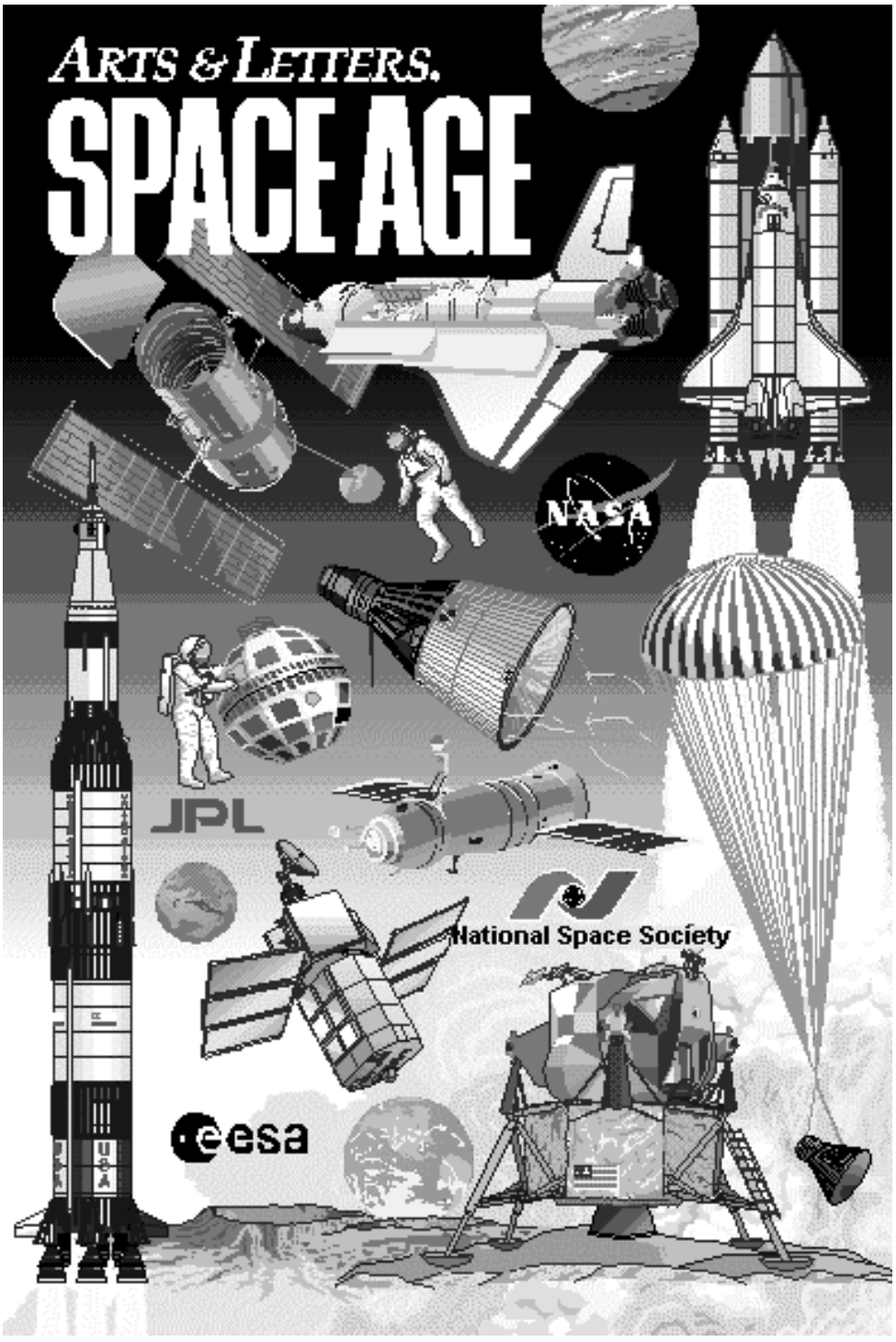
ARTS & LETTERS.
SPACE AGE
NASA
JPL
National Space Society
esa

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Welcome to SPACEAGE

Arts & Letters SPACEAGE, endorsed by the National Space Society, is one of the *Arts & Letters* EXPO Series of art, craft, and knowledge products. SPACEAGE is a 3-in-1 software product with multimedia, clip art, and drawing. This booklet discusses the installation of SPACEAGE and the contents of the multimedia encyclopedia, and shows examples of SPACEAGE clip art. For instructions on how to use the drawing program portion of SPACEAGE, please refer to the Online User's Guide and Help in *Arts & Letters DRAW*.

Installation of SPACEAGE

1. Put the SPACEAGE CD-ROM in the CD-ROM drive.
2. Start Microsoft Windows. At the top of the Windows display, the title bar should read Program Manager.
3. Pull down the File Menu and choose the **Run...** command.
4. Type **x:\install**, where x is the CD-ROM drive on your computer (D, E, etc.). Press the Enter key on your keyboard to run the installation.
5. Pull down the Installation menu and choose **Install**. The Product Choices dialog box will appear.
6. Choose the option that best suits your needs and click on **OK**.

   SPACEAGE [Run from Disk/8.7 MB] Best performance
   SPACEAGE [Disk & CD/2 MB] Average
   SPACEAGE [Run from CD only] Slowest
7. The Install Options dialog box will appear. If you prefer metric units of measurement to English, make sure the SPACEAGE DRAW Metric Setup option is highlighted in the Optional portion of the Install Options dialog box. For English units, click on SPACEAGE DRAW Metric Setup to deselect the option.
8. Follow the on-screen instructions.

The SPACEAGE CD-ROM contains three programs: (1) the SPACEAGE multimedia encyclopedia; (2) *Arts & Letters DRAW*, a complete drawing program with a special collection of space age clip art; and (3) the *Arts & Letters EXPRESS* Art Show.

For instructions on the operation of SPACEAGE Slide Shows and the *EXPRESS* Art Show, please see the tri-fold booklet enclosed with the SPACEAGE CD-ROM.

Cursors

The *Arts & Letters* SPACEAGE Encyclopedia utilizes four cursor-shapes: the usual arrow-shaped pointer, a pointing finger, an upraised hand, and stereo headphones:

You use the cursors to select as you do in any Windows program.

The arrow changes to the pointing finger to alert you that you are passing over a “hot-spot” on a map, photograph, or a key word highlighted in blue. When a hot spot is selected, click the left mouse button to see an explanatory popup. For example, as you move your pointer over the photo of a satellite, it will change into the pointing finger to tell you that there is a label or explanation available. In like manner, when the pointer changes into stereo headphones, you have encountered an audio clip, which you can play by clicking the left mouse button.

When you pause a slide show or video, the cursor changes to the upraised hand, indicating “Stop.”

Printing from SPACEAGE

Each subject window in SPACEAGE contains ”Print Setup” and “Print” buttons at the bottom. Use these buttons to configure your printer as you would in any application and to print the current topic to your printer.

Contents of SPACEAGE Encyclopedia

Welcome to the most complete multimedia on-line encyclopedia of spaceflight. To start SPACEAGE, click on the SPACEAGE icon in the Windows Program Manager.

The opening screen of SPACEAGE is accompanied by a stirring rendition of the theme from *2001*, the Stanley Kubrick film. This performance was orchestrated and recorded by Doug

Bench, of Doug Bench Productions, Dallas, Texas. (After you have once heard this overture, you can skip it by clicking in the window as soon as the opening screen appears.)

As you move your cursor over the contents screen, you will notice that as it passes over the pictures above the subject buttons, it changes into the "Headphones" cursor. Click your left mouse button to hear an audio clip pertaining to that subject.

The eight buttons launch the eight basic topics of SPACEAGE: Robotic Missions, Human Missions, Launch Vehicles, Space Stations, Space Spinoffs, History & People, Space Centers, and the Future. Along the bottom of the SPACEAGE window are other control buttons; the uses of these buttons (and their labels) vary with the subject you are exploring. To exit at any time, click on the Exit button on the far right bottom.

Because SPACEAGE is updated regularly to reflect recent Shuttle missions and other topics relating to space exploration, please note the button on the Contents screen labelled "What's New." Please click on this button for a summary of the changes since the last release of SPACEAGE.

SPACEAGE Theater Slide Shows

Click on the Theater button in the contents screen to display a list of slide shows in the scrolling window. Select a slide show presentation and click on the icon at the left to start the show. The slides are narrated and offer full-screen, detailed images of people, equipment, and historic events. To quit the slide show at any time, click the left mouse button once. To play SPACEAGE Highlights, a collection of 40 slides selected from the various slide galleries, press **F8**. The show will restart automatically when it completes a cycle. Click the left mouse button to end the show.

Pausing a Slide Show

To pause a slide show (except Shift-F8, below), click the right mouse button once; to resume, click it once again. Note that you can also pause video shows. The ability to pause a slide show in an educational situation is useful for asking and answering questions about what the audience has just seen.

Slide Show Grand Tour

Press **F3** to run all of the slide shows in succession automatically.

Auto-Cycle Slide Shows

To set a slide show to run continuously, press **F2** and select a slide show.

Locking the Keyboard

To lock the keyboard, press the **Shift** key together with **F2**, **F3**, or **F8**.

If you press **Shift + F2** and then select a slide show, it will lock the keyboard, but you will be able to pause the show by using the right mouse button. The only exception is **Shift + F8**, which locks the keyboard and disables the pause feature to avoid interruption of the show during unattended operation. Press **Alt + F8** to end the slide show if you have locked the keyboard.

Custom Slide Shows

Function keys **F4** and **F5** play custom slide shows installed in the Windows directory on your fixed-disk drive. This feature allows you to copy a script from the CD and modify it by inserting custom slides in the slide shows for special occasions. Details on how to implement this feature are available upon written request.

SpaceAGE Theater Videos

To play video highlights and the feature presentation, click on the Video button at the bottom of the screen. A list of video selections will be displayed in the scrolling window. Select a video from the list and click on the icon at the left to start the show. To quit the show at any time, click anywhere on the screen.

