Dr. William O. Berry
Acting Deputy Under Secretary of Defense
(Laboratories and Basic Sciences)
Office of the Director of Defense, Research and Engineering

As the Acting Deputy Under Secretary of Defense for Laboratories and Basic Sciences and the Director for Basic Research, Dr. Berry is responsible for providing scientific leadership, management oversight, policy guidance and coordination of the $1.3 billion yearly basic research programs of the Military Services and Defense Agencies. In this capacity, Dr. Berry has cognizance over the complete spectrum of basic research. In addition, he is responsible for science, technology, engineering and mathematics education and workforce issues, policy for grants, policy for Defense Laboratories and international science and technology programs.

Dr. Berry began his association with the Department of Defense as a National Research Council Postdoctoral Fellow at the Air Force Aerospace Medical Research Laboratory in 1976. At the Air Force Office of Scientific Research (1978-1997) he was responsible for the Air Force's basic research program in chemistry and life sciences. From 1983-1988 he served on the Aerospace Medical Panel of the North Atlantic Treaty Organization (NATO) Advisory Group for Aerospace Research and Development and currently is the U.S. Principal Member on the NATO Research and Technology Board. From 1997-2001, Dr. Berry served as the Associate Deputy Assistant Secretary of the Air Force for Science Technology and Engineering and Director of the Washington Office of the Air Force Research Laboratory.

Dr. Berry's research publications are in the fields of environmental toxicology and neuroscience. He is the co-editor of four scientific books and monographs. Dr. Berry earned a BS in Biology from Lock Haven University, Lock Haven, PA, a MAT in Zoology from Miami University, Oxford, OH, and a Ph.D. in Zoology/Biochemistry from the University of Vermont, Burlington, VT. He is a member of the American Association for the Advancement of Science and Sigma Xi, The Scientific Research Society.

Science and Engineering Workforce
How can we meet DoD's needs?

Defense Acquisition Performance Assessment Panel

Presented by

Dr. Bill Berry

Acting Deputy Under Secretary of Defense
(Laboratories and Basic Sciences)

DAPA 9-15-05.ppt

Overview

Scientists and Engineers Create Battlefield Advantage -- the Supply of Clearable S&Es is in question

- Situation
- Goal
- Approach
- Summary & Requirements

Situation

As Technological Advantage decreases
Battlefield Advantage decreases and
the Threat of Technological Surprise increases

S&E Workforce Concerns

- Interest diminishing - Supply diminishing - Demand increasing
  (Trends and dominant opinions - no definitive data or predictive models)
- Public & Private concern & desire to engage abound
- No National strategy – No lead entity – No silver bullet
- DoD must satisfy its needs – has authority & capacity to do so

Existing Efforts could achieve more

- Decentralized leadership & engagement
- Hundreds to Thousands of
  individual, independent, disconnected efforts nationally
- Alignment required for substantial & sustainable impact

Supply – Demand – Impact

STEM* Academia

- Reduced US Citizen performance, interest, enrollment, degrees
- Some Departments already sub-critical
- Full spectrum, comprehensive intervention required (K-20+)

Defense Industry (NDIA survey, Nov. 2005)

- "Perfect Storm" analogy is real & having impact
- Unsatisfied needs exist - expected to continue and increase
  (Snapshot Survey: ~15% open SE requisitions – contract let, need body to work)

DoD has Highest Exposure

- National Defense Workforce cannot be allowed to go sub-critical
- ~200,000 total Federal S&E's, ~45% work for DoD
  (~70%-90% in some Key disciplines)
- ~40+% in some S&E fields (in DoD) can retire – Right Now!

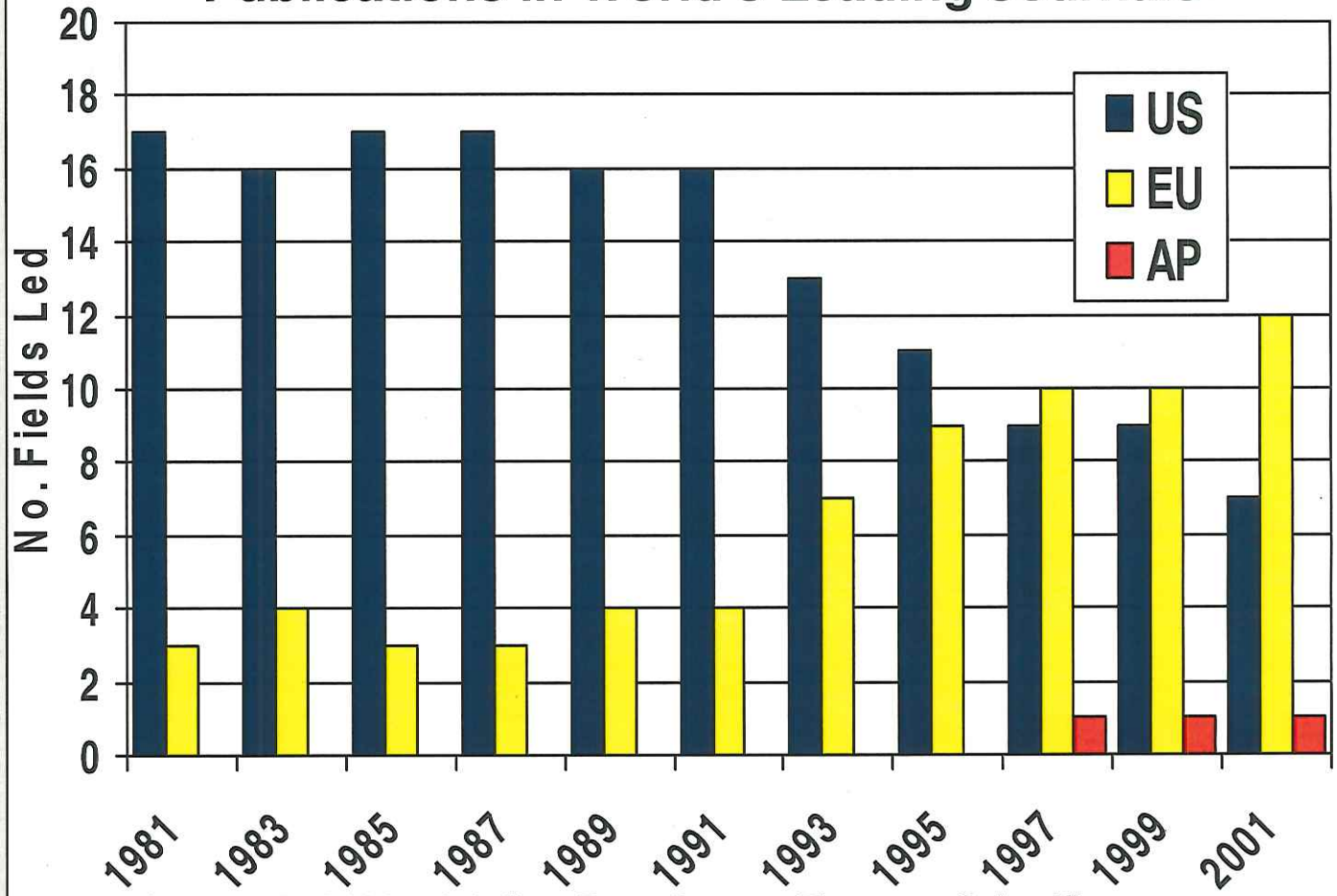
*STEM (Science, Technology, Engineering and Mathematics)

