Projecting U.S. Defense Employment and Purchases Using Inforum Models

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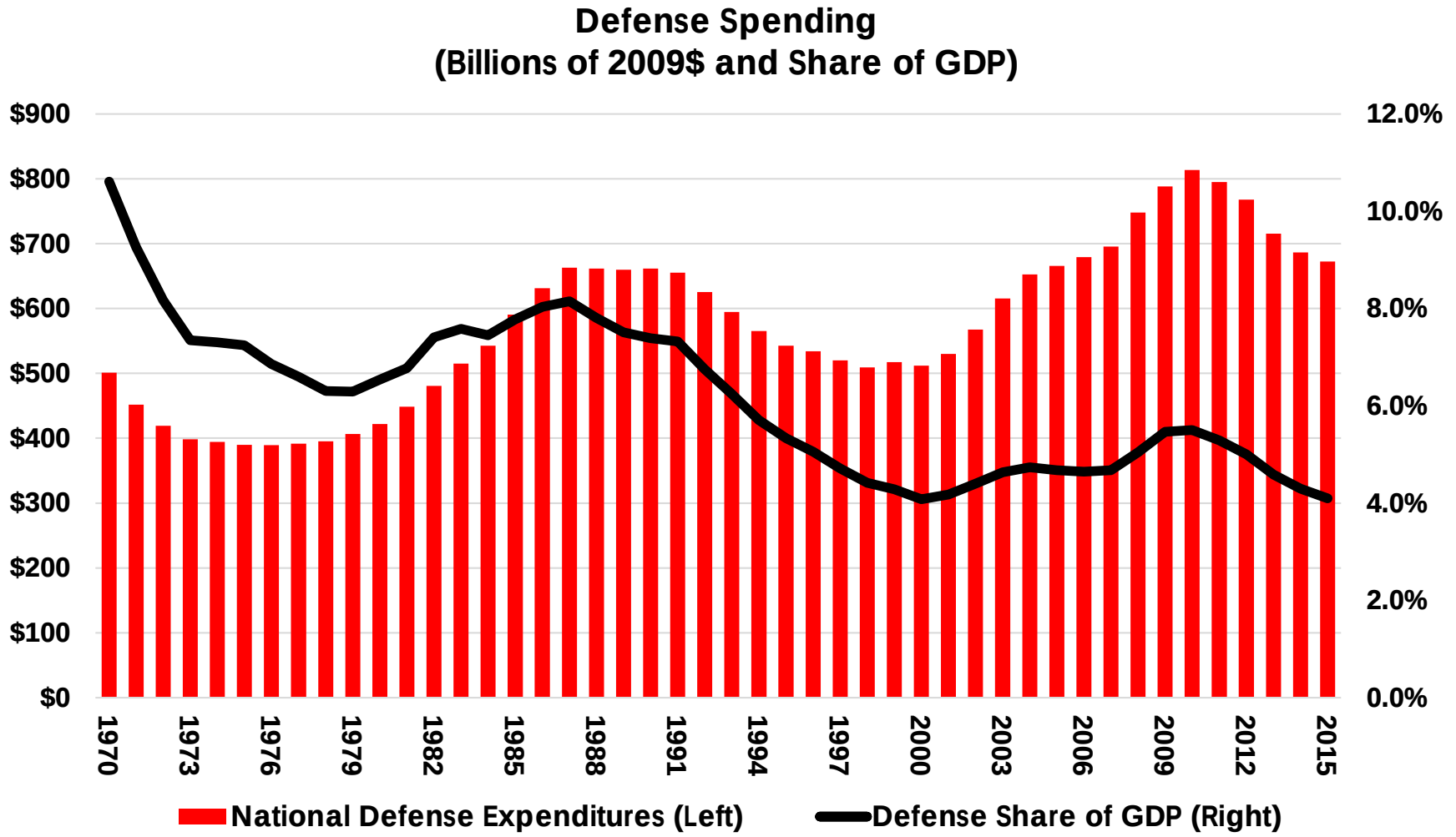
Outline

