



Inspiring Innovation. Advancing Research. Enhancing Education.

Engineering the **National Defense** Workforce for the 21st Century

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OUTLINE

- ASEE
- Global Context for 21st Century Engineers
- Finding **CLEARABLE** Citizens
- With the **RIGHT** Skills
- Competing for a Shrinking Pool
- A Possible Solution

ASEE

- Founded in 1893
- All engineering disciplines
- teaching, research, public service, professional practice, and social awareness
- Voice of academic engineering
- Over 13,000 members

ASEE – Why we exist

The highest potential, career-ready engineering workforce characterized as

- Diverse,
- Enhances our capacity to innovate solutions,
- Understands the impacts of its solutions,
- Adapts to the rapidly evolving technical environments, and
- Plays a leading role in advancing technology.

ASEE – what we do (thematic)

- Promote excellence;
- Exercise global leadership;
- Provide a forum;
- Foster technological education; and
- Provide high quality programs.

Global Context of Engineering

- Population Growth → desire for economic development
- Population Contraction → desire to maintain standard of living and level of services
- Global Climate Change, Pollution, Limits to Natural Resources → desire for more efficient and effective products, processes, and services

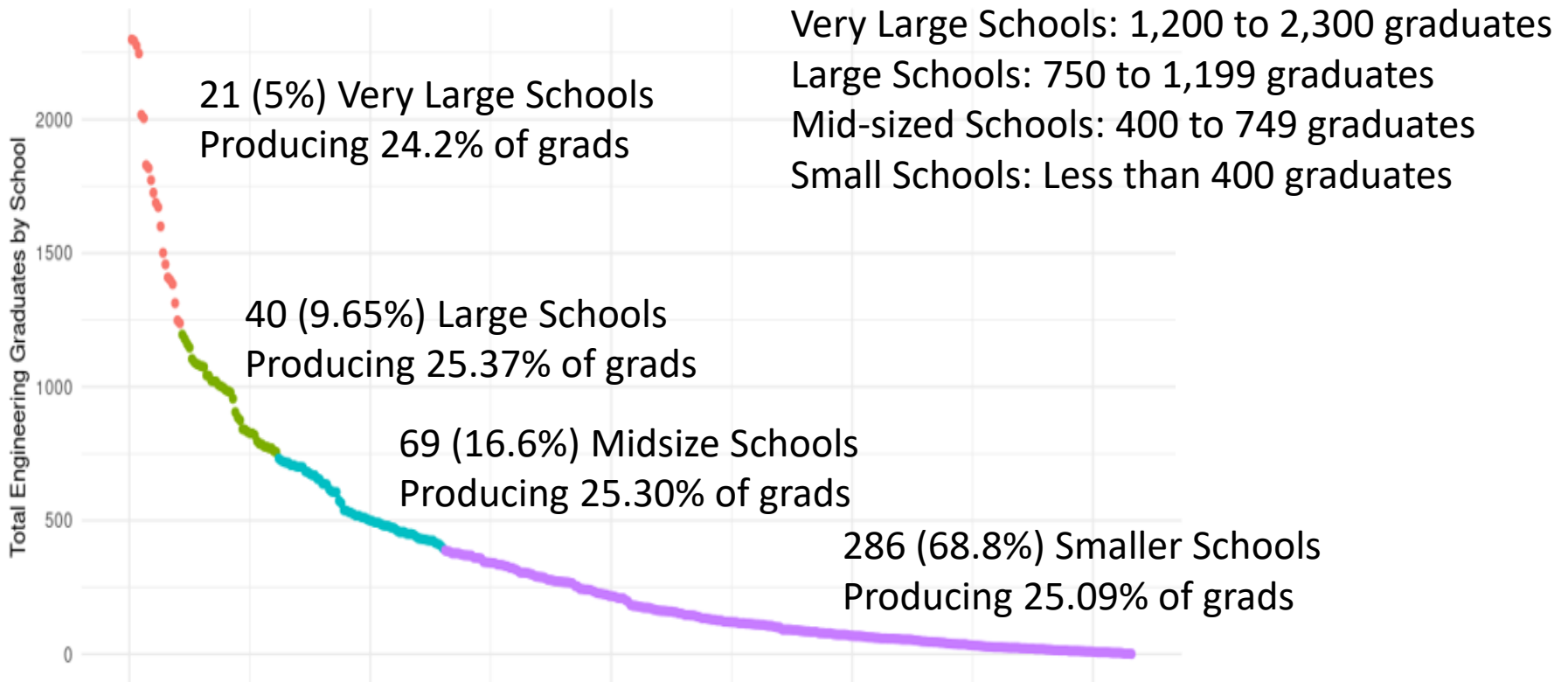
Engineering drives modern societies forward within the above constraints.