World Technology Leadership

20 Technology Areas-
(Led by US in 2001)

Agricultural Science
Biology & BioChem
Chemistry
Clinical Medicine
Computer Science
Ecology & Enviroment
Engineering
Geoscience
Immunology
Materials Science
Math
Microbiology
Molecular Bio & Genetics
Multidisciplinary
Neuroscience
Pharmacology
Physics
Plant & Animal Science
Psych & Psychiatry
Space Science

Scientific Fields Led - Measured by Publications in World's Leading Journals



From: Shelton, Holdridge briefing; Data Source: Thomson Scientific, National Science Indicators, ISI 2002, Copyright retained

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Goal

Ensure that DoD Science and Engineering Workforce needs are met

Comprehensive strategy:

- Institutionalize commitment and response within DoD
- Align all DoD STEM activities to increase ROI (K-20+)
- Identify and expand proven practices across DoD
- Engage enthusiastic stakeholders

- Collateral benefit – a catalyst & model for National action

Three - Component Strategy

- Create human resource systems that are competitive and reward performance
- Engage and guide students and teachers through research, education, competitions, and practical experiences
- Invest in world-class facilities and equipment to exploit major evolving trends in science and engineering

S&E Workforce
Some Current Efforts Across DoD

Pre-college (K-12)

- **Materials World Modules (Ray Pawlicki – Army)**
- **STARBASE – (Ernie Gonzales – OSD-RA)**
- **eCybermission – (Kelly Stratchko – Army)**

Undergraduate

- **Awards to Stimulate & Support Undergraduate Research Education (ASSURE) (with NSF; Koto White – AFOSR)**
- **Research Assistantships in microelectronics (with Semiconductor Industries Association) (Dan Radack – DARPA)**
- **Science, Mathematics and Research for Transformation (SMART) (K. Thompson – DoD/Koto White - AFOSR)**
- **Science, Mathematics and Research for Transformation (SMART)/National Defense Education Act (NDEA), Phase I (K. Thompson – DoD/Peter Purdue - NPS)**

S&E Workforce
Some Current Efforts Across DoD

Graduate

- National Defense Science & Engineering Graduate Fellowships (NDSEG)
- Naval Research – Science and Technology for Americas Readiness (N-STAR – with NSF, Bob Kavetsky – Navy)
- SMART (Keith Thompson/Koto White – AFOSR)
- SMART/NDEA (Keith Thompson/Peter Purdue-NPS)

SMART 05

Science Mathematics and Research for Transformation (SMART)

Congressional Add in FY05 Authorization & Appropriation

- Undergraduate/Graduate Scholarship Pilot Program
- US Citizens only (legislative limitation)
- Disciplines deemed critical to national defense
- 2 yrs of support (max – effective limitation due to pilot status)
- Service Payback required
- $ 2.5M

Implementation

- Internship required (outside of program)
- Mentorship required (outside of program)
- Post-degree work payback (set to 1-1 non-employee/3-1 employee)
- Participants: Army, Navy, Air Force, DARPA, DISA, DTRA

- 32 awards provided – students begin in Fall Semester, 2005

SMART/NDEA 06

Science Mathematics and Research for Transformation (SMART)/ National Defense Education Act (NDEA) 2006, Phase I

SMART/NDEA 06 amendment enables comprehensive approach to education and training – <u>Shaped Workforce</u>

- SMART 05 is a valuable foundation (PE, execution & pgm components)
- Permanent program vs pilot
- Provides both Academic and Non-Academic elements (within program)
- Employee status while enrolled sought
- Expansion of skill/discipline/degree sought (language/associates)
- Will drive greater awareness of S&T workforce needs & planning
- Designed for DoD-wide S&T workforce utility (widening interest/support)
- Planned level expected to meet 10% of anticipated needs over 10 years
- Increased funding sought

