

# KENNEDY SPACE CENTER FACILITIES NEW EMPLOYEE ORIENTATION TRAINING KLASS

The purpose of the shuttle training program is to educate new Shuttle team members on Shuttle operations so they can provide expert support and products to the Space Shuttle Program. Being familiar with operations will help you do the best job possible when it's time for you to launch the Shuttle.

# NASA'S MISSION

**NASA's mission** is to pioneer future space exploration, scientific discovery, and aeronautics research.



Your job is to support the mission of NASA, and specifically to support the Space Operations Mission Directorate. Your number 1 priority is to keep everyone involved safe.

## TODAY'S OBJECTIVES

- Become familiar with background of the Space Shuttle Program
- Become familiar with KSC: operation centers and instrumentation



### Training Objectives:

-Be familiar with background of the Space Shuttle Program

**-Become familiar with KSC: operation centers and instrumentation**

# OVERVIEW

- NASA Centers
- KSC Facilities
- General Shuttle Overview



Here is the overview of what we will discuss. First, we will discuss the Shuttle in general and give you a brief background of the weather impacts to the Shuttle program in the past. Then we will focus on KSC facilities including the launch pads, Vehicle Assembly Building, etc.

# NASA CENTERS & FACILITIES

Directions for NASA Centers: Match the center with its location by dragging its number to the map. If the number sticks, you have placed it in the right spot. If it bounces back, you should try again.

## NASA Centers

- 1** Ames Research Center
- 2** Dryden Flight Research Center
- 3** Glenn Research Center
- 4** Goddard Space Flight Center
- 5** NASA Headquarters
- 6** Jet Propulsion Lab
- 7** Johnson Space Center
- 8** John F. Kennedy Space Center
- 9** Langley Research Center
- 10** Marshall Space Flight Center
- 11** Stennis Space Center

## USA Map



NASA has many centers scattered thought the U.S.

Some Centers to note:

NASA Headquarters: Washington D.C.

KSC: Launch and Landing

Michoud Assembly Facility: External Tank (Brought to KSC via ships)

Johnson Spaceflight Center: Mission Control Center, Space Shuttle program office

Palmdale, California: Orbiter Production

Brigham City, UT: Reusable Solid Rocket Motor (brought to KSC via railroad)

Let's focus on KSC and the Space Shuttle.

## KSC FACILITIES



Kennedy Space Center is home to the Space Shuttle. This is where the Shuttle primarily launches, and where the shuttle almost always lands. It is on the Atlantic ocean on the East Coast of Florida.



The video should open in a new window and requires Real Player.

## DIRECTOR'S WELCOME



Kennedy Space Center Director William Parsons

Welcome to NASA's John F. Kennedy Space Center, our nation's gateway to exploring, discovering and understanding our universe.

By nature, human beings are explorers. For thousands of years, we've pushed beyond our boundaries, broadening our minds and imaginations with each new discovery. That same spirit of exploration is the driving force for Kennedy Space Center.

# KSC FACILITIES



It is on the Atlantic ocean on the East Coast of Florida.

## A RICH HISTORY



Dr. Werner Von Braun explains the Saturn rocket system to President John F. Kennedy at Launch Complex 37 in November 1963.

On July 29, 1958, President Dwight D. Eisenhower signed Public Law 85-568 , creating the National Aeronautics and Space Administration, also known as NASA. In July 1962, the agency established its Launch Operations Center on Florida's east coast, and renamed it in late 1963 to honor the president who put America on the path to the moon. Dr. Werner Von Braun and President John F. Kennedy

Image at right: Dr. Werner Von Braun explains the Saturn rocket system to President John F. Kennedy at Launch Complex 37 in November 1963. Image credit: NASA

NASA's John F. Kennedy Space Center has helped set the stage for America's adventure in space for more than four decades. The spaceport has served as the departure gate for every American manned mission and hundreds of advanced scientific spacecraft. From the early days of Project Mercury to the space shuttle and International Space Station, from the Hubble Space Telescope to the Mars Exploration Rovers, the center enjoys a rich heritage in its vital role as NASA's processing and launch center . As the nation embarks on a new chapter in space exploration, Kennedy will continue to make history.

