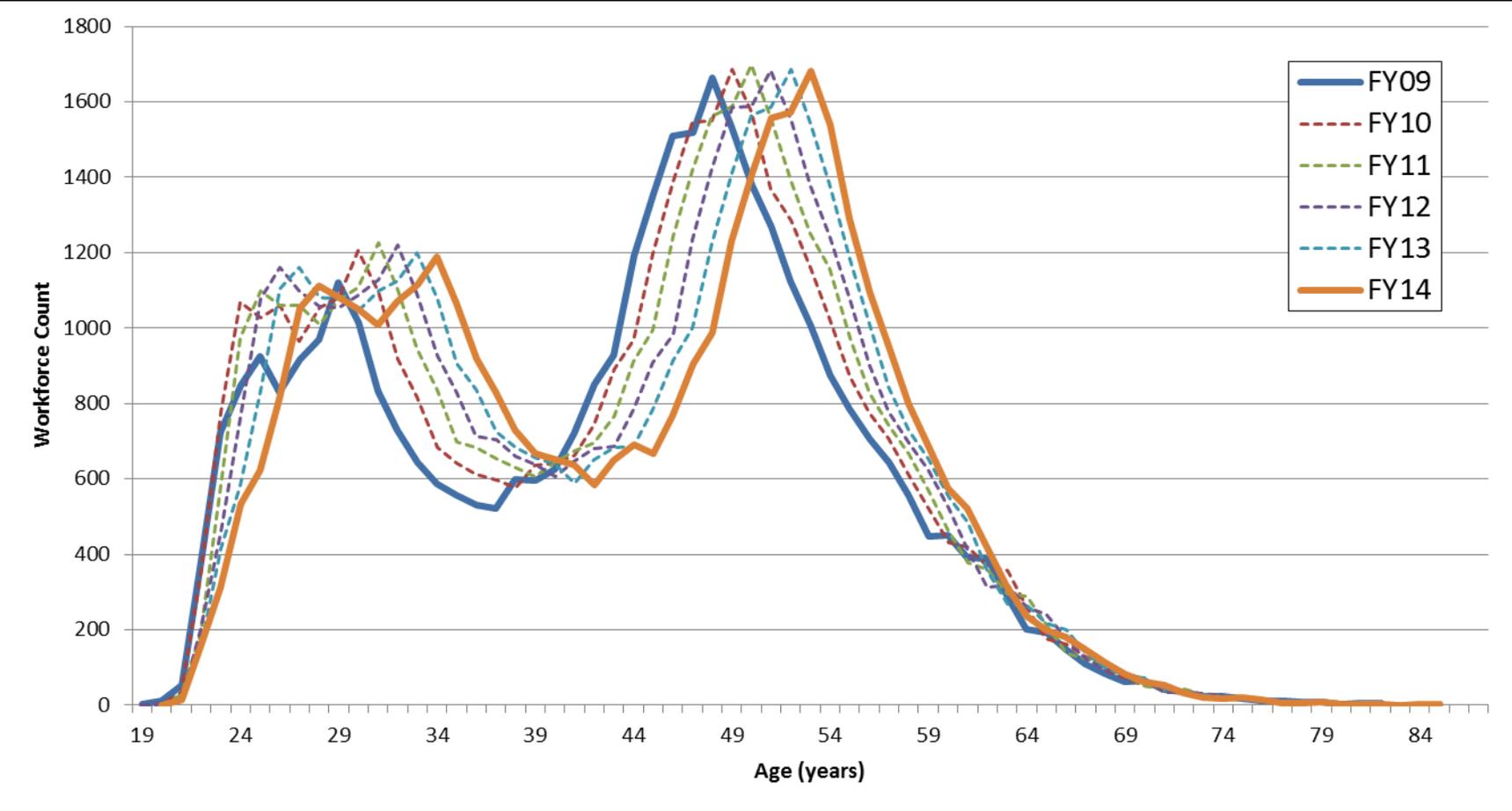
Data Source: USD(AT&L) Defense Acquisition Workforce Data Mart; excludes unknowns

