

NewSpace Commerce Forum



November 12, 2009

Agenda

1. Defining “NewSpace”
2. The Past is not Prologue
3. Introduction to the NewSpace Industry
4. Is NewSpace Real?
5. Economic Potential for North Carolina
6. Conclusion
7. Q & A

Defining “NewSpace”

1. Primarily entrepreneurs, small- and medium-size firms
2. Products and services sold at fixed price
3. Customers include individual consumers
4. Funded at startup primarily by owners and investors

Defining “NewSpace” – Part 2

U.S. Commercial Space Policy Guidelines (NSPD-3, Feb. 1991):

“Commercial space sector activities are characterized by the provision of products and services such that: private capital is at risk; there are existing, or potential, nongovernmental customers for the activity; the commercial market ultimately determines the viability of the activity; and primary responsibility and management initiative for the activity resides with the private sector.”

Defining “NewSpace” – Part 3

Letter from Robert Bigelow to NASA Administrator Bolden (Oct. 2009)

- “Commercial initiatives are allowed to fail.”
- “Requirement of firm, fixed pricing.”
- “... less about who is doing the work than the means of procurement. NASA simply buys a service, at a fixed price, and steps away.”

The Past is not Prologue - History

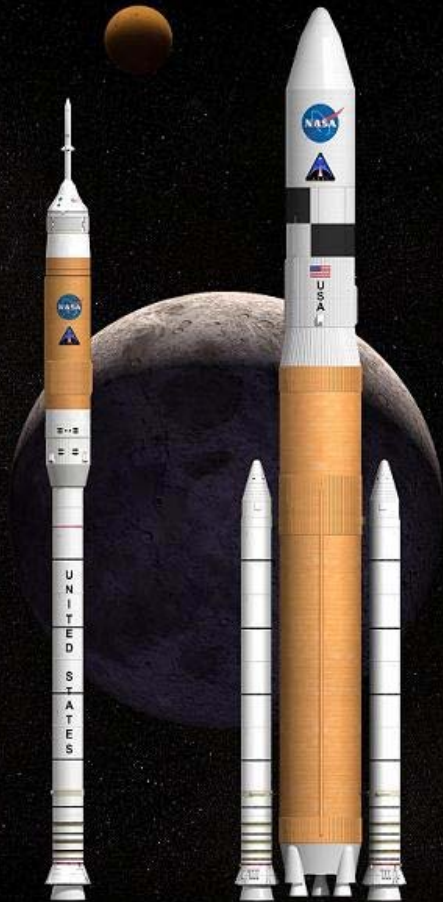
Traditional public sector:

- Federal (NASA as operator)
- Cost-plus contractors
- Cold War anachronism



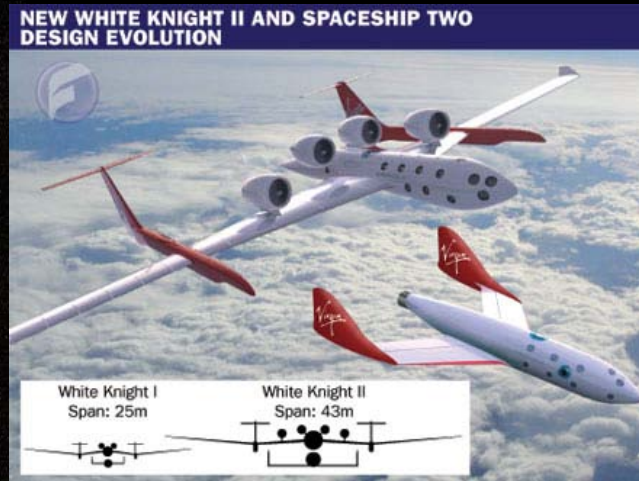
The Past is not Prologue - Transition

PUBLIC



Ares 1 & 5, Orion

PRIVATE (NEWSPACE)



