



X-38

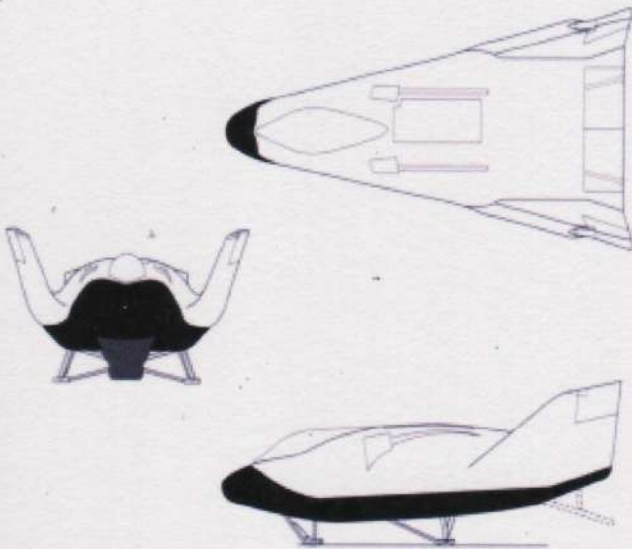
Development of an Emergency Crew Return Vehicle for ISS

TERMINOLOGY

CAPTIVE FLIGHT (or captive carry flight)	An aircraft carrying a spacecraft. Used to test the systems and the aerodynamics of the test craft being carried, just as though it was IN-flight.
<i>Parafoil test</i>	<i>A test to study and analyse the parafoil deployment in landing phase of any kind of payload.</i>
FREE FLIGHT (or glide flight, or drop test)	Flight without help of motors. Spacecraft does not produce its own thrust during descent.

STATS X-38 CRV

	Imperial System	Metric System
Weight (max)	23,500 lb	10,660 kg
Length	30 ft	9,10 m
Width	14,6 ft	4,42 m
Height	7,3 ft	2,22 m
Flight time (max)	9 hours	
Capacity	7 astronauts	



© NASA
X-38 crew return vehicle - 3 views

INTRODUCTION

This exhibit tries to show the development of an Emergency Crew Return Vehicle (CRV) by NASA when there were doubts about the availability of the Soyuz spaceship as an International Space Station (ISS) emergency CRV in the nineties of the last century.

The X-38 project was initiated by NASA to build an emergency CRV to return up to seven ISS crewmembers to Earth. It was intended to be carried to ISS in the cargo bay of a space shuttle and attached to a docking port. If an emergency arose that forced the ISS crew to leave the space station, the CRV would be undocked and - after a deorbit engine burn - would return to Earth much like a space shuttle. The vehicle's life support system would have a duration of about seven hours. A steerable parafoil parachute would be deployed at an altitude of about 40,000 feet (12.2 km) to carry it through the final descent and the landing. The CRV was designed to fly automatically from orbit to landing using onboard navigation and flight control systems. Backup systems would have allowed the crew to pick a landing site and steer the parafoil to a landing, if necessary.

PLAN

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References:

Personal research from author of this exhibit with other collectors, some of them producing some covers here shown.

Literature: X-38 Flight testing the prototype crew return vehicle. Dryden Historical Study No. 2 by William H. Dana.

Websites: <https://www.nasa.gov/centers/armstrong/news/FactSheets/FS-038-DFRC.html>

<http://www.astronautix.com/x/x-38.html>

https://www.esa.int/science_exploration/human_and_robotic_exploration/International_Space_Station/X-38.html

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2. Reason of the project and technological design origins.

