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OV-165

TYPE: SPACE SHUTTLE

LAUNCHED: 21st C

LENGTH: 40 METERS

MAX SPEED: 27,000 KM/H

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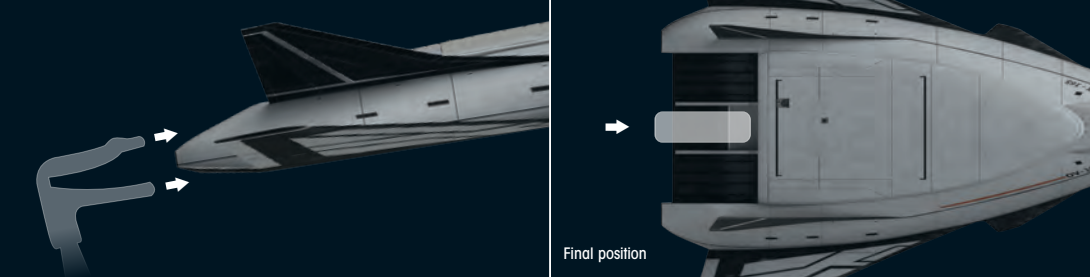
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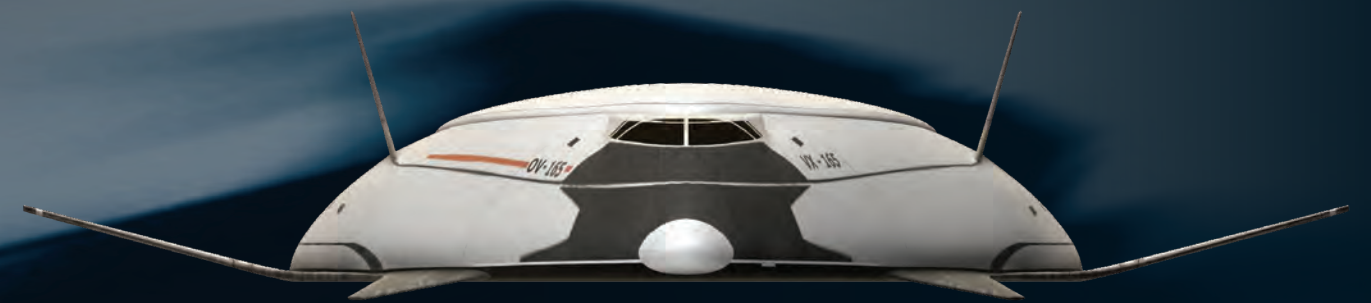
Stand assembly:

Fix the stand to the back of the ship.




OV-165

OV-165 SPECIFICATION




TYPE:	SPACE SHUTTLE
AFFILIATION:	EARTH
LAUNCHED:	21st CENTURY
LENGTH:	40 METERS (APPROX.)
CREW:	FIVE
TOP SPEED:	27,000 KM/H
WEAPONRY:	NONE


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OV-165

The *OV-165* was an orbital vehicle in the early 21st century and a descendant of the Space Shuttles built by NASA.

▲ The *OV-165* was a successor to the Space Shuttle, and it was used to reach Earth's orbit. It took off vertically, but did not need booster rockets to break free of Earth's atmosphere. Instead, it used aerospike engines that could blast it into space; it could then land back on Earth like a conventional airplane.

The *OV-165* was a type of space shuttle orbiter built by humankind in the early 21st century.

The 'OV' part of its name stood for orbital vehicle, while the '1' meant it was flight ready and the '65' meant that it was the 65th shuttle in the series. The program had begun in 1976 with the NASA built *OV-101*, which was also known as the Space Shuttle *Enterprise*.

▼ The *OV-165* had a lifting body design, meaning the body itself produced lift rather than the wings. The fact that it had only small wings meant it produced less drag and was more suitable for atmospheric re-entry. The *OV-165* was often used to carry cargo, which was released through its payload bay doors on its dorsal side.

Whereas the early space shuttles had required booster rockets for lift-off and to propel them beyond Earth's atmosphere, the *OV-165* used aerospike engines. This type of engine used a lot less fuel to blast the ship into low orbit, meaning it did not have to jettison the multi-stage solid booster rockets. This made it much cheaper to fire the shuttle into orbit, and the *OV-165* was also known as a single-stage-to-orbit (SSTO) vehicle. It took off vertically, landed horizontally and could be reused again and again, making its operational costs much cheaper.

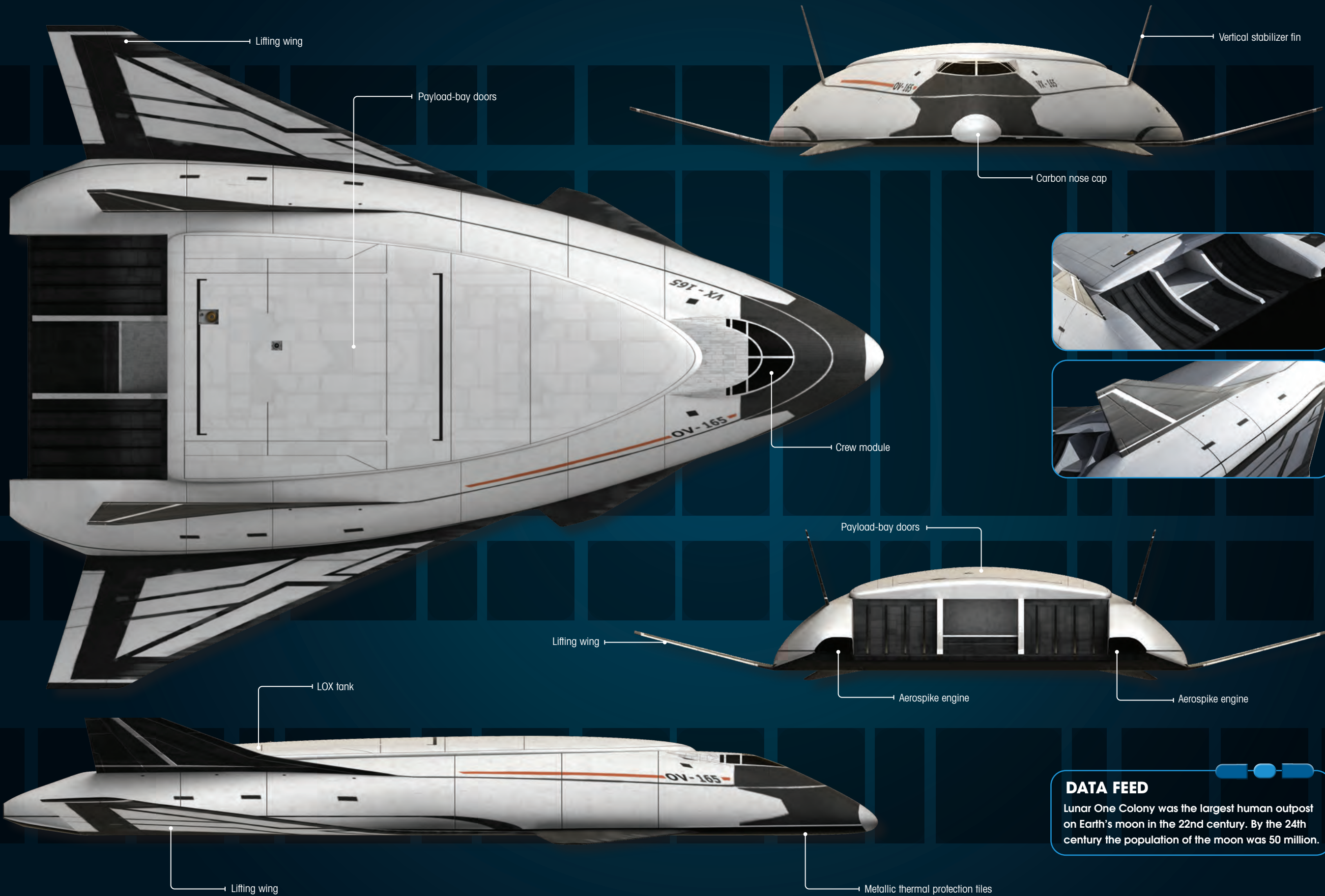
The *OV-165* was 40 meters in length, and it had a top speed of 27,000 km/h (17,000 mph). It was used to launch satellites into orbit, and could also be modified to carry passengers.