- Defense spending overview
- Models and supporting data
- Projecting defense purchases (national and regional) and employment
- Applications of defense projections

Defense Spending and the Economy

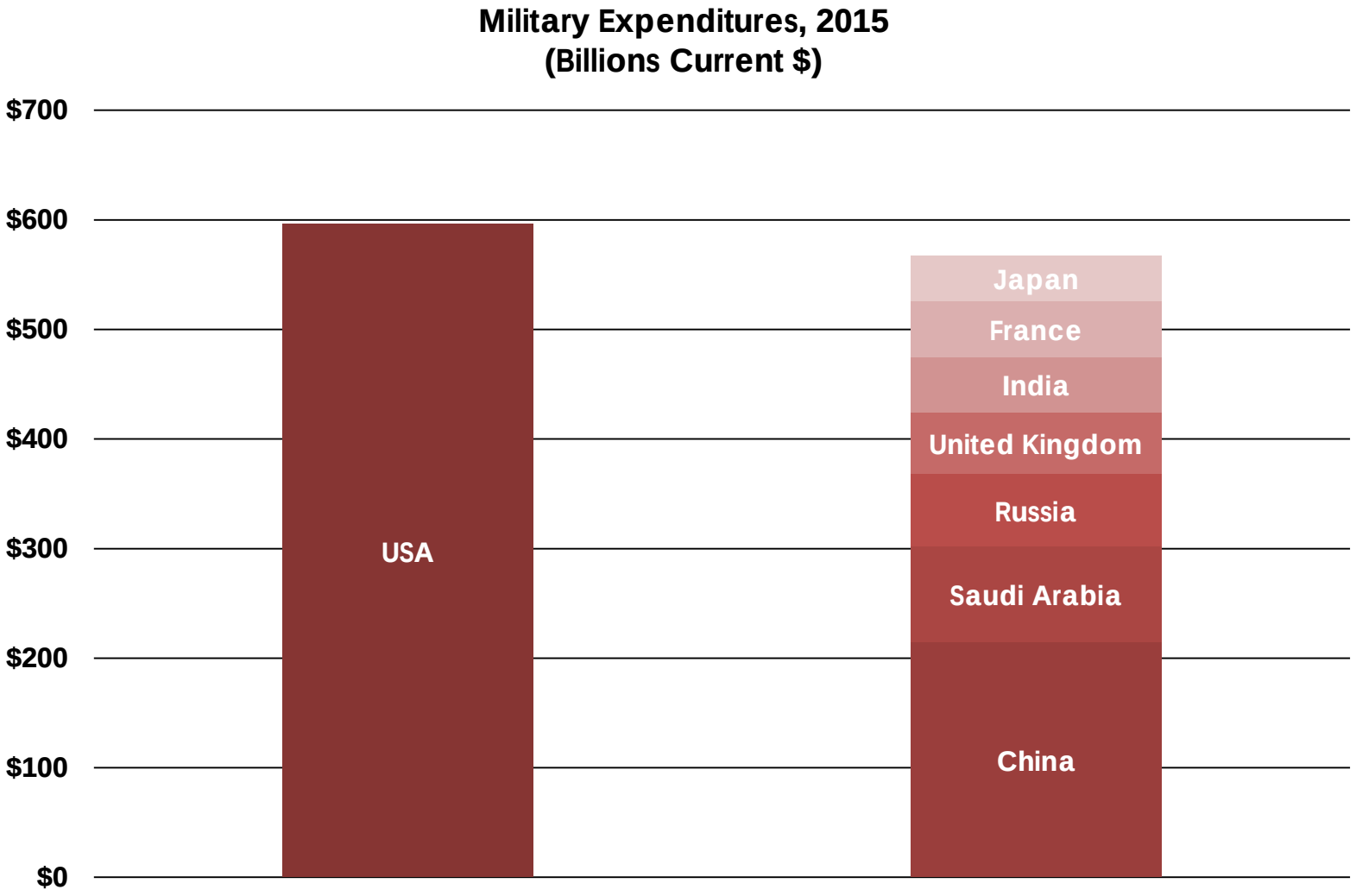
- Changes in defense spending have important consequences for national fiscal policy in addition to the defense industrial base.
- These expenditures have large implications for growth across industries and regions, as well as support a highly-skilled labor force.
- The Defense Employment and Purchases Projection System (DEPPS) was developed to understand the impacts of both changes in the level and the composition of defense spending.