Approach

Agency response is proportional to Leaders' attention

- Set STEM Workforce needs among Highest DoD Priorities
  - Eroding foundation weakens the structure
- Assign central responsibility, require results
  - Status/Action/Needs briefing to (Dep)SecDef every X months
  - Not withdrawing delegated authorities – organizing them
- Bring all Components on board
  - All Components are authorized
- Align efforts
  - DoD is rich in Talent and Technology
  - Improve effectiveness of efforts
  - Partnerships are critical

Summary / Requirements

Ensuring the U.S. Science and Engineering workforce is an issue of National Security

Data, Trends and Reports substantiate concern & action

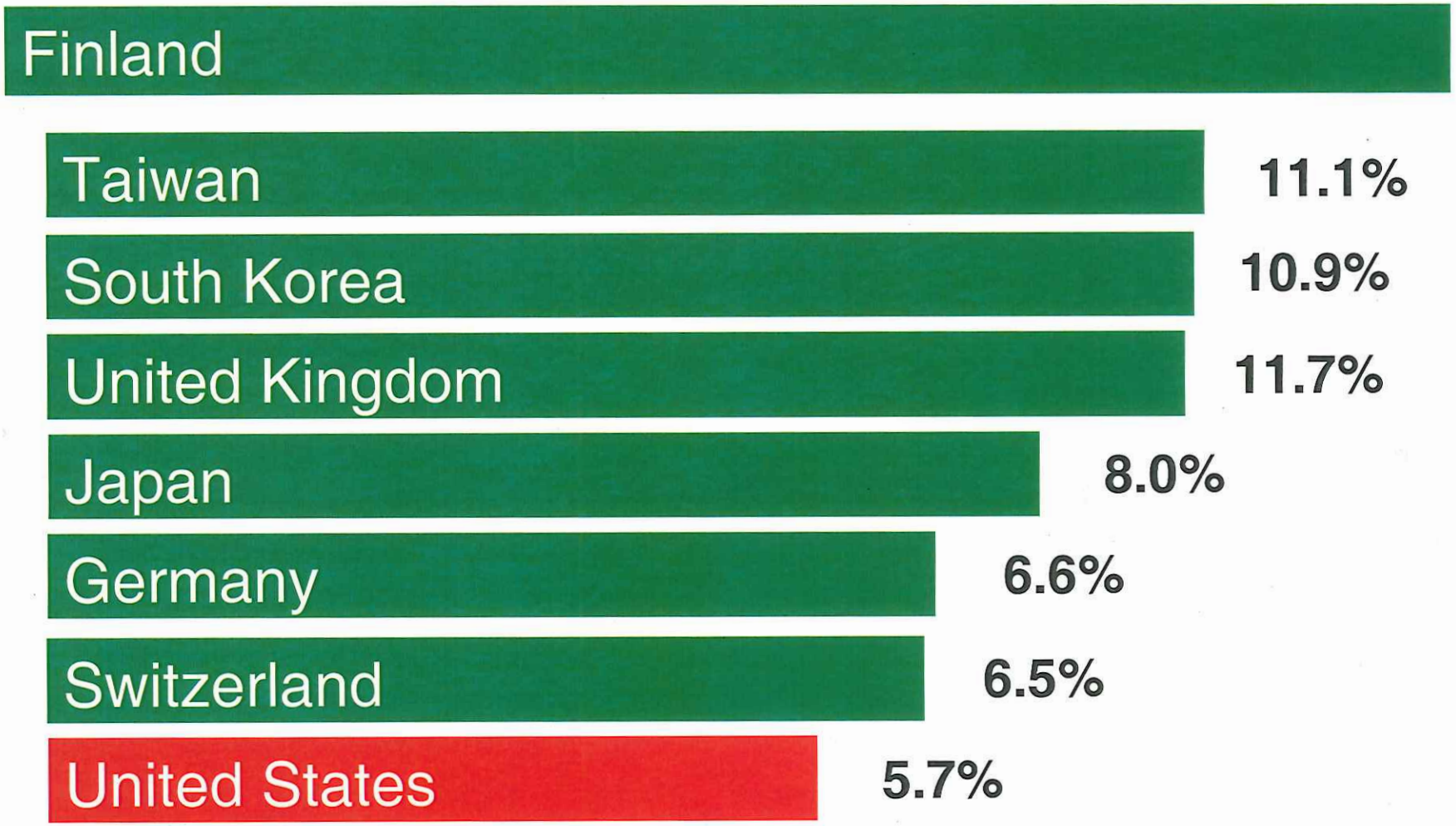
DoD Specific - Leadership Attention & Action

- (Dep)SecDef Publicity & Memorandum to:
  - Set clear priority and direction for DoD S&E Workforce & STEM Ed efforts
  - Assign responsibility & require engagement
  - Establish level of effort – scope and scale
  - Identify Specific actions & follow up (Continue attention thru institutionalization)
    (Engage Components, Build Action Plan, Brief, Scale, Implement, Measure, Brief)

National Level

- DoD (with others) raise issue at Principals & Deputies level
- Cabinet level recognition & priority is mandatory
- No national strategy = No sustainability & Marginal Impact

