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Space Industry's Impact on the California Economy

Study Released
September 2010

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Contents

Industry Overview

- Economic Impact of Space Industry
- Competitiveness of California in Space Industry
- Opportunities and Recommendations

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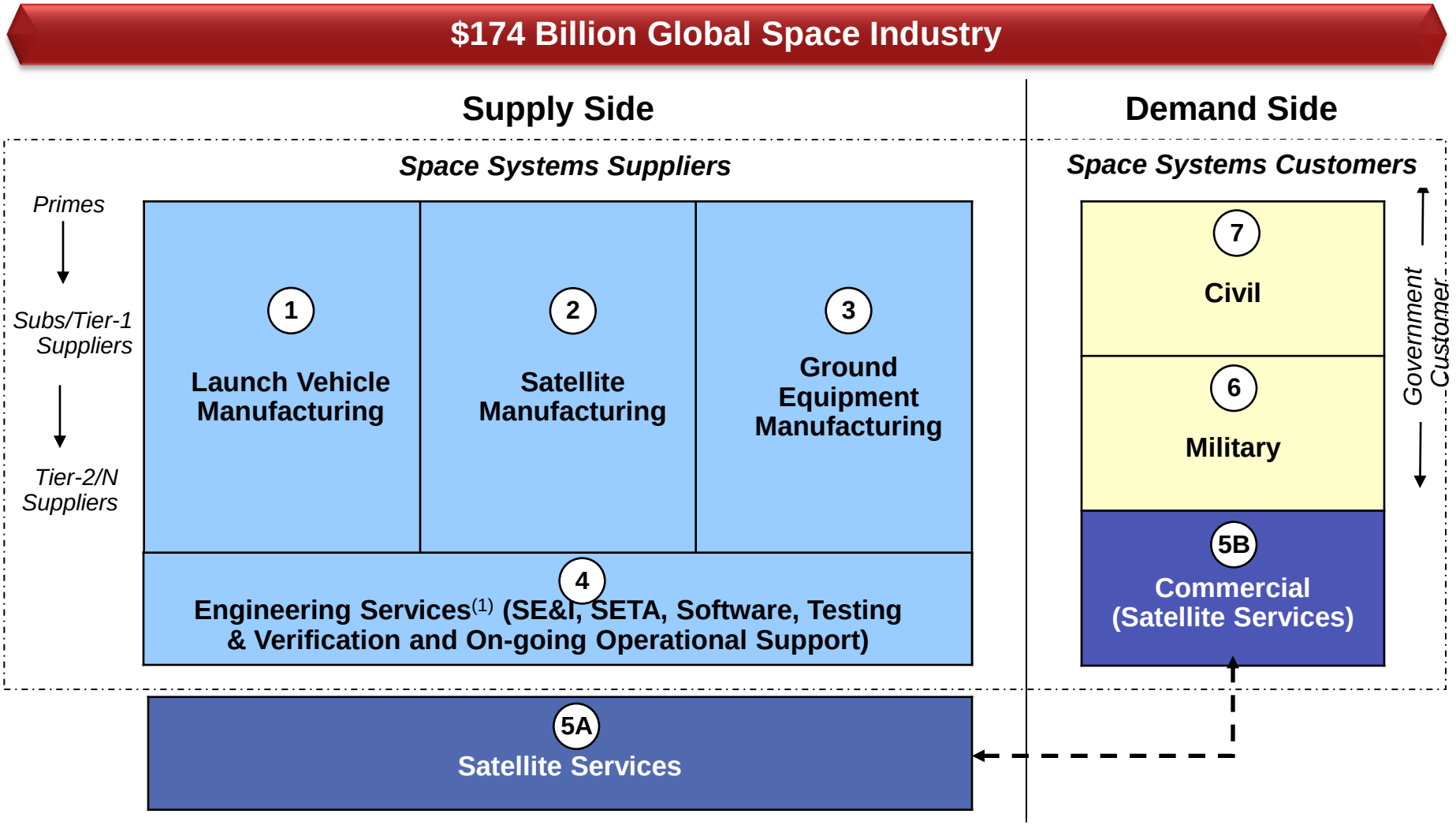
The global space industry is estimated at $174B driven by both supply and demand



Note: (1) Engineering services include directly awarded SE&I, SETA, Software, Testing & Verification & On-going Operational Support contractors; it is exclusive of and in addition to potential similar services that may be covered and bundled in prime contracts

Source: A.T. Kearney analysis

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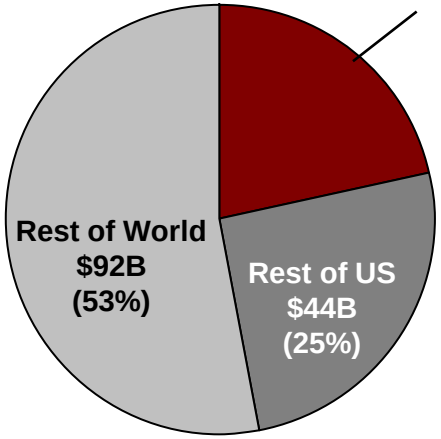
California space industry has a 22% share of the global space market, with a 39% share in satellite manufacturing

Total Global Space Market

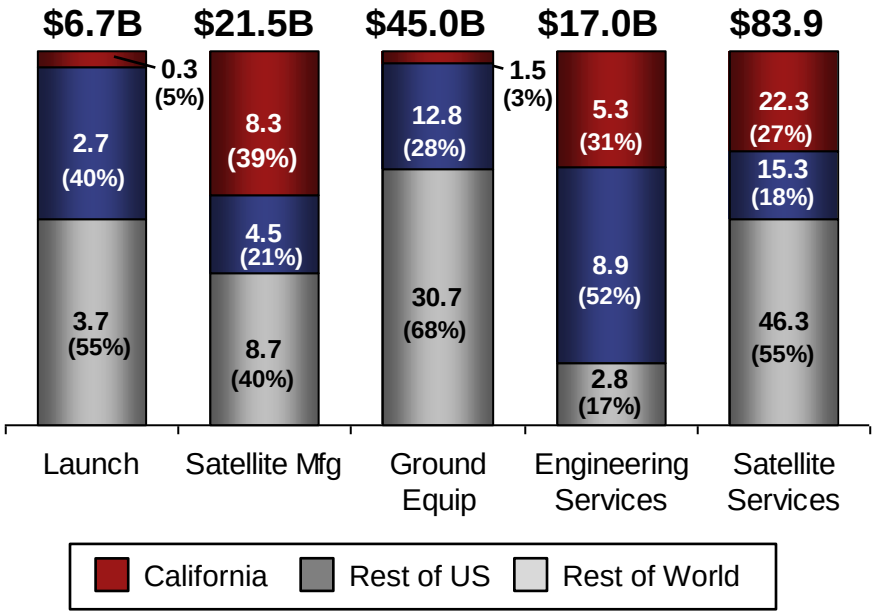
California represents $38B or 22% of the $174B global space market



Key Changes

- The Space Industry globally grew by over $25B (8% annually) since 2008, driven primarily by $19B growth in the satellite manufacturing and services businesses
- California outgrew the global market with annual growth of 11% ($7B) since 2008, driven by the satellite manufacturing business

Revenues by Sector



Change in Share Points by Sector since 2008

	Launch	Satellite Mfg	Ground Equip	Engineer-ing Svcs	Satellite Svcs
California	—	▲5%	▼1%	▼1%	▲1%
Rest of US	▲2%	▼1%	▲2%	▲1%	▼4%
Rest of World	▼2%	▼4%	▼1%	—	▲3%

Source: DoD and NASA FY10 figures from FY11 budget requests, Satellite Industry Association, Federal Aviation Administration, Air Force Magazine, Space News, SEC Filings, Company and industry interviews; A.T. Kearney analysis

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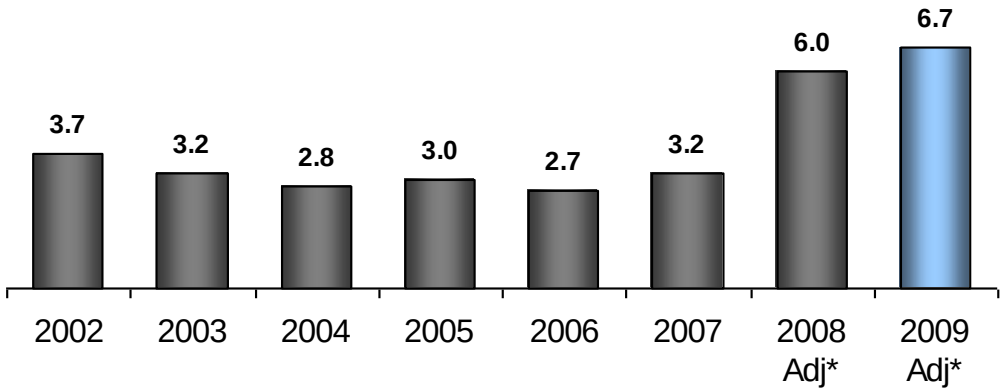
Launch vehicle market has increased by 11% in since 2008…

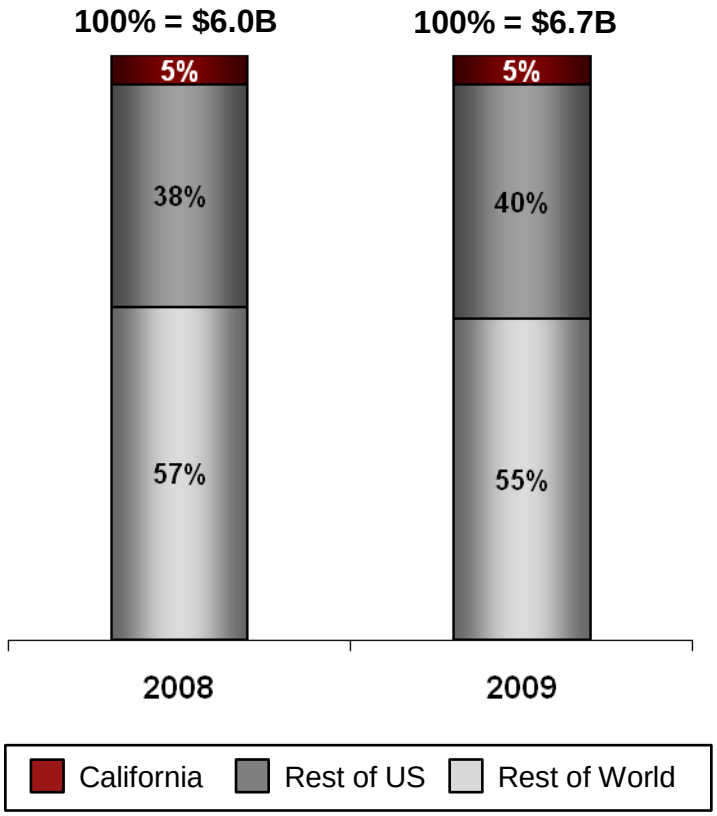
Launch Vehicle Market Size(1)

-Billion $-



* Adjusted to include estimated government spend on development & classified projects(2).

