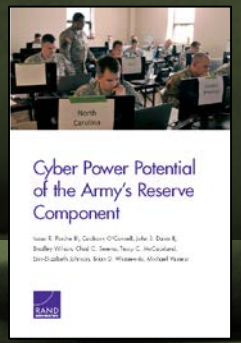
CYBERSPACE WORKFORCE SKILLS IN THE U.S. ARMY RESERVE AND ARMY NATIONAL GUARD

Isaac R. Porche, Ph.D.
October 25, 2017



https://www.rand.org/pubs/research_reports/RR1490.html

Photo by Capt. Tod Key/U.S. Army

Additional Contributions to the Project Provided By:

- Caolionn O'Connell and Tina Panis - CEI Database Analysis
- John S. Davis, II - NSA Cyber Tasks Analysis
- Bradley Wilson - LinkedIn Analysis on Cyber Skills
- Chad C. Serena - Role of the Reserves
- Tracy C. McCausland and Susan Strauss - Survey and HSPC
- Erin-Elizabeth Johnson - Communications Analyst
- Brian D. Wisniewski - Role of the Reserves
- Michael Vasseur - CISCO Analysis
- Kristin Van Able - Visualization of Survey Response
- Pete Schirmer - Project Concepts
- Management - Mike Hansen, Brian Hallmark, Shanthi Nataraj, Michael Linick

What does the Army Cyberspace Workforce do?

- Builds, secures, operates, defends, and protects DoD and U.S. cyberspace resources
- Conducts related intelligence activities
- Enables future operations
- Projects power in or through cyberspace
- Is assigned to the areas of cyberspace effects, cybersecurity, cyberspace IT, and portions of the intelligence workforces

REFERENCE(S): 1.

Bottom Line Up Front

- Objective:
  - The Army asked the Arroyo Center to inventory the cyber skills resident in the reserve component
- Method:
  - The cornerstone of the study is analysis of data from the Civilian Employment Inventory (CEI) database
- Conclusions:
  - The Army will likely need more personnel with Cyberspace Workforce skills than it has now, both in the Active and Reserve components, based on growing demands
  - Many guard and reserve soldiers work in civilian jobs and have skills the Army needs for its Cyberspace Workforce
  - We estimate that over 100,000 reserve component personnel have some competence in skills relevant to the Cyberspace Workforce
  - Using the extrapolated data, we calculate the untapped potential in the guard and reserve as over 11,000 personnel

Preview of findings, observations, and recommendations

DEMAND
for cyber security personnel continues to grow in all sectors

THE CEI DATABASE
provides useful information toward gauging the number of guard and reserve soldiers with cyber skills

CIVILIAN-TRAINED CYBER EXPERTISE
exists and is used in the guard and reserve; tens of thousands of personnel have some cyber expertise

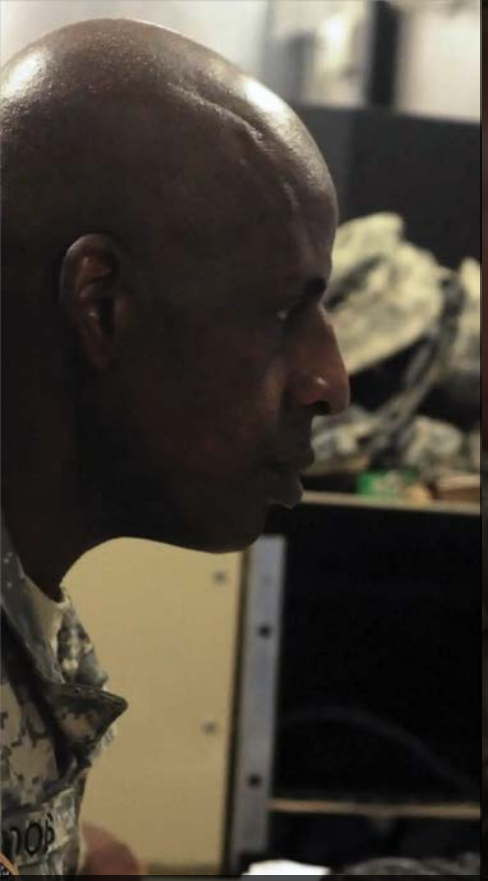
CONTINUOUS PRACTICE
is required to retain cyber proficiency