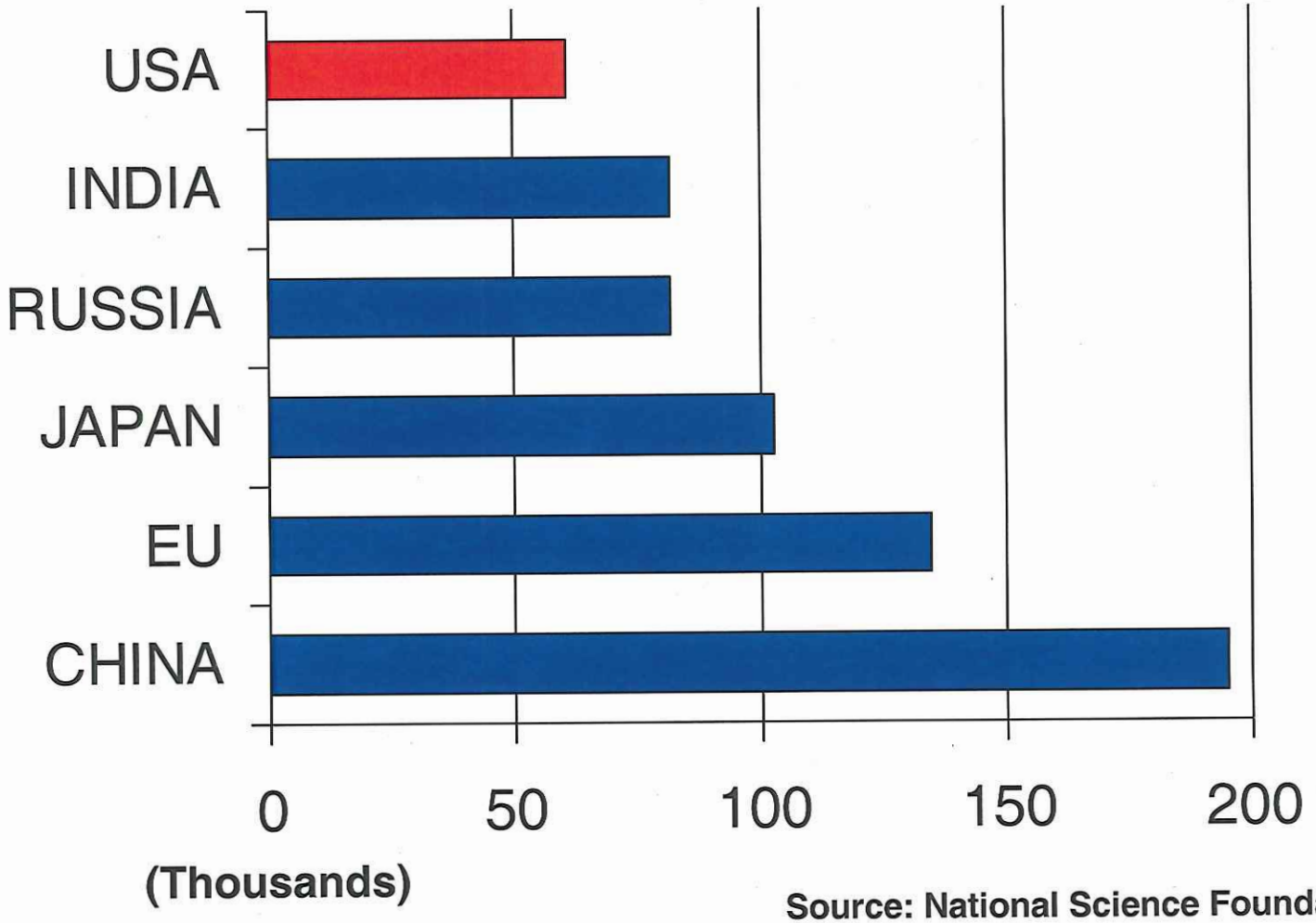
Percentage of 24-year-olds with a Science or Engineering Degree