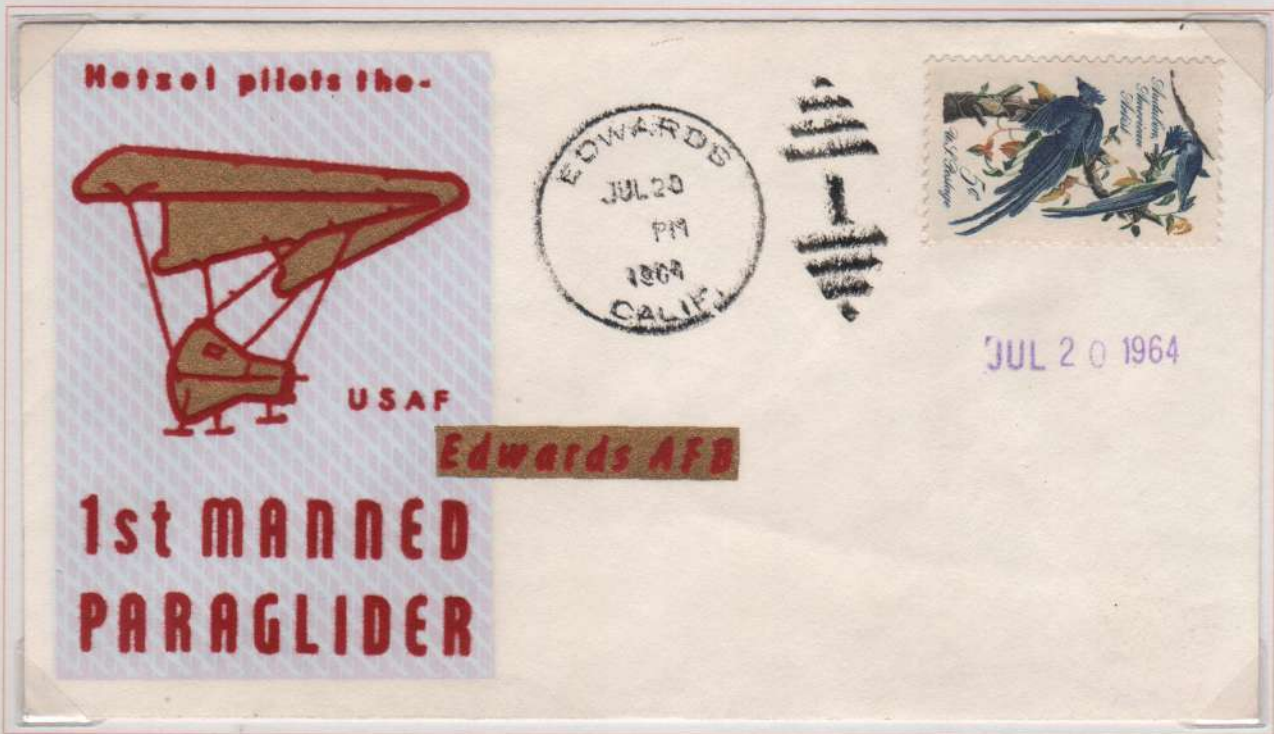
2.1. Parafoil Studies.

What is a parafoil? A self-inflating fabric device that resembles a parachute, behave in flight like an airplane wing, is maneuverable and capable of landing a payload at slow speed.

From 1962 to 1964 a landing system based upon Francis M. Rogallo's paraglider (a triangular-shaped combination of a parachute and a wing) was tested. North American Aviation was contracted to test and build the paraglider for Gemini missions.



May 28, 1964. Edwards, CA. Seventh Gemini full-scale unmanned test and first successful. Cachet shows a paraglider, similar to a parafoil, and Gemini capsule (Gemini 2 launched from Cape Canaveral on Jan 19, 1965 as seen in bottom postmark). 05c correct US domestic postage rate (Jan 1963-Jan 1968).