Four Distinct Generations Across the Acquisition Engineering Workforce*

Source: AT&L Defense Acquisition Workforce DataMart, September 2014

Birth Year

*Excluded: 498 personnel with unknown Birth Year

Four Distinct Generations Across the Acquisition Engineering Workforce*

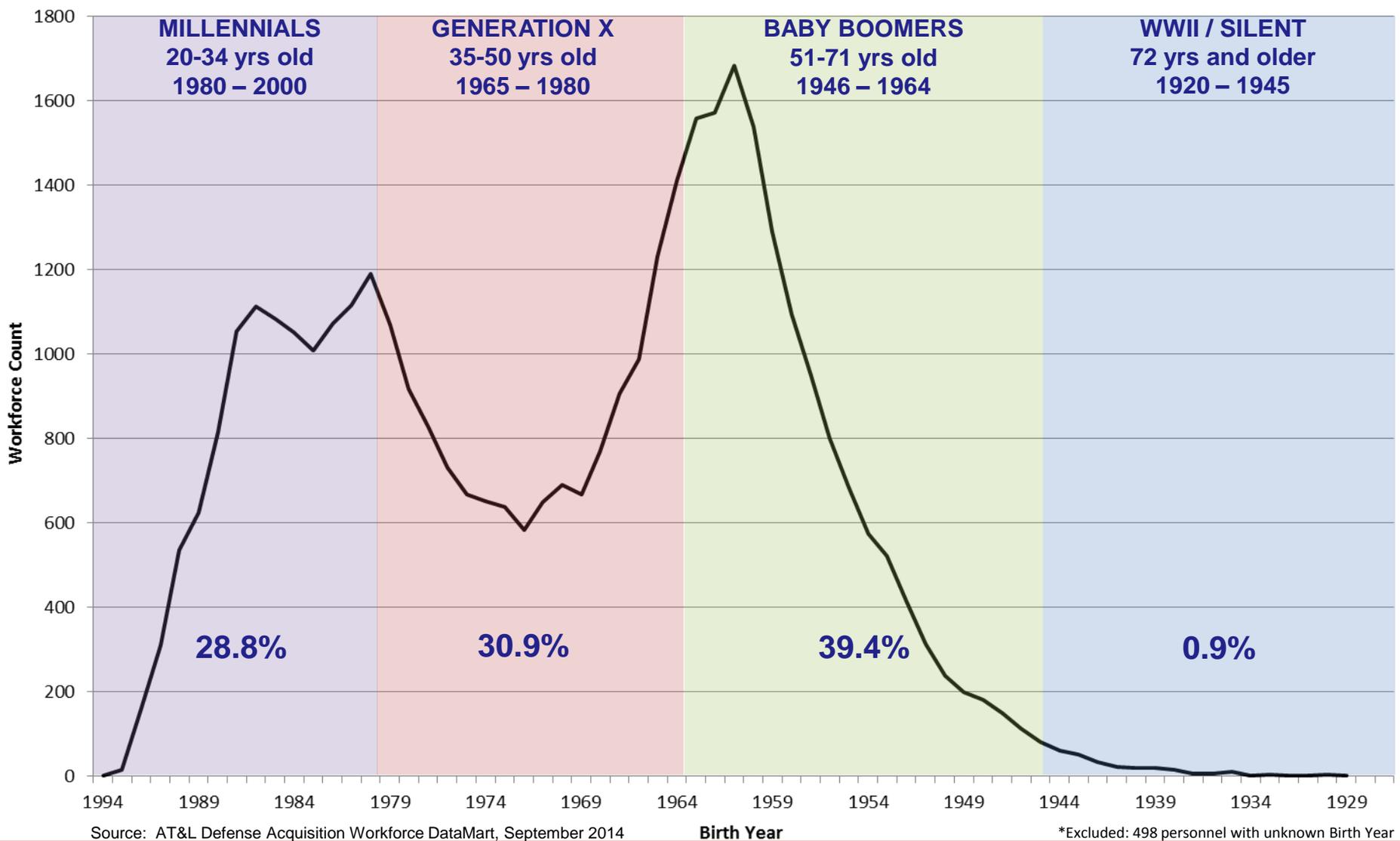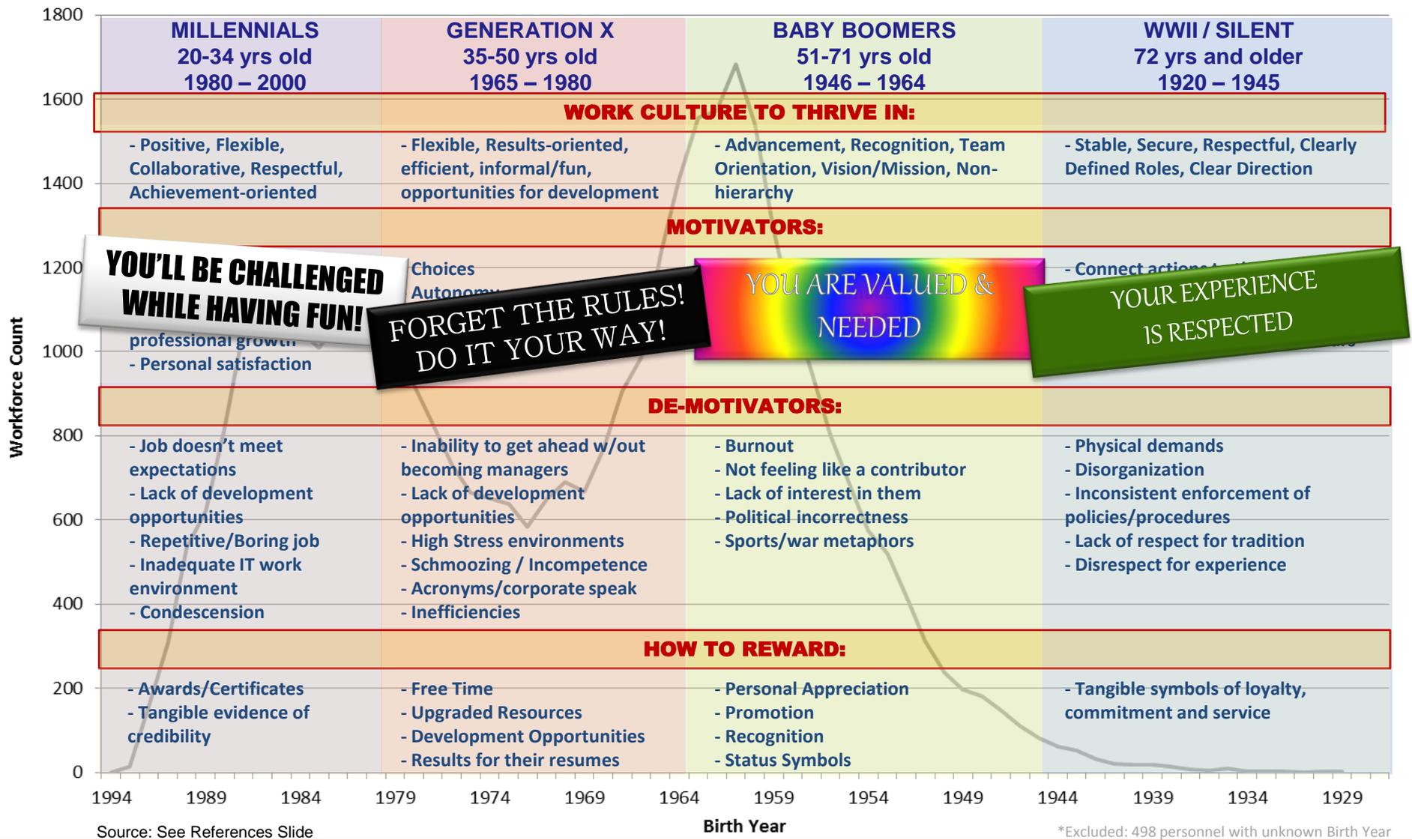| MILLENNIALS 20-34 yrs old 1980 – 2000	GENERATION X 35-50 yrs old 1965 – 1980	BABY BOOMERS 51-71 yrs old 1946 – 1964	WWII / SILENT 72 yrs and older 1920 – 1945
WORK CULTURE TO THRIVE IN:			
- Positive, Flexible, Collaborative, Respectful, Achievement-oriented	- Flexible, Results-oriented, efficient, informal/fun, opportunities for development	- Advancement, Recognition, Team Orientation, Vision/Mission, Non-hierarchy	- Stable, Secure, Respectful, Clearly Defined Roles, Clear Direction
MOTIVATORS:			
YOU'LL BE CHALLENGED WHILE HAVING FUN! — Choices, Autonomy, professional growth, - Personal satisfaction	FORGET THE RULES! DO IT YOUR WAY!	YOU ARE VALUED & NEEDED	- Connect action ... YOUR EXPERIENCE IS RESPECTED
DE-MOTIVATORS:			
- Job doesn't meet expectations - Lack of development opportunities - Repetitive/Boring job - Inadequate IT work environment - Condescension	- Inability to get ahead w/out becoming managers - Lack of development opportunities - High Stress environments - Schmoozing / Incompetence - Acronyms/corporate speak - Inefficiencies	- Burnout - Not feeling like a contributor - Lack of interest in them - Political incorrectness - Sports/war metaphors	- Physical demands - Disorganization - Inconsistent enforcement of policies/procedures - Lack of respect for tradition - Disrespect for experience
HOW TO REWARD:			
- Awards/Certificates - Tangible evidence of credibility	- Free Time - Upgraded Resources - Development Opportunities - Results for their resumes	- Personal Appreciation - Promotion - Recognition - Status Symbols	- Tangible symbols of loyalty, commitment and service

