

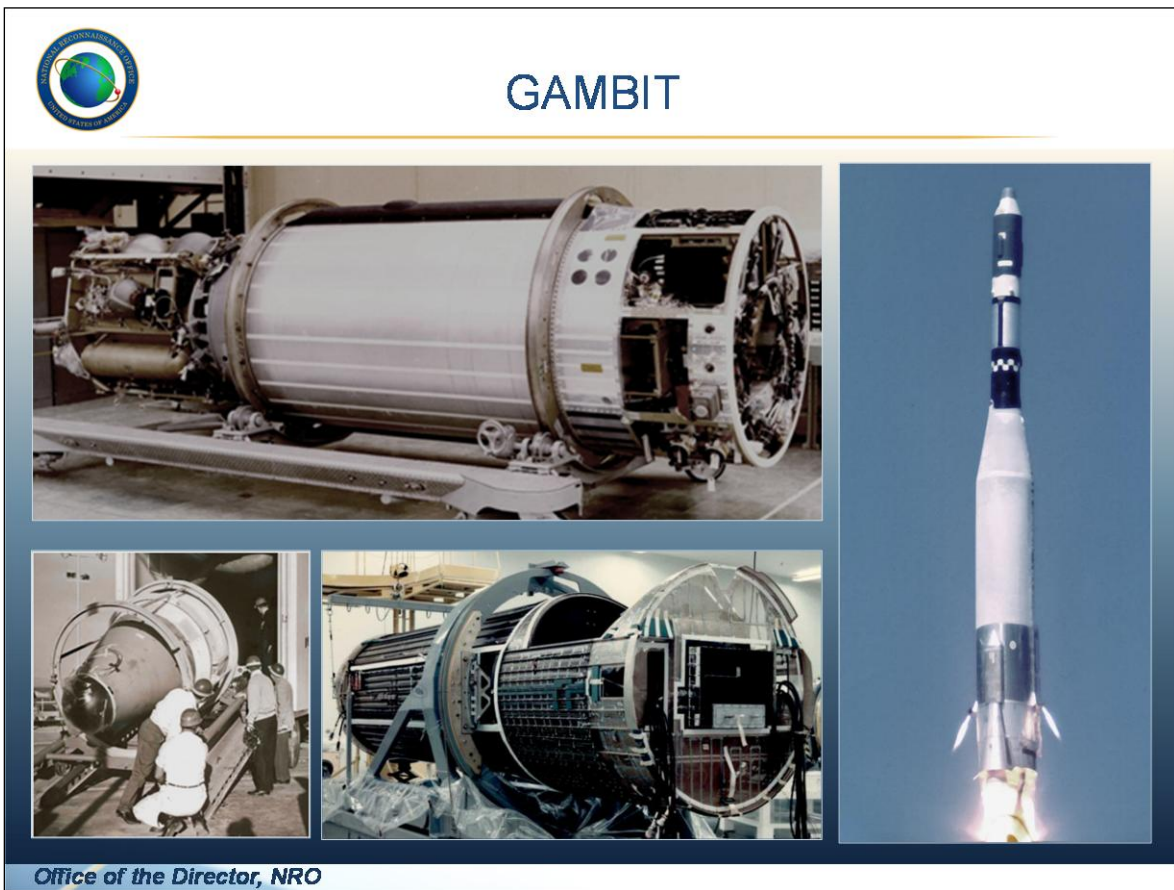
NATIONAL RECONNAISSANCE OFFICE

# **NRO Overview** to SPIE Defense, Security, and Sensing

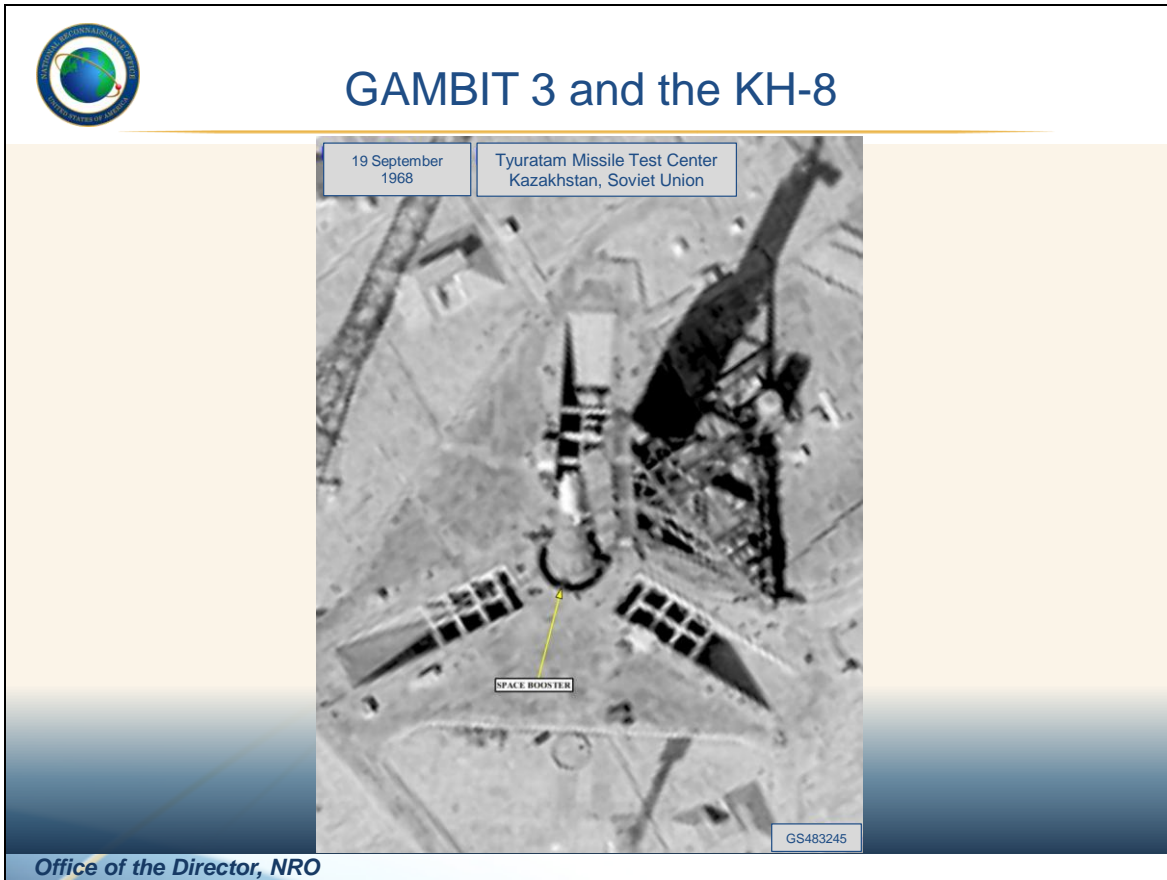
Director Bruce Carlson  
23 April 2012



VIGILANCE FROM ABOVE



- With its first Imagery Reconnaissance Satellite CORONA and its 40-foot resolution, the United States was able to determine the pace and scope of the Soviet Union's ballistic missile deployments and analysts were able to count Soviet heavy bombers - however better resolution was required for more detailed analysis
- In response and thanks to the efforts of Lockheed Martin and others, GAMBIT 1 with the KH-7 camera system that included a 77-inch focal length camera was launched in July 1963 and operated until June 1967
  - GAMBIT I had thin film which permitted longer missions than CORONA and its roll capability and stereo cameras enabled increased target acquisition and gave images a 3D quality
  - GAMBIT I had a resolution of 4 feet, monitored key targets and provided key cartographic information that allowed DoD to produce accurate, large-scale maps - critical since we didn't have GPS then.
- The follow-on system, GAMBIT 3 operated from July 1966 to April 1984 and it had a KH-8 camera system and an 175-inch camera which provided resolution that was better than 2 feet