Market Share by Geography



(1) 2009 figures based on 72 launches from Q2 2009 through Q1 2010
(2) Total classified spend is reported in DoD budgets but not broken out in any detail. It was assumed that classified spend was allocated similarly as unclassified spend
Source: Satellite Industry Association, NASA and DoD FY10 figures from FY11 budget requests, Space News & FAA, A.T. Kearney analysis

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…and experienced the entrance of North and South Korea

Rest of World Launch Revenues by Prime

Prime	Country	# of Launches	Revenue ($MM)
Khrunichev	Russia	14	1,171
Arianespace	France	6	995
TsSKB-Progress	Russia	9	460
China Space	China	7	355
Yuzhnoye	Russia	5	258
Mitsubishi	Japan	2	200
Iranian Space Agency	Iran	1	65
KARI	***S. Korea***	***1***	***65***
Indian Space (ISRO)	India	2	45
North Korea	***N. Korea***	***1***	***26***
Eurockot	Europe/Russia	2	25
Total		**50**	**3,664**

U.S. Launch Revenues by Prime

Prime	State	# of Launches	Revenue ($MM)
ULA	CO	14	1,389
USA / Space Shuttle	TX	5	180
UP Aerospace	CO	1	65
Orbital	VA	1	13
SpaceX	CA	1	7
Total		**22**	**1,653**

Additional U.S. Government Spend

Sponsor	FY10 Budget($MM)
DoD (Largely EELV)	1,342

Key Changes since 2008

- ***Rest of World Market:***
  - Despite 3 fewer launches in the last 12 months, new players – North and South Korea – have entered the launch sector of the space industry
  - India is perceived to be more advanced in the adaptation of technology compared to the more traditional, risk averse, developed markets
  - Similar to the U.S., the global market is experiencing a lower average cost per kilo in launch vehicles
- ***U.S. Market:***
  - While the number of launches has remained relatively steady, the average cost per kilo has decreased
  - Specifically, the mix within ULA's portfolio shifted to more higher capacity launch vehicles with the migration from the Delta 2 to the Delta 4 and Atlas 5

"… vehicle capacity has increased for all major vehicles; up to a metric ton has been gained in the past 10 years…getting a more efficient launch." — Tauri Group

(1) 2009 figures based on 72 launches from Q2 2009 through Q1 2010

Source: Satellite Industry Association, NASA and DoD FY10 figures from FY11 budget requests, Space News & FAA, Aviation Week. A.T. Kearney analysis

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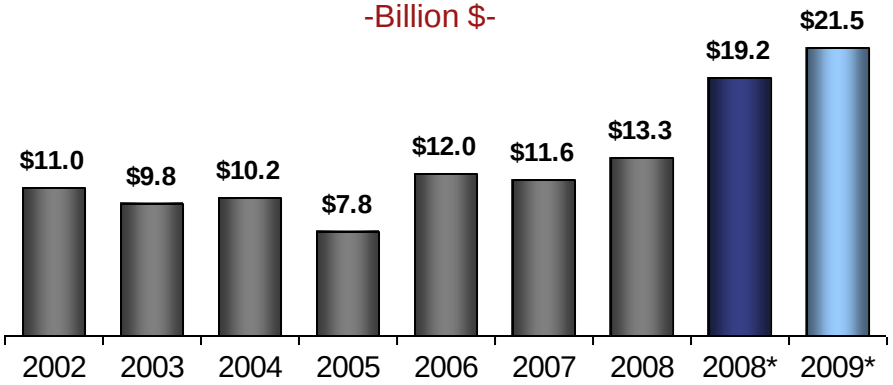
In the satellite sector, California has a strong base in manufacturing

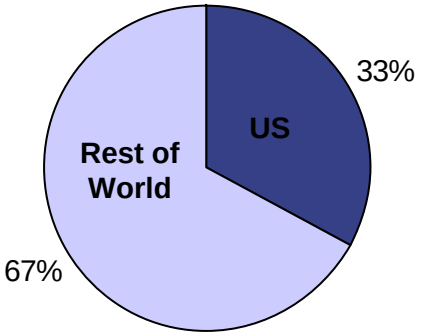
Satellite Manufacturing Market Size(1)

-Billion $-

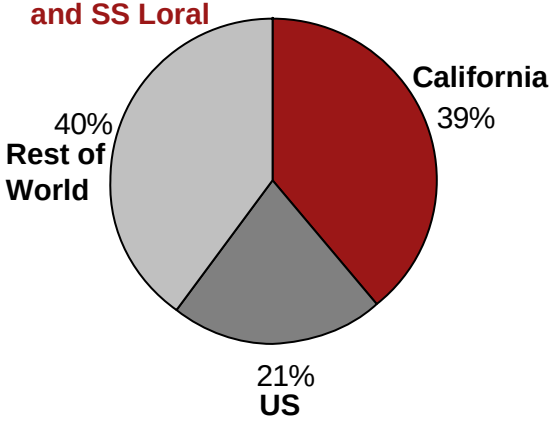


* Adjusted to include estimated government spend on development & classified projects

U.S. customers ordered 33% of the 67 satellites launched from Q2 2009 through Q1 2010



California is a leader in satellite manufacturing with firms such as Lockheed, Boeing, Northrop Grumman and SS Loral



Sector Outlook

- Commercial segment is expected to continue to take a leadership role in driving efficiencies in the sector
- While fewer satellites have been launched, the cost per satellite is increasing driven by size and complexity
- Small satellite manufacturing will continue to thrive, but dominance of the sector will remain with larger satellites
- California should continue to dominate in manufacturing given the cost barrier in relocating plants, however R&D may be at risk for shifting to other states
- NASA will put an emphasis on earth science to understand the drivers behind climate change, creating growth in demand

Estimated Additional Government Spend

Sponsor	FY010 Budget ($MM)
DoD – (AEHF, SBIRS, GPS, NPOESS and others)	3,300
NASA (James Webb Telescope, Mars Science lab, SOFIA & others)	1,200
Total	**4,500**

(1) Adjusted figures includes estimate of classified DoD spend. Figures based on all satellite launches between Q2 2009 and Q1 2010 and DoD/ NASA budgets.
Source: Satellite Industry Association, NASA and DoD FY10 figures from FY11 budget requests, Space News & FAA, A.T. Kearney analysis

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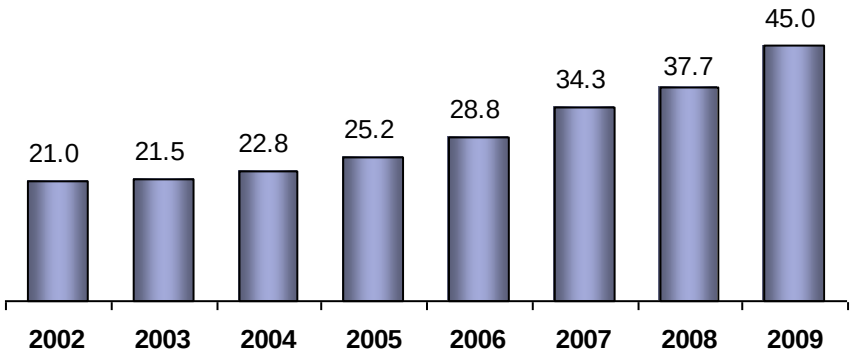
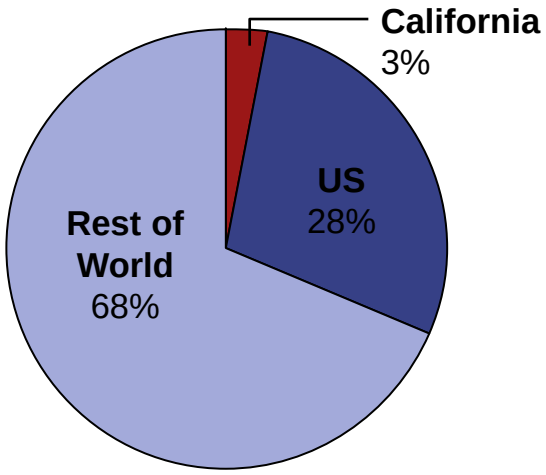
The growth in the Ground Equipment segment comes from the consumer market

Ground Equipment Market Size

-Billion $-



Market Share by Geography



Sector Outlook

- The federal government is expected to invest $5.8 billion through 2013 in the GPS space and ground control segments
- As other countries (e.g. Russia) continue to develop their own independent global navigation satellite systems, the global ground equipment sector should continue experience rapid growth
- Growth in ground equipment will also be fueled through innovation of alternative uses for GPS
  - GPS-enabled smartphone shipments are expected to nearly triple by 2013, compared with 2009 – disrupting the dominance of PNDs – to control 66% of the GPS device market

Source: Satellite Industry Association, Frost & Sullivan, SEC filings, A.T. Kearney analysis

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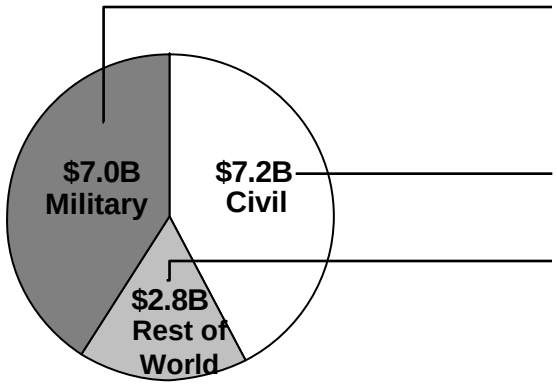
U.S. government drives spend on engineering services, primarily for on-going support of current space operations

Engineering Services Revenues(1)

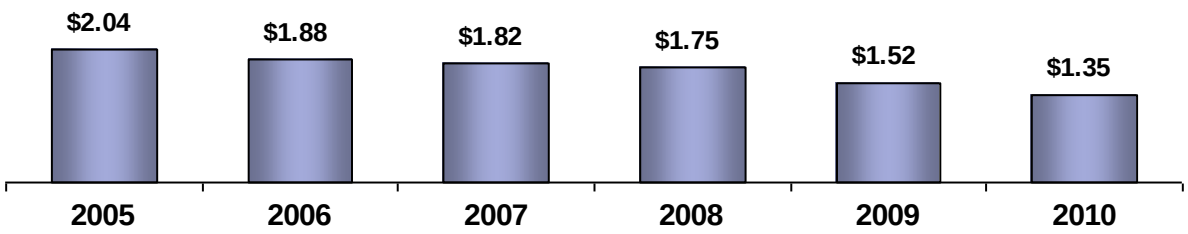


- The DOD continues to be a key buyer of space systems and engineering services partnering with firms that provide project, oversight and technical expertise
- NASA's share of the government market has grown by $0.8B since '08, while military's share has declined by $0.3B
- The U.S. market is driving the growth in this sector, with countries outside of the U.S. maintaining their level of investment in the past 2 years

United Space Alliance (USA)

USA is responsible for Space Shuttle and Int'l Space Station operations, however the Space Shuttle is retiring as seen in the decline in the NASA Obligations to USA

Annual NASA Contract Obligation to USA ($B)



With the cancellation of the Space Shuttle program, it is anticipated the lost revenue will be diverted to companies in the commercial sector via other space-related programs. Thus, the market anticipates a budget shift vs. a complete loss of budget

Note: (1) Engineering services include directly awarded SE&I, SETA, Software, Testing & Verification & On-going Operational Support contractors; it is exclusive of and in addition to potential similar services that may be covered and bundled in prime contracts
(2) The Aerospace Corp is an FFRDC that conducts launch verification and research for the U.S. government

Source: EADS Astrium, NASA contract database, Aerospace Corp Annual Reports, A.T. Kearney analysis

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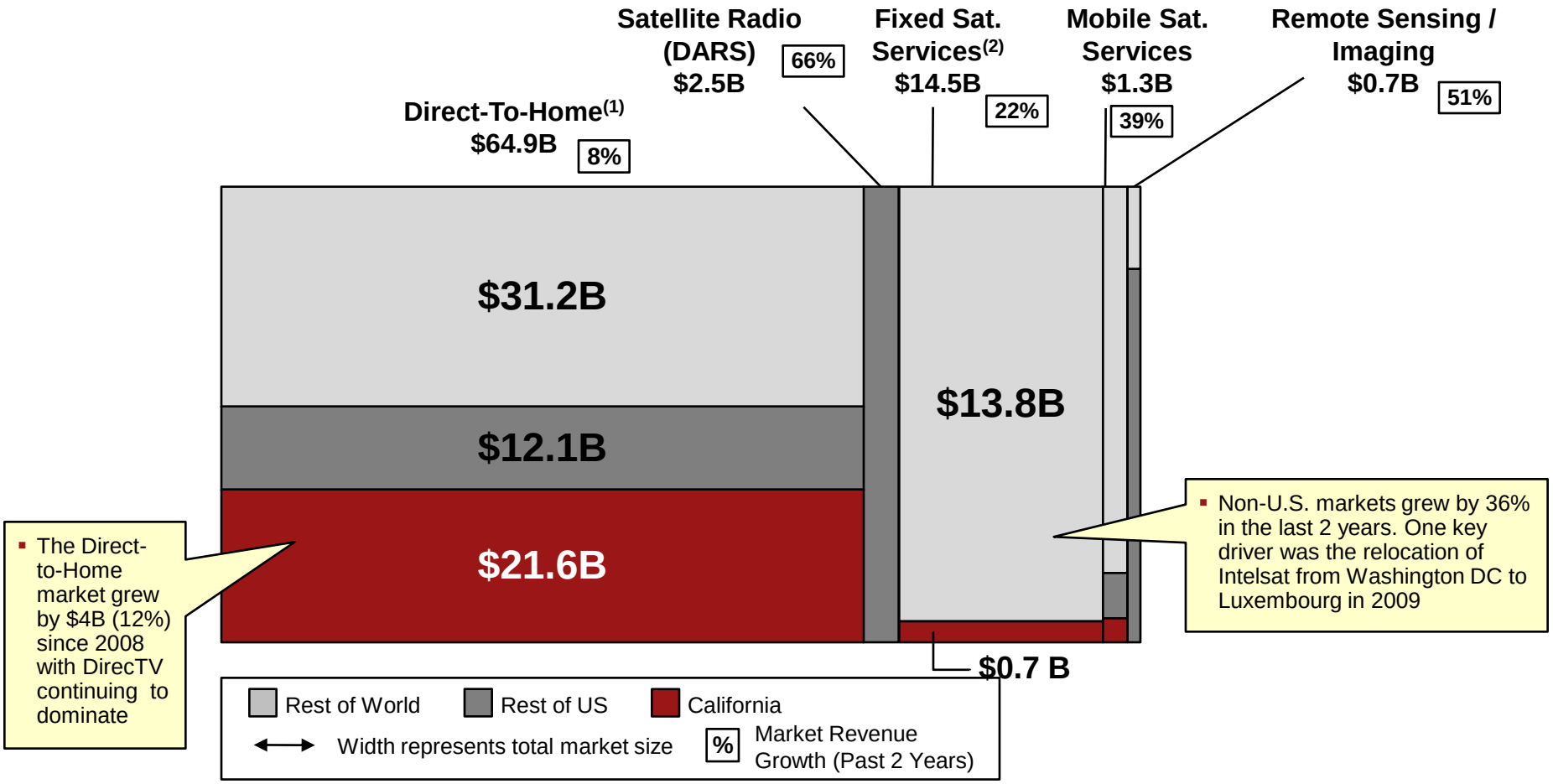
California has captured 27% ($22.3B) of the $84B global satellite services market, largely due to DirecTV

