TECHNOLOGY AND SCIENCE ON THE SPACE SHUTTLE
FRANCO MAURI's COLLECTION

Between the first launch on April 12, 1981 and the final landing on July 21, 2011, NASA's Space Shuttle fleet, Columbia, Challenger, Discovery, Atlantis and Endeavour flew 135 missions, inspired generations. The spacecraft has carried people into orbit repeatedly, launched, recovered and repaired satellites, conducted cutting-edge research and built the largest structure in space, the International Space Station.
As humanity's first reusable spacecraft, the Space Shuttle pushed the bounds of discovery ever farther, requiring not only advanced technologies but the tremendous effort of a vast workforce. Thousands of civil servants and contractors throughout NASA's field centers and across the nation have demonstrated an unwavering commitment to mission success and the greater goal of space exploration.

The collection consists of 9 chapters :

1 STATIC TESTS AND IN FLIGHT
2 SCIENTIFIC RESEARCH
3 SPACE SHUTTLE / MIR
4 SPACE SHUTTLE / ISS (Spacehab)
5 SATELLITES
6 AUTOMATIC INTERPLANETARY PROBES
7 ASTRONOMICAL OBSERVATIONS AND EARTH
8 MISSIONS DEDICATED TO DEPARTMENT OF DEFENSE
9 ASSEMBLY AND SUPLLY OF THE INTERNATIONAL SPACE STATION

Bibliography :

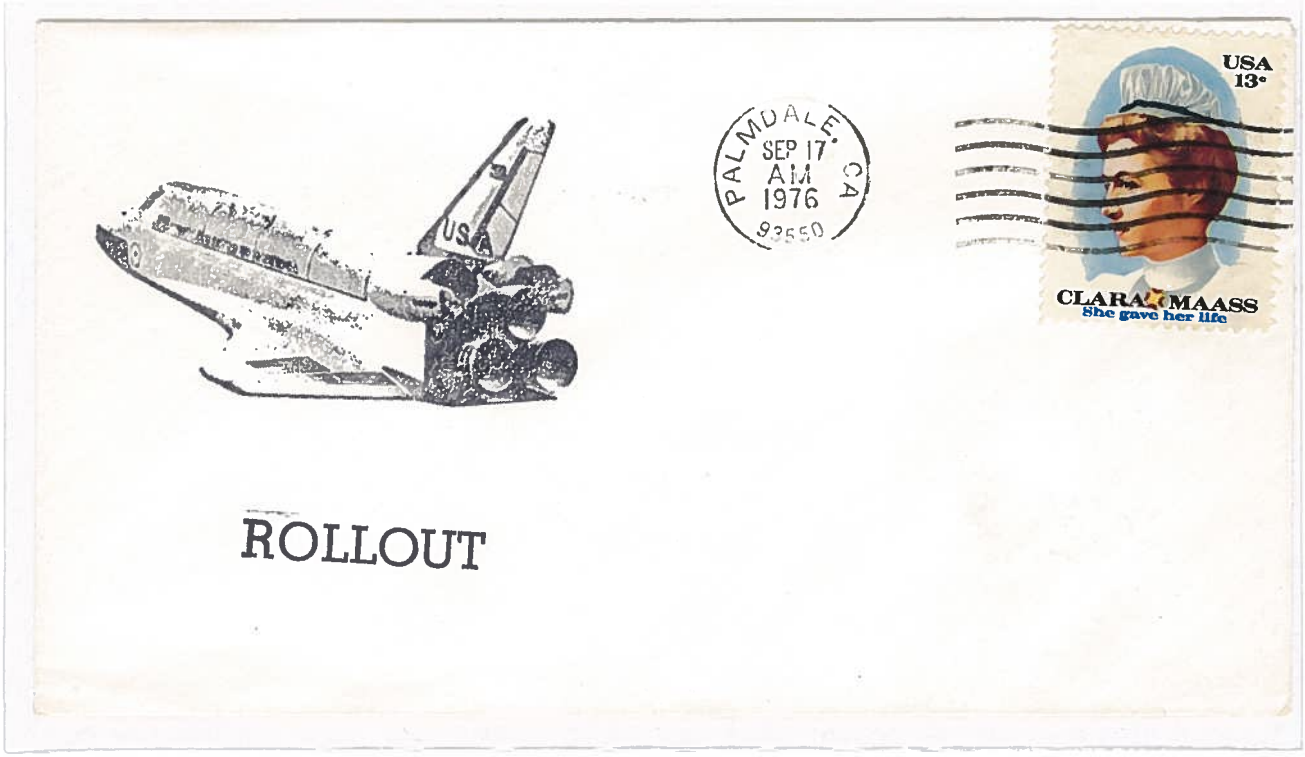
NASA mission archives

AD*ASTRA, quarterly newsletter of AS.IT.AF. (redactor Umberto Cavallaro)

Chapter 1. STATIC TEST AND IN FLIGHT

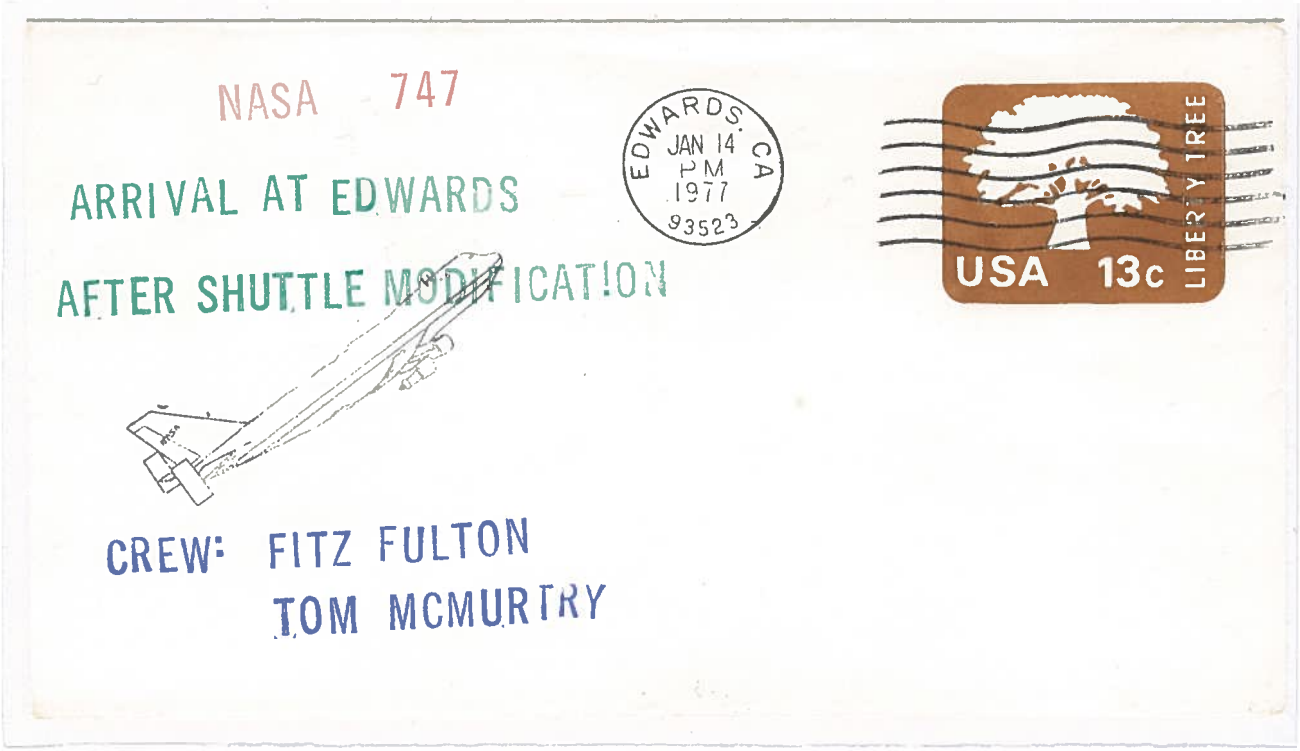
MARCH 20, 1975. Commemorative cover signed by Robert White, X-15 pilot, astronaut, with machine cancel of Edwards affixed on the date and time of flight. Already on August 1, 1973 the experimental aircraft X-24B, which can be considered the prototype of Space Shuttle, makes its first flight piloted by John Manke, released by a mother plane B-52 at 12,000 meters of altitude.

JUNE 28, 1976. Commemorative cover manually cancelled in Moffet Field on the date and time of testing in a wind tunnel. The project of the North American Rockwell, already manufacturer of the Apollo CSM, is chosen definitively in function as the low-coast and the restrained weight of orbiter.



SEPTEMBER 17, 1976. Commemorative cover postmarked with machine cancel in Palmdale on the date and time of rollout.

DECEMBER 6, 1976. Commemorative full post postmarked whit machine cancel in Edwards on the date and time of the flight of the aircraft used by NASA's flight training on the Space Shuttle.



JANUARY 14, 1977. Commemorative cover postmarked with machine cancel in Edwards on the date and time of arrival at the base of the modified " Jumbo ". To transport the Shuttle, still not motorized, between the various sites, in 1974 NASA acquires a Boeing 747 used which is equipped for the transport of the Shuttle on the back of the fuselage.

Commemorative cover postmarked with machine cancel in Edwards on the date and time of arrival at the base of the 747 Shuttle Carrier Aircraft SCA (JANUARY 14, 1977) and on the date and time of arrival of the Shuttle Enterprise OV-101 (JANUARY 31, 1977).

FEBRUARY 15, 1977. Commemorative cover postmarked with machine cancel in Edwards on the date and time of the Shuttle's structural test.

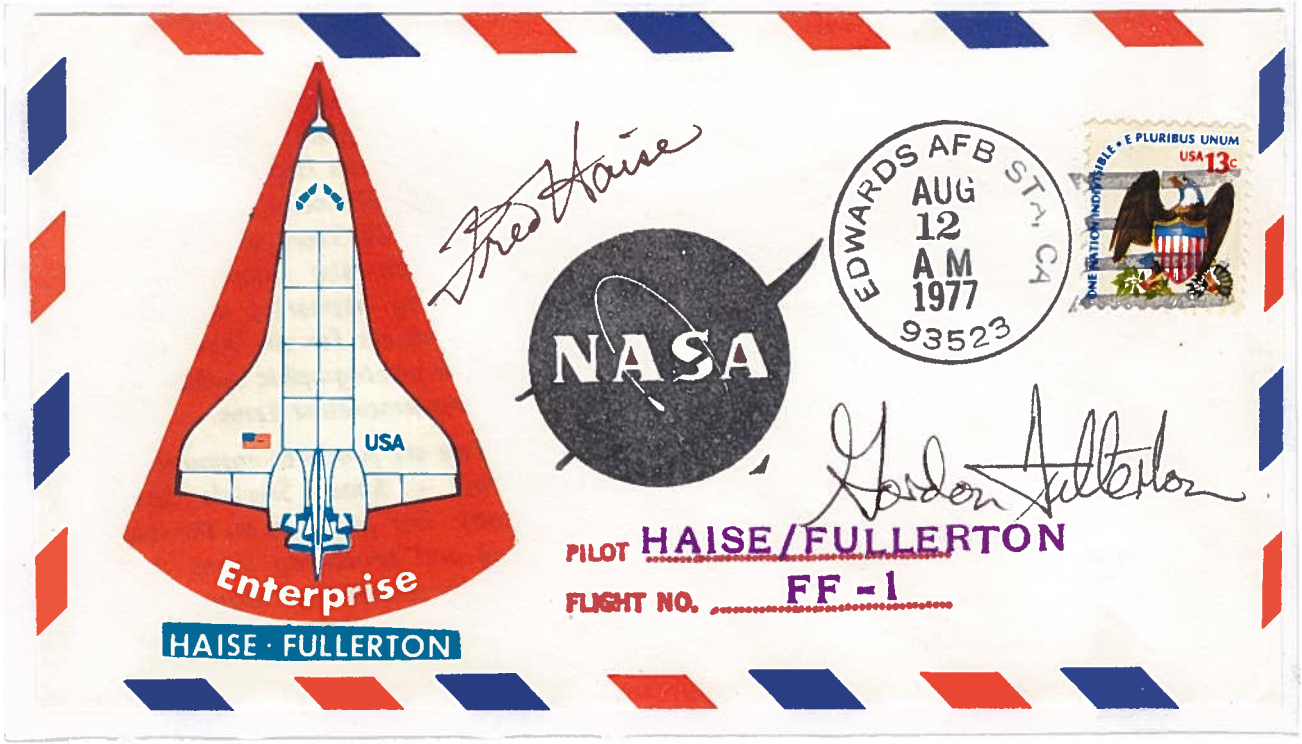
FEBRUARY 22, 1977. Edwards machine cancel on the date and time of flight tests of the SCA loaded Shuttle Enterprise.

MARCH 11, 1977. Commemorative cover manually cancelled in White Sands Missile Range on the date and time of of training flight of the Space Shuttle pilots.

JUNE 18, 1977. SCA/Enterprise. Commemorative cover manually cancelled in Edwards on the date of the bonded flight CA#1 crewed.

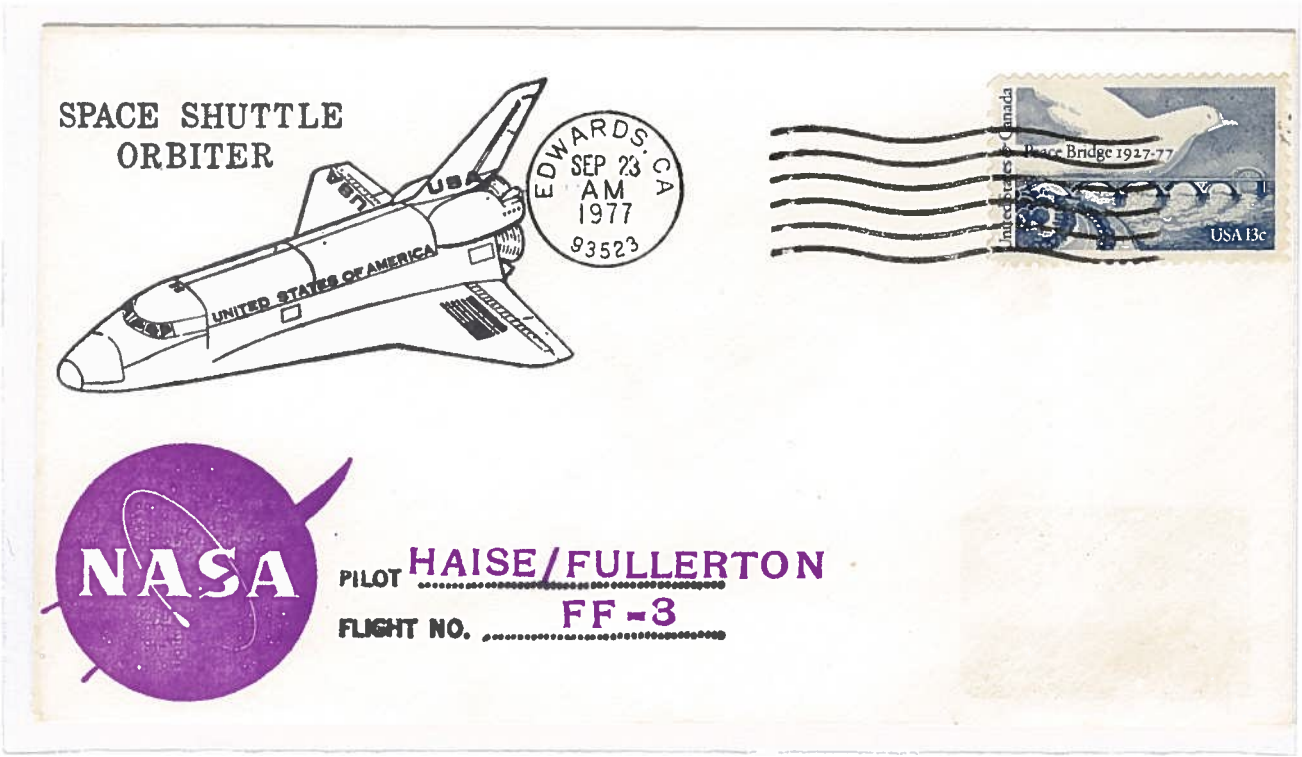
JUNE 28, 1977. SCA/Enterprise. Commemorative cover manually cancelled in Edwards on the date of the bonded flight CA#2 crewed.

JULY 26, 1977. SCA/Enterprise. Commemorative cover manually cancelled in Edwards on the date of the bonded flight CA#3 crewed.



Approach and Landing Test (ALT FF-1). AUGUST 12, 1977. Commemorative cover manually cancelled in Edwards on the date and time of the skygliding. The Shuttle Enterprise, released from 747 to 7,000 meters of altitude, lands after 5 minutes and 23 seconds on the track dry lake at the speed of 400 km/h.

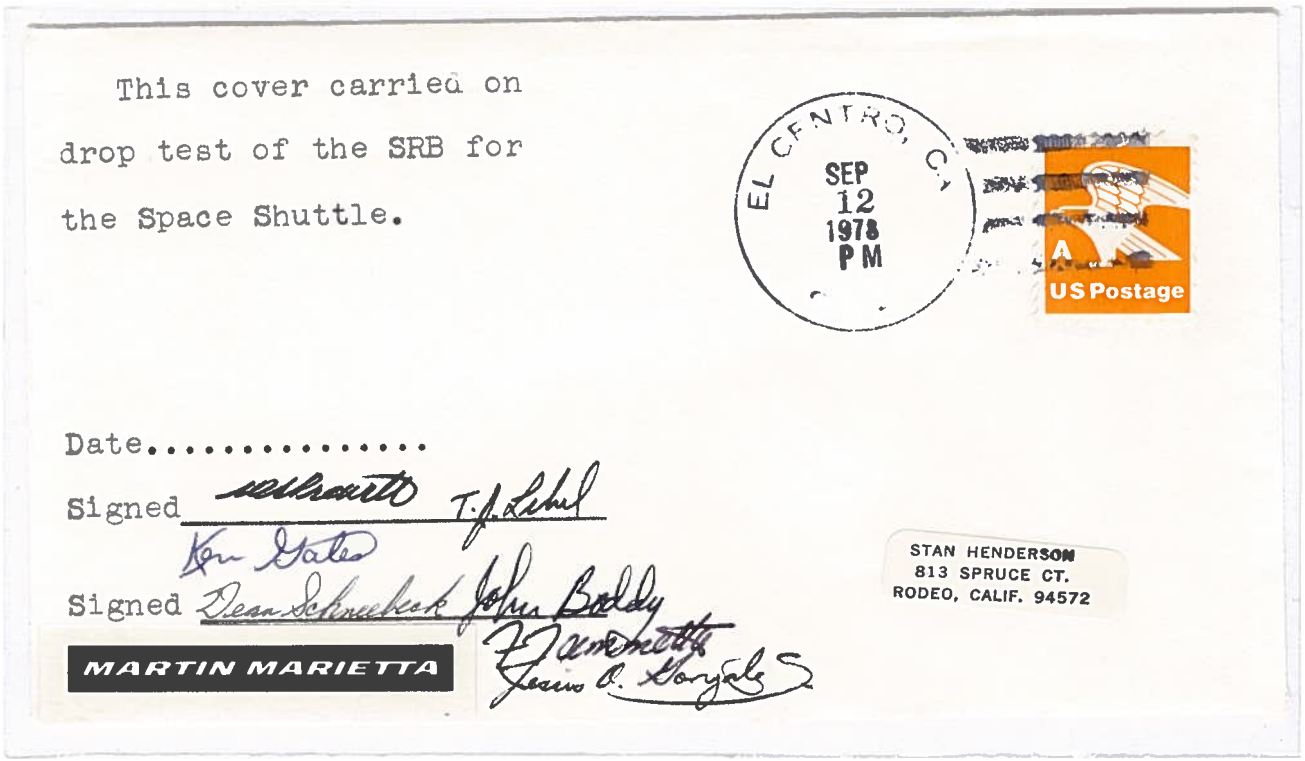
ALT FF-2. SEPTEMBER 13, 1977. Commemorative cover manually cancelled in Edwards on the date and time of the skygliding. The first three flights are performed by placing the tail of the fuselage an aerodynamic cone. Instead of a thermal protection system, the surface is covered mainly with simulated tiles.



ALT FF-3. SEPTEMBER 23, 1977. Commemorative cover postmarked in Edwards with machine cancel on the date and time of skygliding. During the descent is tested a new control system of orbiter and, during the landing phase, a microwave from the ground guidance system.

ALT FF-4. OCTOBER 12, 1977. Commemorative cover postmarked in Edwards with machine cancel on the date and time of skygliding. The two end flights are devoid of aerodynamic cone and mounted no operating engines to simulate re-entry from a space mission.

ALT FF-5. OCTOBER 26, 1977. Commemorative cover manually cancelled in Edwards on the date of gliding flight.



SEPTEMBER 12, 1978. Commemorative cover postmarked with manual cancel in El Centro on the date and time of the descent SRB test. The two solid rocket booster fall off two minutes after launch, to an altitude of more 65 km, and are recovered in the Ocean were takes place the splash down hanging some parachutes.

OCTOBER 19, 1978. Commemorative cover postmarked with machine cancel in Brigham City on the date and time of static test.

DECEMBER 21, 1978. Commemorative cover postmarked with machine cancel in Houston on the date and time of delivery of a Shuttle model.

APRIL 10, 1979. Commemorative cover postmarked with machine cancel in Cape Canaveral on the date and time of delivery of Enterprise orbiter to KSC.

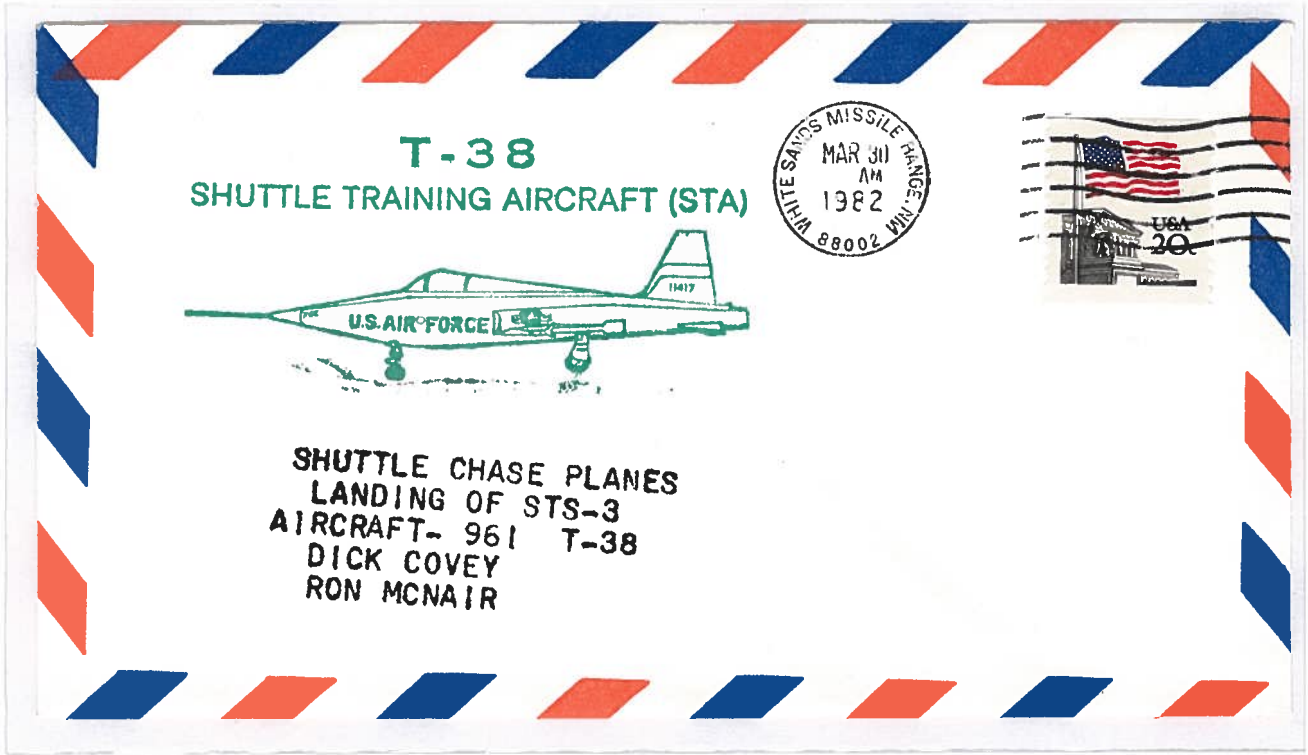
MAY 1, 1979. Commemorative cover postmarked with machine cancel in Cape Canaveral on the date and time of Enterprise roll out.

Mission STS-1 Columbia. APRIL 12, 1981. Commemorative cover postmarked with machine pictorial cancel in KSC on the date and time of launch. Demonstrate safe launch into orbit and safe return of the orbiter and crew. Verify the combined performance of the entire Shuttle vehicle-orbiter, solid rocket booster and external tank. Major systems tested successfully.

Mission STS-1 Columbia. APRIL 13, 1981. Houston machine cancel affixed during the mission.

Chapter 2. SCIENTIFIC RESEARCH

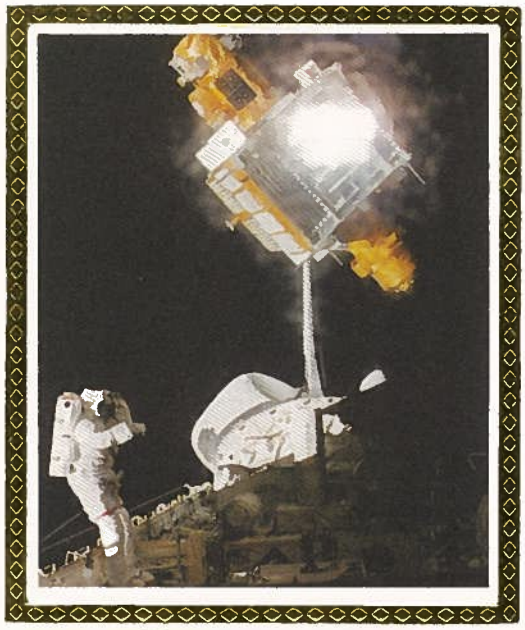
Mission STS-3 Columbia. MARCH 22, 1982. KSC machine cancel on the date and time of launch. Testing continued of Space Shuttle systems for qualification for operational flights. Get away special test canister and Spacelab pallet-mounted experiments for NASA's Office of Space Science-1 (OSS-1). OSS-1 obtained data on near-Earth space environment.



Mission STS-3 Columbia. MARCH 30, 1982. White Sands Missile range machine cancel on the date and time of landing.

Mission STS-4 Columbia. JUNE 27, 1982. Commemorative cover postmarked with manual cancel in KSC on the date of launch. Commercial experiment involving Continuous Flow Electrophoresis System (CFES).

Mission STS-41G Challenger. OCTOBER 5, 1984. KSC machine cancel on the date and time of launch. The Office of Space and Terrestrial Applications-3 (OSTA-3) carried three experiments in the payload bay. Components of Orbital Refueling System (ORS) were connected, demonstrating it is possible to refuel satellites in orbit.



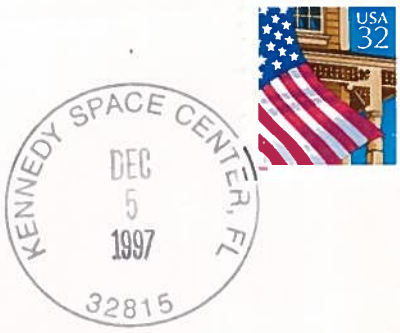
Colorano "Silk" Cachet

SPACE WALK #1
STS-87 - 88th Shuttle Mission
November 24, 1997. Astronaut Winston Scott and Takao Doi of Japan's NASDA (obscured in the dark shadows) await the right opportunity to grab onto the malfunctioning Spartan satellite deployed a few days earlier. A little later, when Columbia moved closer to Spartan, the two mission specialists were able to successfully grab the satellite manually and berth it in Columbia's cargo bay. (NASA photo)

Mission STS-87 Columbia. NOVEMBER 24, 1997. Houston manual cancel affixed during the mission. Primary payload of the flight, the U.S. Microgravity Payload-4 (USMP-4) performed well. This fourth flight of USMP focused on materials science, combustion and fundamental physics.

Return of the Colunbia STS-87
88th Space Shuttle Mission

Colorano "Silk" Cachet



December 5, 1997. Columbia returned to Florida's Kennedy Space Center after a 16 day mission in Earth orbit. Shown in this onboard crew photo taken in Columbia's mid-deck are (in front, L to R) Steven Lindsay, pilot; Takao Doi of Japan's National Space Development Agency; and Winston Scott, mission specialist. In back are (L to R) Kevin Kregel, mission commander, Kalpana Chawla, mission specialist; and Leonid Kadenyuk, mission specialist from the Ukraine. (NASA photo)

Mission STS-87 Columbia. DECEMBER 5, 1997. Commemorative cover postmarked with manual cancel in KSC on the date of landing.

Chapter 2. SCIENTIFIC RESEARCH (The Spacelab)

Mission STS-9 Columbia. NOVEMBER 28, 1983. Commemorative post card postmarked with machine pictorial cancel in KSC on the date and time of launch. First SPACELAB mission. This flight carried the first astronaut to represent the ESA, Ulf Merbold of Germany. ESA and NASA jointly sponsored the SPACELAB-1 (LM1-P), an orbital laboratory which contains an observation platform composed of cylindrical pressurized modules and U-shaped unpressurized pallets which remain in the orbiter's cargo bay.

Mission STS-9 Columbia. DECEMBER 8, 1983. Commemorative full post postmarked in Edwards on the date of landing.

Launch of the Challenger 51-B
17th Space Shuttle Mission

Colorano "Silk" Cachet

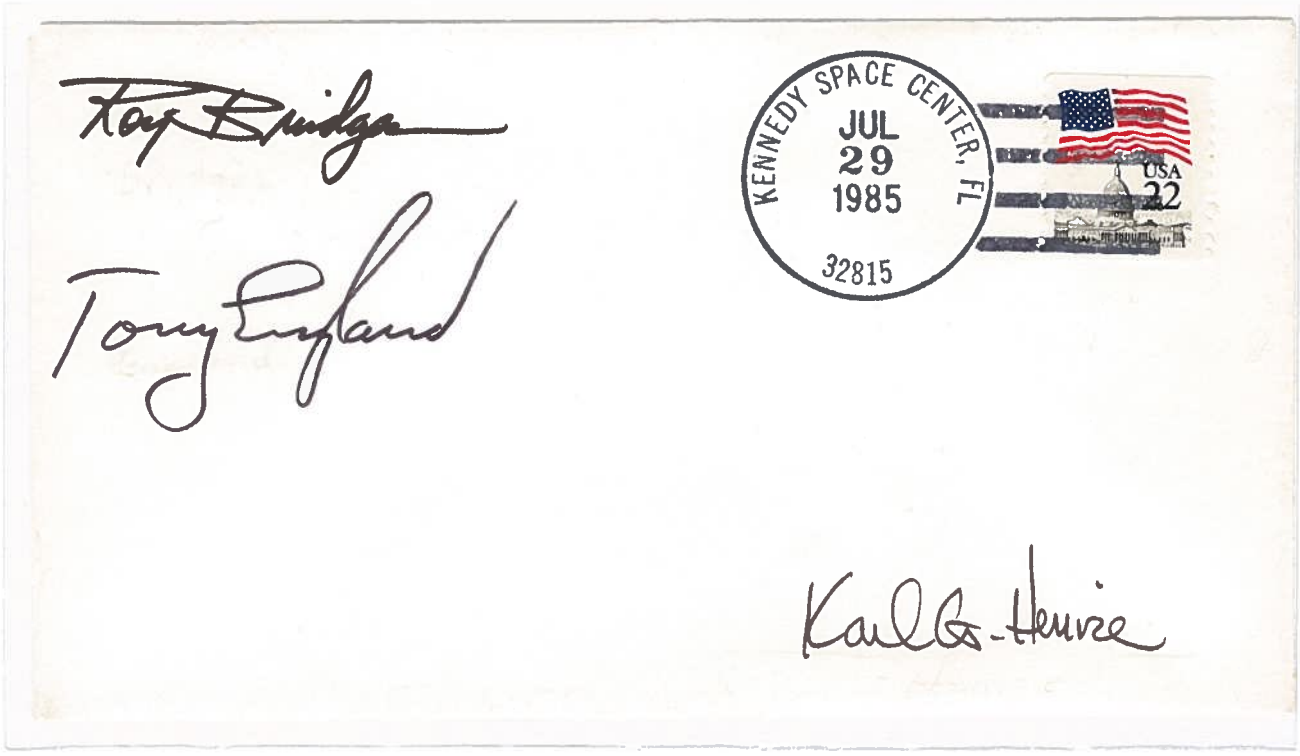
April 29, 1985 — Challenger 51-B streaked into space at 12:02 p.m. today. Accompanying the 7 astronauts are 2 squirrel monkeys and 24 white rats. The crewmembers are Robert F. Overmyer, commander; Frederick D. Gregory, pilot; Don L. Lind, Norman E. Thagard and William E. Thornton, mission specialists; Taylor G. Wang and Lodewijk van den Berg, payload specialists for Spacelab 3.