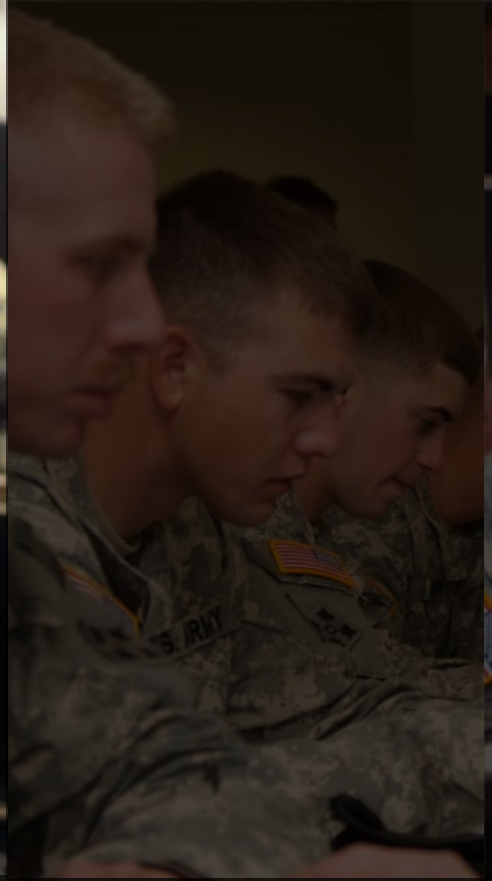
GROWTH IN DEMAND

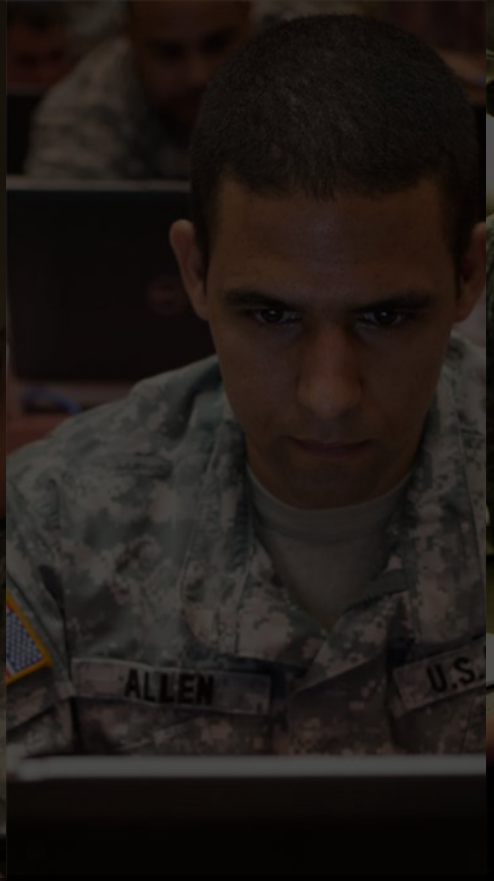
SOLDIER SKILLS

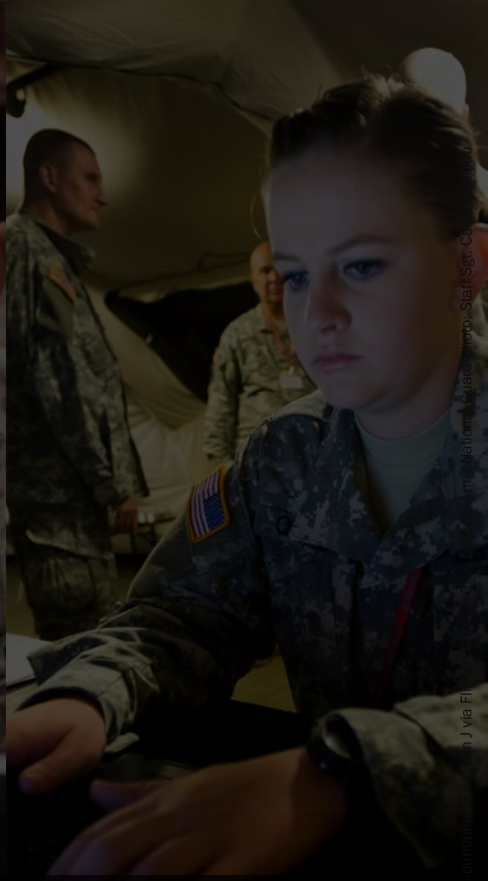
TRAINING AND ASSIGNMENTS

CONCLUSIONS, NEXT STEPS









GROWTH IN DEMAND

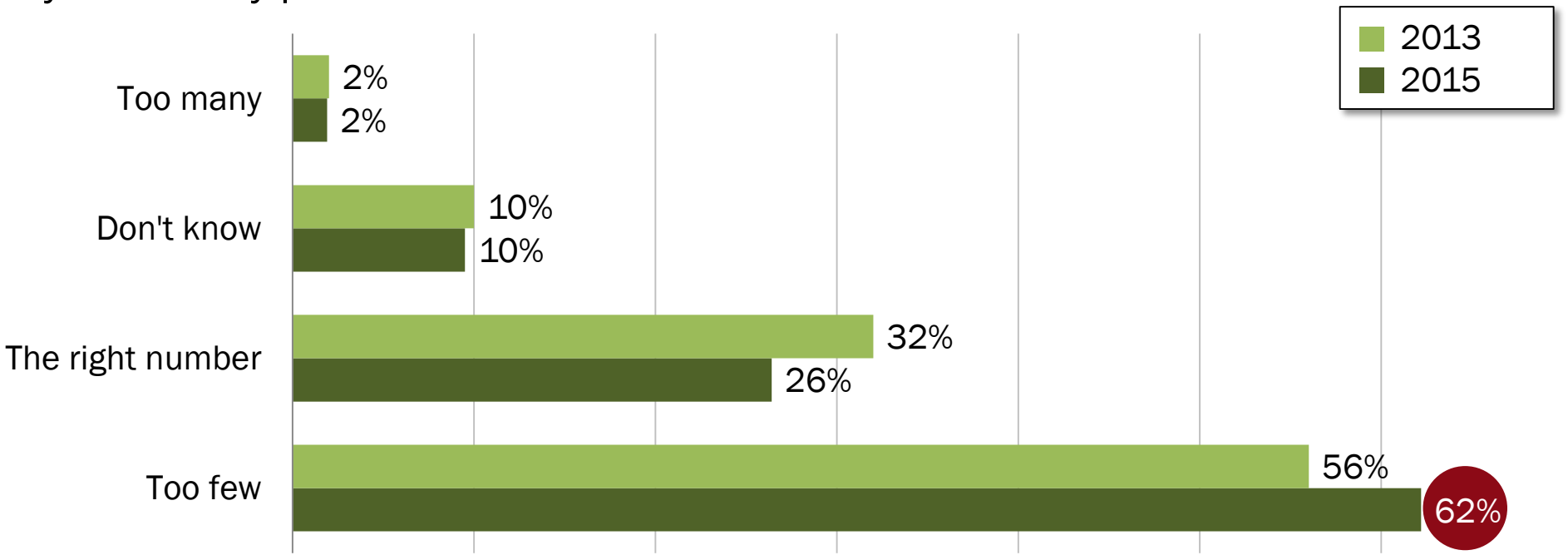
SOLDIER SKILLS

TRAINING AND ASSIGNMENTS

CONCLUSIONS, NEXT STEPS

Multiple studies indicate high demand for cybersecurity personnel among companies in the United States

Q: Does your organization have too many, too few, or the right number of cybersecurity professionals?

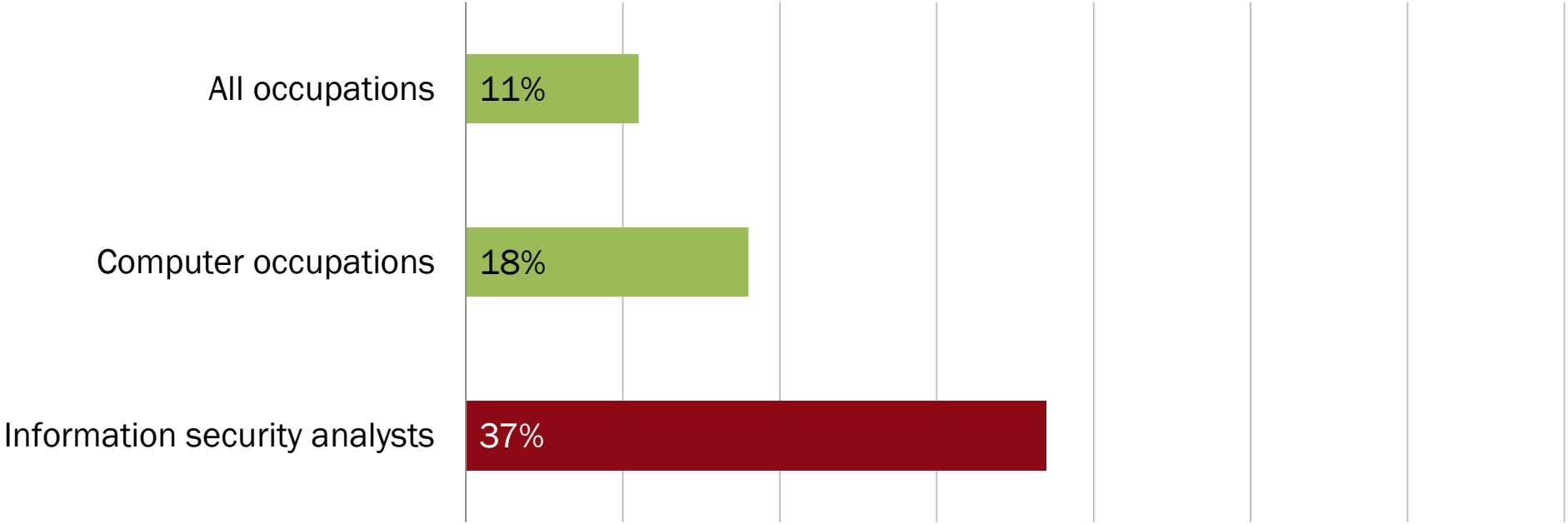


Michael Suby, *The 2013 (ISC)² Global Information Security Workforce Study,* Mountain View, Calif.: Frost & Sullivan, 2013.

Michael Suby and Frank Dickson, *The 2015 (ISC)² Global Information Security Workforce Study*, Mountain View, Calif.: Frost & Sullivan, 2015.

The demand for information security analysts is projected to increase

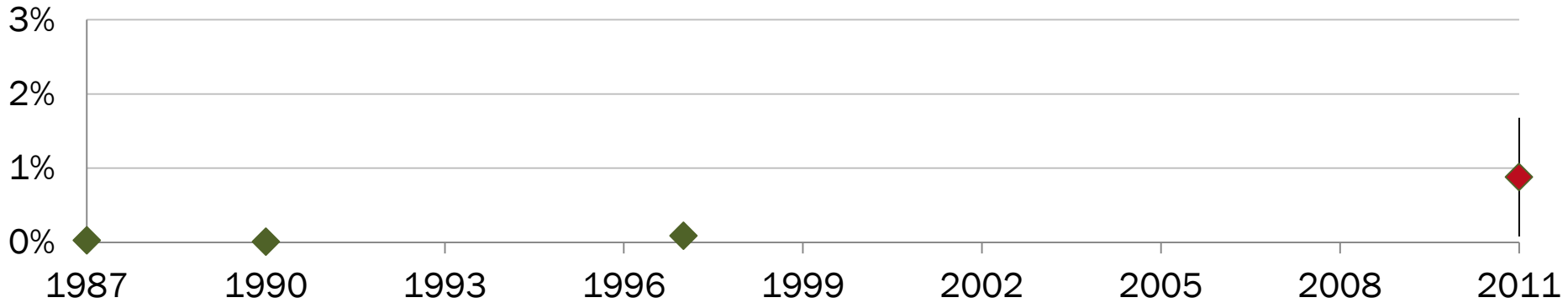
Q: What is the projected demand for information security analysts between 2012 and 2022?



U.S. Bureau of Labor Statistics, “Employment Projections,” web site, undated. As of September 3, 2015: http://www.bls.gov/emp/

Information needs vary by sector across U.S. companies, but the overall trend is upward

Q: On average, what percentage of staff are information security personnel?