HEAT RESISTANCE

The *OV-165* used a metallic thermal protection system that shielded it from the intense heat that built up when re-entering the atmosphere. This was safer and cheaper to maintain than the ceramic protection system that had been used on the earliest space shuttles. They had required thousands of hours of maintenance to check and replace the countless ceramic tiles that composed the exterior of these shuttles.

The *OV-165* was a vital stepping stone in the development of spacecraft, as humans sought to develop the technology that would allow them to explore the solar system and beyond.





MISSION TO MARS

According to the *STAR TREK: VOYAGER* episode 'One Small Step,' another craft that was in operation around the same time as the *OV-165* was the *Ares IV*. In 2032, it took Lt. John Kelly and his crew to Mars.

SAME DESIGNATION

The term 'space shuttle' was still in use in the 23rd century. In 2285, Spock was alerted by public tannoy that his space shuttle would be leaving in 15 minutes for the *U.S.S. Enterprise NCC-1701*.

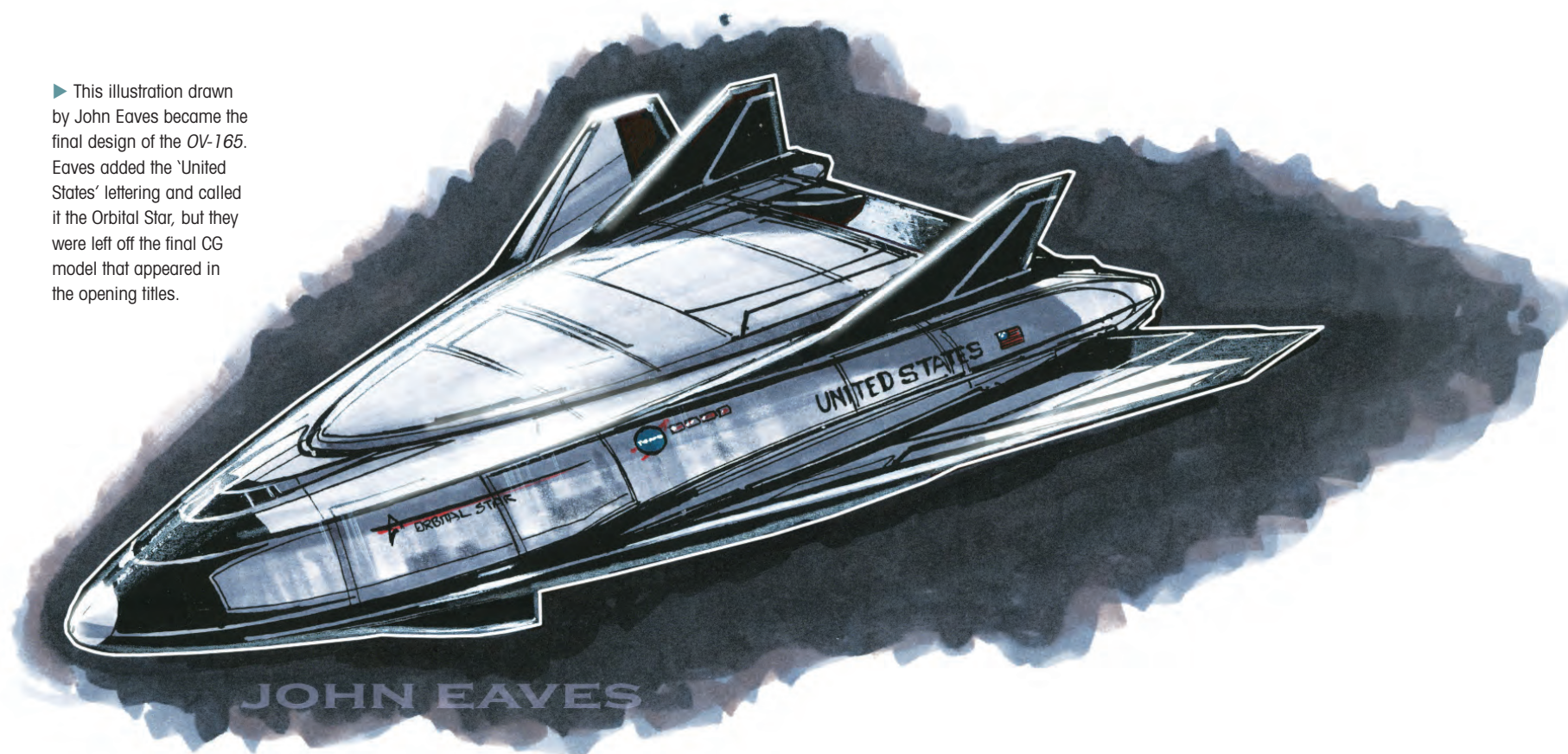
JELICO'S MODEL

The Rockwell X-30 was a real-world example of a single-stage-to-orbit spacecraft that was in development in the 1990s, but the project was cancelled. A model of this craft appeared in Captain Edward Jellico's ready room aboard the *U.S.S. Enterprise NCC-1701-D* in the *TNG* episode 'Chain of Command, Part I.'

DATA FEED

Lunar One Colony was the largest human outpost on Earth's moon in the 22nd century. By the 24th century the population of the moon was 50 million.

► This illustration drawn by John Eaves became the final design of the *OV-165*. Eaves added the 'United States' lettering and called it the *Orbital Star*, but they were left off the final CG model that appeared in the opening titles.



DESIGNING THE

OV-165

John Eaves researched the future of Space Shuttle design when he was asked to invent a suitable craft for the opening titles of *ENTERPRISE*.