Context: Common Themes in Intl Rpts

- Concerns about global shortages of engineers and consequent need to engage full population in engineering
- Declining interest in engineering as a career field
- Balancing quality and quantity

Finding Clearable Citizens

149,314 engineers from 416 schools



COVID IMPACT

ASEE DATA from survey done in May 2021 – looking at DOMESTIC applicants

- BS Public DOWN 1.4%
- BS Private UP 2.2%
- MASTERS Public DOWN 1.4%
- MASTERS Private Down 9.1%
- DOCTORAL Public DOWN 6.1%
- DOCTORAL Private DOWN 3.7%

- Fewer applicants could mean fewer admits, fewer enrollments, and therefore fewer graduates, OR
- Lower quality of those admitted

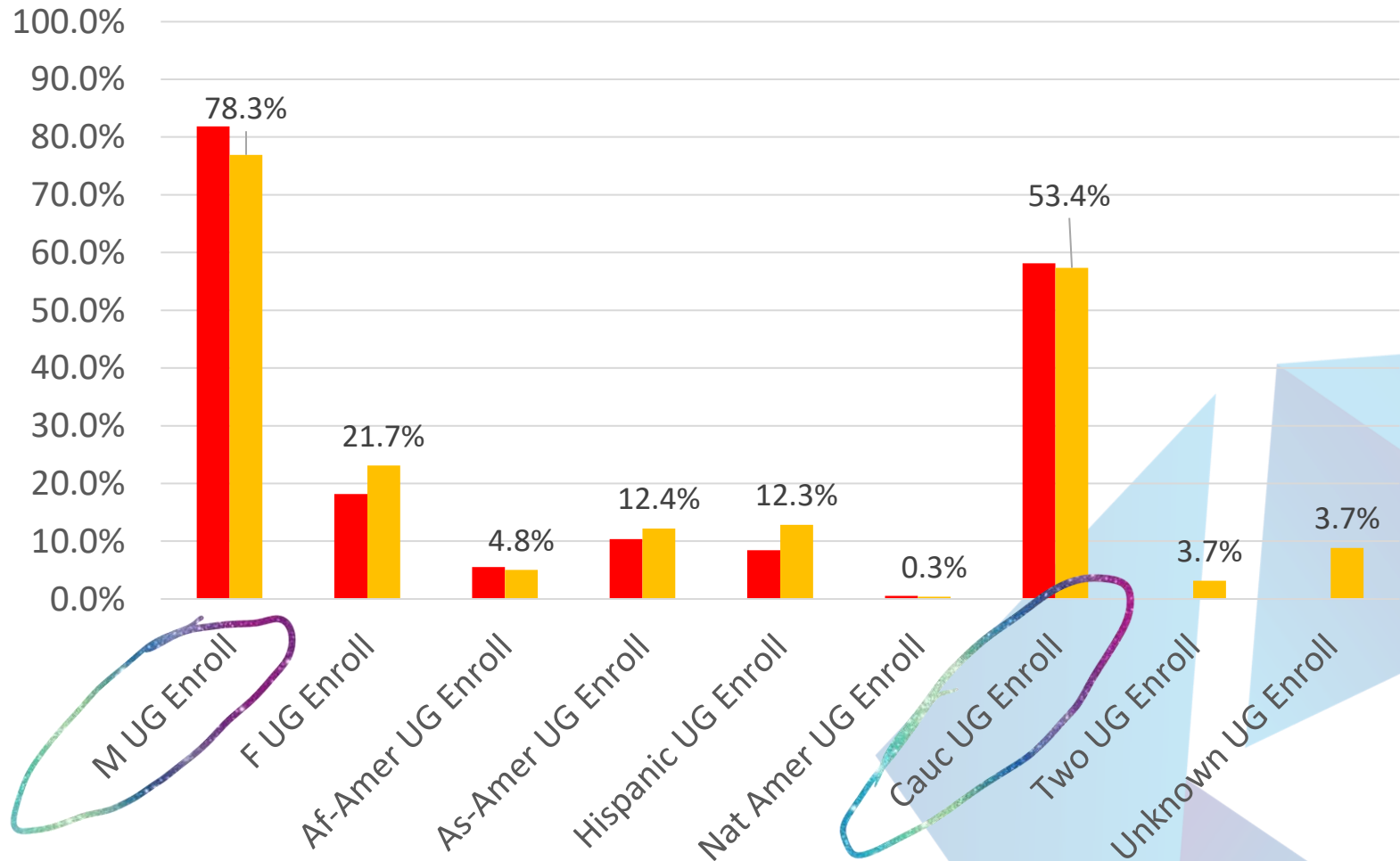
Demographic Challenge - 1

CENSUS DATA BEFORE THE PANDEMIC

- Fewer high school graduates by 2026
- Those students who remain are likely to be
 - more Hispanic,
 - Have fewer high scores on SAT and ACT
 - From families who are economically challenged
- Negative consequences for engineering enrollments.

Demographic Challenge - 2

Engineering Enrollment Demographics-percentages
(ASEE Data)