Source: Money Magazine, Oct 2004, pg 124

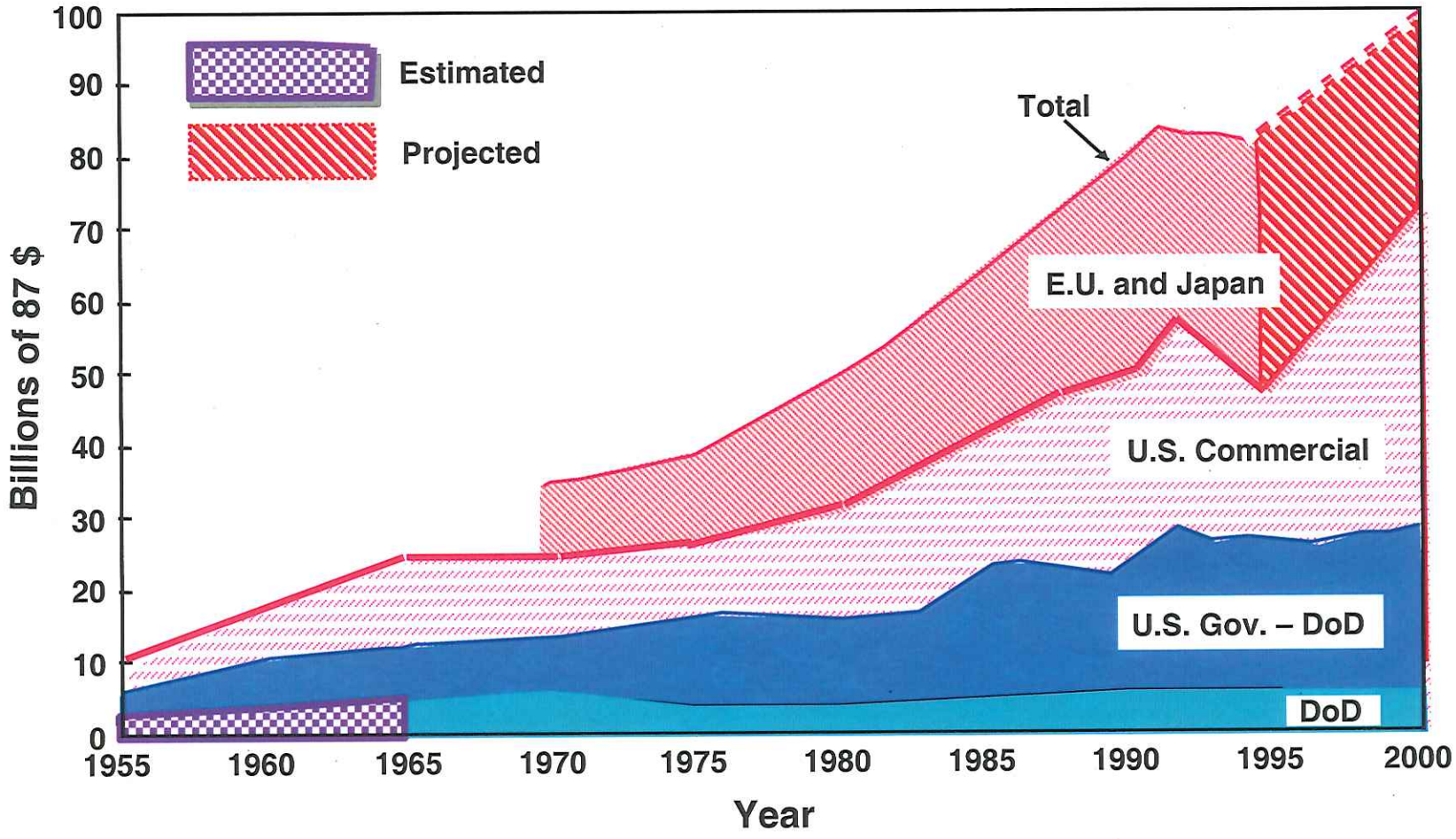
Degrees Awarded in Engineering

Bachelor in Engineering Degrees Awarded - 1999



Source: National Science Foundation

U.S. and Worldwide Research Base Since WWII



Source: Report of the Defense Science Board Task Force on the Technology Capabilities of Non-DoD Providers; June 2000; Data provided by the Organization for Economic Cooperation and Development & National Science Foundation

DoD S&Es as % of Total Fed S&Es

Source: NSF 05-304, Table 16 –Federal Scientists and Engineers 1998-2002, by agency and major occupational group: for 1998-2002 (OPM data)

	1997	1998	1999	2000	2001	2002
Total S&Es	46.6%	45.8%	44.2%	43.5%	43.1%	43.4%
All sci	28.0%	27.4%	26.1%	25.4%	25.6%	26.9%
Comp/Math sci	48.8%	47.6%	45.5%	43.9%	44.0%	45.3%
Life sci	12.2%	12.0%	11.4%	11.2%	11.0%	10.9%
Physical sci	28.2%	27.5%	26.7%	26.2%	26.1%	26.2%
Social sci	21.9%	21.4%	20.4%	20.4%	19.7%	19.6%
All eng	67.3%	67.0%	66.7%	66.4%	66.2%	66.7%
Aerospace	46.7%	45.2%	44.7%	43.6%	43.0%	42.8%
Chemical	61.3%	60.8%	62.3%	63.6%	65.7%	67.6%
Civil	62.1%	61.8%	61.8%	61.3%	60.6%	60.1%
EE&Comp	79.4%	79.4%	79.3%	79.1%	78.5%	79.1%
Industrial	83.8%	82.4%	81.1%	80.2%	79.4%	79.4%
Mechanical	88.2%	88.2%	88.2%	88.2%	88.4%	89.2%
Other eng	54.5%	54.7%	54.6%	55.1%	55.5%	55.9%