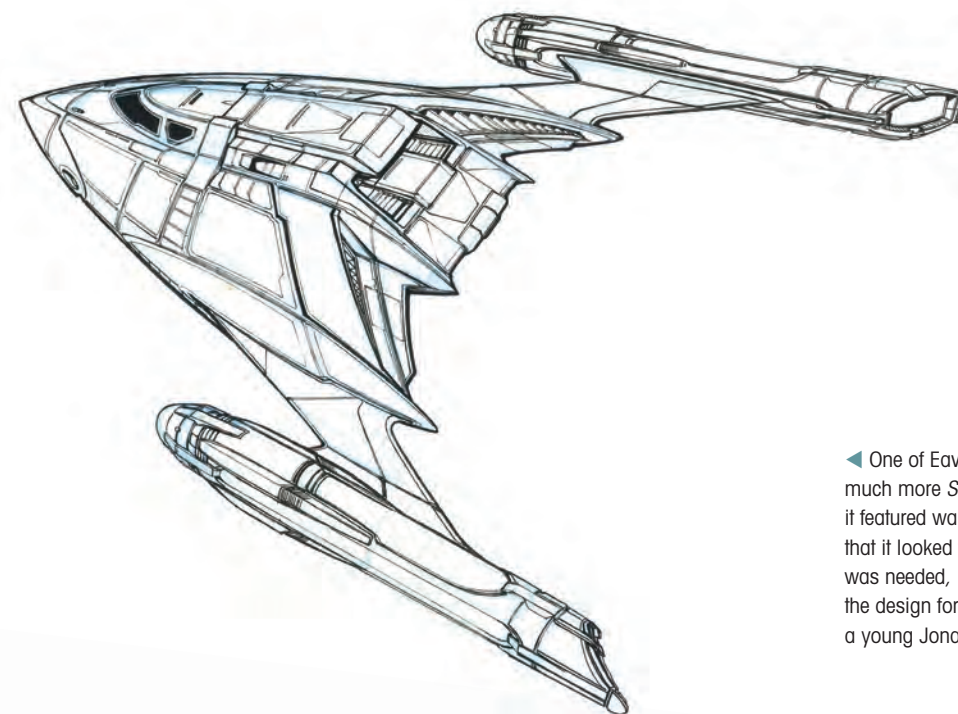
Once an idea had been established for the opening titles of *ENTERPRISE*, the producers asked illustrator John Eaves to come up with two ships that would fill in the missing pieces between the real-world Space Shuttle and the fictional *Enterprise* NX-01. One of these ships became the *S.S. Emmette*, which slotted between the *Phoenix* and *Enterprise*. The other eventually became known as the *OV-165*, and it fitted

between the Space Shuttle and the *Phoenix*. In other words, they asked for a transition design that would bridge the gap between the Space Shuttles of the early 2000s and what would come in the near future.

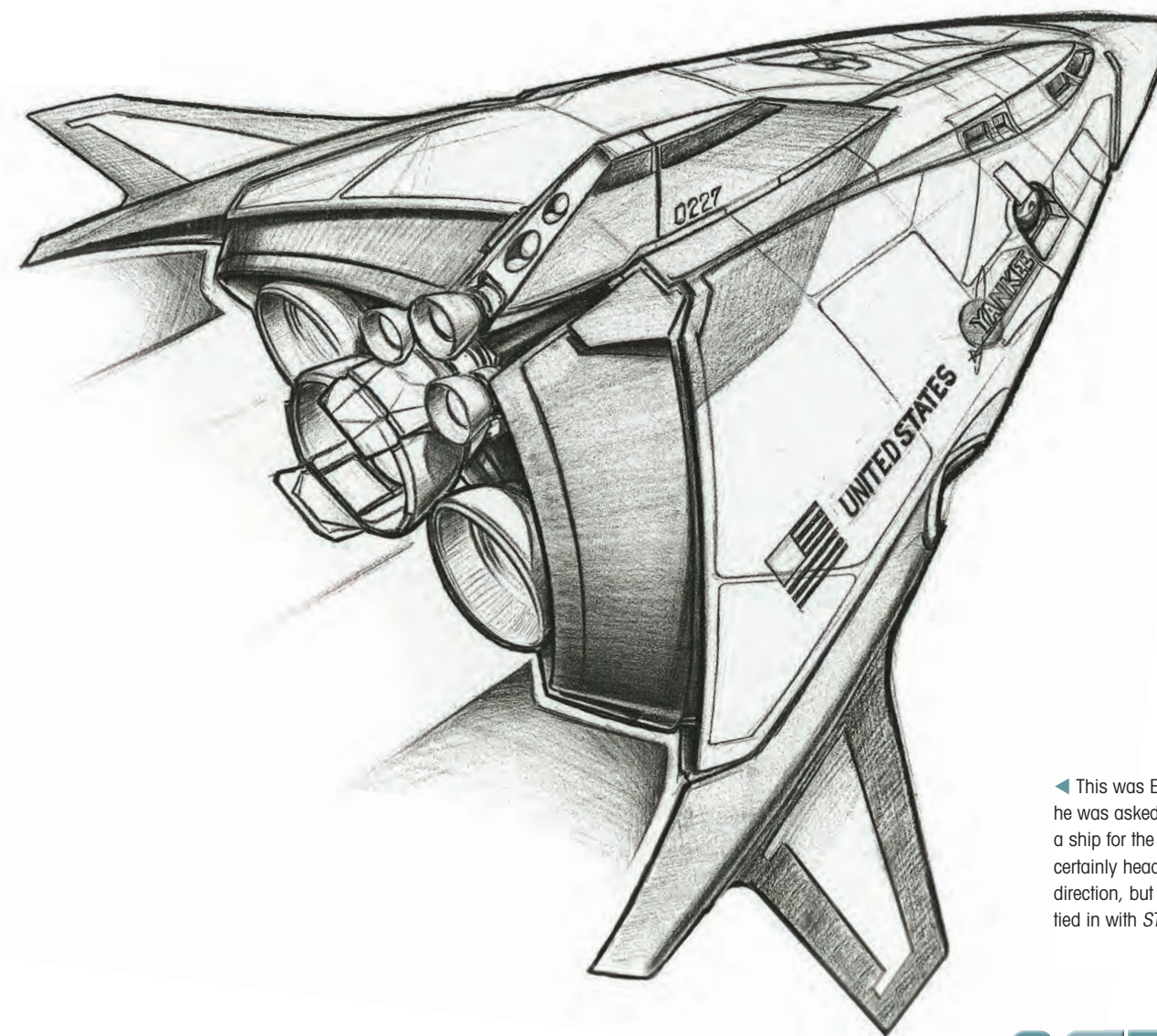
One of the first concepts Eaves devised had massive booster-style rocket exhausts at the back, a pointed front end and a bulbous body with a single fin on top. This sketch was felt to be headed in the right direction, but

the producers wanted something that tied more into Starfleet architecture.