Mission STS-51B Challenger. APRIL 29, 1985. Commemorative cover postmarked with manual cancel in KSC on the date of launch.

Astronaut Robert F. Overmyer, 51-B MISSION COMMANDER, aims a Linhof camera through flight deck windows aboard the Earth-orbiting space shuttle Challenger. The 35mm frame was among the first photographs to be released by NASA upon return to Earth by the STS 51-B crew.

8/-

Mission STS-51B Challenger. APRIL 30, 1985. Commemorative cover postmarked with machine cancel in KSC during the mission. This was the first operational flight for the SPACELAB series developed by ESA. The primary payload was SPACELAB-3 (LM1) which includes five basic discipline areas : material sciences, life sciences, fluid mechanics, atmospheric physics and astronomy.



Mission STS-51F Challenger. JULY 29, 1985. Commemorative cover postmarked with manual cancel in KSC on the date of launch. This was the second and final SPACELAB verification flight. Instead of a laboratory module, this a featured three-pallet train (IGLOO-3P) holding instruments exposed to the space environment. Experiments covered life sciences, astrophysics, astronomy and technology research.

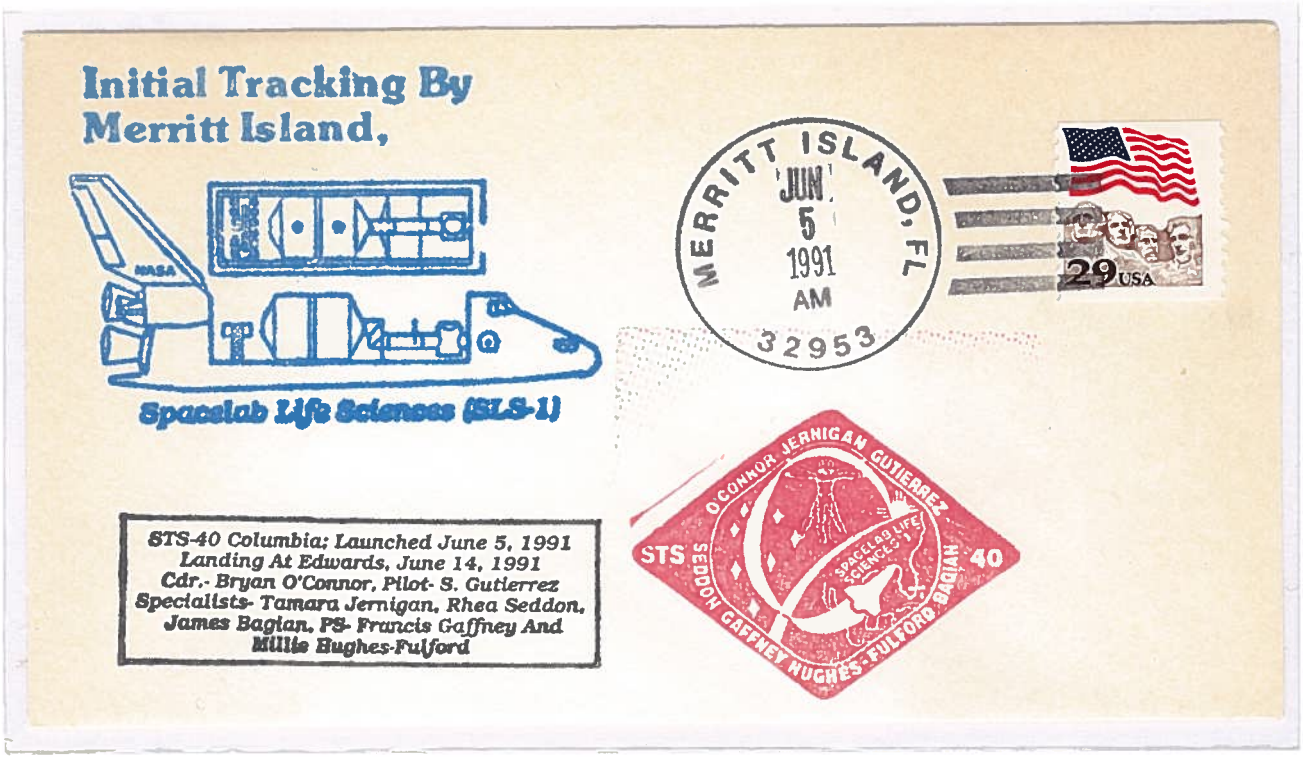
Mission STS-51F Challenger. AUGUST 6, 1985. Commemorative cover postmarked with manual cancel in Edwards on the date and time of landing.

Colorano "Silk" Cachet

SPACE SHUTTLE CHALLENGER 61-A
October 30, 1985 — Riding on the strength of its 2 solid rocket boosters and 3 main engines, the 22nd shuttle flight, 9th by Challenger, made a perfect lift-off at noon today. On board is a record crew of 8 plus a room-sized research laboratory. Crew members are - commander Henry Hartsfield; pilot Steven Nagel; mission specialists Bonnie Dunbar, Guion Bluford and James Buchli; payload specialists Reinhard Furrer, Ernst Messerschmid of Germany and Wubbo Ockels of the Netherlands.

Mission STS-61A Challenger. OCTOBER 30, 1985. Commemorative cover postmarked with machine cancel in Cape Canaveral on the date and time of launch. This flight was a dedicated German SPACELAB (Spacelab D-1) mission featuring the Spacelab module (LM2). Spacelab D-1 encompassed 75 numbered experiments. Though the orbiter was controlled from Johnson Space Center, scientific operations were controlled from the German Space Operations Center at Oberpfaffenhofen, near Munich.

Mission STS-61A Challenger. NOVEMBER 6, 1985. Commemorative cover postmarked with machine cancel in Edwards on the date and time of landing.

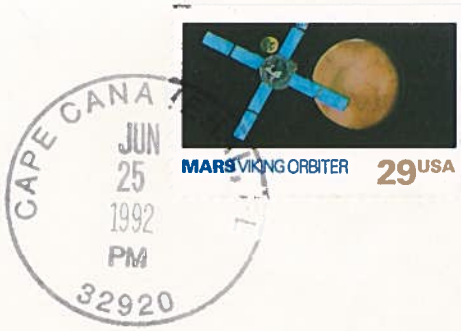


Mission STS-40 Columbia. JUNE 5, 1991. Commemorative cover postmarked with manual cancel in Merritt Island on the date and time of launch. The fifth dedicated SPACELAB mission carried the Spacelab Life Sciences-1 (SLS-1). The first Spacelab flight dedicated to a single discipline, the life sciences, using the habitable module (LM1). Primarly the SLS-1 experiments studied six body systems; of 18 investigations, 10 involved humans, 7 involved rodents and 1 used jellyfish.

Mission STS-42 Discovery. JANUARY 22, 1992. KSC machine cancel on the date and time of launch. First flight of the IML-1 (International Microgravity Laboratory – 1) using the pressurized Spacelab Module (LM2). Research on the uman nervous system adaptation to low gravity and the effects of microgravity on other life forms

Mission STS-45 Atlantis. MARCH 24, 1992. Commemorative cover postmarked with manual cancel in Ksc on the date of launch. The mission carried the first Atmospheric Laboratory for Applications and Science (ATLAS-1) on SPACELAB pallets (IGLOO-2P) mounted in the orbiter's cargo bay, equipped with 12 instruments from U.S., France, Germany, Belgium, Switzerland, the Netherlands and Japan.

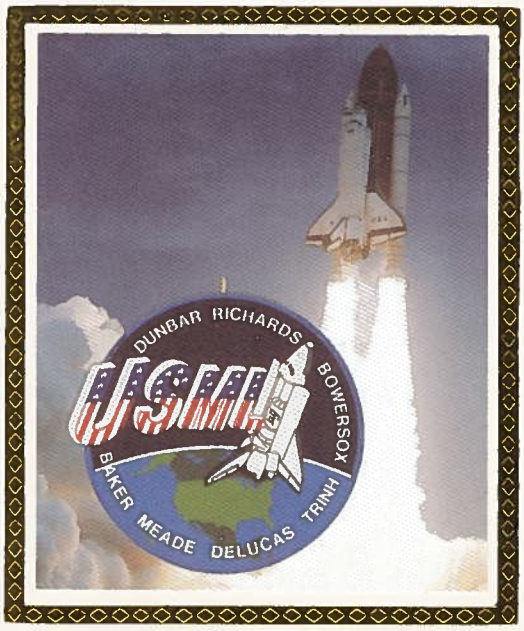
Colorano "Silk" Cachet



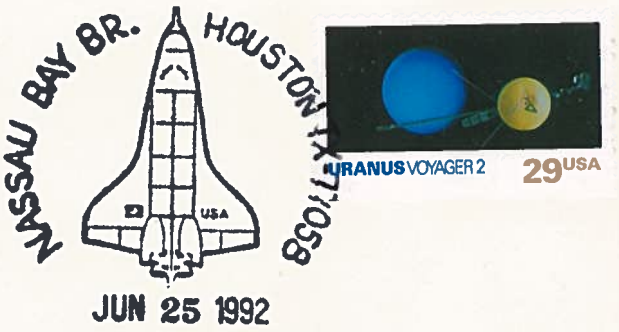
SPACE SHUTTLE COLUMBIA STS-50

June 25, 1992 — The Space Shuttle Columbia, NASA's first modified extended duration orbiter (EDO), lifted off at 12:12 p.m. today on its way to a scheduled record 13-day mission. The crew of seven are Richard N. Richards, mission commander; Kenneth D. Bowersox, pilot; Bonnie J. Dunbar, payload commander; Lawrence J. DeLucas and Eugene H. Trinh, payload specialists; Carl J. Meade and Ellen S. Baker, mission specialists. The seven will divide into two shifts to support U.S. Microgravity Laboratory (USML) research.

Mission STS-50 Columbia. JUNE 25, 1992. Commemorative cover postmarked with manual cancel in Cape Canaveral on the date and time of launch. The primary payload was the United States Microgravity Laboratory-1 (USML-1), a manned SPACELAB module (LM1) with a connecting tunnel to the orbiter crew compartment. USML-1 was a national effort to advance microgravity research in a broad number of disciplines.



Colorano "Silk" Cachet

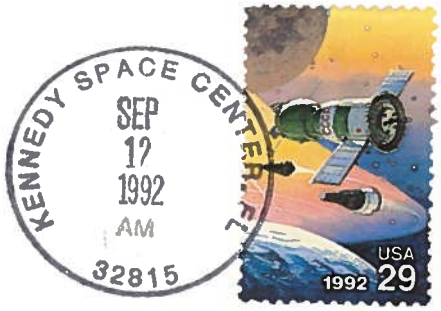


SPACE SHUTTLE COLUMBIA STS-50

June 25, 1992 — The Space Shuttle Columbia lifted off at 12:12 p.m. today on its way toward a scheduled record 13-day mission. On board the modified Columbia, NASA's first extended duration orbiter (EDO) are astronauts Richard N. Richards, mission commander; Kenneth D. Bowersox, pilot; Bonnie J. Dunbar, payload commander; Lawrence J. DeLucas and Eugene H. Trinh, payload specialists; Carl J. Meade and Ellen S. Baker, mission specialists. The seven member crew will divide into two shifts to support U.S. Microgravity Laboratory (USML) research.

Mission STS-50 Columbia. JUNE 25, 1992. Commemorative cover postmarked with machine cancel in Nassau Bay on the date of launch.

SPACE SHUTTLE
STS-47/ENDEAVOUR



Mission STS-47 Endeavour. SEPTEMBER 12, 1992. Commemorative cover postmarked with manual cancel in KSC on the date and time of launch. SPACELAB-J, a joint NASA and NASDA mission utilizing a manned SPACELAB module (LM1), conducted microgravity investigations in materials and life sciences. In flight the first Japanese astronaut aboard the Shuttle, the first African-American woman in space and the first married couple.

STS-47 Endeavour — Payload specialist Mamoru Mohri, representing Japan's National Space Development Agency (NASDA), uses a microscope to produce photomicrographs of mammalian cells. The mammal cell structure experiment is one of a large number of tests that were performed during the eight-day Spacelab-J mission. On his back, Dr. Mohri totes a health monitoring experiment. The primary objective of the physiological monitoring system is to observe the health condition of the Japanese payload specialist so that good health can be maintained during and after the spaceflight.

Mission STS-47 Endeavour. SEPTEMBER 15, 1992. Commemorative cover postmarked with machine cancel in KSC during the mission.

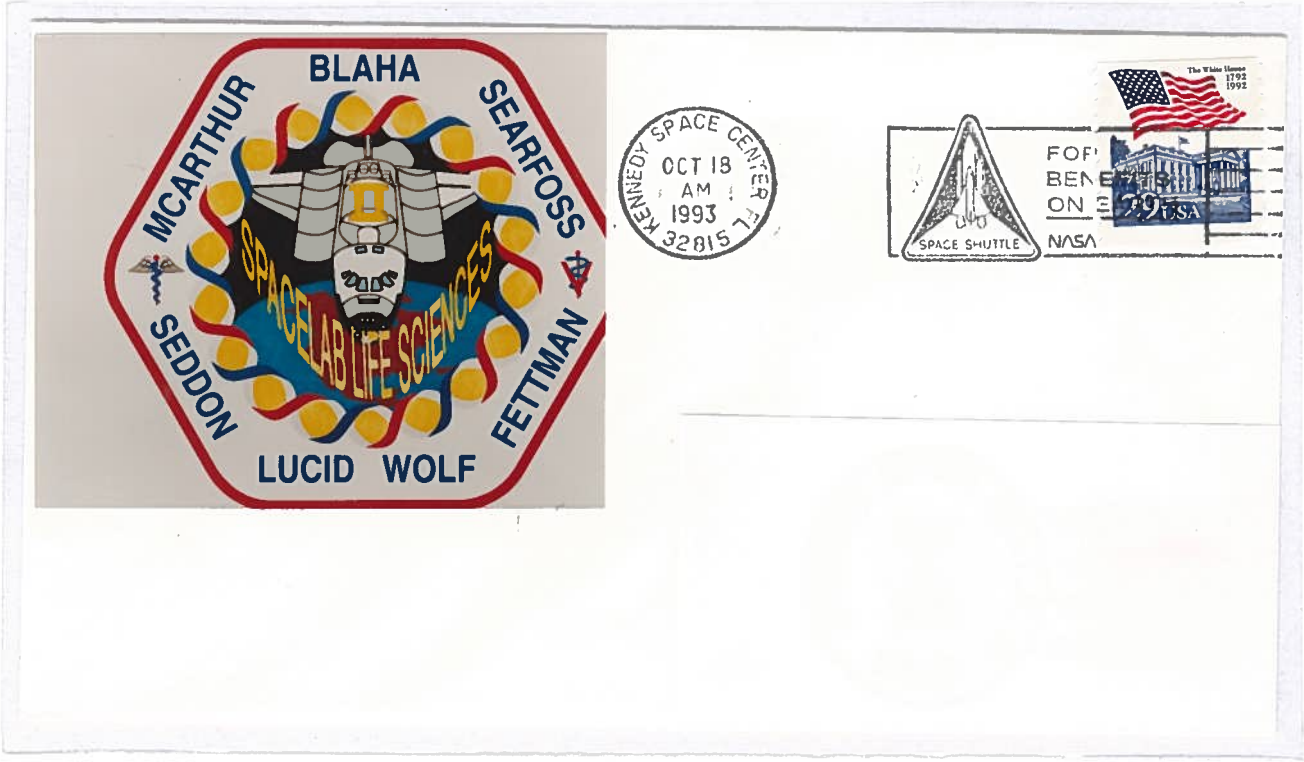
Mission STS-52 Columbia. OCTOBER 22, 1992. Cape Canaveral machine cancel on the date and time of launch. First flight of the USMP-1 (U.S. Microgravity Payload-1), a complement of three experiments mounted on two connected SPACELAB Multipurpose Experiment Support Structures (MPESSs) in the cargo bay of Columbia.

STS-56 DISCOVERY OV-103
ATLAS-2 MISSION

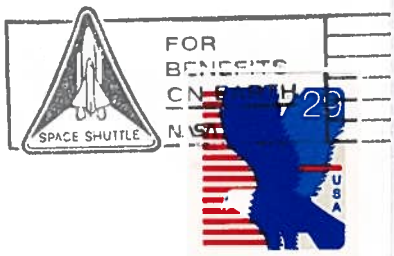
OFFICIAL COMMEMORATIVE

Mission STS-56 Discovery. APRIL 8, 1993. KSC machine cancel on the date and time of launch. The primary payload of the flight was was the ATLAS-2, one element of NASA's Mission to Planet Earth Program. Included six instruments mounted on SPACELAB pallet (IGLOO-P), with seventh mounted on wall of bay into two get away special canisters. All seven ATLAS-2 instruments first flew on ATLAS-1 during STS-45, and will fly a third time in late 1994.

Mission STS-55 Columbia. APRIL 26, 1993. Commemorative cover postmarked with machine cancel in KSC on the date and time of launch. The second dedicated German SPACELAB flight, Spacelab D-2, featuring a Spacelab Laboratory Module (LM1). Some 88 experiments were conducted, covering materials and life sciences, technology applications, Earth observations, astronomy and atmospheric physics.



Mission STS-58 Columbia. OCTOBER 18, 1993. Commemorative cover postmarked with machine cancel in KSC on the date and time of launch. Second dedicated Spacelab Life Sciences Mission (SLS-2) using a SPACELAB Module (LM2). Eight of the experiments focused on crew; six on 48 rodents. Combined data from SLS-1 and SLS-2 will help build comprehensive picture of how humans and animal's adapt to weightlessness.



Mission STS-62 Columbia. MARCH 4, 1994. KSC machine cancel on the date and time of launch. Primary payload were USMP-2 (U.S. Microgravity Laboratory-2) and OAST-2 (Office of Aeronautics and Space Technology-2), mounted on two connected SPACELAB MPESSs (LM1). USMP-2 included five experiments investigating materials processing and crystal growt, while OAST-2 featured six experiments focusing on space technology and spaceflight.

Launch of the Columbia STS-65
63rd Space Shuttle Mission

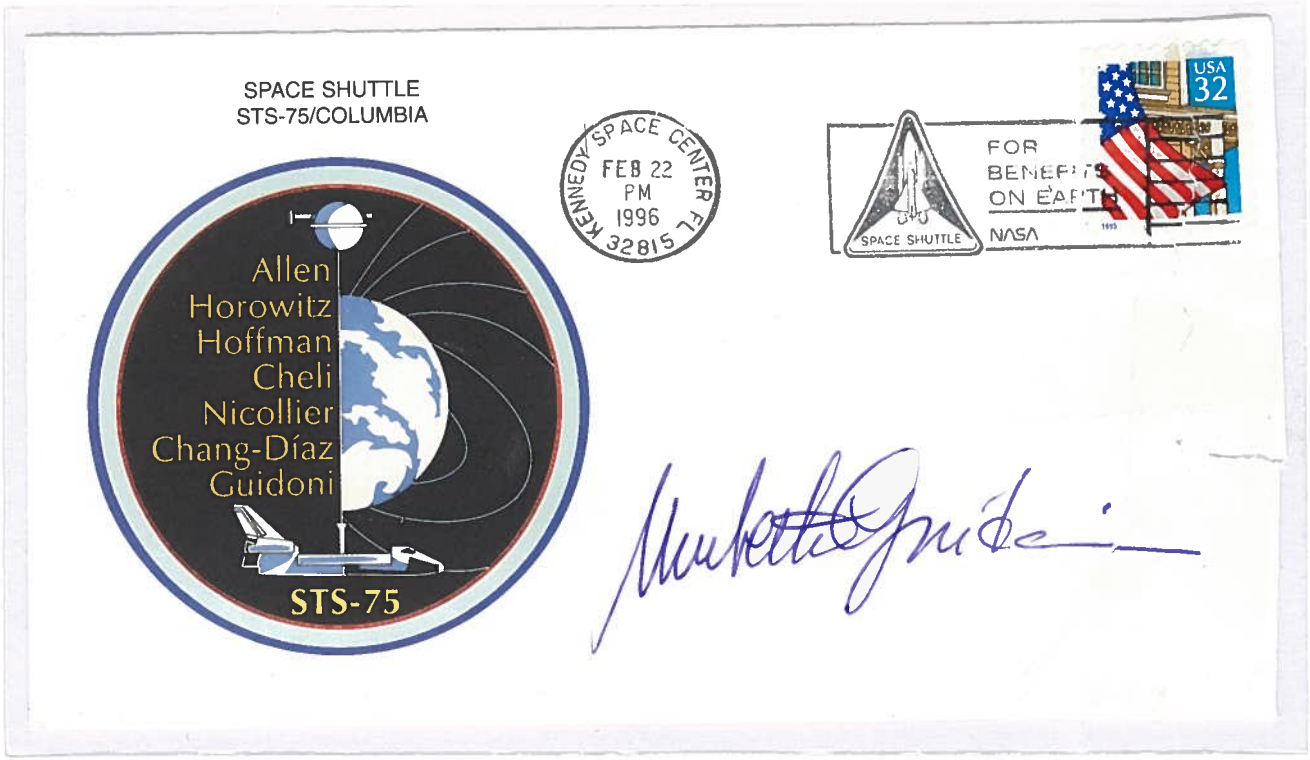
Colorano "Silk" Cachet

July 8, 1994 — Columbia was launched from Pad 39A at 12:43 a.m. today. On board is the International Microgravity Laboratory 2 (IML-2) and a crew of seven astronauts - Robert Cabana, mission commander; James D. Halsell, pilot; Donald A. Thomas, Leroy Chiao, Richard J. Hieb and Carl E. Walz, mission specialists. The seventh crew member is Japan's first female astronaut, Dr. Chiaki Mukai, payload specialist.

Mission STS-65 Columbia. JULY 8, 1994. KSC manual cancel on the date and time of launch. STS-65 marked second flight of International Microgravity Laboratory (IML-2). More than 80 experiments, representing more than 200 scientists from six Space Agencies, were located in SPACELAB Module (LM1). ESA's BIORACK housed 19 experiments making its third flight.

Mission STS-66 Atlantis. NOVEMBER 3, 1994. KSC machine cancel on the date and time of launch. Third flight of the Atmospheric Laboratory for Applications and Science (ATLAS-3), on a SPACELAB pallet (IGLOO-P), which collected more data on trace gases in the atmosphere than on all three of its previous flights combined.

Mission STS-73 Columbia. OCTOBER 20, 1995. KSC machine cancel on the date and time of launch. Second flight of the U.S. Microgravity Laboratory (USML-2) in the SPACELAB Module . Crew divided into two teams to work around the clock in 23 foot (7 meter) long SPACELAB Module (LM1). Research during USML-2 concentrated within same overall areas of USML-1, with many experiments flying for second time.



Mission STS-75 Columbia. FEBRUARY 22, 1996. KSC machine cancel on the date and time of launch. Third flight of the U.S. Microgravity Payload (USMP-3) on the SPACELAB Pallet. USMP-3 included U.S. and international experiments, all of which had flown at least once before, conducted primarily through telescience.

Mission STS-78 Columbia. JUNE 20, 1996. KSC manual cancel on the date and time of launch. The Life and Microgravity SPACELAB (LMS) flight on the longest Shuttle flight to date. Five Space Agencies (NASA, ESA, French Space Agency, Canadian Space Agency and ASI) and scientists from 10 countries worked on primary payload of STS-78, on the SPACELAB module (LM2). More than 40 experiments flown were grouped in two areas: life sciences and medical research.

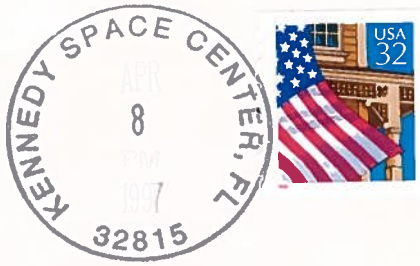
Colorano "Silk" Cachet

COMET HALE-BOPP
STS-83 - 83rd Shuttle Mission
April 6, 1997. A 35mm camera was used to record this time- exposed image of Comet Hale-Bopp. The curved surface of the Earth can be seen below. (NASA photo)

Mission STS-83 Columbia. APRIL 6, 1997. Commemorative cover manually cancelled in Houston during the mission. First flight of the Microgravity Science Laboratory-1 (MSL-1), located in the SPACELAB module (LM1). The planned 16 day mission was cut short after a fuel cell malfunction. Crew was able to conduct some science experiments in the MSL-1 despite the early return, performed in the German Electromagnetic Levitation Furnace Facility (TEMPUS).

Return of the Columbia STS-83
83rd Space Shuttle Mission

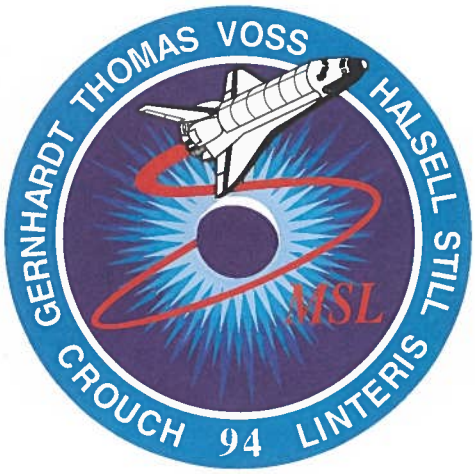
Colorano "Silk" Cachet

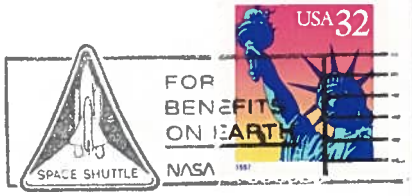


April 8, 1997 - Space shuttle Columbia touched down at Florida's Kennedy Space Center at 2:33 pm (EDT) ending a mission that lasted just under four days. A deteriorating and potentially explosive fuel cell caused the planned sixteen-day mission to be cut short. Shown (L to R) in this in-flight crew photo are Janice Voss, James Halsell, Jr. (mission commander) and Donald Thomas in front. At back are Roger Crouch, Michael Gernhardt, Susan Still (pilot), and Gregory Linteris. (NASA photo)

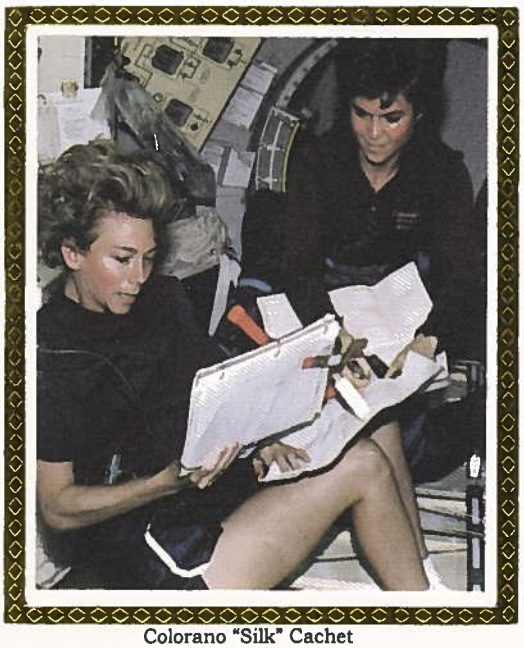
Mission STS-83 Columbia. APRIL 8, 1997. Commemorative cover manually cancelled in KSC on the date and time of landing.

SPACE SHUTTLE
STS-94/COLUMBIA





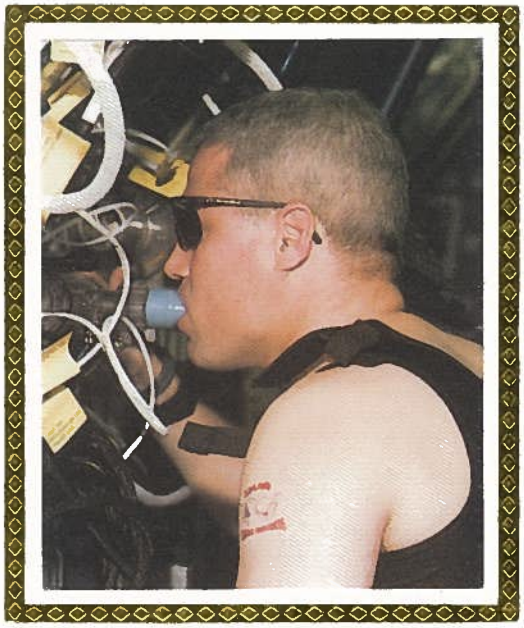
Mission STS-94 Columbia. JULY 1, 1997. Commemorative cover postmarked with machine cancel in KSC on the date and time of launch.



Colorano "Silk" Cachet

MICROGRAVITY SCIENCE LABORATORY (MSL-1)
STS-94 - 85th Shuttle Mission
July 3, 1997. Shuttle pilot, Susan L. Still (L) and payload commander, Janice E. Voss review an inflight maintenance procedure during one of the daily planning sessions inside the Spacelab Science Module in support of the Microgravity Science Laboratory (MSL-1) mission. (NASA photo)

Mission STS-94 Columbia. JULY 3, 1997. Commemorative cover postmarked with manual cancel in Houston during the mission. STS-94 marked the first reflight of same vehicle, crew and payloads. The crew maintained 24-hour/two-shift operations using the SPACELAB module (LM1) as a test-bed, MSL-1tested some of the hardware , facilities and procedures that will be used on the ISS.



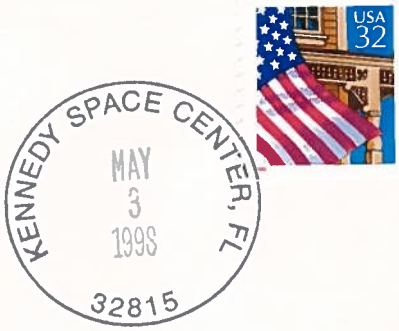
Colorano "Silk" Cachet

NEUROLAB SLEEP/RESPIRATORY EXPERIMENT
STS-90 - 90th Shuttle Mission
April 27, 1998. Astronaut Jay Buckey, Jr. participates in an experiment with a sophisticated lung function test related to the sleep/respiratory study in the Neurolab of the Space Shuttle Columbia. Sleep difficulty among the astronauts while in space has prompted these studies. (NASA photo)

Mission STS-90 Columbia. APRIL 27, 1998. Commemorative cover manually cancelled in Houston during the mission. This was the 16 th and last scheduled flight of the ESA-developed SPACELAB module (LM2) although the Spacelab pallets will continue to be used on the ISS. NEUROLAB's 26 experiments targeted the nervous system.

Return of the Columbia STS-90
90th Space Shuttle Mission

Colorano "Silk" Cachet

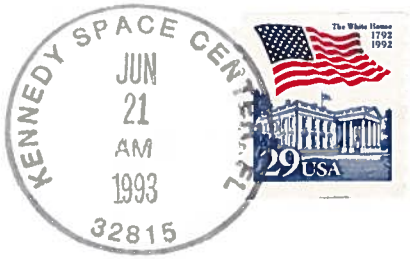


May 3, 1998. Shown in this inflight photo of the bespectacled STS-90 crew are in front (L to R) Scott D. Altman, Richard A Searfoss, and Kathryn P. Hire. In the back (L to R) are Jay C. Buckey, Jr., James A. Pawelczyk, Richard M. Linnehan and Dafydd R. Williams (Canadian Space Agency). (NASA photo)

Mission STS-90 Columbia. MAY 3, 1998. Commemorative cover manually cancelled in KSC on the date of landing.