Satellite Services Market Size(1,3)

-Billion $-



(1) All of DirecTV's $21.6B revenue is allocated to California. DTH width not to scale.
(2) In the Fixed market, Intelsat revenues are counted as Rest of World due to their relocation from Washington DC to Luxembourg in 2009
(3) Growth rate based on 2 year CAGR from CSA 2008 study

Source: SIA, Company reports, A.T. Kearney analysis

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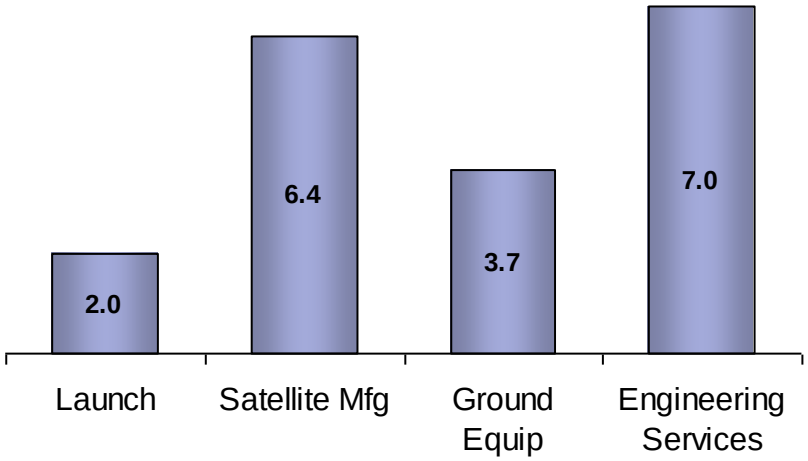
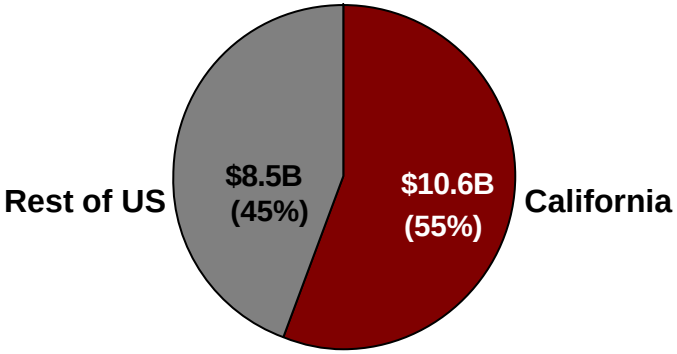
California gets the majority share of the Department of Defense spend

$19.1B DoD Space External Spend

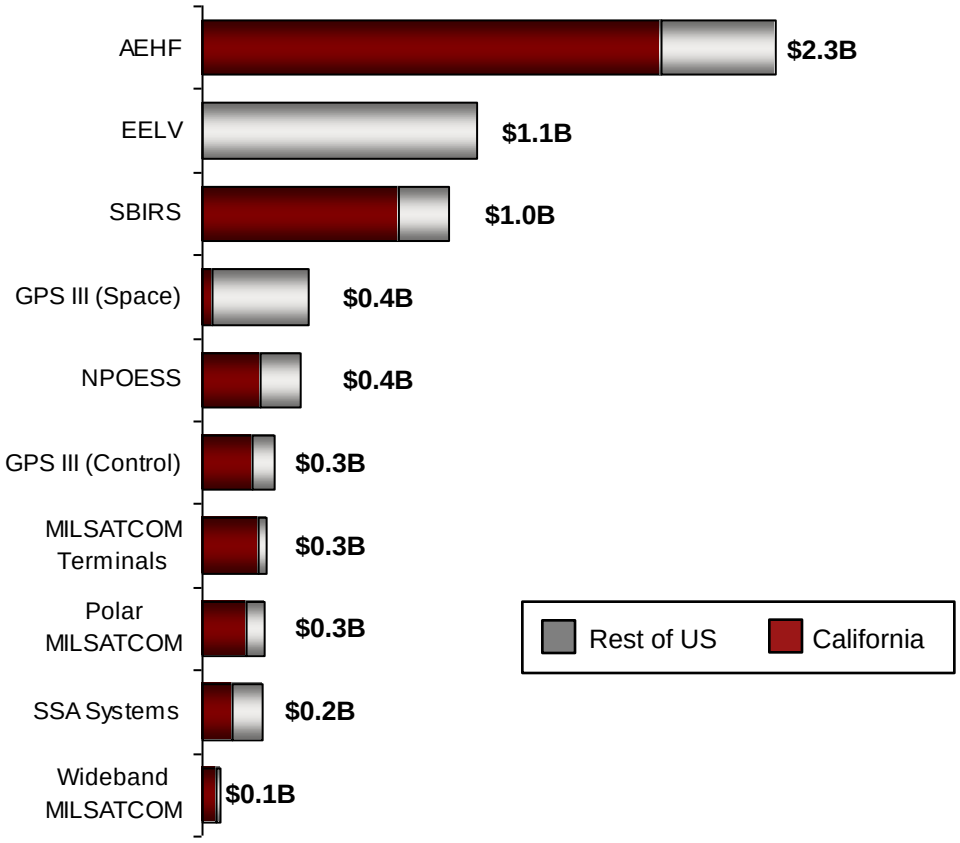
(Includes estimated classified spend)(1)



California Share of DoD Spend



Top 10 DoD Space Projects (FY10 Budget)(2,3)



Note: (1) Includes estimate of classified spend. Engineering services include SE&I, Software, Testing & Verification, On-going Operational Support.
(2) Includes Research, Development, Test & Evaluation (RDT&E) and procurement. California shading based on the location of the prime and tiered suppliers.
(3) GPS IIF work is underway but does not have any dollars associated with it in the USAF FY10 budget

Source: DoD FY10 figures from FY11 Budget Request, Air Force Magazine Space Almanac, A.T. Kearney analysis

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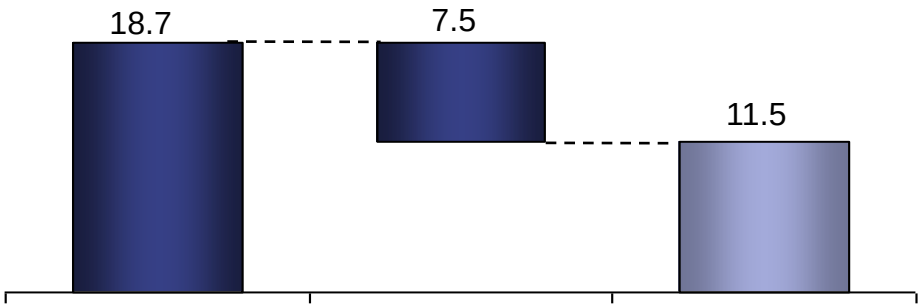
NASA's external spend mostly goes to engineering services including supporting ongoing operations

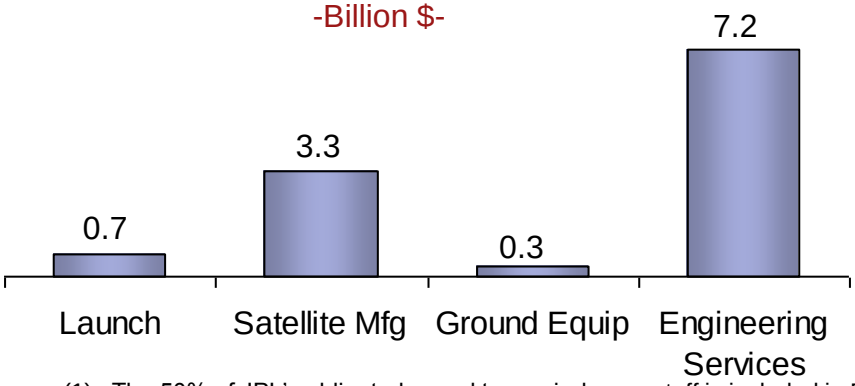
External Spend in NASA Budget(1)

-Billion $-



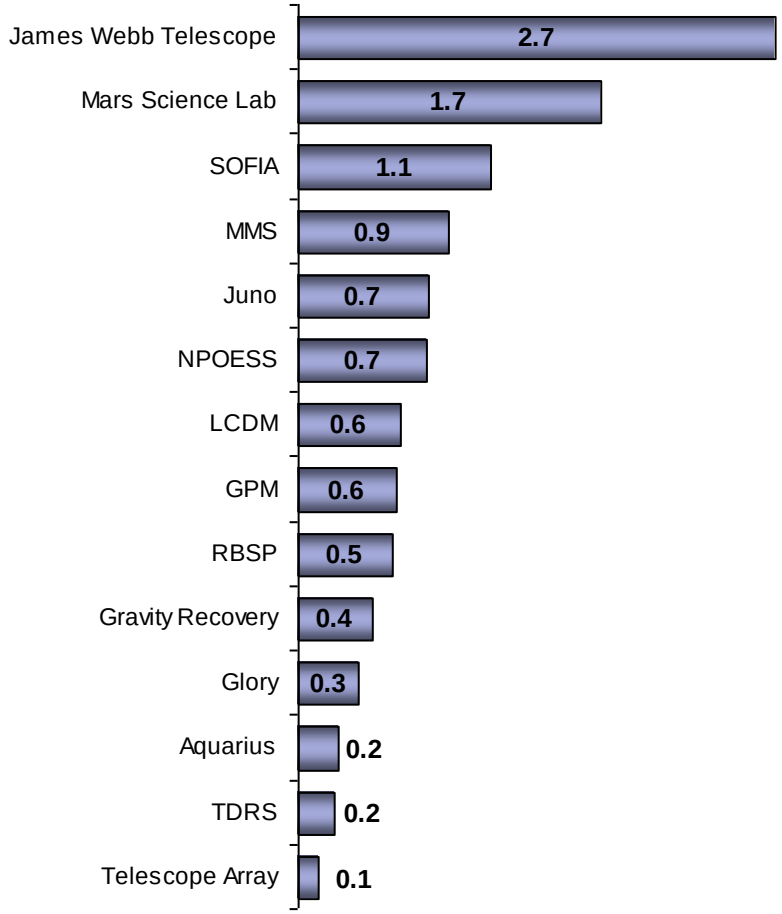
External Spend by Category(2)

-Billion $-



Top NASA Projects (FY10 Budget)

-Billion $-



Note: (1) The 50% of JPL's obligated spend to pay in-house staff is included in FFRDC. NASA overhead calculated at 18% based on estimate from all NASA contracts; overhead includes items such as IT support, construction and facilities maintenance.
(2) Engineering Services includes on-going operations such as Space Shuttle & Int'l Space Station operations.