The Lynx, WK2/SS2,
Dragon, Falcon 1

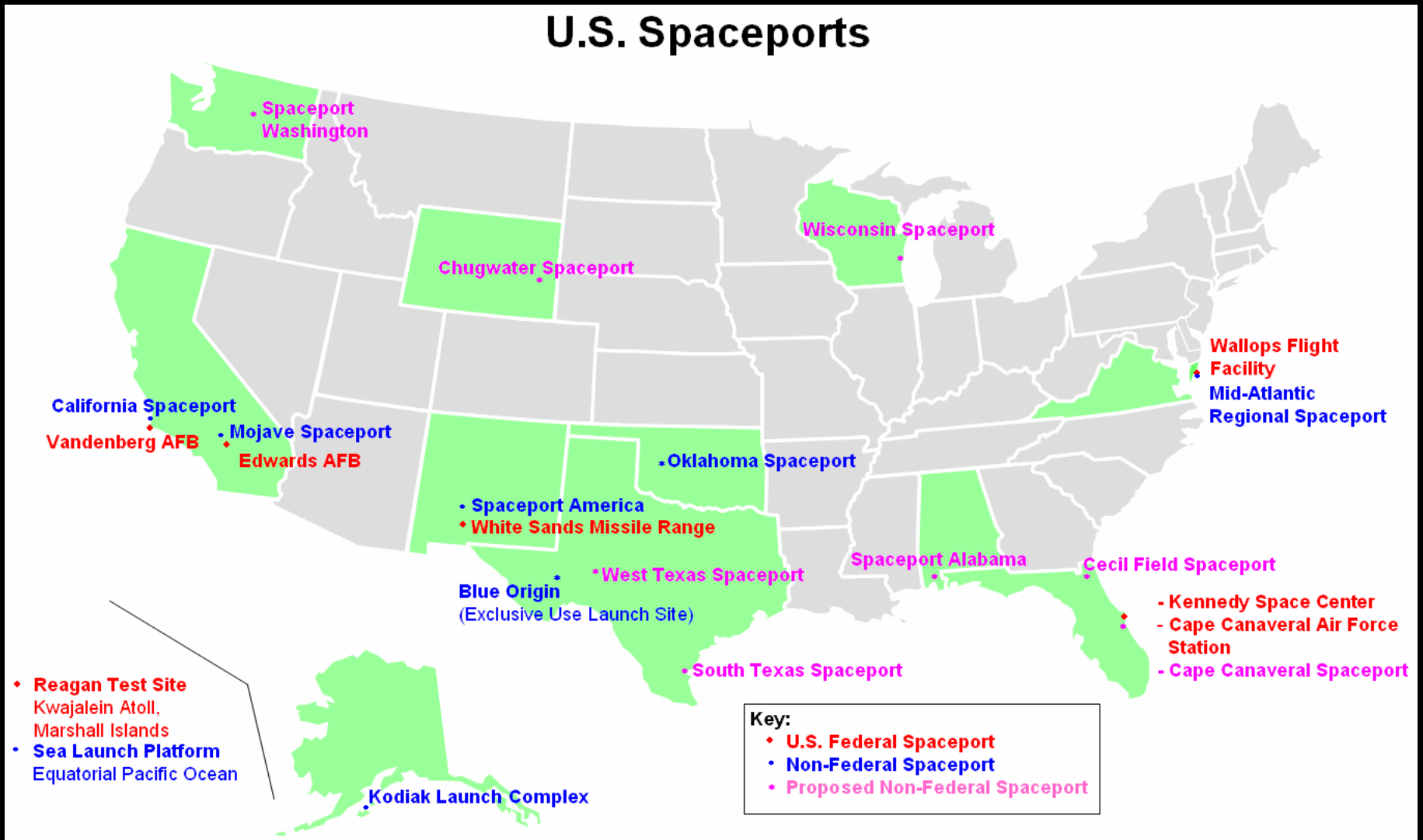


Six NewSpace Industry Sectors

1. Atmospheric Flight
 - Rocket Racing League®
 - Zero Gravity Corporation
2. Suborbital Transportation
 - XCOR Aerospace
 - Virgin Galactic
3. Orbital Transportation
 - Space Exploration Technologies Corp. (SpaceX)
4. Destinations (On-orbit, Near-Earth Asteroids, Lunar)
 - Bigelow Aerospace
 - Odyssey Moon
5. Service and Support
 - Orbital Outfitters

Six NewSpace Industry Sectors (cont.)