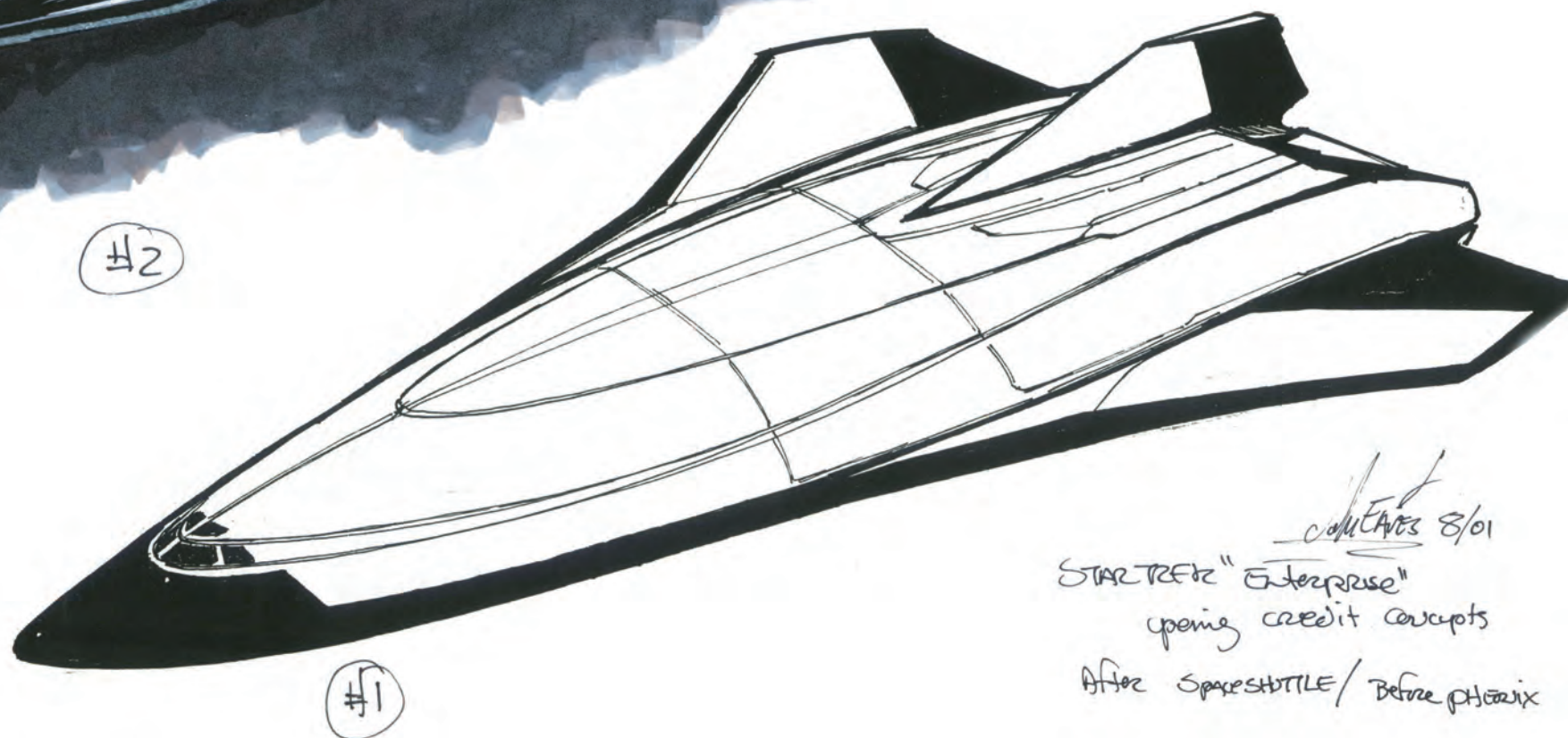
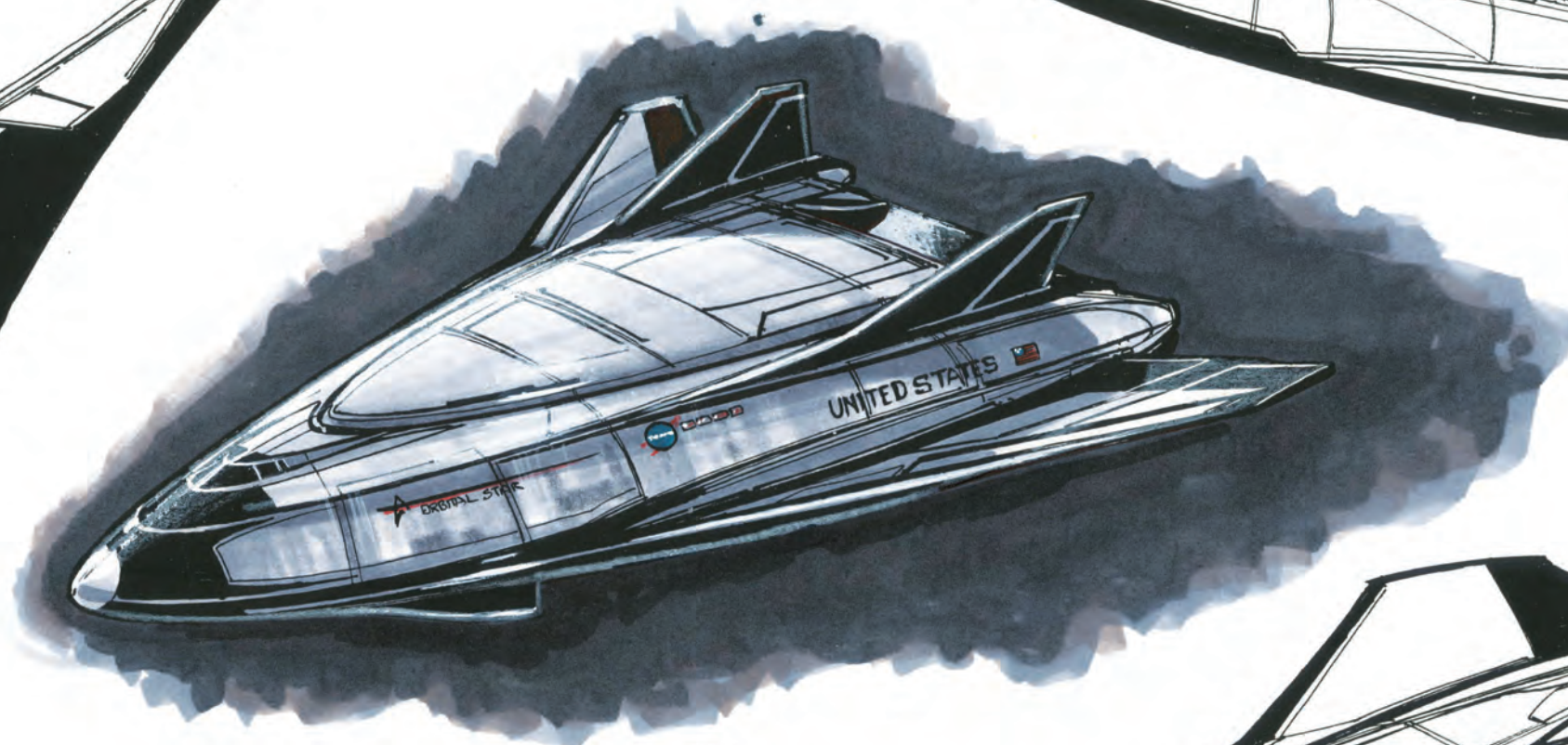
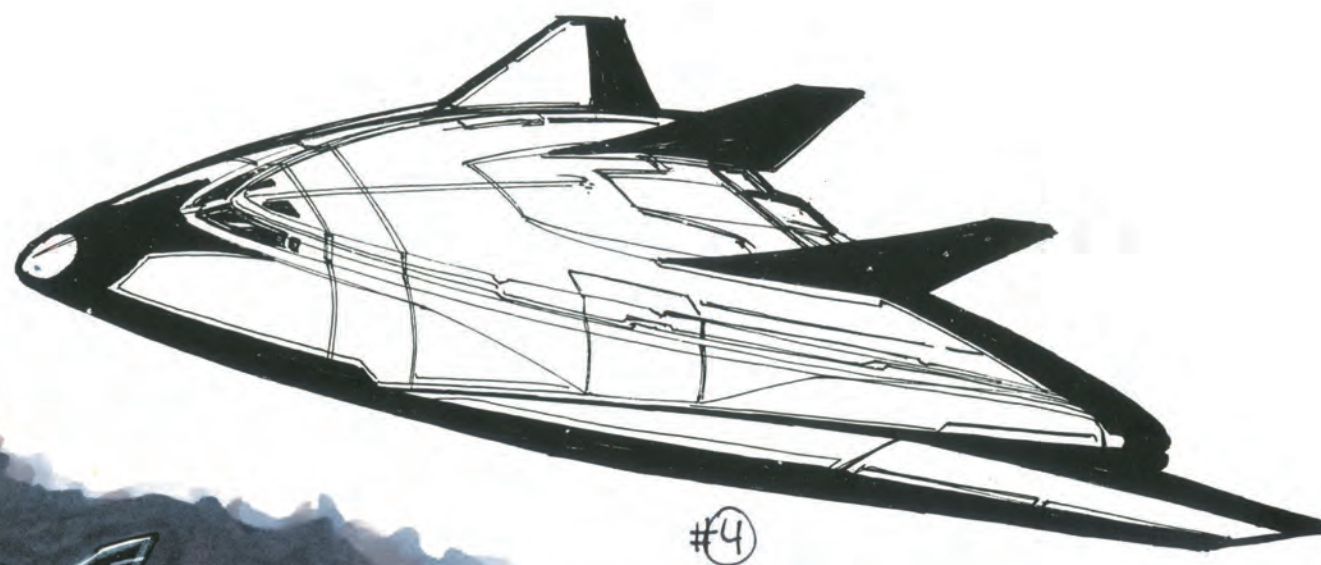
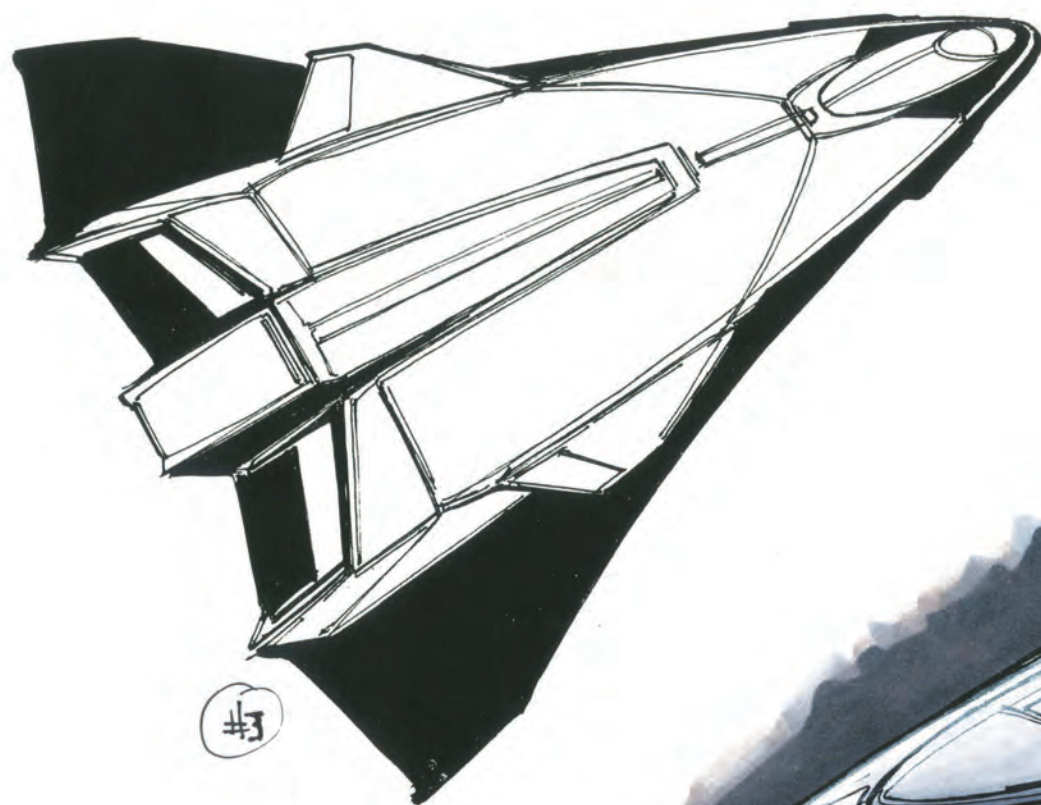
Eaves followed this with another drawing that featured a craft with warp nacelles and a more angular main body. This was certainly more Starfleet-like, but it was felt it looked a little too advanced. Eaves resubmitted this drawing when he was asked to come up with a design for the model spacecraft that the young Jonathan Archer flies in 'Broken Bow.'