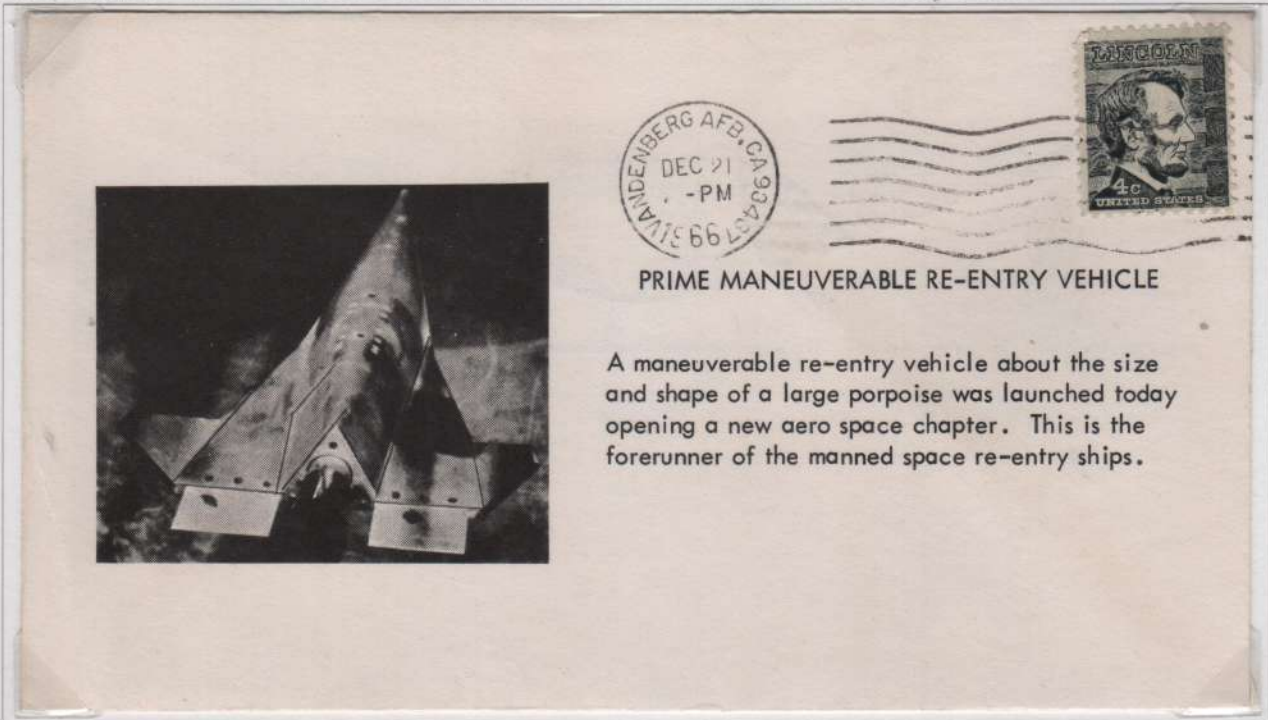
Jul 29, 1964. Edwards, CA. First successful tow flight piloted by E.P. Hetzel of North American Aviation. All covers were incorrectly cancelled Jul 20, 1964 by postal clerk.

However, these successes arrived too late. As most of previous tests ended unsuccessfully, on Aug 10, 1964 NASA decided that paraglider would not fly on Gemini, even though development testing still continues beyond this date until Dec 1964.

2.2. Lifting bodies.

What is a lifting body? A lifting body is a fixed-wing aircraft or spacecraft configuration in which the body itself produces lift.

Designed by Martin Company, US Air Force and NASA tested a lifting body called SV-5 or X-23 PRIME (Precision Recovery Including Maneuvering Entry) to check some re-entry characteristics. Only three unmanned tests were performed, all launched from Vandenberg, AFB in Dec-66, Mar-67 and Apr-67. PRIME shared same body shape that X-38 CRV.



Dec 21, 1966. Vandenberg AFB, CA. First unmanned test atop of an Atlas 7001 rocket. PRIME demonstrated the full planned cross-range maneuvers and the problems involved in using on spray-on ablative heat shields before its destruction on re-entry. 4c correct US postage rate (Jan 1963-Jan 1968) for unsealed envelopes meanwhile 5c was correct US postage rate for sealed envelopes.

From 1969 to 1971 Martin Marietta developed the manned X-24A lifting body. Dropped at Edwards from a modified B-52 Stratofortress airplane X-24A flew 28 times to verify that the lifting body could land consistently without power. X-24A body shape and flight data for performance calculations were too the same ones the X-38 CRV will use years later.



May 25, 1971. Edwards, CA. X-24A Flight #27. Flight time was 548 sec. at max. speed 765 mph (1.265 kph) from an altitude 65.298 ft (19.903 m). John Manke piloted the longest flight of X-24A series. Black rubber stamp cachet extremely rare on X-24A covers which normally only show the blue 4-lines text. 11c correct airmail US postage rate (Apr 1971-Dec 1973).

On the other site, in Europe the European Space Research Organization (ESRO) began to consider the development of a lifting body called Lifting Body 21 or LB-21, later referred as Bumerang.