6. Commercial Spaceports



Atmospheric Flight



- Created in 2005
- “NASCAR with rockets”
- Rocket Racer[®] flew at AirVenture show in Oshkosh, WI (2008)
- \$5.5M VC financing applied to aircraft & rocket engine design, raceway avionics, gaming (2009)



- Created in 1993
- Weightlessness for fun, science, tech development
 - Five small companies flew new hardware aboard G-FORCE ONE[®] (Sept. 2008)



Suborbital Transportation – Part 1



- Steady, evolutionary rocket engine development
- 2008: Lynx announced
- 2009: completed wind tunnel tests
- 20??: first flight



- Spending \$250M through 2010
- *WhiteKnightTwo* - 22 test flights to date



Suborbital Transportation - Part 2

- Runways needed (not RDU, maybe GTP or ???)
 - Lynx needs 7900 feet
 - WK2/SS2 needs 10,000 feet
- Revenue flights in 2011 - 2012
- Suborbital Point-to-Point passenger flights in 10 years?

Suborbital Transportation - Part 3

- Emerging markets:
 - Tourism and adventure travel
 - Science and high-speed research
 - Microsatellite orbital insertion
 - Microgravity research (manufacturing, pharmaceuticals, etc.)
 - Hardware qualification
 - Commercial remote sensing
 - Military surveillance
 - Media, advertising, and sponsorship
 - Space diving

Orbital Transportation



Falcon 9: first all-engine firing - 2008



Dragon

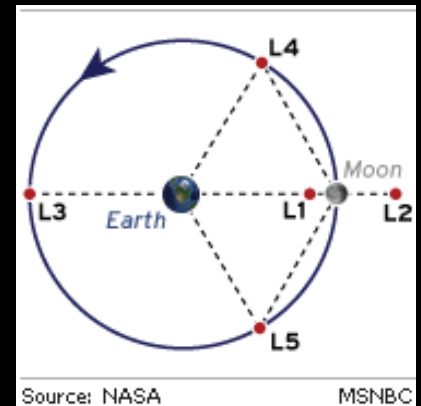
Falcon 1: successful launch - 2008, RazakSAT in orbit – 2009

- Falcon 9: first launch in 2009 at Cape Canaveral
- Commercial transportation to on-orbit destinations (ISS, commercial)

Destinations (On-orbit, NEAs, Lunar) - Part 1



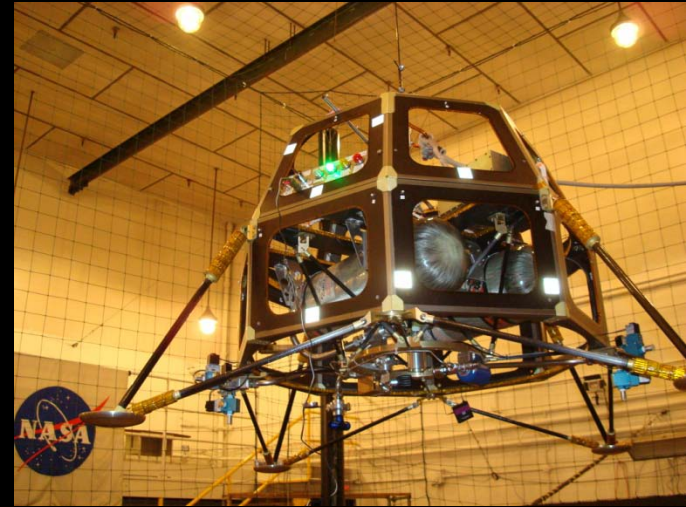
Two Genesis modules on-orbit since 2007



L1/Lunar Habitats

- Spending \$500M through 2015
- Orbiting hotels, labs, college campus, etc. next decade
- Shift focus to L1 and Moon by 2012

Destinations (On-orbit, NEAs, Lunar) – Part 2



- Competing for \$30M Google Lunar XPRIZE (First of 21 teams)
- What business?
 - Science at much lower cost
 - Space-based solar power (WSJ, 10/19/09, “Five Technologies That Could Change Everything,” PG&E, DOD as first customers)
 - Resources (He^3 , platinum group metals, nickel, cobalt, etc.)
 - Tourism (first virtual, then real)

Service and Support



"Have Space Suit – Will Travel." – Robert A. Heinlein



- Industrial Suborbital Spacesuit (IS3)
 - Emergency “get me down” pressure suit
- Development began in 2007
- Technologies
 - Textiles
 - Bio-metric sensors
 - Life support

Commercial Spaceports and Tenants – Part 1

- Mojave Air & Space Port
 - XCOR Aerospace
- Cape Canaveral Spaceport
 - SpaceX
- Oklahoma Spaceport
 - Armadillo Aerospace
 - TGV Rockets
- Mid-Atlantic Regional Spaceport
 - Orbital Sciences Corp.
- Sheboygan, WI Spaceport
 - GLASEC (Great Lakes Aerospace Science and Educ. Center)