◀ One of Eaves's early ideas was much more *STAR TREK*-like in that it featured warp nacelles. It was felt that it looked too advanced for what was needed, but Eaves resubmitted the design for a toy model used by a young Jonathan Archer.



◀ This was Eaves's first idea when he was asked to come up with a ship for the near future. It was certainly headed in the right direction, but needed to be more tied in with *STAR TREK* architecture.



◀ Once Eaves had looked into what NASA had been working on and found out about the VentureStar, he drew several concepts that were based on that ship. The producers chose the middle drawing that is labelled '#2.'

In the end, the producers went for an alternative design that Jim Martin, another illustrator, had come up with for the toy spacecraft.

Meanwhile, Eaves had contacted a friend of his that was stationed at Edwards Air Force Base to ask him what NASA was working on to take over from the Space Shuttle. He was told that the VentureStar, a single-stage-to-orbit reusable spaceplane, was in development. When Eaves looked into this proposed craft, his ideas for what was needed became much clearer.

Eaves drew up several alternative

designs for an advanced Space Shuttle that were based on the VentureStar, but he added more *Enterprise*-like detail to the body panels to tie it into the world of *STAR TREK*.

The producers chose one of these concepts, as they felt it best connected the route of present day spacecraft with how *STAR TREK* envisioned the future of starships. For his part, Eaves enjoyed the challenge of the task and was delighted with the finished CG model, especially as it was seen in the main titles docking with the International Space Station.



VISUAL EFFECTS

'BROKEN BOW'

Completing the visual effects for *STAR TREK: ENTERPRISE*'s pilot was an extraordinary challenge, both in terms of workload and creativity

▲ 'Broken Bow' had more than 300 effects shots in it, including stunning footage of the CG *Enterprise* NX-01 in a spacedock orbiting Earth. To finish the work on time required a Herculean effort from the entire VFX team.

The main reason why an outside company in the shape of Montgomery/Cobb was brought in to create the main titles for *ENTERPRISE* was because the in-house effects teams were incredibly busy working on the opening feature-length episode 'Broken Bow.'

For the *STAR TREK* visual effects team the challenge had always been to stay on the

absolute cutting edge of effects technology, and to constantly improve the quality of their work. Pilots are particularly important since they have a scale that is unlike anything else on television, and often involve breakthrough work that wouldn't be out of place in a movie. Visual effects producer Dan Curry said that on 'Broken Bow' the aim was simply "to do the best work we'd ever done."

VFX supervisor Ronald B. Moore added that the logistical challenge was extraordinary. "The pilot had over 300 effects shots in it. A lot of movies don't have that many, and they probably have more than a month or two to do them." In order to get everything done in the time they had, the team brought in both their regular computer-generated vendors – Foundation Imaging and Eden FX. Foundation handled most of the space shots and Eden principally dealt with CG elements that had to be added to live-action footage.