Aug 08, 1971. Munich (red meter stamp Postalia). First remote-control drop at Airfield Helo Squadron (Schleissheim). Consortium (MBB, Dornier, ERNO) performed LB-21 test. Mounted on a special pallet was carried aloft by a Luftwaffe C.160 Transall airplane, and upon reaching the test flight location the pallet was pulled out of the rear loading door by a parachute. Around 10 cards exist (no registers).

20 Pf correct domestic German postage rate for postcards (Apr 1966-Jul 1972).

From 1977 to 1992 the space French agency CNES (Centre National d'Études Spatiales) prompted the design of a mini-shuttle or a spaceplane to carry 4-6 astronauts to ISS atop of an Ariane 5 rocket and return to Earth as a glider. Hermes would be the European space crew vehicle as well as another kind of emergency crew return vehicle for ISS.



Nov 09, 1987. Gravenhage. Ministerial Council of 13 countries members of European Space Agency (ESA) adopted two resolutions for the long-term space plan 1988-2000 and on the negotiation of the US Space Station. ESA thus gave its agreement in principle for the start of the Ariane 5 rocket, Columbus space module and Hermes spaceplane on Jan 01, 1988. In 1992 ESA cancelled the Hermes program due to high costs and for Soyuz rockets availability as emergency space vehicles. 75ct correct international Netherlands postage rate (Sep 1986 - Jun 1990).

3. Development of X-38 program.

3.1. X-38 V-131 prototype. First captive and free flights, and first parafoil issues.

Scaled Composites Inc, of Mojave, CA built three X-38 prototypes which were delivered to Houston for installation of avionics, computer systems and other hardware in preparation for flight tests at Dryden Flight Research Center (DFRC), Edwards. For first time NASA engineers were responsible of full operational systems. It helped to better understand the vehicle partially "made in-house".

Rollout X-38 V-131



Sep 24, 1977
Houston, TX
JSC -Spacepex 1977

Above postmark is the original design of Nassau Bay Branch Houston, TX 77058 postmark in use from Feb 28, 1990 to May 20, 2009 in several colors (black, red, blue).



Jun 03, 1997. Houston, TX (hand pictorial cancel, blue ink). Roll-out of X-38 V131 at Johnson Space Center (JSC) where program office is located.

Nassau Bay branch is the nearest post office to Johnson Space Center.

Cover signed by John F. Muratore X-38 Program Manager (1996-2003) at Johnson Space Center.

32c correct domestic US postage rate (Jan 1995-Jan 1999).

X-38 V-131 departs from JSC



Jun 04, 1997. Houston, TX (hand pictorial cancel, black ink). Departure of X-38 V-131 aboard an USAF (United States Air Force) C-17 transport aircraft to Dryden Flight Research Center (DFRC) where it arrived on the same day.

Cover numbered on reverse side 19 of 23 units.

All captive flights conducted at Edwards had two main goals: to evaluate the strength of the X-38 body structure, always in fixed position under the B-52 and to understand the interactions between the two aircraft.

X-38: First captive flight

First captive flight X-38 V-131



Jul 30, 1997. Edwards AFB, CA. X-38 V-131 in its first captive flight under wings of a NASA NB-52 008 mothership aircraft to see the transition and behaviour from lifting body to a parafoil/parachute deployment.

X-38: Second captive flight

Second captive flight X-38 V-131



Aug 02, 1997. Edwards AFB, CA. NASA NB-52 aircraft flew to 47,000 ft (14,325 m) with X-38 as rehearsal position for a future drop test.

Image cachet wrong as X-38 was not dropped from aircraft.

X-38: Third captive flight

Third captive flight X-38 V-131



Oct 01, 1997. Edwards AFB, CA. Captive flight to check all components, just some incidents in parafoil pyrotechnics initiators were found.

X-38: Fourth captive flight

Fourth captive flight X-38 V-131



Nov 19, 1997. Edwards AFB, CA. All test objectives accomplished despite of the failure of 6 parafoil pyrotechnic initiators.



Feb 12, 1998. Edwards AFB, CA. After four previous flights with some issues, for first time this fifth flight was conducted with excellent results.