Defense Spending & Share of GDP



Source: BEA, National Income and Product Accounts

Defense Spending Around the World



Source: Stockholm International Peace Research Institute

Models Used in DEPPS

- Lift (Long-term Interindustry Forecasting Tool)
  - Bottom-up interindustry macro model, 120 sectors
- Iliad (Interindustry Long-run Integrated and Dynamic model)
  - Detailed input-output model, 352 sectors
- STEMS (State Employment Modeling System)
- Defense Translator
  - Matrix calculated by DoD that shows the industry components of the defense budget by major weapon program

The Defense Budget

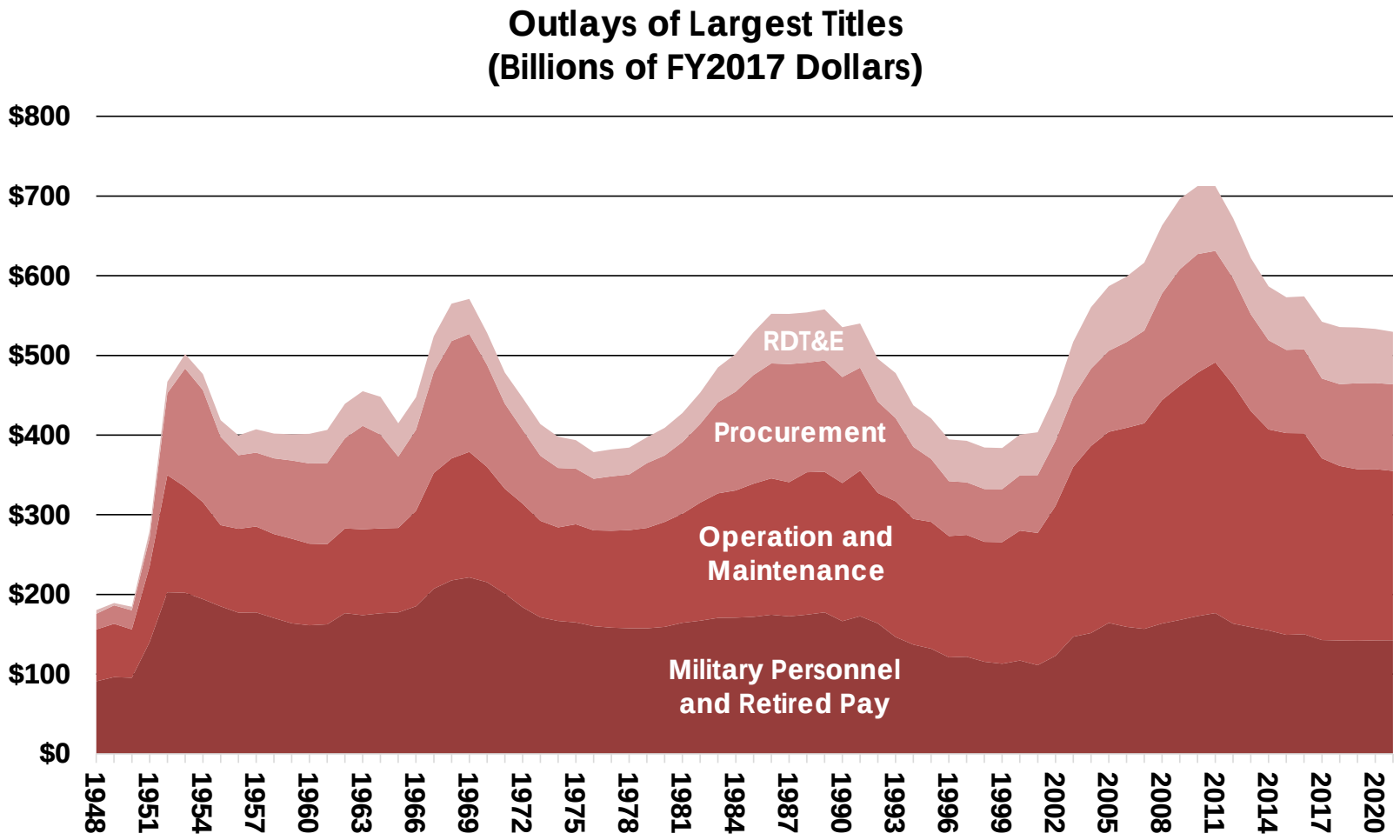
- Published annually by Department of Defense
- Corresponds to the most recent President's Budget and planned Future Years' Defense Program (FYDP)
- *National Defense Budget Estimates for FY 2017* provides historical data and estimates through 2021.
- Provides data in outlays (actual expenditures in a given year) in fiscal year

