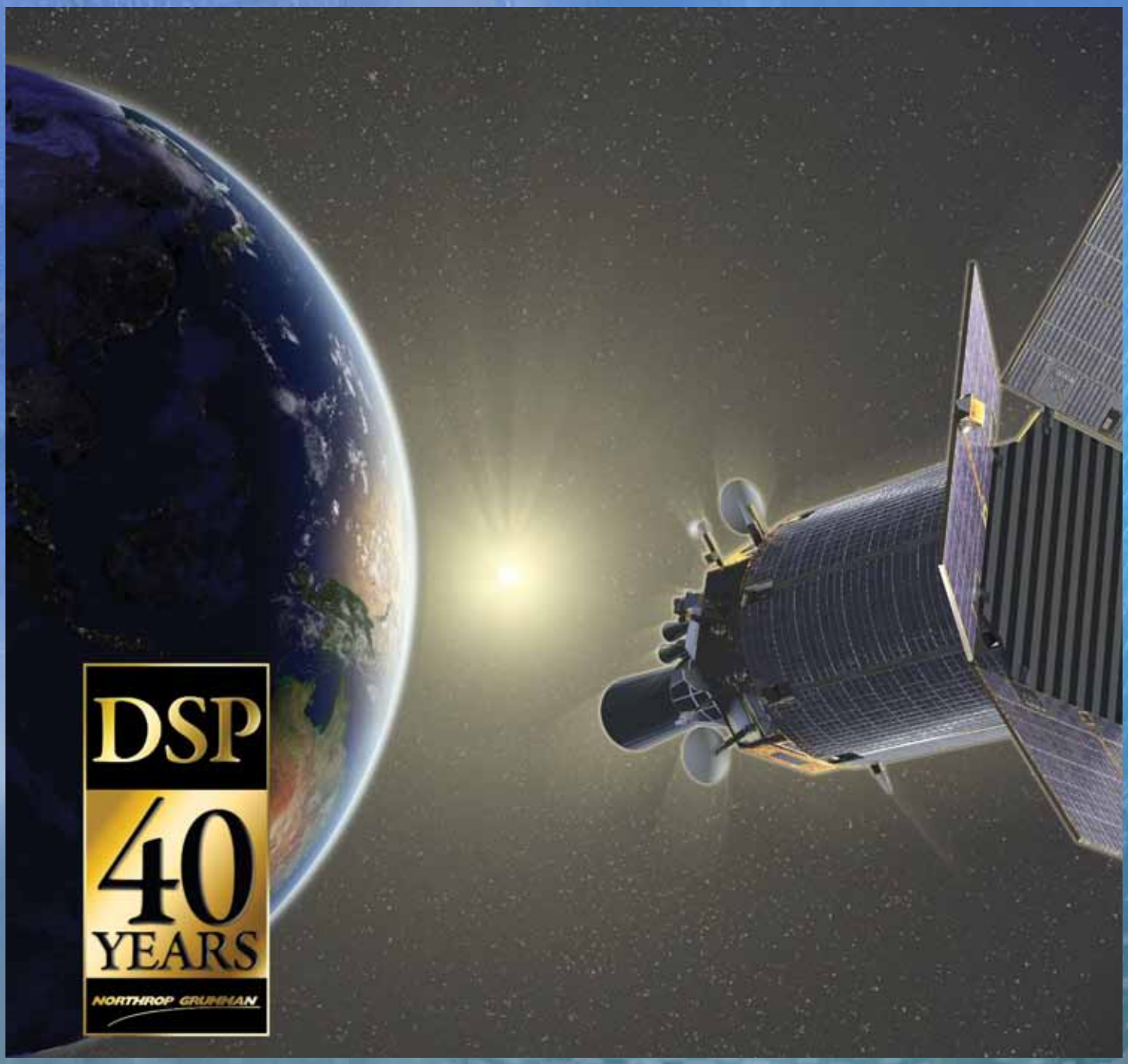
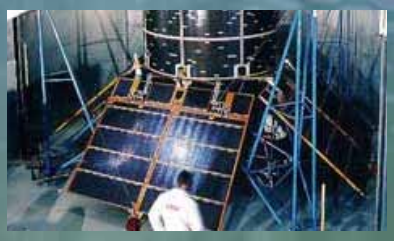
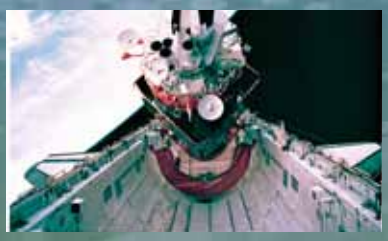
NORTHROP GRUMMAN