Galleries

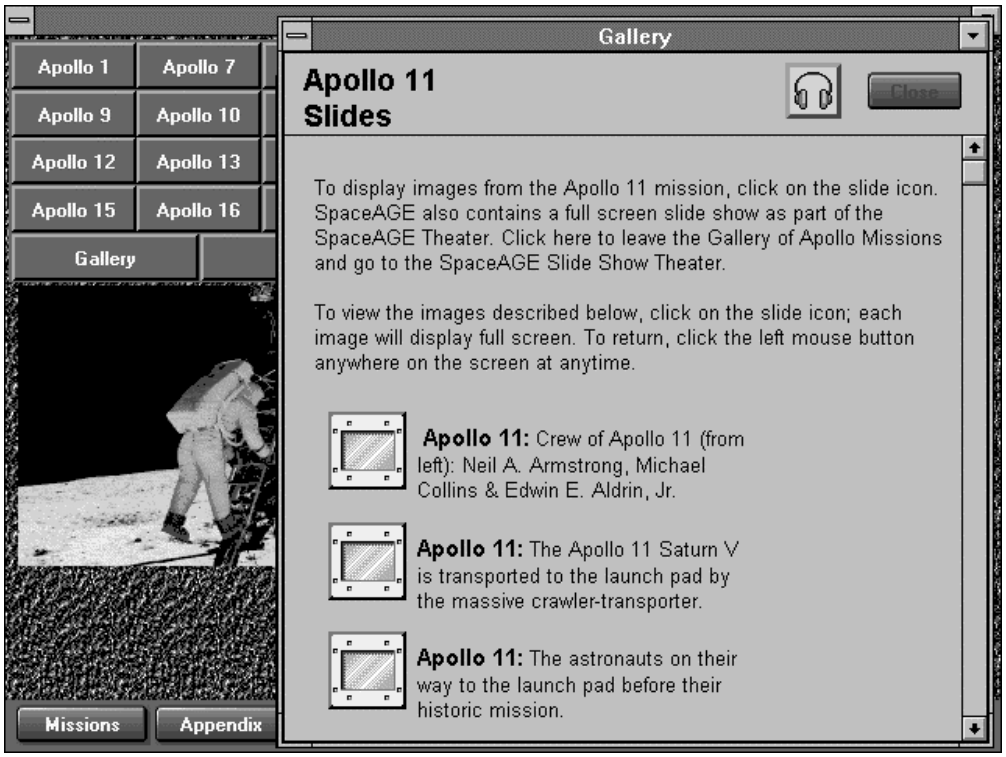
Most of the topics have a Gallery button. For instance, in Human Missions — Apollo 11, the Gallery button is at the left bottom of the bank of mission buttons.

When you click on the Gallery button, the Gallery menu appears, labeled with its topic in the upper left-hand corner. From this menu, you can select from two options:

1. Individual Slides — This option allows you to display full-screen slides illustrating the topic. In the case of Apollo 11, the slides are actual photographs illustrating the progress of the famous mission that landed the first humans on the Moon. Each slide is tagged with a brief description.

2. Audio Recordings — This option allows you to hear the actual transmissions between Mission Control and the astronauts of Apollo 11, as well as other pertinent contemporary recordings.

Click on the Close button in the upper right-hand corner to exit Gallery.

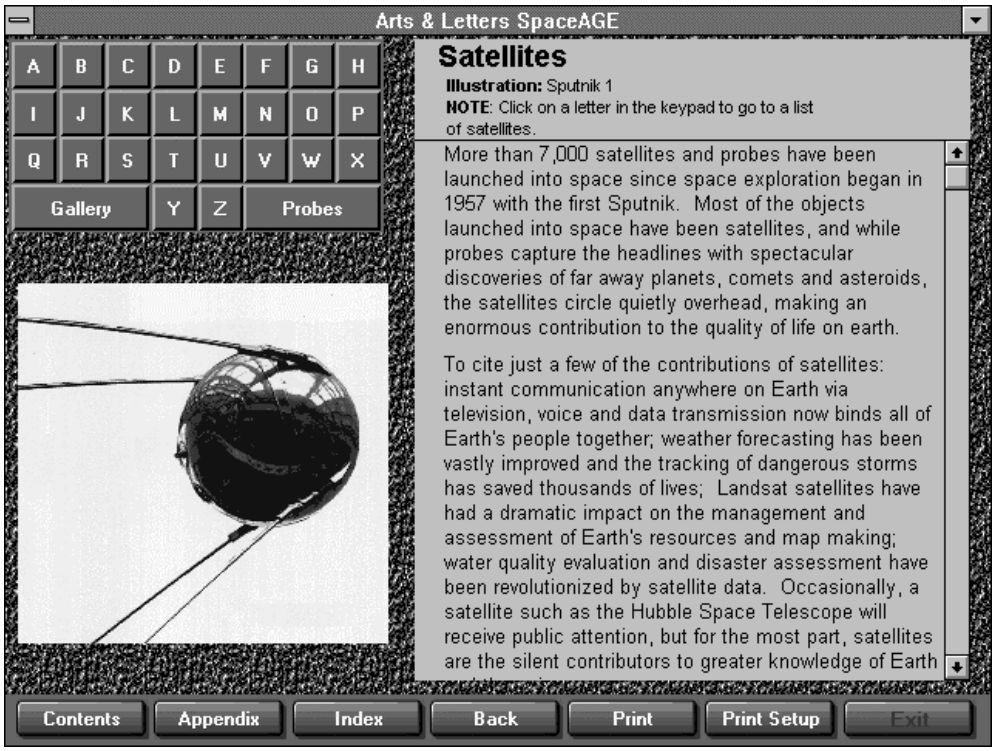


Robotic Missions

Selecting “Robotic Missions” initially presents you with an alphabetic keypad in the upper left-hand corner, with larger buttons labeled “Gallery” and “Probes.” Information about satellites is presented in a scrolling window at the right. Selecting “Gallery” gives you a menu of photographs of satellites, each labeled with a brief description. Clicking on “Probes” switches you to the topic of probes, with its own gallery.

Using the alphabetic keypad, you can search a thorough listing of probes or satellites. Clicking on a letter jumps the scrolling window to entries beginning with that letter.

The other categories of SPACEAGE operate in much the same manner, producing ever-deeper levels of information.

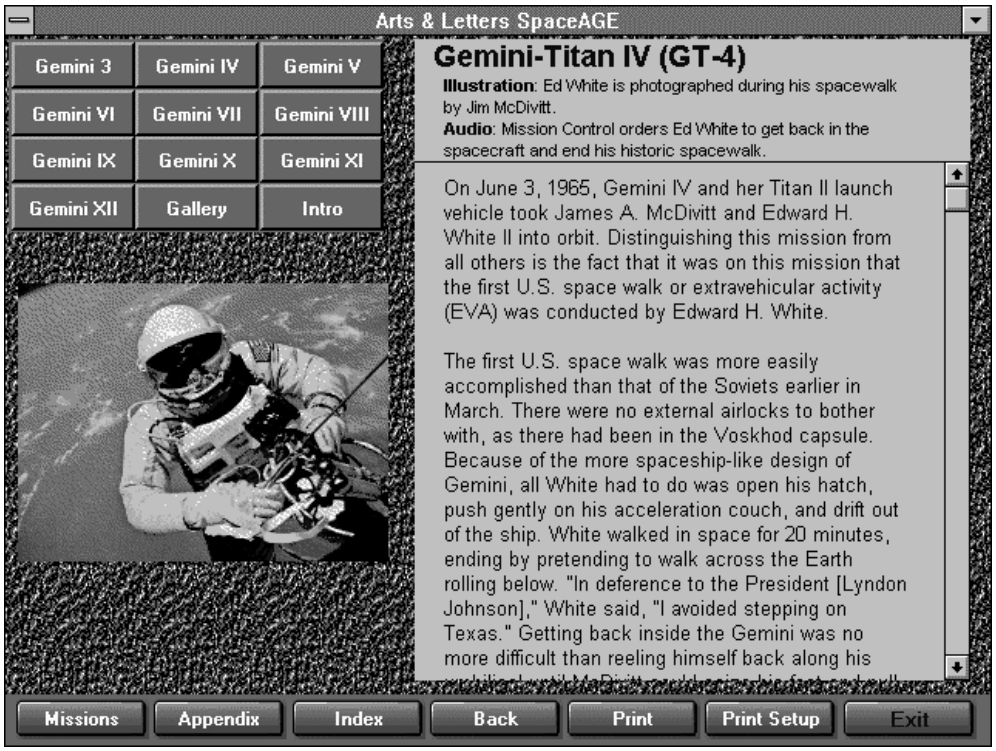


Human Missions

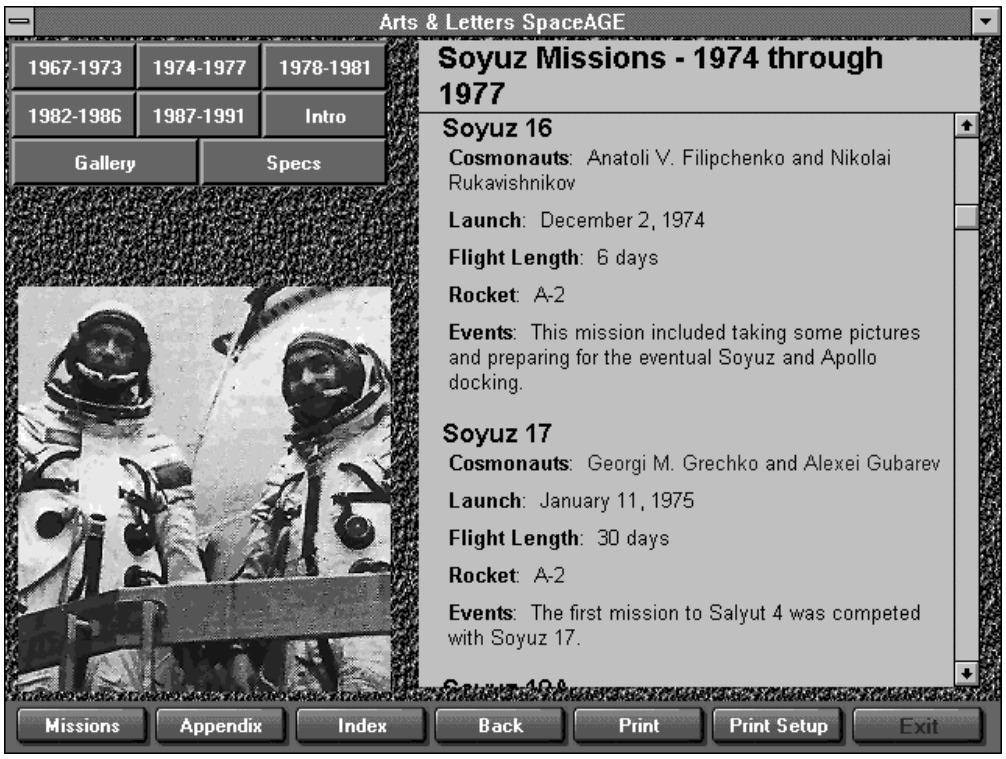
Click on this topic to see the major programs of the two greatest players in the Age of Space Exploration: the United States and the former Union of Soviet Socialist Republics (U.S.S.R.).