Chart axes: Workforce Count (0 to 1800, vertical) vs Birth Year (1994 to 1929, horizontal)

Source: See References Slide

*Excluded: 498 personnel with unknown Birth Year

Factors Important to All Four Generations

- **A University of Minnesota research study revealed that several themes are important to all four generations: Flexibility, Values, and Happiness at Work**
  - All four rated <u>freedom to set own hours</u> as long as the work gets done as the highest importance regarding flexibility
- **The study also showed that all four Generations share the same top three values: Family, Integrity, and Love**
  - Family was #1 for all four
  - Integrity was #2 for Baby Boomers and Silent
  - Love was #2 for Millennials & Gen X
- **All four generations rated "feeling valued" as the top reason for workplace happiness**

Source: Research and Training Center on Community Living, University of Minnesota, August 16, 2008

Initiatives to Address Workforce Trends

Current Initiatives to Address Workforce Trends

- ## Better Buying Power 3.0 Initiatives

  - *Increase DoD support for STEM education*: Develop the DoD engineering talent pipeline

  - *Strengthen organic engineering capabilities*: Understand the technical skills required to meet the need

- ## Acquiring objective trend data to understand the needs and gaps of the workforce (utilizing both existing and new data sources)

  - DoD FY2016-2021 Strategic Workforce Planning: Environmental Scan

  - Engineering and Production, Quality, and Manufacturing Career Field FIPTs

Future Initiatives

- **Improving the Technical Edge**
  - Understanding the skill set needs of the future
  - Tailoring education and training to fill gaps
  - Motivating the workforce to stay

- **Force of the Future**
  - Hiring authorities
  - Recruitment initiatives
  - Pay flexibility
  - Development/retention

Conclusions

- **Additional data is needed in order to have informed, actionable, and strategic plans for the engineering workforce**

- **Specifically, we need to dig deeper into the trends/data to gain a better understanding and to potentially determine the root cause**

- **There is an opportunity to compare the ENG workforce trends/data with Industry data and discuss effective recruitment/retentions strategies**

Systems Engineering:
Critical to Defense Acquisition

Defense Innovation Marketplace
http://www.defenseinnovationmarketplace.mil

DASD, Systems Engineering
http://www.acq.osd.mil/se

For Additional Information

Aileen Sedmak

ODASD, Systems Engineering

703-695-6364 | aileen.g.sedmak.civ@mail.mil

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