Defense Outlays by Title

Appropriations Title	Description	FY17 Outlays (Billions $)
Miltary Personnel	Active duty and reservist pay, travel, and uniforms. Also includes DoD contributions to military retirment fund.	$142.8
Operations and Maintenance	Civilian pay, fuel, goods, and services for operations, maintenance, and repair expenditures	$228.1
Procurement	Purchases of weapons, equipment, and military capital goods	$100.1
Research, Development, Testing, & Evaluation	Development and testing of new military systems, other research activities and associated pay	$71.3
Military Construction	Construction of military facilities	$8.3
Family Housing	Housing for miltary personnel and their dependents	$1.2
	Total	$553.0

Note: Revolving and Management Funds ($2.4 Billion) not shown
Source: National Defense Budget Estimates for FY 2017, Table 6-11

Defense Outlays by Title



Source: National Defense Budget Estimates for FY 2017, Table 6-11

Contract Awards Database

- Detailed information on every federal contract in excess of $25,000.
  - Name of entity receiving funds
  - Amount of funds
  - Recipient's location (State, County, Zip Code)
  - Awarding Agency (Department of Defense, Commerce, Agriculture, etc.)
  - Industry Code
- Searchable database available at USASpending.gov

Other Data Used in DEPPS

- Manpower projections from DoD Defense Manpower Data Center (DMDC)
  - Active-Duty and Reserve Military
  - Civilian
- Recent retirement outlays data from DoD Office of the Actuary
  - Detail by state and international regions
- Recent Energy data, specifically total petroleum expenditures, from the Defense Logistics Agency (DLA)

Components of DEPPS

- The DEPPS system is divided into 3 main components:
  - IDEPPS – Direct and indirect spending impacts on 352 sectors (Iliad 6).
  - RDEPPS – Direct and indirect spending by state for 120 sectors (Lift 3).
  - LDEPPS – Employment for 71 industries and 101 occupations.

IDEPPS

- Purpose: Determine the defense related production necessary to supply the goods and services implied by the Defense Budget
- Generates projections of purchases for 352 sectors (Iliad) in inflation-adjusted dollars.
  - Direct – Purchases made by DoD
  - Indirect – Purchases made by DoD suppliers used to produce goods eventually bought by DoD

IDEPPS – Defense Purchases
Top 10 Industries

Top 10 Projected Total (Direct + Indirect) Defense Purchases
(Billions of 2016 Dollars, Ranked by 2016 Value)