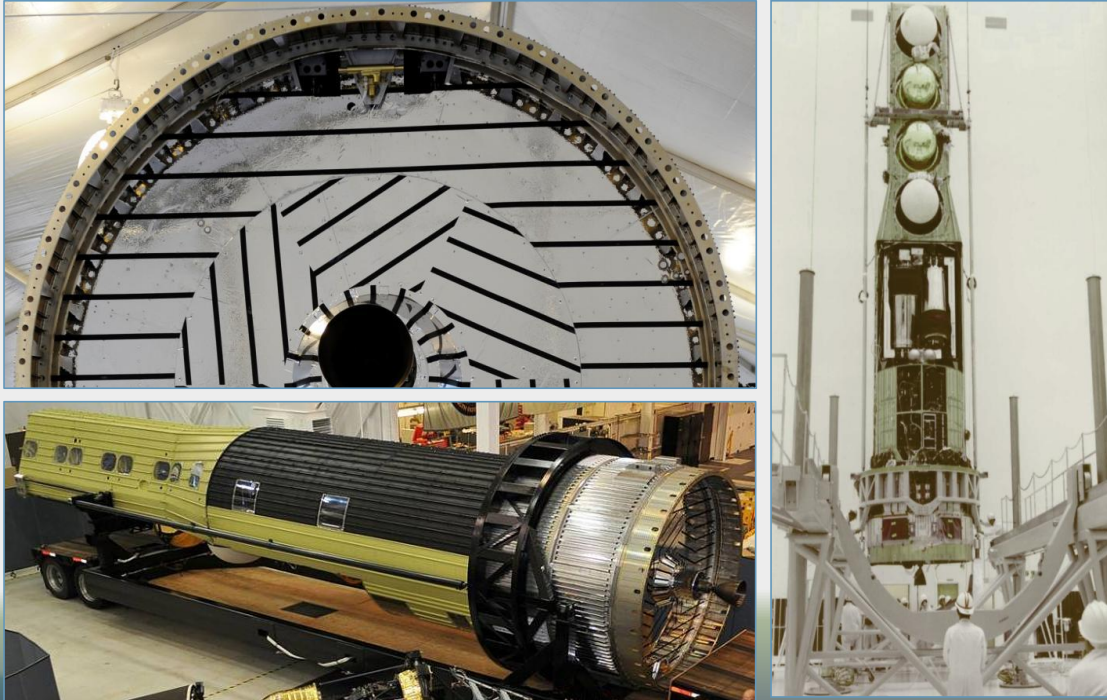


- Like Gambit 1, GAMBIT 3 and its KH-8 played an important role in National Security - here's an example from a recently declassified image of the Tyuratam (tier-ah-tam) Missile Test Center.
- Tyuratam Missile Test Center, which is located in Kazakhstan, is also known as the Baikonur ((Bike-on-or) Cosmosdrome. Because of an existing international treaty, the Soviets had to provide the date, time and place for an ICBM launch in August 1957 - but they weren't too happy about that. So they provided the TASS news agency and the United Nations the name Baikonur, which is a small city some 200 miles away from Tyuratam. This is the site where the space age began, with the Soviet Union's launch of the Sputnik satellite in October 1957 and in addition to other notable launches, it was also the launch site for Yuri Gagarin's flight in 1961 as the first human in space.
- This particular site is also notable since images taken by GAMBIT confirmed it as the site where the Soviet Union was working on a space vehicle to go to the moon. At the time, the Soviet Union denied any intentions of taking part in a "race to the Moon" with the United States, however, imagery in the hands of our national leaders proved otherwise.

- The Soviet's attempt to launch a space vehicle to the moon failed catastrophically on 3 July 1969, just days before Neil Armstrong set foot on the moon. Many of you will recall just where you were and what you were doing when you got that news.