Commercial Spaceports and Tenants - Part 2

- Spaceport America: Virgin Galactic



Sept. 2006



- 2008: design completed
- 2009: FAA launch license, formal groundbreaking

Commercial spaceflight, entertainment, education, R&D, manufacturing

NewSpace Timeline



2009-10

2011-12

2013-15

2016-20

Suborbital



Orbital



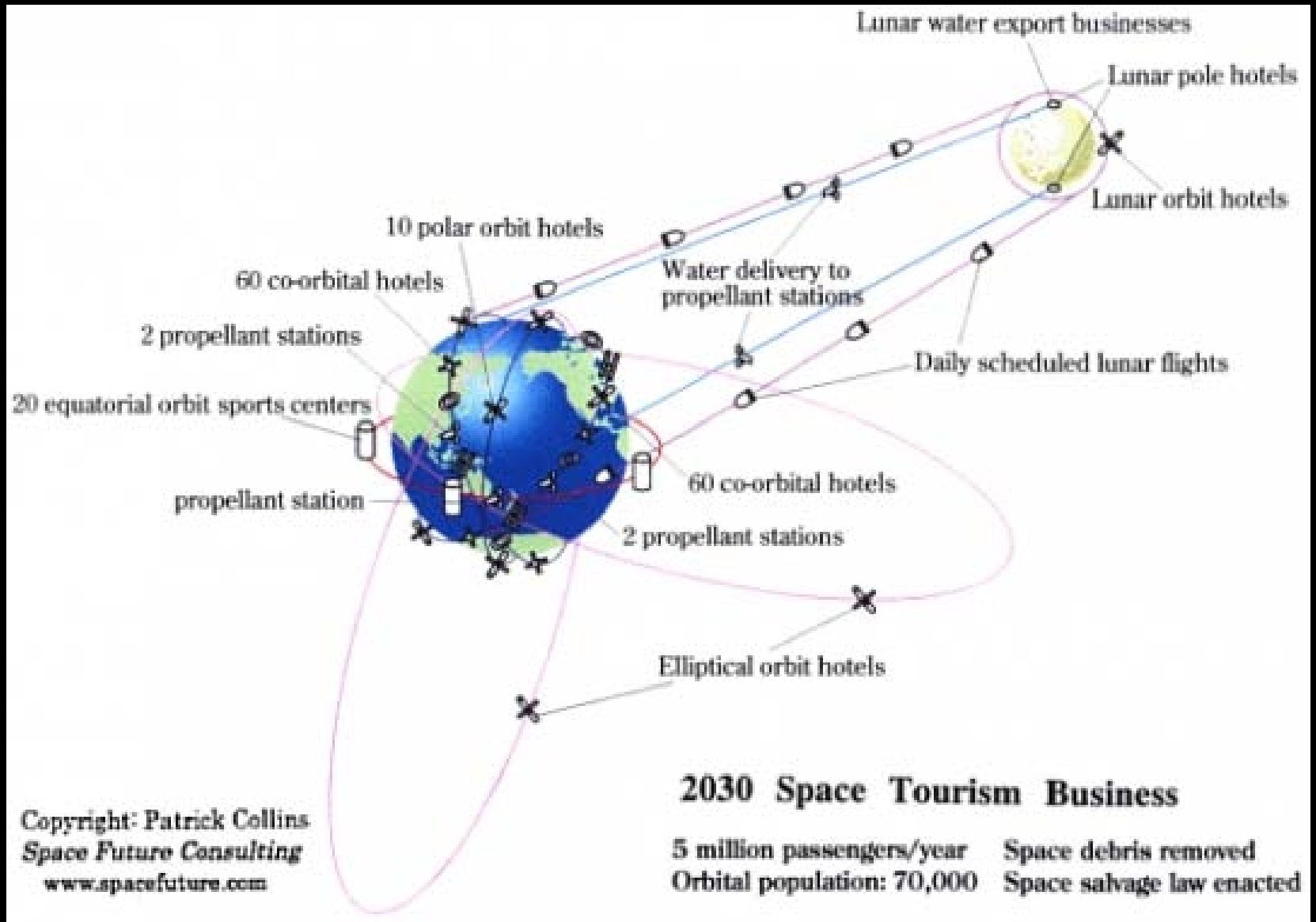
L1 Habitats



Lunar Habitats



Looking Ahead to 2030



Is NewSpace Real?