Chapter 2. SCIENTIFIC RESEARCH (The Spacehab)

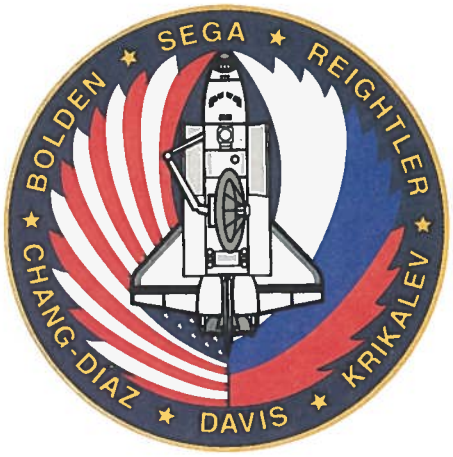
SPACE SHUTTLE
STS-57/ENDEAVOUR

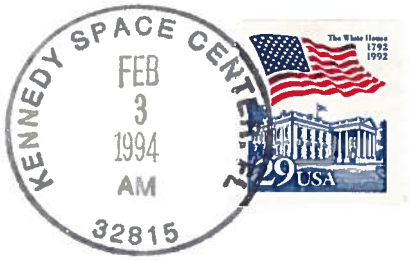


Mission STS-57 Endeavour. JUNE 21, 1993. Commemorative cover manually cancelled in KSC on the date and time of launch. STS-57 marked the first flight of the commercially-developed SPACEHAB (Spacehab-1), a pressurized laboratory (conf. RSM) designed to more than double pressurized workspace for crew-tended experiments. Altogether 22 experiments were flown, covering material and life sciences, and wastewater recycling experiment for space station.

Mission STS-57 Endeavour. JUNE 24, 1993. Commemorative cover mechanically cancelled in Nassau Bay during the mission.

SPACE SHUTTLE
STS-60/DISCOVERY





Mission STS-60 Discovery. FEBRUARY 3, 1994. Commemorative cover manually cancelled in KSC on the date and time of launch. First flight of Russian cosmonaut on U.S. Space Shuttle. Mission marked second flight of SPACEHAB pressurized module Spacehab-2 (conf. RSM) activated shortly after reaching orbit. Tacking up about one quarter of payload bay, the 1,100 cubic foot (31 cu. m.) module carried 12 experiments, 4 involved materials scienze topics, 7 life sciences investigations, and a space dust collection experiments.

This 35mm frame shows the major payloads of the Space Shuttle Discovery's STS-60 mission, backdropped against clouds over the Atlantic Ocean. In the foreground is the SPACEHAB module, with the Wake Shield Facility (WSF) partially visible in its berthed position near the Orbital Maneuvering System (OMS) pods and the vertical stabilizer. Television cameras on the Remote Manipulator System (RMS) were being used for a survey of the cargo.

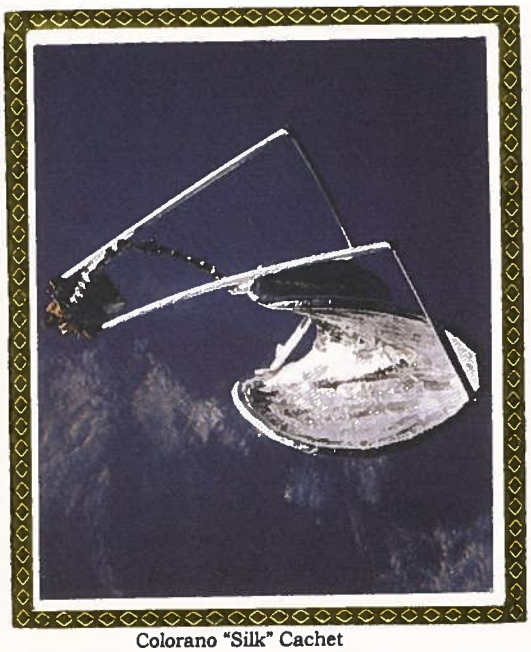
Mission STS-60 Discovery. FEBRUARY 4, 1994. Commemorative cover mechanically cancelled in KSC during the mission.

Launch of the Endeavour STS-77
77th Space Shuttle Mission

Colorano "Silk" Cachet

May 19, 1996 - At precisely 6:30:00 a.m. (EST) the space shuttle Endeavour left Kennedy Space Center's Pad 39B to begin a ten-day mission. Shown in the front row of this pre-flight crew photo are (L to R) pilot Curtis Brown, Jr. and mission commander John Casper and in the rear, astronauts Daniel Bursch, Mario Runco, Jr., Marc Garneau and Andrew Thomas, all mission specialists. (NASA photo)

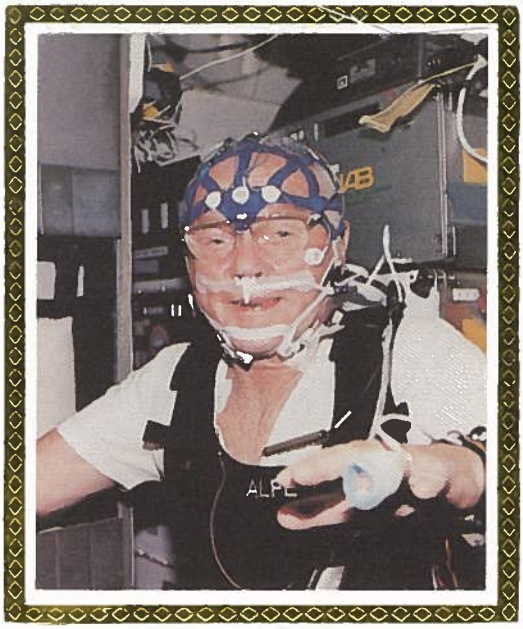
Mission STS-77 Endeavour. MAY 19, 1996. Commemorative cover postmarked with manual cancel in KSC on the date of launch.



Colorano "Silk" Cachet

INFLATABLE ANTENNA EXPERIMENT
STS-77 - 77th Shuttle Mission
May 20, 1996 - Following its deployment from the space Shuttle Endeavour, the Inflatable Antenna Experiment (IAE), part of the Spartan-207 payload, nears completion of its inflation process. The IAE experiment will lay the groundwork for future technology development in inflatable space structures which will be launched and then inflated like a balloon.(NASA photo)

Mission STS-77 Endeavour. MAY 20, 1996. Commemorative cover postmarked with manual cancel in Houston during the mission. Primary payloads, all located in the cargo bay, were the SPACEHAB-4 (conf. LSM) and the Inflatable Antenna Experiment (IAE) mounted on SPARTAN-207 free flyer. Spacehab-4 carried nearly 3,000 pounds (1.361 kg) of support equipments and experiments. Potential benefits of Inflatable Antennas include their lower costs, greater reliability, and lower mass and volume.

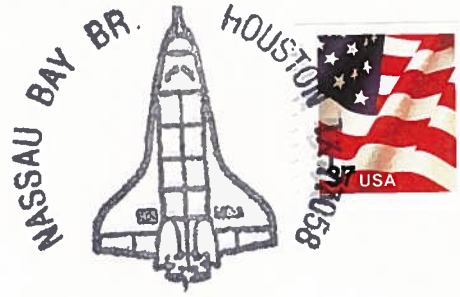


Colorano "Silk" Cachet

SENATOR "GUINEA PIG"
STS-95 - 92nd Shuttle Mission
November 4, 1998. At age 77, U.S. Senator John H. Glenn, Jr., became the oldest human to fly in space. Glenn willingly participated in a variety of experiments including heart and bone cell activity studies. He is shown here near his sleep station, attached to complex sleep monitoring equipment. (NASA photo)

Mission STS-95 Discovery. NOVEMBER 4, 1998. Commemorative cover manually cancelled in Houston during the mission. The scientific research mission returned space pioneer John Glenn to orbit, 36 years, 8 months and 9 days after he became the first American to orbit the Earth. The primary objective included conducting a variety of science and medical experiments in the pressurized SPACEHAB module (conf. RSM).

Colorano "Silk" Cachet



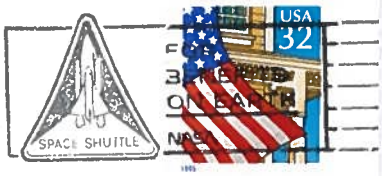
SPACE SHUTTLE COLUMBIA STS-107
January 16, 2003. The STS-107 crew patch is dominated by the yellow microgravity symbol (µg) flowing into the rays of the astronaut symbol. The sunrise is representative of the numerous experiments that are the dawn of a new era for continued microgravity research. The seven stars of the constellation Columba (the dove) was chosen to symbolize peace, the Shuttle Columbia, the mission crew members, and the original seven astronauts who paved the way to make research in space possible. (NASA photo)

Mission STS-107 Columbia. JANUARY 16, 2003. Commemorative cover postmarked with machine cancel in Nassau Bay on the date and time of launch. After a 16-day mission, Columbia and his crew were lost during reentry over East Texas. As a research mission, experiments in the SPACEHAB RDM (Double Research Module) included 9 commercial payloads, 4 payloads for the ESA, 1 payload for ISS Risk Mitigation and 18 payloads for NASA.

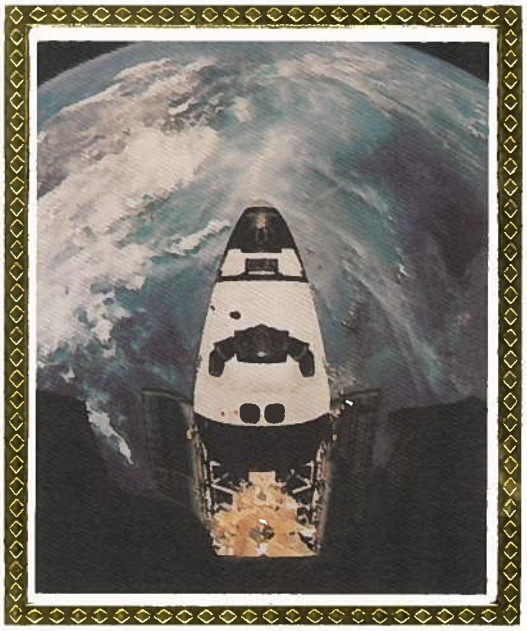
Chapter 3. SPACE SHUTTLE / MIR

Mission STS-63 Discovery. FEBRUARY 6, 1995. Nassau Bay machine cancel during the mission. This flight included several history-making achievements : first flight of a female pilot and first approach and flyaround by Shuttle with Russian space station MIR. Flying in forward payload bay was SPACEHAB-3 (conf. RSM), the commercially-develope module which carried 20 technology experiments.

SPACE SHUTTLE
STS-71/ATLANTIS



Mission STS-71 Atlantis. JUNE 27, 1995. KSC machine cancel on the date and time of launch.



Colorano "Silk" Cachet

ATLANTIS AS SEEN FROM MIR
STS-71 - 69th Shuttle Mission
June 30, 1995. Docked with Russia's Mir Space Station and backdropped against a half globe of earth, the Space Shuttle Atlantis is partially visible through a window of Mir's Kvant 2 module, The crew cabin and forward cargo bay of Atlantis are most prominent. (NASA photo).

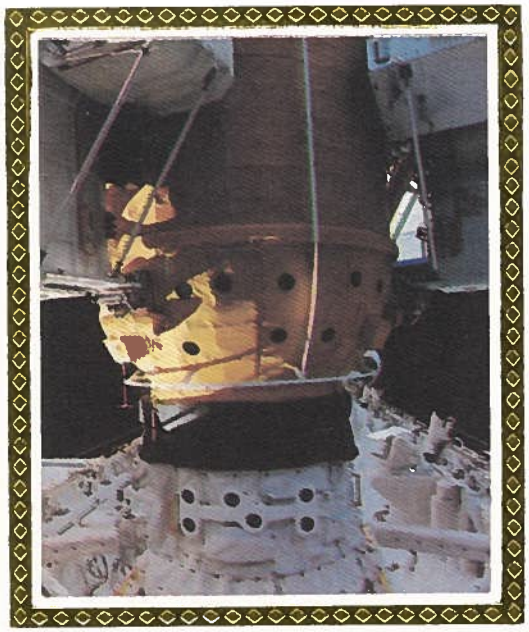
Mission STS-71 Atlantis. JUNE 30, 1995. Commemorative cover manually cancelled in Houston during the mission. First docking with MIR and first on-orbit changeout of Shuttle crew. When linked, June 29, Atlantis and MIR formed largest spacecraft ever in orbit with a total mass of about 225 tons.). For next five days operations conducted including biomedical investigations and transfer of equipment to and from MIR.

Colorano "Silk" Cachet

NOV 12 1995

SPACE SHUTTLE ATLANTIS STS-74
At precisely 7:30:43:071 am (EST), the Space Shuttle Atlantis left Kennedy Space Center's Launch Pad 39A to begin an eight day mission that would include a docking with Russia's Mir Space Station in Earth orbit. The crew of five on board Atlantis included a representative from the Canadian Space Agency. On board Mir were two Russian cosmonauts and a member of the European Space Agency. (NASA photo)

Mission STS-74 Atlantis. NOVEMBER 12, 1995. Commemorative cover mechanically cancelled in Houston on the date of launch. Second docking to MIR, continuing phase I activities leading to construction of ISS. Primary payload was Russian-built module (DM), designed to become permanent extension on MIR to afford better clearances for Shuttle-MIR linkups.



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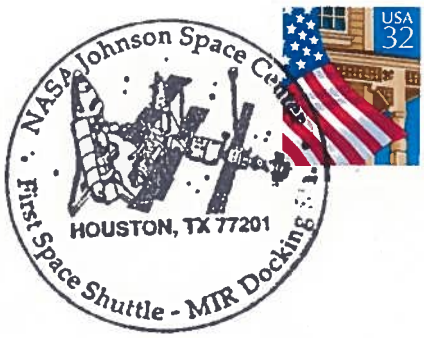


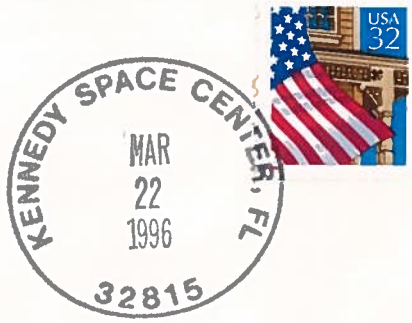
NOV 14 1995

DOCKING MODULE DEPLOYMENT
STS-74 - 73rd Shuttle Mission
This view from Atlantis' aft window captures the deployment of the Docking Module (DM) prior to delivery to Russia's Mir Space Station in Earth orbit. The Docking Module will be left behind when Atlantis and Mir separate, making the next five Atlantis-Mir dockings easier. (NASA photo)

Mission STS-74 Atlantis. NOVEMBER 14, 1995. Commemorative cover mechanically cancelled in Houston during the mission.

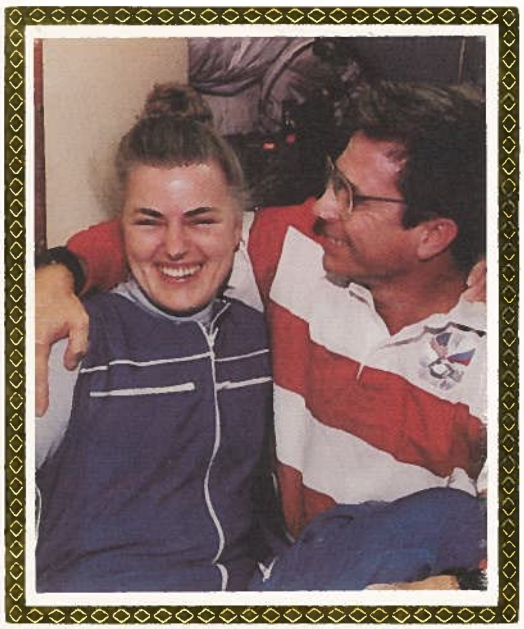
Launch of the Atlantis STS-76
76th Space Shuttle Mission

Colorano "Silk" Cachet



March 22, 1996 - At precisely 3:13:04 a.m. (EST), space shuttle Atlantis left Pad 39B at Kennedy Space Center to begin a mission that would include the 3rd docking with the Russian Mir space station. Shown in the front row ofthis pre-flight crew photo are (L to R) Ronald Sega, mission commander Kevin Chilton, and pilot Richard Searfoss. Back row (L to R) are Michael (Rich) Clifford, Shannon Lucid and Linda Godwin. (NASA photo)

Mission STS-76 Atlantis. MARCH 22, 1996. Commemorative cover manually cancelled in Houston during the mission. STS-76 marked first flight of SPACEHAB pressurized module (conf. RSM) to support Shuttle-MIR dockings. Single module primarily served as stowage area for farge supply of equipment slated for transfer to space station, but also carried ESA's BIORACK experiment rack for on-orbit research.



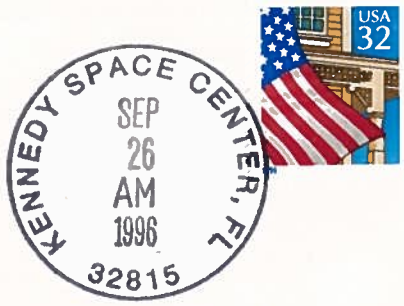
Colorano "Silk" Cachet

FIRST ASTRONAUT EXCHANGE
STS-79 - 79th Shuttle Mission
September 19, 1996. Astronauts Shannon Lucid and John E. Blaha reunite soon after the docking of Atlantis And Mir. Later, Lucid would exchange her blue Mir suit for an outfit like the one Blaha is wearing and Blaha would change from his red and white striped STS-79 attire to the blue Mir uniform. (NASA photo)

Mission STS-79 Atlantis. SEPTEMBER 19, 1996. Commemorative cover postmarked with manual cancel In Houston during the mission. Fourth Shuttle-MIR docking, first U.S. crew exchange aboard MIR, return to Earth of U.S. astronaut Lucid after 188 days in space. STS-79 marked second flight of SPACEHAB module and first flight of SPACEHAB double module (conf. LDM). Total logistic transfer to and from MIR of more than 6,000 pounds (2,722 kg) was most extensive to date.

Return of the Atlantis STS-79
79th Space Shuttle Mission

Colorano "Silk" Cachet

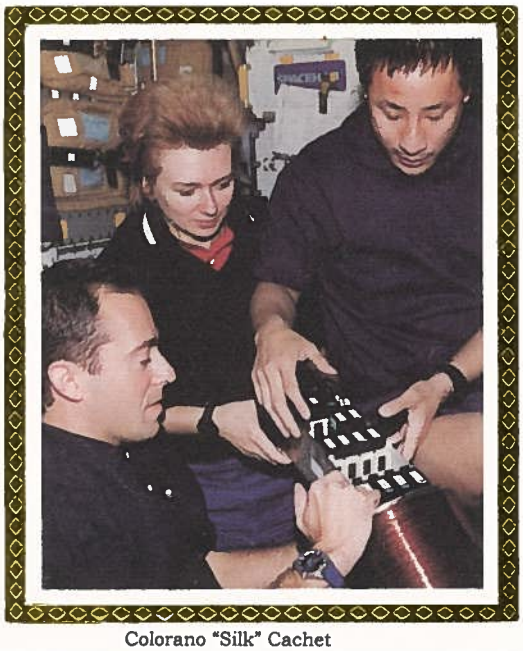


Sept. 26, 1996. The 10-day STS-79 mission came to a successful end when Atlantis touched down at KSC Runway 15. This inflight photo was taken after a successful docking with Russia's Mir Space Station. In front (L to R) are Aleksandr Kaleri, Jay Apt, John Blaha, William Readdy, and Shannon Lucid. At back (L to R) are Thomas Akers, Carl Walz, Valeri Korzun, and Terrence Wilcut. Blaha will remain on Mir, replacing Lucid who had spent six months aboard the Russian Space Station. (NASA photo)

Mission STS-79 Atlantis. SEPTEMBER 26, 1996. Commemorative cover postmarked with manual cancel in KSC on the date and time of landing.

Cdr. Jerry M. Linenger
Group 14 Astronaut

Mission STS-81 Atlantis. JANUARY 12, 1997. Commemorative cover postmarked with manual cancel in KSC on the date of launch. This fifth of nine planned dockings continued Phase 1B of the NASA/ Russian Space Agency cooperative effort. Same payload configuration flown on previous docking flight, featuring SPACEHAB double module (conf. LDM) flown again. Crew also tested on the Shuttle the Treadmill Vibration Isolation and Stabilization System (TVIS), designed for use in the Russian service module of ISS.



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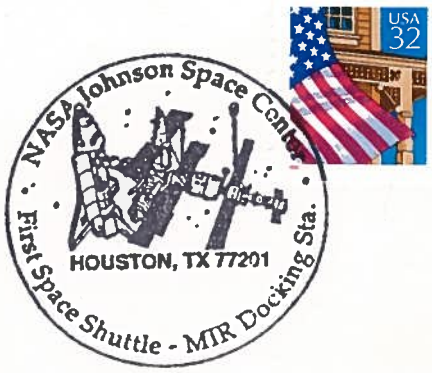
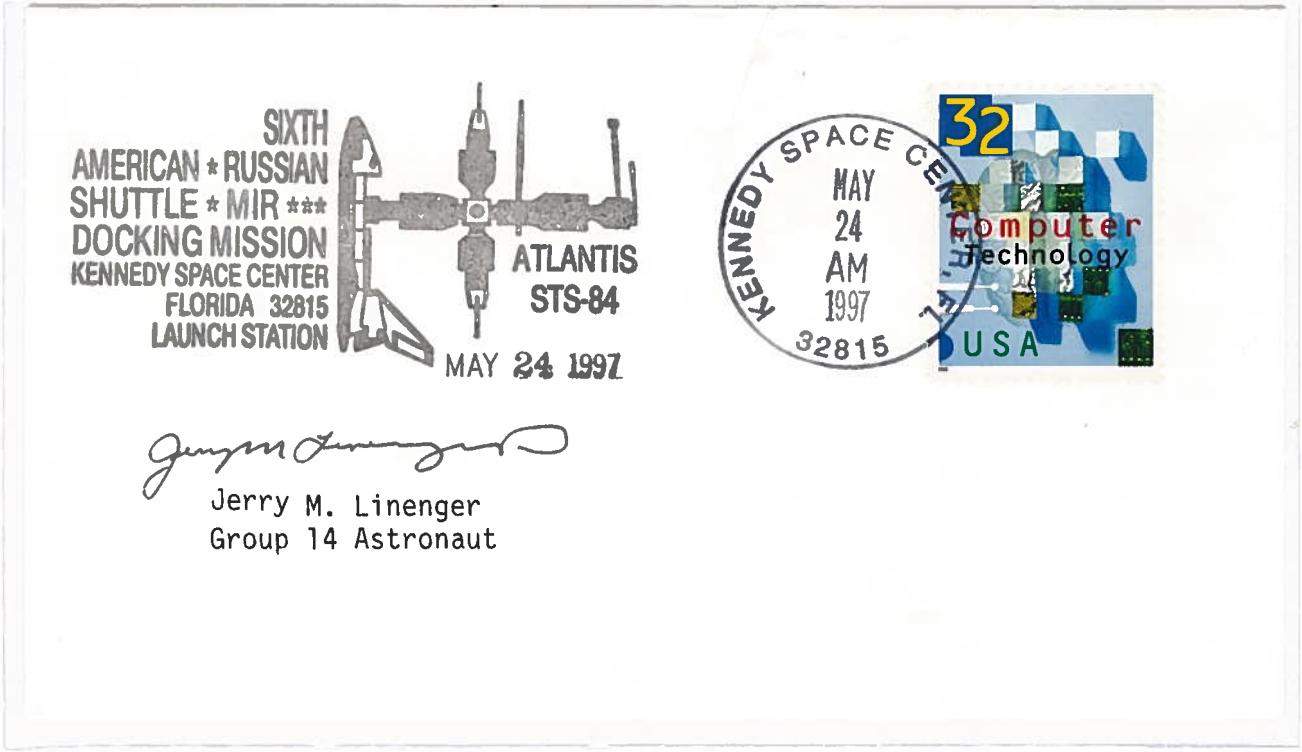


MAY 20 1997

AN INTERNATIONAL TEAM
STS-84 - 84th Shuttle Mission
May 20, 1997. Biorack operations on Spacehab, aboard the space shuttle Atlantis, draw the collective attentions of (L to R) Jean-Francois Clervoy, payload commander from the European Space Agency; cosmonaut Elena V. Kondakova of the Russian Space Agency, and astronaut Edward T. Lu of NASA, both mission specialists. (NASA photo)

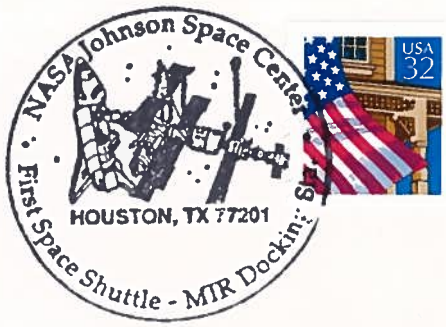
Mission STS-84 Atlantis. MAY 20, 1997. Commemorative cover postmarked with machine cancel in Houston during the mission. STS-84 docking with MIR occurred May 16 above the Adriatic Sea. Research program planned for Foale featured 35 investigations (33 on MIR, 2 on STS-84) in six disciplines. Other activities conducted during the mission included investigations using BIORACK facility in the SPACEHAB double module (conf. LDM).



Mission STS-84 Atlantis. MAY 24, 1997. Commemorative cover postmarked with manual cancel in KSC on the date and time of landing.

Mission STS-86 Atlantis. SEPTEMBER 25, 1997. Commemorative cover postmarked with manual cancel in KSC on the date of launch. The seventh MIR docking mission continued the presence of a U.S. astronaut on the Russian space station with the transfer of physician David A. Wolf to MIR. First joint U.S.-Russian EVA during a Shuttle mission was conducted by Titov and Parazynski. Crews transferred more than 4 tons. of supplies and experiments from the SPACEHAB (conf. LDM) to MIR.

Colorano "Silk" Cachet

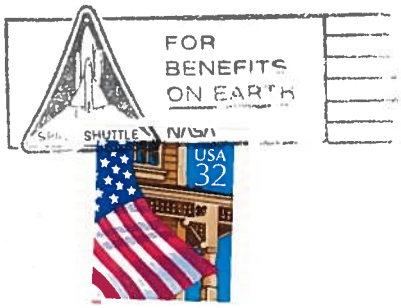


OCT 2 1997

FRENCH ASTRONAUT
STS-86 - 87th Shuttle Mission
October 2, 1997. Jean-Loup J.M. Chrétien, mission specialist representing the French Space Agency (CNES), floats into the Core Module of Russia's Mir space station prior to a gift exchange ceremony with the Mir-24 crew. (NASA photo)

Mission STS-86 Atlantis. OCTOBER 2, 1997. Commemorative cover postmarked with machine cancel in Houston during the mission.

SPACE SHUTTLE
STS-89/ENDEAVOUR



Mission STS-89 Endeavour. JANUARY 22, 1998. Commemorative cover postmarked with machine cancel in KSC on the date and time of launch. Docking of Endeavour to MIR occurred Jan. 24 at an altitude of 214 nautical miles. Endeavour returned to space after completing its first Orbiter Maintenance Down Period. More than 8,000 pounds (3,629 kg) of scientific equipment, logistical hardware and water were taken from Endeavour to MIR.

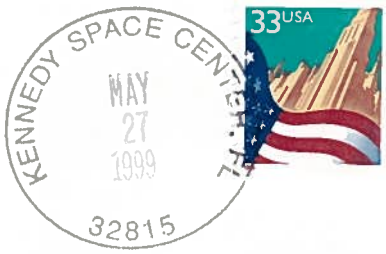
Mission STS-91 Discovery. JUNE 2, 1998. Commemorative cover postmarked with machine cancel in KSC on the date and time of launch.

Mission STS-91 Discovery. JUNE 4, 1998. Commemorative cover postmarked with machine cancel in Houston during the mission. Ninth and final Shuttle-MIR docking. During four days, crew transferred 5,800 pounds of water, cargo experiments and supplies between the two spacecrafts. During this time, the SPACEHAB single module (conf. LSM) was moved in the orbiter's payload bay.

Chapter 4. SPACE SHUTTLE / ISS (Spacehab)

Launch of the Discovery STS-96
94th Space Shuttle Mission

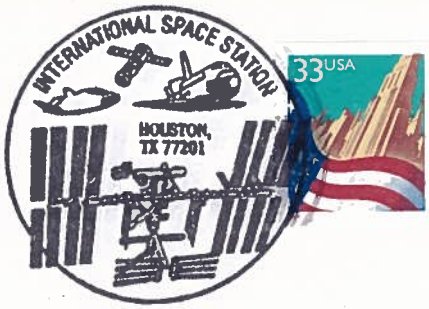
Colorano "Silk" Cachet



May 27, 1999. Space Shuttle Discovery left Florida's Kennedy Space Center early this morning en route to a history-making first docking with the International Space Station. On board were six astronauts and a Russian cosmonaut, shown in this official crew photo. Seated (L to R) Kent Rominger (mission commander), Ellen Ochoa, Rick Husband (pilot), and standing (L to R) Daniel Barry, Julie Payette (Canadian Space Agency), Valery Tokarev (Russia), and Tamara Jernigan. (NASA Photo)

Mission STS-96 Discovery. MAY 27, 1999. Commemorative cover postmarked with manual cancel in KSC on the date of launch. First flight to dock with the ISS. The Discovery carried to the station an Integrated Cargo Carrier (ICC), with parts for the Russian cargo crane Strela and the SPACEHAB Double Module Shoss (Oceaneering Space System Box).

Colorano "Silk" Cachet

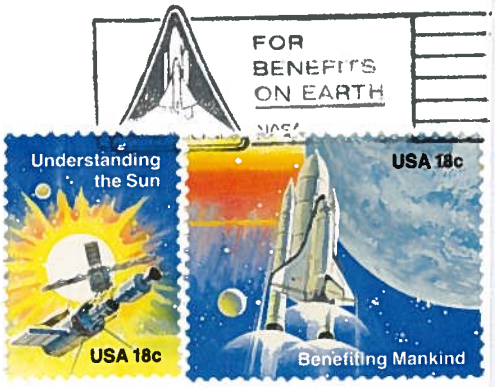


MAY 30 1999

ENTRY INTO THE INTERNATIONAL SPACE STATION
STS-96 - 94th Shuttle Mission
May 30, 1999. Onboard the Russian-built Zarya module, astronauts Julie Payette (top) and Ellen Ochoa handle a portion of the almost two tons of supplies that have been moved over from the docked Space Shuttle Discovery. (NASA photo)

Mission STS-96 Discovery. MAY 30, 1999. Houston machine cancel affixed during the mission.

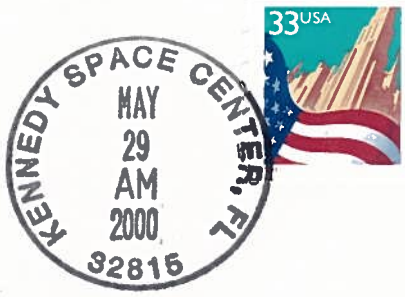
SPACE SHUTTLE
STS-101/ATLANTIS



Mission STS-101 Atlantis. MAY 19, 2000. KSC machine cancel on the date and time of launch. STS-101 delivered supplies to ISS, hauled up using a SPACEHAB module (conf. LDM) and an Integrated Cargo Carrier Pallet. On their 10-day mission, the astronauts completed one EVA, the 49th conducted from a Shuttle. During the mission, commander Halsell and pilot Horowitz fired Atlantis' jets three times to bost the ISS about 27 miles into a slightly orbit of 225 miles.

Return of the Atlantis STS-101
98th Space Shuttle Mission

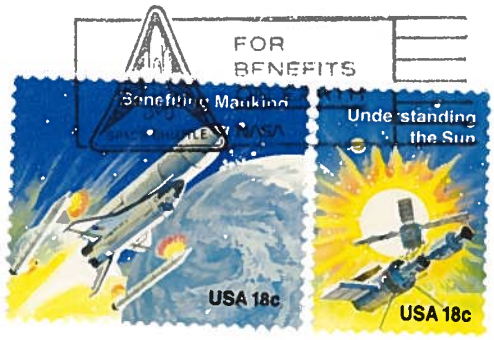
Colorano "Silk" Cachet



May 29, 2000. After spending ten days in space, the crew of STS-101 returned to Earth at Florida's Kennedy Space Center, having completed a successful mission working to ready the International Space Station (ISS). Shown here aboard the ISS in the Unity module (L to R) in front are Susan Helms, Yury Usachev, and James Voss; in back, Mary Ellen Weber, James Halsell, Jeffrey Williams, and Scott Horowitz. (NASA Photo)

Mission STS-101 Atlantis. MAY 29, 2000. KSC manual cancel on the date and time of landing.

SPACE SHUTTLE
STS-106/ATLANTIS



Mission STS-106 Atlantis. SEPTEMBER 8, 2000. Commemorative cover postmarked with machine cancel in KSC on the date and time of launch. Space Station Assembly Flight ISS-2A.2b utilized the SPACEHAB double module (conf. LDM) and the ICC to bring supplies to the station. STS-106, during its 11-days mission to the ISS, completed all assigned mission objectives to prepare the station for the first crew scheduled to launch in October.