IMMENSE WORKLOAD

Foundation's CG supervisor Rob Bonchune said that the task was so great that he had to split his supervising duties with David Morton. "This was the biggest thing we ever did for *STAR TREK*," said Bonchune. "We had to create over 70 shots, so Dave Morton worked on the gas

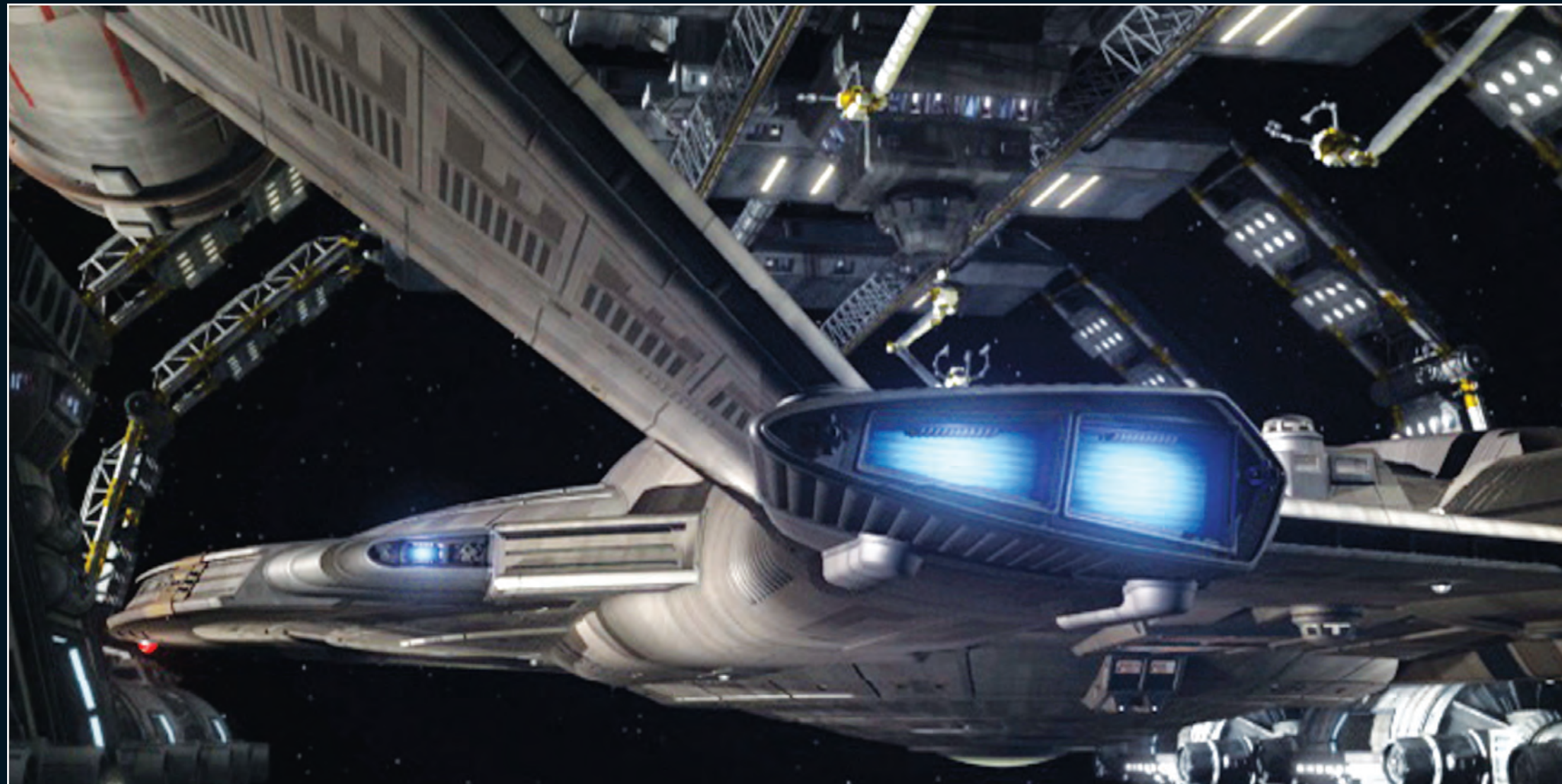
giant stuff, while I supervised model construction and space sequences."

To ensure that everything could be approved as quickly as possible, Curry and his boss, supervising producer Peter Lauritson, made regular visits to the vendors rather than waiting for shots to be delivered to them. This freed up Ron Moore, who was able to devote himself to supervising the compositing work at Composite Image Systems Hollywood (CIS).

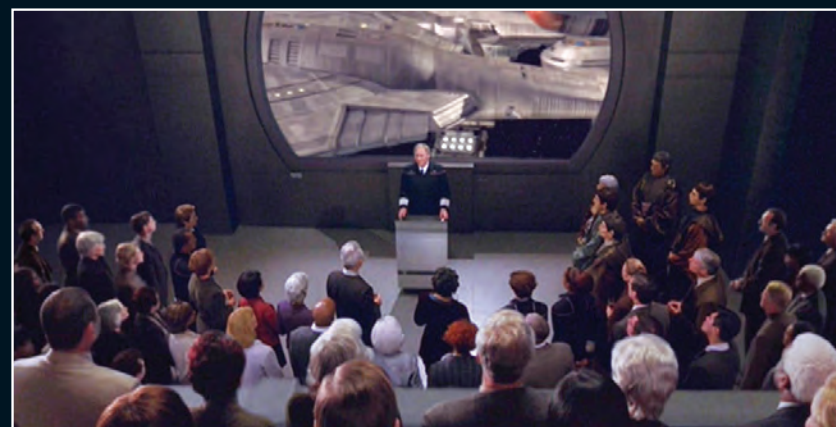
In the seven years since the *STAR TREK: VOYAGER* pilot 'Caretaker' was filmed, effects technology had changed enormously. Then almost all the effects had to be created practically, but in the intervening years CG had improved immeasurably and became dominant, and for the first time the main ship wasn't even built as a physical model.

STAR TREK's VFX team always pushed computer technology to its limits, but Curry

▲ The pilot involved a sequence of shots that showed off *Enterprise* NX-01 in all its glory. For the first time in *STAR TREK* history, there was no physical studio model of the hero ship and only a CG model was created. It was incredibly detailed and more photorealistic than any other ship that had been built before for a *STAR TREK* TV series.



▼ Visual effects producer Dan Curry managed to digitally add more people to the room where Admiral Forrest gave his speech at the launching ceremony of *Enterprise*.



felt that this wasn't really where the challenge lay. "The thing that I stressed to our vendor companies and the staff was that the technology to create visual effects was available to anyone who wanted to invest in the hardware. What we had to do was make sure that we tried to approach everything with

superior artistry and thinking. We tried to make sure that each shot informed the audience about what was going on and delighted them with images and surprises."

BUILDING ENTERPRISE

This approach was most obvious in the design of *Enterprise* NX-01 itself. The design of the ship was worked up by Doug Drexler in the art department, under the supervision of production designer Herman Zimmerman, with considerable input from the show's creators Rick Berman and Brannon Braga. Drexler actually created the design by working with his own CG model of the ship, which was passed on to Foundation.