The U.S. programs include Mercury, Gemini, Apollo, ASTP, and Space Shuttle. Clicking on one of these produces a window that presents a photo, sound clip, and scrolling mission data for each of the individual missions. The mission data is not just facts and figures; pains were taken to include impressions of the astronauts and little-known facts.

For example, if you select Gemini, then select the Gemini IV mission, you can hear Astronaut Ed White, making the first American spacewalk and reluctant to end it. (And you can hear him being told in no uncertain terms to get back in the spacecraft!) Select Gemini III, and you'll find that one of the astronauts smuggled a corned beef sandwich aboard for his partner.



The U.S.S.R. programs include Vostok, Voskhod, Soyuz, and ASTP. The information to be found in them is structured the same as that of the U.S. missions. You will share the thoughts of the first man in space, Yuri Gagarin, as he experienced true weightlessness and looked down upon the Earth from a hitherto impossible vantage point. You will also find out about the returning Cosmonauts who overshot their landing zone and spent more time lost in the Ural Mountains than they did in space.



Launch Vehicles

This topic allows you to find the specifications of the launch vehicles, or rockets, of the spacefaring nations of the earth. China, Europe, India, Japan, Russia, and the USA are included. You can also browse a brief history of rocketry.

Space Stations

“Space Stations” presents information on the Salyut, Mir-1, Skylab, Alpha, and other space stations. Photographs contain hot spots that you can click on to see more information. Also included is a brief history of the development of space stations.

Spinoffs (of NASA Technology)

When the Space Race began in the late-fifties, Congress and the American people didn’t particularly care about the practical applications of space travel — what mattered was demonstrating to the world that a democracy could match or exceed the accomplishments of a totalitarian state. Once the race to the Moon had been won, however, Americans began to question the benefits of the space program.

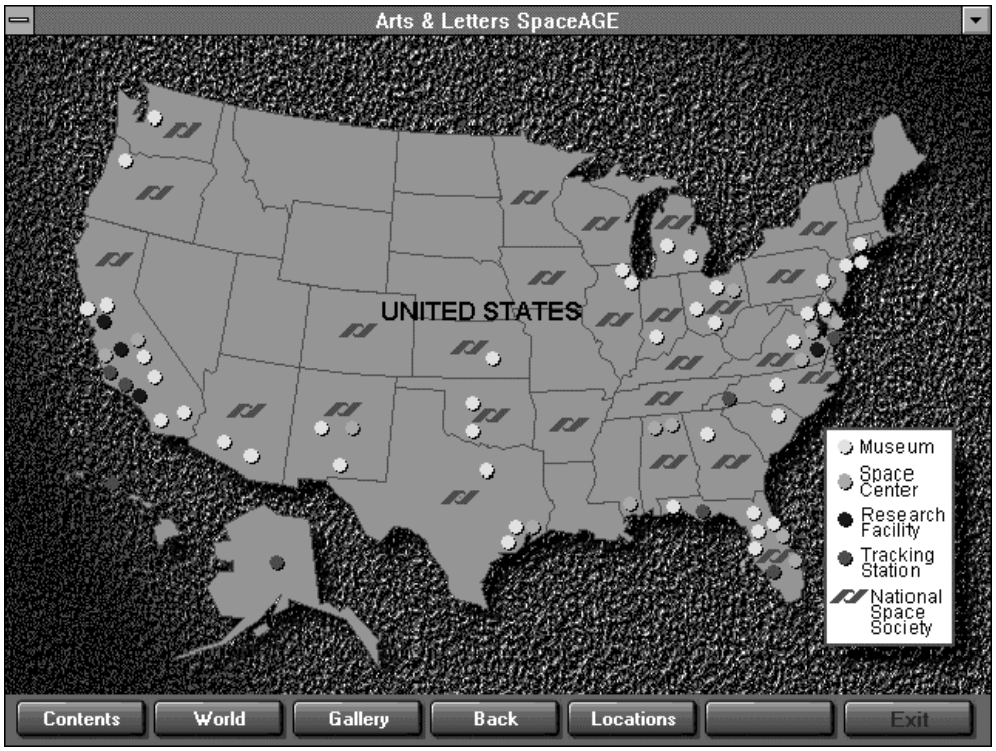
“Spinoffs” lists technological applications from the space program in the areas of Computers, Consumer, Dental, Education, Energy, Food, Industry, Medical, Safety, Natural Resources, Telecommunications, and Transport. In all, there have been many benefits accruing from the space program, and you’ll find them listed here.

History & People

This topic presents an in-depth time-line survey of the history of space flight from the beginning of this century to the present. Significant events are presented on the date on which they occurred. In addition, biographical sketches of major figures, such as Wernher von Braun and Robert Goddard, are included.

Space Centers

"Space Centers" uses maps of regions of the world to allow you to locate space centers and places of interest. At first you are presented with a map of the world. Click on a region of the world, such as Europe, Asia, or the United States. A more detailed map of the area will appear, displaying color-keyed symbols. Simply click on the symbols to see popups that give you additional information. National Space Society chapters are also located in this manner.



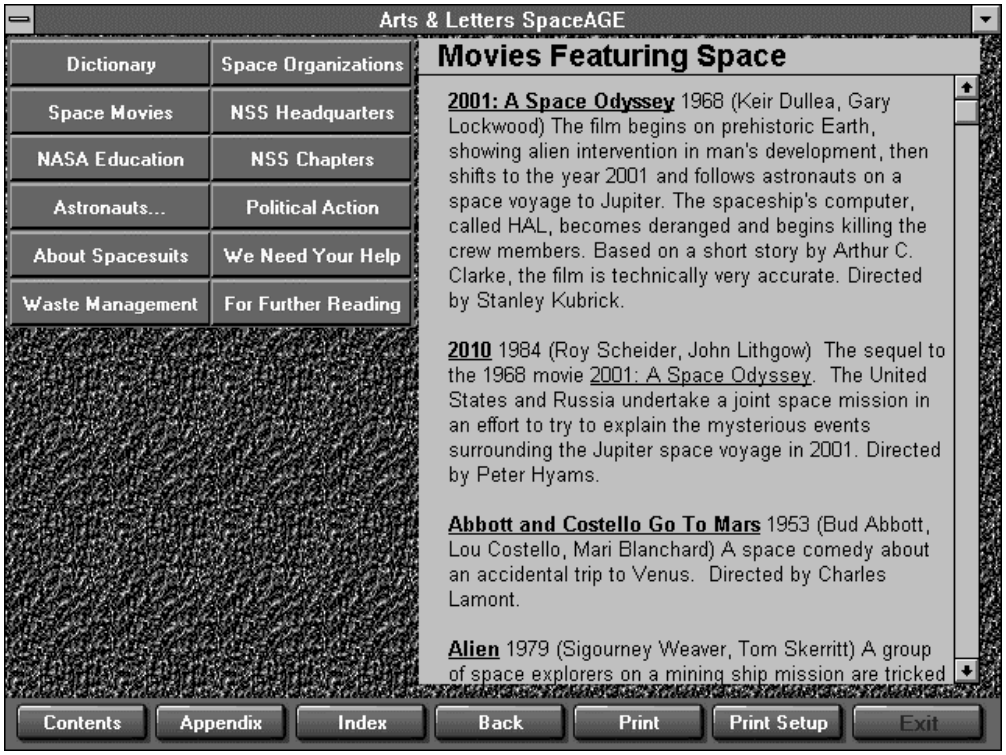
When you click on some map symbols, a full-screen image will appear and voice-over narration will describe what you are viewing. Click anywhere on the screen with the left mouse button to return to the map. To repeat the narration, click on the screen with the right mouse button.

The Future

"The Future" allows you to view and read about launch vehicles of the future, such as the Delta Clipper-X (DC-X), and to read about missions planned for the future, such as the return to the Moon and the establishment of permanent bases there.

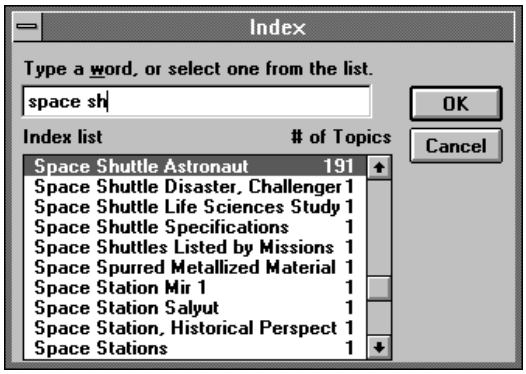
Appendix

"Appendix" includes a dictionary of terms associated with space flight (acronyms are explained here), a list of movies that feature space or space travel, NASA Education Programs, and Space Organizations. Interesting articles about astronauts, their space suits, and the way in which waste is managed during space exploration are also available. A practical topic telling how to take political action on behalf of space exploration is also included, as is a complete space bibliography.

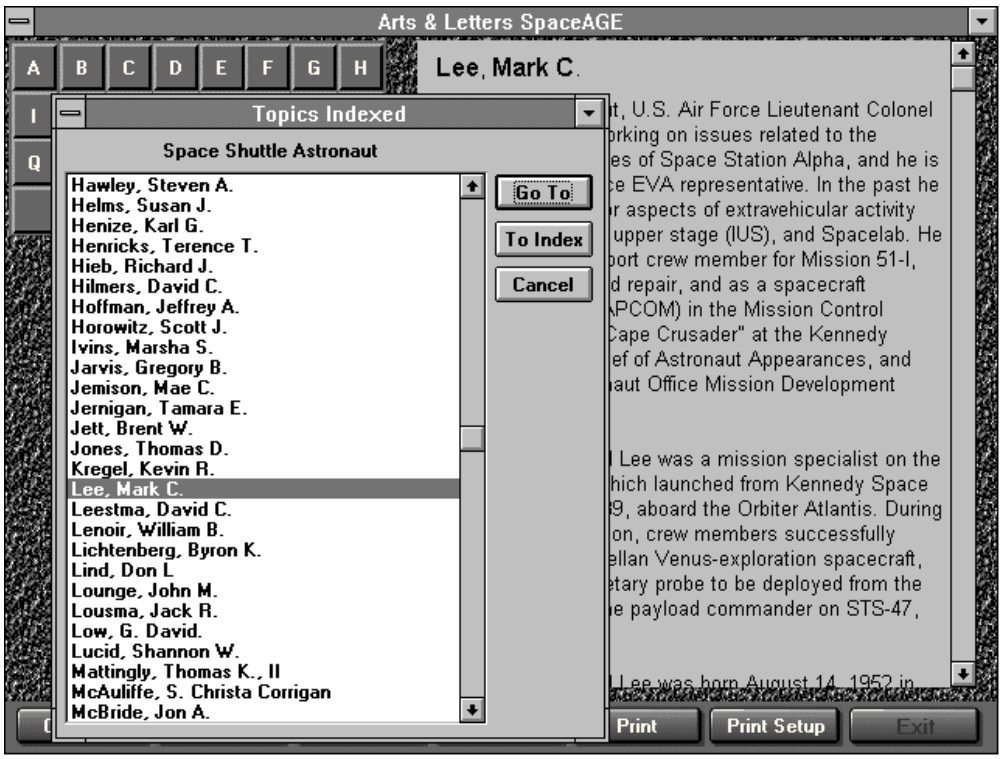


Index

The SPACEAGE Search Index operates much as the familiar Windows helpfile index does. There is one important difference, however; when you search a topic for which there are several entries, the Index tells you how many topics by that name there are.