Feb 27, 1998. Edwards AFB, CA. These six first captive flights were serialized as C-C-X but this denomination was not followed in future captive flights for other X-38 prototypes.

Short explanations for Ariane rocket and ESA logo shown in the above covers:

Ariane rocket *. In the beginning X-38 vehicle once operational could be used for brief science missions placed in orbit by a Space Shuttle or expendable booster rockets such as the American Delta series and the French Ariane 5 rocket.

ESA logo *. X-38 was an original project between NASA and ESA (throughout the German Aerospace Center DLR and Dassault Aviation, France, providing critical design support, software that glides the parafoil steering the X-38 to a safe landing with Dutch, German and Spanish companies producing key components). However, in 1999 ESA declined to allocate funding directly for the CRV program, and instead offered ESA governments the chance to contribute individually.

X-38 free flights were final stage before becoming operational NASA space vehicles to be used in real space missions with crew if an emergency in ISS occurred.

X-38: First free flight

First free flight X-38 V-131



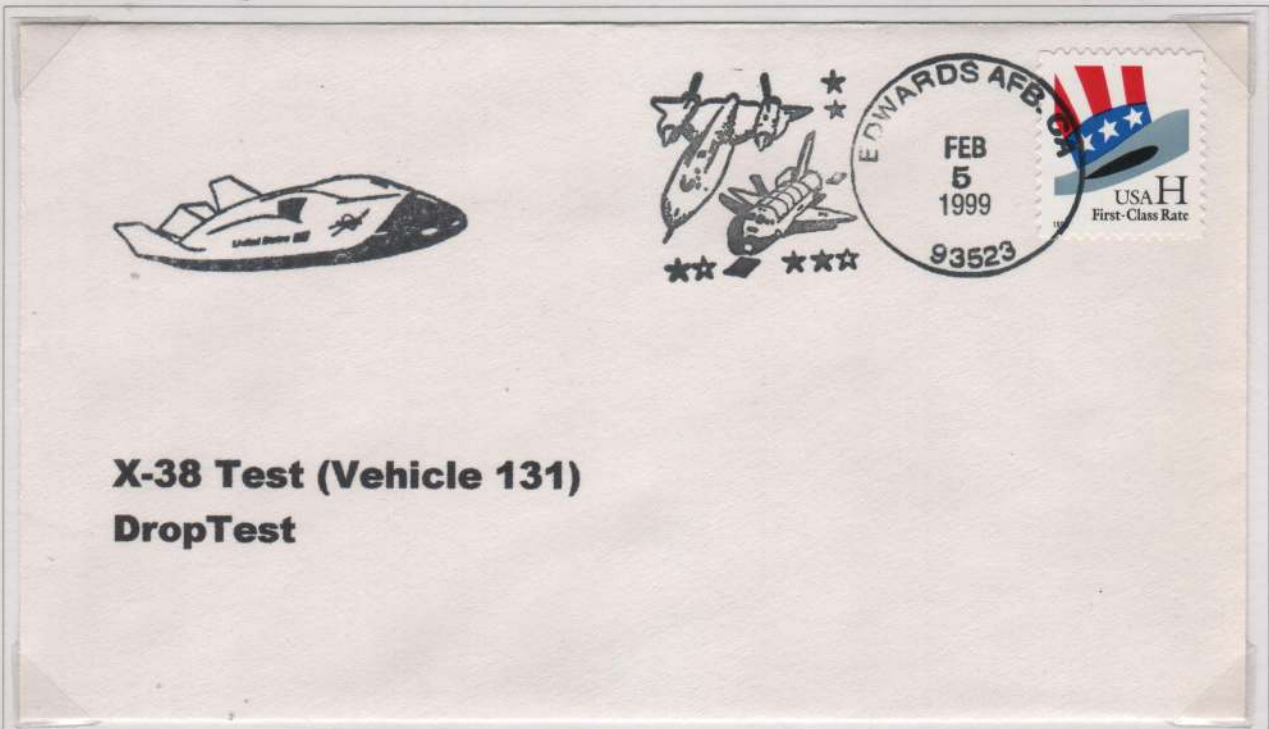
Mar 12, 1998. Edwards AFB, CA. X-38 dropped from a NASA NB-52 mothership, deployed a ram-air parafoil and manoeuvred for a precise landing at Dryden Flight Research Center (DFRC).