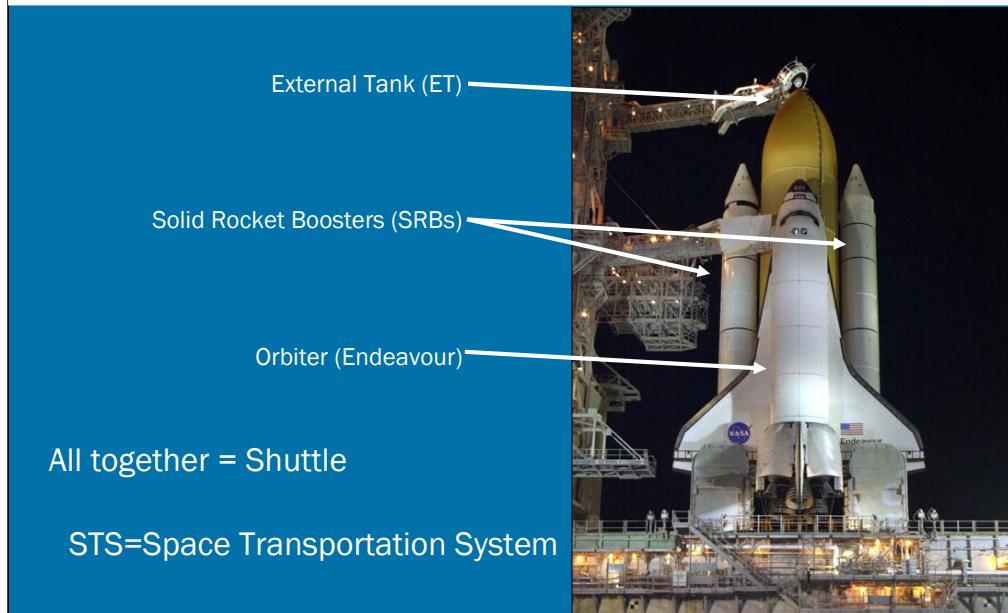
# KSC VISITOR COMPLEX



Click image to view the interactive map

Kennedy Space Complex is a full-day experience, so plan on spending 6-8 hours. The KSC Visitor Complex is not tax supported. It is self-sufficient, funded entirely through visitor revenues, and operated for NASA by Delaware North Park Services of Spaceport (DNPSS) as a commercially viable enterprise that enables the telling of the NASA story without cost to the taxpayer.

# GENERAL SHUTTLE OVERVIEW



First let's review some terminology. When we discuss the "Space Shuttle", Shuttle refers to the entire vehicle, including the Orbiter, the External Tank, and the Solid Rocket Boosters. The entire vehicle put together is considered the Shuttle. If we are talking about Atlantis, Endeavour, etc, we are strictly talking about the "Orbiter."

STS stands for Space Transportation System. All missions start with "STS" and then the number in which the mission was initiated. For example, STS-112. The mission numbers are not launched in sequential order. The mission numbers are assigned in order when they are on the "drawing board." However, some circumstances with payload development or orbiter processing, for example, may cause one mission to be postponed allowing another mission to move ahead of it in line. This is why the missions are not launched in order.

# SHUTTLE FLIGHTS 1981 - JUNE 2008

OV-099, Challenger:	10
OV-102, Columbia:	28
OV-103, Discovery:	34
OV-104, Atlantis:	29
OV-105, Endeavour:	21
Total Flights:	122



OV = Orbiter Vehicle

So far we've had 122 Shuttle Flights. Here is the breakdown per orbiter. Discovery has flown the most missions: 34. Of course, we lost Challenger (launch, 28 Jan 86) and Columbia (Landing, 1 Feb 03) to mishaps.

OV stands for Orbiting Vehicle. Each orbiter is given a designation OV-#. The Shuttle Processing folks refer to the Orbiters with this OV-terminology, for example, "OV-105" for Endeavour.

Enterprise (OV-101)

The orbiter Enterprise was a test vehicle and was not intended for spaceflight. It is on display at the Dulles Airport outside of Washington, D.C.

This slide will need to be updated from time to time. To get the latest orbiter statistics, visit:

<http://www.nasa.gov/centers/kennedy/news/facts/shuttlefacts-toc.html>

## VAB AND LCC



Vehicle Assembly Building (VAB)

Launch Control Center (LCC)

Here are the Vehicle Assembly Building and the Launch Control Center. The Vehicle Assembly Building, "VAB", is where the Shuttle is stacked. All the elements come together in this building for the stack. The Launch Control Center (LCC) is where all Shuttle Operations, pre-launch, launch, and post-launch, are managed. The LCC consists of three firing rooms, labeled LCC1, LCC2, LCC3, but verbally called, "Firing Room 1," "2," or "3." Firing rooms 1 or 3 are assigned to operations, and firing room 2 is the back up.

Forecaster's often talk to the KSC.DO (Duty Officer) on the hotline to provide weather data. The KSC.DO sits in one of the firing rooms.

All launch operations are run from the LCC. The Launch Director and Weather Coordinator (astronaut talking to the RECCE aircraft) are also located in the firing room.

# ORBITER PROCESSING FACILITY

Orbiter  
Processing  
Facility (OPF)



The orbiter is processed at one of three Orbiter Processing Facilities at KSC after landing and before rolling to the VAB for stacking. At the OPF, the orbiter is prepared for its next flight. The Payload may be installed horizontally at the OPF or vertically at the launch pad.

## INSIDE OPF



At the OPF, the orbiter is prepared for its next flight. Panels fold down all around the orbiter at the OPF to allow personnel to access the different locations on the orbiter. The Payload may be installed horizontally at the OPF or vertically at the launch pad.