Defense Support Program

Celebrating 40 Years of Service







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Silent Sentries in Space

Defense Support Program
Celebrating 40 Years of Service

For four decades, the Defense Support Program's satellites have kept constant watch over the world to detect strategic and tactical missile launches and provide early warning of an enemy attack.

Using increasingly sophisticated sensors, DSP satellites are able to detect ICBM launches, nuclear detonations, and other missile launches much earlier than ground-based radar.

The need for satellites with these capabilities was precipitated by the Cold War that lasted from 1945 to 1990 and was marked by political tension and a nuclear arms race between the Soviet Union and the United States. Since then, the threat to our nation has grown to several countries with nuclear capabilities, further emphasizing the key role these space sentinels play in monitoring various missile programs and providing critical information to the U.S. government and its allies.

The U.S. Air Force assembled a team to develop the Defense Support Program as the space-based segment of the Integrated Tactical Warning and Attack Assessment system. Since the beginning, Northrop Grumman has worked closely with the Air Force in developing this program that has proven to be critical in building the nation's future missile defense capabilities.

Each DSP satellite built by Northrop Grumman includes a primary infrared payload built by Northrop Grumman Electronic Systems and secondary payloads built by the Sandia and Los Alamos National Laboratories that are integrated onto the satellites. Strategically located ground stations communicate with the orbiting satellites, process mission and other data, and provide reports to the National Command Authority.

No crystal ball could have foreseen the ultimate missions the DSP satellites perform, including tactical missile warning, missile defense, technical intelligence, and observing natural disasters such as major fires and volcanic eruptions. Recent enhancements to the ground data processing system and the satellite constellation utilization methodology have made these advanced missions possible.

DSP Flight History

DSP is one of the most successful space programs in U.S. history, performing well in cost, schedule, satellite longevity, and most importantly, mission success.

DSP Flights 1-4 (Phase I) established the initial operational constellation and took place between 1970-1973. Each satellite weighed approximately 2000 pounds, and had a power output of 400 watts through a combination of solar cells around the body of the satellite and on four deployable paddles. These satellites were designed to provide early warning, via the primary infrared sensor, against mainly Soviet ICBMs and short-range submarine-launched ballistic missiles (SLBMs) around the continental United States.

DSP Flights 5-7 (Phase II), launched between 1975-1977, increased on-orbit lifetime to two years and solar panel output to 480 watts. Other improvement packages were added, increasing the satellite weight from 2000 to 2300 pounds.

DSP Flights 8-11 (MOS/PIM) flew between 1979-1984, when the Soviet threat included longer range SLBMs, mobile ICBMs, and anti-satellite systems. Four DSP satellites were produced with performance improvement modifications (PIM) that included increased satellite survivability to JCS Level 1, increased fuel capacity, extended on-orbit lifetime to three years, and increased power output to 500 watts. These multi-orbit satellites (MOS) could be placed into either geosynchronous or highly elliptical orbits. Satellite weight increased to 2580 pounds.

DSP Flights 12-13 (Phase II Upgrade), launched between 1984-1987, carried a significantly upgraded primary infrared sensor with a greater number of detectors and associated electronics for enhanced signal processing and better polar coverage. Solar panels were now providing 680 watts of power, and the satellite weight increased to 3690 pounds.