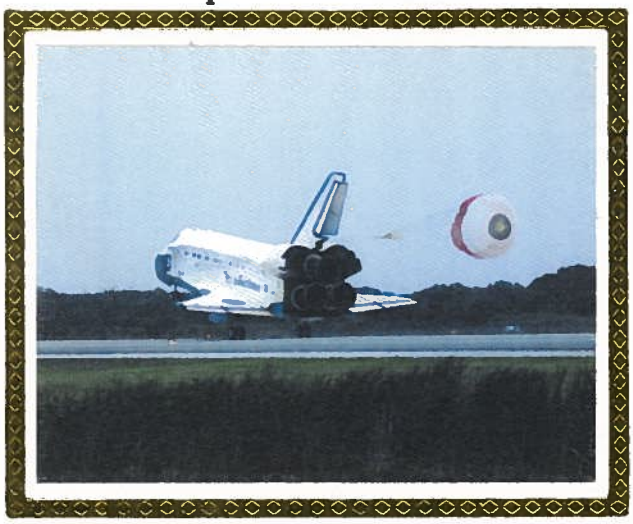
Launch of the Discovery STS-116
117th Space Shuttle Mission

Colorano "Silk" Cachet

DEC 9, 2006. *Discovery's* crew poses in front of the Space Vehicle Mockup Facility at JSC. (L to R) Robert Curbeam; Expedition 14 flight engineer Sunita Williams; shuttle pilot William Oefelein; mission commander Mark Polansky; Joan Higginbotham; Nicholas Patrick; and European Space Agency astronaut Christer Fuglesang. (NASA photo)

Mission STS-116 Discovery. DECEMBER 9, 2006. KSC manual cancel on the date and time of launch. The primary payload was the P-5 truss segment of the ISS. The Shuttle also carried a SPACEHAB logistic module (conf. LSM) to resupply ISS and an ICC. SPACEHAB adds impressive storage room in an astronaut-friendly environment.

Return of the Discovery STS-116
117th Space Shuttle Mission



Colorano "Silk" Cachet

DEC 22, 2006. The space shuttle *Discovery* returned to Earth today, landing at Florida's Kennedy Space Center at 5:32 p.m. The 13-day mission to the International Space Station (ISS) lasted almost 13 days, covered a distance of 5.3 million miles and completed 204 Earth orbits. Astronaut Sunita Williams remained at the ISS as a member of the station crew, while Thomas Reiter returned home after spending almost 6 months in space. (NASA photo)

Mission STS-116 Discovery. DECEMBER 22, 2006. Commemorative cover postmarked with manual cancel in KSC on the date and time of landing.

Launch of the Endeavour STS-118
119th Space Shuttle Mission

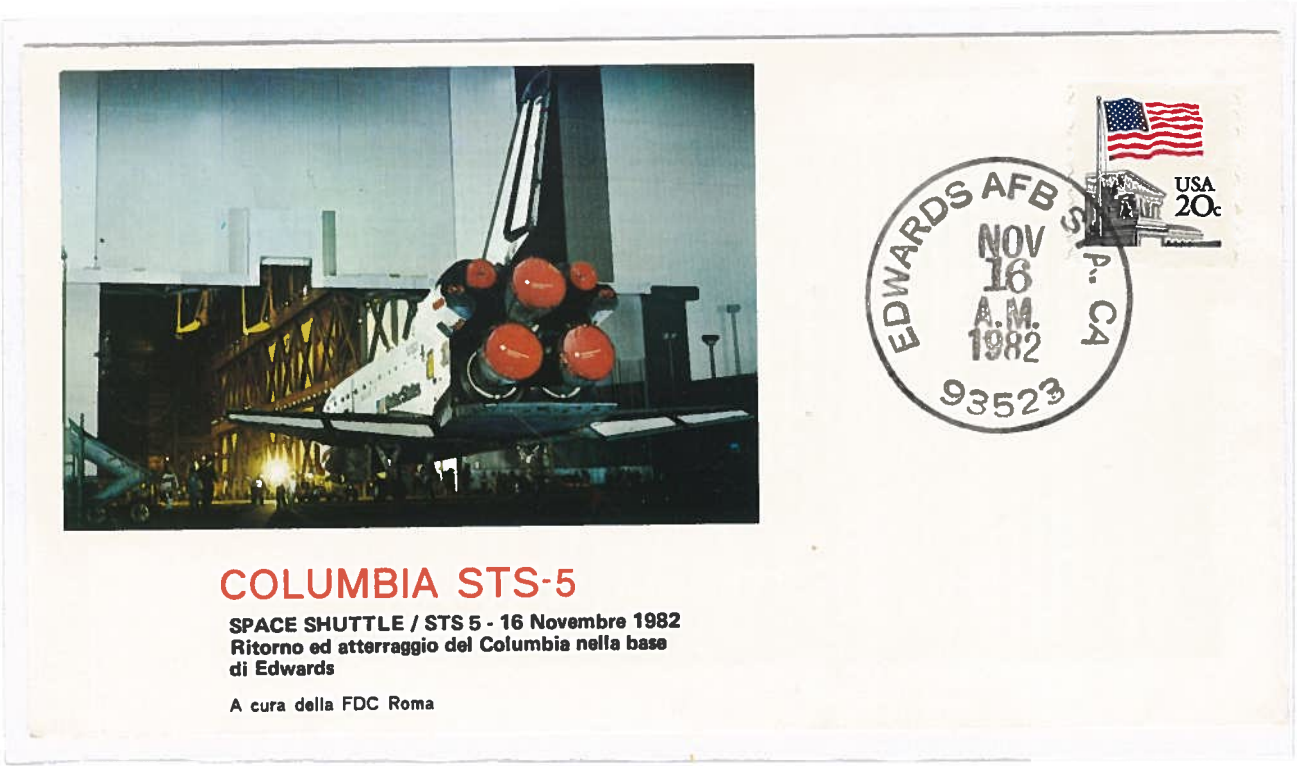
Colorano "Silk" Cachet

AUG 8, 2007. Pictured (L to R) in this official STS-118 crew photo are: Richard (Rick) Mastracchio, Barbara Morgan, Charles Hobaugh (pilot), Scott Kelly (commander), Tracey Caldwell, Dafydd (Dave) Williams of the Canadian Space Agency, and Alvin Drew, Jr. During the mission the crew delivered almost 5000 pounds of equipment and supplies to the International Space Station (ISS) and brought home 5000 pounds of completed experiments, spare parts, and trash. (NASA photo)

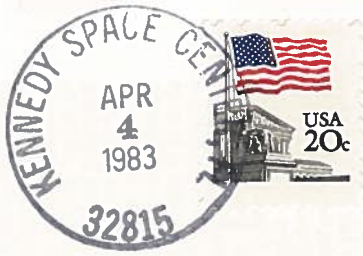
Mission STS-118 Endeavour. AUGUST 8, 2007. Commemorative cover postmarked with manual cancel in KSC on the date and time of launch. The last SPACEHAB mission (conf. LSM) is scheduled to carry more than 5,000 pounds of spare parts and cargo into space, fourteen years after its first pressurized module flew into space on a orbiter.

Chapter 5. SATELLITES

Mission STS-5 Columbia. NOVEMBER 11, 1982. Cape Canaveral machine cancel on the date and time of launch. The first Shuttle operational mission deployed two commercial communications satellites, the Canadian ANIK C-3 and SBS-C (Satellite Business System), equipped with a solid rocket motor (PAM-D) which fired about 45 min. after deployement. The first scheduled EVA of the Shuttle program was canceled due to a malfunction of the space suit.



Mission STS-5 Columbia. NOVEMBER 16, 1982. Edwards manual cancel on the date of landing.

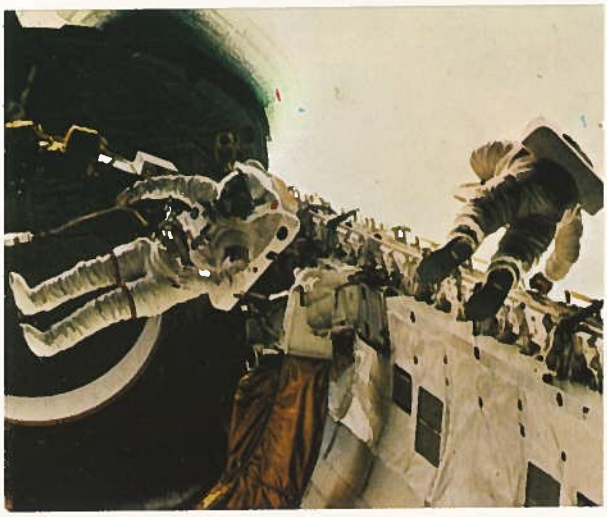


CHALLENGER
STS-6

4.4.1983 (Ore Italiane 20,30)
SPACE SHUTTLE (STS-6)
Lancio Spola Spaziale "CHALLENGER"
da "Cape Canaveral" con Equipaggio:
Astronauti: Comm. Paul Weitz
Pilot. Karol Bobko
Specialisti: Story Musgrave
Donald Peterson.

A cura della FDC Roma

Mission STS-6 Challenger. APRIL 4, 1983. Commemorative cover postmarked with manual cancel in KSC on the date of launch. The primary payload was the first Tracking and Data Relay Satellite (TDRS-1), over next several months gradually placed into its properly circularized orbit. The first spacewalk of the Shuttle performed by astronauts Peterson and Musgrave, lasted about 4 hours and 17 minutes.

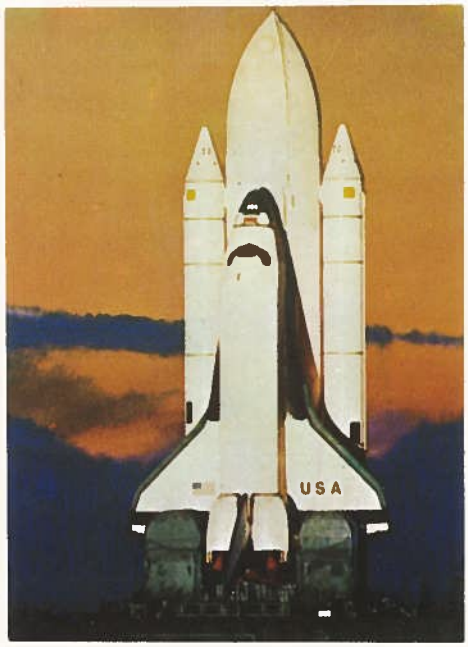


CHALLENGER
STS-6

7.4.1983
SPACE SHUTTLE (STS-6)
Passeggiata Spaziale

A cura della FDC Roma

Mission STS-6 Challenger. APRIL 7, 1983. Commemorative cover postmarked with manual cancel in Houston during the mission.

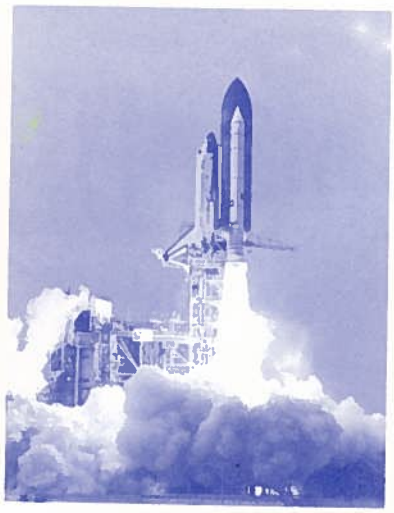


CHALLENGER
STS-6

9.4.1983
SPACE SHUTTLE (STS-6)
Atterraggio Navetta "Challenger"
ad "Edwards AFB" con Astronauti.
(Durata Missione Spaziale: 5 giorni,
23 minuti, 42 secondi)

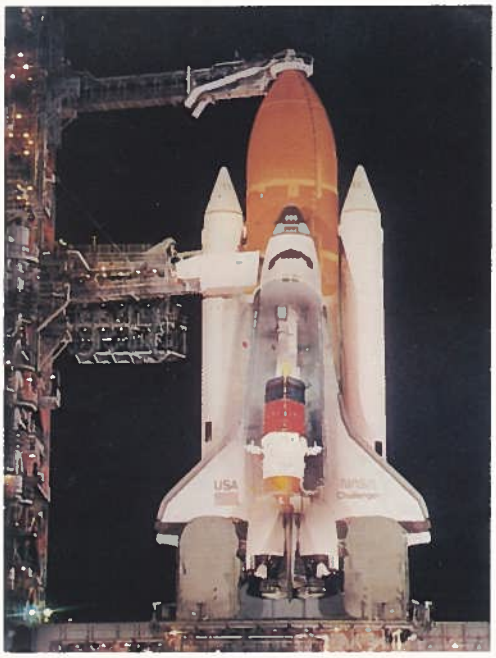
A cura della FDC Roma

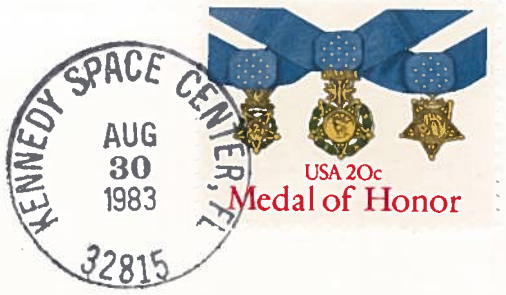
Mission STS-6 Challenger. APRIL 9, 1983. Commemorative cover postmarked with manual cancel in Edwards on the date and time of landing.



STS-7 »Challenger« – Crippen – Hauck – Fabian –
Dr. Sally K. Ride – Dr. Norman Thagard
on 6 day – 5 astronauts' mission June 18–24, 1983

Mission STS-7 Challenger. JUNE 18, 1983. Commemorative cover postmarked with machine cancel in Cape Canaveral on the date and time of launch. Sally Ride became the first American woman to fly in the space. Two communications satellites were deployed, the Canadian ANIK C-2 and the Indonesian PALAPA B-1, both attached to motors (PAM-D).



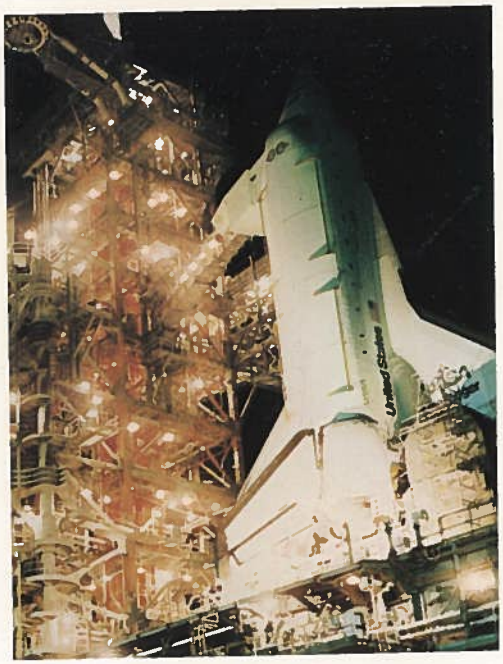


CHALLENGER STS-8

SPACE SHUTTLE / STS 8 - 30 Agosto 1983
Conto alla rovescia per il Challenger.
Astronauti: Truly - Brandenstein - Gardner - Thornton e Bluford, il primo astronauta americano di colore.

A cura della FDC Roma

Mission STS-8 Challenger. AUGUST 30, 1983. Commemorative cover postmarked with manual cancel in KSC on the date and time of launch. Bluford became the first African-American to fly in space. First night launch and landing. INSAT 1-B, a multipurpose Indian satellite, was deployed. Testing was conducted between the TDRS-1 and the orbiter using a Ku-Band antenna.

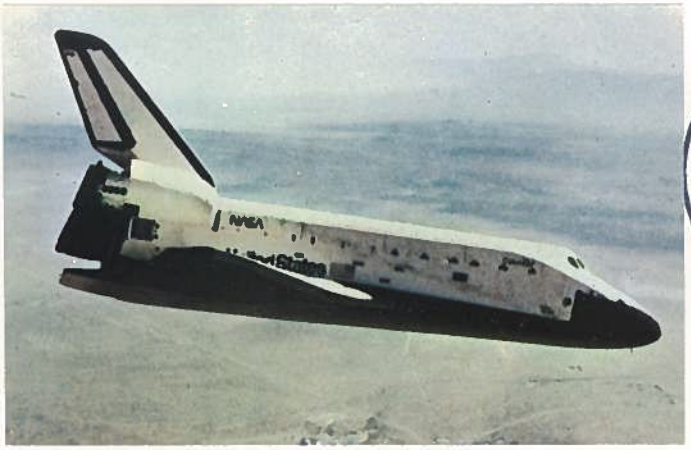


CHALLENGER STS-8

SPACE SHUTTLE / STS 8 - 31 Agosto 1983
Lancio -

A cura della FDC Roma

Mission STS-8 Challenger. AUGUST 31, 1983. Commemorative cover postmarked with manual cancel in Houston during the mission.



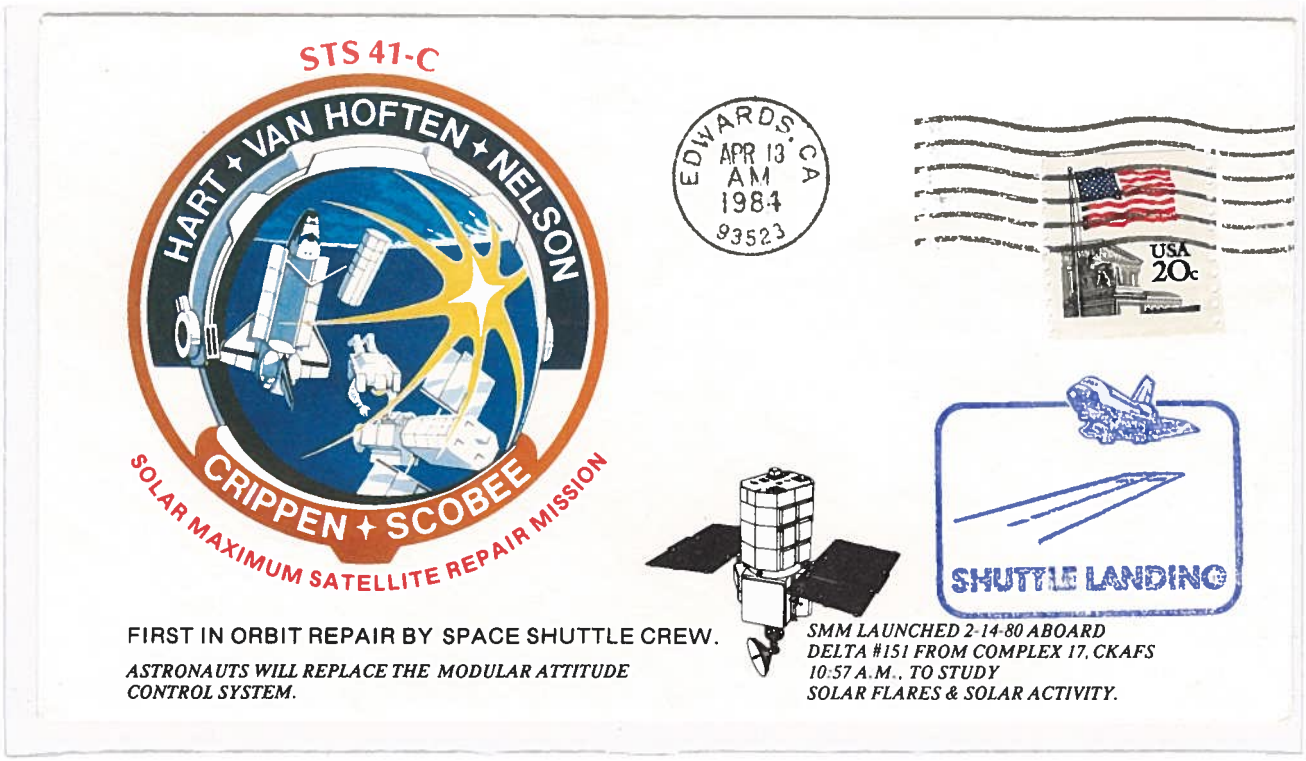
CHALLENGER STS-8

SPACE SHUTTLE / STS 8 - 5 Settembre 1983
Il Challenger attorno alla base di Edwards
segnando il record di 145 ore di volo.

A cura della FDC Roma

Mission STS-8 Challenger. SEPTEMBER 5, 1983. Commemorative cover postmarked with manual cancel in Edwards on the date and time of landing.

Mission STS-41B Challenger. FEBRUARY 11, 1984. Cape Canaveral machine cancel on the date and time of landing. The WESTAR-VI and PALAPA-B2 satellites were deployed, but failure of rocket motors left them in radical low-Earth orbit. The first untethered spacewalk were carried out by Mc Candless and Stewart using the Manned Maneuvering Unit.



Mission STS-41C Challenger. APRIL 13, 1984. Edwards machine cancel on the date and time of landing. The first direct ascent trajectory for Space Shuttle. The Long Duration Exposure Facility (LDEF) was deployed, carrying 57 experiments which were left in orbit with an intention of retrieving them during a later mission. Astronauts replaced instruments in the SOLAR MAX SATELLITE while it remained in orbit.

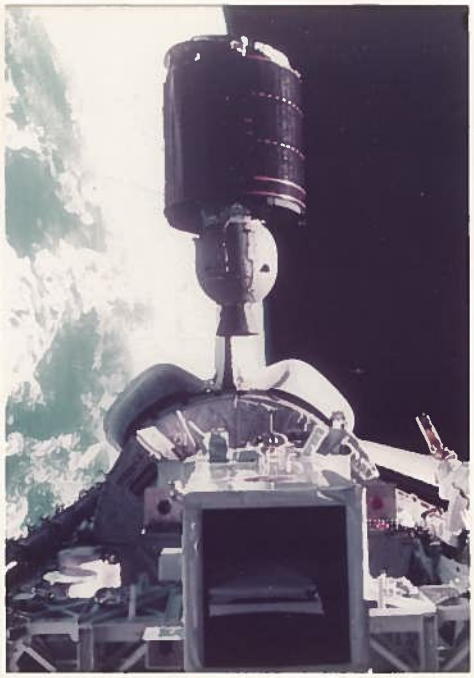
Mission STS-41D Discovery. AUGUST 30, 1984. Cape Canaveral machine cancel on the date and time of launch. Three satellites were deployed during this mission : SBS-D (Satellite Business System), SYNCOM IV-2 (also know as LEASAT 2) and TELSTAR.

Mission STS-41D Discovery. SEPTEMBER 5, 1984. Commemorative cover manually cancelled in Edwards on the date and time of landing. The Office of Application and Space Technology (OAST-1) solar wing extended from the payload bay, carrying different types of solar cells, to its full height several times.

Mission STS-41G Challenger. OCTOBER 13, 1984. KSC machine cancel on the date and time of landing. This was the first flight to include two women, Ride and Sullivan. Sullivan was the first American woman to walk in space. The Earth Radiation Budget Satellite (ERBS) was deployed less than 9 hours into the flight.

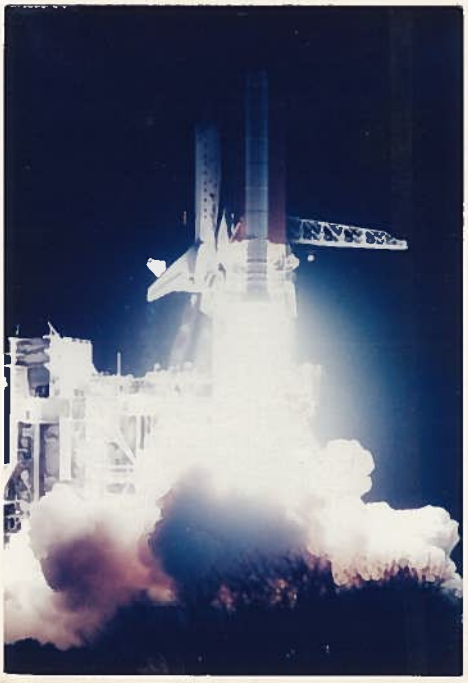
Mission STS-51A Discovery. NOVEMBER 8, 1984. KSC machine cancel on the date and time of launch. The Canadian communications satellite TELESAT-H (ANIK) was deployed into geosynchronous orbit on flight day 2. On the third day, the Defense communications satellite SYNCOM IV-1 (also know as LEASAT-1) was deployed. Two malfunctioning satellites, PALAPA B-2 and WESTAR-VI, were retrieved and deposited in the payload bay.

Mission STS-51D Discovery. APRIL 12, 1985. KSC machine cancel on the date and time of launch. The TELESAT-I (ANIK C-1) communications satellite was deployed attached to his PAM-D motor. SYNCOM IV-3 (also know as LEASAT-3) was also deployed but the spacecraft sequencer failed to initiate the antenna deployement, spin up and ignition of perigee kick motor. The mission was extended two days to make certain the sequencer start levers was in the proper position.



MEXICO'S MORELOS SATELLITE rises from DISCOVERY'S cargo bay to begin its useful life in space and to further modern communications through the land of our neighbor to the south.

Mission STS-51G Discovery. JUNE 17, 1985. Commemorative cover postmarked with machine cancel in KSC on the date and time of launch. Three communications satellites, all attached to the PAM-D motor, were deployed : MORELOS-A, for Mexico, ARABSAT-A and TELSTAR-3D, for AT&T.



51-1 LAUNCH - Discovery's dawn launch just before 7 a.m. (EDT) marked the twentieth successful beginning of a Space Transportation System (STS) flight. Five crewmembers aboard carried with them three communications satellites for in-space deployment and hopes for returning an errant one to operating condition. Onboard were Astronauts Joe H. Engle, Mission Commander; Richard O. Covey, Pilot; and James D. van Hoften, William F. Fisher and John M. (Mike) Lounge, Mission Specialists.

Mission STS-51I Discovery. AUGUST 27, 1985. KSC machine cancel on the date and time of launch. Three communications satellites were deployed : ASC-1, American, AUSSAT-1, Australian, attached to PAM-D motors, and SYNCOM IV-4 (also know as LEASAT-4). which failed after reaching the correct geosynchronous orbit. Fisher and Van Hoffen performed two EVA, part of time spent retrieving, repairing and redeploying LEASAT-3, deployed on mission STS-51D.

KENNEDY SPACE CTR., FL
AUG 30
PM
1985
32815

USA 22
ON EARTH
NASA

51-1 ONBOARD SCENE

Astronaut James D. van Hoften on the Discovery's remote manipulator system (RMS) arm visually tracks the distant Syncom IV-3 communications satellite after its second release.

Mission STS-51I Discovery. AUGUST 30, 1985. Commemorative cover postmarked with machine cancel in KSC during the mission.

51-1 POST LANDING SCENE

EDWARDS, CA
SEP 3
AM
1985
93523

USA 22

EDWARDS AIR FORCE BASE, CALIFORNIA

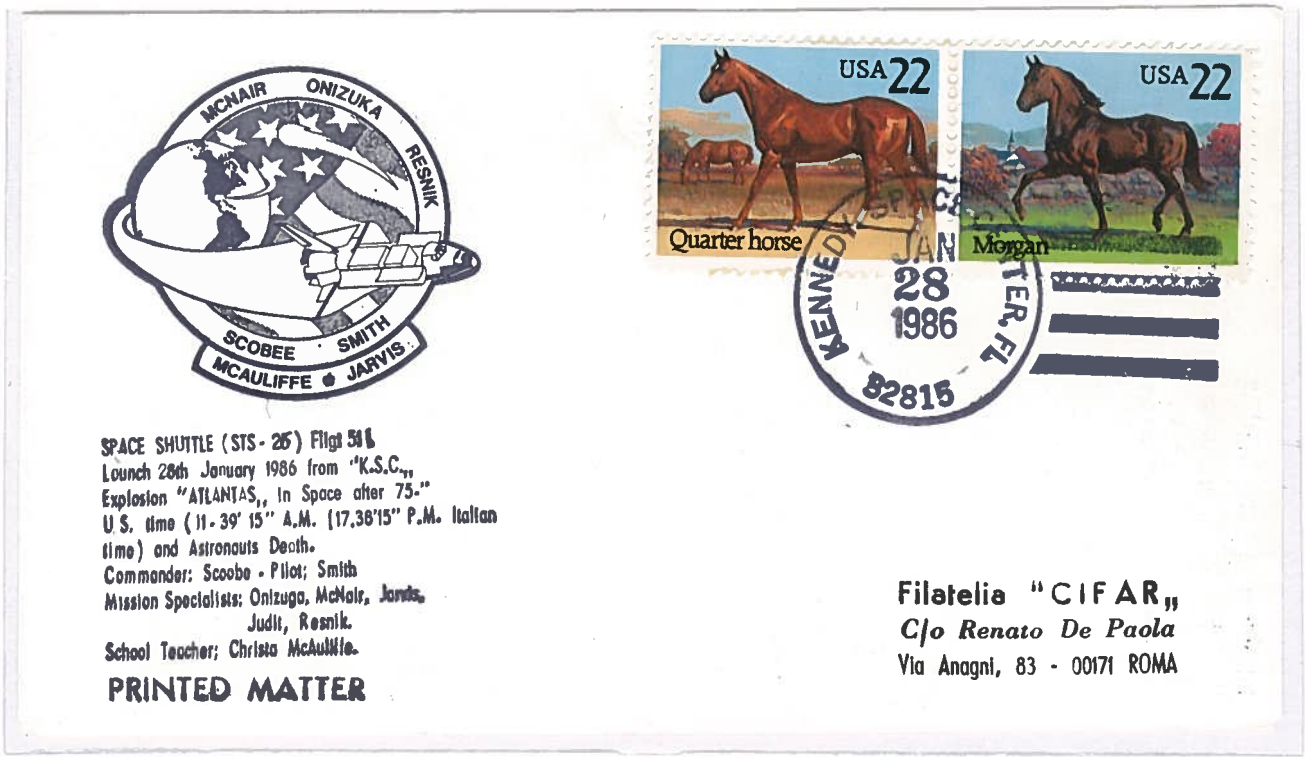
51-1 POST LANDING SCENE

Surrounded by post flight servicing personnel and facilities, the Space Shuttle Discovery was captured in a dawn scene at 6:45 a.m. (PDT), Sept. 3, 1985 following a week-long stay in Earth orbit. The spacecraft's five-member crew released three communications satellites and captured and worked on a fourth, which was also re-deployed from the cargo bay.

Mission STS-51I Discovery. SEPTEMBER 3, 1985. Commemorative cover postmarked with machine cancel in Edwards on the date and time of landing.

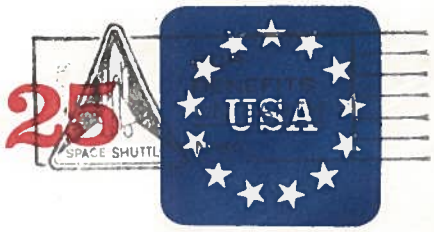
Mission STS-61B Atlantis. NOVEMBER 29, 1985. Commemorative cover postmarked with machine cancel in Houston during the mission. Three communication satellites were deployed : MORELOS-B (Mexico), AUSSAT-2 (Australia) and SATCOM KU-2 (RCA Americom). SATCOM KU-2 attached to PAM-D2 designed for heavier payloads. Two experiments were conducted to test assembling erectable structures in space: ease and access.

Mission STS-61C Columbia. JANUARY 12, 1986. Commemorative cover postmarked with machine cancel in KSC on the date of launch. The SATCOM KU-1 (RCA Americom) satellite, attached to PAM-D2 motor, was deployed.



Mission STS-51L Challenger. JANUARY 28, 1986. KSC manual cancel on the date of launch. The explosion, 73 sec. after liftoff, claimed crew and vehicle. The cause of explosion was determined to be an o-ring failure in the right solid rocked booster. Cold weather was determined to be a contributing factor. The planned orbital activities of the mission were the deployement of the TDRS-B satellite and deployement and re-stow of the Comet Halley Active Monitoring Program (CHAMP) experiment, using the satellite SPARTAN-203 (Shuttle-Pointed Tool for Astronomy).

Mission STS-26 Discovery. SEPTEMBER 29, 1988. Commemorative cover postmarked with manual cancel in KSC on the date of launch. The primary payload, NASA Tracking and Data Relay Satellite-3 (TDRS-3), attached to an Inertial Upper Stage (IUS), became the second TDRS deployed. After deployement , IUS propelled the satellite to a geosynchronous orbit.



Head-on view of the tracking and data relay satellite (TDRS-D), as photographed with a 70mm camera from inside Discovery's cabin. Crewmembers released the cylindrical form into space from the cargo bay. At its final destination high above the earth, TRS-D will no longer maintain its cylindrical form, having transformed into an operational satellite with antenna spanned out in various directions and its interim upper stage (IUS) discarded.