Rank	Supplying Industry	2014	2015	2016	2017	2018	2019	2020
1	Scientific research and development services	43.6	42.1	42.4	41.9	41.0	40.3	39.6
2	Architectural, engineering, and related services	41.3	38.9	38.1	37.9	37.7	38.4	38.0
3	Petroleum refineries	32.2	30.3	29.5	28.5	26.4	25.7	25.6
4	Aircraft	28.1	27.1	25.4	24.9	23.4	22.1	21.1
5	Crude oil extraction	25.5	23.9	23.3	22.5	20.9	20.3	20.2
6	Management of companies and enterprises	24.0	22.3	21.6	21.2	20.4	20.1	20.0
7	Telecommunications	22.1	19.6	19.1	18.8	18.2	17.9	17.7
8	Offices of physicians and other health practitioners	21.1	19.0	19.0	19.7	19.5	19.4	19.4
9	Ship building and repairing	16.5	18.1	18.8	15.7	16.1	15.4	16.7
10	Real estate	19.1	17.6	17.1	16.9	16.4	16.2	16.0

IDEPPS - Projected Defense Purchases

Projected Defense Purchases of
200 Semiconductors and electron tubes
(Millions of 2016 dollars)

	2014	2015	2016	2017	2018	2019	2020
SUMMARY OF DEFENSE PURCHASES							
Direct Purchases	97	97	99	91	79	75	73
Indirect Purchases	2,899	2,682	2,636	2,643	2,583	2,555	2,532
Total	2,996	2,779	2,735	2,735	2,662	2,630	2,605
INDIRECT DEFENSE PURCHASES BY PURCHASING SECTOR							
Aircraft Engines	23	21	19	18	16	15	15
Aircraft Parts	78	72	69	68	64	63	62
Ammunition	17	19	14	14	14	14	14
Communications Equipment	961	883	899	930	927	927	921
Missiles	339	307	269	275	274	276	271
Motor Vehicles	21	18	16	16	16	16	17
Shipbuilding	105	115	119	98	101	96	104
Tanks	13	10	8	8	9	10	10
Other Electronic Equipment	263	260	277	289	286	285	281
Other Ordnance	8	6	6	5	5	5	5
Other	1,072	970	941	921	871	847	832
Total	2,899	2,682	2,636	2,643	2,583	2,555	2,532

IDEPPS – Sources of Defense Purchases

Sources of Projected Defense Purchases
200 Semiconductors and electron tubes
(Millions of 2016 dollars)

	2014	2015	2016	2017	2018	2019	2020
Military Personnel	35	36	33	32	32	32	32
Operations & Maintenance + Funds	775	696	701	680	612	585	578
Total Procurement	1,485	1,365	1,299	1,332	1,346	1,361	1,365
Aircraft	358	344	300	288	270	260	251
Missiles	192	175	173	235	277	295	298
Weapons and Tracked Vehicles	35	27	20	23	24	26	27
Shipsbuilding	117	133	141	117	121	119	127
Ammunition	38	33	24	25	26	26	28
Other	744	652	642	644	628	634	633
RDT&E	675	656	677	667	650	631	611
Military Construction	24	23	21	20	18	17	16
Family Housing	3	4	3	3	3	3	3
Total	2,996	2,779	2,735	2,735	2,662	2,630	2,605

RDEPPS

- Geographic distribution of impacts of planned defense expenditures.
  - Detail available for 120 industries in inflation-adjusted dollars
  - Detail available for 50 states plus DC
- Results describing…
  - Direct spending (purchases and pay)
  - Indirect spending from purchases
  - Indirect spending from pay

RDEPPS – Top 10 States by Industry

Top 10 States in Direct Purchases of :
Communications and audio-video equipment
(Millions of 2016 Dollars, Ranked by 2016 Value)