Source: NASA NAIS database, NASA FY10 figures from FY11 Budget Request; NASA Interviews, A.T. Kearney analysis

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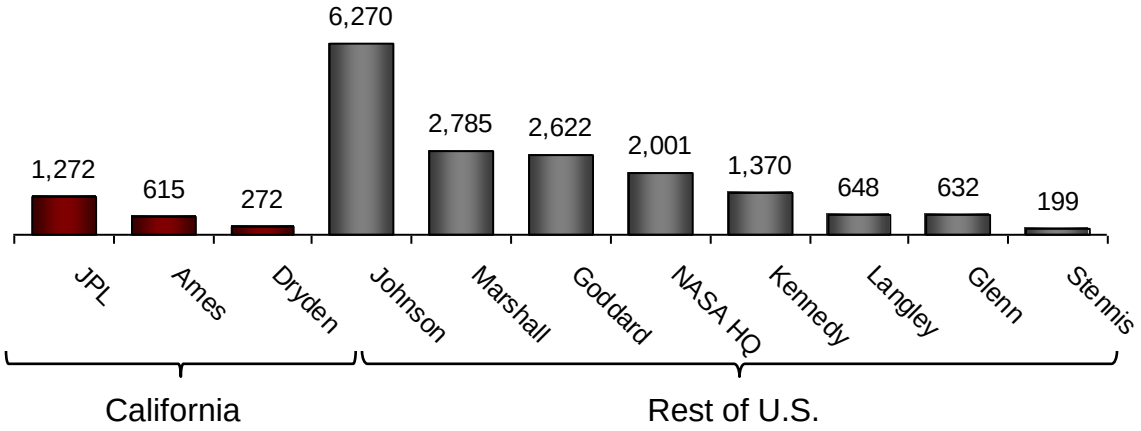
NASA centers continue to allocate significant budget to be spent in California, but the share has declined slightly

FY 2009 Budget by Research Centers(1)

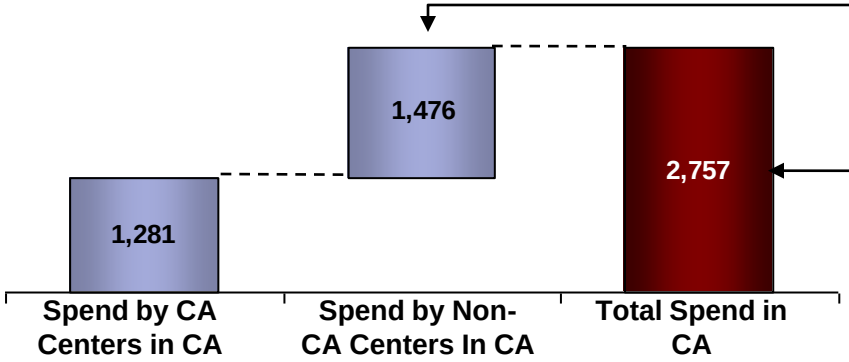
-Million $-



California Research Centers account for $2.2B or 12% of the total $18.7B FY10 NASA Budget

FY 2009 Obligated Spend in California(1)

-Million $-



California companies are able to attract $1.5MM in spend from NASA centers outside the state

California companies received $2.8B or 18% of the total $15.4B NASA Obligated Spend in FY09 compared to $2.9B or 21% of the total $14.0B in FY08

Note: (1) The 50% of JPL's obligated spend to pay in-house staff is excluded
Source: NASA NAIS database, NASA FY09 Budget Request, A.T. Kearney analysis

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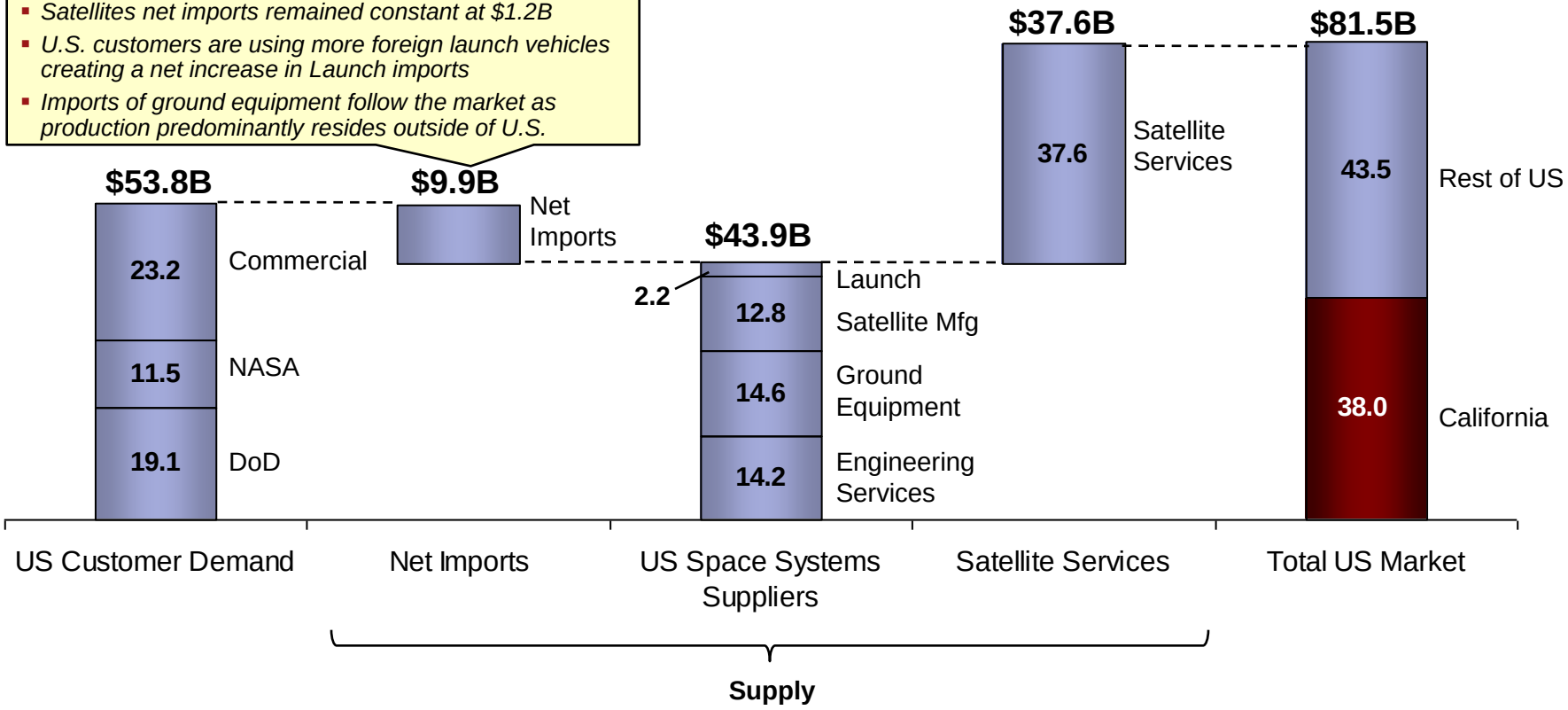
California's space industry market amounts to $38B and accounts for more than 46% of the U.S. market

U.S. Market Space Systems Demand and Supply Equation

-Billion $-

- *Net Imports increased overall by $2B*
- *Satellites net imports remained constant at $1.2B*
- *U.S. customers are using more foreign launch vehicles creating a net increase in Launch imports*
- *Imports of ground equipment follow the market as production predominantly resides outside of U.S.*



Note: (1) The majority of net imports from U.S. customers using non-U.S. launch vehicles and sourcing consumer ground equipment from abroad

Source: DoD and NASA FY10 figures from FY11 budget request; Satellite Industry Association, Forecast International, Air Force Magazine, Company reports, Interviews, A.T. Kearney analysis

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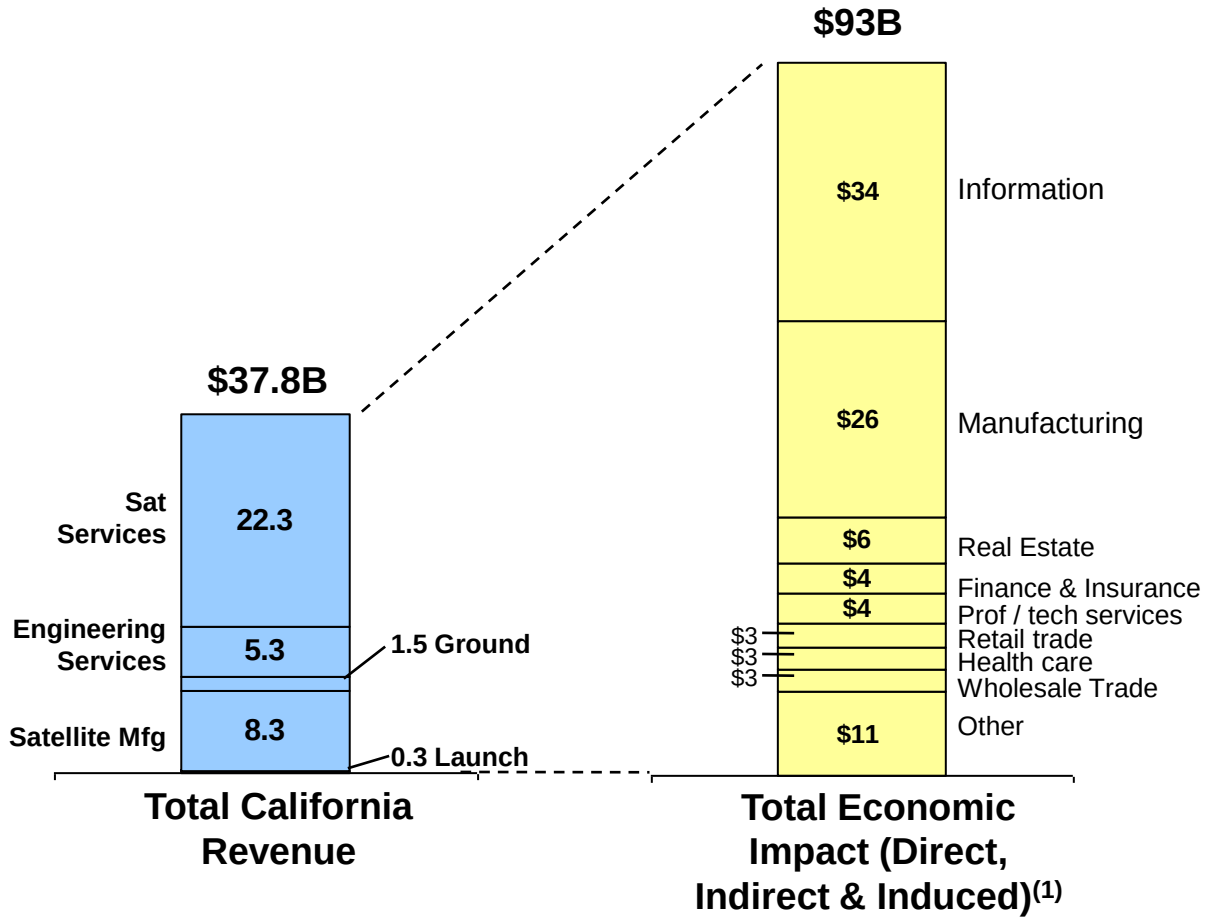
- Industry Overview
- **Economic Impact of Space Industry**
- Competitiveness of California in Space Industry
- Opportunities and Recommendations

The California space industry creates $93B in total economic impact from revenues of $38B

