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Thursday, February 15, 2007

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## Colorado's aerospace odyssey

Fifty years ago, a Boulder glass-jar company forged a partnership with some CU scientists, launching Colorado as a key location for space-based research and innovation. The sector could be poised for a new blastoff in 2007.

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Article Last Updated: 01/13/2007 01:17:41 PM MST

Just over fifty years ago, the nation was searching for a place to build missiles that was protected against the threat of naval attack. It found the perfect spot just outside Littleton.

Glenn L. Martin Co. broke ground on its new facility in Jefferson County's Waterton Canyon in 1956 and began to build Titan intercontinental ballistic missiles.

At about the same time, Boulder-based Ball Brothers Co. was looking for new technology to boost its glass-jar-making business.

The company came across a group of scientists at the University of Colorado who were developing devices that kept Air Force rockets from spinning once they were launched. It bought their technology in 1956 and launched Ball Brothers Research Corp.

Two years later, Canada and the United States were seeking a safe place from which to monitor and defend their airspace. They found a perfect site for their North American Aerospace Defense Command inside Cheyenne Mountain, south of Colorado Springs. It was seen as an impenetrable fortress that could withstand a direct Russian nuclear attack.

At a time when the U.S. was fighting the Cold War against the Russians - before the Russians launched Sputnik, Apollo missions took men to the moon and the space shuttle made space travel almost commonplace - Colorado found itself incubating aerospace and military surveillance technology.

Those early-day accomplishments may have been "kind of the geographic luck of the draw," said Tom Clark, executive vice president of the Metro Denver Economic Development Corp. But over the ensuing decades, the state has maintained its edge through wars and treaties, space voyages and discoveries, and is now poised to become a leader in the nation's aerospace industry.

### A hub for space science

Colorado's aerospace industry has grown exponentially, becoming a center for such things as rocket science, space-related defense, space exploration and remote sensing.

The Waterton Canyon facility is now the headquarters for Lockheed Martin's Space Systems unit, which is designing Orion, the successor to the space shuttle. Ball Aerospace now has about 3,000 employees.

Colorado Springs has become the hub of U.S. military space efforts, attracting the Air Force Space Command, the Air Force Academy, the Space Foundation and companies such as Raytheon, Northrop Grumman and Boeing.

"We're known as a very strong center for both defense-related and space science-related activities," said Lee Peterson, chair of the aerospace engineering sciences department at the University of Colorado at Boulder. "People from all over recognize Colorado in



1960: Ball Brothers Research staff test a pointing control near a street in Boulder. (Courtesy of Ball Aerospace & Technologies Corp.)

that way."

Local economic development leaders are now touting Colorado's aerospace economy as the nation's second-largest, behind California, but it has been growing for decades.

Last year, Lockheed Martin celebrated the 50th anniversary of its Jefferson County-based Space Systems unit and Boulder-based Ball Aerospace also celebrated its 50th anniversary.

The Air Force Space Command is preparing for its 25th anniversary on Sept. 1.

The Air Force Academy, which celebrated the 50th anniversary of its creation in 2004, now has a Center for

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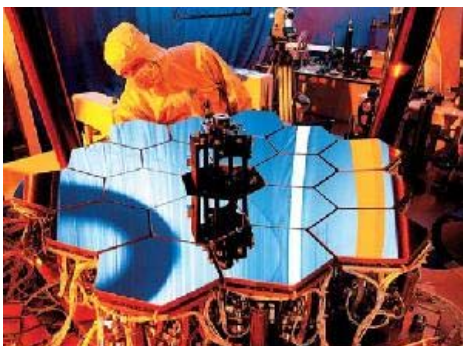
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mirrors on a space telescope. (Courtesy of Ball Aerospace & Technologies Corp.)

Space and Defense Studies.

"It's a natural fit for the academy to start developing the thinking and awareness of the cadets about space power,"

said Michael Terry, an assistant professor at the academy.