For example, if you search for "Space Shuttle Astronauts," the Index will tell you that there are 191 topics, or shuttle astronauts.



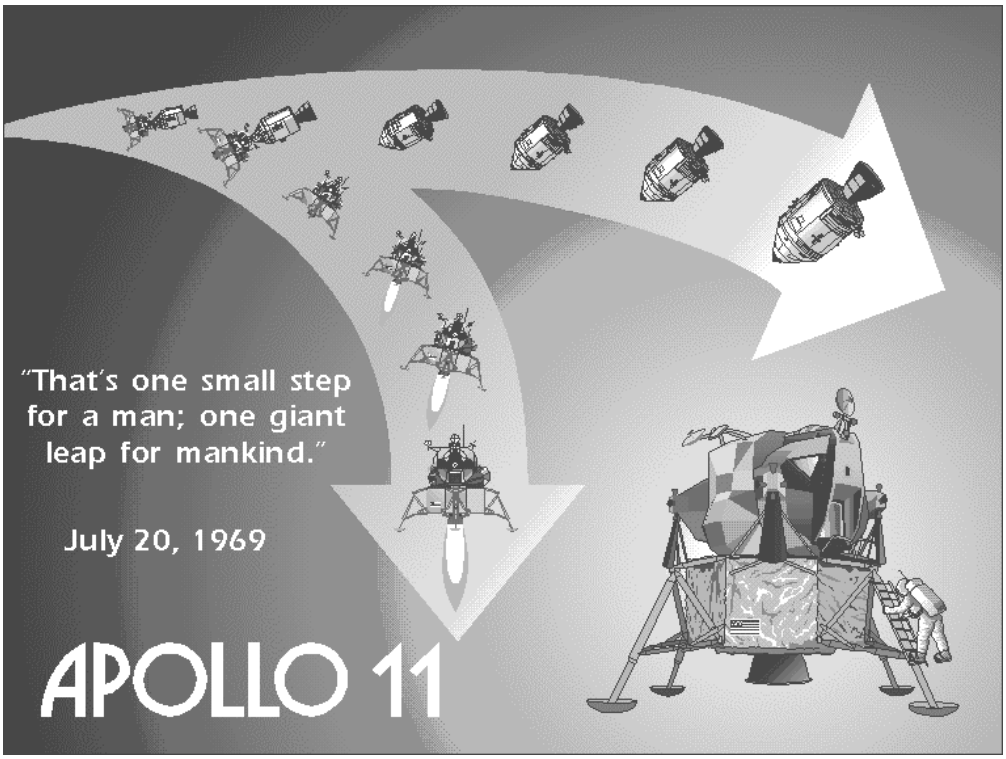
When you click on the OK button, the Index produces a list of the topics by title, or in this case, a list of the 191 shuttle astronauts. Click on one of the names, and the Index presents you with the biographical sketch of that astronaut. Using the Printer Setup and Print buttons, you can create a hard copy of the biographical sketch. You can also browse through more names, using the alphabetical keypad in the upper left-hand corner of the window.

The Clip Art of SPACEAGE

The clip art of SPACEAGE is award-winning *Arts & Letters* clip art, fully-colored, highly-detailed, and *vector-based* (as opposed to raster-based). In addition, many of the images are Flex-ART™, which means that they are composed of discrete modules that can be manipulated and modified in minutes to produce completely different poses.

You can, for example, deploy the space shuttle's Remote Manipulating System to create a scene showing a satellite being serviced or retrieved. You can move an astronaut's arms and legs to show him servicing the satellite. You can take apart images of space stations and put them together in new and original combinations. Your freedom of composition with Flex-ART is unparalleled. The concept of Flex-ART is discussed in detail in this manual, and many of the pieces included with SPACEAGE are illustrated.

The history of the U.S. space program is illustrated with images from Mercury through Apollo to the space shuttle (and its servicing of the Hubble Space Telescope), and a look to the future with the Alpha space station. Recent Russian efforts are represented by the Mir space station and Soyuz space craft.



Flex-ART™

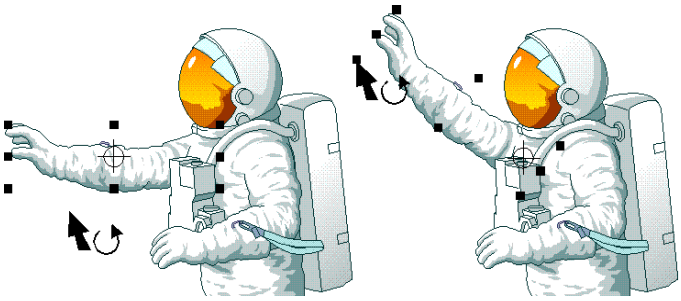
Arts & Letters products now include Flex-ART, the latest development in the evolution of static clip-art images to flexible art that can be modified in minutes. Flex-ART images are modular in design and can be easily manipulated to create dramatic results.

Using Flex-ART

When you break apart a Flex-ART image, you can select the modular pieces that make up the image. Each module is named, and the names show in the status bar above the drawing area as the modules are selected. For example, when an astronaut is broken apart, the resulting modules are "R-Upper/Lower Arm," "Body," "R-Leg," "L-Leg," and "L-Upper/Lower Arm." (The names also appear in the Lock/Hide/Name dialog box.)

If the name is a single or hyphenated word, such as "Body" or "R-Leg," you should not break the module apart any further, unless you need to change the color of its fill or the width of its line. If, on the other hand, the module is named with two words separated by a slash (/) mark, you can break it apart further into at least two more modules. For example, "R-Upper/Lower Arm" can be broken into "R-Upper Arm" and "R-Lower Arm," both of which can be manipulated separately.

Using **Rotate**, **Bring to Front**, and **Send to Back**, the modules can be moved in relation to each other to create different poses.

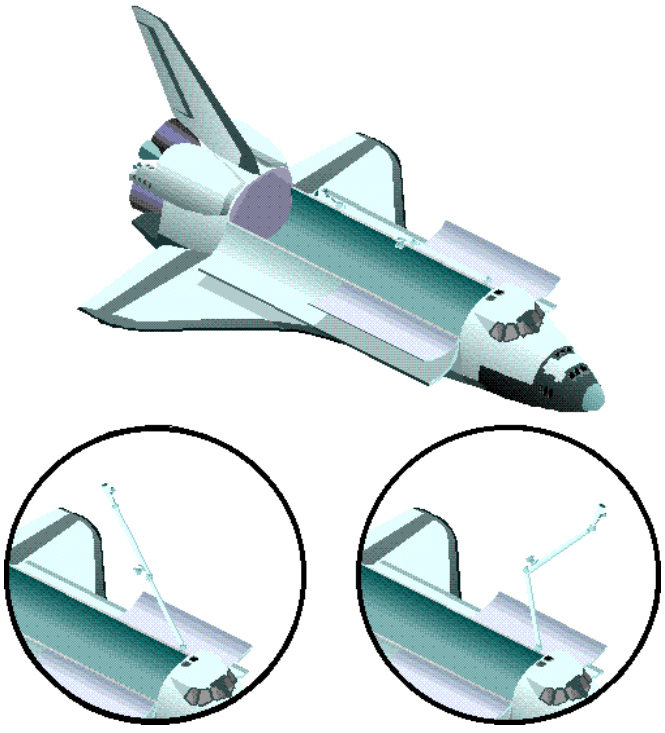


Rotate

Rotating modules is an easy way to change the appearance of the image. After breaking the image apart, simply select a module and choose the **Rotate** tool from the toolbox. A center-point marker will appear (the cross-hairs in the center of the selected module). The center point marks the spot around which an object will rotate. You should move the center point to the approximate location of a joint or hinge. For example, if you wish to rotate an astronaut's leg, move the center point to his hip; if you do not, the top of the leg will move away from the body.

Once the selected module has been rotated, you may need to move it slightly to adjust its position, depending on where you placed the center point prior to rotating. You may have to experiment to find just the right spot from which a module should be rotated. If you rotate a module and it doesn't look right to you, choose **Undo Rotate** from the **Edit** menu.

The space shuttle entitled "Doors Open/RMS (Coming)" can be broken apart and the RMS can be deployed using **Rotate**. The RMS, or Remote Manipulating System, is a device that deploys objects such as satellites from the cargo bay of the shuttle. It is also used to retrieve satellites and pull them into the cargo bay so that they can be repaired and redeployed or ferried back to Earth.