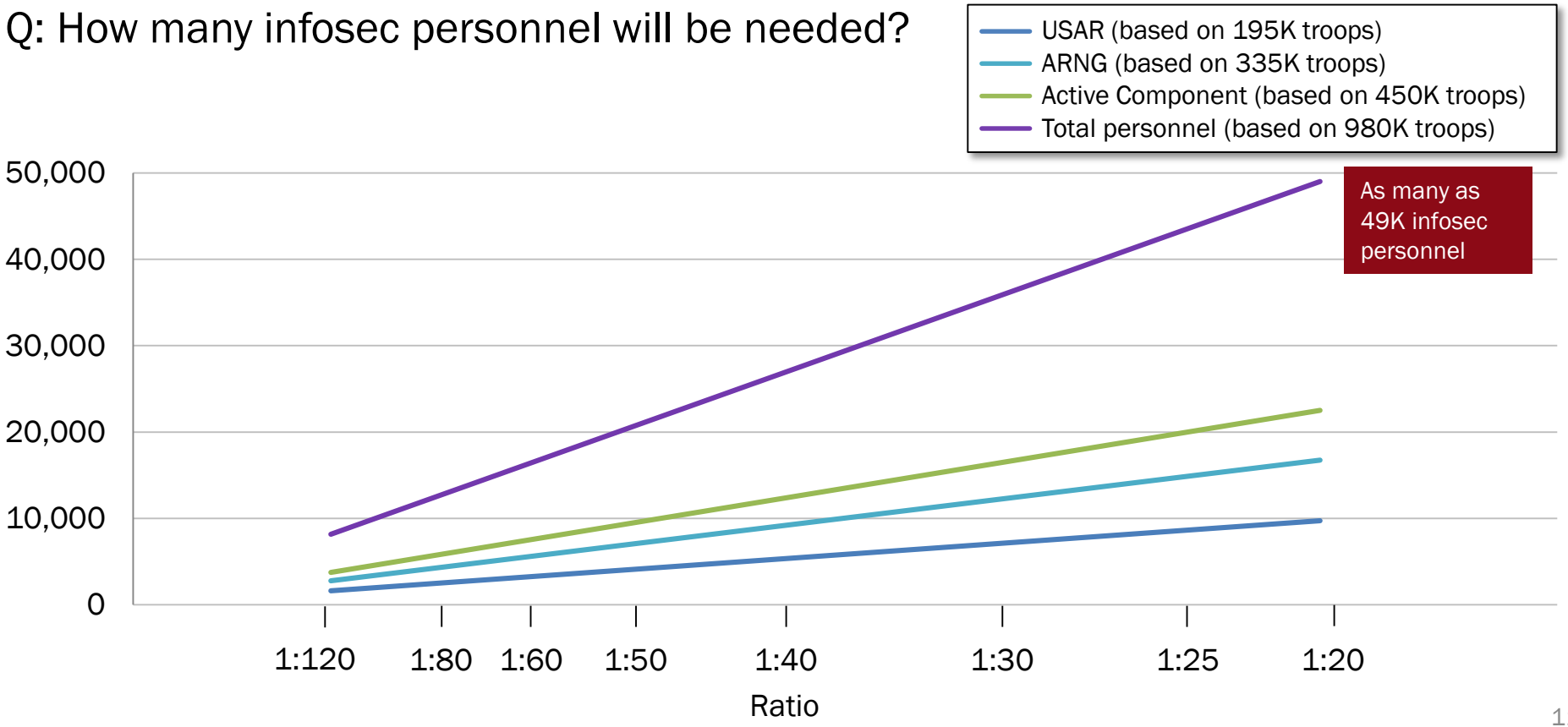


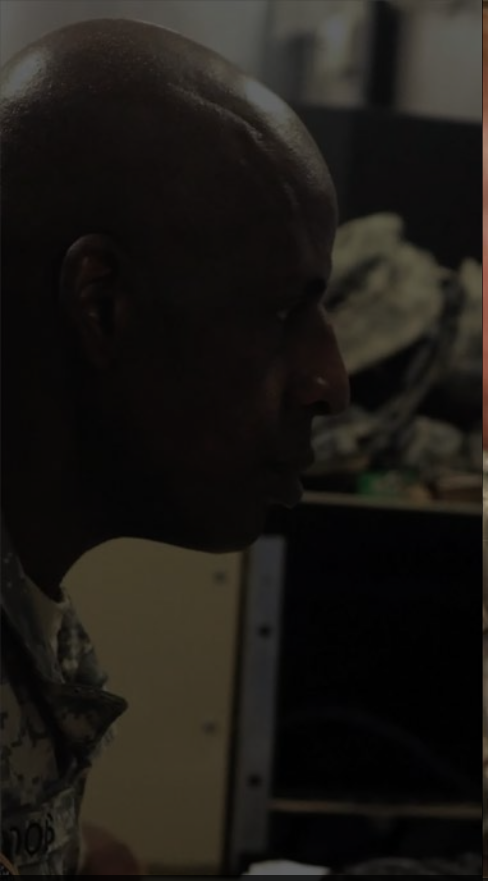
	1987	1990	1997	2011
Low	0.03%	0.01%	0.02%	0.08%
High	0.03%	0.01%	0.16%	1.68%
Average	0.03%	0.01%	0.09%	0.88%

Harold F. Tipton and Micki Krause, Information Security Management Handbook, 6th Edition, Boca Raton, Fl.: Auerbach Publications, 2007.
Lawrence A. Gordon, Martin P. Loen, William Lucyshyn, and Robert Richardson, *CSI/FBI Computer Crime and Security Survey*, Computer Security Institute, 2006.
Charles Cresson Wood, *Information Security and Data Privacy Staffing Levels: Benchmarking the Information Security Function*, Houston, Tex.: Information Shield, 2012.

Based on 2021 Army end-strength estimates and the acceptable ratios, we calculated the demand for infosec personnel

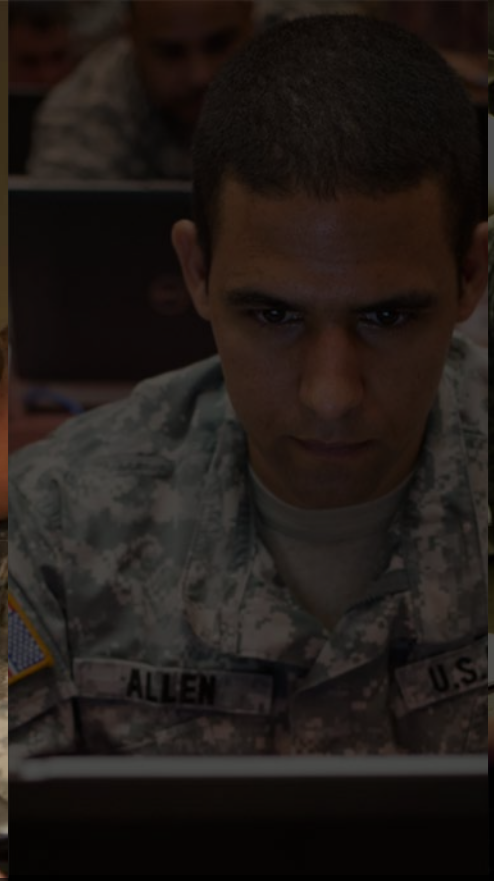
Q: How many infosec personnel will be needed?



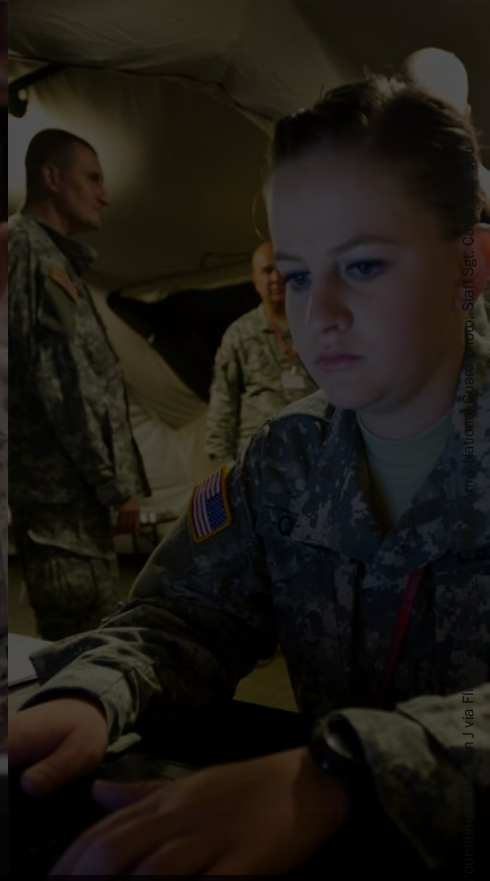


GROWTH IN DEMAND

SOLDIER SKILLS



TRAINING AND ASSIGNMENTS

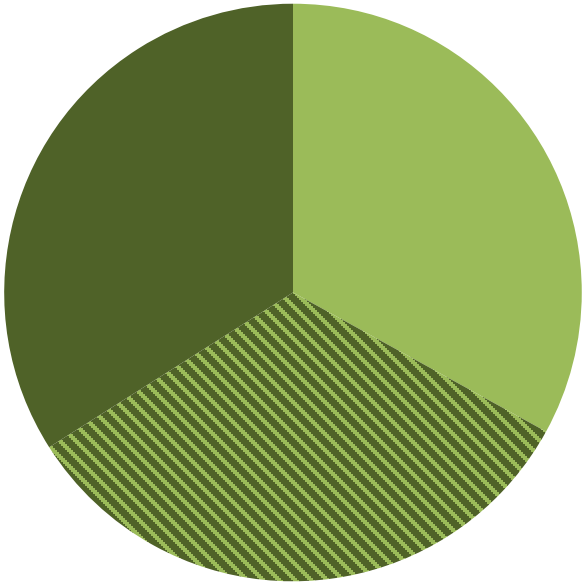


CONCLUSIONS, NEXT STEPS

The guard and reserve may have untapped potential

Q: Where do staff use cyber skills relevant to the Cyberspace Workforce?