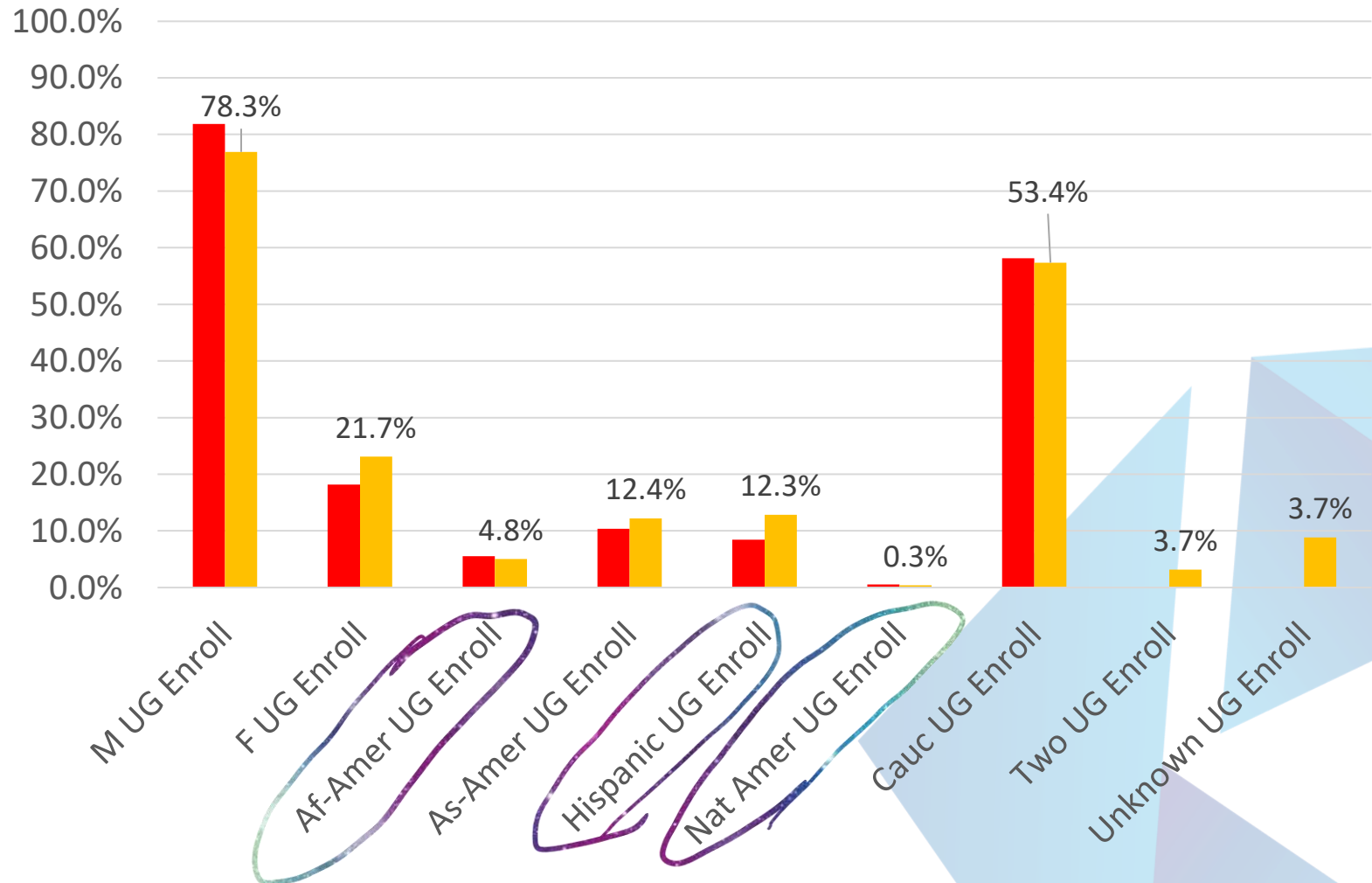


Demographic Challenge - 2

- BS: 133,765 (89.67%) US, of that 39.3% are White Males
- MS: 28,215 (47.0%) are US, of that 40.2% are White Males
- Ph.D: 5141 (41.8%) are US, of that 43.8% are White Males

Demographic Challenge - 3

Engineering Enrollment Demographics-percentages
(ASEE Data)



Demographic Challenge - 3

- HISPANICS – 22% of college-age population, but only 13% of college freshman. Gap has expanded by 9% over past 35 years.
- AFRICAN AMERICANS – 15% of college-age population, but only 6% percent of freshmen.
- Trend has been exacerbated by COVID

With the Right Skill Sets

- We're preparing students for jobs that don't yet exist, using technologies that have not yet been created, to solve problems we don't yet know that we have (in addition to the ones we already know about).
- We must also prepare engineering students to ***lead***
 - Technically,
 - Entrepreneurially,
 - Managerially, and
 - Politically and socially in a technological society.

Challenges in US Engineering Education

- 1960's – The Soviet “threat”
- 1970's – The Japanese “threat”
- 1980's – The demographic “threat”
- 1990's – The global “threat”
- 2000's – The environmental “threat”
- 2010's – The Chinese “threat”
- 2020'S – The demographic “threat” – again!

Responses to Challenges in Engineering Education

- 1960's – The scientific engineer
- 1970's – The transactional engineer
- 1980's – The managerial engineer
- 1990's – The global engineer
- 2000's – The holistic engineer
- 2010's – The elite engineer
- 2020's – The “just as good as an” engineer

Implications for KSAs

Engineers have to be more agile and facile

- Across engineering, physical science AND social science fields,
- Working with non-engineering professionals,