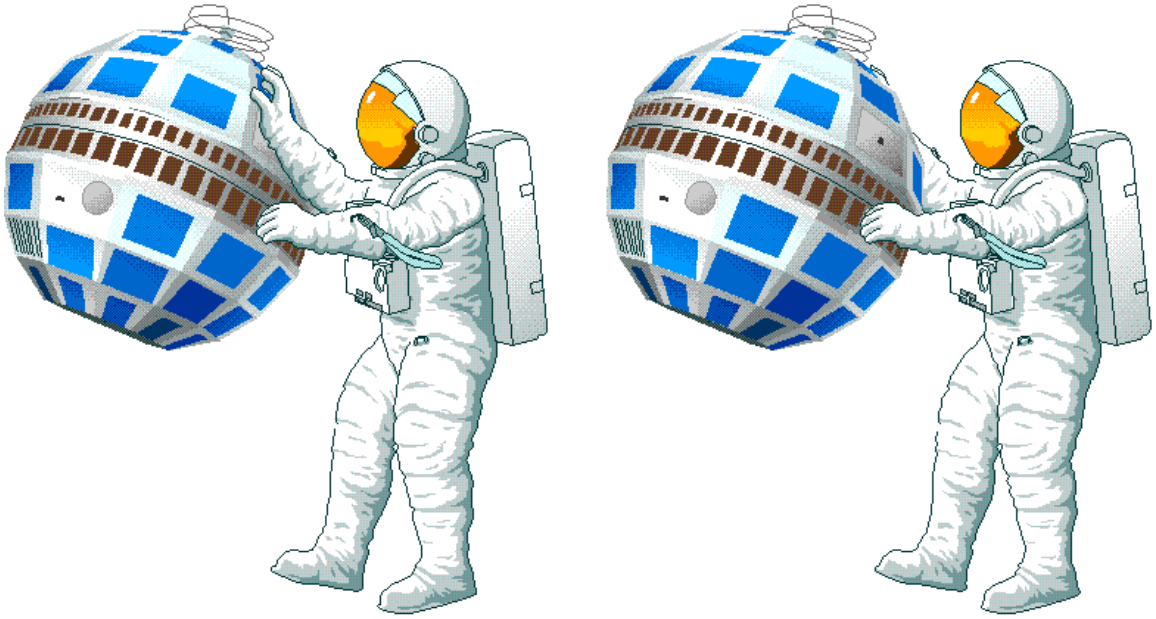


When you first break apart the shuttle, you will find three modules: “Shuttle,” “Near Side,” and “RMS 1/2/3.” This initial RMS module can be rotated out of the bay as one piece (as shown in inset).

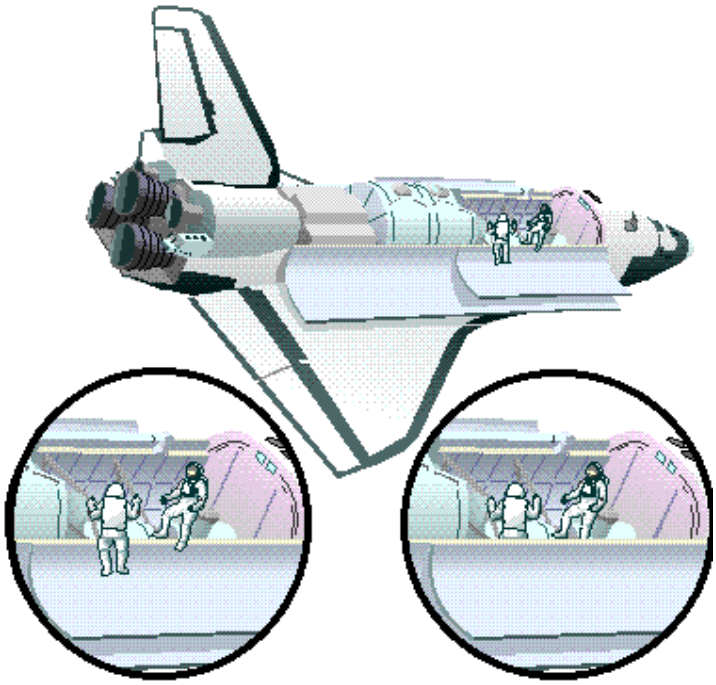
Then it can be broken apart into two more modules: “RMS 1” and “RMS 2&3.” “RMS 2&3” can be rotated at the joint it shares with “RMS1.” Finally, “RMS 2&3” can be broken apart into “RMS 2” and “RMS 3,” and “RMS 3” can be rotated at an angle from “RMS2” (as shown in inset).

Bring to Front and Send to Back (Stacking Order)

Altering the stacking order of modules allows you to combine images to create realistic compositions. In the example below, an astronaut and a satellite are placed in the drawing area. (The astronaut, one of several, is the same image used in the section “Using Flex-ART;” his arms have been flexed to create a different pose.) The satellite is maneuvered into position behind the astronaut, and the astronaut’s right arm is selected and sent to the back. In the resulting image, the astronaut appears to be examining the satellite. You could achieve the same result if the satellite were in front of the astronaut; all you would do differently would be to select the astronaut’s left arm and bring it to the front.



Stacking order is crucial to using the Flex-ART included with SPACEAGE. Many of the Flex-ART images are composed of foreground, middle ground, and background pieces. The space shuttle labeled “Doors Open w/Lab (Going)” illustrates this process. When you break apart the shuttle, you produce three modules: “Far Side/RMS,” “Laboratory,” and “Near Side.



By using the stacking order, you can place astronaut figures not only within the bay but within the bay and behind the space laboratory.

First, break apart the shuttle into its three modules. Add the astronauts in the positions where you want them to appear in the final composition.

There are two methods of putting the astronauts within the bay. The simpler of the two is to select “Near Side,” pull down the **Arrange** menu, and click on **Bring to Front**. Doing so will change the stacking order of the composition so that the “Near Side” draws last (and over the astronauts’ lower bodies). When you look closely at the illustration, however, you will see that one of the astronauts appears to be behind the space laboratory that is being stored in the bay.

One way to achieve this effect is to cut that astronaut to the Clipboard. After doing so, select the space laboratory and pull down the **Edit** menu. Select **Paste Options** and click on **Behind Object**. The cursor will change to an hourglass, then to the Add Object cursor. Place the Add Object cursor within the bay and slightly above the space lab, then click. The place of this astronaut in the stacking order will be *behind* the space lab but *in front of* the “Far Side/RMS.”

You can further refine a composition such as this by manipulating the astronauts’ arms and legs to make it appear as if they are working on the shuttle or space station.

As you have seen, the image of the space shuttle is available in a number of different configurations, including versions of the two previously-displayed space shuttles, these with their cargo bay doors shut.

Typical Shuttle Launch

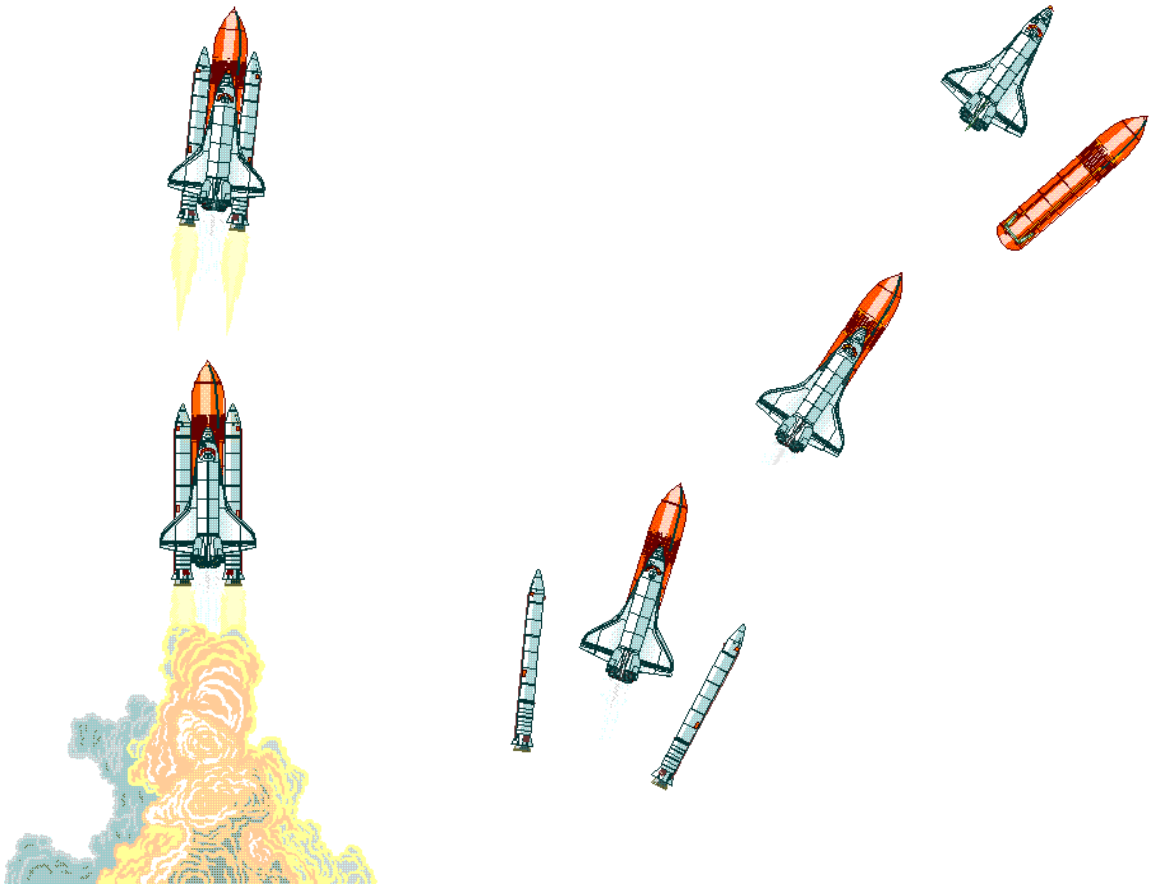
Another configuration is “Shuttle Launch,” which shows the shuttle with its boosters and external fuel tank at the moment of launch, boosters firing, with billowing clouds of exhaust.

This Flex-ART image can be broken apart into six separate modules that can be used to illustrate the different stages of a typical shuttle launch.

The series below was created by duplicating the basic image five times, removing or rearranging parts of it, and rotating the resulting images. When “Shuttle Launch” is initially broken apart, the modules “Launch (Smoke)” and “Launch (in flight)” appear. The module “Launch (in flight)” is moved into position just above the original “Shuttle Launch.”