Cover numbered on reverse side 10 of 17 units, shows a very appropriate 32c stamp issued Oct 14, 1997 for 50th anniv. first supersonic flight of Bell X-1 aircraft piloted by USAF Captain Charles E "Chuck" Yeager, first aircraft to break the sound barrier on Oct 14, 1947.

Cover signed by John F. Muratore X-38 Program Manager (1996-2003) at Johnson Space Center (JSC); John Harper Mission Control at JSC plus other two unidentified signatures. ONLY 4 covers were signed.

X-38: Second free flight

Second and Final free flight X-38 V-131



Feb 05, 1999. Edwards AFB, CA. Atmospheric free flight or drop test to evaluate complete flight sequence of X-38. The blue and white parafoil used in this flight was also used on fourth free flight (Jul 09, 1999 for X-38 V-132).

3.2. Parafoil tests to solve parafoil problems.

Although the X-38 landed safely at Edwards in first free flight on Mar 12, 1998, there were some problems with the parafoil. Parafoil tests conducted from 1.998 to 2.000 at Army's Yuma Proving Ground in Arizona were pallets with payloads dropped from several UH-1 or CH-47 helicopters in its subscale drop configuration, or from C-130, C-141 and C-17 airplanes in its full-scale parafoil. Test program used parafoils of sizes from 750 ft² (69.67 m²) to 7.500 ft² (696.77 m²).

Initial drop tests indicated some problems with parafoil guidance, navigation and control systems (GN&C), which took longer time than planned to be fixed. Pioneer Aerospace Co was the manufacturer responsible of the parafoil development.

Parafoil test. No X-38 prototype



Jul 29, 1998, Yuma, AZ. A geometric subscale parafoil to eliminate the twist was dropped from helicopter with excellent result.

Parafoil GN&C consisted of winches, laser or radar altimeter, global positioning system (GPS), magnetic compass, barometric altimeter, flight computer, and modems for uplink commands and downlink data.

Parafoil test. No X-38 prototype



Aug 25, 1998. Yuma, AZ. Parafoil sequence was split in five stages but only first stage, when parafoil is deployed, was studied. Around 10 units exist. Blank or non cacheted envelopes, were first serviced by US cachet maker in Illinois and later forwarded to an US collector in Maryland who applied the cachet whose image is wrong because any X-38 CRV was dropped from Yuma.

The winches were used to steer the parafoil and to perform the dynamic flare maneuver for a soft landing. The laser or radar altimeter was used to initiate the flare. In the event of a GPS failure, the software navigated by dead reckoning using the compass and barometric altimeter data.

Parafoil test. No X-38 prototype



Oct 13, 1998. Yuma, AZ. Full-scale parafoil dropped from aircraft at an air speed of 130 miles per hour (209.21 km/h) to begin the parafoil test in its full sequence of five stages.

Cachet with the drawing of X-38 is wrong as any X-38 prototype was dropped from Yuma. It was applied only to visually link these parafoil tests to X-38 program as well as making these space covers more attractive to collectors.

Parafoil test to determinate correct operations served the engineers to gain experience in X-38 descent and landing phase.

Parafoil test. No X-38 prototype



Oct 14, 1998, Yuma, AZ. Full-scale parafoil dropped from aircraft. During its 11-minute parafoil flight, the parafoil slowed the pallet to a gentle vertical landing speed of less than 8 miles per hour (12.87 km/h).

Intermediate parafoil tests at Yuma enabled the X-38 program to resolve problems and resume flight research with new X-38 prototypes.

3.3. X-38 V-132 prototype. First parafoil successes.

Scaled Composites delivered to NASA fuselage and structural concept of X-38 V-131 and X-38 V-132 which were subscale copies of X-23A (PRIME) and X-24A body shapes used for initial parafoil deployment, unpiloted captive flights and atmospheric flight tests.

X-38 V-132 arrives at JSC



DEC 4 1998
Houston, TX 77201
Pictorial hand pmk.
(from Dec 04, 1998?
to Dec 9, 2006).