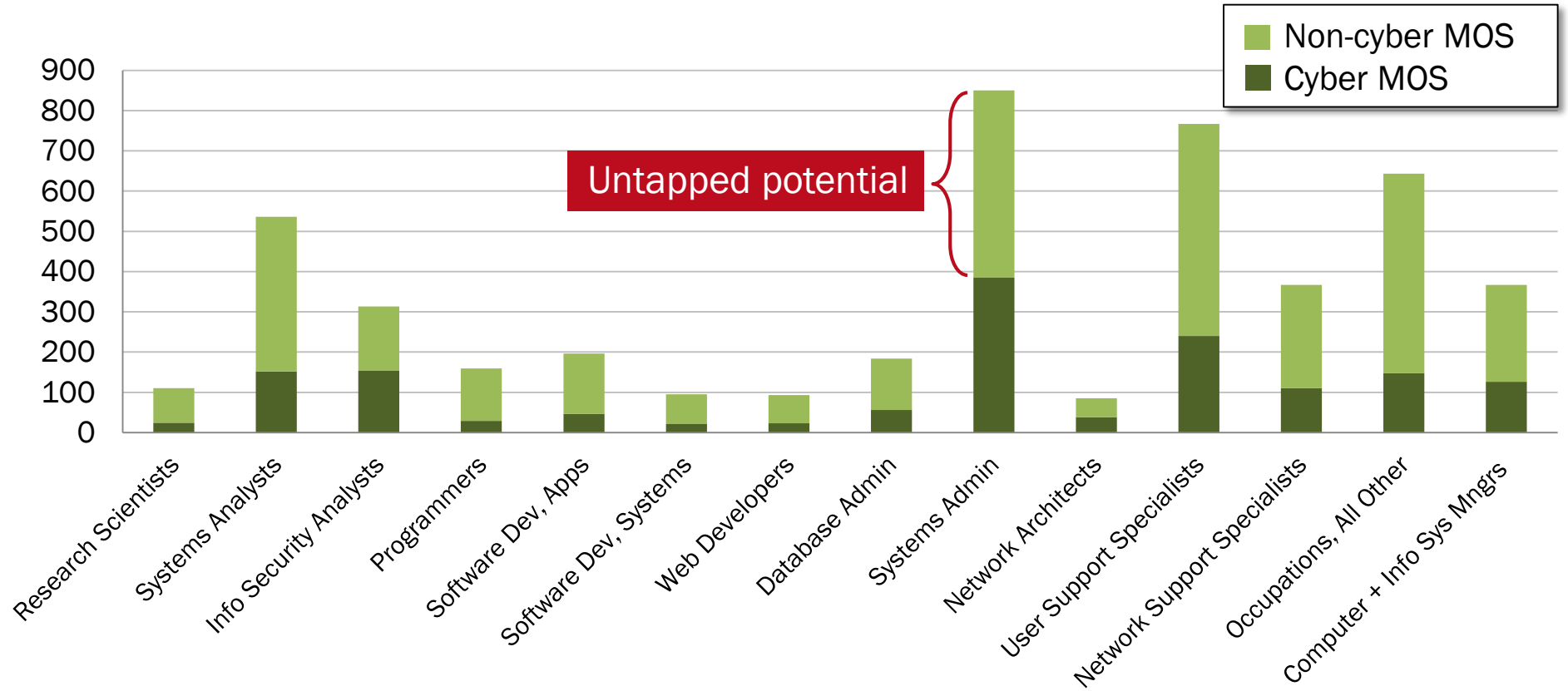
MILITARY ONLY
Possible preparedness issues?



CIVILIAN ONLY
Is this untapped potential?

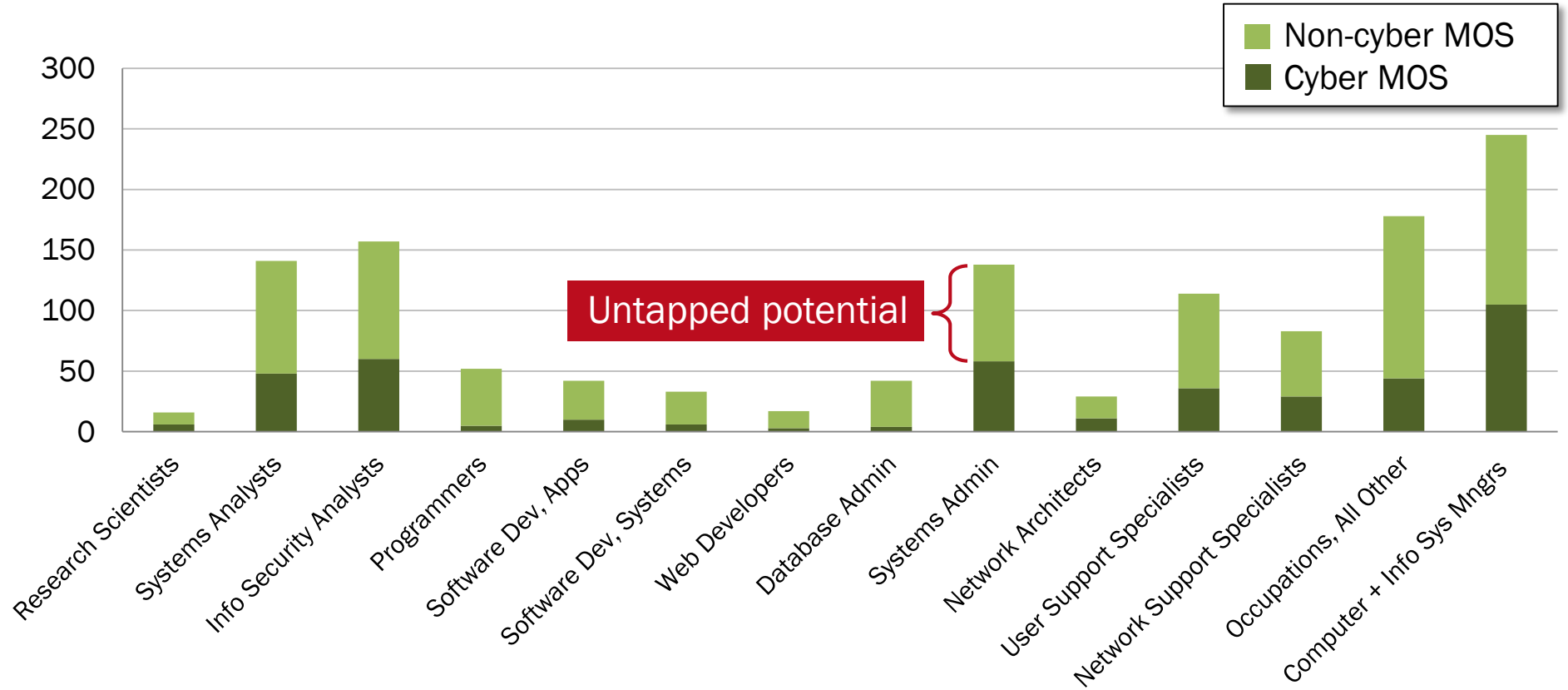
MILITARY AND CIVILIAN
Deep expertise, highly trained

Looking at the number of ARNG civilian professionals by MOS reveals untapped potential



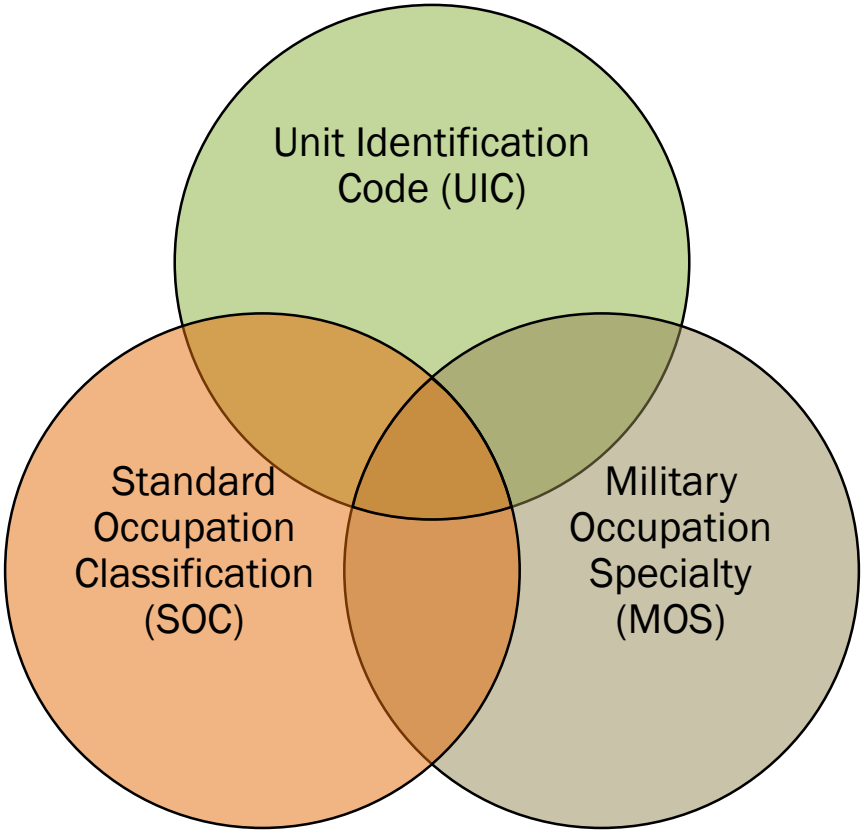
Data analysis from the CEI database

Similarly, looking at the number of USAR civilian professionals by MOS reveals untapped potential