Published every 5 years – most current available as of 6/2005

updated 6/13/05 kt

DoD Civilian S&E's in 1985 & 2005

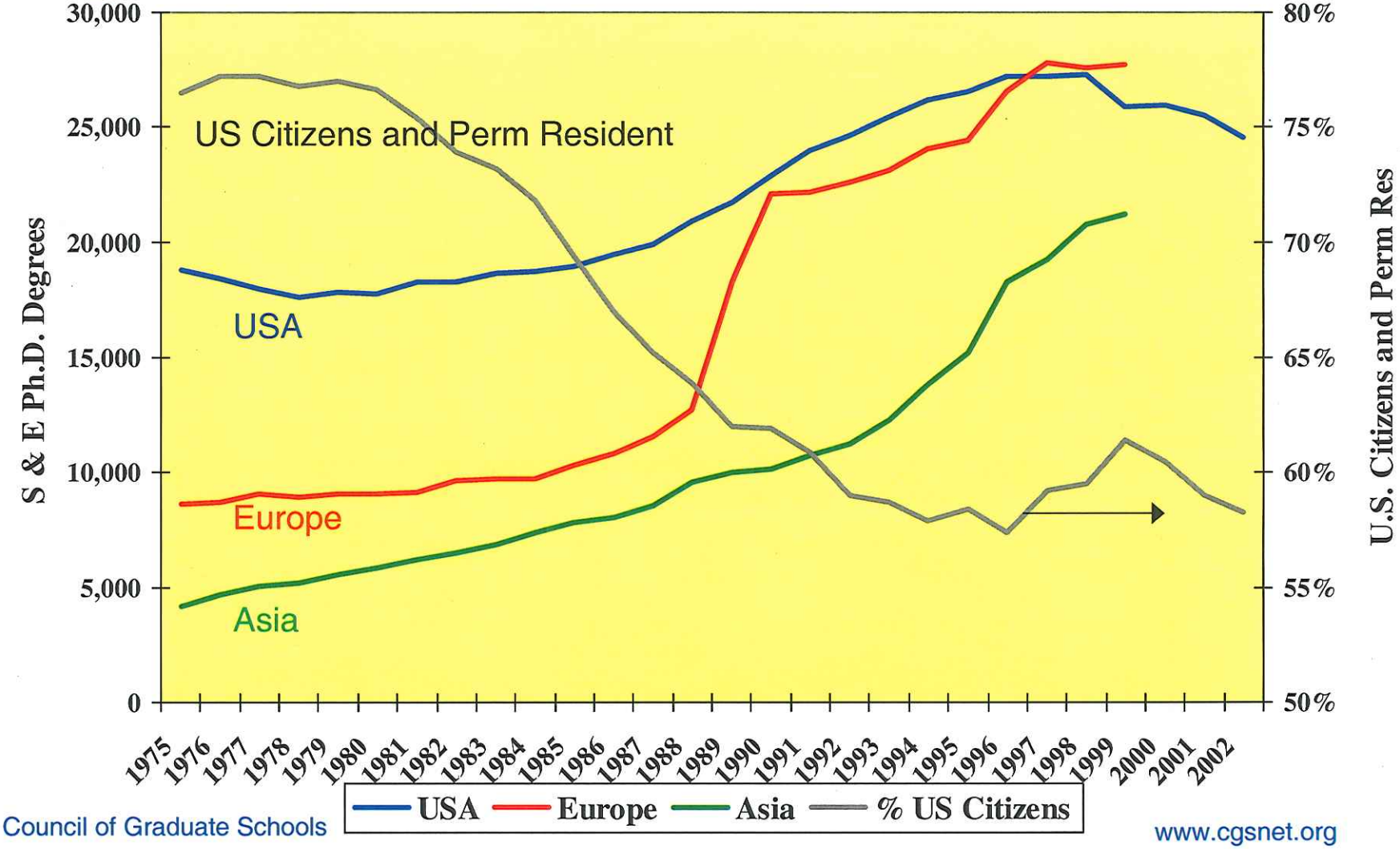
All DoD Civilians in S&E Occupational Series

	S&E Employees		50+		% ≥ 50	
	1985	2005	1985	2005	1985	2005
< BS	11276	7586	3593	2449	31.9%	32.3%
BS	67449	54673	15232	15390	22.6%	28.1%
MS	21973	22515	5955	9701	27.1%	43.1%
Ph.D.	5594	5777	1864	3262	33.3%	56.5%
Total	106292	90551	26644	30802	25.1%	34.0%