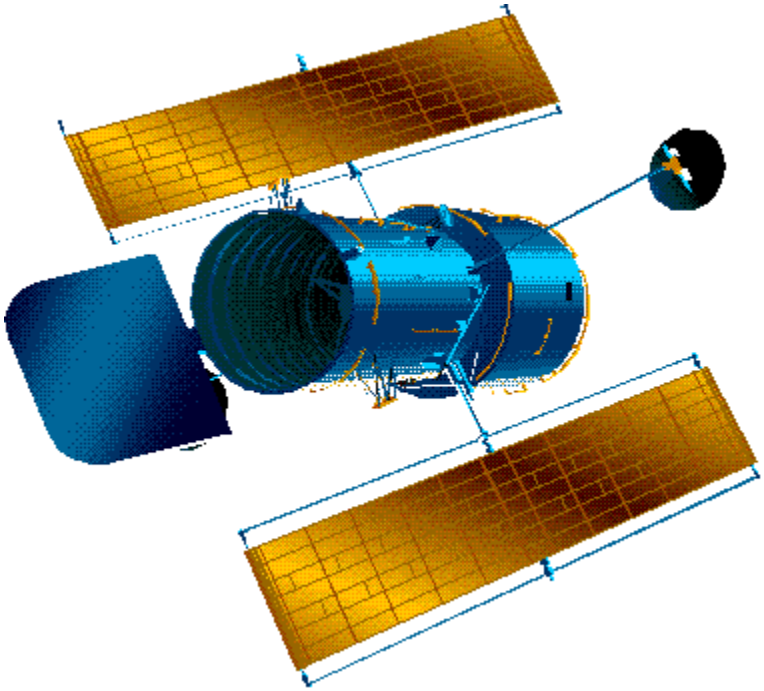
In its turn, “Launch (in flight)” breaks into the modules “Shuttle w/Boosters,” “Booster Blasts,” and “Shuttle Blasts.” Deleting the “Blast” modules makes it appear as if the engines have been shut down. Breaking the “Shuttle w/Boosters” apart produces a level of four modules composed of two solid fuel boosters, the external tank, and the Shuttle itself. The blasts of the solid fuel boosters can be deleted, and the boosters themselves can be rotated and moved away from the shuttle to simulate their jettisoning after their fuel is exhausted.

In similar manner, the shuttle can be separated from the external tank, which can be rotated to appear as if it is dropping away from the rising shuttle. The end product is an impressive series of very detailed images that accurately represent a typical shuttle launch. Combined with the detailed shuttle images previously illustrated, this series can be used to depict an entire shuttle mission, from launch to reentry.



The Hubble Space Telescope

The single largest problem facing astronomers on Earth is the blurring effect of the Earth's atmosphere. Ordinarily invisible, the air currents in our atmosphere distort observations of distant objects in outer space. In addition to having to peer through a thick, moving atmosphere, astronomers have begun to have to contend with light pollution — light from cities reflecting from the moisture in the atmosphere and lighting up the star fields that were once completely dark. It has long been a dream of astronomers to have a telescope in space, beyond the atmosphere and its distortions.



The Hubble Space Telescope was to be that telescope. However, after its flawless launch in April 1990, scientists found that the main mirror of the reflecting telescope suffered from spherical aberration. This optical problem caused a degradation in spatial resolution, or the ability to record fine detail. Part of the disappointment was the fact that although regular servicing had been planned for the Hubble, the main mirror was the one component that could not be serviced in orbit.

Less widely reported and understood is the fact that even with its problems, the Hubble still performed all tasks well. Although the Hubble's performance was not everything that was anticipated, the Hubble is reckoned by the scientific community to be a success.

The Hubble Servicing Mission

In addition, the Hubble received a new pair of glasses to compensate for its spherical aberration and bring its vision closer to what was originally intended. Since the mirror could not be altered, the instruments that record its images were. During the first of their regularly-scheduled maintenance visits, in December of 1993, astronauts successfully installed COSTAR, the Corrective Optics Space Telescope Axial Replacement. COSTAR consists of ten tiny mirrors that were fixed in front of the Hubble's instruments.

In addition, astronauts replaced other instruments, as well as faulty solar collectors that vibrated every time sunlight hit them and caused the telescope to jiggle at inopportune moments. One of the Hubble's solar panels was simply disconnected and tossed overboard to burn up in the Earth's atmosphere.

In SPACEAGE the Hubble Space Telescope can be represented as fully operational, with its solar panels extended and telescope uncovered, or with its solar power panels furled and its telescope covered.

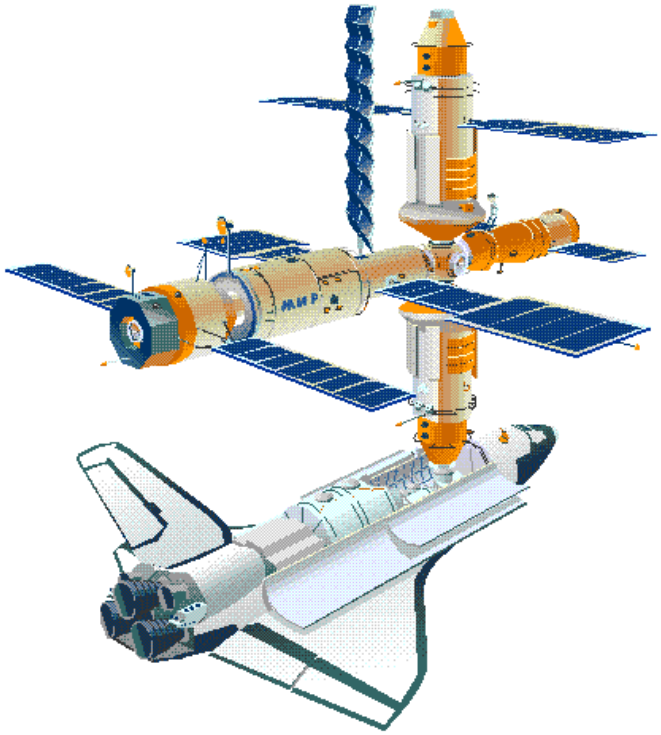
On January 12, 1994, NASA proudly announced that the Hubble repair mission had achieved its objectives and that the telescope's vision had been successfully sharpened. As evidence, their spokesperson showed two photos of a distant galaxy taken by the Hubble before and after servicing. The improvement was obvious: the first appeared to be seen through a haze; the second was sharp as a razor.

Since then, the Hubble has continued to produce breath-taking and scientifically astonishing photos.

The Space Shuttle Rendezvous with Mir

In February of 1986, the Soviet Union launched its most ambitious space station attempt: a new design called Mir, or "Peace." Mir looks like the earlier Salyut space stations, but it is much larger and is not as jammed with scientific equipment. Cosmonauts have more room to move around, to exercise, and to relax.

A multiple docking module, with five docking ports, allows four modules to attach to the base unit, while a single dock in the base unit has allowed Kvant 1 to dock and expand the station. Kvant 2 was added later, and the Kristall experimental factory module was attached in 1990.



The composition “Mir-1 & Shuttle” (found in Space - Compositions library) illustrates the U.S. space shuttle’s docking with Mir. The shuttle and Mir can be manipulated separately; each can be broken apart into its constituent modules.

Space Station Alpha

Also included in SPACEAGE is Space Station Alpha, a cooperative effort of the United States, Canada, the European Space Agency (ESA), Japan, and Russia. Space Station Alpha is still in the developmental stage; in fact, the designation Alpha is only one of five names under consideration. (The other four are Unity, Alliance, Aurora, and Sigma.) The station is represented in SPACEAGE in four different configurations. In addition, the modules that comprise Alpha can be rearranged to create a space station of your own design.

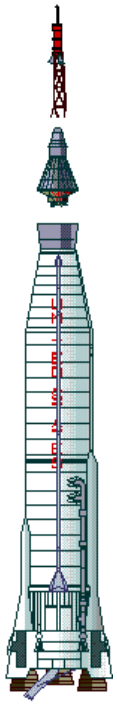
Alpha 1 is the first or power station phase, which will utilize simplified Freedom hardware and other existing systems, such as the orbiter and Spacelab. A power station will be on-line in three flights, using Freedom photovoltaic modules for a 20-day Shuttle/Spacelab mission docked to the station. Subsystems, payload racks, and docking ports for international laboratories are added.

Alpha 2 is the second or human-tended capability phase of the station. With the addition of the U.S. Common Module, a human-tended capability would be possible.

Alpha 3 depicts the third or international human-tended capability of the station. At this point there will be a permanent human presence.

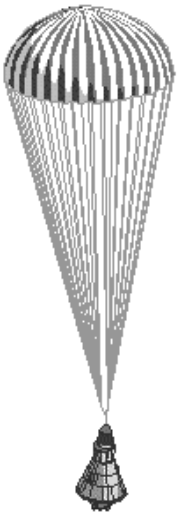
Alpha 4 is the final, or expanded, version of the station. There will be an international community permanently occupying the station.

Mercury and Gemini



In addition to the images of present and future space activity, SPACEAGE incorporates imagery depicting the history of humanity’s leap into space.

Project Mercury represented the beginning of the U.S. human-crewed space program. Mercury capsules carried a very cramped crew of one for relatively brief jaunts into space. Like all U.S. space flights (until the shuttle), Mercury capsules were intended to be braked initially by the atmosphere then by parachutes and finally “land” in the ocean.



Because they were to splashdown in the ocean, U.S. space capsules had to be buoyant. The danger of a space capsule shipping water and sinking when the astronaut opened his hatch was real (and was realized when astronaut Gus Grissom lost his capsule in just that manner). On the other hand, because of the size of their territory and their relatively weak naval presence, the Russians planned for their space flights to ended on land within the Soviet Union. The Russians didn’t have to worry about their spacecraft sinking, but they did have to consider the

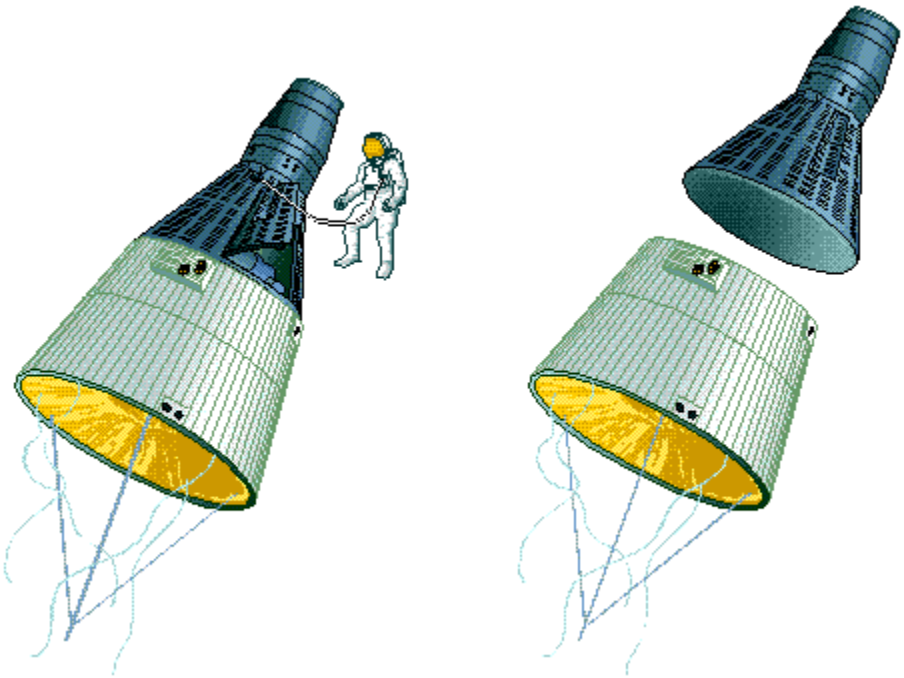
impact with which they touched down.

