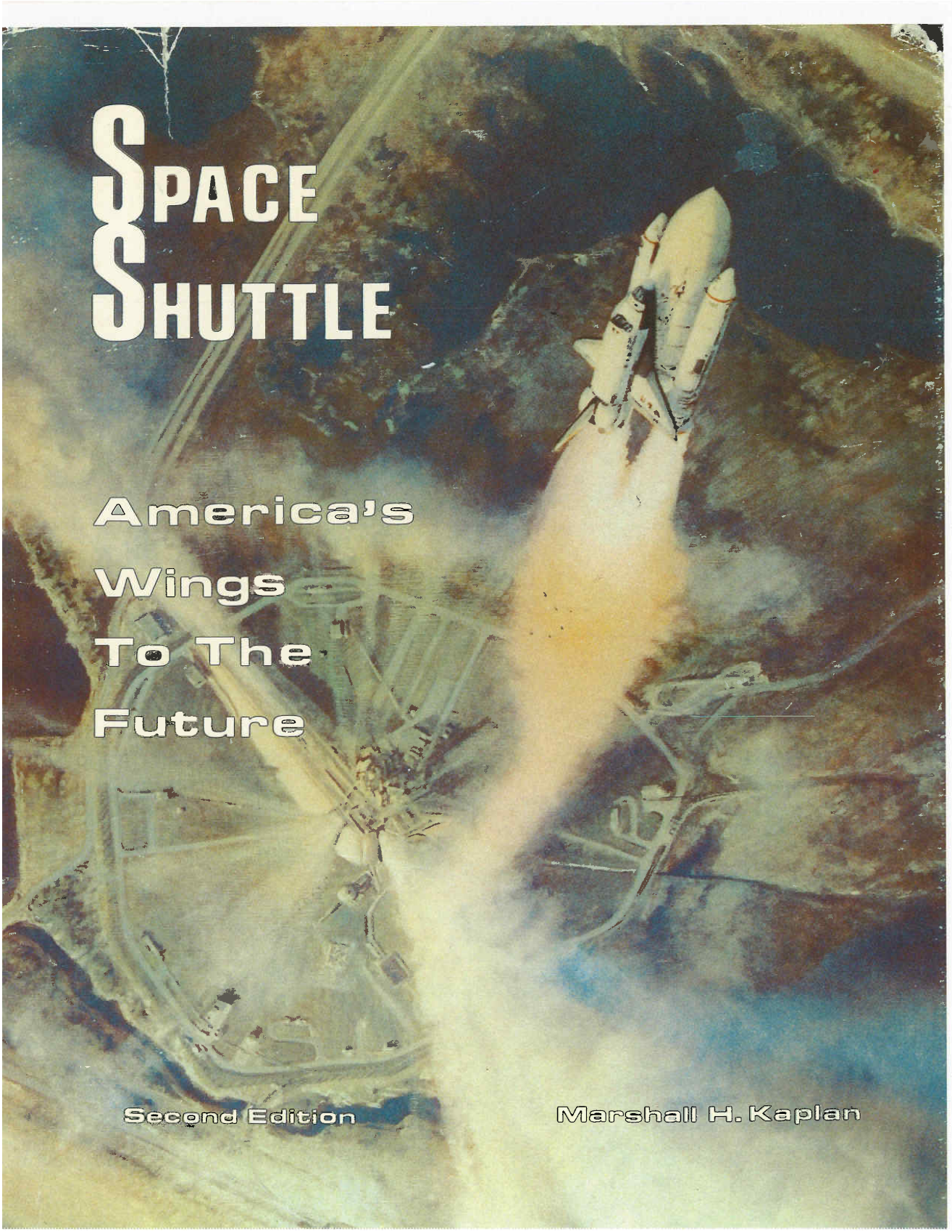

SPACE SHUTTLE

America's
Wings To The Future

Second Edition

Marshall H. Kaplan

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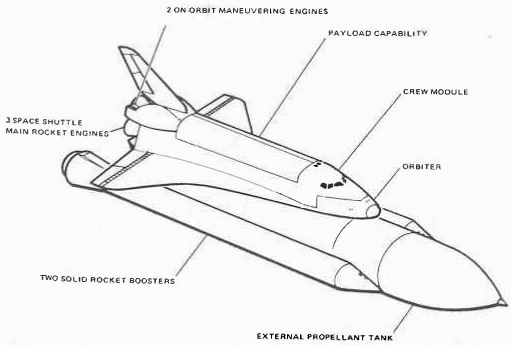
INTRODUCTION