Upper left closer view

X-38 appears in pmk

Sep 09, 1998. Houston, TX. Again NASA engineers outfitted X-38 V-132 with avionics and computer systems. It is unknown if this early date postmark Sep 09, 1998 is backdated or simply an initial date of use previous to Dec 04, 1998 as referred in all philatelic sources consulted.

X-38: Seventh captive flight

First captive flight X-38 V-132



Feb 24, 1999. Edwards AFB, CA. Captive flight of X-38 V-132 under NASA NB-52 wing pylon's aircraft for testing aerodynamics and avionics systems.

X-38 V-132 contained the full lifting body flight system that allowed the vehicle to fly autonomously prior to parafoil deployment.

X-38: Third free flight

First free flight X-38 V-132



X-38--V-132
DEPLOYED

Mar 05, 1999. Edwards AFB, CA. X-38 successfully deployed its parafoil and glided to a landing on the lakebed after 9 minutes flight. V-132 tested the rudders and flaps which allow it to make a controlled flight after the drop from the NB-52 airplane. *Black and white pasted-on cachet applied after postmarking. See how the upper right corner covers the postmark a little.*

X-38: Fourth free flight

Second free flight X-38 V-132



THE 2ND FREE FLIGHT TEST OF THE X-38 TEST VEHICLE 132 AT NASA'S DFRC. THE VEHICLE IS RELEASED FROM A HIGHER ALTITUDE



John F. Manthe

Jul 09, 1999. Edwards AFB, CA. Released from 35,000 ft (10,668 m) X-38 V-132 descended for 31 seconds before soft landing at Rogers Dry Lakebed at Dryden Flight Research Center (DFRC). In this flight the parafoil had been already used on second free flight (Feb 05, 1999 for X-38 V-131).

During a post flight inspection, a fuel leak was discovered in the B-52's right wing. The problem was fixed and another free flight was scheduled for Mar 30, 2000.

Cover numbered on reverse side 7 of 11 units.

X-38's primary navigational equipment, the Inertial Navigation System/Global Positioning System was a unit already in use on Navy fighters.

Parafoil test X-38 V-132



Jul 29, 1999. Edwards AFB, CA. Parafoil or parachute test. X-38 prototype is suspended under its giant 7.500 ft² (696.77 m²) parafoil (required to land such a heavy vehicle) during its descent at Dryden Flight Research Center (DFRC).
33c correct US domestic postage rate (Jan 1999-Jan 2001).

X-38: Fifth free flight

Third and Final free flight X-38 V-132



Mar 30, 2000. Edwards AFB, CA. Released from an altitude of 39.000 ft (11.887 m) X-38 V-132 flew freely for 45 seconds, reaching a speed of over 500 miles per hour (804 km/h) before deploying its parasail for landing on Rogers Dry Lakebed at Dryden Flight Research Center (DFRC).
Cover signed by Robert "Bob" Baron X-38 Project Manager at Dryden Flight Research Center (DFRC), Edwards.

3.4. X-38 V-131R prototype. Full successful free flights but program canceled.

X-38 V-131R was designed at 80% of the size from the original X-38 version with the final configuration.

X-38: Eighth and Last captive flight

First captive carry flight X-38 V-131R



Aug 04, 2000. Edwards AFB, CA. Unpiloted X-38 captive carry flight to determinate correct operation of aerodynamics systems. Cover numbered on reverse side 12 of 18 units.

X-38: Sixth free flight

First free flight X-38 V-131R



Edwards AFB, CA. Pictorial hand pmk. (from Dec 10, 1996 to Feb 28, 2001) depicts a SR-71 airplane and the space shuttle.