Personal Spaceflight market (The Tauri Group, 2008):

- 450 customers have made \$39M in deposits
- \$1.2B invested
- 14 vehicles in development
- 1200 employed

Futron Corp. predicts \$1.5B market for commercial lunar services over next decade

“Investment in the personal spaceflight industry rose by more than 20 percent since January 2008.” (The Tauri Group, 2009)

Is NewSpace Real? – Part 2

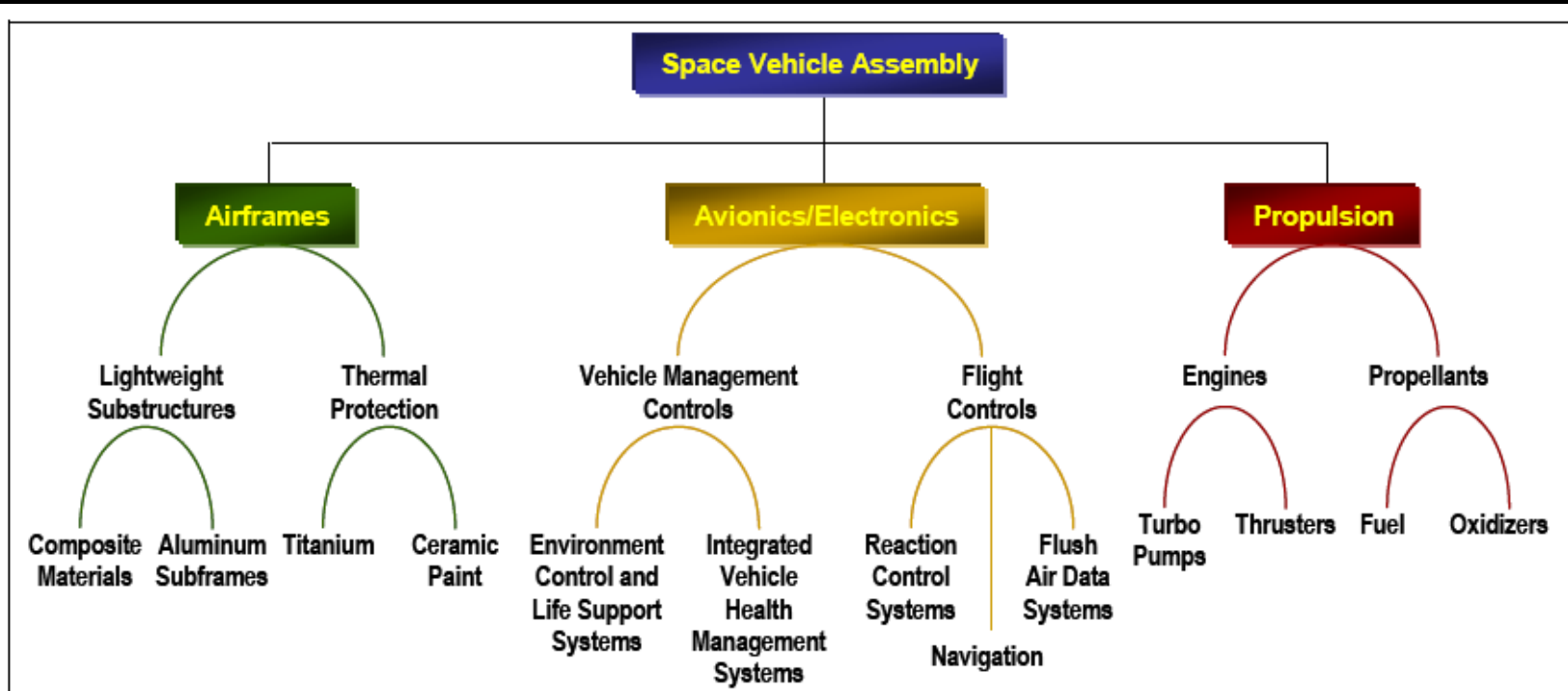
Augustine Committee* strongly endorses turning Earth-LEO transportation over to the NewSpace industry (Oct. 2009)

NASA Administrator Bolden adds two NewSpace-oriented committees to NASA Advisory Council (Nov. 2009)