	2014	2015	2016	2017	2018	2019	2020
California	2,392	2,323	2,393	2,406	2,384	2,344	2,287
Massachusetts	682	614	611	633	632	633	631
New York	650	562	550	579	583	591	594
Virginia	322	295	292	295	284	281	281
Maryland	263	239	238	244	240	239	238
Utah	218	205	204	205	198	196	194
Iowa	239	207	203	215	218	221	221
South Carolina	189	182	183	179	167	162	160
Florida	211	185	182	190	191	192	193
Indiana	159	137	135	142	144	146	147
Top 10 Total	5,327	4,949	4,989	5,088	5,041	5,005	4,947
TOTAL U.S.	6,194	5,742	5,775	5,884	5,808	5,765	5,705

RDEPPS – State Summary Tables

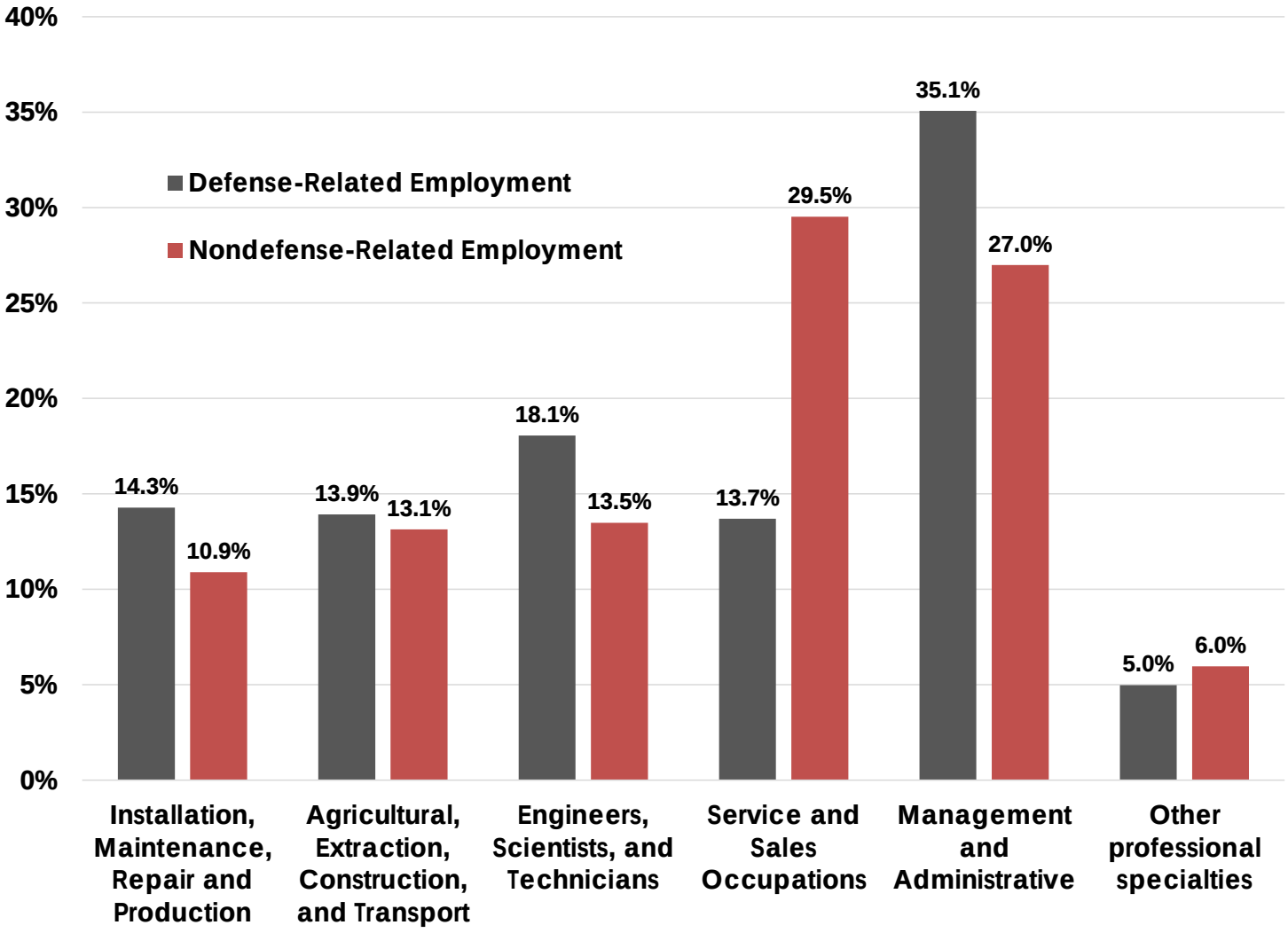
California Summary
Billions of 2016 dollars