## HEXAGON



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- In a recently declassified video, Dr. Stan Weiss of Lockheed Martin, the 1st program manager for HEXAGON, stated that due to the power demands they had to develop the largest solar array system in operation at the time. He also said they faced technology challenges due to the length of Hexagon, specifically the risk of mis-alignment and to assure accuracy for the film path and camera - through hard work and perseverance, these challenges and others were overcome with great success
- HEXAGON had multiple film recovery buckets and extended missions which lasted an average of about four-months - improvements which moved the United States closer to achieving a continuous space imaging capability
- One HEXAGON frame covered more than 400 miles or about the distance from Cincinnati, Ohio, to Washington DC
- HEXAGON carried 60 miles worth of film - nearly 300 times the amount carried on GAMBIT

- Working together, *GAMBIT* and *HEXAGON* were America's Eyes in Space and were the most sophisticated satellites of their time. But these systems were built with 50s and 60s technology -- the systems we put into orbit today are even more advanced



- Huge success: six satellites in seven months
- Most aggressive launch schedule in 25 years and the satellites we launched are more complex and technically demanding than any we have launched before
- True testament to the pioneering and innovative efforts of the men and women of the NRO
- Refreshed the Nation's overhead reconnaissance constellation - Average age down 2 years -
- Majority of Constellation is aging, but despite age of some satellites, still very robust, adaptable
- Some, designed to monitor Soviet communication in Northern Fleet are now used to geo-locate sensitive signals in the war zone

- Through this campaign and the dedicated efforts of the NRO workforce, we proved once again that the NRO knows how to develop, acquire, launch, and operate our nation's intelligence collection satellite constellation and our worldwide coverage is as good as it has been in years





The graphic features a circular logo in the top left corner with the text "NATIONAL ROCKET LAUNCH CENTER" and "COLUMBIAN UNIVERSITY". The main title "2012 Launch Campaign" is centered at the top. Below it, a dark blue bar contains the year "2012". The central part of the graphic is a calendar grid with columns for MAR, APR, MAY, JUN, JUL, and AUG. The APR column shows a rocket launch on 3 Apr with the word "SUCCESS" in orange. The JUN column shows two launches: NROL-38 CCAFS on 18 Jun and NROL-15 CCAFS on 28 Jun. The AUG column shows a launch: NROL-36 VAFB on 2 August. Each launch is accompanied by a small rocket illustration. The background of the calendar grid is a stylized space scene with a grid of light points. At the bottom, a yellow banner contains the text "Without launch success, there can be no mission success!". The footer of the slide is a blue bar with the text "Office of the Director, NRO".

MAR	APR	MAY	JUN	JUL	AUG
	NROL-25 VAFB 3 Apr <b>SUCCESS</b>		NROL-38 CCAFS 18 Jun	NROL-15 CCAFS 28 Jun	NROL-36 VAFB 2 August

**Without launch success, there can be no mission success!**

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## Worldwide Threats

- + **Terrorism**
  - + Al-Qa'ida
  - + Global Jihad
  
- + **Proliferation**
  - + Iran's technical advancements and uranium enrichment
  - + North Korea's export activities
  
- + **Cyber**
  - + Emerging technologies implemented before security responses
  - + State and Non-State actors

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- As James Clapper, Director of National Intelligence, pointed out during recent congressional testimony, the United States no longer faces one dominant threat. Rather, it is the multiplicity and interconnectedness of potential threats - and the actors behind them - that pose our biggest challenge
- We've done a great job degrading the capabilities of Al-Qa'ida
- It's now focused on smaller, simpler plots and has less influence on the global jihad
- Regional affiliates and to a lesser extent, small cells and individuals will drive the global jihad
- In the area of Proliferation Iran's recent advances strengthen our assessment that it is well capable of producing enough highly enriched uranium for a weapon if its leaders choose to do so
- While North Korea continues to export its ballistic missile and associated materials to several countries, including Iran and Syria - we expect Kim Jong Un to continue this practice

- Finally, the Cyber threat is one of the most challenging we face. Emerging technologies are developed and implemented before security measures can be put in place - provides easy access to disruptive technology for state and non-state actors
- Two of our greatest challenges are real-time attribution of cyber attacks and managing our IT vulnerabilities as a nation




## Carbon Nanotube Research

**Mission:**

- + Revolutionary satellite technologies through novel nano-materials

**Current Goal:**

- + Strongest & lightest multifunctional material for structures & components - focused on bulk carbon nanotube (CNT) material