DSP-1 Flights 14-23 (Phases IV and V), launched between 1989-2007, were designed for multiple launch vehicle capability. These satellites included further upgraded sensors for increased resolution, an improved survivability to JCS Level 2, and an increased on-orbit life goal of five years. Power output grew to 1275 watts; satellite weight to 5250 pounds.

These four carefully orchestrated major system upgrades significantly improved mission capability and system performance, survivability and flexibility. In addition, the DSP satellites have demonstrated a longevity of approximately four times the design life requirement, providing more than 184 satellite-years on-orbit beyond their design lives to date.

The technological advancements and process improvements achieved over the course of building and operating these satellites have benefited many other nationally-critical programs and had a major influence on evolving Northrop Grumman's core competencies.

DSP clearly demonstrated its vital capability and reliability during Operation Desert Storm in 1991. Its constellation of satellites detected the launch of Iraqi Scud missiles, providing timely warning to civilian populations and coalition forces, including Patriot missile battery commanders in Saudi Arabia and Israel. DSP's performance verified that the system could provide significant early warning of tactical missile attacks, protecting our warfighters and contributing to the security of our nation and its allies.

DSP Engineering History

	Phase I	Phase II	MOS/PIM	Phase II UG	DSP-1
Flight Number	1, 2, 3, 4	5, 6, 7	8, 9, 10, 11	12, 13	14-23
Launch Years	1970-1973	1975-1977	1979-1984	1984-1987	1989-2007
Launch Vehicle	Titan IIIC	Titan IIIC	Titan IIIC and Titan 34D	Titan 34D	3 Titan IV-A, 5 Titan IV-B, 1 STS, 1 EELV Delta IV Heavy
Weight (lbs)	2000	2300	2580	3690	5250
Power (watts)	400	480	500	680	1275
Design Life (years)	1.25	2.0	3.0	3.0	3.0
Detectors					
2000 (PbS) (SWIR)	X	X	X		
6000 (PbS) (SWIR)				X	X
2nd Color (HgCdTe) (MWIR)				Demo	X
Capability					
Below the Horizon (BTH)	X	X	X	X	X
Above the Horizon (ATH)		Demo		X	X
RADEC	X	X	X		
Advanced RADEC				X	X

DSP Launch History

23 Flights Since 1970

DSP Operational History		
Flight Number	**Launch Date**	**Launch Vehicle**
DSP-1	11/6/70	Titan IIIC/Transtage
DSP-2	5/5/71	Titan IIIC/Transtage
DSP-3	3/1/72	Titan IIIC/Transtage
DSP-4	6/12/73	Titan IIIC/Transtage
DSP-5	12/14/75	Titan IIIC/Transtage
DSP-6	6/26/76	Titan IIIC/Transtage
DSP-7	2/6/77	Titan IIIC/Transtage
DSP-8	6/10/79	Titan IIIC/Transtage
DSP-9	3/16/81	Titan IIIC/Transtage
DSP-10	3/6/82	Titan IIIC/Transtage
DSP-11	4/14/84	Titan 34D/Transtage
DSP-12	12/22/84	Titan 34D/Transtage
DSP-13	11/29/87	Titan 34D/Transtage
DSP-14	6/14/89	Titan IVA/IUS
DSP-15	11/13/90	Titan IVA/IUS
DSP-16	11/24/91	STS/IUS
DSP-17	12/22/94	Titan IVA/IUS
DSP-18	2/23/97	Titan IVB/IUS
DSP-19	4/9/99	Titan IVB/IUS
DSP-20	5/8/99	Titan IVB/IUS
DSP-21	8/6/01	Titan IVB/IUS
DSP-22	2/14/04	Titan IVB/IUS
DSP-23	11/11/07	Delta IV EELV Heavy

Northrop Grumman's California-based Telemetry and Orbital Test Station and Satellite Payload Orbital Test Station will continue their support of this endeavor. These sites constantly track and perform trending analysis for spacecraft and payload and mission data, respectively.

Northrop Grumman – especially its employees who dedicated many years of their lives to working on DSP – is honored to have been entrusted with supplying the government with this highly reliable space system that continues to contribute to our national security and helps protect our military forces.

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