	2014	2015	2016	2017	2018	2019	2020
AGGREGATE MEASURES							
Total Direct Expenditures (Purchases and Pay)	65.5	63.5	62.5	61.9	60.6	59.9	59.5
Indirect Defense Purchases Resulting from Direct Purchases	35.2	32.8	32.0	31.5	30.4	29.9	29.7
Indirect Defense Purchases Resulting from Pay	13.7	14.8	14.6	14.2	14.1	14.1	14.1
Total Nondefense Expenditures	3,652.6	3,750.1	3,877.2	3,987.5	4,096.3	4,215.5	4,329.5
Total Output	3,766.6	3,860.5	3,985.7	4,094.7	4,201.2	4,319.3	4,432.5
Government Industry Compensation	15.6	16.7	16.5	16.3	16.3	16.3	16.4
LARGEST PURCHASES BY INDUSTRIAL SECTORS							
Total Direct Expenditures (Purchases and Pay)							
85 Professional, scientific and technical services	11.4	10.9	10.9	10.8	10.7	10.6	10.4
54 Aerospace products and parts	8.7	8.3	8.0	8.3	8.1	8.0	7.8
92 Offices of physicians, dentists, and other health practioners	4.9	4.5	4.5	4.6	4.6	4.6	4.6
55 Ship and boat building	2.3	2.4	2.4	2.1	2.1	2.1	2.2
43 Communications and audio-video equipment	2.4	2.3	2.4	2.4	2.4	2.3	2.3
Indirect Defense Purchases Resulting from Direct Purchases							
85 Professional, scientific and technical services	4.8	4.5	4.5	4.4	4.2	4.2	4.1
80 Real estate	2.4	2.2	2.2	2.2	2.1	2.1	2.1
87 Management of companies and enterprices	2.4	2.2	2.1	2.1	2.0	2.0	2.0
61 Wholesale trade	2.0	1.8	1.8	1.8	1.7	1.7	1.6
88 Administrative and support services	1.7	1.6	1.5	1.5	1.5	1.4	1.4

LDEPPS

- Employment projections are made using LDEPPS
  - Detail available for 71 industries and 101 occupations
  - Projects defense-related employment resulting from DoD direct-hires, direct purchases, and indirect purchases
  - Based on projections of defense related production implied by the Defense Budget
  - Extra focus on science, engineering, and other technical occupations.