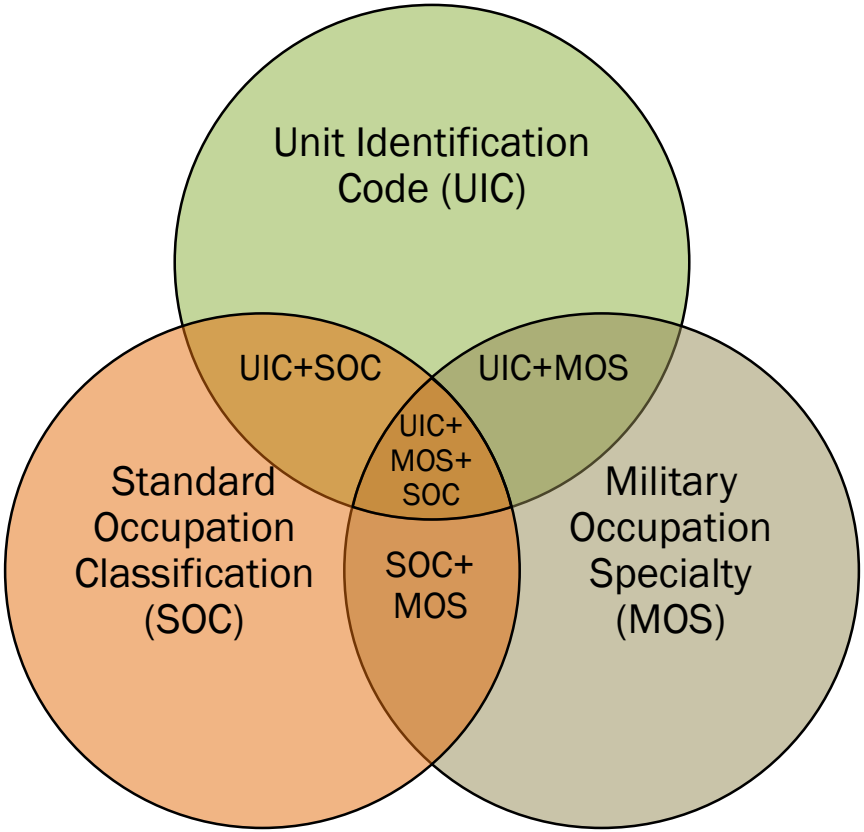


Data analysis from the CEI database

A broader look at identifying cyber expertise



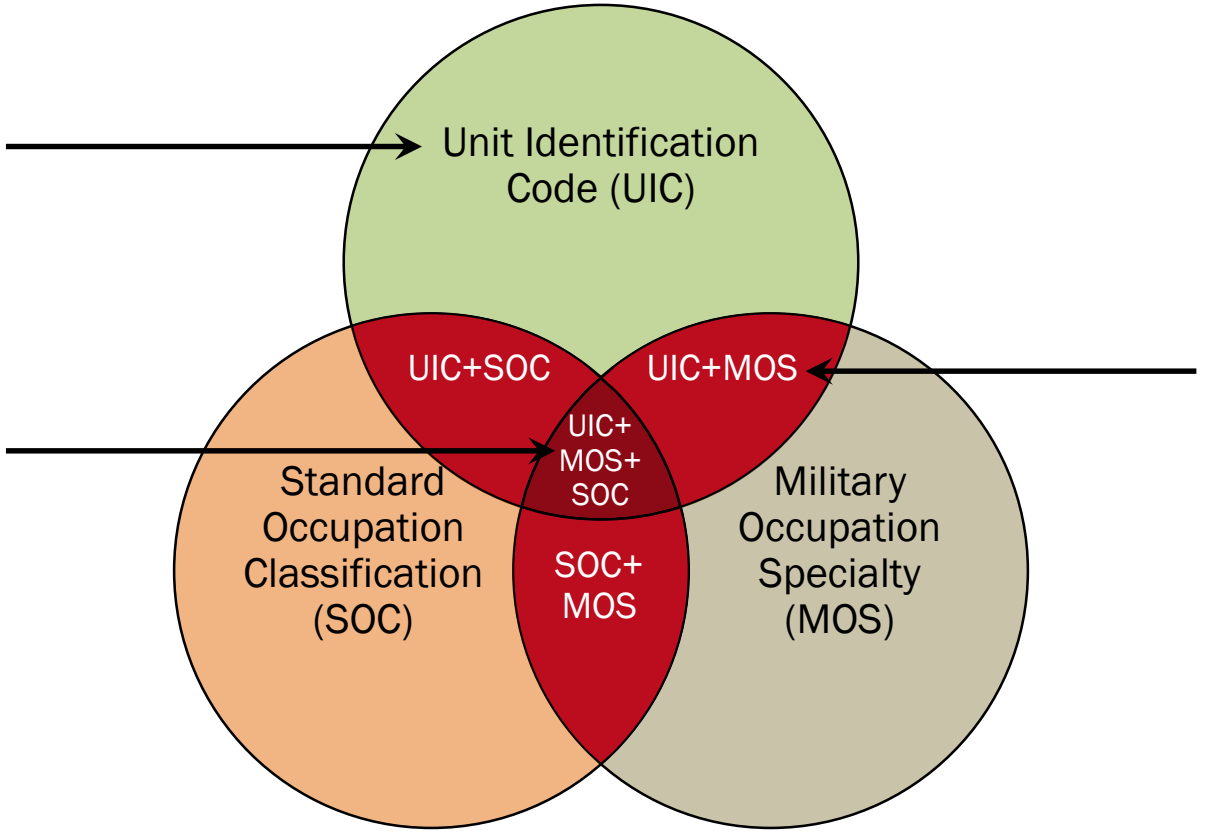
A broader look at identifying cyber expertise



Level of cyberspace operations expertise, by wedge

Outer wedges: **PARTIAL** cyberspace operations expertise

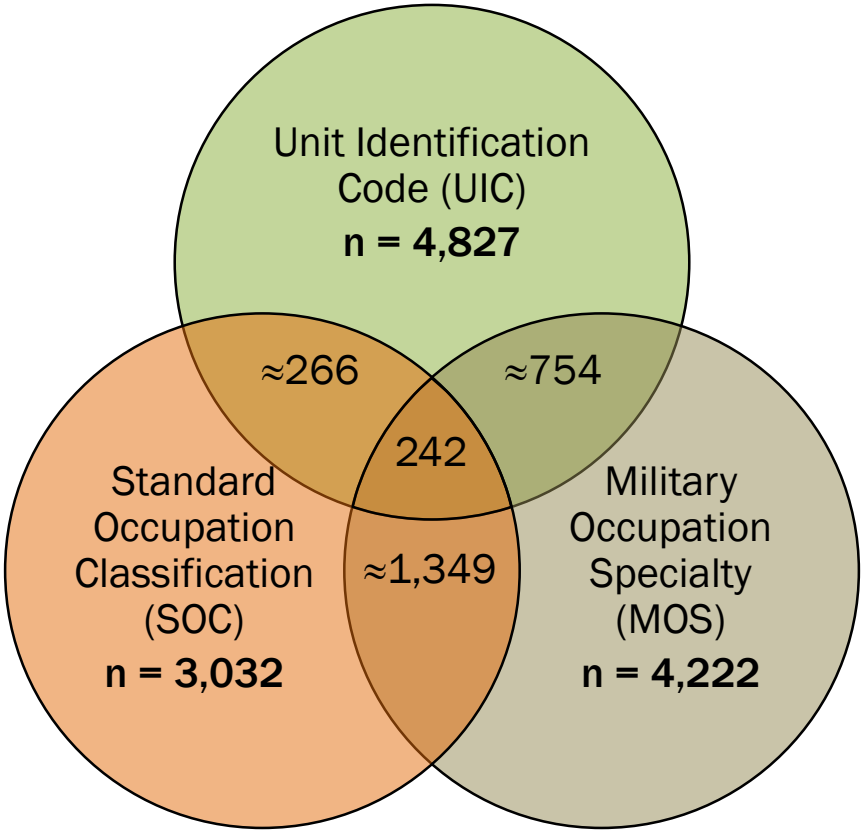
Center wedge: **DEEP** cyberspace operations expertise



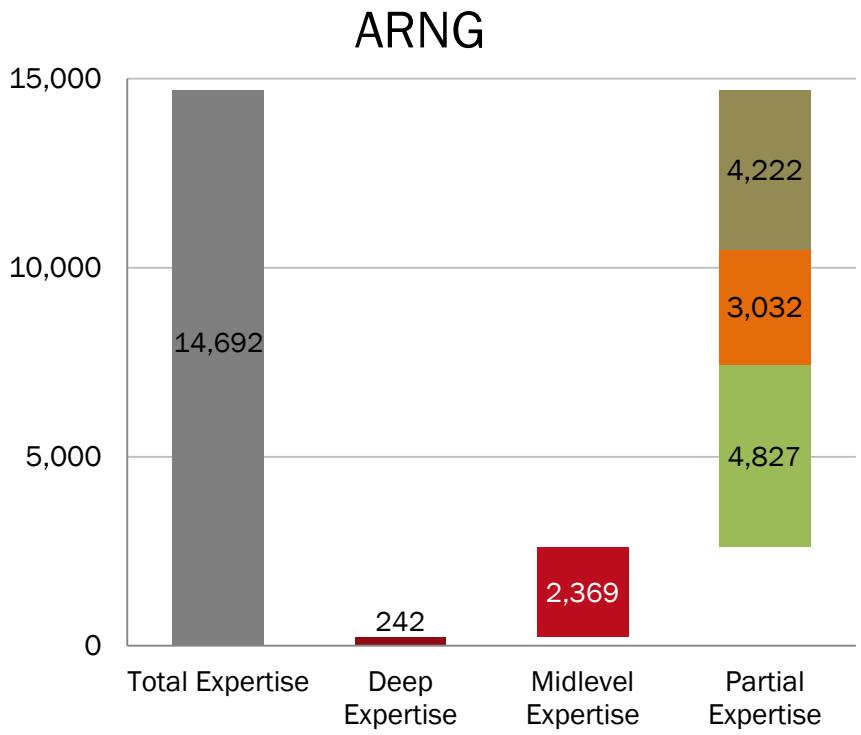
Middle wedges: MIDLEVEL cyberspace operations expertise