Mission STS-29 Discovery. MARCH 13, 1989. Commemorative cover postmarked with machine cancel in KSC on the date and time of launch. The primary payload, TDRS-4, attached to an IUS, became the third TDRS to deployed. After deployment, the IUS propelled the satellite to a geosynchronous orbit. Among secondary payloads an Air Force experiment, using orbiter as calibration target for ground-based experiment for Air Force Maui Optical Site (AMOS) in Hawaii.

ASTRONAUTS BLAHA AND BAGIAN ON THE MID DECK

Astronaut John E. Blaha, Pilot, has his blood flow checked by Astronaut James P. Bagian, Mission Specialist and a Physician.

Mission STS-29 Discovery. MARCH 15, 1989. Commemorative cover postmarked with machine cancel in KSC during the mission.

STS-32 Space Shuttle Columbia separates from its solid rocket boosters. The photograph was taken by Astronaut Michael L. Coats, acting chief of the Astronaut Office, from the Shuttle Training Aircraft.

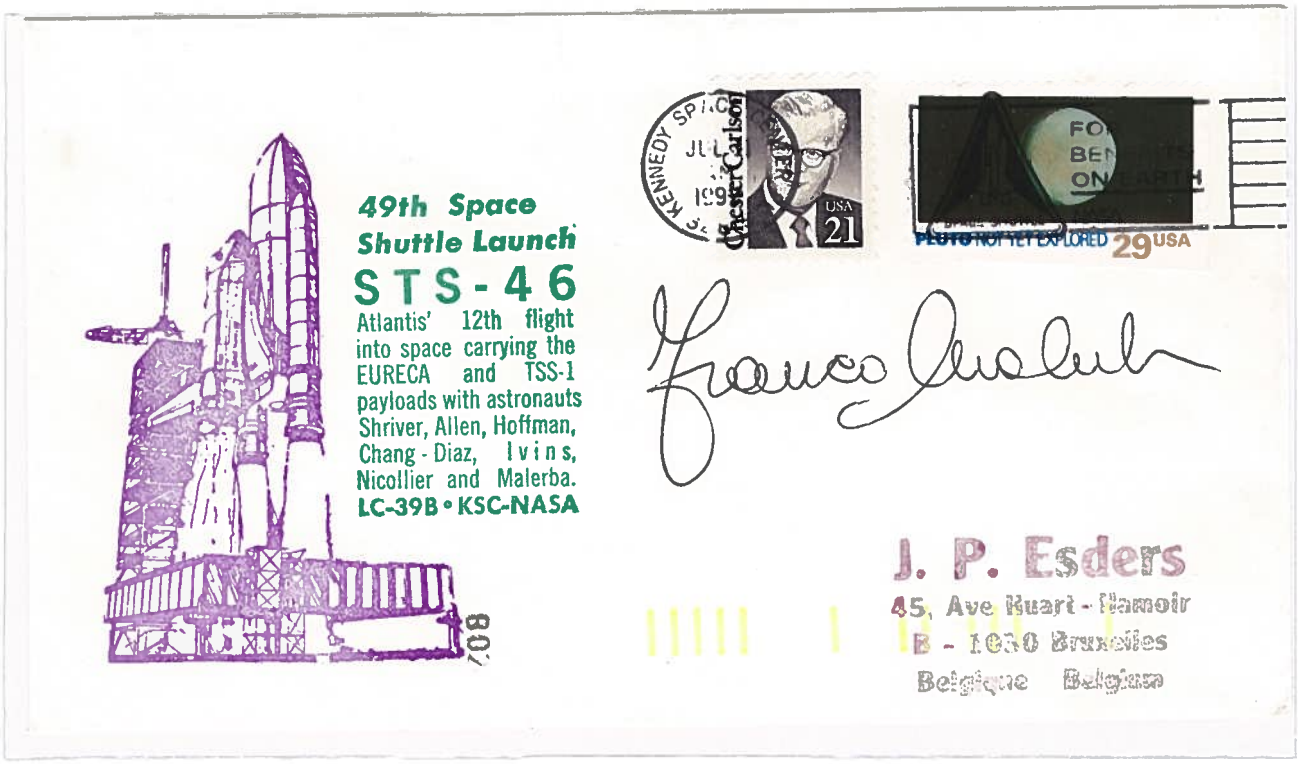
Mission STS-32 Columbia. JANUARY 9, 1990. Commemorative cover postmarked with machine cancel in KSC on the date and time of launch. Objectives were deployment of SYNCOM IV-F5, Defense communications satellite (also know as LEASAT 5) and retrieval of NASA's Long Duration Exposure Facility (LDEF) using RMS. SYNCOM IV-F5 deployed first, and third stage minuteman solid perigee kick motor propelled the satellite to geosynchronous orbit.

STS-32 Onboard Scene — A 35mm scene of Astronaut James D. Wetherbee, STS-32 pilot, with a pair of drumsticks. Wetherbee plays drums for Max Q, a band made up of NASA astronauts.

Mission STS-32 Columbia. JANUARY 20, 1990. Commemorative cover postmarked with manual cancel in Edwards on the date and time of landing.

Mission STS-43 Atlantis. AUGUST 2, 1991. KSC machine cancel on the date and time of launch. About six hours into flight, the IUS propelled the satellite TDRS-5 into geosynchronous orbit. TDRS-5 becomes the fourth member of the orbiting TDRS cluster. Among the secondary payloads Shuttle Solar Backscatter Ultra-Violet (SSBUV) instrument and Space Station Heat Pipe Advance Radiator Element II (SHARE II).

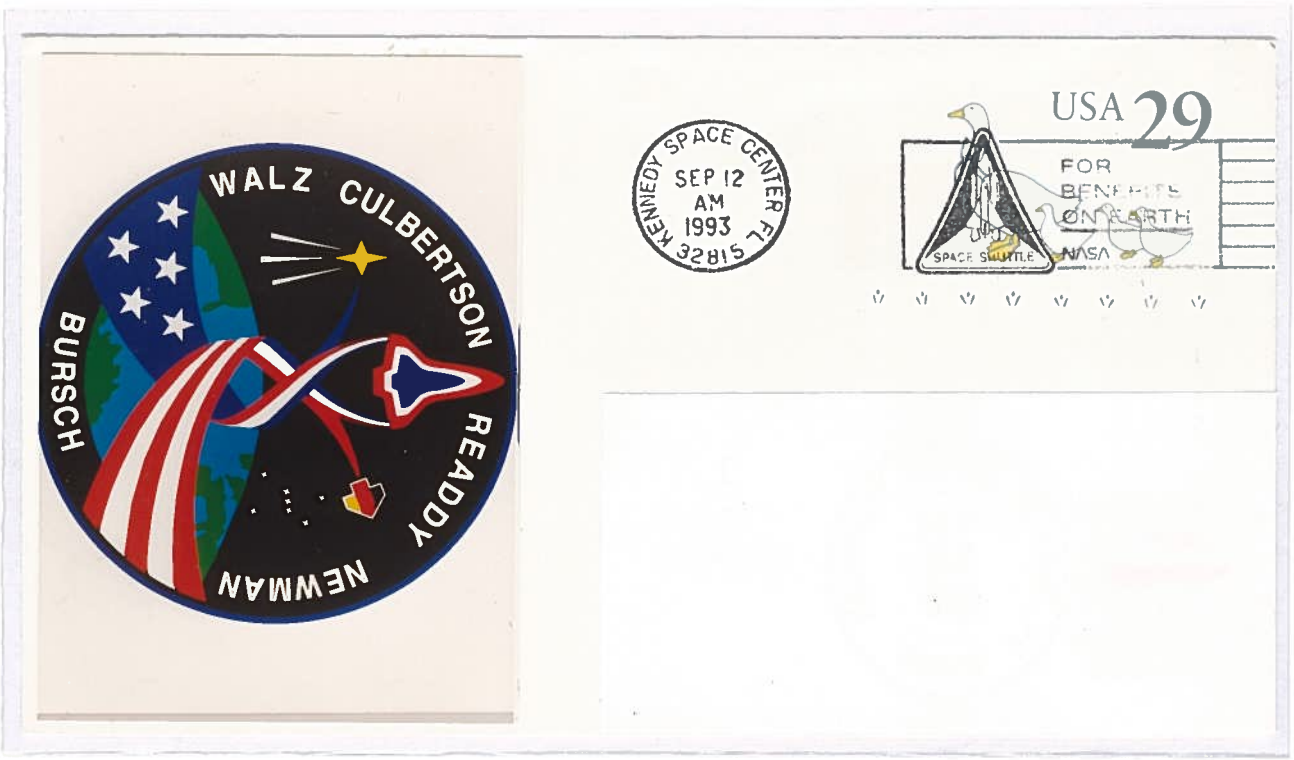
Mission STS-49 Endeavour. MAY 7, 1992. KSC machine cancel on the date and time of launch. The satellite INTELSAT VI (F-3), stranded in an unusable orbit since its launch in March 1990 aboard a Titan vehicle, was captured by crew members during three EVA and equipped with a new perigee kick motor. The satellite was subsequently released into orbit for operational use.



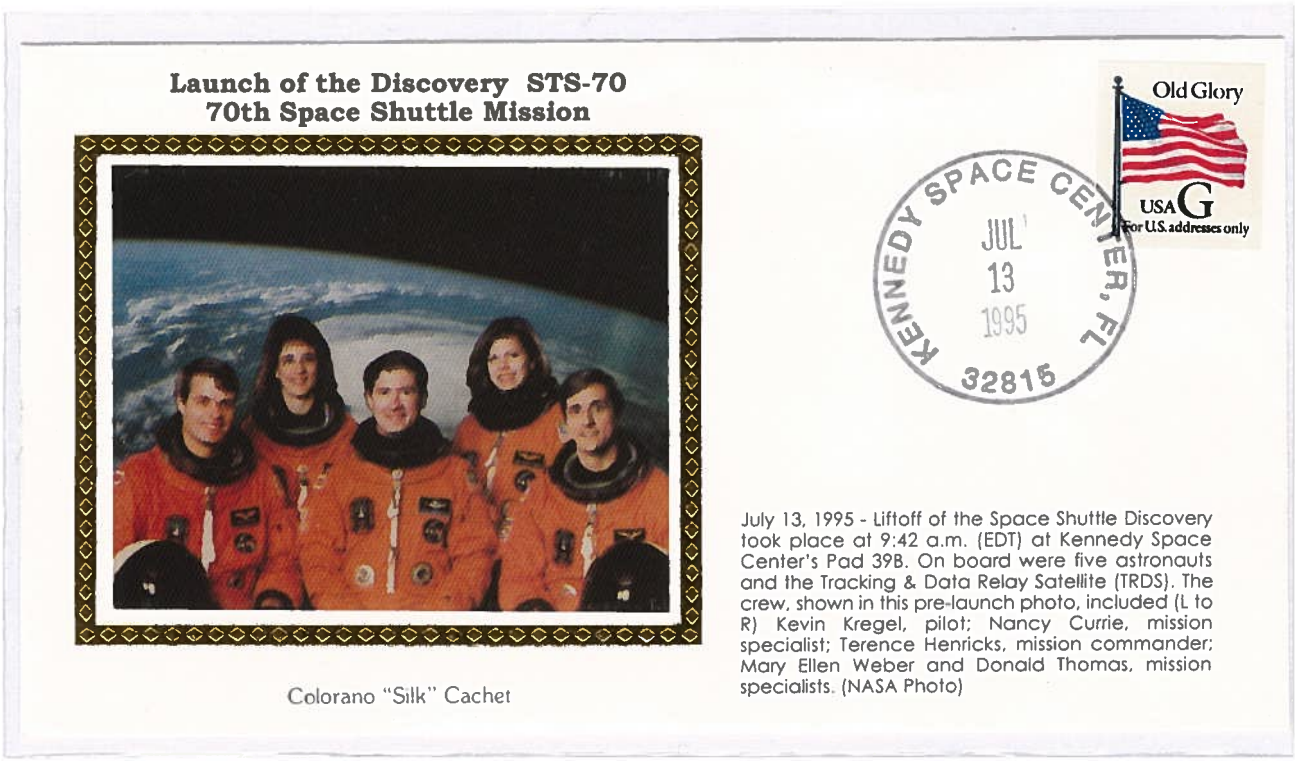
Mission STS-46 Atlantis. JULY 31, 1992. Commemorative cover postmarked with machine cancel in KSC on the date and time of launch. The primary objective was deployment of the ESA's European Retrievable Carrier (EURECA) and operation of the joint NASA/ASI Tethered Satellite System (TSS). EURECA, boosted to its operational altitude of about 310 statute miles (499 km) on the sixth day, was to be retrieved on STS-57 in 1993. During TSS deployment, because of a jammed tether line, the satellite reached a maximum distance of only 840 feet (256 meters) from orbiter, instead of planned 12,5 miles (20 km). After numerous attempts over several days to free the tether, the satellite was stowed for return to Earth.

Mission STS-52 Columbia. NOVEMBER 1, 1992. KSC machine cancel on the date and time of landing. Deployement of the LAGEOS-II (Laser Geodynamic Satellite II), a joint effort between NASA and ASI. On day two, was deployed and boosted into an initial elliptical orbit by IRIS (Italian Research Interim Stage) and later Apogee Kick Motor circularized LAGEOS orbit at its operational altitude of 3,666 miles.

Mission STS-57 Endeavour. JUNE 21, 1993. KSC machine cancel on the date and time of launch. On June 24, the crew captured and stoved the approximately 9,424 pounds (4,275 kg) European Retrievable Carrier (EURECA) deployed on mission STS-46. Lowand Wisoff spent the beginning of the scheduled EVA manually folding the spacecraft's two antenna.



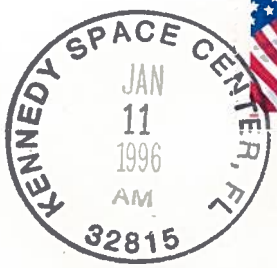
Mission STS-51 Discovery. SEPTEMBER 12, 1993. KSC machine cancel on the date and time of launch. About 45 minutes after ACTS (Advanced Communications Technology Satellite) deploy, the Transfer Orbit Stage (TOS) booster, flying on the Shuttle for first time, fired to propel Pioneering Communications Technology Spacecraft to geosynchronous transfer orbit.



Mission STS-70 Discovery. JULY 13, 1995. KSC manual cancel on the date of launch. About seven hours after liftoff, IUS booster, attached to TDRS-G, completed first of two scheduled burns to place the satellite in geosynchronous orbit. Once it completes on-orbit checkout, TDRS-G will become operational spare, completing esisting TDRS Network of Advanced Tracking and Communications Satellites.

Launch of the Endeavour STS-72
74th Space Shuttle Mission

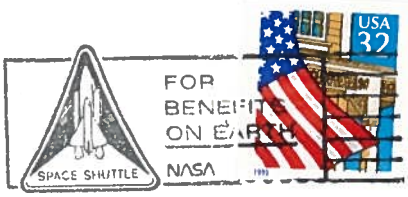
Colorano "Silk" Cachet



January 11, 1996 - The Space Shuttle Endeavour left Kennedy Space Center's Pad 39B at precisely 4:41:00:072 am (EST). Shown in this pre-flight crew photo (front, L to R) are pilot Brent W. Jett and mission commander Brian Duffy. In the back (L to R) are mission specialists Winston E. Scott, Leroy Chiao, Koichi Wakata, and Daniel T. Barry. Wakata represented Japan's National Space Development Agency (NASDA). (NASA photo)

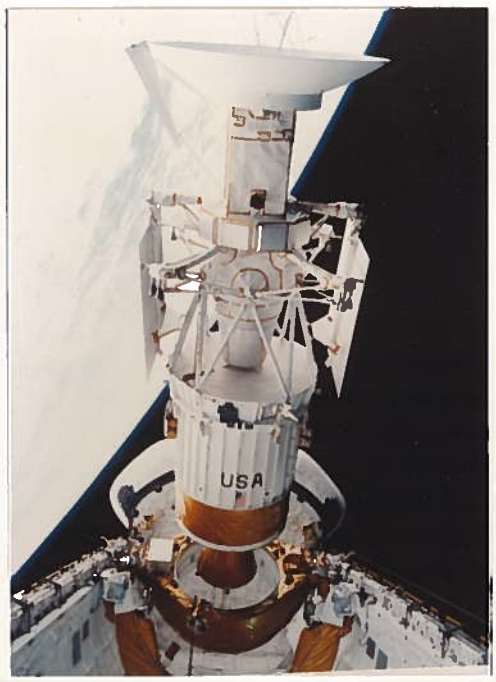
Mission STS-72 Endeavour. JANUARY 11, 1996. KSC manual cancel on the date and time of launch. On flight day three, astronaut Wakata operated RMS arm to pluck Japanese Space Flyer Unit (SFU) from orbit, completing 10-month scientific mission. On flight day four, Wakata again operated robot arm, to deploy Office and Space Technology-Flyer (OAST-Flyer), comprised of Spartan Platform, holding four experiments, at a distance of approximately 45 miles (72 km) from orbiter, retrieved on flight day six.

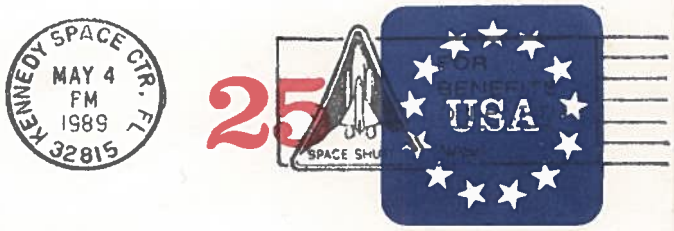
SPACE SHUTTLE
STS-75/COLUMBIA



Mission STS-75 Columbia. FEBRUARY 22, 1996. KSC machine cancel on the date and time of launch. Reflight of U.S. / Italian Tethered Satellite System (TSS-1R). TSS concept designed to study electrodynamics in electrically charged ionosphere. Excellent scientific data was being gathered on flight day three, when the satellite was just short of full deployment of about 12,8 miles (20,6 km).

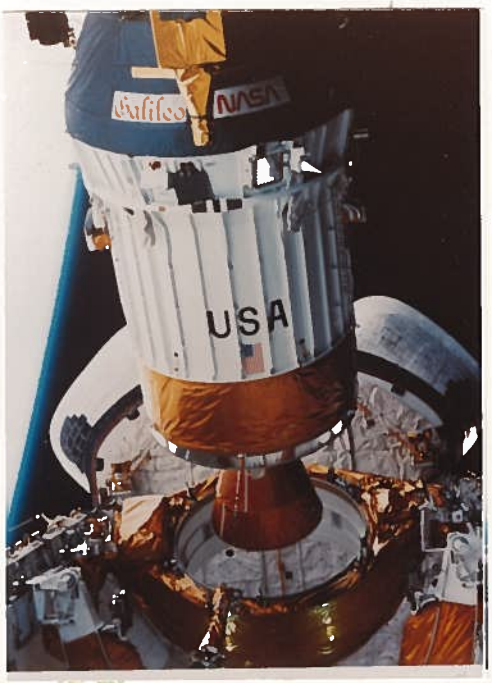
Chapter 6. AUTOMATIC INTERPLANETARY PROBES





In the early evening hours of Atlantis' first day in space, the Magellan spacecraft is released into space to begin its long journey to the planet Venus for an extensive radar mapping mission. The scene was photographed through Atlantis' aft flight deck windows with a handheld 70mm camera.

Mission STS-30 Atlantis. MAY 4, 1989. KSC machine cancel on the date and time of launch. The MAGELLANO spacecraft was deployed from the Shuttle's payload bay 6 hourd and 14 min. into the mission. Two successive IUS propulsion burns placed the spacecraft on its trajectory to Venus. MAGELLANO arrived at Venus in August 1990 and began a 243-day mission of mapping the planet's surface with radar.



The Galileo spacecraft and its inertial upper stage (IUS) have just detached from a cradle-like device aboard Space Shuttle Atlantis, STS-34 to begin a six-year journey to Jupiter. The scene was exposed with a 70mm handheld Hasselblad camera.

Mission STS-34 Atlantis. OCTOBER 18, 1989. KSC machine cancel on the date and time of launch.

STS-34 LANDING

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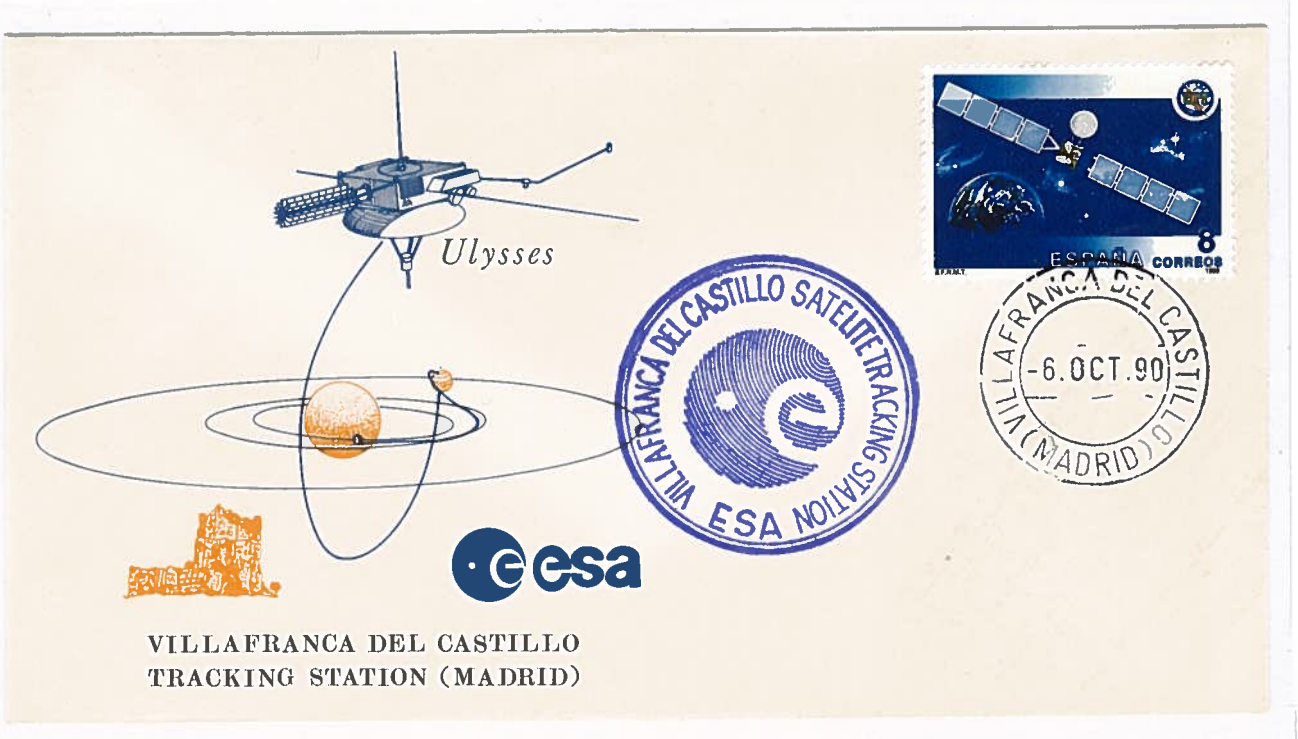
USA

A side view of the Space Shuttle Atlantis during main gear touchdown on Runway 23 at Edwards Air Force Base. Astronaut Donald E. Williams, mission commander; and four other astronauts successfully deployed the Galileo planetary spacecraft, destined for Jupiter.

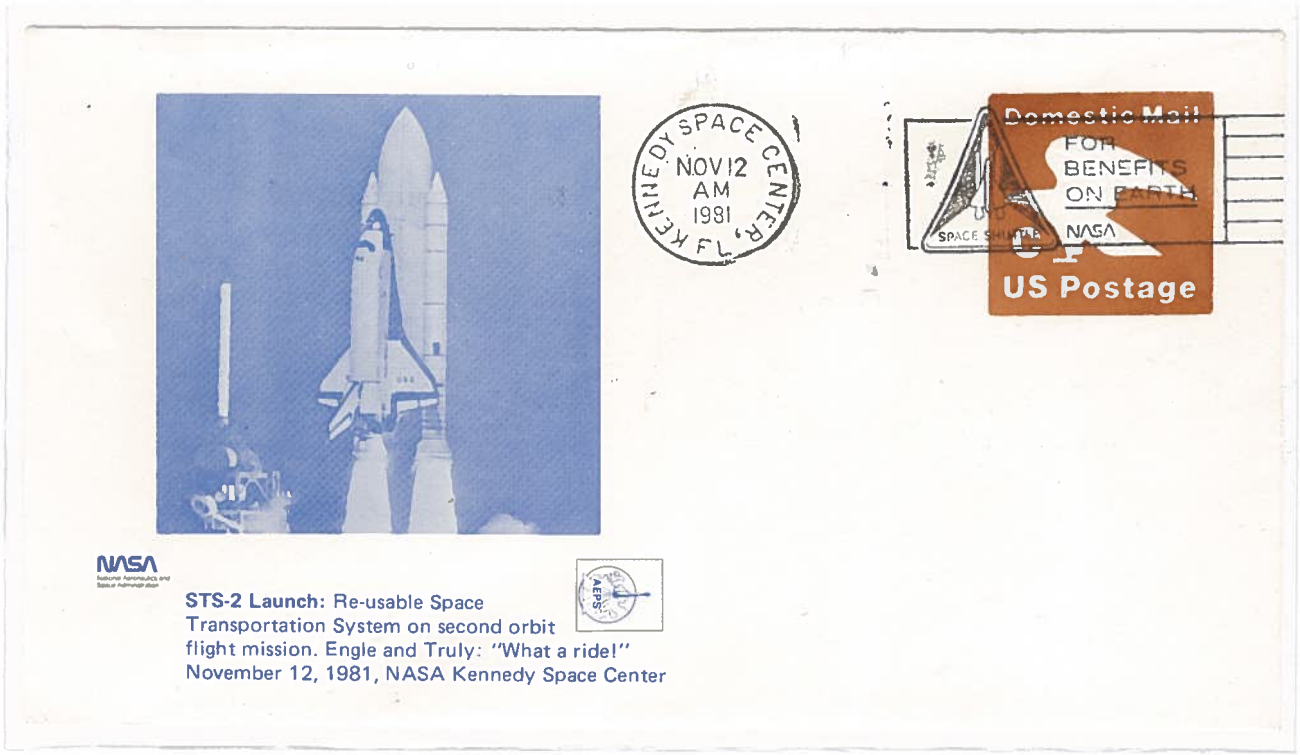
Mission STS-34 Atlantis. OCTOBER 23, 1989. Edwards manual cancel on the date and time of landing. The primary payload, GALILEO / JUPITER spacecraft and attached IUS, was deployed 6 hours, 30 min. into the flight. IUS stages fired, placing GALILEO on trajectory for 6-year trip to Jupiter, via gravitational boosts from Venus and Earth.



Mission STS-41 Discovery. OCTOBER 6, 1990. Villafranca manual cancel on the date of launch.

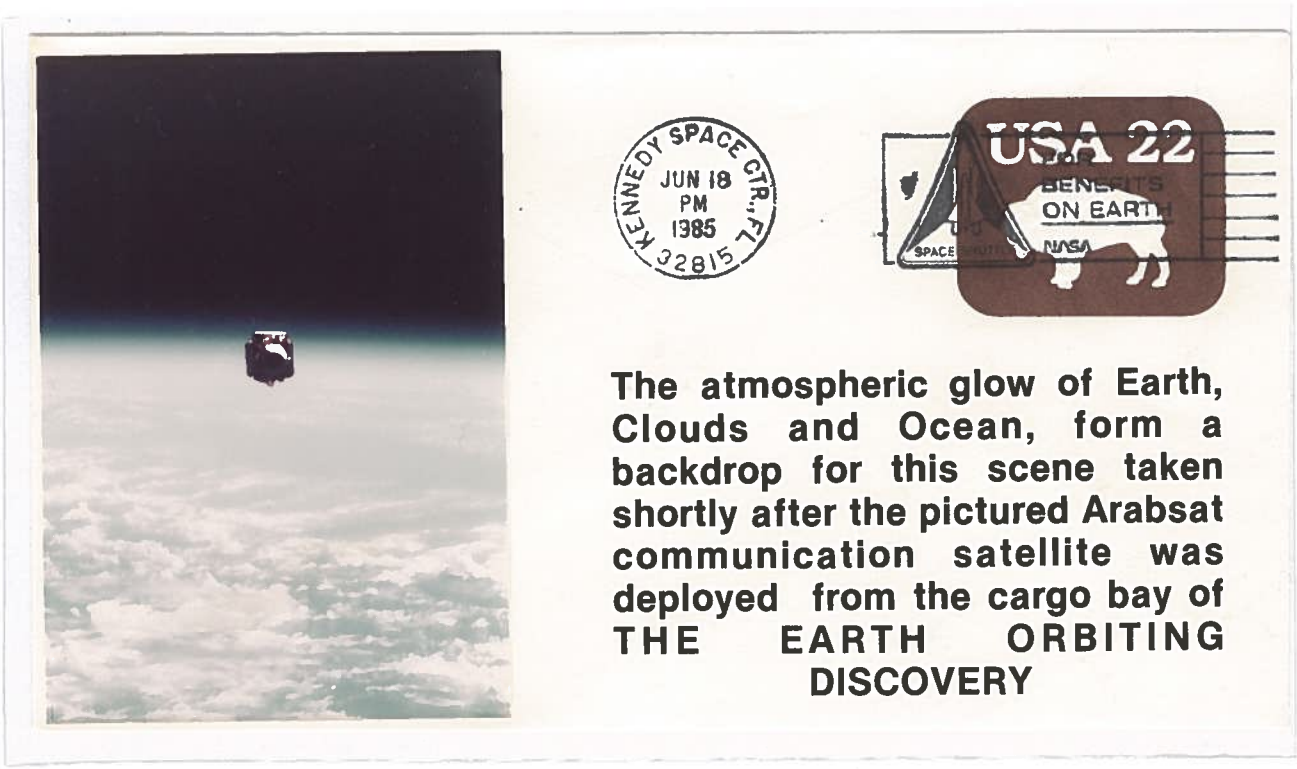
Mission STS-41 Discovery. KSC manual cancel on the date of launch.Attached to ULYSSES ESA-built spacecraft were two upper stages, IUS and PAM-2, combined together for first time, to send ULYSSES toward an out-of-ecliptic trajectory. Its voyage to the Sun began with a sixteen month trip to Jupiter, were the planet's gravitational energy was used, and on toward a solar South Pole passage in 1994, and a solar North Pole passage in 1995.

Chapter 7. ASTRONOMICAL OBSERVATIONS AND EARTH



Mission STS-2 Columbia. NOVEMBER 12, 1981. Commemorative cover postmarked with machine pictorial cancel in KSC on the date and time of launch. Demonstrate safe re-launch and safe return of the orbiter and crew. First time Remote Manipulator System test. Mission scientists were satisfied with data received from OSTA-1 (Office of Space and Terrestrial Applications-1), Earth observation experiments mounted on Spacelab pallet in payload bay.

