millions of people watched the roaring engines and thundering rush of fire and twin pillars of smoke that make up the unique signature of a space shuttle launch they saw four large machines work together precisely to send astronauts satellites observatories and Space Station segments into orbit the four elements when combined ahead of launch were called a shuttle stack they included the shuttle itself also known as the orbiter plus a pair of solid rocket boosters and a single external fuel tank the external tank or ET is the
familiar orange structure that dominates most images of the shuttle that lift off and more than fifteen stories tall it is the largest single part of the shuttle stack it gets its signature orange color from the foam insulation sprayed on the tanks aluminum structure the insulation helps the tank act as a thermos bottle to keep the super cold propellants from evaporating too quickly it also helps prevent ice from forming on the tanks exterior and promotes the right exterior and promotes the right aerodynamic shape for launching into space the main job of the tank is to
hold about five hundred and thirty-five thousand gallons of super cold liquid hydrogen and liquid oxygen the lower portion of the tank holds the liquid hydrogen which is the fuel for the engines the second coldest known chemical it is stored in the tank at minus 423 degrees Fahrenheit the upper part of the tank holds liquid oxygen chilled to minus 297 degrees during the Space Shuttle fleets 30 years of operation the tank like the shuttle itself has undergone numerous upgrades and weight saving improvements for
example designers quickly saved 600 pounds by not painting the tank white after the first two missions following a few revisions to designs and materials the latest version of the tank known as the super lightweight tank is 17,000 pounds lighter than the first one Columbia used in 1981 the tank also received extra attention after 2003's Columbia accident which was blamed in part on a piece of the insulating foam on the tank breaking off striking the left wing and creating a hole in the shuttles heat shield engineers implemented changes to the
foam and the way it is applied and

refined before the next launch some foam

was removed altogether to eliminate risk

further the twin solid rocket boosters

or SRBs are bolted to either side of the

tank with a shuttle itself riding

piggyback this approach was

revolutionary in rocket design when it

debuted in 1981 until then Rockets were

built by stacking one stage on the top

of another and then casting off the

stages one at a time until a small

spacecraft was left on its own in orbit

until the space shuttles first mission
in 1981 no astronaut had ridden into orbit on the strength of solid fuel

Rockets the SRBs hold their own fuel a mixture of powdered aluminum and a chemical called ammonium perchlorate. When dry the combination feels like a pencil eraser the fuel is the solid in the solid rocket boosters named the 15 story tall boosters work much simpler than liquid fuel rockets that require complex engines and pumps they produce nearly seven million pounds of thrust the solid rocket boosters do not ignite until the shuttles main engines are up
and running at liftoff flames shoot down

through the inside of the booster to

ignite the fuel

once ignited the boosters cannot be

turned off a pair of boosters combines

to burn nine tons of fuel every second

the boosters accelerate the four and a

half million pound shuttle stack to

3,000 miles per hour and 24 miles high

in just two minutes

by then most of the fuel is used up and

the Boosters fall away leaving the

shuttles own main engines to reach orbit

the Boosters parachute safely into the
ocean where they are recovered and

101
00:04:05.930 --> 00:04:11.420
reused on later launches after the

102
00:04:09.979 --> 00:04:13.849
shuttle engines shut down and the

103
00:04:11.419 --> 00:04:16.069
orbiter is on its way the external tank

104
00:04:13.849 --> 00:04:19.759
falls away and safely burns up in the

105
00:04:16.069 --> 00:04:21.980
atmosphere over the ocean NASA's shuttle

106
00:04:19.759 --> 00:04:23.839
fleet performed unprecedented work in

107
00:04:21.980 --> 00:04:25.910
orbit during its career whether

108
00:04:23.839 --> 00:04:28.459
deploying spacecraft to distant worlds

109
00:04:25.910 --> 00:04:30.200
setting up the Hubble Space Telescope to

110
00:04:28.459 --> 00:04:32.120
view the edge of the universe or

111
00:04:30.199 --> 00:04:36.019
building the largest orbiting laboratory

112
00:04:32.120 --> 00:04:38.750
in history getting into space to perform

113
00:04:36.019 --> 00:04:42.310
that historic work took teamwork with

114
00:04:38.750 --> 00:04:42.310
the machinery of a shuttle stack
you