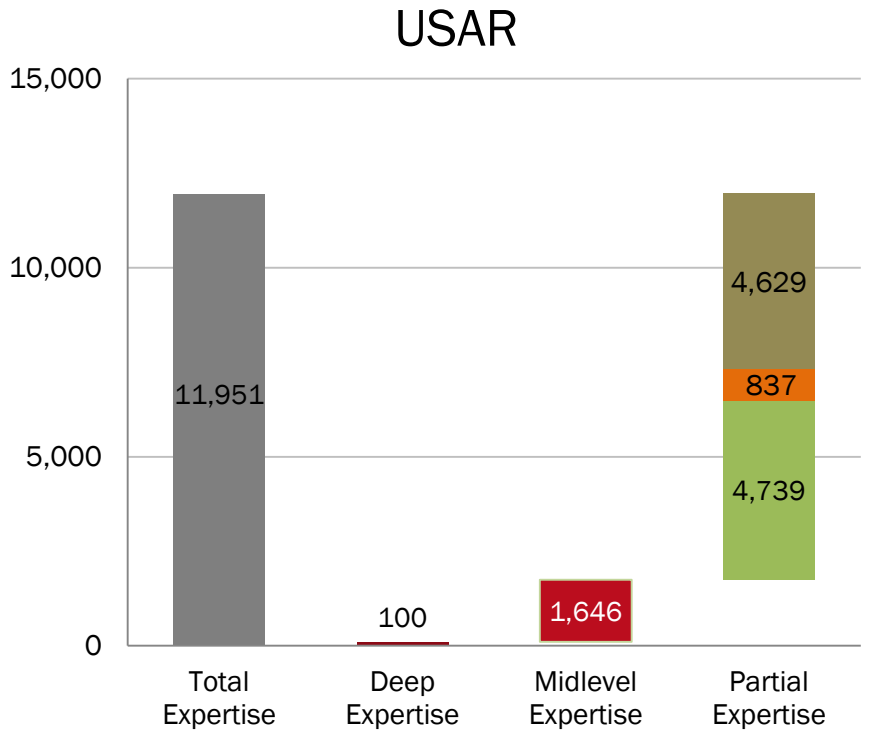
ARNG: Analysis of entries from the CEI database

Is this untapped potential?



At least 32,000 ARNG and USAR personnel have some competence in skills relevant to the Cyberspace Workforce





MOC+UIC+SOC | (UIC+SOC)+(MOS+SOC)+(MOS+UIC) | UIC only | SOC only | MOS only

draft

Extrapolation to the total guard and reserve shows up to an estimated 105,179 personnel have some competence in skills relevant to the Cyberspace Workforce

	CEI Number	Sum of Estimates for ARNG+USAR	
		Lower Bound	Upper Bound
Partial cyber expertise	27,629	86,347	89,169
Midlevel cyber expertise	4,406	14,201	15,541
Deep cyber expertise	259	890	1,251
Any (sum of partial, midlevel, deep)	32,294	102,221	105,179
N (Total)	226,220	550,000	

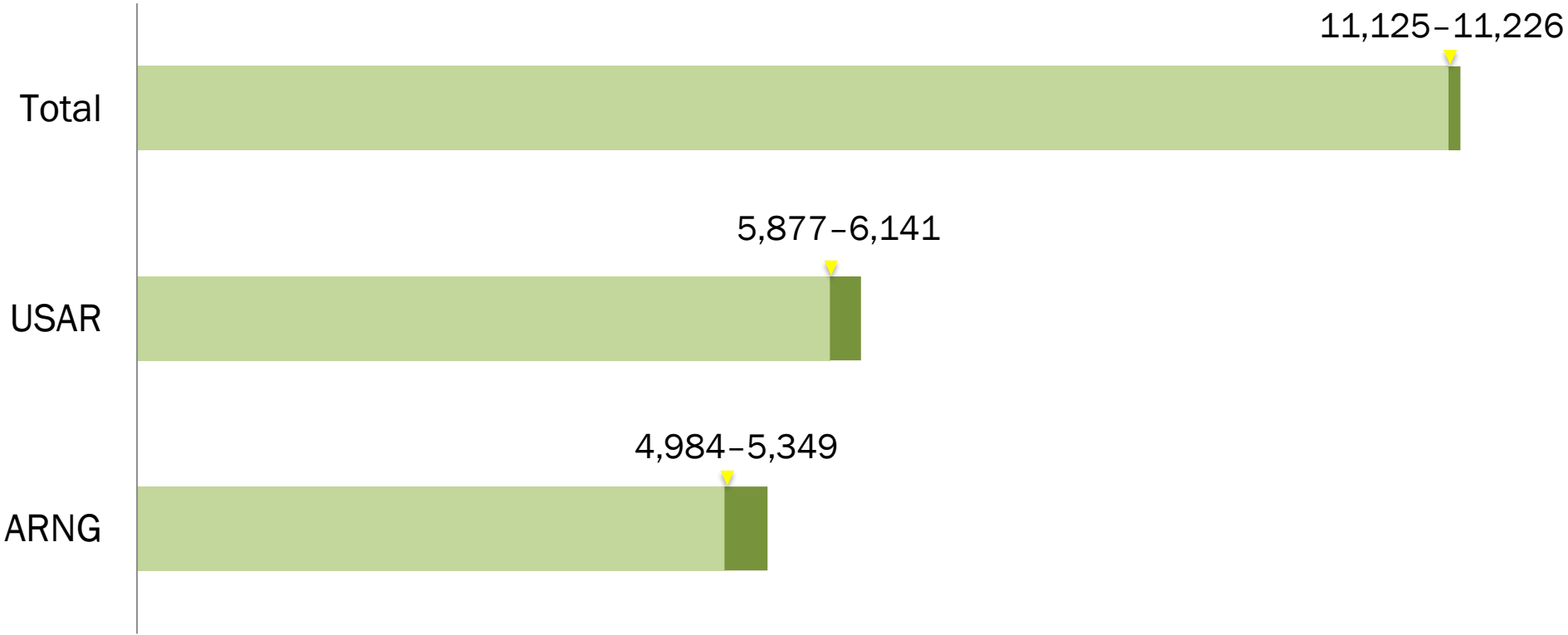
This projected supply represents potential to meet the projected demand for cyber expertise

Q: What is the projected (potential) supply from the RC?

	Low Estimate	High Estimate
Deep expertise	890	1,251
Midlevel expertise	14,201	15,514
Partial expertise	86,347	89,169

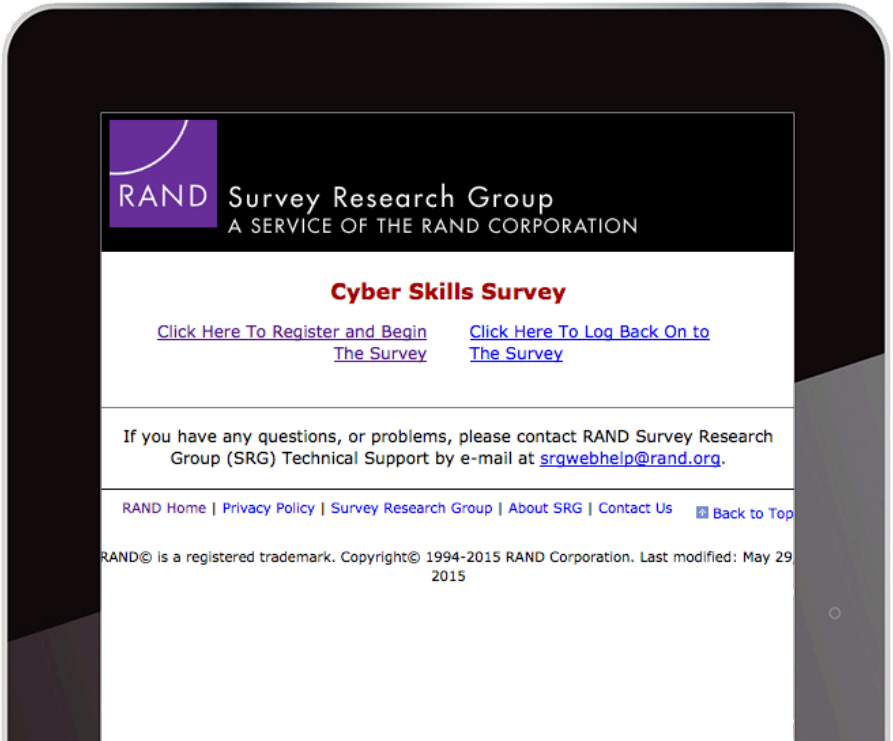
Potential future demand for the total Army: 49,000

Using the extrapolated data, we calculate the untapped potential in the guard and reserve at as many as 11,226 personnel