### The ups and downs of rockets

It hasn't all been easy. The aerospace industry sustains regular ups and downs and occasional cutbacks, such as the cancellation of the manned orbiting laboratory program in 1969 and the end of design work on the Viking program in the 1970s.

"I can remember, gosh, probably three cycles in my career," said Grover Hall, vice president of technical operations for Lockheed Martin Space Systems, who has worked at the company since 1968.

But industry leaders say CU Boulder's production of new talent and Colorado's lifestyle, which draws highly skilled individuals to the state, have helped the industry maintain its strength and grow over time.

"It's been very easy for us over the years to bring new talent into Colorado because of the quality of life and all its different dimensions," said Lockheed Martin's Space Systems executive vice president Joanne Maguire.

"You had an emerging expertise in space and ballistic missiles, and this led to relationships with the universities and the universities developing expertise in things like satellites and ballistic missile controls, which in turn made it attractive to NASA," said Elliot Pulham, president of the Colorado Springs-based Space Foundation.

"So you began to see civil space research being done. And as that evolved, the importance of space to the entire Department of Defense grew. ... It all had a very synergistic effect."

Colorado's aerospace industry matured along with advancements in technology and the nation's use of space.

"Most people probably think of (Lockheed Martin) two ways - rockets and Mars," said Maguire, referring to its Titan and Atlas rockets and its Mars explorers. She sees a healthy diversification in programs like Orion, NASA's new crew exploration vehicle, the successor to the space shuttle.

Many see a bright future for the aerospace industry.

On the Front Range, "there are all these ingredients to kind of make us the Silicon Valley for space," said CU's Peterson. "It's not unlike how Silicon Valley was in the early '70s."

If that happens, it could bring economic vitality to the state. Just as the industrial age brought the first multimillionaires, and the information technology age led to the first multibillionaires, Pulham said, "the space age will eventually create the first trillionaires."

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## Colorado's aerospace industry

Total employees in 2006: 24,665

### MAJOR AEROSPACE CONTRACTORS

#### Lockheed Martin

- About 9,000 employees in Colorado
- Space Systems unit has headquarters in Jefferson County
- Major projects include Orion crew exploration vehicle, Mars Phoenix Lander

#### Ball Aerospace & Technologies Corp.

- About 2,500 employees in Colorado
- Headquarters in Boulder
- Major projects include James Webb Space Telescope, WorldView remote sensing satellites, Kepler mission, National Polar-Orbiting Operational Environmental Satellite System Preparatory Project

#### Raytheon Co.

- About 3,100 employees in Colorado, mostly in Aurora

#### Northrop Grumman

- About 2,900 employees in Colorado

#### Boeing Co.

- About 2,300 employees in Colorado, mostly in Colorado Springs and metro Denver

#### United Launch Alliance

- About 1,000 employees in Colorado, based in metro Denver

#### ITT Corp.

- About 600 employees in Colorado Springs

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**MILITARY BASES**

**Buckley Air Force Base**

- Located in Aurora, home to the 460th Space Wing

**Peterson Complex**, including Peterson Air Force Base, Cheyenne Mountain Air Force Station and Schriever Air Force Base

- Located near Colorado Springs, home to the 21st Space Wing, responsible for missile warning and space control. Also headquarters for the Air Force Space Command and the North American Aerospace Defense Command. Also hosts the U.S. Army Space and Missile Defense Command, the 310th Space Group, Joint National Integration Center and the Space Innovation and Development Center

**U.S. Air Force Academy**

- Located north of Colorado Springs, has established a Center for Space and Defense Studies

**FACTS:**

- About 126 aerospace companies do business in Colorado.
- Three Colorado counties with the highest aerospace employment are Jefferson (26 percent), Arapahoe (24 percent) and El Paso (19 percent). Nearly 73 percent of Colorado's aerospace employees work in metro Denver.

Sources: *Aerospace companies, Metro Denver Economic Development Corp.*

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