- Commercial Space: Brett Alexander, Executive Director, Commercial Spaceflight Federation
- Technology and Innovation: Esther Dyson, IT guru, NewSpace investor (including XCOR Aerospace)

*U.S. Human Space Flight Plans Committee chaired by former Lockheed Martin CEO Norm Augustine

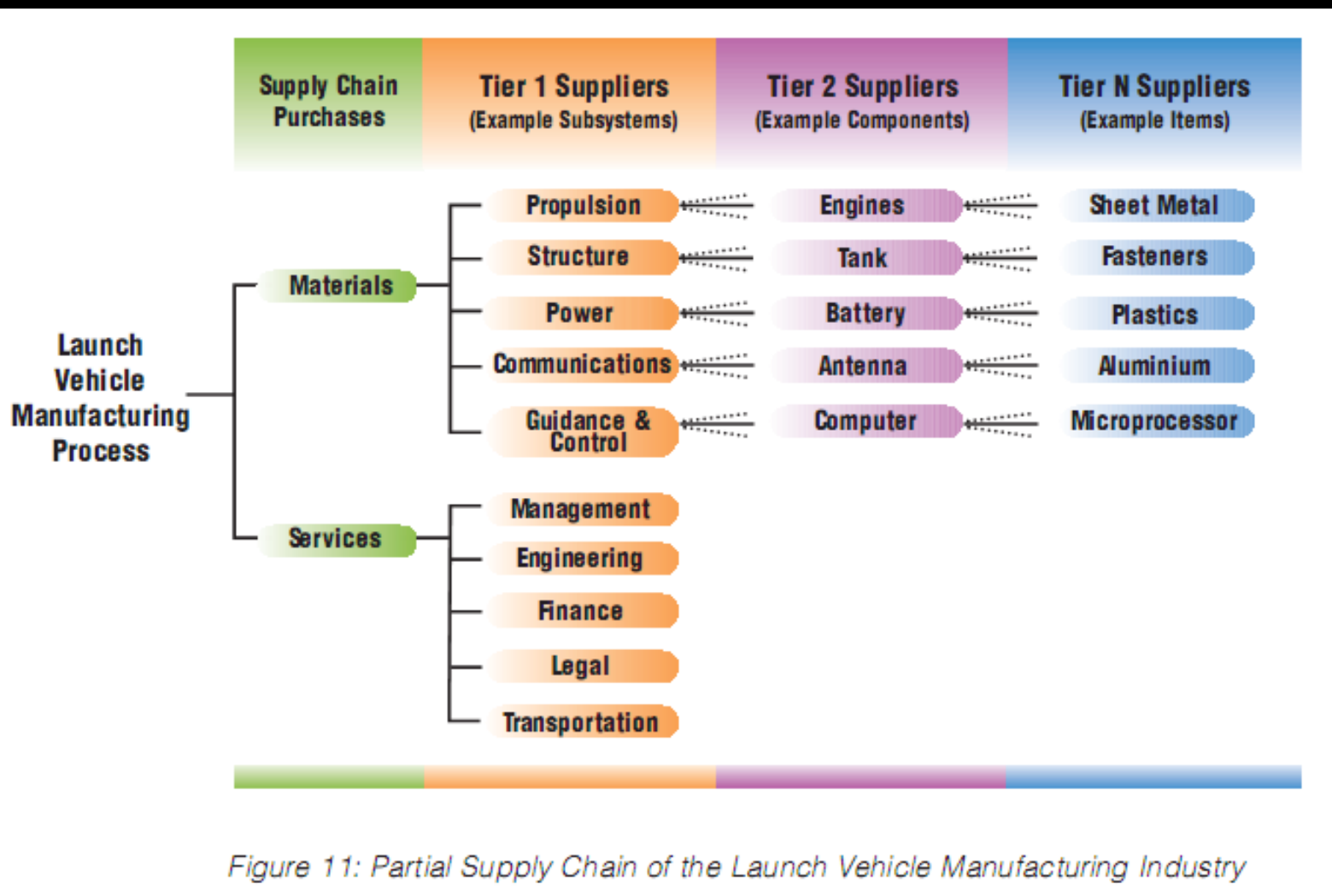
Economic Potential for North Carolina



Data Source: Cambridge Systematics

Figure 3 – Space Vehicle Supply Chain

Economic Potential for North Carolina – Part 2



Economic Potential for North Carolina – Part 3

NC Industry Snapshot: biotech/pharma



- Biomedical research division of Astrotech
- “Big pharma will let biotech take the risk, and then, when there is a breakthrough, come in and buy it” – CEO Thomas B. Pickens III