## LAUNCH COMPLEX 39 A & B



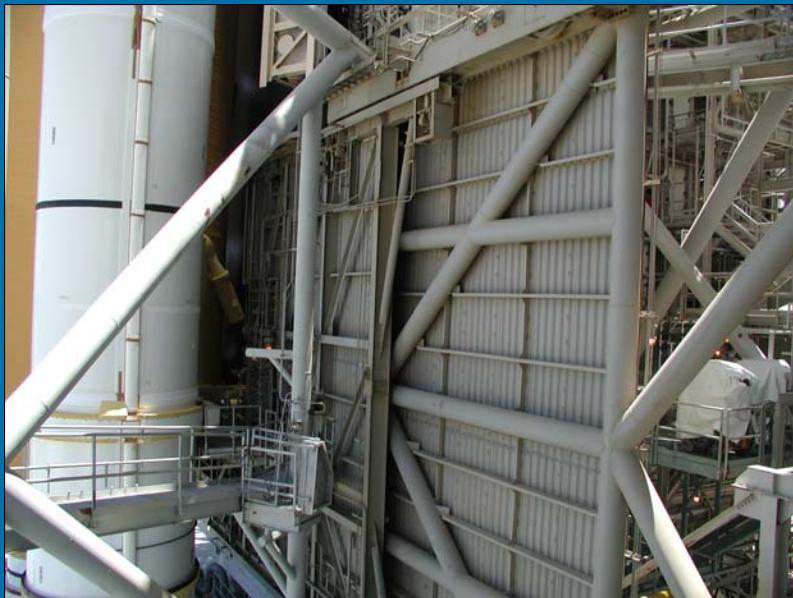
Now let's discuss the launch pads.

Both pads are octagonal shaped and share identical features. Pad A (South Pad) is located 3.4 Statute Miles from the Vehicle Assembly Building via the crawlerway; Pad B (North Pad), 4.2 Statute Miles. Launches are conducted from atop a concrete hardstand 390 by 325 feet, located at the center of the pad area.

You can see the water storage tower for the sound suppression system and the liquid hydrogen/oxygen storage tanks, as well.

The launch structure is made up of the fixed service structure and the rotating service structure (RSS). The RSS is 'extended' to cover the vehicle and 'retracted' to expose the vehicle.

## ORBITER WEATHER PROTECTION



Orbiter Weather Protection (OWP) consists of two panels (sliding doors), one on the Fixed Service Structure and one on the Rotating Service Structure. The panels fold in between the orbiter wing and the ET/SRBs to add protection against weather, especially hail.

Weather is a major concern if the OWP is not extended, especially severe weather or any size hail.

# SHUTTLE LANDING FACILITY (SLF)

A single landing strip--considered 2 runways

- Runway 15 from northwest
- Runway 33 from southeast
- 15,000 feet long
- 1,000 foot-paved overruns at each end
- 300 feet wide (length of football field)
- 50-foot asphalt shoulders each side
- 16" thick in the center, 15" thick on sides
- Slope of 24", center line to edge, for drainage



The SLF runway was made specifically for Orbiter landings. The runway is about 3 miles long, and has 1000' overruns on each end. It's also 300' wide (length of a football field), and is sloped for drainage purposes.

There is very little rubber on the runway relative to commercial runways due to the relatively minimal traffic. Orbiter landing marks are labeled so that measurements can be taken for further analysis.

## SHUTTLE LANDING FACILITY (SLF)

- Night Landings: Flatbed trailers hold eight Xenon lights, 4 on each end of runway
- Each Xenon light produces 1 billion candlepower (candela)
- Only turn on lights that will be behind crew when it lands



For night landings, Flatbed trailers holding eight Xenon lights are at each end of the runway. Each Xenon light produces 1 billion candle power. This gives the STS Commander and pilot a 3 dimensional view of the runway. The lights are so bright that personnel at the SLF cannot look into them or they can damage their vision. The lights are lit up for landing operations. The lights are behind the crew and vehicle as to not endanger the crew's vision.

## **TERMINOLOGY/ACRONYMS**

- ET** - External Tank
- KSC** - Kennedy Space Center
- LCC** - Launch Control Center
- OPF** - Orbiter Processing Facility
- SLF** - Shuttle Landing Facility
- SRB** - Solid Rocket Booster
- STS** - Space Transportation System
- VAB** - Vertical Assembly Building
- OV** - Orbiting Vehicle

Here are the important terms we learned today. What does each acronym stand for? <note: with each click, a new term will slide in>

## TERMINOLOGY/ACRONYMS

OV-099 - Challenger

OV-100 - Enterprise

OV-102 - Columbia

OV-103 - Discovery

OV-104 - Atlantis

OV-105 - Endeavour

RSS - Rotating Service Structure

OWP - Orbiter Weather Protection

And we learned a little bit about the Shuttle Orbiter fleet. <note:  
with each click, a new term will slide in>