Space Industry Economic Contribution to the California Economy



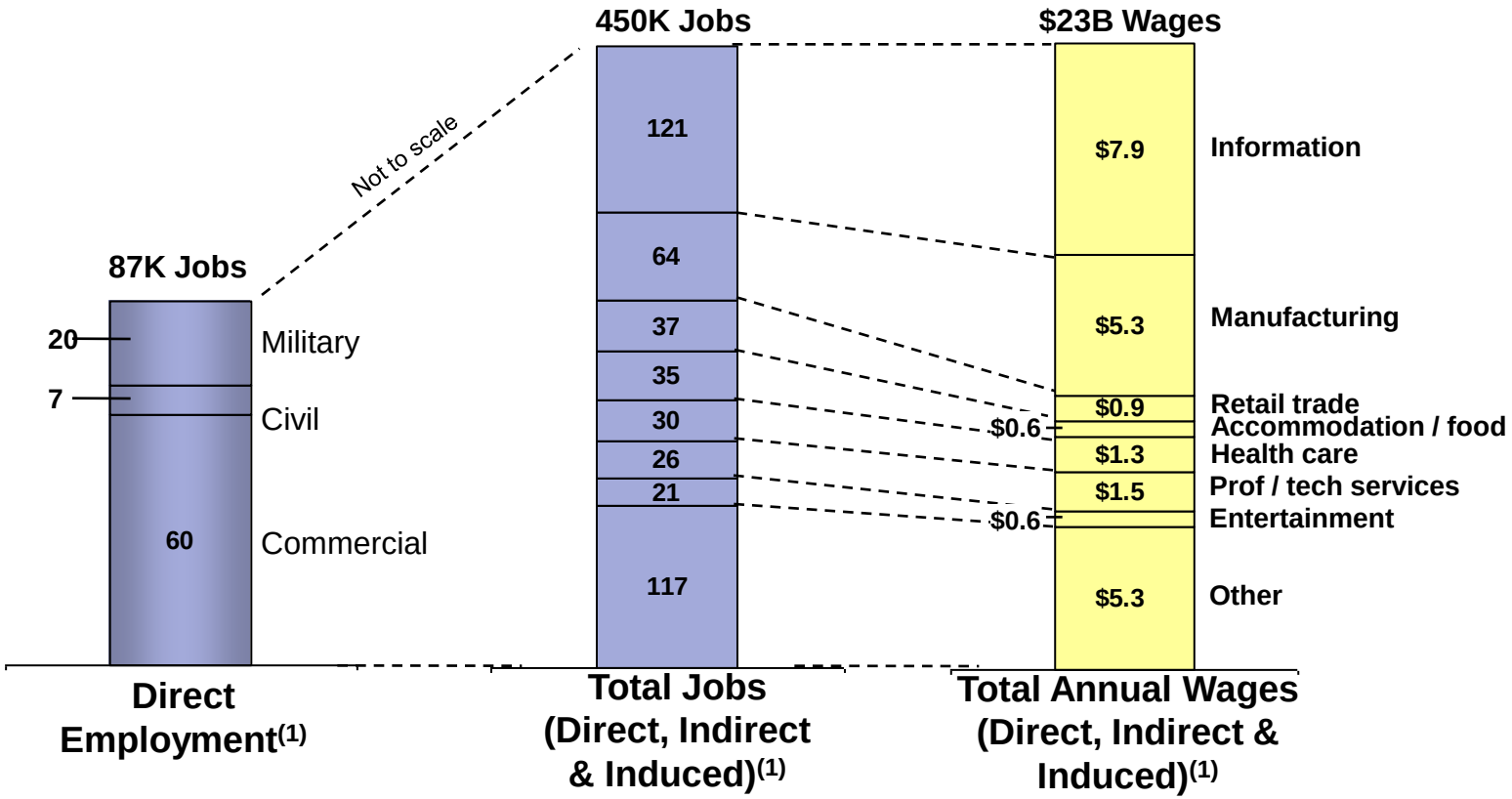
As large or larger than other prominent CA industries

- Agriculture—$38B[2]
- Motion Picture/ Entertainment—$30B[3]

Note: (1) Indirect and induced employment based on U.S. Bureau of Economic Analysis employment multipliers. 2009 data
(2) Source: CA Agriculture Statistics Review
(3) Source: Los Angeles County Economic Development Corp.

The California space industry employs 87,000 people directly and creates 450,000 jobs across all industries

Space Industry Employment and Wage Contribution to California Economy



(1) Indirect and induced employment based on U.S. Bureau of Economic Analysis employment multipliers

Source: U.S. Bureau of Economic Analysis, (2009 data) A.T. Kearney analysis

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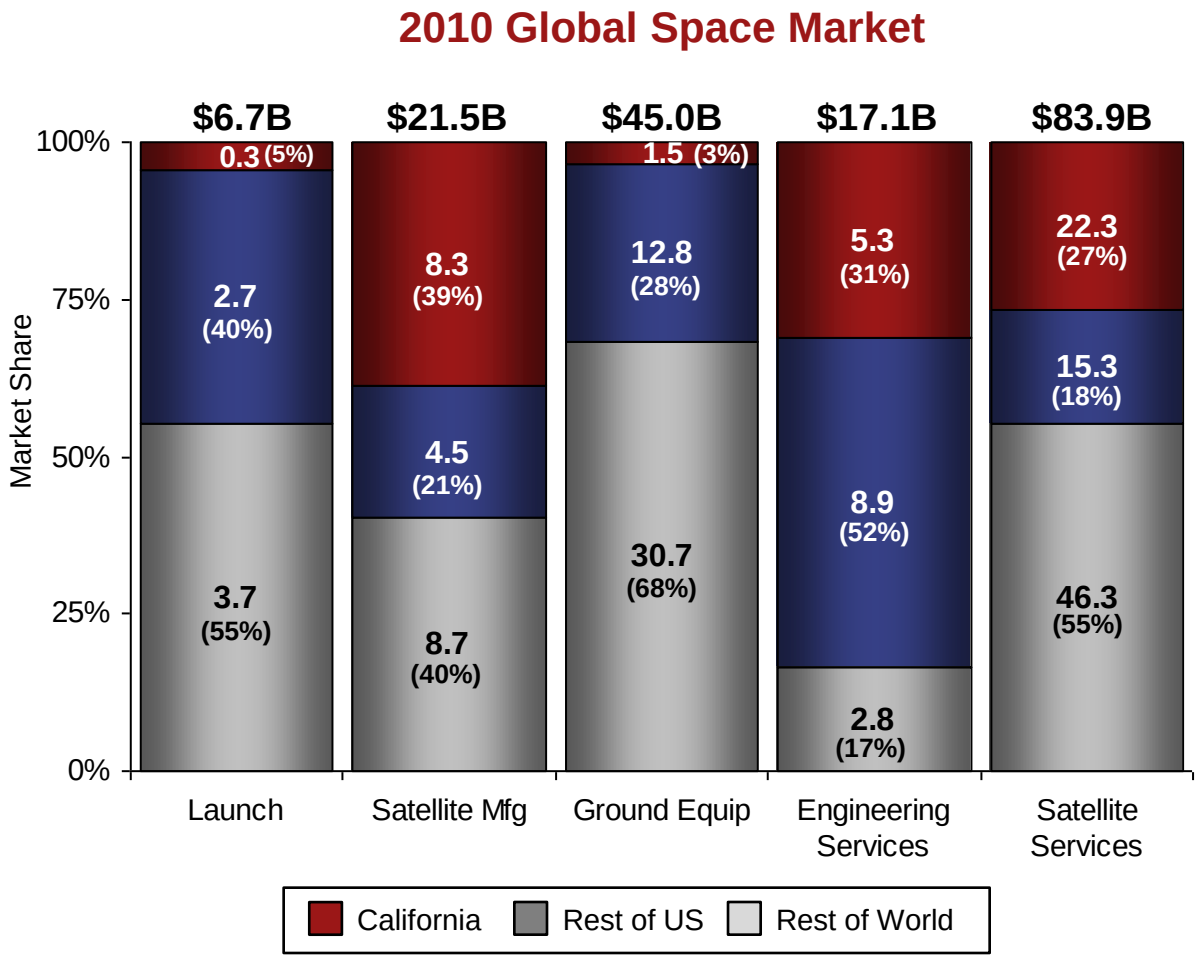
The California Space Enterprise represents 22% of the global space market



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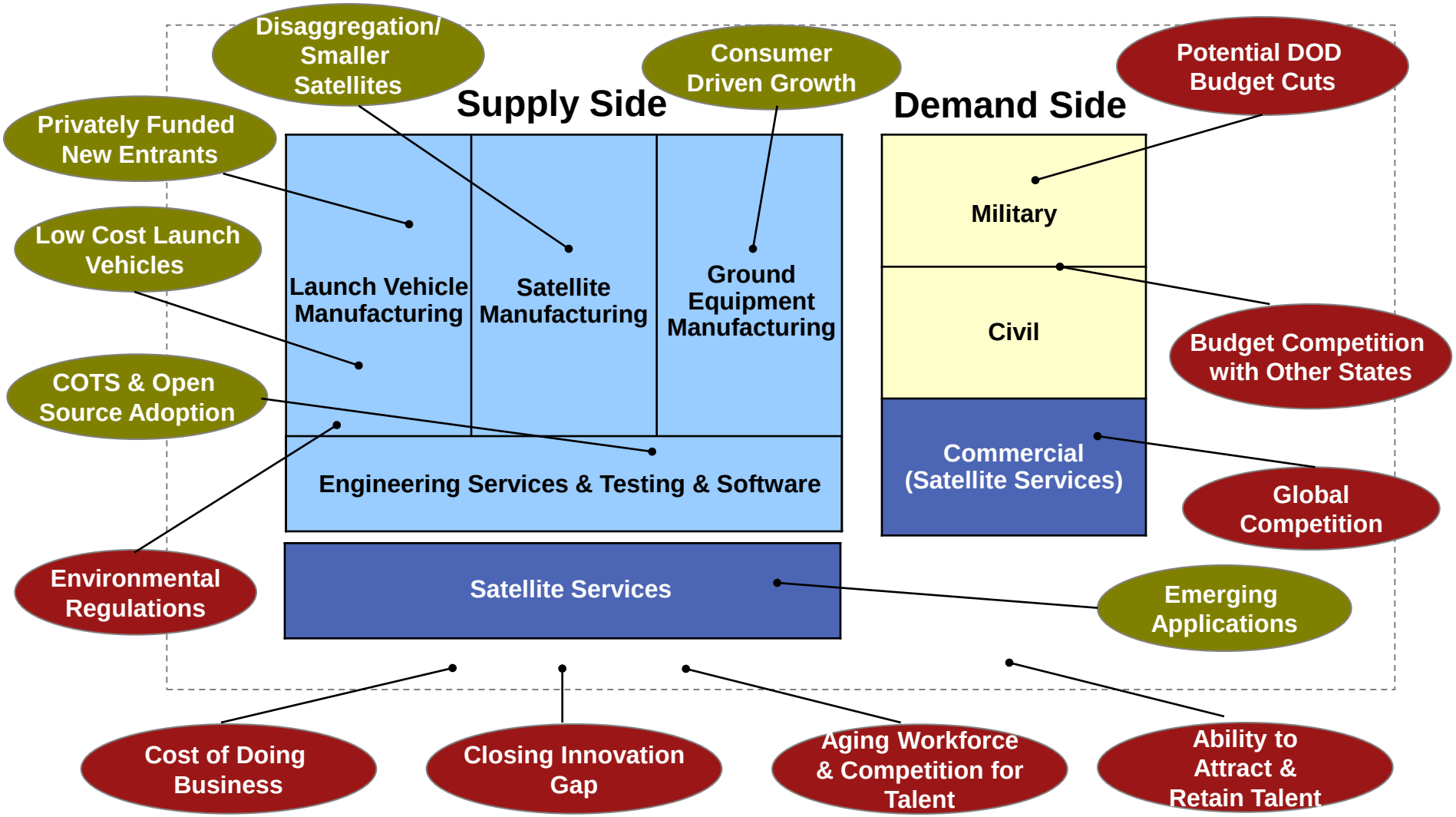
California's space industry faces opportunities and challenges