“...delivering commercially consequential technology”  
for NRO systems  
(President’s Council of Advisors on S&T, 2010)

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- One of the true jewels of the NRO is our ability to conduct Research and Development and then transition our developments into our operations
- Since the discovery of the Carbon Nanotube (CNT) in the early 1990s, many university programs have demonstrated the amazing multi-functional properties of this novel material.
  - A single CNT has been shown to have strength greater than steel, more electric conductivity than copper, exhibit metal or semi-metal properties with proper doping, while being the lightest multi-functional material
  - The University of Michigan recently developed a carbon nanotube coating that acts like a “Magic black cloth” or sort of a cloaking device that conceals an object’s 3D geometry and makes it look like a flat sheet.
- In 2007, the NRO initiated an R&D program to bring carbon nanotubes and their promised revolutionary properties from university-laboratories to a high-volume domestic production capability

- In just four years, the NRO R&D program resulted in a CNT pilot production plant (Nanocomp) that manufactures self-assembled CNT sheets and yarns for very lightweight structural applications, wires and cables, heaters, ballistic protection, battery electrodes, replicated optics and more



## Radiation Hardened Microelectronics

- + **Developing advanced Microelectronics**
  - + Communications links
  - + Signal Acquisition
  - + Onboard Processing
  - + Onboard Data Storage
  
- + **Research approach**
  - + Adapt advanced commercial intellectual property
  
- + **Examples include:**
  - + Multi-core processor designs
  - + Universal Carbon nanotube-based storage technology

*Office of the Director, NRO*

- We are also developing advanced microelectronics to support future needs for applications which include:
  - Communications Links
  - Signal Acquisition, and
  - Onboard processing and data storage
  
- These efforts will allow us to enhance system survivability and performance and address new identified mission challenges
  
- Our basic approach is to adapt commercial circuit designs and processing technology for satellite applications
  
- For example we are working to adapt state-of-the-art multi-core processor designs to improve onboard processing by more than 1,000 times

- And we are working with Industry to develop a universal Carbon Nanotube based storage technology that has the potential to simultaneously provide non-volatile power, nano-second access time and Giga-bit density - this effort could result in a paradigm shift in data storage for both satellite and ground station applications.




## Future Constellation Characteristics

- + **Persistence**
- + **Resilience**
- + **Integrated Processing**
  - + Rapid exploitation
  - + Instant dissemination

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- Based on the threats we see today and our best-estimate for tomorrow, we will need to have an overhead constellation that provides persistence, resilience, and integrated processing to our mission partners, warfighters and policy decision-makers alike.
- Our strong and collaborative partnership with Industry will be , as it has been since our beginning in 1961, vital to the our success and our national security.
- This may prove to be more challenging than it has been in the past, due to our new fiscal reality






## Budget — New Fiscal Reality

- + **Most recent budget submission required a DoD/Intelligence Community cut of \$450 Billion**
  - + NRO provided one-third of all the IC cuts and the amount was double what any other IC agency provided
  - + Independent Cost Estimate savings allowed us to save all of our programs and our ground stations
  - + No more fat to trim
- + **The NRO will continue to use Evolutionary Acquisition**

Office of the Director, NRO

- Most of you have seen the comments of Secretary of Defense Panetta and the impact that the latest budget submission will have on the department and the Intelligence Committee
  - Specific to the NRO we provided 1/3 of the cuts required for the IC - the largest chunk of any agency
  - The good news is that we had a lot of savings to use and we were able to save all of our major programs and ground stations - while take big cuts
  - However, we do not know what is in store from Congress and the Sequestration cuts
- The NRO will continue to use evolutionary acquisition as a way to drive down costs, improve capabilities and replenish our Constellation



## Summary

- + **We develop, acquire, launch and operate the Nation's overhead reconnaissance constellation**
- + **All of our programs are "Green"**
- + **We solve tough problems**

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- What I'd like to leave you with this evening is that quite simply, the NRO is known for its ability to work with mission partners, America's space industry, and customers in order to solve their toughest problems on Earth and transport those solutions to space.