Source: DMDC Data for Sept, 1985 & April 2005

updated 6/13/05 kt

Doctoral S&E Degrees by World Region

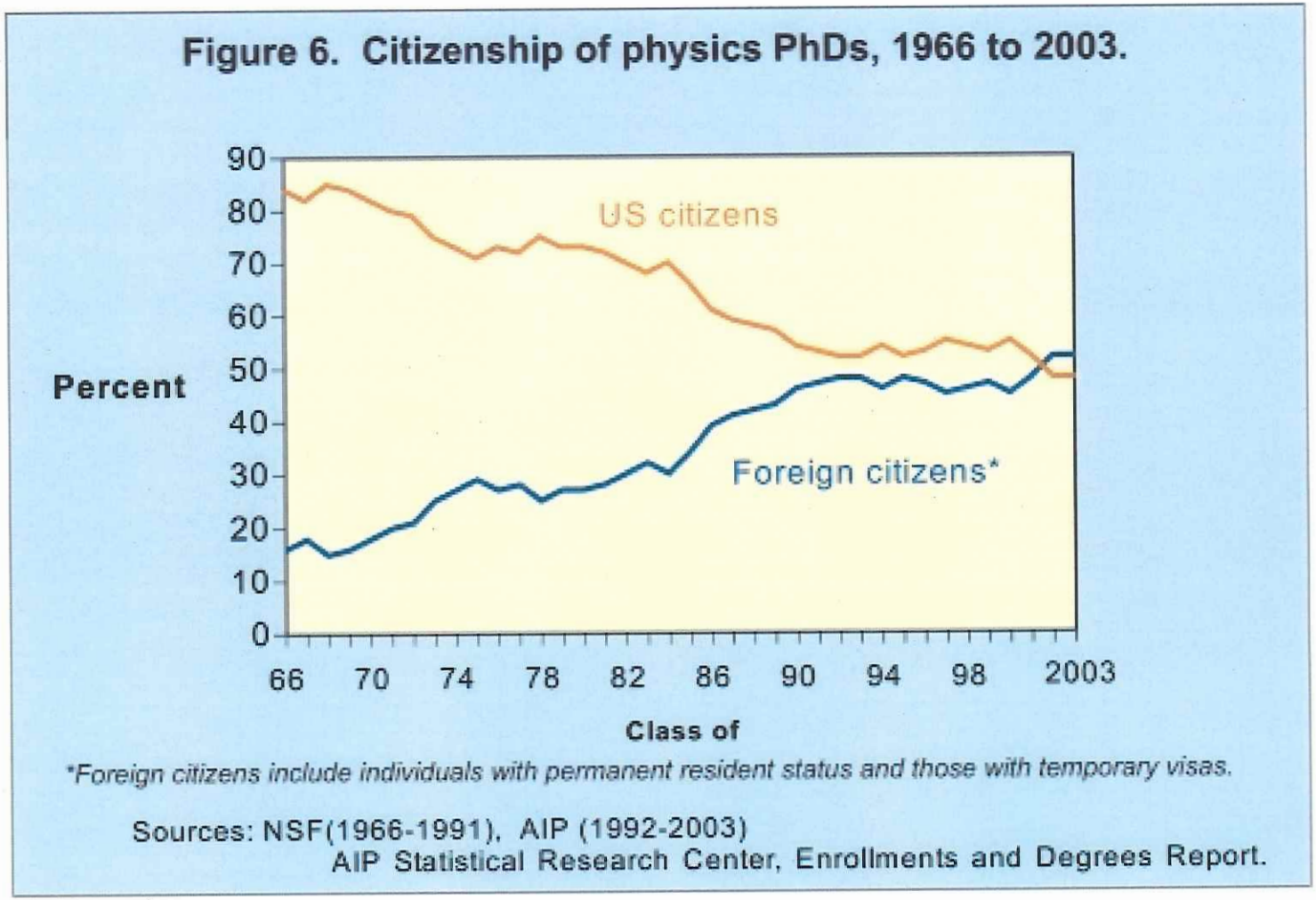


Council of Graduate Schools

www.cgsnet.org

Source: NSF Science and Engineering Indicators

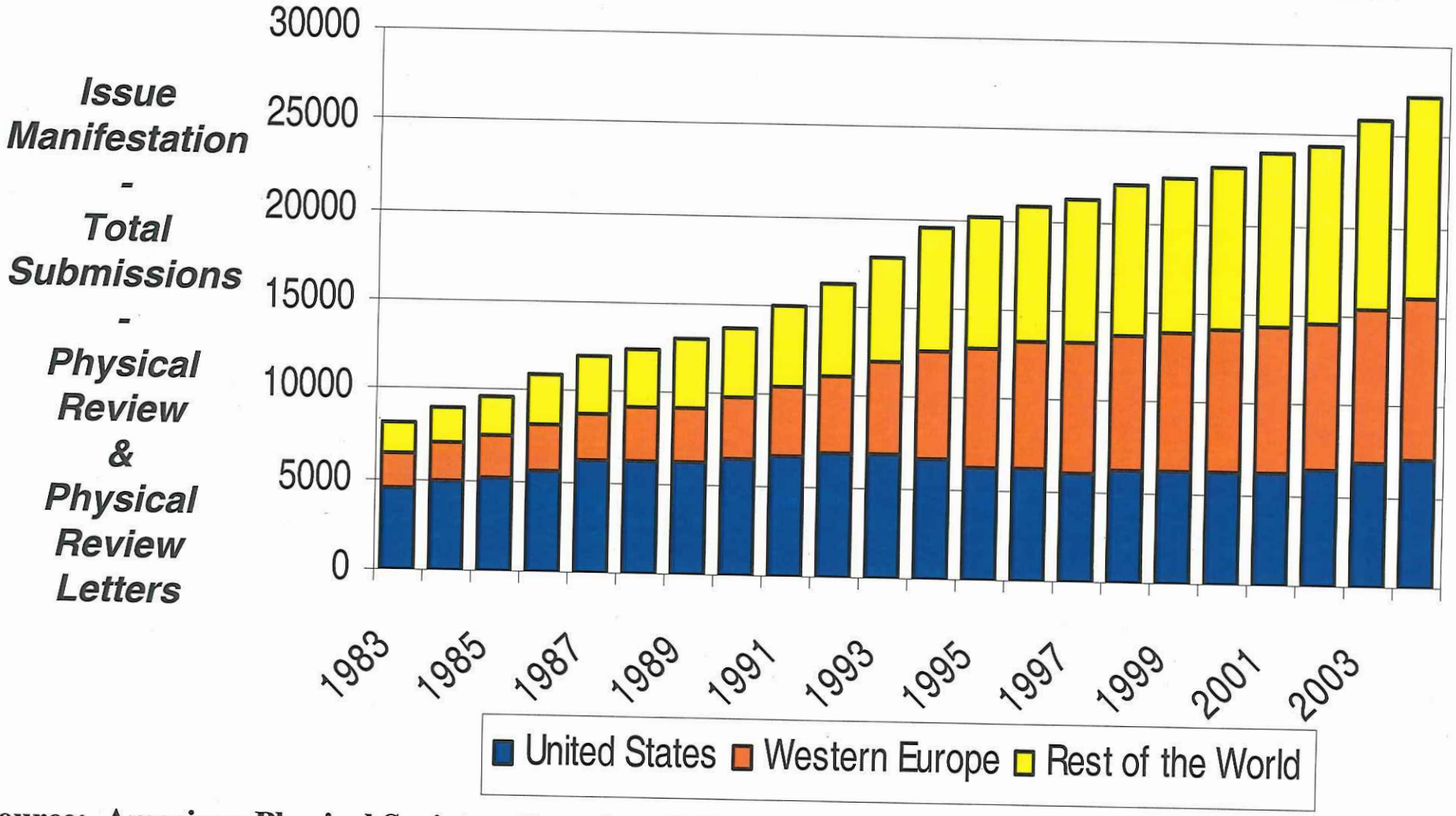
Physics PhD Degrees



Source: AMERICAN INSTITUTE OF PHYSICS http://www.aip.org/statistics/trends/highlite/ed/figure6.htm
http://www.aip.org/statistics/