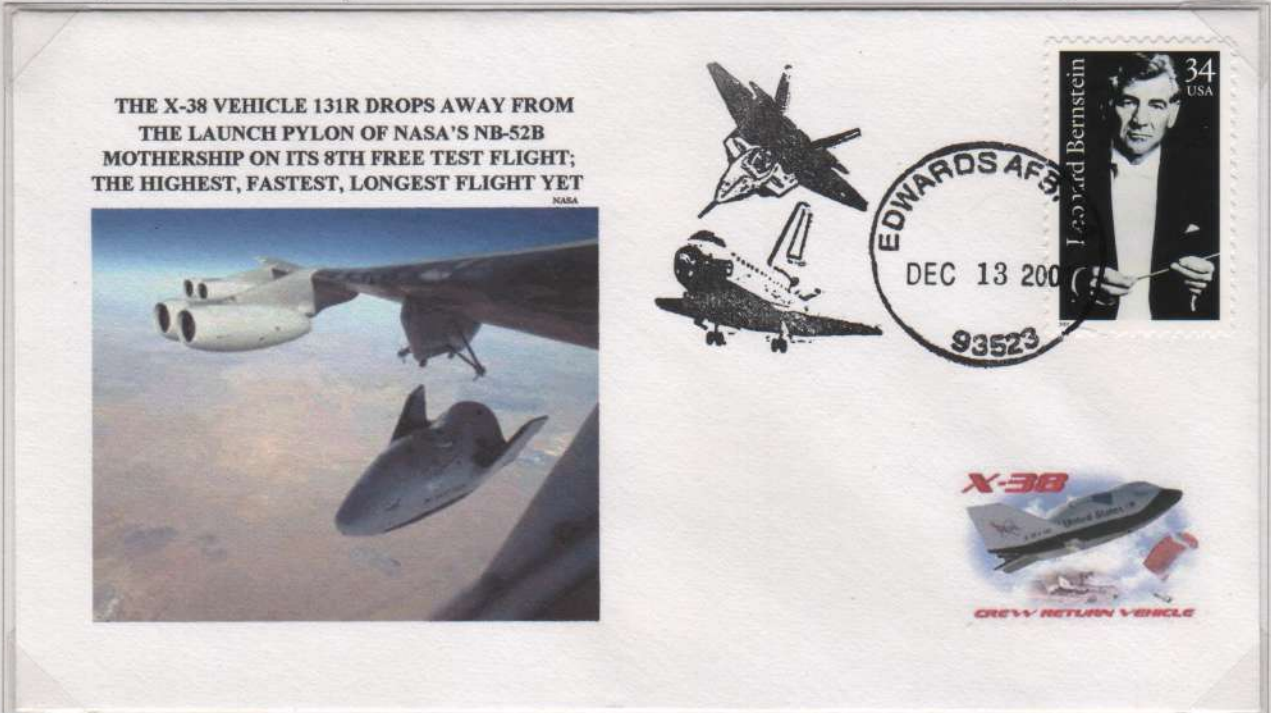
Nov 02, 2000. Edwards AFB, CA. This first free flight evaluated upgraded avionics and control systems and the aerodynamics of the modified X-38, which is more representative of the final design of X-38 CRV. Cover numbered on reverse side 9 of 16 units.



Jul 10, 2001. Edwards AFB, CA. X-38 descended from 37.500 ft (11.430 m) and served the engineers to evaluate software and deployment of parafoil in a smooth landing on Rogers Dry Lakebed at Dryden Flight Research Center (DFRC).
 Cover numbered on reverse side 5 of 22 units.
 34c (30c for Frank C. Laubach stamp + 4c for Project Mercury stamp) incorrect US domestic postage rate; correct is 37c from Jul 2001-Jun 2002.



Edwards AFB, CA Pictorial hand pmk. (from Mar 01, 2001 to Oct 21, 2005) depicts a space shuttle in two positions (in orbit and landing).



Dec 13, 2001. Edwards AFB, CA. **X-38 LAST FLIGHT.** The 13 minutes test flight in a descent from 45.000 ft (13.716 m) to Rogers Dry Lakebed at Dryden Flight Research Center (DFRC) was the highest, fastest, and longest flight ever performed.
 Cover numbered on reverse side 5 of 22 units.
 34c incorrect US domestic postage rate (correct is 37c from Jul 2001-Jun 2002).

IN CONCLUSION: REASONS FOR CANCELLATION OF THE X-38 PROGRAM.

- a) Availability of a regular supply of Soyuz capsules by Roscosmos (Russian Space Agency) as emergency vehicles.
- b) Leave less people in ISS let possible one of two Soyuz was enough for emergency evacuation.
- c) Budget concerns.
- d) Although X-38 program successfully demonstrated the feasibility of the prototypes, NASA cancelled the program in 2002.