LDEPPS – Composition of Civilian Employment, 2016



LDEPPS – Defense Employment of Engineers and Scientists

Thousands of Workers	2014	2015	2016	2017	2018	2019	2020
Computer and mathematical science occupations							
Computer specialists	147.4	135.1	127.5	123.7	117.3	113.0	109.7
Mathematical science occupations	9.9	9.7	9.4	9.3	9.1	8.9	8.8
Total	157.3	144.8	136.9	133.0	126.4	121.9	118.5
Architectural and engineering occupations							
Architects, surveyors, and cartographers	15.6	14.8	14.3	14.0	13.6	13.4	13.2
Aerospace engineers	19.0	18.2	17.4	17.3	16.9	16.5	16.2
Chemical engineers	1.6	1.5	1.5	1.4	1.4	1.3	1.3
Civil engineers	26.2	25.3	24.6	24.1	23.5	23.2	22.9
Electrical and electronics engineers	39.5	38.3	36.9	36.5	35.5	34.8	34.3
Industrial engineers, incl health and safety	18.6	17.4	16.3	16.0	15.4	14.9	14.5
Mechanical engineers	30.1	29.1	28.0	27.6	26.9	26.3	25.9
Materials engineers	3.3	3.1	3.0	2.9	2.9	2.8	2.8
All other engineers	43.4	42.5	41.3	40.9	39.8	39.1	38.7
Drafters, engineering, and mapping techs	67.8	65.0	62.3	61.4	59.5	58.3	57.4
Total	265.2	255.2	245.5	242.2	235.5	230.5	227.2
Life, physical and social science occupations							
Life scientists	16.0	15.5	15.1	14.8	14.4	14.2	14.0
Chemists and materials scientists	6.2	5.9	5.7	5.6	5.4	5.3	5.2
Environmental scientists and geoscientists	7.8	7.4	7.1	7.0	6.8	6.7	6.6
Astronomers, physicists, & space scientists	3.5	3.5	3.4	3.4	3.3	3.3	3.2
All other physical scientists	3.1	3.1	3.1	3.1	3.0	3.0	3.0
Social scientists and related occupations	19.6	19.5	19.3	19.1	18.8	18.6	18.5
Life, physical, and social science techs	17.7	16.8	16.4	16.0	15.5	15.2	15.0
Total	73.8	71.7	70.1	68.9	67.2	66.1	65.5
Total Computer, Engineers, and Scientists	496.3	471.6	452.5	444.1	429.0	418.5	411.1

DEPPS Applications

- DEPPS can be used to analyze a variety of defense-related scenarios:
  - Multiplier analysis
  - Impacts of base closures
  - Analysis of import dependence and bottlenecks
  - Projections of defense energy requirements

Multiplier Analysis

- Method of determining impacts of alternative budgets
- Alternative spending scenarios are used as DEPPS inputs
- Scenarios:
  - Drastic decline is the defense budget (Fiscal Cliff)
  - Unexpected conflicts around the world
  - Additional aircraft procurement spending
- Multipliers of interest: GDP, budget deficit, industry impacts (output, employment, exports)

Base Closures

- Consolidation of military bases to increase operational readiness and reduce expenditures
- Objective is to determine the effects of base closures on the state economy
- Frame assumptions on the likely distribution of expenditures and pay that would be reduced
  - Allocate to major spending categories (Procurement, O&M, etc)
  - Use defense translator and RDEPPS to determine distribution of impacts by industry

Import Dependence

- Benefits from less reliance on imports:
  - Self-sufficiency in time of war, particularly when shipping is disrupted
  - Insulation from economic sanctions
  - Development and maintenance of a domestic defense industrial base (defense suppliers)
- Policy options to reduce reliance on imports:
  - Import Protection
  - Diversifying Supply Sources
  - Stockpiling

DoD Energy Requirements

- DoD is one of the largest consumers of energy in the world.
- Petroleum costs, while currently at a relative low, are fairly volatile and expected to rise.
- Price drivers from LIFT model can help forecast prices of electricity, coal, gas, and petroleum products.
- Defense analysts have linked energy-saving technologies to the Inforum LIFT model to evaluate effects of changes in energy consumption

Additional Information

- Previous DEPPS Publications: http://www.economics.osd.mil/Annual_Publications.html
- IDEPPS Guide: http://www.economics.osd.mil/IDEPPS_Primer.pdf
- RDEPPS Guide: http://www.economics.osd.mil/RDEPPS_Primer.pdf
- LDEPPS Guide: http://www.economics.osd.mil/LDEPPS_Primer.pdf
- U.S. Defense Budget: http://comptroller.defense.gov/Budget-Materials/
- Inforum Models: http://www.inforum.umd.edu/services/models.html

Thank You!

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