Source: A.T. Kearney analysis

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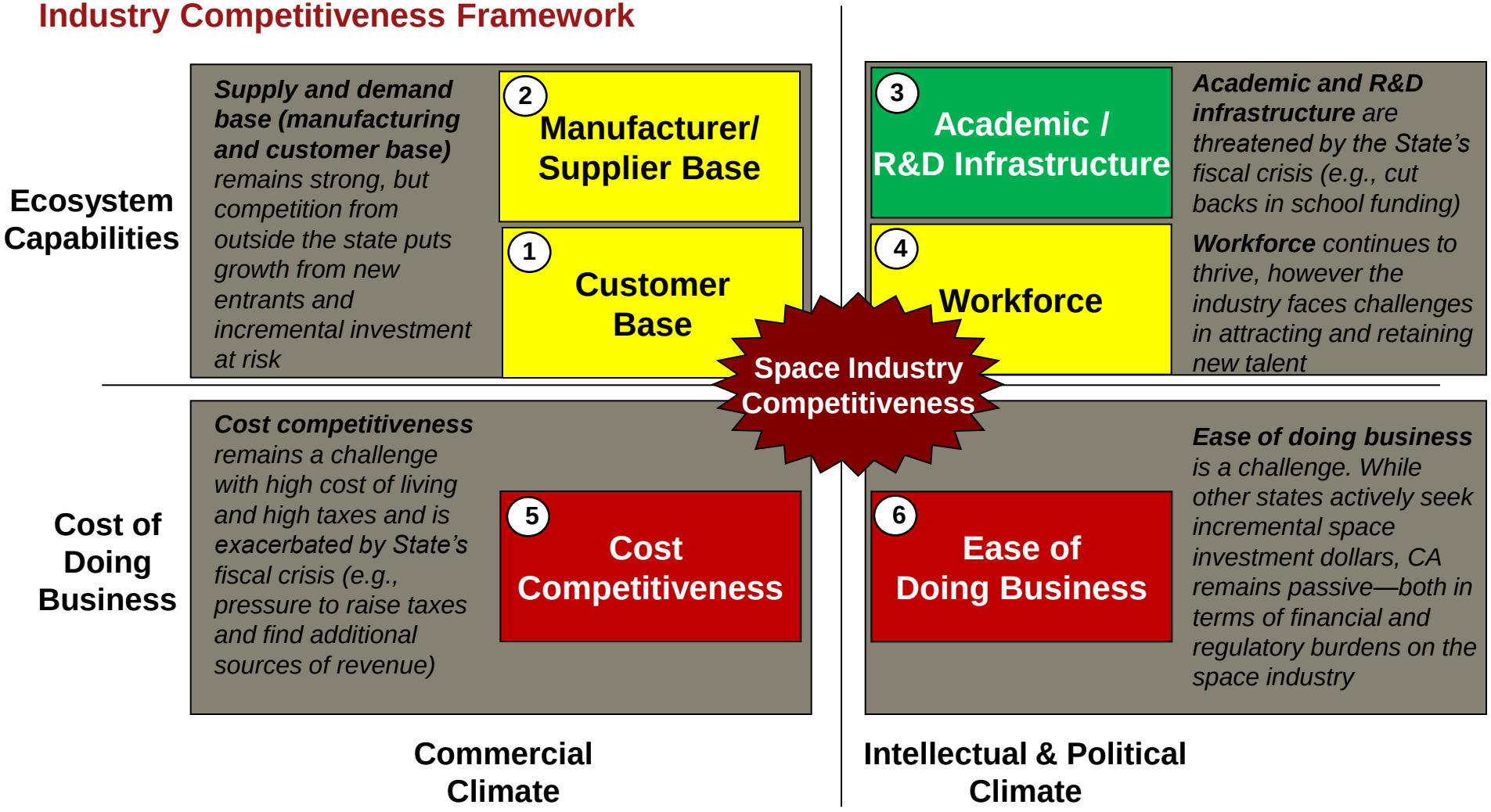
California's strong space ecosystem enables the space enterprise to thrive, but challenges exist

Industry Competitiveness Framework



Source: A.T. Kearney interviews and analysis

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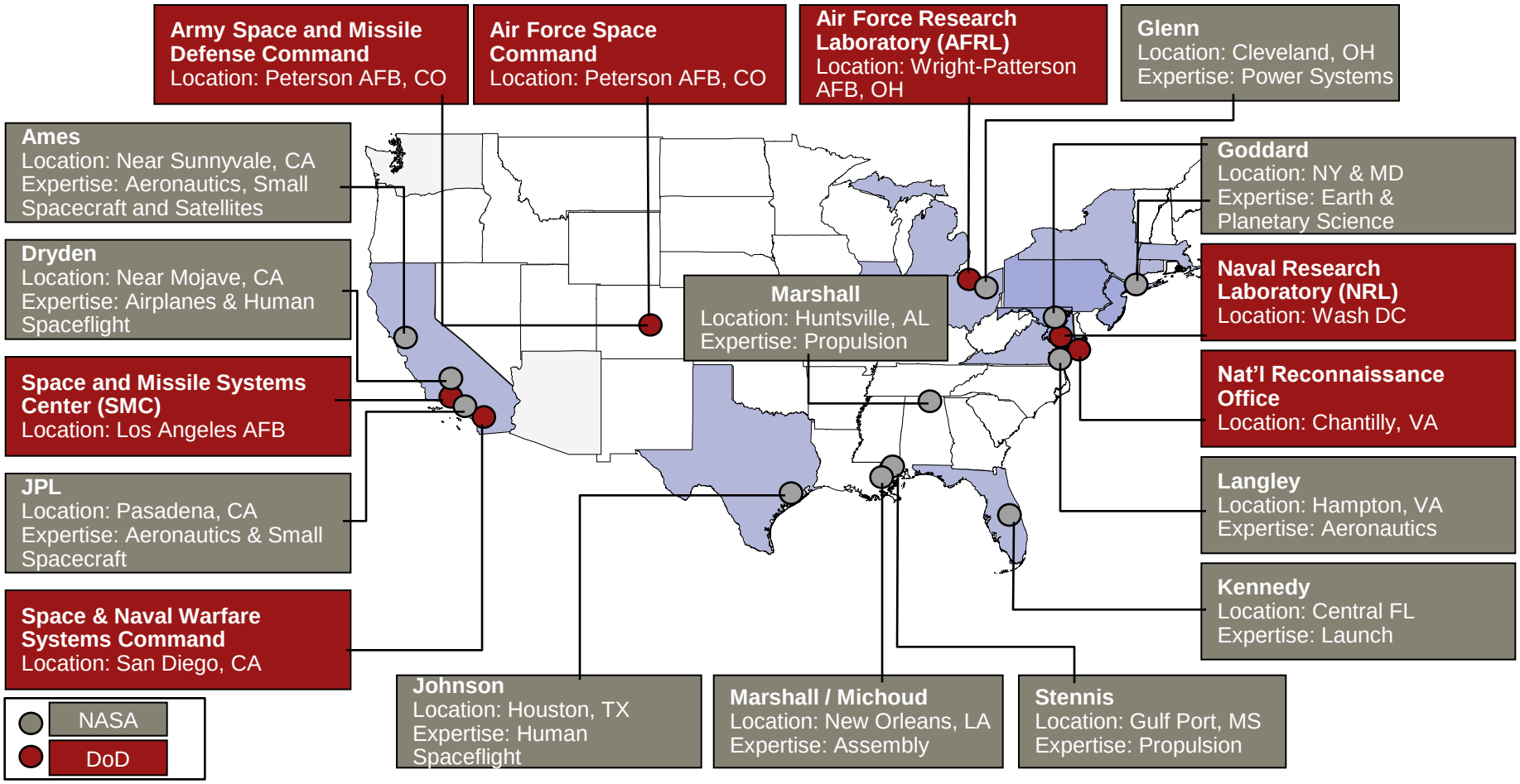
The strong government and civil customer base is pivotal for the California space industry

Major Government and Civil Space Industry Customers



Note: A&D concentration (in terms of the number of companies) is higher for shaded states

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California companies span across the space industry and lead important segments such as satellite manufacturing

Partial List

		California	U.S.	Rest of World
Launch	**Vehicle Mfg & Services**	▪ Sea Launch ▪ SpaceX	▪ United Launch Alliance	▪ Arianespace ▪ Khrunichev ▪ Yuzhnoye ▪ TsSKB-Progress ▪ CNSA (China)
	Propulsion	▪ Rocketdyne / Pratt & Whitney ▪ Aerojet	▪ ATK	▪ Safran (Snecma)
Satellite Mfg	**Primes & Payload**	▪ Lockheed Martin (Sunnyvale) ▪ Boeing ▪ Northrop Grumman ▪ SS / Loral ▪ SAIC	▪ Lockheed Martin (Denver) ▪ Orbital ▪ General Dynamics ▪ Ball ▪ Sierra Nevada	▪ EADS Astrium ▪ Thales Alenia Space ▪ Mitsubishi ▪ MacDonald, Dettwiler ▪ OHB Technology
	Tier 2 / 3	▪ L-3 ▪ Com Dev USA	▪ Honeywell ▪ United Technologies ▪ ITT	▪ Com Dev ▪ Thales Alenia ▪ Tesat ▪ FinMeccanica
Ground Equipment		▪ ViaSat ▪ Trimble ▪ Magellan ▪ Mio	▪ Garmin ▪ HughesNet ▪ Sirius XM	▪ Various Chinese / Taiwanese suppliers
Engineering Services		▪ The Aerospace Corp ▪ Raytheon ▪ Jacobs Technology ▪ SAIC	▪ United Space Alliance ▪ ATK ▪ CSC	
Satellite Services	**DTH**	▪ DirecTV	▪ Dish / Echostar	▪ British Sky Broadcasting ▪ Other regional / local DTH
	DARS		▪ Sirius XM	
	FSS	▪ Loral Skynet /Telesat ▪ ViaSat	▪ Intelsat / PanAmSat	▪ SES / New Skies ▪ Eutelsat ▪ JSAT ▪ Shin Satellite ▪ Space Comm Corp
	MSS	▪ Globalstar	▪ MSV ▪ Iridium ▪ ICO ▪ Terrestar ▪ Orbcomm	▪ Inmarsat ▪ Asia Cellualr ▪ Thuraya
	Remote Sensing		▪ GeoEye ▪ Digital Globe	▪ RapidEye ▪ Spot Image

California Supplier Base Position

- ● Strong players / leadership in sector
- ◑ Some supplier base in sector
- ○ Weak position in sector

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Smaller, entrepreneurial space companies are pushing to "change the game" in the launch segment—net impact on industry in California is uncertain

Emerging Players in Spacecraft & Launch Segments

State / Region	Company	Investors/Leadership
California	SpaceX	Elon Musk, CEO
	Interorbital	Randa Milliron, CEO
	Masten Space	David Masten, CEO
	Scaled Composites	Owned by Northrop Grumman
	XCOR Aerospace	Jeff Greason, CEO
Texas	Armadillo Aerospace	Millionaire video-game programmer John Carmack
	Blue Origin	Jeff Bezos
Virginia	Explorer	Ansari family
	t/Space	Charles Duelfer, CEO
Colorado	UP Aerospace	Partnered with Lockheed Martin
Illinois	PlanetSpace	Millionaire Chirinjeev Kathuria
Nevada	Sierra Nevada	Fatih & Eren Ozmen
	Bigelow Aerospace	Real-estate billionaire Robert Bigelow
New Mexico	Virgin Galactic	Richard Branson of Virgin Group
Oklahoma	Rocketplane Limited	George French, CEO/Chairman
Rest of World	Da Vinci Project	Team leader Brian Feeney
	Starchaser	Steve Bennett, CEO

SpaceX successful launches of Falcon 1 in 2008 and Falcon 9 on June 7, 2010 have demonstrated the ability to reduce launch costs by as much as 75%

Emerging and Potential New Applications

- **Cellular and Internet Backhaul**
- **HD Video Content**
- **Space Tourism**
- **Geospatial Content & Mobile Video**
- **Micro-gravity R&D (Pharmaceutical Industry)**