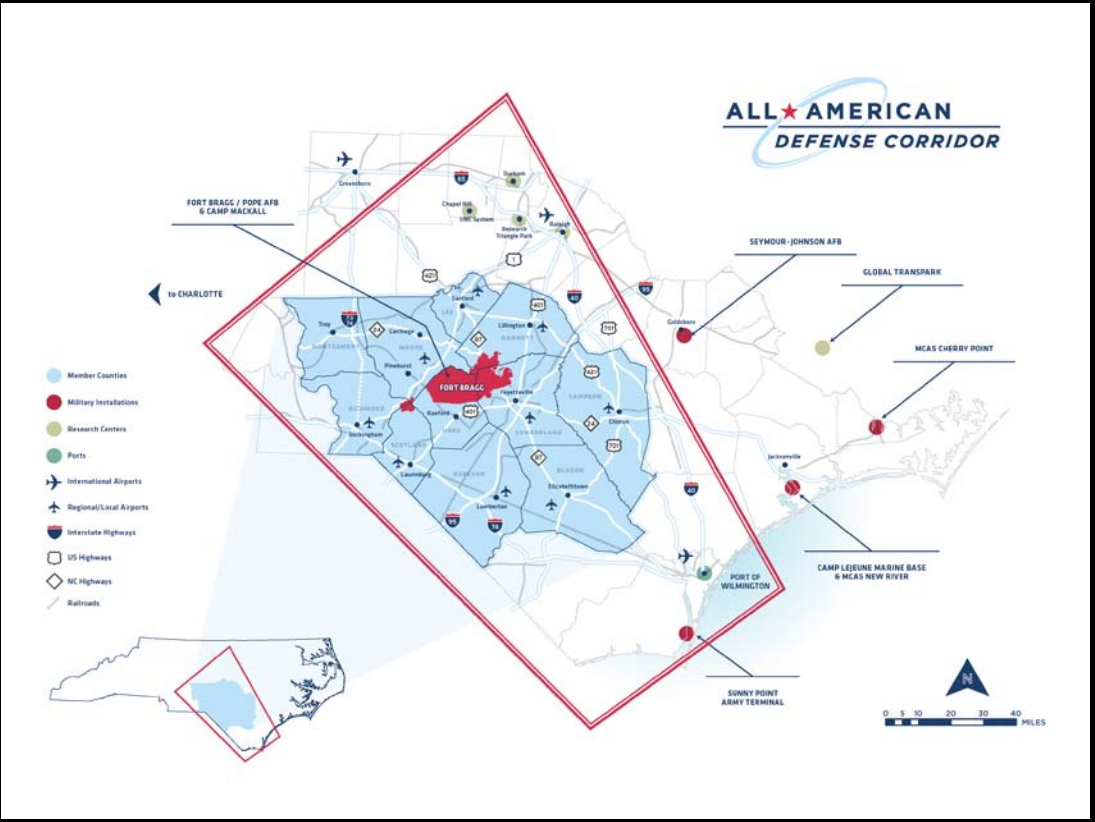
Economic Potential for North Carolina – Part 3 (cont.)

NC Company Snapshot: HondaJet



Economic Potential for North Carolina – Part 3 (cont.)

NC Workforce Snapshot: Defense



**THE 2009 NORTH CAROLINA
DEFENSE ASSET INVENTORY AND
TARGET INDUSTRY CLUSTER ANALYSIS**

**A STRATEGY FOR GROWING NORTH CAROLINA'S
DEFENSE AND HOMELAND SECURITY ECONOMY**



**NORTH CAROLINA MILITARY FOUNDATION
JULY 2009**

Conclusion – Part 1

“No flying machine will ever fly from New York to Paris because no known motor can run at the requisite speed for four days without stopping”

- Orville Wright

Conclusion – Part 2

“Humans do not have the capacity to start from a clean sheet of paper. By *design*, human beings are incapable of this. Before anyone else makes a mark on that blank page, it’s *already* filled – with your past, the company’s past, the things you think are appropriate for the business, ...”

The Last Word on Power, Tracy Goss

Conclusion – Part 3



Credit: ArcelorMittal

Q & A