BIRTH OF A NATIONAL SPACELINE

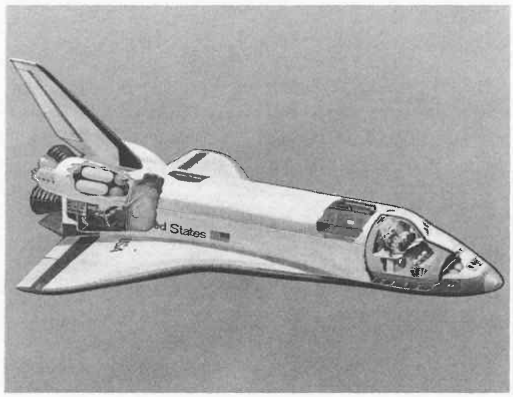
It is 6:55 in the morning on April 12, 1981. The sun has risen and brought to light clear, blue skies with cool morning breezes to Cape Canaveral, Florida. You are there to witness a historical event which will take place within the next few minutes. This will be the launch of the first Space Shuttle into orbit. After almost nine years of intense development and testing, the National Aeronautics and Space Administration is about to try out their new system for transporting cargo into orbit, the *Space Transportation System*. We know it as the *Space Shuttle*.



The Space Shuttle flight system consists of the Orbiter, an External Tank, and two Solid Rocket Boosters. The Orbiter contains three main rocket engines and two smaller motors for orbital maneuvering.

Let's look back for a moment and see how we got to this point. On December 17, 1903, Orville and Wilbur Wright were successful in achieving sustained flight in a powered aircraft. There were only a few spectators that cold, gray December morning in 1903. The first flight lasted only twelve seconds over a distance of 120 feet. They demonstrated an average speed of thirty-one miles per hour. The Space Shuttle *Orbiter,* named *Columbia,* which is the airplane-like craft you are about to see launched, is the length of the Wright brothers' historic first flight, but it will achieve speeds of 17,500 mph as it circles the earth. Historical events are not always instantly acclaimed or spectacular. The initial notification of the Wright brothers' success was simply a telegram to their father. Sixty-six years later, a man first stepped onto the

The Orbiter is illustrated in a cutaway manner to expose the various components and crew positions which make up this complicated combination spacecraft and aircraft. It is launched vertically as part of the Space Shuttle vehicle and lands on a runway, similar to those used by present-day jet aircraft.



moon, and an estimated 500 million people around the world saw the event on television or listened to it on the radio as it happened. Neil Armstrong proclaimed, "One small step for a man. One giant step for mankind." We are about to witness another giant step, for on this morning in 1981, the first Shuttle flight will be seen and heard around the world as it happens. You will be sharing the enthusiasm of almost a billion people as the five rocket motors scream upwards through the atmosphere and on into space.

Five . . . four . . . three . . . two . . . one . . . zero. The huge engines light up, and a mighty roar is heard. Within seconds, the big bird will leave historic pad 39A from which the Apollo moon rockets were launched. All five gigantic engines will roar at full blast. At first, the huge piggyback combination of rockets, tank, and Orbiter will move ever so slowly upward. As it clears the gantry, you will notice the vehicle turn about its axis and move perceptibly faster. Seconds later, it will be accelerating, and its flight will take the bird out toward the eastern horizon. Within a few minutes, Columbia will be hurled up to speeds of over 17,000 mph into orbit around our globe. On the way up, it will drop two huge rocket motors into the Atlantic Ocean and, later, a gigantic propellant tank into the Indian Ocean.

This was the first test flight of the system. There were a total of four such flights between Spring 1981 and mid-1982. A whole new era of transportation then came into being with the inauguration of an operational system in 1982. This is known as the *National Spaceline,* providing almost a monthly delivery service for payloads going into orbit. The system is planned to consist of up to five cargo carriers (Orbiters) with associated boosters and tanks, two launch and landing sites, supporting facilities, and an assortment of devices for on-orbit services. Both men and women crew-members can be aboard the Shuttle. The Spaceline provides delivery of satellites, platforms, and supplies, and return of old spacecraft. What makes the National Spaceline possible is that the system is largely reusable and offers a variety of options for users. It will lead to the economical and routine use of space. Hopefully, space will now become commonplace.