- Communicating with the general public, and
- Wm Wulf’s “macro-ethics” at the level of the profession, not just the individual.
 - Engineers and IT workers are increasingly socially active (e.g., workers at Amazon, Facebook, Google, and Microsoft)

Challenges for Engineering Schools

- Build better awareness of engineering (STEM \neq Engineering).
- Maintain interest in engineering.
- Enroll more students.
- Retain more students.
- Increase relevance.
- Build better on-ramps for veterans, transfers, and returning students.

Challenges for NDIA Employers

- Potential employees have their own ways of working that may not align with DoD practices.
- Potential employees have their own ethical concerns that may not align with DoD practices (e.g., Google and Amazon).
- COVID isolation has further decreased loyalty and willingness to compromise
- You have to find ways to adjust to them and not just expect them to adjust to you.

The Competition

Not just

- Lockheed,
- Northrop, and
- Raytheon,


BUT ESPECIALLY


- Facebook,
- Google, and
- Amazon

This is where the cool kids want to work, because the work is cutting edge AND Open source AND they get lots of perks

How Do You Compete?

Collectively, look at the analogs

- NACME
 - GEM
 - Graduate Fellowships for STEM Diversity (NPSC) – National Labs (originally)
 - SMART and NREIP/SEAP
 - IPERF . . .
 - Overlaps in some of the above
- 

Private
- 

Government

Possible Solution

- Consortia of NDIA members
- Offer undergraduate scholarships, graduate and postdoctoral fellowships to US citizens
- Scholars and Fellows intern at NDIA member firms
- Scholars and Fellows paid salaries while interning; paid stipends & sponsored tuition and fees during academic year
- Seek academic partners willing to reduce tuition and fees

Thank you