Following Mercury and preceding Apollo, the Gemini program was an important stepping stone to the Moon. The Gemini capsule closely resembled the Mercury capsule, but it was much larger, and where the Mercury capsule carried a crew of one, Gemini carried two. (The name, Gemini, refers to the constellation, whose name translates as “the twins.”) The Gemini astronauts sat side by side with relatively greater freedom of movement and much greater control over their capsule.

Another important difference between Mercury and Gemini capsules was that whereas all the controls and life systems for the Mercury astronauts were crammed into the capsule itself, the Gemini capsule moved all those systems into a detachable Orbital Attitude and Maneuvering System that was attached beneath the capsule. Once the Gemini was in orbit, the OAMS allowed its astronauts to control the movements of their craft and to practice docking with a target vehicle (the Agena) sent into orbit for just that purpose. When the mission was over, the OAMS was jettisoned and only the capsule made a safe descent to Earth.

The final unusual characteristic of the Gemini capsule was that for the first and last time, astronauts had ejection seats with which to escape a launch gone bad.

Gemini had many objectives, one of the greatest of which was to give astronauts practice in space walking, or Extra Vehicular Activity (EVA). The Gemini capsule in SPACEAGE shows an astronaut space walking, with its hatch open to outer space. When this hatch is deleted, a closed hatch is revealed. The capsule can also be separated from the OAMS so that the capsule can be represented as returning to Earth.

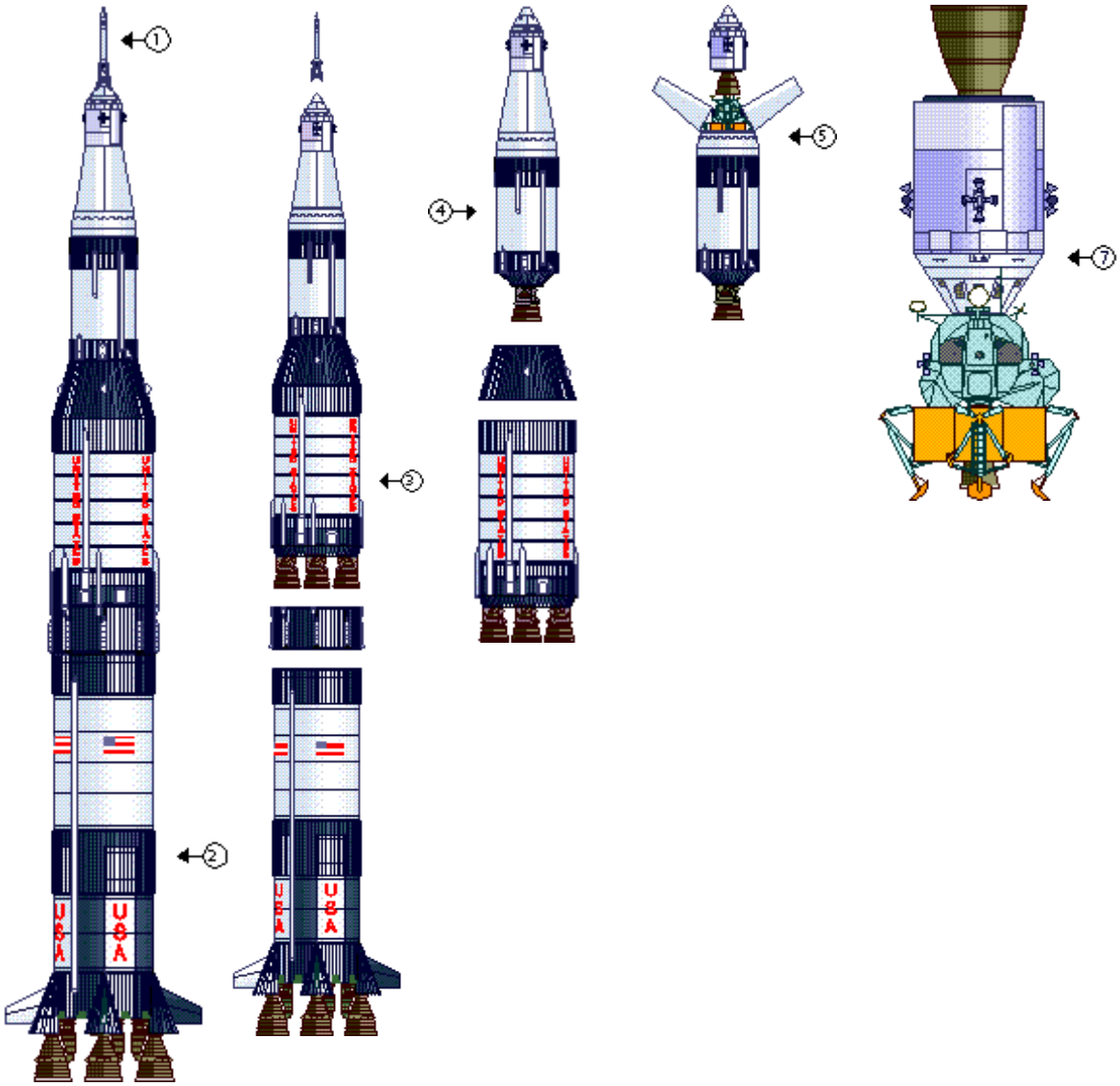


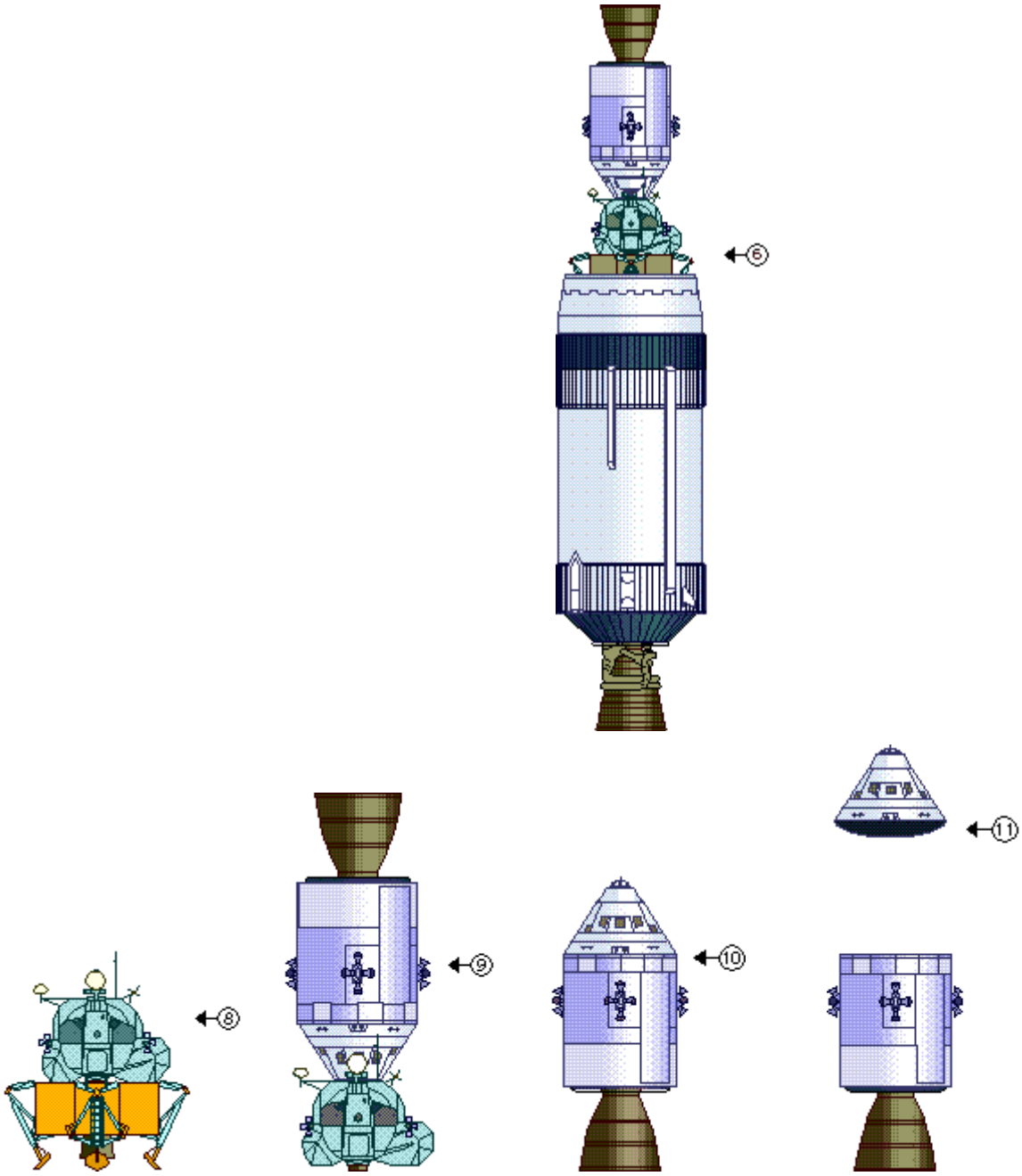
Like Mercury, Gemini used a parachute to break its descent to the ocean. A paraglider to allow the capsule to return to dry land had been on the drawing boards, but before it could be perfected, Project Gemini began and an ordinary parachute had to suffice.

Apollo 11: Humanity

Apollo was the program intended to put a man on the moon by 1970, and it was the eleventh Apollo mission that did so.

The Apollo 11 mission to the Moon is illustrated using the “Saturn V (stages)” image. (The other, less intricate, Saturn V image can be used when the detail available in this image is unnecessary.) This intricate image of the Saturn V booster and its famous payload breaks down into the smallest of detailed modules.





The initial image is of the entire Saturn V launch vehicle. On its very tip, high above the ground, is the Launch Escape System (1), or Rescue Tower, which was to be the astronauts' method of escape should anything go wrong during the launch. Attached to the Command Module, the Rescue Tower was equipped with rockets that were to lift the Command Module a safe distance away from the Saturn V and allow the Command Module's parachutes to open. Fortunately, it was never needed, and the Rescue Tower was jettisoned soon after the second stage separated from the first.