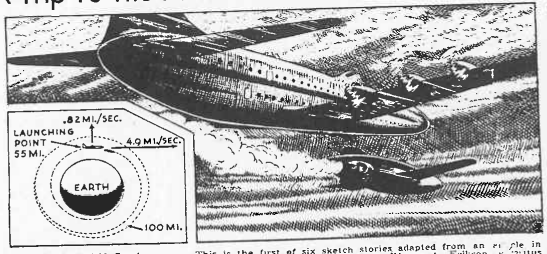
The Space Shuttle has come. Just as scheduled airline operations started 22 years after the first flight in 1903, the National Spaceline started scheduled service 24 years after our historic first flight of Explorer I on January 31, 1958. Over 2,000 spacecraft have been placed into orbit by throwaway launchers. However, the Space Shuttle is basically a reusable system. It leaves Earth

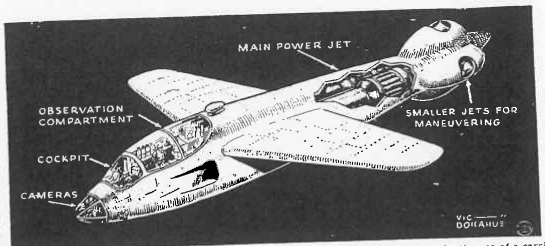
In 1947 the Sacramento Bee *printed this article entitled "A Trip to the Moon and Back." This represents some early serious thoughts on space travel. Although the Space Shuttle does not use the launch technique depicted here, people are again thinking about launching future Shuttles from large aircraft. There are a number of similarities between the spacecraft shown here and the Orbiter.*

THE SACRAMENTO BEE, THURSDAY, FEBRUARY 13, 1947

A Trip To The Moon And Back

No. 1: The Rocket Ship





Released By NEA Service

All aboard for the moon! The rocket ship will leave at midnight! Back to earth in time for a late breakfast! Round trip tickets only! Scoffers kindly will remember they are the people who would have laughed at Columbus.

The moon is within reach. The trip will not be made tomorrow, but many rocket experts believe it will not be long now.

A lot of problems remain—and this is a semi technical discussion of how they may be solved.

The following plan seems to the author the most feasible because of its minimum power requirement, simplicity of navigation and adaptability to the techniques of modern aviation.

This is the first of six sketch stories adapted from an article in the American Journal of Physics, "A Trip To The Moon And Back, by Henry A. Erikson, [illegible] professor of physics at the University of Minnesota. These stories take such a journey out of the realm of fantasy and into science, describing in semi technical language the problems of mechanics and navigation and the surprising reactions of the rocket ship's passengers.

A rocket ship will be used. It must leave the earth, assisted at first by a carrier plane, and gain enough velocity to cover the distance to the moon in a reasonable period of time and arrive with a residual velocity which will permit a swing around the moon at a height of about 10 miles. Then the ship must return to the earth for a safe landing.

The rocket ship is a monoplane of the jet propulsion type. The housing is of sheet aluminum alloy, strong enough to sustain air at atmospheric pressure within when there is a vacuum outside. Walls have horizontal compartments. Air in these compartments exposed to the sun may be interchanged with air within the ship by means of a fan. There is an extra supply of oxygen, and air purifying equipment.

The five and six tenths tons of fuel and exhaust mass take up about 180 cubic feet of space.

The main power jet is in the axis of the ship at the stern. This jet can increase the speed of the ship only in the direction of the axis, the center of mass of the ship being also in the axis.

For maneuvering purposes there are four small jets in the stern, set at right angles to the axis and to each other. By means of these four jets the axis of the ship may be given any direction, even turned so that the ship is traveling stern first. Two opposite jets of the four also are mounted so their angles in the plane of the four jets may be changed, thus making it possible to roll the ship.

The ship must have a total speed potential of at least four miles per second, or about 14,000 miles an hour. This assumes an exhaust speed of two miles per second, a speed not yet attained but within theoretical limits of some of the fuels available.

An exhaust speed of three miles per second, however, would make the trip much less difficult. This speed may be obtainable in the future if scientists can obtain atomic energy through the use of comparatively small quantities of fission-able materials. This might enable them to vaporize materials such as water, mercury or lead to obtain the higher exhaust speed. It must be remembered the velocity of a rocket depends on the magnitude of the escaping mass as well as on its speed of escape.

Assuming an exhaust speed of three miles a second, the best strategy seems to be the use of a carrier airplane from which to launch the rocket ship at 55 miles above the earth, at a horizontal speed of four and nine tenths miles per second and a vertical speed of eighty two hundredths miles per second.

The ship then will coast to a hight of 100 miles where, after minor corrections in velocity by means of the ship's own power, it will move automatically in a circular orbit around the earth at that hight at a constant speed of four and eighty six one hundredths miles per second.

Now, with the more or less technical details behind us, we are ready for the trip.

(The second of the trip to the moon sketches will appear in The Bee tomorrow.)

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