As Rob Bonchune explained, they then built their own version of the ship. "CG artist Pierre Drolet was dedicated wholeheartedly to

building *Enterprise*," said Bonchune. "He was one of our fastest and best model builders. We used the model Doug had supplied as a blueprint. If you put the two side by side, there would be detail differences, but there would be no real shape differences. We just built it in higher detail."

Bonchune went on to say that everyone was aware that they weren't building the ship just for the pilot, but for all the episodes that would follow. "We were trying to build for seven years, so we were trying to put everything we could into it," said Bonchune. "It was absolutely the most detailed ship we had ever built. You could fly from the bottom of the ship into the hangar bay with the drop shuttles, so that you were standing next to a shuttle. We put much more effort into it than working a simple nine-to-five day. It was a true labor of love."



When we first saw *Enterprise* it was in drydock in orbit around Earth. Like everything else on the show this had to be built from scratch. Bonchune explained that the design ethic was to create what could logically look like a precursor to the drydock featured in *STAR TREK: THE MOTION PICTURE*. "It was still a drydock shape; it was just clunkier and a little more primitive. We put in little things like grappler hooks at the bottom to move things around. There were little details like gold foil and thermal blankets on some things."

BACKGROUND DETAIL

Curry regarded the launch sequence – which he worked on with Rob Bonchune – as one of the highlights of the pilot. The sequence even involved an effect that most viewers would never notice, which showed the room where Admiral Forrest addressed the crew.

"When we saw the dailies, Rick Berman decided that the event should be bigger and have more people," Curry recalled, "so I figured out a way I could hand-paint set extensions. By reducing and tweaking perspective and shooting background people against greenscreen, we were able to build layers of audience and make the room bigger than the original set had been."

Some of the most impressive shots in the pilot involved the Suliban, who contorted their bodies into 'impossible' positions and could blend seamlessly into a background so that

▲ Many of the effects involving the Suliban were created using a combination of real actors and CG figures. In this shot, the Suliban in the foreground was a real actor, but the other Suliban crawling up the wall were CG characters.

◀ [Main picture] After the art department had finalized the design of *Enterprise*, Foundation Imaging went to enormous lengths to create the CG version of it. The level of detail that they put into it was simply astonishing, as they knew it would have to stand up to close scrutiny over several seasons.



he said was what made the shots look so convincing.

The Suliban chameleon effect was produced by Ron Moore, Eden, and CIS. Curry said that the idea was that the Suliban had a way of camouflaging themselves that made them almost invisible. "It was as if the Suliban could take the light and colors of the surface behind them and transmit it around in front of them," said Curry. As Eden's co-founder John Gross explained, they used the CG Suliban to replicate the movements of the actor who was filmed on the set. The advantage of a CG character was that the shape could be covered (mapped) with any image – in this case the wall that he was blending in with.

ALIEN TONGUES

Eden also found themselves adding CG elements to footage of real actors. "When they shot the girls on Rigel X, obviously they didn't have tongues like that!" Gross laughed. "Eddie Robison created a tongue element that did its thing and then tracked it into the girl's mouth so that as she moved, it moved with her. He had to line that up frame by frame. It was hard, but luckily it was not as hard as it sounded, because it moved so fast."

Eden also created a CG model of the surface of Rigel X and of the landing platform. "That went through a couple of revisions as far as whether it was sitting on top of a mountain or built into the side," said Gross. "We built everything to scale and the things on the roof that they stood next to were about six feet tall, but when we looked at our shots, Peter Lauritson commented that the platform didn't look big enough. And he was right; it looked like it was the size of the set and we wanted it to look massive, so we shrunk all those things down and it looked much better."

The Rigel X sequence also involved a CG snowstorm. The snow in the wide shots was obviously all CG, but Moore revealed that he also had Eden give him some CG snow, which he added to the live action footage.

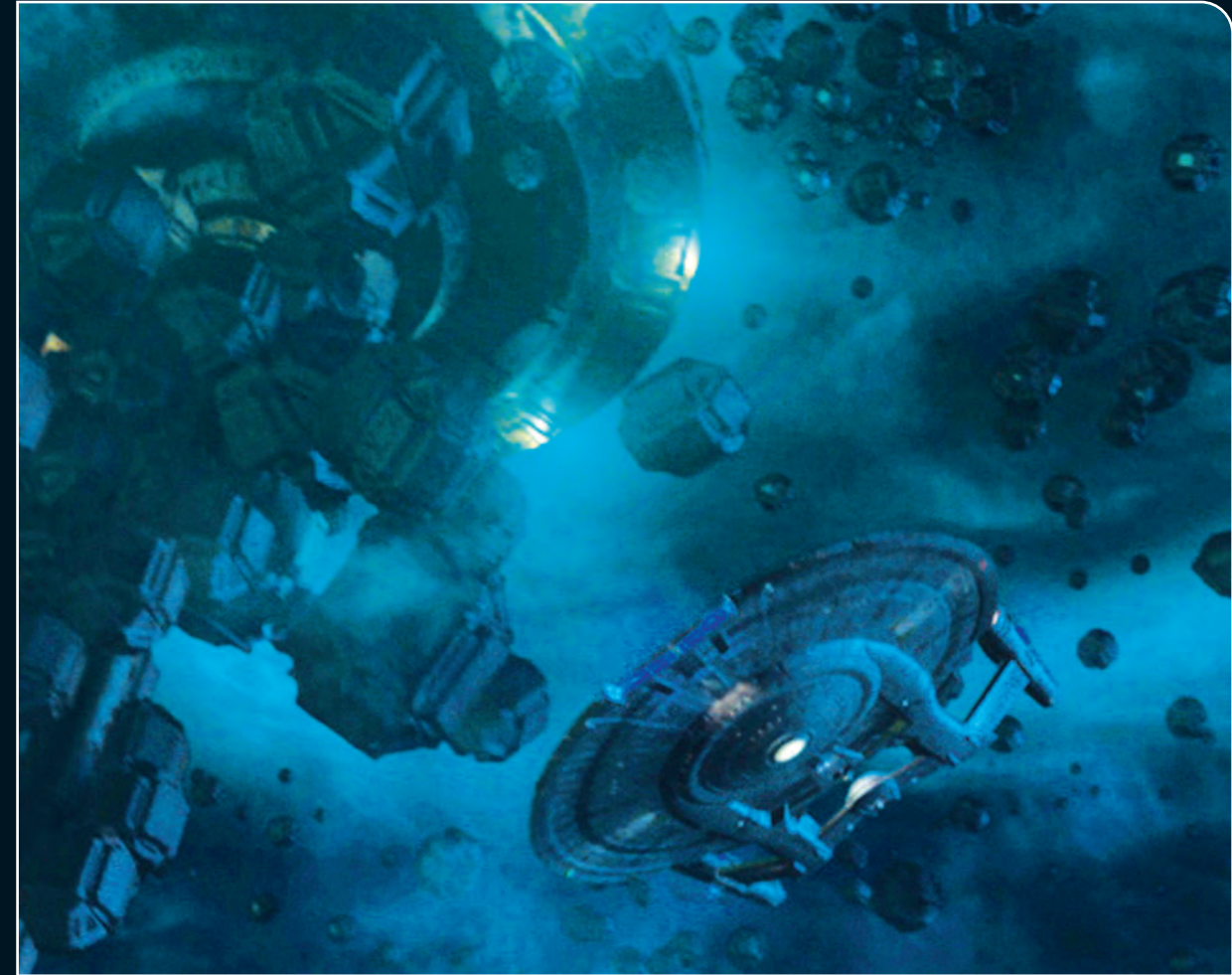
"It was a challenge to make sure the snow was interacting properly," said Moore. "It didn't always match – one shot had got heavy snow,

they were effectively invisible. "The Suliban contortion was purely the idea of Rick Berman and Brannon Braga," Curry said, "although early on they asked me, 'How possible is that?' And I assured them we could do something very interesting with it."