The S IC stage (2), the first and lowest stage, was composed of five powerful F1 rockets bundled together. Combined, their thrust was equal to 53.4 million newtons, or 12 million pounds of thrust. When their fuel was exhausted three minutes into the launch, explosive

bolts severed the S IC stage from the ascending launch vehicle and the S II stage (3), composed of five J2 rockets, was ignited. The S II stage's rockets generated 7.1 million newtons, or 1.6 million pounds of thrust. The rockets of S II burned for six minutes before falling silent, then they in turn were jettisoned.

The single J2 rocket of stage IVB (4) was fired and burned for two minutes to put the spacecraft into orbit. Stage IVB's rocket generated 889,600 newtons, or 200,000 pounds of thrust. After one and a half orbits, the J2 was fired once more to boost the spacecraft toward its lunar rendezvous. After it was in a translunar trajectory, the Command and Service Module (CSM) (5) separated from stage IVB, reversed its orientation, and docked (6) with the Lunar Module (LM). Stage IVB was discarded, and the CSM and LM continued to the moon.

After the spacecraft was in orbit around the Moon, the two-man crew of the LM separated it from the CSM (7). Using its single variable thrust engine to brake their descent, they dropped softly to the surface of the moon (8).

The first visit to the Moon was relatively short, compared to those that followed. After establishing the presence of humanity on the Moon and leaving human footprints in the dust of millions of years, the crew blasted off from the Moon in the Ascent Module. They used the Descent Module as a launching pad, leaving it on the Moon, and rendezvoused in orbit with the CSM. After the Ascent Module had docked with the CSM and its two-man crew had reentered the CSM, the Ascent Module itself was jettisoned (9).

Shortly before achieving Earth orbit, the astronauts jettisoned their faithful Service Module (10) and continued the final leg of their journey in the Command Module. After skipping off the upper reaches of the atmosphere like a flat stone thrown across water, the Command Module reentered the atmosphere, slowed sufficiently for its parachutes to open, and splashed down in the Pacific Ocean, where it was recovered by the U.S.S. Hornet.

Lunar Module

SPACEAGE also features a detailed image of the Lunar Module, which can be separated into the Descent and Ascent Modules. The reason the Lunar Module looked as angular and lumpy as it did was that because it never had to operate within an atmosphere, with the friction and resistance of air. In the vacuum of space and the Moon, it needed absolutely no streamlining. Its design included the ingenious idea of dividing it into two modules, each with particular tasks to perform.

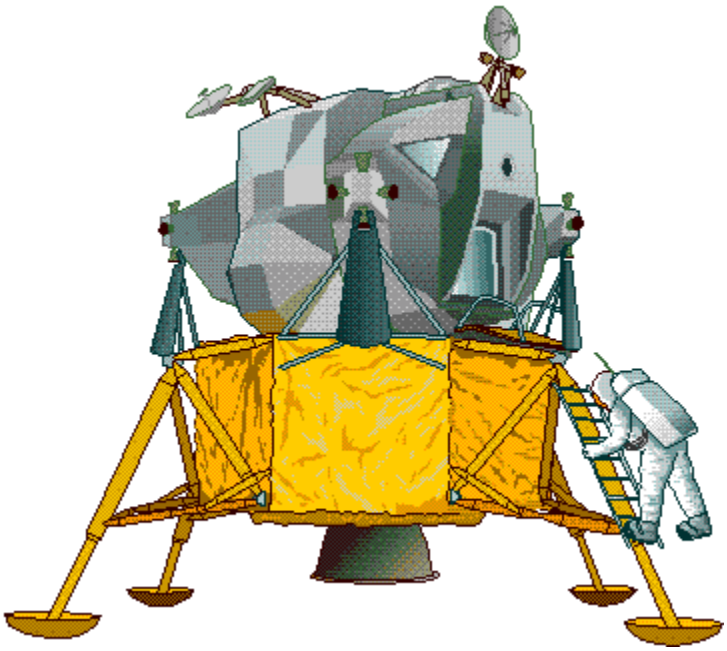
The Descent Module included a rocket engine that could vary its thrust greatly and thus bring the entire Lander down gently. It also included a "porch" and ladder to aid the astronauts in leaving and entering. Its final task was to serve as the launching pad for the Ascent Module, which was to rise and rendezvous with the Command and Service Module orbiting the Moon above.

"That's one small step for man; one giant leap for mankind."

—Neil Armstrong

The figure of an astronaut, equipped with the Apollo Extravehicular Mobility Unit (EMU), can be positioned on the ladder leading down from the Lunar Module to reproduce the moment when Neil Armstrong became the first human to touch the surface of the Moon.

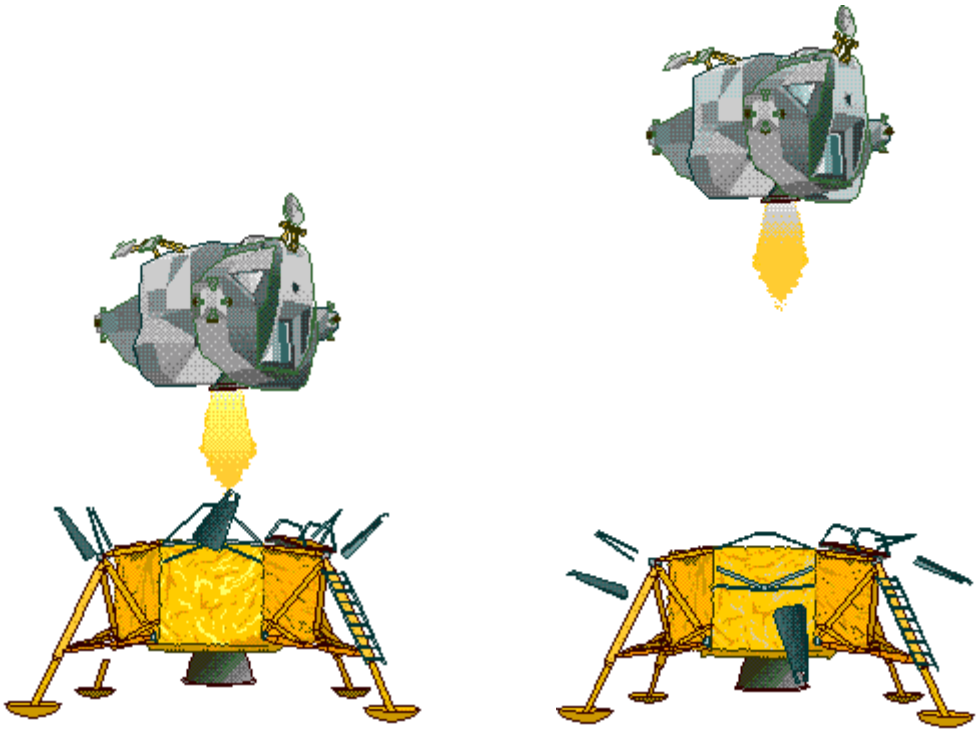
Because the astronaut is a Flex-ART image, its arms and legs are modules separate from its body, and these modules can be rotated and positioned to create many different poses.

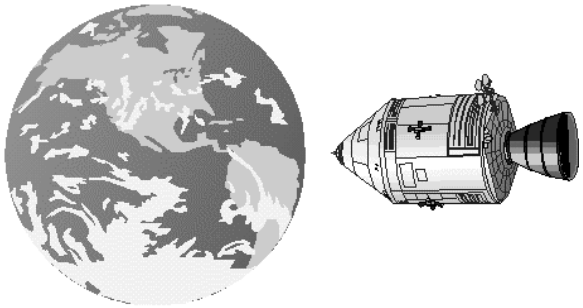


The Lunar Lander proved to be more than just an exploration vehicle. In the case of Apollo 13, it served as a lifeboat, when an explosion crippled crucial life-support systems in the Command Service Module. The astronauts abandoned their planned Moon landing and lived in the Lunar Lander until they could return to Earth. Once in Earth orbit, they reoccupied the Command Module, jettisoned their lifeboat and the crippled Service Module, and reentered Earth's atmosphere safely.

The ascent stage rocket was one of the few non-redundant systems in the Apollo program, and if it had failed to fire, the astronauts would have been stranded on the moon with no hope of rescue.

The rocket blast from the ascent engine shown in this sequence is "artistic license." In the absence of an atmosphere you would not see flames from the rocket blast as you would on Earth.





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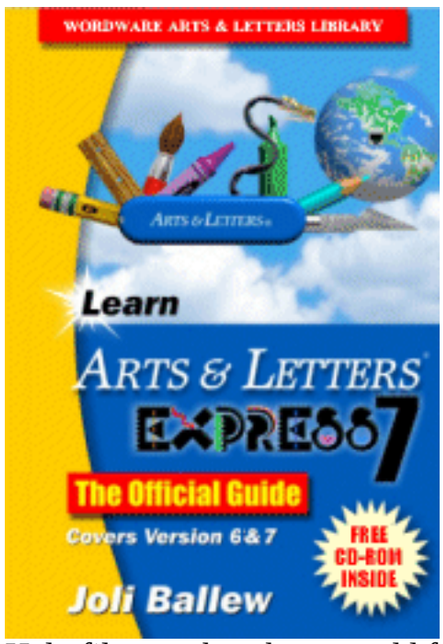

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Joli Ballew is a full-time writer and graphic artist and resides in the Dallas area. She has also worked as an educational content consultant, a network administrator, a high school algebra teacher, and a college instructor. After graduating from the Performing Arts Magnet in Dallas where she studied music and the arts, she attended college at the University of Texas at Arlington, and graduated with a B.A. in Mathematics and a minor in English.

Currently Joli has three books available: *Windows 2000 Professional Test Yourself* from Syngress Media, and *Windows 2000 Server On Site and Windows XP Professional - The Ultimate User's Guide* both published by Paraglyph Press. Joli is working on two new books to be published in late 2002; *The Complete Idiot's Guide to Photoshop Elements* by Alpha books (co-authored with Greg Holden) and *A Simple Guide to Photoshop 7.0*, published by Pearson Education.

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Sam Andrew, Technical Editor for the book, combines real world experience in graphics with an understanding of education and curriculum development.

Sam is the Curriculum Manager for Technology Education for Highlands High School in Pennsylvania and was instrumental in developing their Computer Graphic Design Specialist Program replacing a traditional Industrial Arts program. Highlands now has articulation agreements with six colleges and technical schools to which Highland graduates are able to go with advanced credit. Arts & Letters EXPRESS has been an integral part of the Highlands' curriculum for the past ten years. Sam is currently developing a Computer Graphic Design class for adults in the community.

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