Source: Popular Mechanics, MSNBC, Interviews, A.T. Kearney analysis

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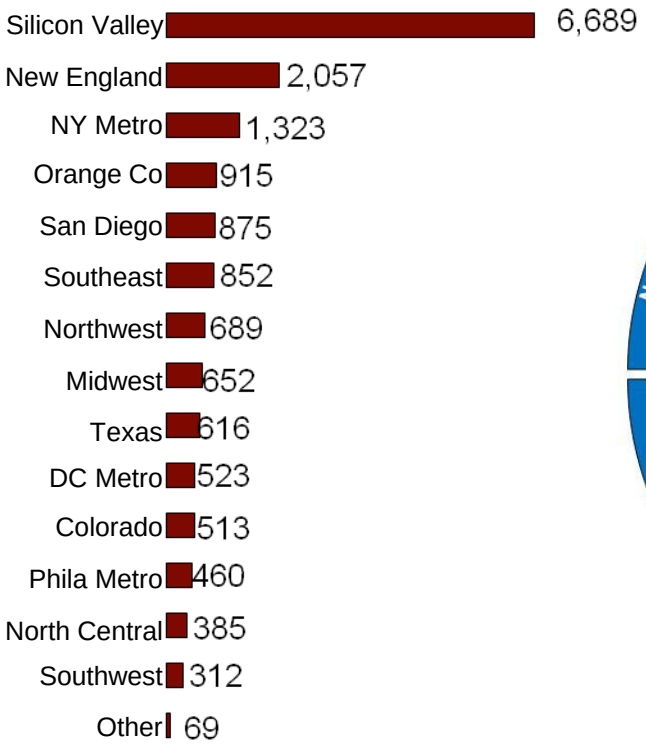
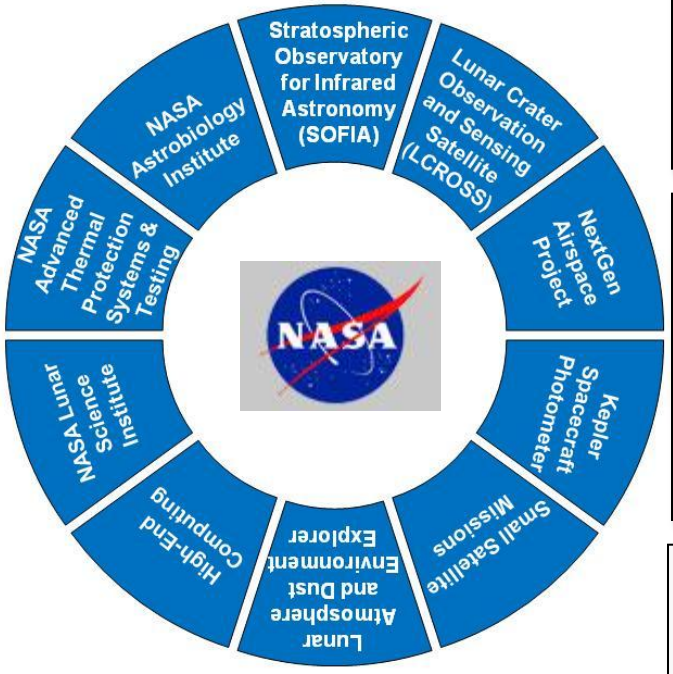
Closer cooperation with Silicon Valley can unlock unmatched R&D synergies further differentiating California

2009 Total Venture Capital Funding by Region[1]

(in $ millions)



NASA Programs Led by Ames



Selected NASA Ames Partnerships

Going Green: Google is working with Ames to measure climate change using sophisticated climate models and large-scale computing power to support research from climate researchers around the world.

Driving Innovation: As part of the STEM program, Carnegie Mellon Innovations Lab – based in Ames National Research Park – developed MAX prototype rovers which were tested in the Atacama Desert – dry and sterile – as an analog for the Mars environment

Converging Science: Ames, HP & UC Santa Cruz formed the Bio|Info|Nano R&D Institute to create scientific breakthroughs made possible by the convergence of biotechnology, information technology, and nanotechnology.

(1) Numbers represent total venture capital funding, which includes space industry funding
Source: AMES "Economic Benefit Study"

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However, the Space Industry may risk losing top engineering talent to other industries

Current Dynamics Facing the Space Industry…

- The Space Industry globally is a highly risk averse sector, with a slow adoption curve for new technologies
- Entry into the sector has been generally through acquisition of heritage platforms
- For new entrants, tension exists between employing older experienced talent to compete with larger companies on government contracts and hiring "new blood" to provide a resource base for sustaining and growing operations

What "The Millennial Generation" Expect…

- Team-oriented environments
- To be given multiple tasks
- Structure
- Some connection with their boss
- Instantaneous feedback
- Quick reward and career progression

Implications on Future Talent…

- Young engineers may opt for fast-moving, higher paying careers in other industries
- California may lose talent as the cost of living continues to rise relative to other states

"We can't attract young talent because we are not doing innovating things"

"Space is not on the list of top talent at universities"

"…government needs to figure out how to transfer legacy knowledge to the younger generation…"

Source: AMES "Economic Benefit Study"

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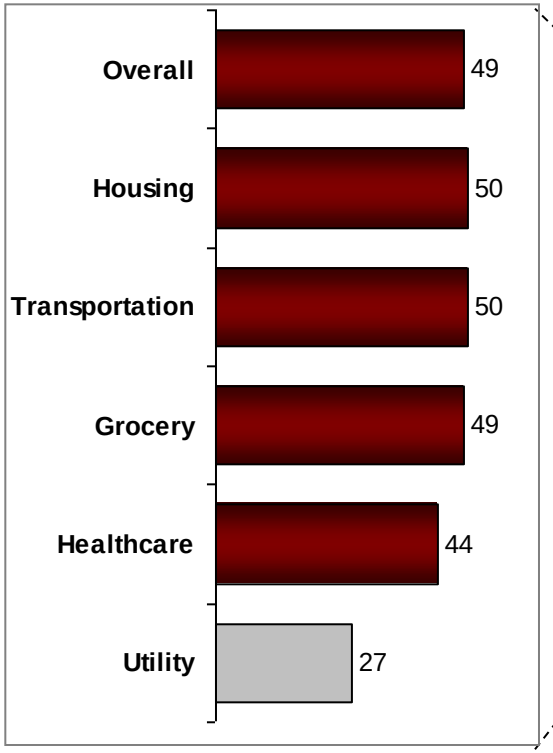
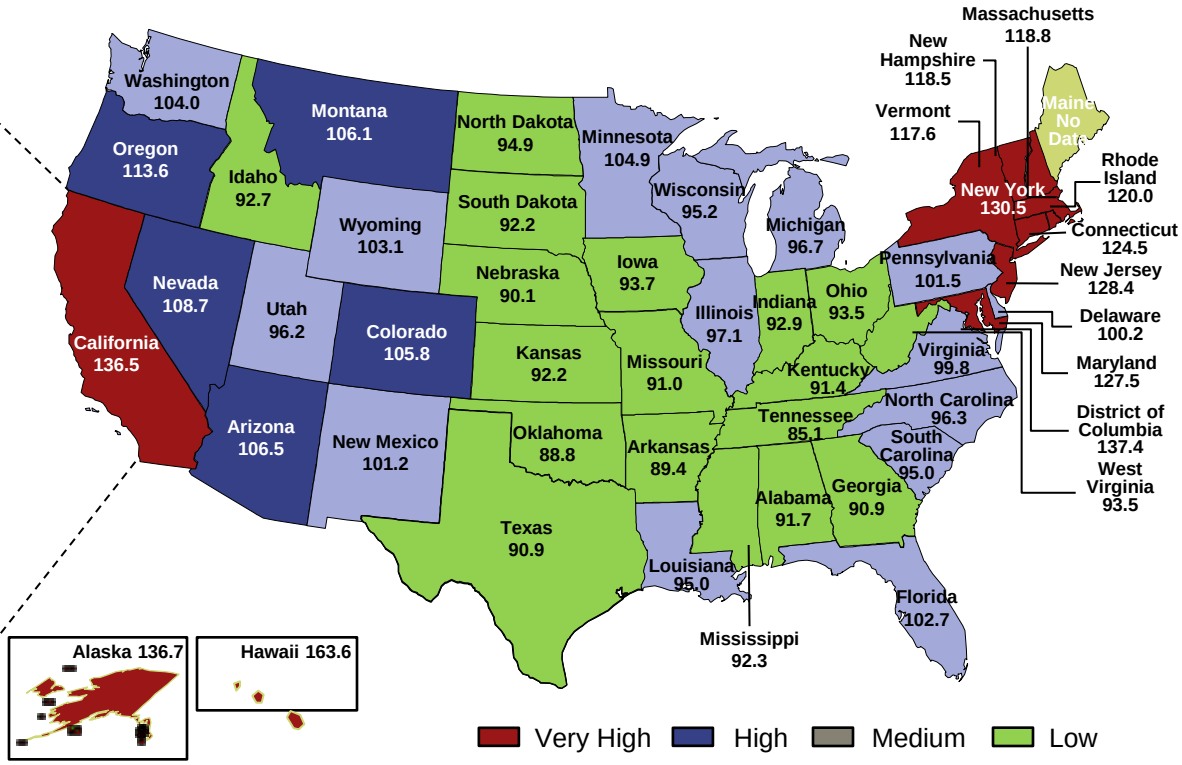
For example, relatively high cost of living adversely impacts California's ability to attract and retain talent

California Ranking in Major Cost of Living Components



Cost of Living Index Q2 2010



Source: C2ER (ACCRA), Interviews, A.T. Kearney analysis

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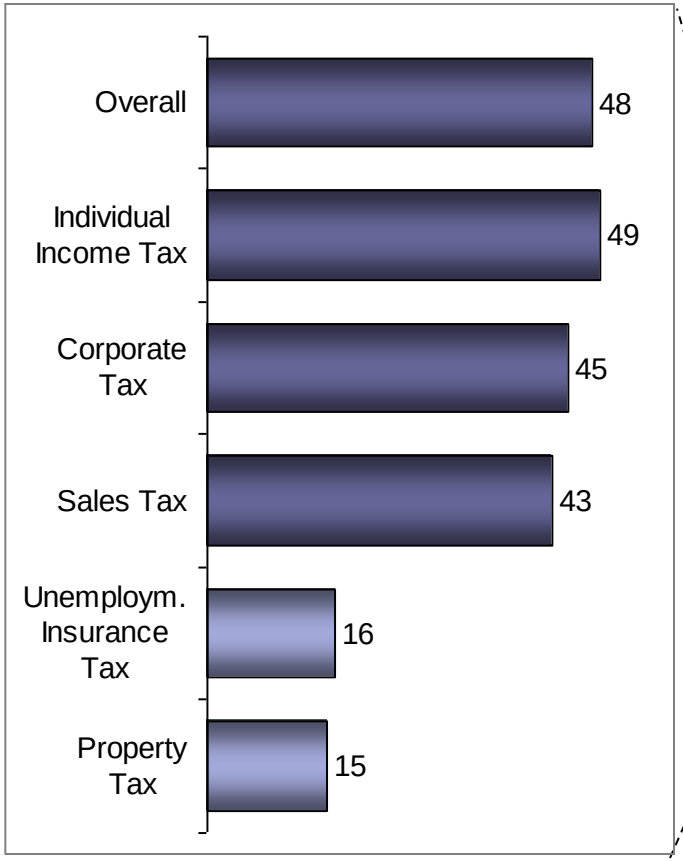
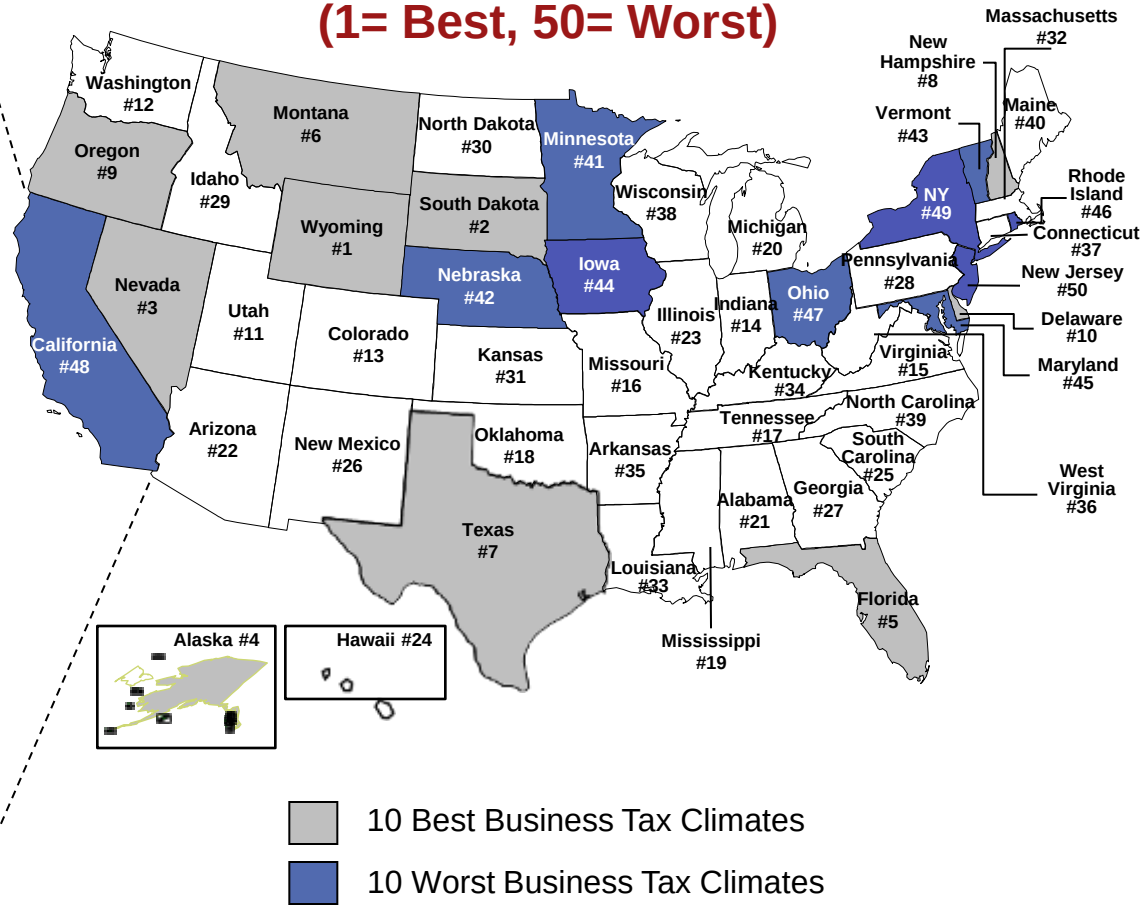
California's tax climate adds to the cost competitiveness challenge