The contortion effect was created by John Teska at Foundation Imaging, who worked with a CG model of a Suliban. This was used to replace the actor at vital moments, and could be manipulated to do anything he wanted. Curry was full of praise for Teska's work, which

▲ The blue female dancers on Rigel X were given extended CG tongues with which they caught CG butterflies.

▼ Additional CG snow had to be created for the scene of the landing pad on Rigel X to make sure each shot matched.



◀ Foundation Imaging created the shots that showed *Enterprise* entering the gas giant and approaching the 'helix' of Suliban ships. They were able to build these at the beginning of the schedule, but had to wait until later for the final model of *Enterprise*.

another had light snow. We ended up analyzing the whole thing and balancing it by adding CG snow in the compositing bay."

The last sequence in the pilot, when Archer infiltrated the helix-shaped Suliban base, was actually created by Foundation relatively early in the schedule. Curry described it as a huge undertaking, since it involved dozens of CG models operating in a complex gaseous environment. Curry was also delighted with the matte painting of the Klingon capital, which was done by Illusion Arts.

AMAZING EXPERIENCE

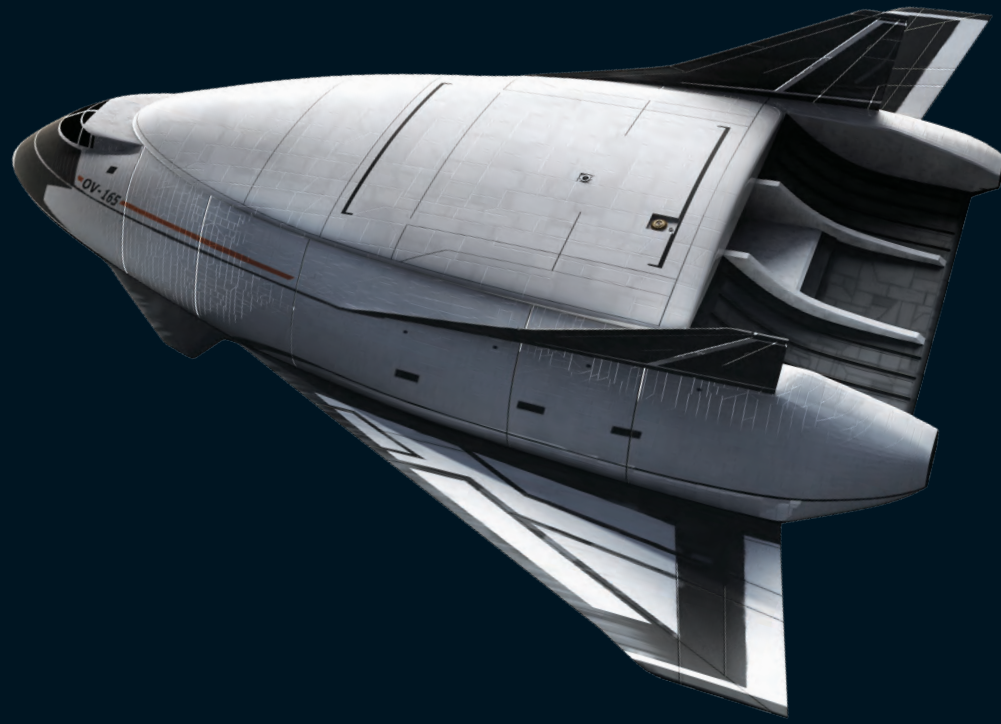
In total, the team completed over 300 shots – far more than in the average VFX movie. By the end they were all exhausted, but despite the pressure they all looked back happily at the experience. Bonchune described working with Peter Lauritson and Dan Curry as one of the most collaborative experiences of his working life. "That part was just great," said Bonchune.

"Sometimes I didn't think they realized how much we valued the level of their involvement – it was not a burden at all; it was a plus. Working with the art department too was pretty cool all the way around."

For his part, Curry was impressed with everyone's work. "Everybody at Foundation, Eden and CIS were involved in an incredible labor of love," said Curry. "Just working with such a wonderful group of people was a source of gratification."

"All of us in the visual effects department and our vendor companies rediscovered the joy of working on *STAR TREK* with this series. I think it was the fact that it focused on the wonder of discovery and exploration. A lot of it must be attributed to Scott Bakula, who brought such a casual demeanor to the set; his respect for the crew made *ENTERPRISE* a joy to work on. All of us in postproduction found it was pretty much the same kind of joy and enthusiasm you brought to your first job."

ON SCREEN



TRIVIA

A brief shot of the real 'Enterprise' space shuttle is seen during the opening credits of *ENTERPRISE*. Originally, it was going to be called 'Constitution' and unveiled on Constitution Day in 1976. However, after a concerted letter writing campaign by *STAR TREK* fans to the White House, it was named 'Enterprise.' It was first shown to the public at a dedication ceremony in Palmdale, California in 1976, and Gene Roddenberry and most of *THE ORIGINAL SERIES* cast were in attendance.



Joseph Ruskin was one of just three actors who appeared in both *ENTERPRISE* and *THE ORIGINAL SERIES*. He played the Suliban doctor in 'Broken Bow' and Galt in 'The Gamesters of Triskelion' [pictured below]. The others were Clint Howard, who portrayed Muk in 'Acquisition' and Balok in 'The Corbomite Maneuver,' while Jack Donner played a Vulcan priest in 'Home' and 'Kir'Shara' and Sub-Commander Tal in 'The Enterprise Incident.'



After the Space Shuttle Columbia tragedy in 2003, an opening screen was added to the *ENTERPRISE* episode 'Stigma,' which read "In memory of the Columbia crew... You will always be an inspiration."

- FIRST APPEARANCE:** OPENING TITLES (ENT)
- TV APPEARANCES:** STAR TREK: ENTERPRISE
- DESIGNED BY:** John Eaves

KEY APPEARANCE

STAR TREK: ENTERPRISE

Opening Titles

The only on-screen appearance of the OV-165 came in the opening titles of *ENTERPRISE*. It was intended to be the next stage in the evolution of space travel based on real-world technology back in 2001.

At that time, Lockheed Martin was working on a replacement for the Space Shuttle called the VentureStar. It was a single-stage-to-orbit reusable spaceplane that could launch into orbit at a fraction of the cost of the Space Shuttle. Unfortunately, technical failures meant the project was cancelled not long after *ENTERPRISE* debuted.

The OV-165 was closely based on the VentureStar, and at the time represented the prevailing opinion of where space vehicles were heading. It might still be possible to develop affordable single-stage-to-orbit spaceplanes, but at present no-one is close. British aerospace manufacturer Reaction Engines are developing the promising Skylon spaceplane, but it will not be ready until at least 2025.

In the meantime, billionaires Jeff Bezos and Elon Musk with their respective aerospace companies Blue Origin and SpaceX are leading the way in spaceflight with space vehicles that use recoverable space rockets.

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