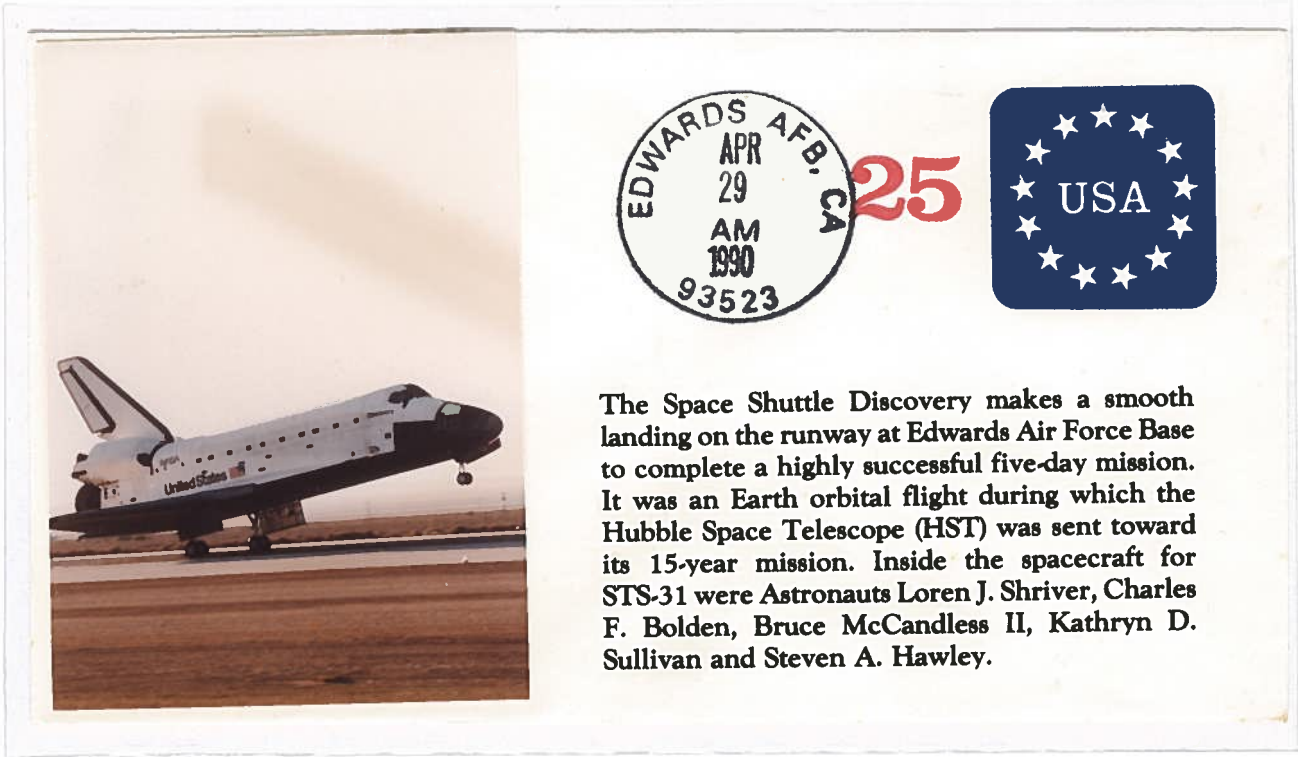
Mission STS-2 Columbia. NOVEMBER 14, 1981. Commemorative cover postmarked with machine pictorial cancel in Edwards on the date and time of landing.



Mission STS-51G Discovery. JUNE 18, 1985. KSC machine cancel during the mission. Also carried was the SPARTAN-1 module which included 300 lb (140 kg) of astronomy experiments. It was deployed and operated successfully, independent of the orbiter, before being retrieved.

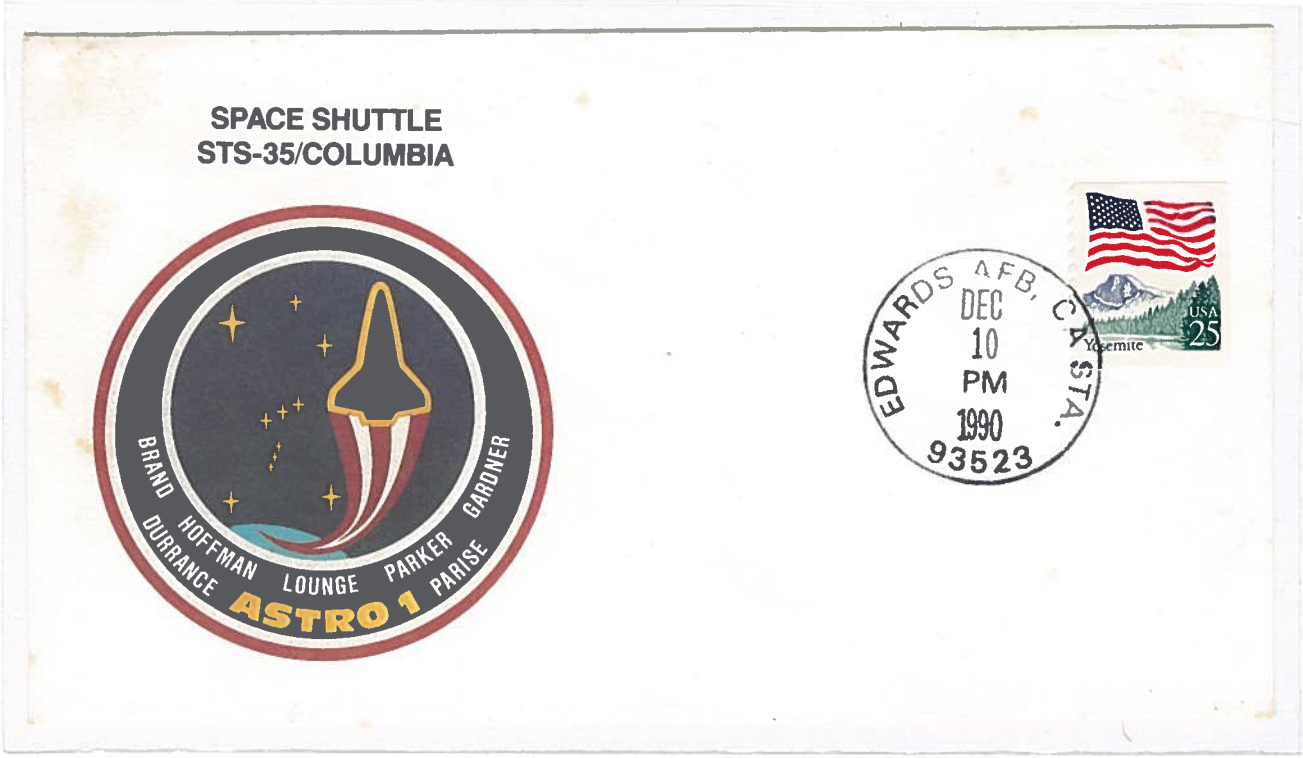
Mission STS-61C Columbia. JANUARY 18, 1986. Edward machine cancel on the date and time of landing. Comet Halley Active Monitoring Program (CHAMP) experiment, a 35 mm camera to photograph Comet Halley, did not function properly due to battery problems.

Mission STS-31 Discovery. APRIL 24, 1990. Commemorative cover postmarked with manual cancel in KSC on the date and time of launch. The primary payload was the Hubble Space Telescope (HST), deployed in a 380 statute miles (612 km) orbit. It was designed to operate above the Earth's turbulent and obscuring atmosphere to observe celestial objects at ultraviolet, visible and near-infrared wavelengths. The HUBBLE mission was a joint NASA-ESA effort going back to the late 1970s.



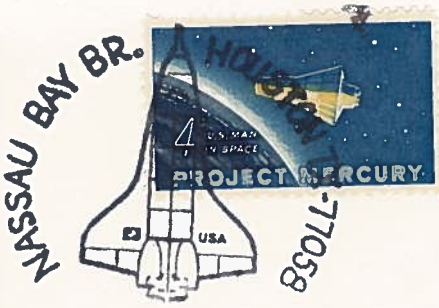
Mission STS-31 Discovery. APRIL 29, 1990. Commemorative cover postmarked with manual cancel in Edwards on the date and time of landing.

Mission STS-35 Columbia. DECEMBER 2, 1990. Commemorative cover postmarked with machine cancel in KSC on the date and time of launch. The primary objectives were round-the-clock observations of celestial sphere in ultraviolet and X-ray astronomy with ASTRO-1, observatory consisting of 4 telescopes. In a typical ASTRO-1 ultraviolet observation, the flight crew member on duty maneuvered the Shuttle to point the cargo bay in the direction of the astronomical object to be observed.



Mission STS-35 Columbia. DECEMBER 10, 1990. Commemorative cover postmarked with manual cancel in Edwards on the date and time of landing.

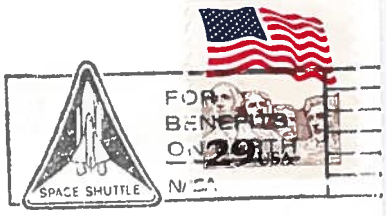
Colorano "Silk" Cachet



SPACE SHUTTLE ATLANTIS STS-37

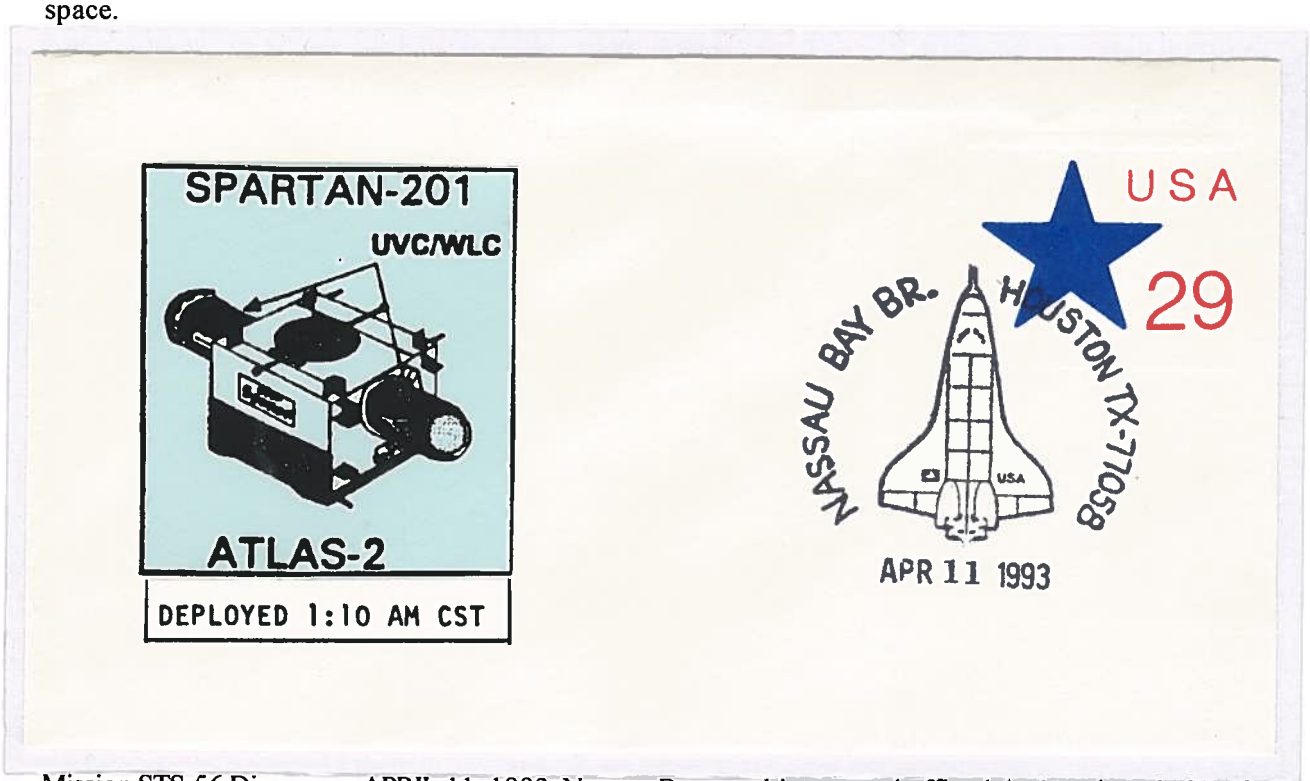
April 5, 1991 — The Atlantis spacecraft rocketed into space at 9:22 a.m. today carrying the $600-million Gamma Ray Observatory (GRO) and a crew of five. Dr. Charles Pellerin, NASA's director of astrophysics, said once the observatory is deployed it could last as long as 10 years. The astronauts on board are Steven R. Nagel, commander; Kenneth D. Cameron, pilot; Jerry L. Ross, Linda M. Godwin and Jerome Apt, mission specialists.

Mission STS-37 Atlantis. APRIL 5, 1991. Nassau Bay machine cancel on the date of launch. The primary payload, Gamma Ray Observatory (GRO), was deployed on flight day three. The GRO high-gain antenna failed to deploy; it was finally freed and manually deployed by Ross and Apt during an contingency space walk. GRO was launched on a two-years mission to search for the high energy celestial gammaray emissions which cannot penetrate Earth's atmosphere.



Mission STS-48 Discovery. SEPTEMBER 12, 1991. KSC machine cancel on the date and time of launch. The primary payload, the Upper Atmosphere Research Satellite (UARS), was deployed on the third day of mission. During its planned 18-month mission, the 14,500 pound observatory will make the most extensive study ever conducted of the Earth's troposphere, the upper level of the planet's envelope of life sustaining gases which also include the protective ozone layer.

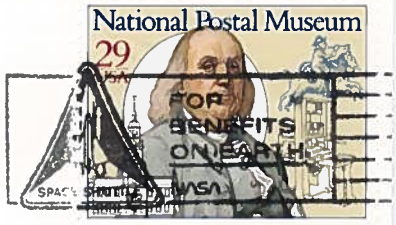
Mission STS-54 Endeavour. JANUARY 13, 1993. Sunnivale manual cancel on the date and time of launch. The primary payload was the 5th Tracking and Data Satellite (TDRS-F), deployed on day one and transferred to its proper orbit by the IUS. On day five Runco and Harbau spent nearly 5 hours in cargo bay, testing their abilities to move freely in the cargo bay, to increase NASA's knowledge of working in space.Also carried into orbit in the payload bay was a Hitchiker Experiment called the Diffuse X-ray Spectrometer(DXS). This instrument collected data on X-ray radiation from diffuse sources in deep space.



Mission STS-56 Discovery. APRIL 11, 1993. Nassau Bay machine cancel affixed during the mission. On April 11, crew used Remote Manipulator System arm to deploy Spartan-201 (Shuttle Point Autonomous Research Tool for Astronomy-201), a free-flying science instrument platform designed to study velocity and acceleration of solar wind and observe Sun's corona. Spartan-201 retrieved on April 13.

SPACE SHUTTLE
STS-51/DISCOVERY

Mission STS-51 Discovery. SEPTEMBER 12, 1993. KSC manual cancel on the date and time of launch. After 6 days of data collection, ORFEUS-SPAS (Orbiting and Retrievable Far and Extreme Ultraviolet Spectrograph-Shuttle Pallet Satellite), first in series of ASTRO-SPAS astronomical mission, deployed on flight day two, retried with RMS.

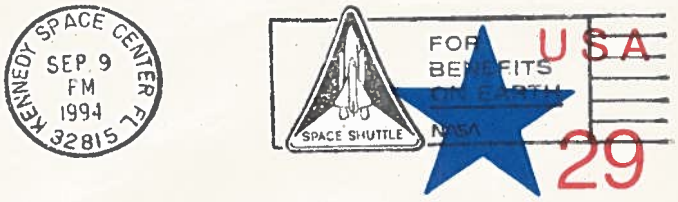


STS-61 ONBOARD SCENE — The Hubble Space Telescope (HST) begins its separation from the Space Shuttle Endeavour following a week and a half berthed in the space vehicle's cargo bay.

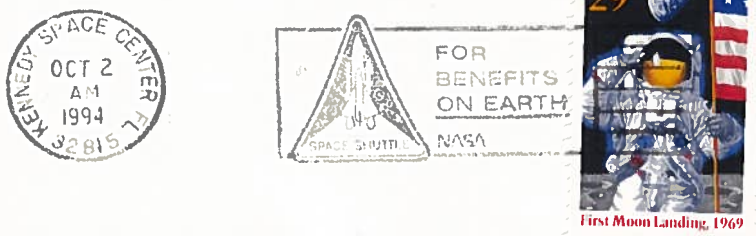
Mission STS-61 Endeavour. DECEMBER 9, 1993. KSC machine cancel during the mission. The final Shuttle flight of 1993 was one of most challenging and complex manned mission ever attempted. Hubble rendez-vous occurred on flight day three, with Nicollier using the RMS to position the 43-foot (13 meters) long HST in payload bay. During a record five EVA, totaling 35 hours and 28 min., two teams of astronauts completed the first servicing of the telescope.

STS-59 Endeavour. APRIL 9, 1994. Commemorative cover postmarked with machine cancel in KSC on the date and time of launch. Primary payload was the Space Radar Laboratory-1 (SRL-1), located in payload bay. Activated by crew and operated by teams on ground, include two instruments : SIR-C / X-SAR, and an atmospheric instrument called MAPS. The DARA and ASI provided X-SAR instrument. More than 400 sites were imaged, covering 38.5 milion miles of the Earth, 20 percent of the planet.

STS-59 Endeavour. APRIL 20, 1994. Commemorative cover postmarked with manual cancel in Edwards on the date and time of landing.



Mission STS-64 Discovery. SEPTEMBER 9, 1994. KSC manual cancel affixed on the date and time of launch. First flight of Lidar-in-space Technology Experiment (LITE), part of NASA's mission to planet Earth, to study Earth's atmosphere, cloud structures, storm systems, pollutants, forest burning. LITE is a type of optical radar using laser pulses instead of radio waves.

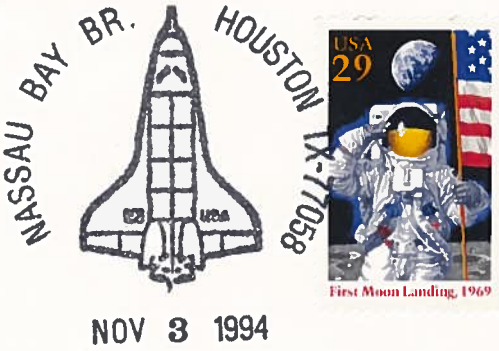


The Space Radar Laboratory (SRL-2) in the Space Shuttle Endeavour's cargo bay, is backdropped against blackness of space over Earth, in this 35mm frame exposed by one of the STS-68 crew members.

Mission STS-68 Endeavour. OCTOBER 2, 1994. KSC manual cancel affixed during the mission. STS-68 marked second flight of Space Radar Laboratory (SRL-2), part of NASA's mission to planet Earth. Flying SRL during different seasons, allowed comparison of changes between first and second flight. Unusual events also imaged, erupting volcano in Russia and islands of Japan after earthquake.

Mission STS-68 Endeavour. OCTOBER 11, 1994. Commemorative cover postmarked with manual cancel in Edwards on the date and time of landing.

Colorano "Silk" Cachet

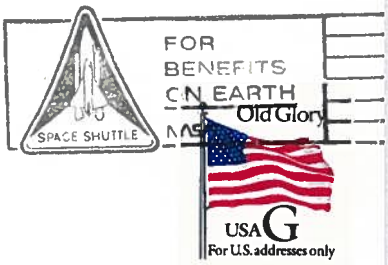


SPACE SHUTTLE ATLANTIS STS-66

November 3, 1994 — The space shuttle Atlantis returns to work after a refurbishing and two year layoff, liftoff occurred at noon today. Five NASA astronauts and a European mission specialist are onboard for the Atmospheric Laboratory for Applications and Science (ATLAS-3) mission. The six astronauts are Donald R. McMonagle, mission commander, Curtis L. Brown, pilot; Ellen Ochoa, payload commander; and Scott E. Parazynski, Joseph R. Tanner and Jean-Francois Clervoy, European Space Agency mission specialist.

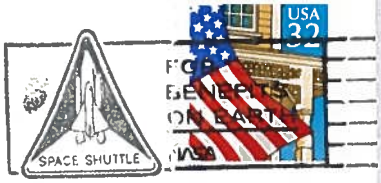
Mission STS-66 Atlantis. NOVEMBER 3, 1994. Commemorative cover postmarked with machine cancel in KSC on the date and time of launch. CRISTA-SPAS released from orbiter's RMS arm on second day of mission. Flying at distance of about 25-55 miles (40-70 km) behind the Shuttle, collected data for more than eight days before being retrieved and returned to cargo bay.

SPACE SHUTTLE
STS-67/ENDEAVOUR

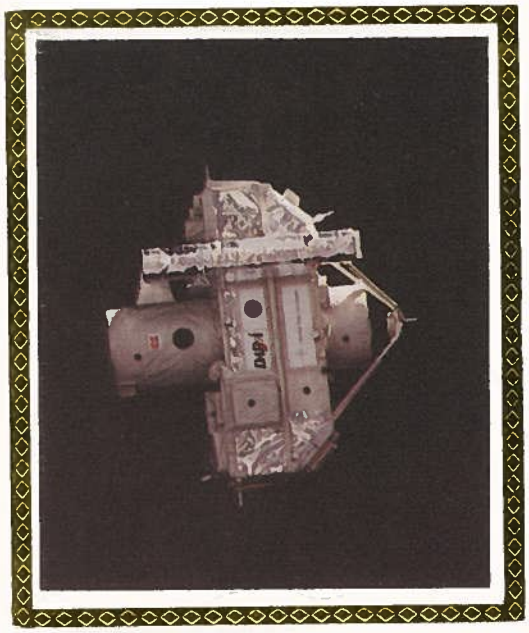


Mission STS-67 Endeavour. MARCH 2, 1995. KSC machine cancel on the date and time of launch. The longest Shuttle flight to date, sustained examination of the " hidden Universe " of ultraviolet light. The observatory ASTRO-2 marked the second flight of three ultraviolet telescopes flown on ASTRO-1, mounted on instrument on Spacelab pallet in cargo bay. ASTRO-2 demonstrated benefits of human interaction in on-orbit astronomy.

SPACE SHUTTLE
STS-69/ENDEAVOUR



Mission STS-69 Endeavour. SEPTEMBER 7, 1995. KSC machine cancel on the date and time of launch. STS-69 marked first time two different payloads were deployed and retrieved during the same mission. SPARTAN 201-03 was the third Spartan 201 mission in planned series of four. To study outer atmosphere of Sun and its transition into solar wind. WSF-2 is a 12 foot (3.7 meter) diameter stainless steel disk designed to generate an ultravacuum environment in space.



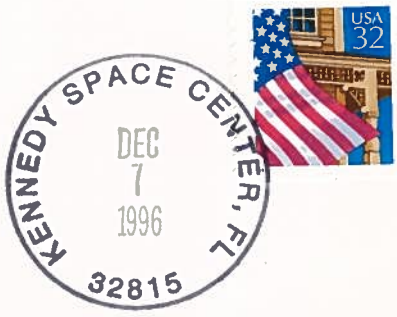
Colorano "Silk" Cachet

CAPTURE OF THE ORFEUS-SPAS II SATELLITE
STS-80 - 80th Shuttle Mission
December 4, 1996. The Orbiting Retrievable Far and Extreme Ultraviolet Spectrometer - Shuttle Pallet Satellite (ORFEUS-SPAS) appears suspended in space during Columbia's approach just prior to capture. A joint project of Germany and the US, ORFEUS includes a one-meter diameter telescope. Part of the satellite's mission included the DARA School Project, an innovative educational program designed to reach astronomy and physics students in 170 German schools. (NASA photo)

Mission STS-80 Columbia. DECEMBER 4, 1996. Commemorative cover postmarked with manual cancel in Houston during the mission. Making its second flight aboard the Shuttle, ORFEUS SPAS II featured three primary scientific instruments : a telescope and two spectrographs. Some 422 observations of almost 150 astronomical objects were completed, including the Moon, stars, galaxies and Quasar 3C273.

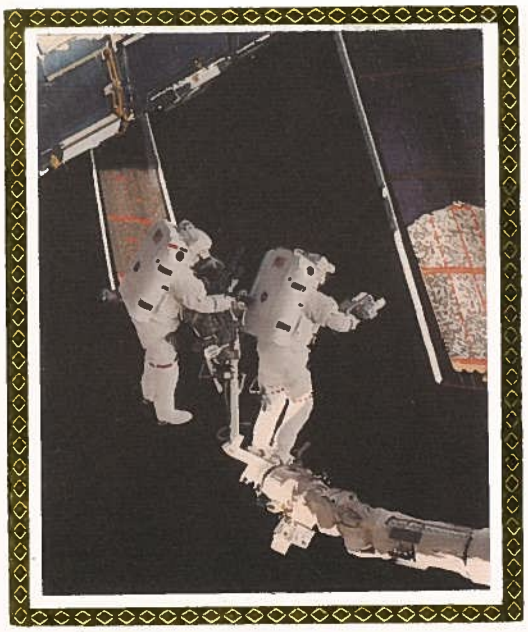
Return of the Columbia STS-80
80th Space Shuttle Mission

Colorano "Silk" Cachet



December 7, 1996. After almost 18 days in earth orbit, the space shuttle Columbia touched down at Florida's Kennedy Space Center at 6:49:19 am (EST). Shown in this in-flight crew photo are (L to R, front) Thomas D. Jones and Story Musgrave, both mission specialists; and in the rear, Kenneth D. Cockrell, mission commander; Tamara E. Jernigan, mission specialist; and Kent V. Rominger, pilot. (NASA photo)

Mission STS-80 Columbia. DECEMBER 7, 1996. Commemorative cover postmarked with manual cancel in KSC on the date of landing.



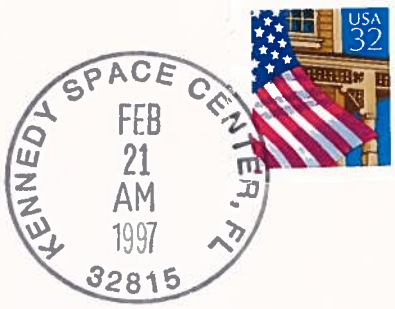
Colorano "Silk" Cachet

SPACEWALK #2
STS-82 - 82nd Shuttle Mission
February 14, 1997. Astronaut Joseph R. Tanner (R) stands on the end of Discovery's remote manipulator system (RMS) arm and aims a camera at the solar array panels on the Hubble Space Telescope as astronaut Gregory J. Harbaugh assists. This second extravehicular activity (EVA-2) photograph was taken from inside Discovery's cabin. (NASA photo)

Mission STS-82 Discovery. FEBRUARY 14, 1997. Commemorative cover postmarked with manual cancel in Houston during the mission. STS-82 demonstrated anew the capability of the Space Shuttle to service orbiting spacecraft as well as the benefits of human spaceflight. Discovery's maneuvering jets fired several times during the mission to reboost the HST telescope's orbit by eight nautical miles. A six-member crew completed servicing and upgrading of the HST during four planned EVA, and a fifth unscheduled EVA.

Return of the Discovery STS-82
82nd Space Shuttle Mission

Colorano "Silk" Cachet

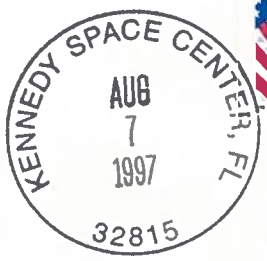


February 21, 1997. Space shuttle Discovery returned safely to Earth at Kennedy Space Center's Runway 15 after completing a successful mission to service the Hubble Space Telescope. Touchdown occurred at 3:32 am (EST), resulting in a mission that was just minutes short of ten days. Shown in this onboard crew photo are (front, L to R) Scott Horowitz (pilot), Kenneth Bowersox (commander), and Steven Hawley. In the rear are (L to R) Steven Smith, Gregory Harbaugh, Mark Lee, and Joseph Tanner. (NASA photo)

Mission STS-82 Discovery. FEBRUARY 21, 1997. Commemorative cover postmarked with manual cancel in KSC on the date and time of landing.

Launch of the Discovery STS-85
86th Space Shuttle Mission

Colorano "Silk" Cachet



August 7, 1997. Space shuttle Discovery left Kennedy Space Center to begin the sixth shuttle mission of 1997. Six astronauts would perform a variety of scientific experiments during the successful 12-day flight. Shown (L to R) in this pre-flight crew photo are mission commander Curtis L. Brown and shuttle pilot Kent V. Rominger in front, and in back: Robert L. Curbeam, Jr., Stephen K. Robinson, N. Jan Davis, and Bjarni Tryggvason (from the Canadian Space Agency). (NASA photo)

Mission STS-85 Discovery. AUGUST 7, 1997. Commemorative cover postmarked with manual cancel in KSC on the date of launch. This was second flight of CRISTA-SPAS (Crista-Spas-02). The fourth mission in a cooperative venture between the DARA and NASA. Payload included three telescopes and four spectrometers. During than more 200 hours of free flight, CRISTA collected 38 full atmospheric profiles of the middle atmosphere. A total of 22 sounding rockets and 40 ballons were launched to provide correlating data.

Colorano "Silk" Cachet

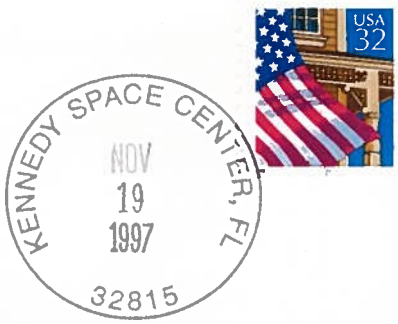
CRISTA-SPAS SATELLITE CAPTURED
STS-85 - 86th Shuttle Mission

August 16, 1997. After flying free for nine days, the CRISTA-SPAS-2 satellite has just been grappled by Discovery's Remote Manipulator System (RMS). A short while later the satellite was re-berthed in the cargo bay. Puget Sound and the Seattle, Washington area can be seen in the background. (NASA photo)

Mission STS-85 Discovery. AUGUST 16, 1997. Commemorative cover postmarked with manual cancel in Houston during the mission.

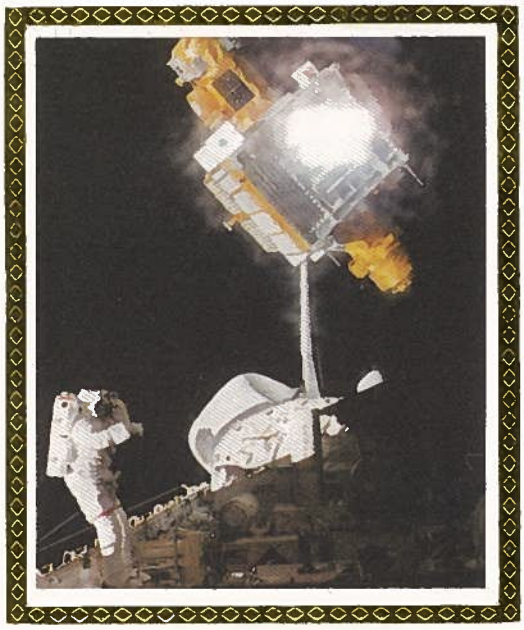
Launch of the Columbia STS-87
88th Space Shuttle Mission

Colorano "Silk" Cachet



November 19, 1997. Space Shuttle Columbia left Kennedy Space Center for a 16-day mission in Earth orbit that would include two space walks. Shown in this pre-flight photo are crew members (L to R in orange suits) Kalpana Chawla, pilot Steven Lindsey, commander Kevin Kregel, and Leonid Kadenyuk. Wearing the white EVA Mobility Units are (L to R) Winston Scott and Takao Doi. Kadenyuk is from the Ukraine, and Doi represents the Japanese Space Agency. (NASA photo)

Mission STS-87 Columbia. NOVEMBER 19, 1997. Commemorative cover postmarked with manual cancel on the date of launch.



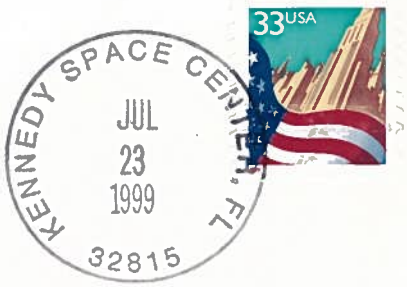
Colorano "Silk" Cachet

SPACE WALK #1
STS-87 - 88th Shuttle Mission
November 24, 1997. Astronaut Winston Scott and Takao Doi of Japan's NASDA (obscured in the dark shadows) await the right opportunity to grab onto the malfunctioning Spartan satellite deployed a few days earlier. A little later, when Columbia moved closer to Spartan, the two mission specialists were able to successfully grab the satellite manually and berth it in Columbia's cargo bay. (NASA photo)

Mission STS-87 Columbia. NOVEMBER 24, 1997. Commemorative cover manually cancelled in Houston during the mission. Research using other major payload, SPARTAN-201-04 free flyer, was not completed. SPARTAN deploy delayed to Nov. 21 to allow time for companion spacecraft, the solar and heliospheric observatory (SOHO) already on-orbit, to come back on-line. SPARTAN failed to execute a pirouette maneuver several minutes after the release. Captured Nov. 24 during an EVA.

Launch of the Columbia STS-93
95th Space Shuttle Mission

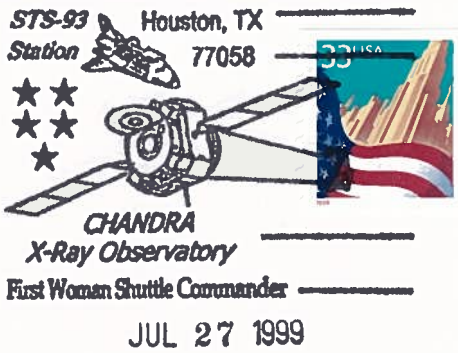
Colorano "Silk" Cachet



July 23, 1999. Five astronauts pose in this pre-flight crew photo with a model of their primary payload — the Chandra X-Ray observatory. Shown (L to R) are Eileen Collins (mission commander), Steven Hawley, Jeffrey Ashby (pilot), Michel Tognini, and Catherine Coleman. Tognini represents France's Centre National d'Etudes Spatiales. Collins is the first woman to command a shuttle flight. (NASA Photo)

Mission STS-93 Columbia. JULY 23, 1999. Commemorative cover postmarked with manual cancel in KSC on the date of launch. STS-93, the shortest scheduled mission since 1990, was the first mission in Space Shuttle history to be commanded by a woman, Eileen Collins. On the first day, the CHANDRA X-RAY OBSERVATORY was deployed. Following the second IUS burn, Chandra's solar array were deployed and the IUS separated from the observatory. The Southwest Ultraviolet Imaging System (SWUIS) was used aboard Columbia to capture imagery of Earth, the Moon, Mercury, Venus and Jupiter.