Physical Review Submissions

Submissions to the Physical Review and Physical Review Letters 1983 - 2004



Source: American Physical Society – ***Data from Editor in Chief, August 2005***

Most recent data available at: http://forms.aps.org/general.html

Kt mod-8/17/2005

Defense Industry Perspective

NATIONAL DEFENSE INDUSTRIAL ASSOCIATION

STRENGTH THROUGH INDUSTRY & TECHNOLOGY

Quick-Look Presentation
August 31, 2004

- Industry Demand Data
  - Survey responses highly indicative of a high demand/low supply market place with future negative trends for US Citizens
- Workforce Demand Thematic
  - **Perfect Storm Analogy is real – not just anecdotal**
  - Focused on cleared and clearable engineers
- Employment Considerations
  - Priming the pump is only first step – effective utilization and retention are critical!

AIA

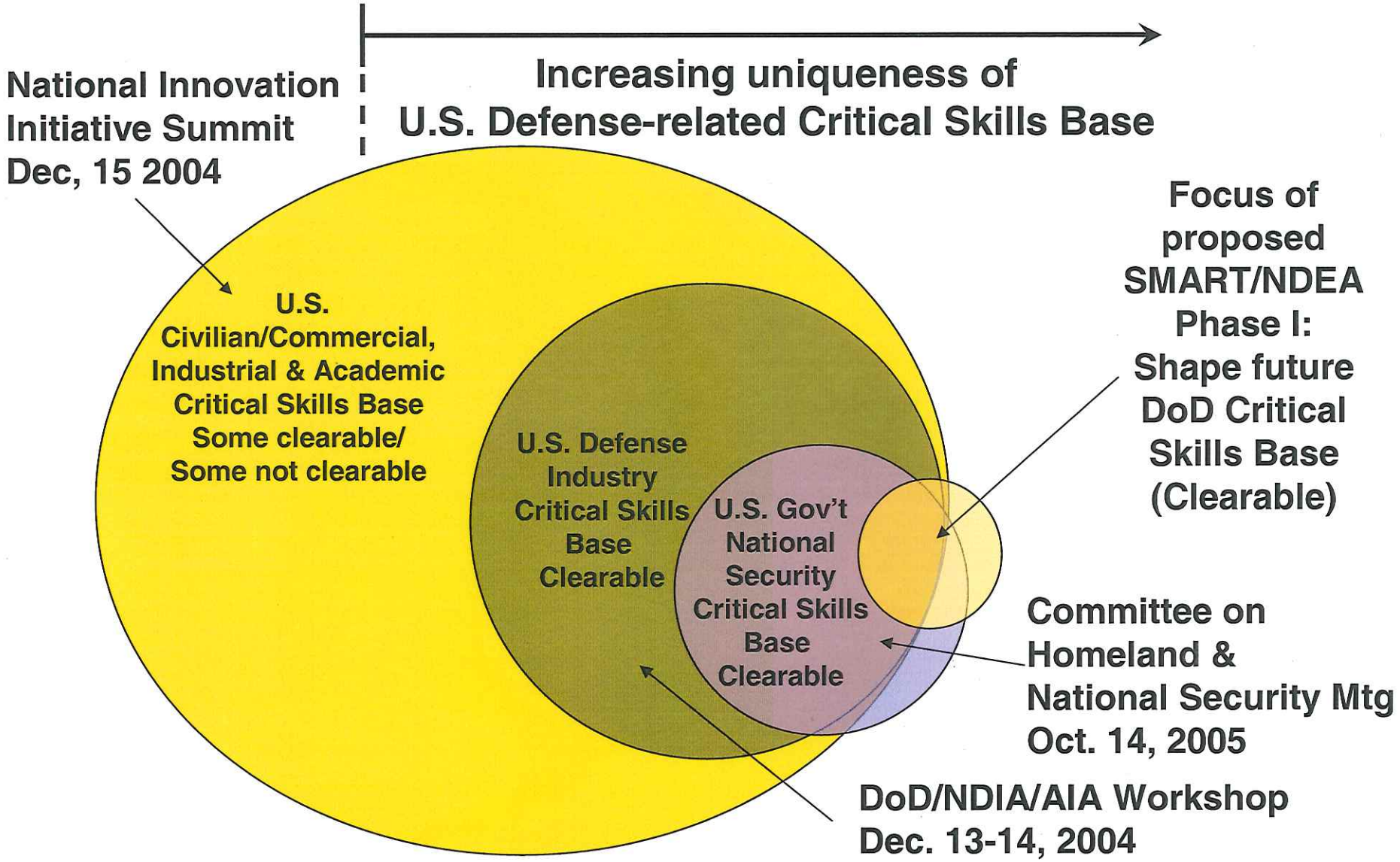
AEROSPACE INDUSTRIES ASSOCIATION

Report on
Aerospace Workforce
March 26, 2004

- Immediately reverse the decline in scientifically and technologically trained US workforce…
- **America's breakdown of intellectual and industrial capacity threatens national security and our capability to continue as a world leader**
- Substantive, long-term US Gov. investment in SME education and training at the undergraduate and graduate levels

Initial DoD Critical Skills Focus

Proposed SMART/NDEA Phase 1 Relative to Other U.S. Sectors



A Model for Outreach/Integration

- HUB & Spoke Interface
  - HUB should be Strongest Presence
  - Easier Coordination
  - Local Meetings
- Comprehensive Delivery
- Critical Mass
- Greater Impact Training Teachers
- Improved ROI <u>For Everybody</u>