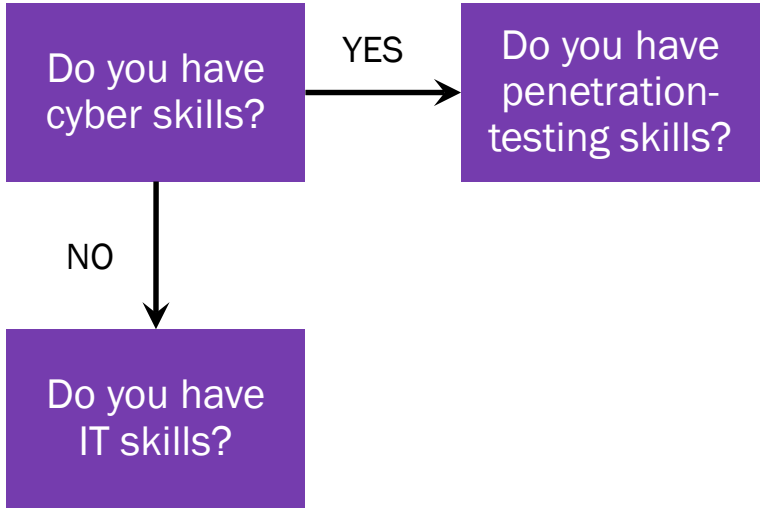


We surveyed select guard and reserve soldiers to identify specific skills that exist in the component

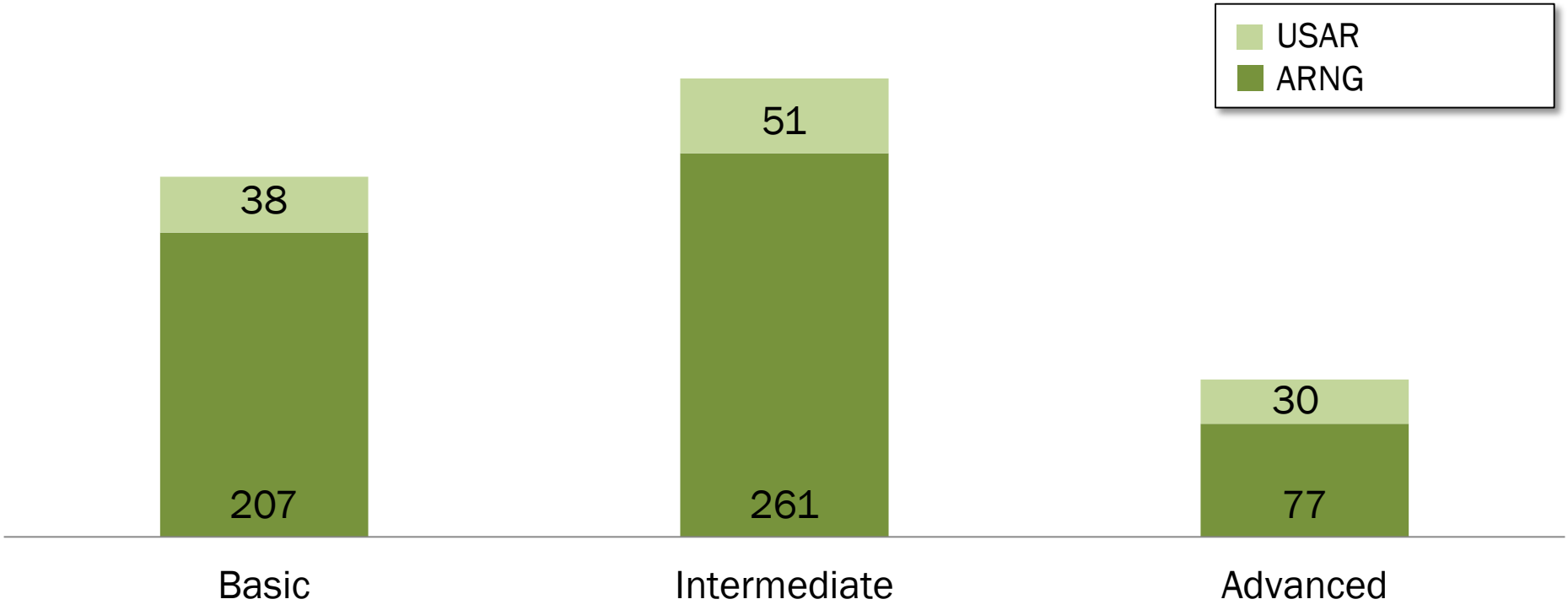
https://www.randsurvey.org/skills/



Sample questions



Respondents indicated varying levels of cyber expertise



NOTE: There were 668 respondents who reported having cyber expertise, but one respondent did not provide a level of expertise.

GROWTH IN DEMAND

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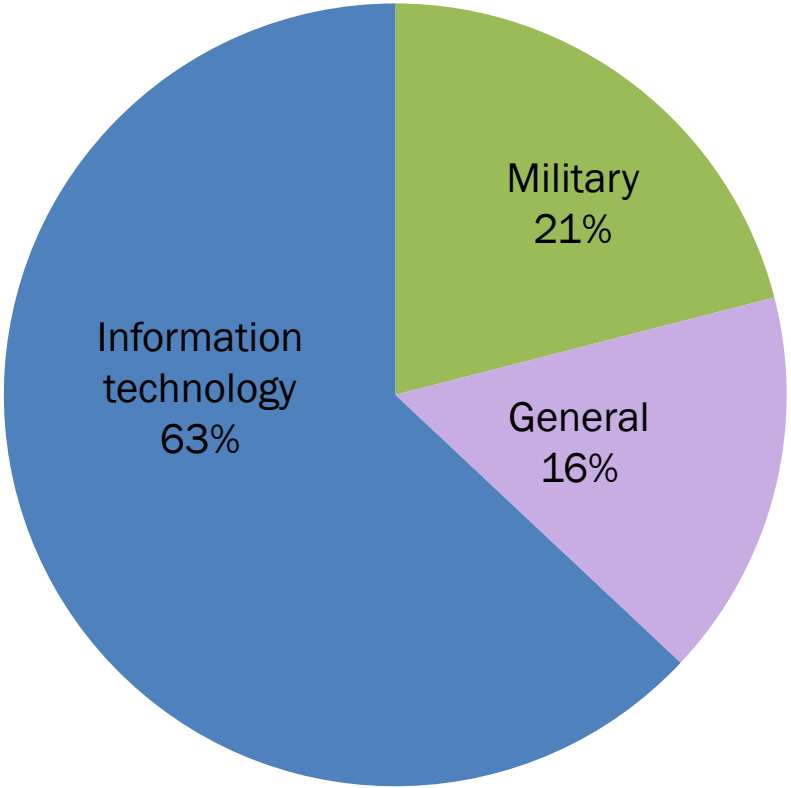
CONCLUSIONS, NEXT STEPS

We found that only one-fifth of all cyber job KSAs are inherently military

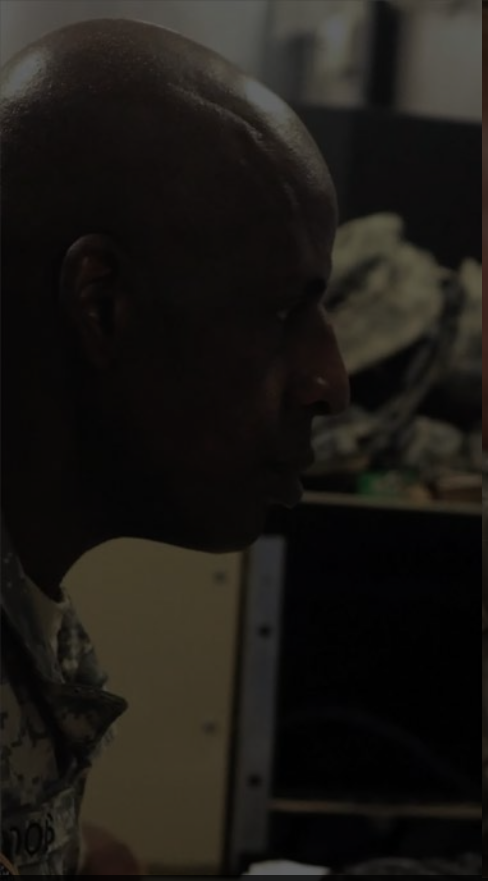
- Evaluated the Knowledge, Skills, and Attributes (KSAs) of 26 different cyber job roles (e.g., BDA Analyst, CND Analyst, CND Incident Responder, Cyberspace Policy and Strategy Planner, Data Administrator, Software Engineer, etc.)
- KSAs divided into three categories
  1. Military (e.g., intel confidence levels, Joint Targeting Cycle)
  2. General (e.g., preparing and presenting briefs, analytical thinking, non-specialized software [e.g., MS Word])
  3. Information technology (e.g., virtualization products like VMware, TCP/IP networking protocols, database administration)