Colorano "Silk" Cachet

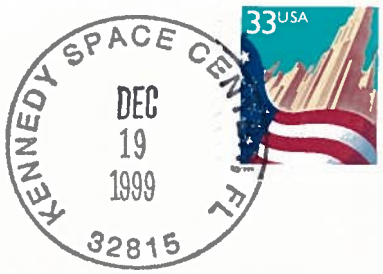


FRENCH ASTRONAUT MICHEL TOGNINI
STS-93 - 95th Shuttle Mission
July 27, 1999. Astronaut Michel Tognini, mission specialist, representing France's Centre National d'Etudes Spatiales (CNES), prepares for Space Shuttle Columbia's descent to Earth on the fifth and final day of the STS-93 mission. (NASA photo)

Mission STS-93 Columbia. JULY 27, 1999. Commemorative cover postmarked with machine cancel in Houston on the date of landing.

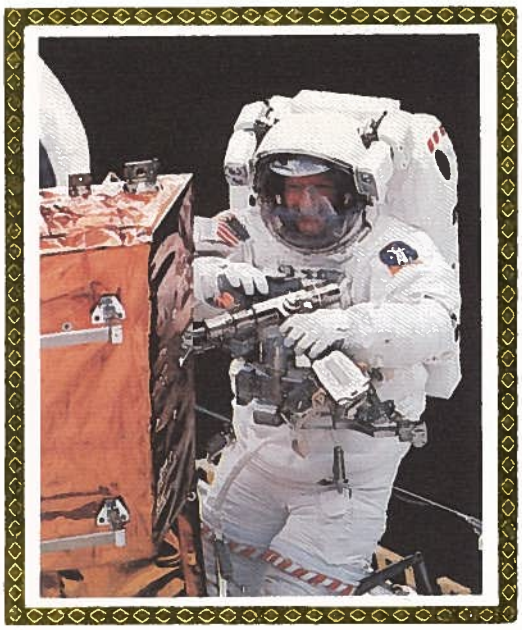
Launch of the Discovery STS-103
96th Space Shuttle Mission

Colorano "Silk" Cachet



December 19, 1999. Space Shuttle *Discovery* left Florida's Kennedy Space Center today to begin a mission to repair the Hubble Space Telescope. Shown in this pre-flight crew photo are (L to R) C. Michael Foale, Claude Nicollier, Scott Kelly (pilot), Curtis Brown Jr. (mission commander), Jean-Francois Clervoy, John Grunsfeld and Steven Smith. Nicollier and Clervoy represent the European Space Agency (ESA). (NASA Photo)

Mission STS-103 Discovery. DECEMBER 19, 1999. KSC manual cancel on the date of launch.



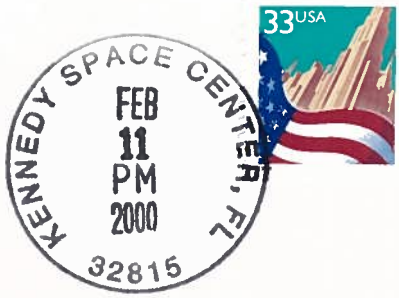
Colorano "Silk" Cachet

SECOND EXTRAVEHICULAR ACTIVITY (SPACE WALK)
STS-103 - 96th Shuttle Mission
December 23, 1999. Astronaut Claude Nicollier from the European Space Agency (ESA), works at a storage enclosure using one of the Hubble Space Telescope (HST) power tools during the second of three space walks that would successfully upgrade the orbiting observatory's main computer. Nicollier was joined by C. Michael Foale during this 8-hour, 10-minute space walk, the third longest in shuttle history. (NASA photo)

Mission STS-103 Discovery. DECEMBER 23, 1999. Houston machine cancel affixed during the mission. STS-103 restored the HST to working order and upgraded some of its systems, allowing the decade-old observatory to get ready to begin its second scheduled decade of astronomical observations. After a 30-orbit chase, using the orbiter's robotic arm, the HST is placed in the rear of cargo bay. Three EVA were conducted for a total time of about 25 hours. Hubble was released from Discovery's cargo bay on Christmas Day.

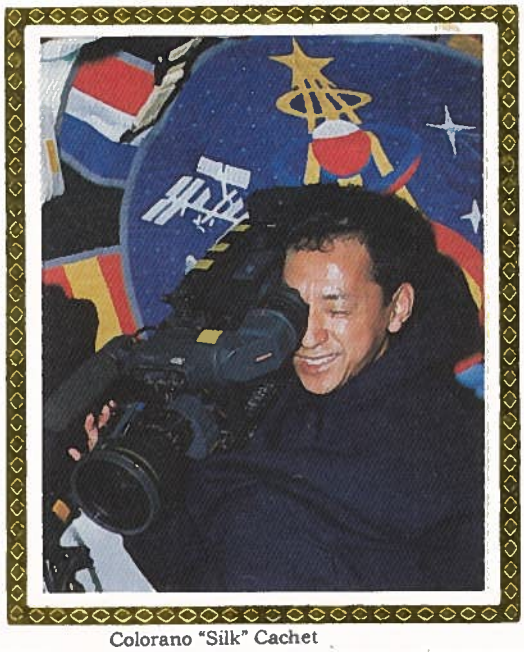
Launch of the Discovery STS-99
97th Space Shuttle Mission

Colorano "Silk" Cachet



February 11, 2000. An international crew assigned to STS-99 poses for the traditional crew portrait at Johnson Space Center. In front (L to R) are Japan's Mamoru Mohri and Gerhard Thiele of the European Space Agency. At rear (L to R) are mission specialist Janice Voss, mission commander Kevin Kregel, shuttle pilot Dominic Gorie, and Janet Kavandi, mission specialist. (NASA Photo)

Mission STS-99 Endeavour. FEBRUARY 11, 2000. Commemorative cover postmarked with manual cancel in KSC on the date and time of launch.

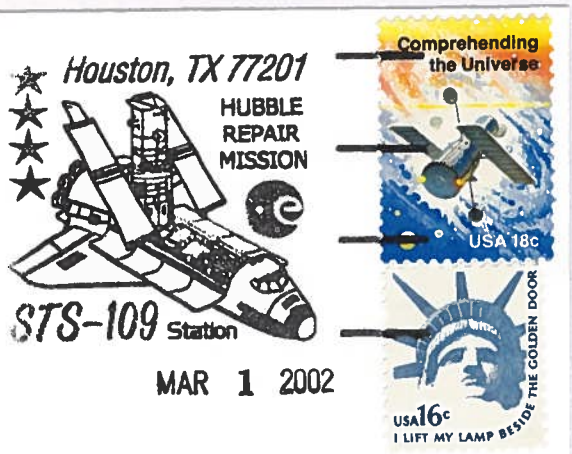


Colorano "Silk" Cachet

THE BLUE TEAM
STS-99 - 97th Shuttle Mission
February 16, 2000. Astronauts worked around-the-clock, in two teams, during the most ambitious Earth-mapping mission to date. The goal was to provide a 3-dimensional topographical map of the world's surface. Here, Japan's Mamoru Mohri, a member of the Blue Team, uses a high-definition television camera in *Endeavour's* mid-deck (NASA photo)

Mission STS-99 Endeavour. FEBRUARY 16, 2000. Commemorative cover postmarked with machine cancel in Houston during the mission. The Shuttle Radar Topography Mission mast was deployed successfully to its full length, and the antenna was turned to its operation position. During 222 hours and 23 min. of mapping, Endeavour's radar images filled 332 high density tapes, covering 99,98% of the planned mapping area from 60 degrees North to 56 degrees South.

SPACE SHUTTLE
STS-109/COLUMBIA



Mission STS-109 Columbia. MARCH 1, 2002. Houston machine cancel on the date of launch. The 11-day mission rejuvenated the HST in a series of five spacewalks , assisted by mission specialist Nancy Jane Currie operating the robotic arm. The spacewalkers installed new and improved equipment that gave the telescope more power and a camera able to see twice as much area, with more speed and clarity.

Colorano "Silk" Cachet

HUBBLE SPACE TELESCOPE
STS-125 - 126th Shuttle Mission
MAY 14, 2009. A wide view of the Hubble Space Telescope, locked down in the cargo bay of the Earth-orbiting Space Shuttle Atlantis, which will be the site of a great deal of hands-on servicing over the next five days. The Canadian-built remote manipulator system arm (right) was instrumental in grappling and subsequently capturing the giant orbital observatory for the final servicing mission. (NASA photo)

Mission STS-125 Atlantis. MAY 14, 2009. Houston machine cancel affixed during the mission. Conducting five spacewalks during their mission, to extend the life of the orbiting observatory, Atlantis astronauts repaired and upgraded it. The result is six working, complementary science instruments with capabilities beyond what was available and an extended operational lifespan until at least 2014.

Chapter 8. MISSIONS DEDICATED TO DEPARTMENT OF DEFENSE

Mission STS-4 Columbia. JUNE 28, 1982. Commemorative cover postmarked with manual cancel in Houston during the mission. The final STS research and development flight. Cargo included a classified Department of Defense (DoD) payload.

Mission STS-4 Columbia. JULY 4, 1982. Edwards manual cancel on the date and time of landing.

Mission STS-51C Discovery. JANUARY 24, 1985. Commemorative cover postmarked with machine cancel in KSC on the date and time of launch. Mission dedicated to the DoD. The U.S. Air Force Inertial Upper Stage (IUS) was deployed and met the mission objectives.

Mission STS-51C Discovery. JANUARY 27, 1985. Commemorative cover postmarked with manual cancel in KSC on the date of landing.

Initial Stage of Takeoff
Flight 51-J
Atlantis Space Shuttle
Just leaving Pad
at Kennedy Space Center

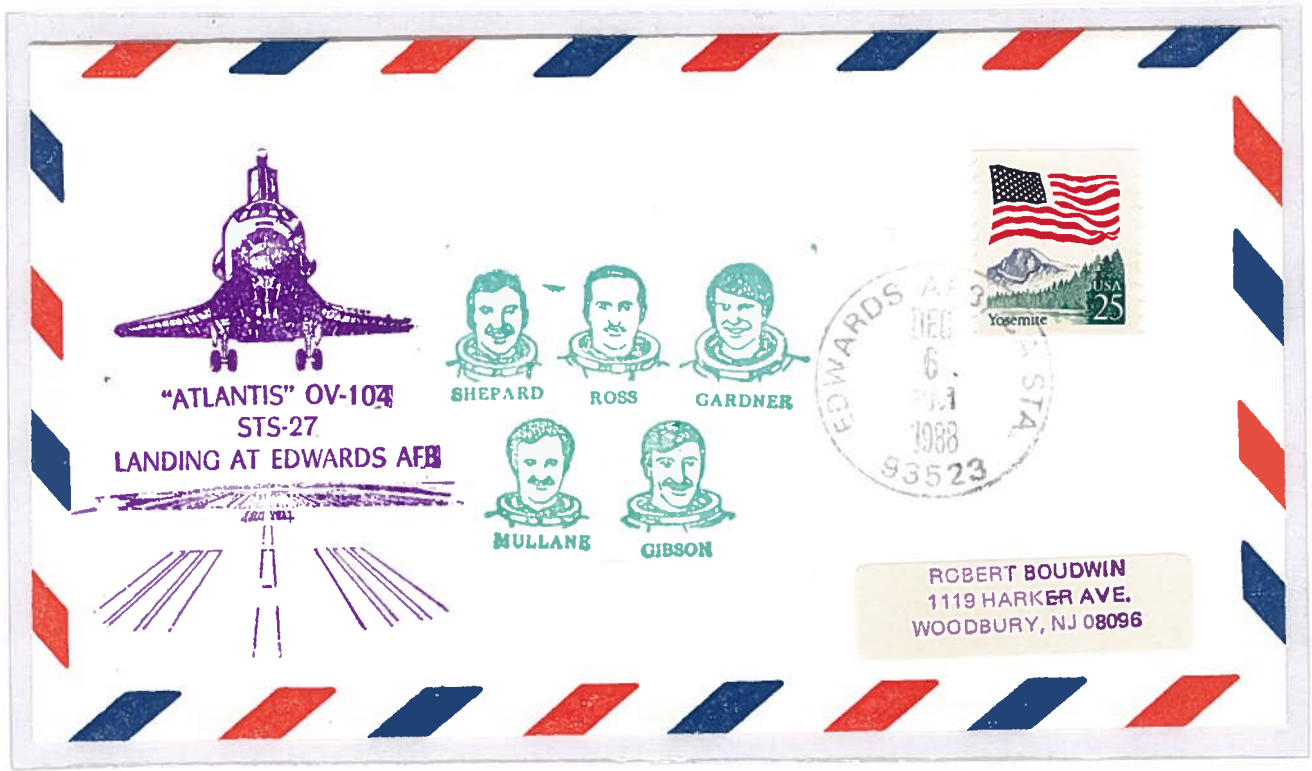
Mission STS-51J Atlantis. OCTOBER 3, 1985. Commemorative cover postmarked with machine cancel in KSC on the date and time of launch. Mission dedicated to the DoD. The launch was delayed 22 minutes, 30 seconds due to a main engine liquid hydrogen prevalve close.

FIRST FLIGHT
SPACE SHUTTLE ATLANTIS

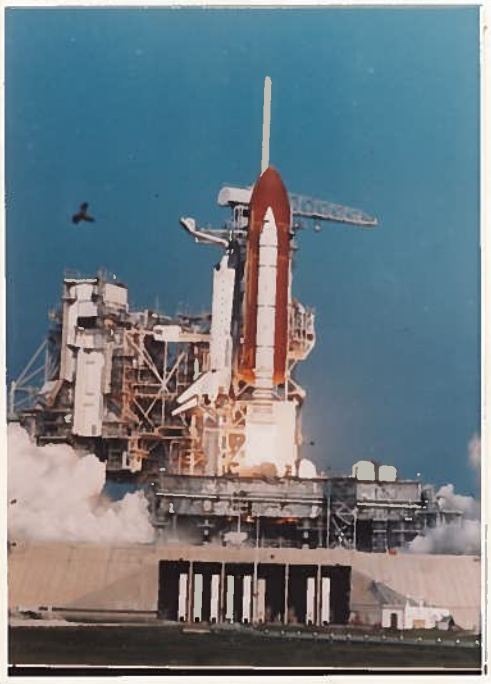
STS 51-J Crew Insignia. Designed by Atlantis' first crew pays tribute to the Statue of Liberty and the ideas it symbolizes. The historical gateway figure bears additional significance for Astronaut Karol J. Bobko, Mission Commander and Astronaut Ronald J. Grabe, Pilot, both New York natives.

Mission STS-51J Atlantis. OCTOBER 4, 1985. Commemorative cover postmarked with machine cancel in KSC during the mission.

Mission STS-27 Atlantis. DECEMBER 2, 1988. Commemorative cover postmarked with manual cancel in Houston on the date of launch. Mission dedicated to the DoD. The launch, set for December 1, was postponed due to unacceptable cloud cover and wind conditions.



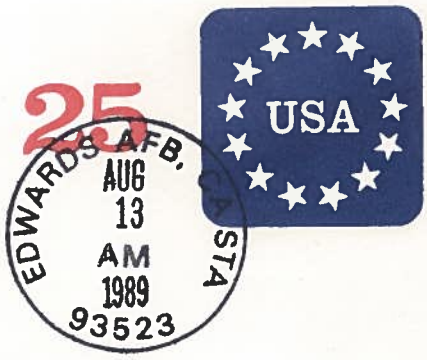
Mission STS-27 Atlantis. DECEMBER 6, 1988. Commemorative cover postmarked with manual cancel in Edwards on the date of landing.



Columbia STS-28 is pictured just prior to clearing the tower at Launch Pad 39-B. The spacecraft renews flight after a period of three and a half years. The five crew-members aboard are Astronaut Brewster H. Shaw Jr., Richard N. Richards, David C. Leestma, James C. Adamson and Mark N. Brown.

Mission STS-28 Columbia. AUGUST 8, 1989. Commemorative cover postmarked with machine cancel in KSC on the date and time of launch. Mission dedicated to the DoD and first flight of Columbia since mission 61C.

STS-28 LANDING AT EDWARDS AIR FORCE BASE



Space Shuttle Columbia seen just prior to main gear touchdown at Edwards Air Force Base. The landing marked a successful end to a five-day DOD-devoted mission.

Mission STS-28 Columbia. AUGUST 13, 1989. Commemorative cover postmarked with manual cancel in Edwards on the date and time of landing.

Mission STS-33 Discovery. NOVEMBER 22, 1989. Commemorative cover postmarked with machine cancel in KSC on the date and time of launch. Mission dedicated to the DoD. Due to nature of the mission, specific details remain " top secret ". S. David Griggs, a veteran of STS-51D, was to have been the pilot of this mission.

Mission STS-33 Discovery. NOVEMBER 27, 1989. Commemorative cover postmarked with manual cancel in Edwards on the date and time of landing.

Mission STS-36 Atlantis. FEBRUARY 28, 1990. Commemorative cover postmarked with machine cancel in Nassau Bay on the date of launch. Mission dedicated to DoD. The launch set for February 22 was postponed due to illness of the crew commander and weather conditions. It was the first time since Apollo 13 in 1970 that a manned space mission was affected by the illness of a crew member.

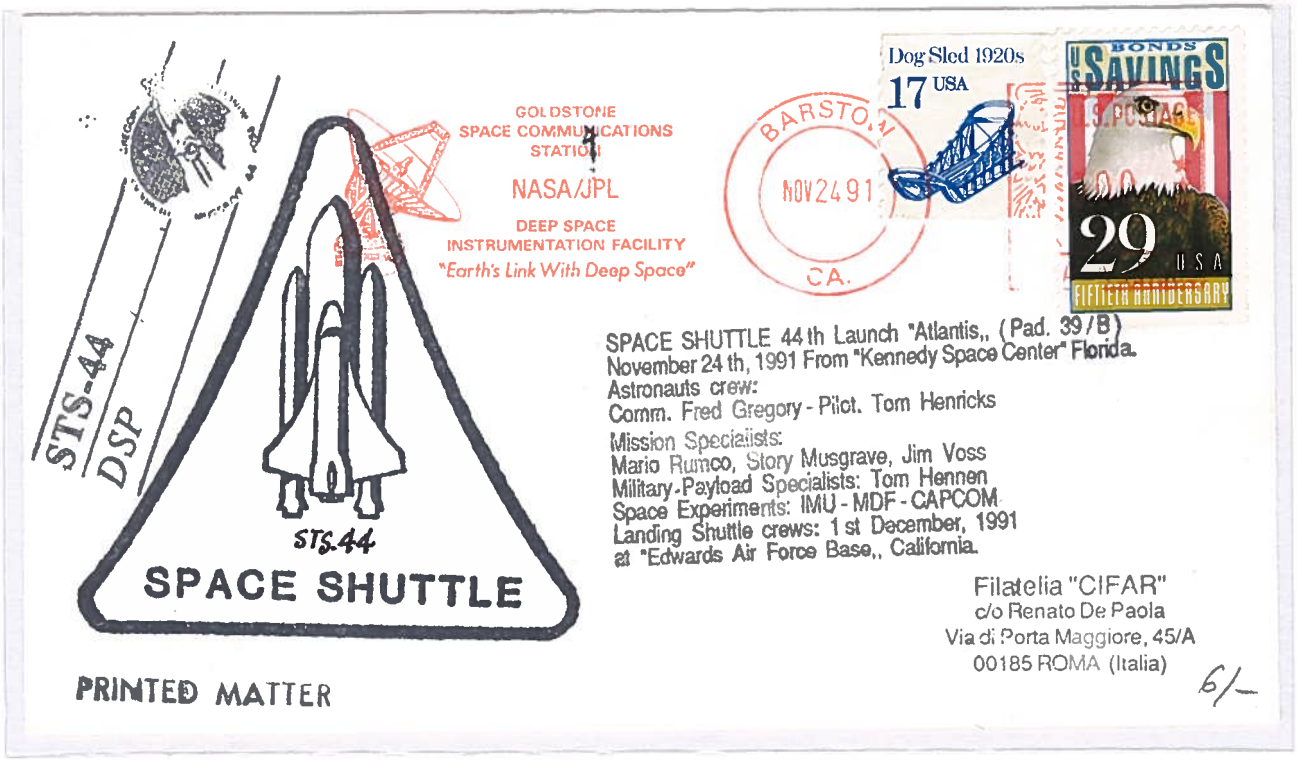
Mission STS-36 Atlantis. MARCH 13, 1990. Commemorative cover postmarked with machine cancel in KSC on the date and time of piggyback home.

Mission STS-38 Atlantis. NOVEMBER 15, 1990. Commemorative cover postmarked with manual cancel in Houston on the date and time of launch. Mission dedicated to DoD. The launch was originally scheduled for July 1990. The mission was extended by one day due to unaccettable crosswinds at the original planned landing site of Edwards. Continued adverse conditions led to a decision to shift the landing to KSC.

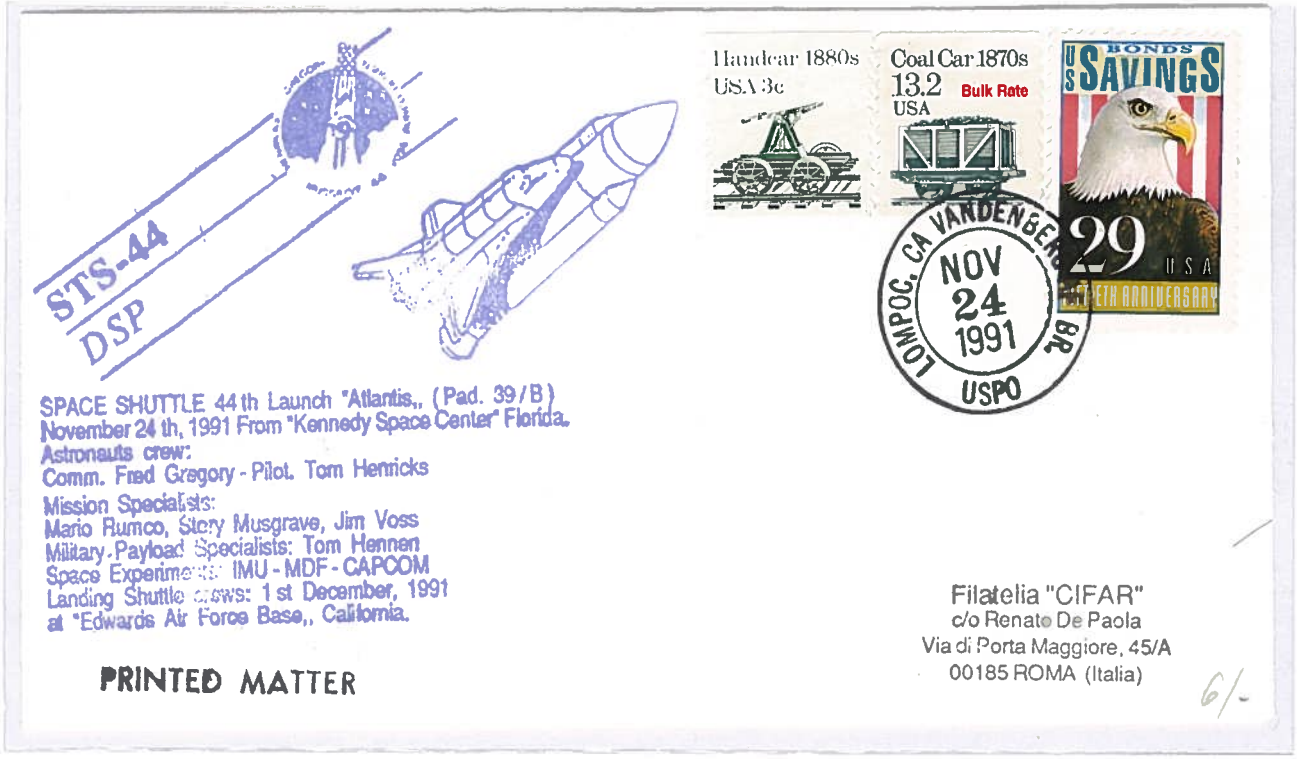
Mission STS-38 Atlantis. NOVEMBER 20, 1990. Commemorative cover postmarked with machine cancel in KSC on the date and time of landing.

Mission STS-39 Discovery. APRIL 28, 1991. Commemorative cover postmarked with machine cancel in KSC on the date and time of launch. Dedicated DoD mission. An unclassified payload included Air Force Program-675 (AFP675); Infrared Background Signature Survey (IBSS); Chemical Release Observation (CRO) and Shuttle Pallet Satellite-II (SPAS-II) experiments.

Mission STS-39 Discovery. MAY 6, 1991. Commemorative cover postmarked with machine cancel in KSC on the date and time of landing.

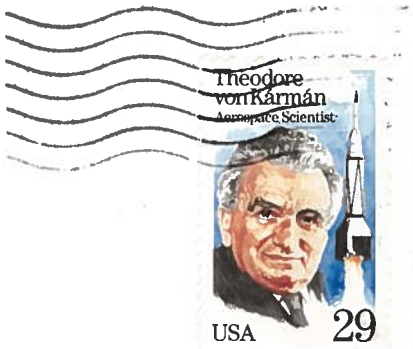


Mission STS-44 Atlantis. NOVEMBER 24, 1991. Commemorative cover postmarked with manual cancel in Barstow on the date of launch. A dedicated DoD mission. The unclassified payload included a Defense Support Program (DSP) satellite and attached IUS. Among various experiments were Military Man in Space (M88-1) and extended Duration Orbiter Medical Project, a series of investigations in support of extended duration orbiter.



Mission STS-44 Atlantis. NOVEMBER 24, 1991. Commemorative cover postmarked with manual cancel in Lompoc on the date of launch.

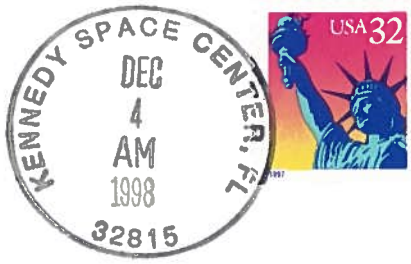
Mission STS-53 Discovery. DECEMBER 2, 1992. Commemorative cover postmarked with machine cancel in Nassau Bay on the date of launch. A classified DoD primary payload, plus two unclassified secondary payloads and nine unclassified middeck experiments.



Mission STS-53 Discovery. DECEMBER 9, 1992. Commemorative cover postmarked with machine cancel in Edwards on the date and time of landing.

Chapter 9. ASSEMBLY AND SUPPLY OF THE ISS

SPACE SHUTTLE
STS-88/ENDEAVOUR



Mission STS-88 Endeavour. DECEMBER 4, 1998. KSC manual cancel on the date and time of launch. First ISS flight. On Dec. 5, the 12,8 ton. Unity Connecting Module was first connected to Endeavour's docking system; on Dec. 6, using the robot arm, the Zarya Control Module was captured from orbit and mated to Unity. Zarya was launched from Baikonour on November 1998. Astronauts Ross and Newman conducted three spacewalks to attach cables, connectors and rails. The two modules were powered up after the astronauts' entry.

Return of the Endeavour STS-88
93rd Space Shuttle Mission

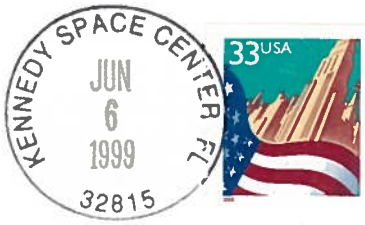
Colorano "Silk" Cachet

December 15, 1998. After assembling the Node and the Functional Cargo Block, cornerstones of the new International Space Station (ISS), and releasing two satellites, Endeavour's crew of six space travelers returned safely to Earth today at 10:53 pm (EST). Shown in the new space station are (L to R) at bottom: Frederick Sturckow, Robert Cabana, and Nancy Currie, and at top: Sergei Krikalev, James Newman, and Jerry Ross. (NASA photo)

Mission STS-88 Endeavour. DECEMBER 15, 1998. KSC manual cancel on the date of landing.

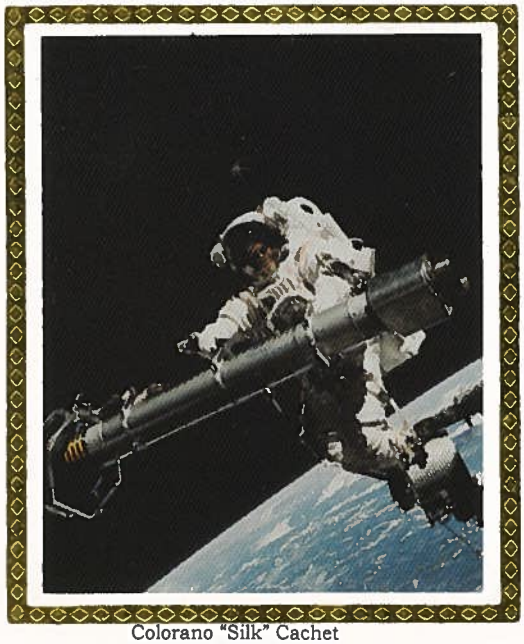
Return of the Discovery STS-96
94th Space Shuttle Mission

Colorano "Silk" Cachet



June 6, 1999. After completing an almost ten-day, 153-orbit mission, Space Shuttle Discovery returned safely to Florida in the early morning hours, landing at 2:03:43 am. This inflight crew photo, taken in the Unity node of the International Space Station pictures at bottom (L to R) Daniel Barry, Julie Payette (Canadian Space Agency), Ellen Ochoa, at center Rick Husband (pilot), and at top (L to R) Valery Tokarev (Russia), Tamara Jernigan, and Kent Rominger (mission commander). (NASA Photo)

Mission STS-96 Discovery. JUNE 6, 1999. KSC manual cancel on the date of landing. Second ISS flight. On May 29, Discovery made the first docking to the ISS. Jernigan and Barry transferred a U.S. built crane called the Orbital Transfer Device, and parts of the Russian crane Strela and attached them to locations on the outside of the station. The 45th spacewalk in Space Shuttle history lasted 7 hours and 55 minutes. The crew transferred 3,567 pounds of supplies and equipment to the interior of the station.



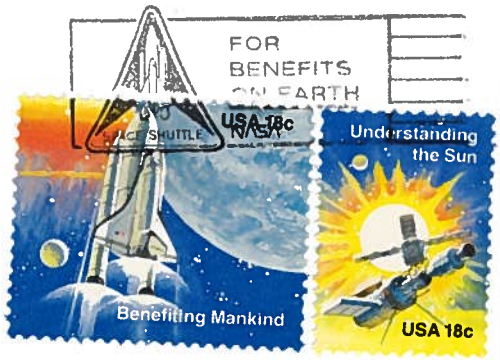
Colorano "Silk" Cachet

MAY 21 2000

EXTRAVEHICULAR ACTIVITY (SPACE WALK)
STS-101 - 98th Shuttle Mission
May 21, 2000. Astronaut James S. Voss works on installing the newly delivered main boom of the Russian crane, Strela. During a 6-hour, 44-minute spacewalk, astronauts Voss and Williams also secured a US-built crane installed last year, replaced a faulty antenna, and installed several handrails and a camera cable to the exterior of the International Space Station. (NASA photo)

Mission STS-101 Atlantis. MAY 21, 2000. Houston machine cancel affixed during the mission. Third ISS flight. During the six-hour, 44 minute EVA, mission specialists Voss and Williams secured a U.S. built crane installed on the station last year; installed the final parts of a Russian built crane, Strela, on the pressurized Mating Adapter-1 that connects the Unity node to the Zarya control module. The astronauts equipped the ISS with new or replacement gear and transferred more than a ton. of supplies into the ISS.