California Ranking in Major Tax Components(2)



State Business Tax Climate Index(1) FY 2009 (1= Best, 50= Worst)



Note: (1) Tax Foundation's Annual Study

(2) California income tax rates are relatively low for low income groups, but high overall

Source: Tax Foundation CCS California Economy, Interviews, A.T. Kearney analysis

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Perceived lack of support from California government is seen as a challenge in attracting and retaining businesses

Select Interviewee Quotes

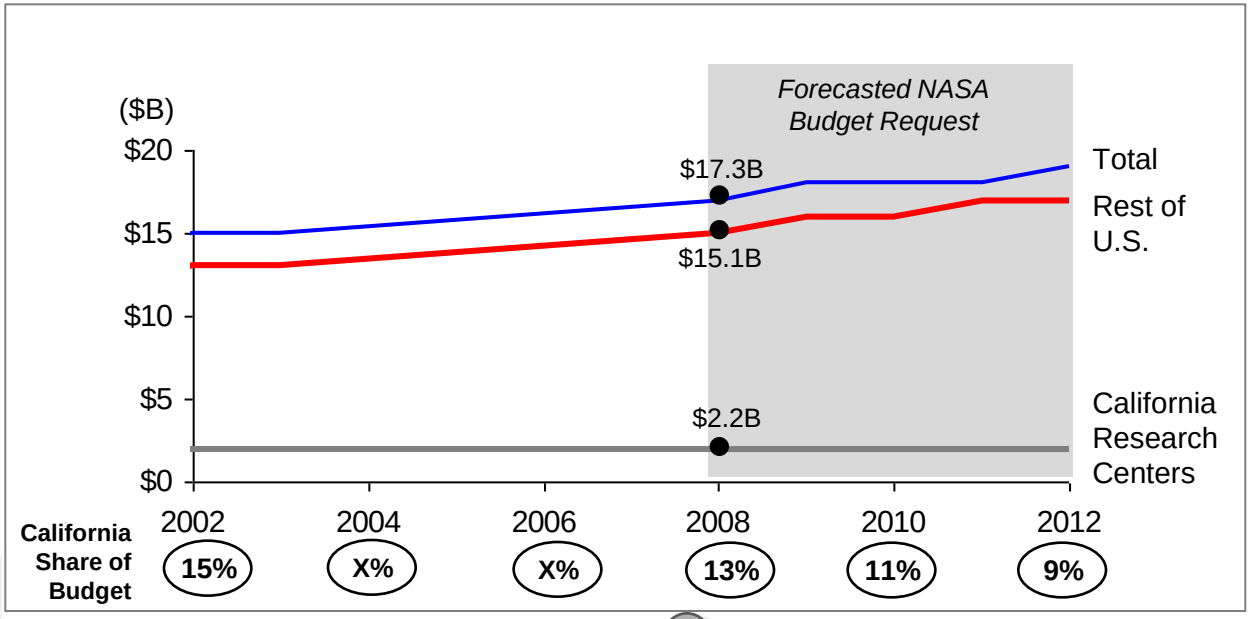
"Space is the furthest thing out of their mind…they want to attract the service industry"

"(We) moved our manufacturing out of CA to NM…they gave us land, facilities…it was a great opportunity"

"Unlike other states, California is not as engaged as a delegation in support of the NASA program"

"Our government can't spell aerospace…they focus on farming and entertainment and ignore aerospace which pays taxes and keeps jobs in California"

NASA Budget by Research Center Location



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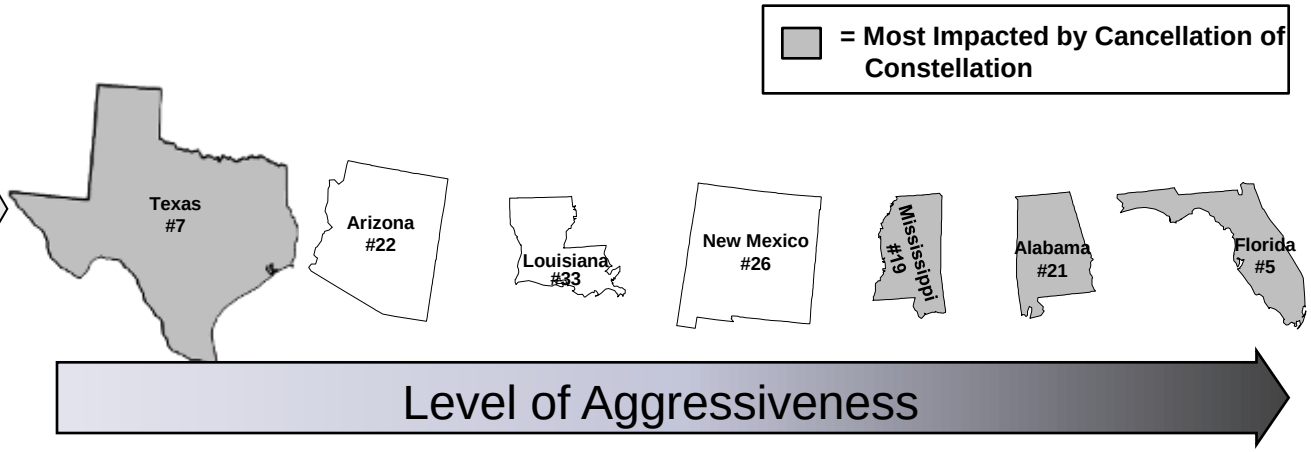
With the future direction of U.S. space in "flux", other states are taking an aggressive approach to carve out their space industry share

States Focused on Attracting New Businesses to the Space Industry



Case Example: *Florida's Recent Legislative & Business Development Efforts*

State Policies to Attract the Space Industry

- **Space Technology Research and Diversification Initiative:** develop multi-university space research and technology programs
- **Space Infrastructure Enhancement Fund:** make a number of space infrastructure improvements
- **Governor-sponsored Incentive Package**: $32 million tax incentive package to lure private companies to Florida
- **Space and Aerospace Catalyst and Enhancement Act:** provide $15 million to 'refurbish a launch complex at Kennedy Space Center'
- **Marketing Programs**: increase visibility (booths at major tradeshows)

Source: Florida Senate Web Site, Interviews, California Research Bureau, A.T. Kearney analysis

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Regulatory compliance leads to lost business, particularly in the launch and propulsion segments

Environmental Regulations: Key Findings from Interviews

- Overall, California leads the nation in environmental standards
- Major environmental compliance requirements related to the space industry are often similar in other states
- Environmental permit/compliance process in California is stated as more burdensome and time consuming than other states
- Regulatory compliance often means additional overhead and increases the cost of doing business in California

Consequences

SpaceX established its testing facility in Texas as the State was able to move faster on the permit process

Aerojet is migrating operations toward Washington State due to burdensome environmental permitting for propulsion systems

Wyle Labs has been shifting its new facility investments towards other states

L-3 Communications views regulations as an impediment to upgrading manufacturing processes due to high cost of environmental process qualification (cleaning agents, etc)

Source: Interviews, A.T. Kearney analysis

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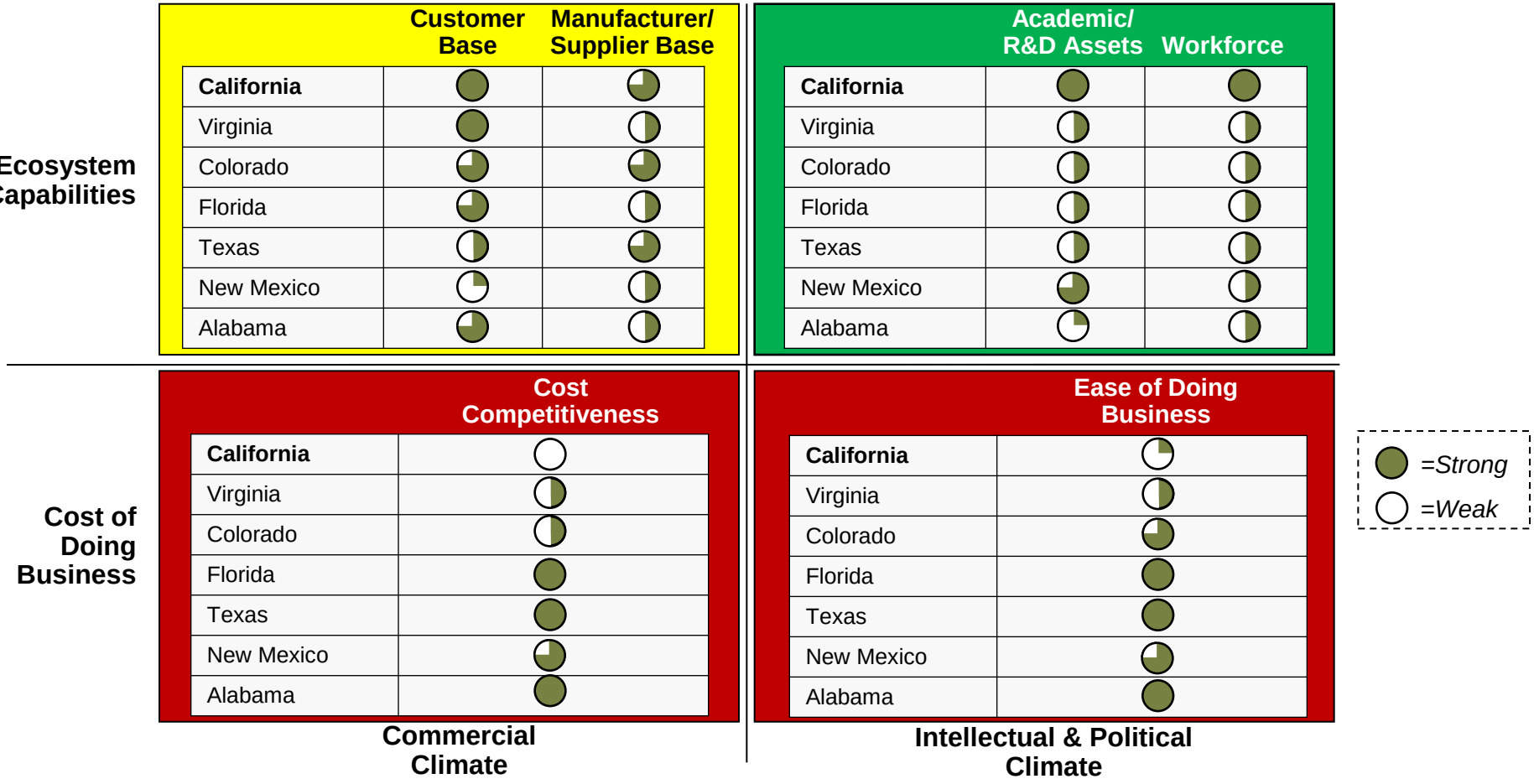
California's space intellectual base remains strong, yet the ability to attract and retain business poses challenges for the ecosystem

Space Industry Competitiveness Scorecard



Source: A.T. Kearney analysis

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To conclude, California's space industry has continued to grow—both in absolute terms and in share but risks should be addressed

- Recent decisions by the Obama Administration have created a number of uncertainties regarding the future direction of the Space industry—particularly human space exploration
- California's ecosystem may well position the state to capitalize on the future changes, to further achieve continued growth
  - Strong intellectual capital base
  - Entrepreneurial spirit
  - Manufacturing and customer base in the space industry
- At the same time the threats are real, and it would serve California state and local governments well to actively work to negate the threats to ensure this large and wealth-contributing industry thrives in the State
  - Attracting and retaining talent
  - Developing economic policies to attract and retain commercial investment
  - Active involvement of federal and state legislators to retain and grow California's share of DoD and NASA budgets