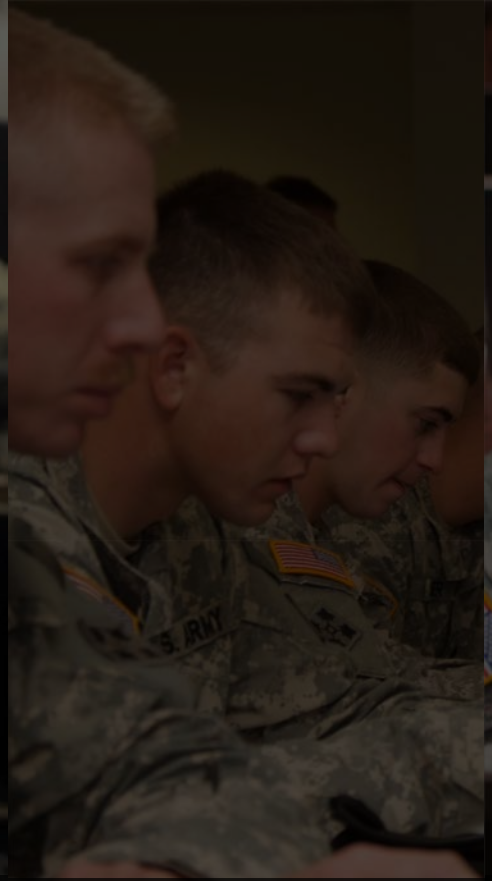


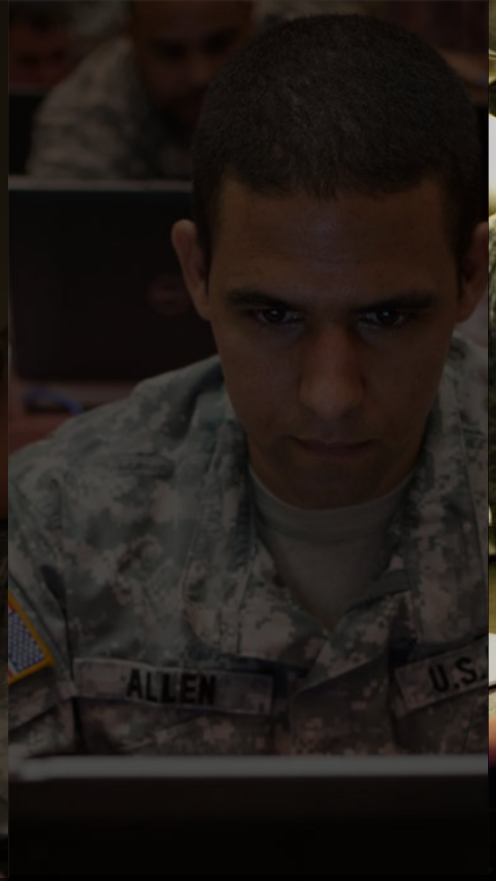
What do other organizations do to manage populations with special skills?

Organization Type	Organization(s)	Notes
Foreign military	• UK's Land Information Assurance Group	• Is a cyber reserve unit • Older entrants allowed • All training through civilian employer
U.S. government	• Federal civilian workforce • National Security Agency • Defense Language Force Management*	• Recruitment of students • Outreach to secondary schools and lower
Other	• Medical and Dental Corps* • Judge Advocate General Corps*	• Recruitment of trained graduates of medical and law schools

* Uses Military Accessions Vital to the National Interest (MANVI), which allows noncitizens with in-demand skills to join the Army in exchange for expedited U.S. citizenship.







GROWTH IN DEMAND

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CONCLUSIONS, NEXT STEPS

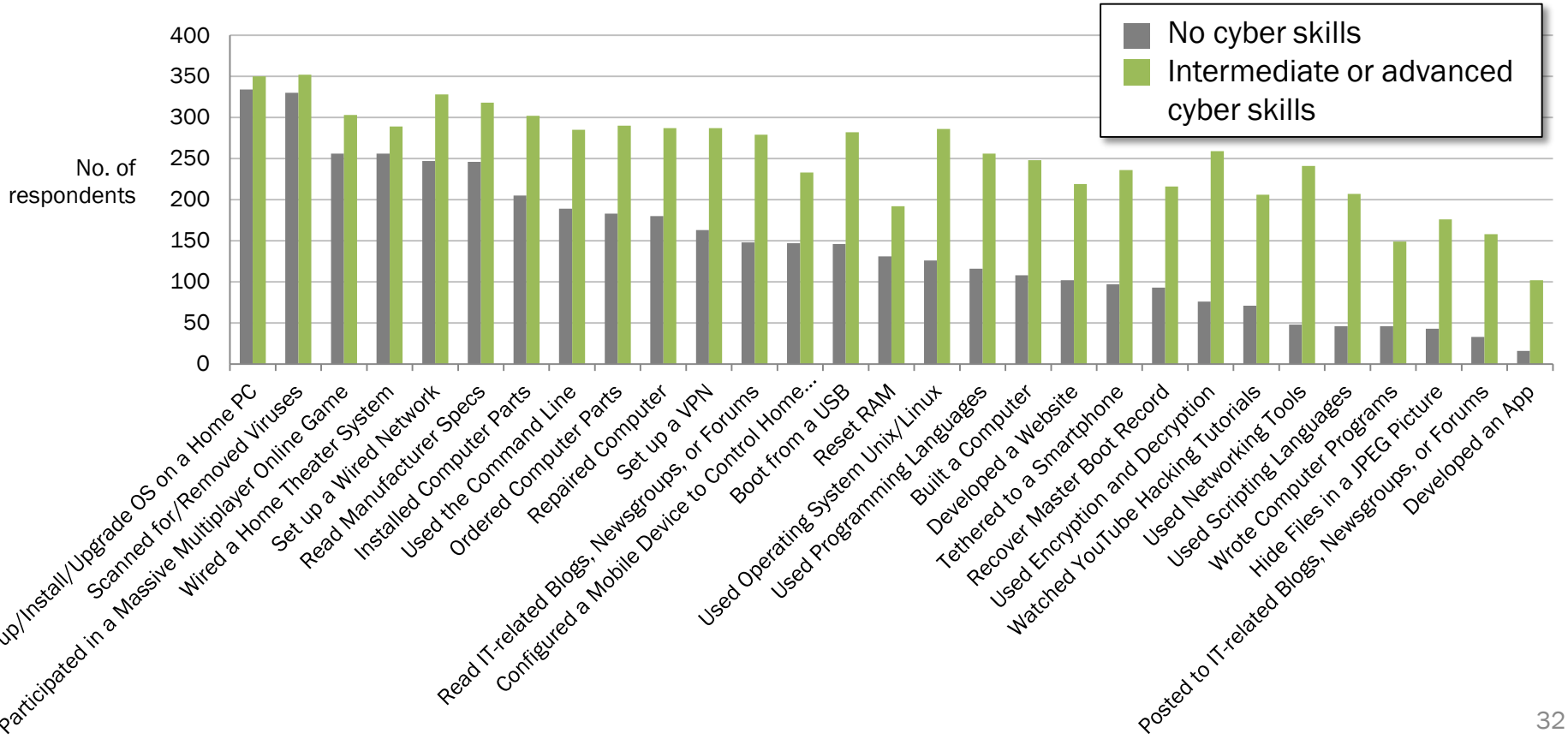
Key findings and observations

- Demand for a cyberspace workforce continues to grow in all sectors
- The CEI database provides useful information towards gauging the number of guard and reserve soldiers with cyber skills
- The guard and reserve use civilian-trained personnel and have tens of thousands of personnel with some cyber expertise
  - The guard and reserve have personnel with skills relevant to the cyberspace workforce, but many are not in specific jobs that use those skills; they represent the untapped potential
  - Those underused personnel are interested in applying their skills to their Army careers
- Generally accepted that proficiency in cyberspace operations requires continuous practice
  - Guard and reserve soldiers who exercise their relevant cyber skills in their day job have an advantage
  - Basic skills to support the CMF can be gained in the civilian sector

Recommendations for incorporating guard and reserve soldiers into the Army's Cyber Workforce

- Continue to tap into the existing "cyber" talent in the ARNG and USAR
  - Take advantage of guard and reserve soldiers who work in civilian jobs requiring cyberspace operations expertise—they could potentially contribute to the Cyber Mission Force and to other organizations
- Explore models from other service/countries for interesting options; for example,
  - The UK LIAG (a cyber reserve unit) allows civilians to join at age 50 and requires entrants to be fully trained by their civilian occupation

Future work: Analyze biodata collected from survey respondents



Current Reserve and National Guard Cybersecurity Work

- Sept. 2017 - The West Virginia Secretary of State's Office and the West Virginia Military Authority engaged in a partnership that will provide members of the WVNG specializing in Cyber Systems Operations to join the daily operations of the West Virginia Secretary of State's Office to assess elections systems and monitor cybersecurity.
- Nov. 2016 - The Ohio Secretary of State's office has engaged with the National Guard's cyberprotection unit to test the state's network to find vulnerabilities and search the state's election system for malicious activity.
- Nov. 2016 - Lt. Gen. Charles Luckey, the Reserve's current chief, recently began a geographic and demographic analysis of home stations. The goal of the study is to determine where the Reserve should be putting their cyber forces in order to "both capture talent and make it more palatable to stay in the Army."

QUESTIONS?

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Photo by Capt. Kyle Key/U.S. Army

Other observations from CEI data and survey responses

- Guard and reserve soldiers have a range of skills relevant to the cyberspace workforce, including some advanced skills
  - Most use these skills in the Army, but many do not
  - Those who do not are overwhelmingly interested in doing so
  - They represent untapped potential
- Many cannot use these skills because
  - There are no relevant jobs in their units
  - They are confused about how to pursue a cyber career in the military

References

1. U.S. Department of Defense, *Cyberspace Workforce Management*, DoDD 8140.01, August 11, 2015.
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3. Michael Suby and Frank Dickson, *The 2015 (ISC)^2 Global Information Security Workforce Study*, Mountain View, Calif.: Frost & Sullivan, 2015.
4. U.S. Bureau of Labor Statistics, "Employment Projections," web site, undated. As of September 3, 2015: http://www.bls.gov/emp/
5. Harold F. Tipton and Micki Krause, Information Security Management Handbook, 6th Edition, Boca Raton, Fl.: Auerbach Publications, 2007.
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