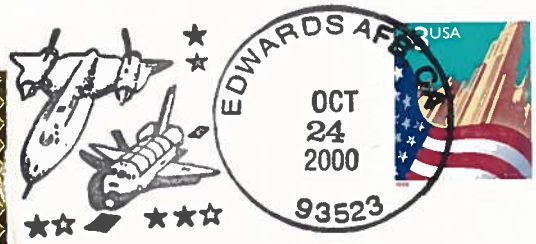
SPACE SHUTTLE
STS-106/ATLANTIS



Mission STS-106 Atlantis. SEPTEMBER 8, 2000. KSC machine cancel on the date and time of launch. ISS flight 2A 2b. On flight day two, Atlantis completed a successful rendezvous and docking with the ISS. STS-106, during its 11-days mission to the ISS, completed all assigned mission objectives to preparate the station for the first crew scheduled to launch in October. A 6 hour and 14 minute EVA, the 50TH spacewalk in Space Shuttle history, was completed by Lu and Malenchenko, routing and connecting nine power, data and communications cables between the Zvezda module and Zarya.

Return of the Discovery STS-92
100th Space Shuttle Mission

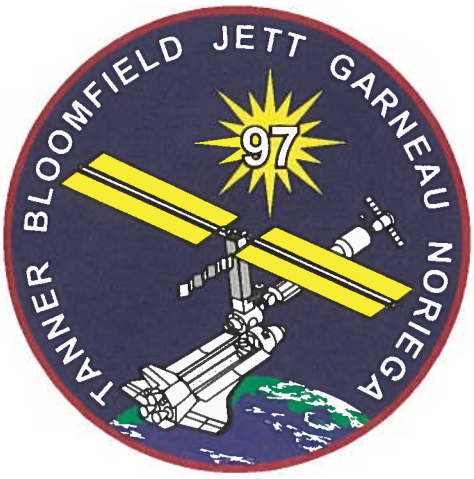
Colorano "Silk" Cachet



Oct. 24, 2000. The main landing gear on the space shuttle *Discovery* is just about to touch down at Edwards Air Force Base in the Mojave Desert, bringing the 100th shuttle mission to a successful close. Inclement weather at Florida's Kennedy Space Center necessitated the California landing, the first in more than 4 years. (NASA Photo)

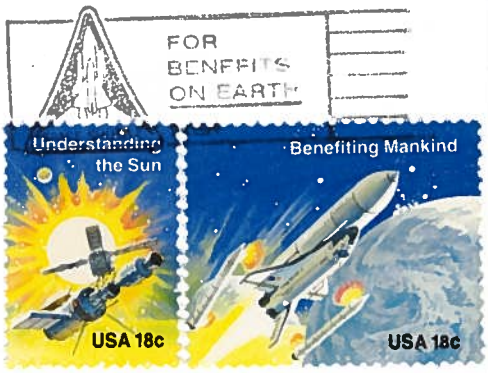
Mission STS-92 Discovery. OCTOBER 24, 2000. Edwards machine cancel on the date of landing. ISS assembly flight 3. 3A. In the afternoon of flight day two, Discovery and her crew completed a successful rendezvous and docking with the ISS. STS-92 completed all assigned objectives to install the Zenith Z1 truss on the Unity connecting module and the third Pressurized Mating Adapter (PMA3) for use as a docking port for subsequent Shuttle missions. During the mission, five mission specialists performed four EVA, for a total time of more than 27 hours.

SPACE SHUTTLE
STS-97/ENDEAVOUR



Mission STS-97 Endeavour. NOVEMBER 30, 2000. Commemorative cover postmarked with machine cancel in Nassau Bay on the date of launch. ISS assembly flight 4A. On their 11-day mission, the astronauts completed three EVAs, to deliver and connect the first set of U.S. provided solar arrays to the ISS, prepare a docking port for arrival of the U.S. laboratory Destiny. Mission specialist Garneau used the RMS to remove the P6 truss from the payload bay, maneuvering it into an overnight park position to warm its components.

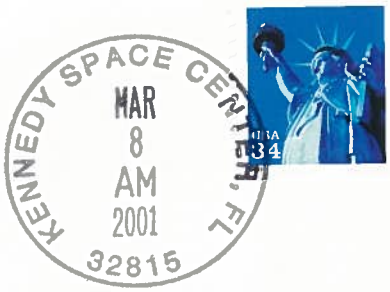
SPACE SHUTTLE
STS-98/ATLANTIS



Mission STS-98 Atlantis. FEBRUARY 7, 2001. KSC machine cancel on the date and time of launch. ISS assembly flight 5A. After docking to ISS, on day 2, Station and Shuttle crews opened hatches and unloaded supplies: three 12-gallons bags of water, a spare computer, cables to be installed inside the Station to power up Destiny. On Feb. 10, the U.S. laboratory Destiny was successfully installed on node 1 using the RMS and concurrent EVAs.

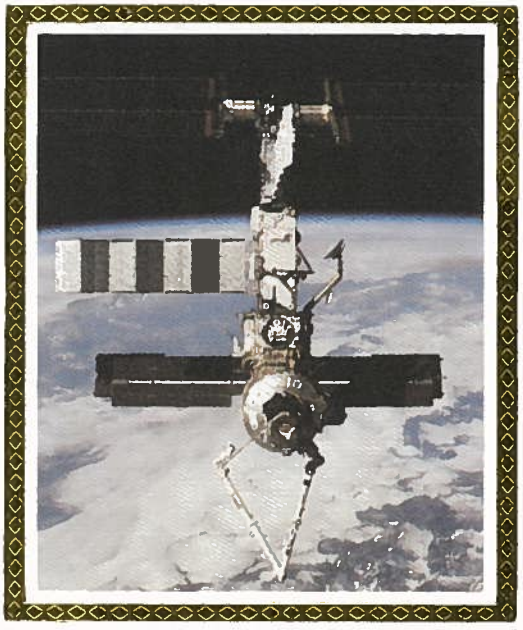
Launch of the Discovery STS-102
103rd Space Shuttle Mission

Colorano "Silk" Cachet



March 8, 2001. This pre-flight crew photo depicts the ten astronauts who will participate in the STS-102 mission. At top (L to R) are the 4 permanent STS-102 crew members: pilot James Kelly, Andrew Thomas, commander James Wetherbee, and Paul Richards. The three at bottom left are the Expedition One crew currently living aboard the International Space Station (ISS): Sergei Krikalev, William Shepherd, and Yuri Gidzenko. The three at bottom right are the new ISS Expedition Two crew: James Voss, Yury Usachev, and Susan Helms. (NASA Photo)

Mission STS-102 Discovery. MARCH 8, 2001. KSC manual cancel on the date and time of launch. ISS assembly flight 5A.1. A sunrise launch carried the second resident crew to the ISS. Joint operations between the Shuttle crew and the Station crews resulted in unloading almost five tons of experiments and equipment from MPLM Leonardo and packing almost one ton. of items for return to Earth. On March 11, Helms and Voss began a record-breaking EVA. They prepared the pressurized Mating Adapter-3 to be moved from the Unity module to make room for Leonardo. On March 18, the MPLM was back in Discovery's payload bay.



Colorano "Silk" Cachet

FIRST USE OF RAFFAELLO, THE 2nd ITALIAN MULTIPURPOSE LOGISTIC MODULE

A NEW LOOK FOR THE INTERNATIONAL SPACE STATION
STS-100 - 104th Shuttle Mission
April 29, 2001. As the shuttle *Endeavour* prepared to leave the International Space Station (ISS) and head for home, the newly-installed Space Station Robotic Manipulator System (SSRMS), or Canadarm2 as it is also called, is clearly visible at the bottom of this photo taken by a shuttle crew member. (NASA photo)

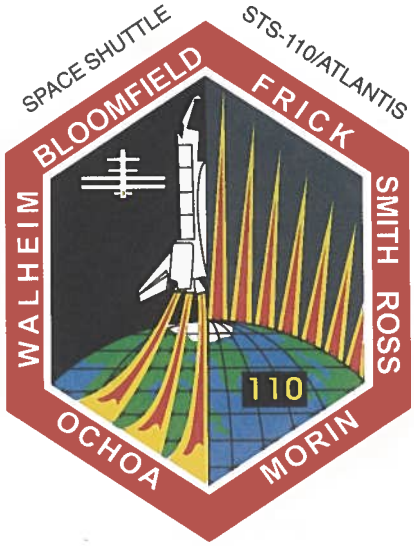
Mission STS-100 Endeavour. APRIL 29, 2001. Houston manual cancel affixed during the mission. ISS assembly flight 6A. The highest priority objective of the flight was the installation, activation and checkout of the Canadarm 2 robotic arm on the station. Other major objective for Endeavour's mission was to berth the Raffaello logistic module to the station, activate it, transfer cargo between Raffaello and the station. Raffaello is the second of three ASI-Developed Multi-Purpose Logistics Module. Among the crew members, the Italian astronaut Umberto Guidoni, mission specialist.

Mission STS-104 Atlantis. JULY 12, 2001. Nassau Bay machine cancel on the date of launch. ISS assembly flight 7A. Its primary objectives were to install the Quest Joint Airlock and help performance on the ISS. Mission specialists Gernhardt and Reilly conducted three spacewalks while Atlantis was docked to the ISS, they spent a total of 16 hours and 30 minutes outside. Once installed and activated, the ISS Airlock became the primary path for ISS spacewalk entry and departure for U.S. spacesuits, which are know as Extravehicular Mobility Units, or EMUs.

Colorano "Silk" Cachet

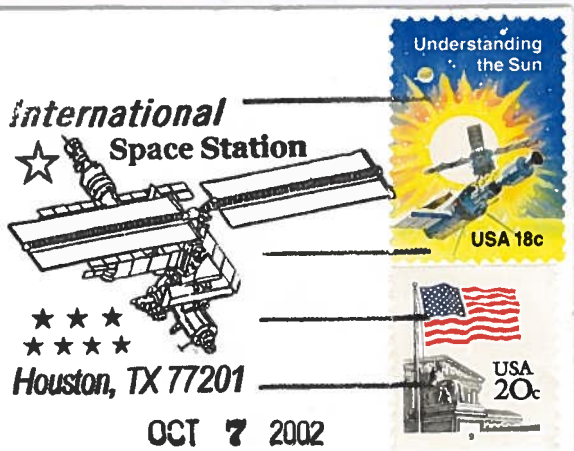
Mission STS-105 Discovery. AUGUST 16, 2001. Houston machine cancel affixed during the mission. ISS assembly flight 7A.1. Part of the mission was to bring the next resident crew, Expedition 3, to the ISS and return, Expedition 2, to Earth. The payload included the Early Ammonia Servicer (EAS) to be installed on the ISS . During this time docked with the ISS, crew unloaded 7,000 pounds of supplies, equipment and science racks from the MPLM Leonardo, storing it on the Space Station.

Mission STS-108 Endeavour. DECEMBER 5, 2001. KSC machine cancel on the date and time of launch. ISS assembly flight UF-1. Endeavour delivered the Expedition 4 crew to the orbital out post. The Expedit. 3 crew returned to Earth. While at the Station, Endeavour pilot Mark Kelly and mission specialist Linda Godwin, conducted one spacewalk. Using the robotic arm, attached the MPLM to a berth on the Station's Unity node, so that about 2,7 metric tons (3 tons) of equipment and supplies.



Mission STS-110 Atlantis. APRIL 8, 2002. Houston machine cancel on the date of launch. ISS assembly flight 8A. STS-110 was the first Shuttle mission to feature the upgrade Block II main engines. The intent of the upgrade was to increase the flight capacity of the engines, while increasing reliability and safety. The main purpose of STS-110 was to attach the S0 truss segment to ISS to the Destiny Laboratory Module . With the launch of Atlantis, mission specialist Jerry Ross became the first human to have traveled to space seven times.

Mission STS-111 Endeavour. JUNE 5, 2002. Houston machine cancel on the date of launch. ISS assembly flight UF2. STS-111 resupplied the Station and replaced the Expedition 4 crew with the Expedition 5 crew. June 8, using the Shuttle's robotic arm, commander Kenneth Cockrell moved the MPLM Leonardo to the Unity module. June 10, Whitson and Walz used the Canadarm 2 to move the Mobile Remote Service Base System (MBS) to the mobile transporter on Destiny Lab. The MBS will allow the Canadarm 2 to travel the length of the Station.



Mission STS-112 Atlantis. OCTOBER 7, 2002. Houston machine cancel on the date of launch. ISS assembly flight 9A. Activities include three EVAs to attach the Starboard 1 (S1) truss segment to the Station, using the Canadarm 2, with four remotely operated bolts. The 14 ton., 45 foot S1 truss provided structural support for the Space Station radiators. Other payload was the Crew and Equipment Translation Aid (CETA) Cart A, the first of two human-powered carts that will ride along the ISS railway, providing mobile work platforms for future spacewalking astronauts.

Launch of the Endeavour STS-113
112th Space Shuttle Mission

Colorano "Silk" Cachet

Nov. 23, 2002. The four astronauts shown in this pre-flight crew photo will take up the sixth crew to the International Space Station (ISS) and return with the three ISS residents who comprise the Expedition Five crew. In front (L to R) are shuttle pilot Paul Lockhart, and mission commander James Wetherbee. At rear are mission specialists Michael Lopez-Alegria and John Herrington. (NASA Photo)

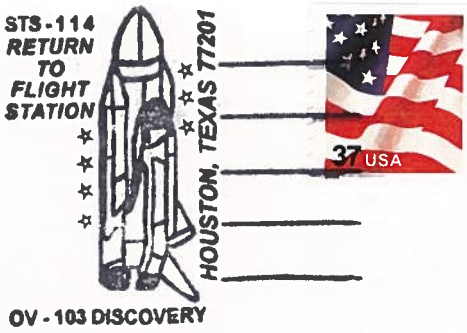
Mission STS-113 Endeavour. NOVEMBER 23, 2002. KSC manual cancel on the date of launch. ISS assembly flight 11A. Over the course of the mission, the STS-113 crew and the Expedition 6 crew combined to install the new P1 truss to ISS, perform three spacewalks to outfit and activate the truss, and transfer supplies and equipment. During the second EVA, working from the Canadarm 2, Herrington lifted the CETA cart to the S1 truss where he attached it to the tracks and secured it to its sister CETA.

Colorano "Silk" Cachet

SPACE SHUTTLE DISCOVERY STS-114
July 26, 2005. The STS-114 crew patch signifies the return of the Space Shuttle to flight and honors the memory of the STS-107 Columbia crew. The blue Shuttle rising above Earth's horizon includes the Columba constellation of seven stars, echoing the STS-107 patch and commemorating the seven members of that mission. (NASA photo)

Mission STS-114 Discovery. JULY 26, 2005. Nassau Bay machine cancel on the date of launch. ISS assembly flight LF1. Two and a half years were spent researching and implementing safety improvements for orbiters and external tanks. Prior to the first spacewalk, mission specialist Wendy Lawrence and pilot James Kelly guided the Station's robotic arm, Canadarm 2, to lift the MPLM Raffaello for attachment to the Unity module.

Colorano "Silk" Cachet



FIRST EXTRAVEHICULAR ACTIVITY (SPACEWALK)
STS-114 - 114th Shuttle Mission
July 30, 2005. Astronaut Soichi Noguchi (JAXA) and crewmate Stephen Robinson (not shown) completed a demonstration of Shuttle thermal protection repair techniques and enhancements to the ISS attitude control system during a successful 6-hour, 50-minute space walk. (NASA photo)

Mission STS-114 Discovery. JULY 30, 2005. Houston machine cancel affixed during the mission. ISS assembly flight LF1. The first spacewalk demonstrated repair techniques on the Shuttle's thermal protection system. During the second, the spacewalkers replaced the failed gyroscope. On the third, attached to the Canadarm 2, Robinson was moved to the site on Discovery's under side where he gently pulled the two protruding gap fillers from between thermal protection tiles. Other event was installing a fifth Materials International Space Station Experiment (MISSE).

Launch of the Discovery STS-121
115th Space Shuttle Mission

Colorano "Silk" Cachet

July 4, 2006. The seven astronauts comprising the STS-121 crew are (L to R) mission specialists Stephanie D. Wilson and Michael E. Fossum, Shuttle commander Steven W. Lindsey, mission specialist Piers J. Sellers, Shuttle pilot Mark E. Kelly, European Space Agency astronaut Thomas Reiter of Germany, and Lisa M. Nowak, both mission specialists. (NASA photo)

Mission STS-121 Discovery. JULY 4, 2006. KSC manual cancel on the date and time of launch. ISS assembly flight ULF1.1. The fourth day in space was a busy one. In order to unload the cargo from the MPLM Leonardo, the astronauts had to remove the Module from payload bay and moor it to the Space Station's Unity Module. Fossum and Sellers made preparations for the next day's spacewalk and reviewed procedures to configure Quest, the U.S. Airlock, which is the main exit and entry access for spacewalkers.

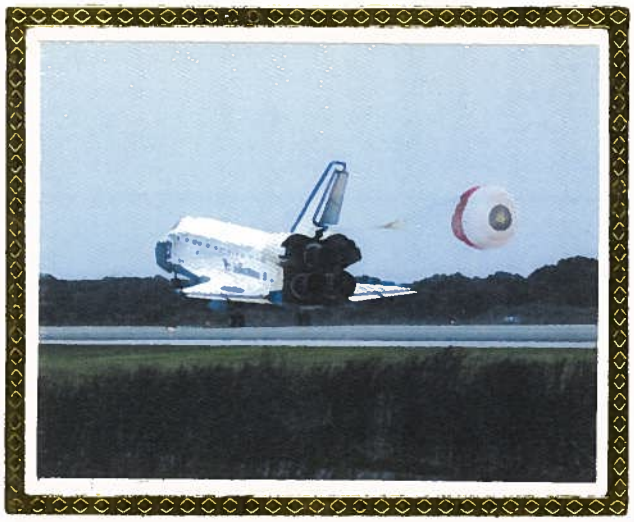
Launch of the Atlantis STS-115
116th Space Shuttle Mission

Colorano "Silk" Cachet

SEP 9, 2006. The crew of STS-115 pose for a pre-flight group portrait. In front (L toR) are pilot Christopher J. Ferguson and mission commander Brent W. Jett, Jr. In back (L toR) ar astronauts Heidemarie M. Stefanyshyn-Piper, Joseph R. (Joe) Tanner, Daniel C. Burbank and Steven G. MacLean, who represents the Canadian Space Agency. (NASA photo)

Mission STS-115 Atlantis. SEPTEMBER 9, 2006. KSC manual cancel on the date and time of launch. ISS assembly flight 12A. The mission was biled as one of most complicated space construction effort ever conducted, and the STS-115 astronauts had trainer longer than any other NASA crew. The STS-115 crew delivered and installed the P3/P4 Truss structure on the ISS. Three EVA were carried out to put the new P3/P4 Truss in service, utilizing both Shuttle and Station robotic arms, Canadarm and Canadarm 2.

Return of the Discovery STS-116
117th Space Shuttle Mission



Colorano "Silk" Cachet

DEC 22, 2006. The space shuttle *Discovery* returned to Earth today, landing at Florida's Kennedy Space Center at 5:32 p.m. The 13-day mission to the International Space Station (ISS) lasted almost 13 days, covered a distance of 5.3 million miles and completed 204 Earth orbits. Astronaut Sunita Williams remained at the ISS as a member of the station crew, while Thomas Reiter returned home after spending almost 6 months in space. (NASA photo)

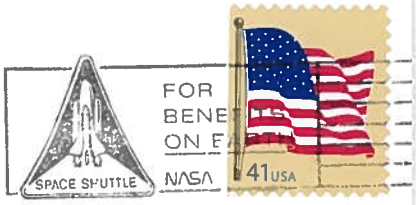
Mission STS-116 Discovery. DECEMBER 22, 2006. KSC manual cancel on the date and time of launch. ISS assembly flight 12A.1. The STS-116 crew continued construction of the outpost adding the P5 Space Truss segment during the first of four EVA. The next two spacewalks rewired the Station's power system, preparing it to support the Station's final configuration and the arrival of additional science modules. A fourth EVA was added to allow the crew to retract solar arrays that had folded improperly.

Mission STS-117 Atlantis. JUNE 22, 2007. Edwards machine cancel on the date of landing. ISS assembly flight 13A. Atlantis delivered to ISS the second Starboard Truss Segment (S3/S4 truss) and its associated energy systems, including a set of solar arrays. On 11 June 2007, NASA managers annonced a two-days extension of the mission, adding a fourth EVA.

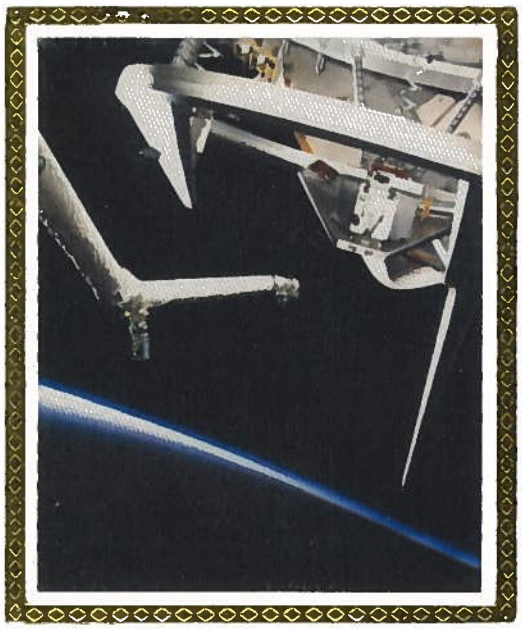
Mission STS-118 Endeavour. AUGUST 8, 2007. KSC machine cancel on the date and time of launch. ISS assembly flight 13A.1. On the flight day 4, Rick Mastracchio and Dave Williams started the first EVA of the mission, installing the S5 truss to the Station, increasing the total mass of the ISS to 232,693 kg. The EVA duration was 6 hours and 17 minutes, and all objectives were successfully completed, as well as External Stowage Platform 3 (ESP-3) and a Replacement Control Moment Gyroscope (CMG).

Mission STS-120 Discovery. NOVEMBER 7, 2007. KSC manual cancel on the date and time of landing. ISS assembly flight 10A. Launch package consisted of the pressurized habitable Harmony Module (also know as Node 2), built for NASA by Thales Alenia Space in Torino, Italy. After Discovery undocked, the Station's robotic arm detached PMA-2 from Destinity, and moved it to the forward port of Harmony. Following the relocation of PMA-2, the robotic arm has moved Harmony from its initial position to its final position on the forward port of Destinity.

Mission STS-122 Atlantis. FEBRUARY 7, 2008. KSC manual cancel on the date and time of launch. ISS assembly flight 1E. A veteran space flier, Navy cmdr. Stephen N. Frick commanded the STS-122 Shuttle mission to deliver the ESA's Columbus Laboratory to the ISS. On flight day 5, after awakening, both crews began preparing for the mission first spacewalk. Assisting the spacewalkers inside the Station and Shuttle were pilot Alan Poindexter and mission specialist Hans Schlegel, and with Melvin inside the ISS working the robotic arm.



Mission STS-123 Endeavour. MARCH 11, 2008. KSC machine cancel on the date of launch. ISS assembly flight 1J/A. It was the twenty-fifth Shuttle mission to visit the ISS, and delivered the first module of the Japanese Laboratory, Japanese Experiment Module (KIBO), and the Canadian Special Purpose Dexterous Manipulator (SPDM) dextre robotics system to the Station. It was the first mission to fully utilize the Station-to-Shuttle Power Transfer System (SSPTS), allowing Space Station power to augment the Shuttle power systems.



Colorano "Silk" Cachet

Remote Manipulator System
STS-124 - 123rd Shuttle Mission
June 1, 2008. Space Shuttle Discovery's Remote Manipulator System (RMS), docking mechanism, vertical stabilizer and orbital maneuvering system (OMS) pods are featured in this image photographed by an STS-124 crewmember during flight day two activities. The blackness of space and Earth's horizon provide the backdrop for the scene.(NASA Photo)

Mission STS-124 Discovery. JUNE 1, 2008. Houston machine cancel on the date of launch. STS-124 delivered the Pressurized Module (PM) of the Japanese Experiment Module, called KIBO. KIBO was berthed to the Harmony Module and the pressurized section of the JEM, brought up by the STS-123 crew, was moved from Harmony to the JEM-PM. The Japanese Remote Manipulator System, a robotic arm, was also delivered by STS-124 and attached to KIBO.

Mission STS-126 Endeavour. NOVEMBER 30, 2008. Edwards machine cancel on the date of landing. ISS assembly flight ULF2. Endeavour carried a reusable logistics module Leonardo that held supplies and equipment, including additional crew quarters, additional exercise equipment, equipment for the regenerative life support system and spare hardware. STS-126 was scheduled to be a sixteen-day mission with four spacewalk, largely dedicated to servicing and repair of the Solar Alpha Rotary Joints.

Launch of the Discovery STS-119
125th Space Shuttle Mission

Colorano "Silk" Cachet

March 15, 2009. From the right (front row) are NASA astronauts Lee Archambault, commander, and Tony Antonelli, pilot. From the left (back row) are Nasa astronauts Joseph Acaba, John Phillips, Steve Swanson, Richard Arnold and Japan Aerospace Exploration Agency astronaut Koichi Wakata, all mission specialists. The Space Shuttle Discovery's main mission was to deliver the final pair of power generating solar array wings and the S6 truss segment. (NASA Photo)

Mission STS-119 Discovery. MARCH 15, 2009. KSC manual cancel on the date and time of launch. ISS assembly flight 15A. The Discovery delivered to the ISS the fourth Starboard Integrated Truss Segment S6, completing the construction of the Integrated Truss Structure, and the fourth set of solar arrays and batteries to the Station.

Colorano "Silk" Cachet

JUL 27 2009

FIFTH EXTRAVEHICULAR ACTIVITY (SPACEWALK)
STS-127 - 127th Shuttle Mission
July 27, 2009. In the mission's 5th and final EVA, astronauts Cassidy (pictured) and Mashburn completed a 4 hour, 54 minute spacewalk during which they secured multi-layer insulation around Dextre and performed a number of "get ahead" tasks. (NASA photo)

Mission STS-127 Endeavour. JULY 27, 2009. Houston machine cancel affixed during the mission. ISS assembly flight 2J/A. Endeavour carried a wide variety of equipment and cargo, with the largest item being the KIBO Japanese Experiment Module Exposed Facility (JEM EF) and the KIBO Japanese Experiment Logistic Module-Exposed Section (ELM ES). The Exposed Facility is a part not pressurized of KIBO that will allow astronauts to perform science experiments that are axposed to the vacuum of space.

Return of the Discovery STS-128
128th Space Shuttle Mission

Colorano "Silk" Cachet

September 11, 2009. The red-clad crewmembers are with STS -128. They include, front row from left, Rick Sturckow, Jose Hernandez and Patrick Forrester; behind them in red are Kevin Ford, John "Danny" Olivas, with European Space Agency astronaut Christer Fuglesang. At bottom left is Tim Kopra who joined the station crew in July. Surrounding the Discovery crew (clockwise) are Nicole Scott, Canadian astronaut Robert Thirsk, cosmonaut Roman Romanenko, European Space Agency's Frank De Winne, cosmonaut Gennady Padalka and Michael Barratt. The Space Shuttle Discovery touched down September 11, 2009 at 5 53 pm (PDT) at NASA's Edwards Air Force base. (NASA photo)

Mission STS-128 Discovery. SEPTEMBER 11, 2009. Edwards machine cancel affixed during the mission. ISS assembly flight 17A. Space Shuttle Discovery carried the MPLM Leonardo as its primary payload. Leonardo contained a collection of experiments for studying the physics and chemistry of microgravity. Three spacewalks were carried out during the mission which removed and replaced a materials processing experiment outside ESA's Columbus Module, and returned an empty ammonia tank assembly.

Colorano "Silk" Cachet

SECOND SESSION - EXTRAVEHICULAR ACTIVITY
STS-129 - 129th Shuttle Mission
Nov. 21, 2009. Astronaut Randy Bresnik participates in the mission's second session of extravehicular activity. During the spacewalk, Bresnik and astronaut Mike Foreman installed a Grappling Adaptor to On-Orbit Railing Assembly, or GATOR, on the Columbus laboratory, as well as performing additional construction and maintenance on the ISS. GATOR contains a ship-tracking antenna system and a HAM radio antenna. (NASA photo)

Mission STS-129 Atlantis. NOVEMBER 21, 2009. KSC manual cancel affixed during the mission. ISS assembly flight ULF3. The payload bay carried two Large Express Logistics Carriers holding two spare gyroscopes, two nitrogen tank assemblies, two pump modules. The 11-day flight included three spacewalks. STS-129 was the first flight of an Express Logistic Carriers. The completion of this mission left six Space Shuttle remaining until the end of the STS Program, after STS-135 was approved in February 2011.

Colorano "Silk" Cachet

CUPOLA OF THE INTERNATIONAL SPACE STATION
STS-130 - 130th Shuttle Mission
Feb. 19 , 2010. NASA astronaut George Zamka, STS-130 commander, is pictured in a window of the newly-installed Cupola of the ISS while space shuttle Endeavour remains docked with the station. (NASA photo)

Mission STS-130 Endeavour. FEBRUARY 19, 2010. KSC manual cancel on the date of launch. ISS assembly flight 20A. Space Shuttle Endeavour's primary payloads were the Tranquillity Module and the Cupola, a robotic control station with six windows around its sides and another in the center, providing a 360-degree view around the Station. Tranquillity was shipped from the Thales Alenia Space Facility in Turin, Italy. Three spacewalks were carried out during the mission.

Mission STS-131 Discovery. APRIL 5, 2010. KSC manual cancel on the date and time of launch. ISS assembly flight 19A. The primary payload of STS-131 was the MPLM Leonardo. The MPLM was filled with food and science supplies for the ISS. The MPLM also carried the third and final Minus Eighty Degree Laboratory Freezer for ISS (MELFI), Window Orbital Research Facility (WORF), the Muscle Atrophy Resistive Exercise (MARES). At least three spacewalks were planned for this mission.

Mission STS-132 Atlantis. MAY 14, 2010. KSC manual cancel on the date and time of launch. ISS assembly flight ULF4. The primary payload was the Russian Rassvet Mini-Research Module, along with an Integrated Cargo Carrier-Vertical Light Deployable (ICC-VLD). Rassvet means " dawn " in Russian. The Module was built by Russian Aerospace Company Energia. Three spacewalks were conducted during the mission.

Colorano "Silk" Cachet

STS-133/EXPEDITION 26 GROUP PORTRAIT
STS-133 - 133rd Shuttle Mission
March 4, 2011. Taking a break from a busy week on the ISS, the STS-133/Expedition 26 group pose for a portrait in the PMM. The STS-133 crew, in red shirts (from left) are Alvin Drew, Eric Boe (below), Nicole Stott, Michael Barratt, Steve Bowen and Steve Lindsey (below). The dark blue-attired Expedition 26 crew members (from bottom left) are Scott Kelly, European Space Agency astronaut Paolo Nespoli, Cady Coleman and Russian cosmonaut Oleg Skripochka. (NASA Photo)

Mission STS-133 Discovery. MARCH 4, 2011. KSC manual cancel affixed during the mission. ISS assembly flight ULF5. The mission transported several items to the ISS, including the Permanent Multipurpose Module Leonardo, which was left permanently docked to one of the Station's port. The Shuttle also carried the third of four Express Logistics Carriers to the ISS, as well as a humanoid robot called Robonaut. The mission was affected by a series of delays due to technical problems with the external tank and, to a lesser extent, the payload.

Launch of the Endeavour STS-134
134th Space Shuttle Mission

Colorano "Silk" Cachet

MAY 16, 2011. Attired in training versions of their shuttle launch suits are the six astronauts that comprise the STS-134 crew. Pictured clockwise from bottom center are mission commander Mark Kelly, shuttle pilot Gregory Johnson, and mission specialists Michael Fincke, Greg Chamitoff, Andrew Feustel and the European Space Agency's Roberto Vittori (NASA photo)

Mission STS-134 Endeavour. MAY 16, 2011. KSC manual cancel on the date and time of launch. ISS assembly flight ULF6. This flight delivered the Alpha Magnetic Spectrometer and an Express Logistic Carrier to the ISS. The Alpha Magnetic Spectrometer (AMS-02) was attached to the ISS's S3 Truss segment. The AMS-02 Unit is a particle physics detector which contains a large permanent magnet, and is designed to search for antimatter and investigate the origin and structure of dark matter.

Mission STS-135 Atlantis. JULY 8, 2011. KSC manual cancel on the date and time of launch. ISS assembly flight ULF7. The MPLM Raffaello made up the majority of the payload. This was Raffaello's fourth trip to the ISS since 2001 and the 12th use of an MPLM. STS-135 delivered only bags and supply containers. On flight day 4, Raffaello was lifted out of Atlantis's payload bay using the Station's Canadarm 2. It was berthed to Nadir port of the Harmony Module. On flight day 11 the MPLM was secured in th

Mission STS-135 Atlantis. JULY 21, 2011. Commemorative cover postmarked with manual cancel in KSC on the date and time of landing. ISS assembly flight ULF7.