STS-114 OVERVIEW:

SHUTTLE INSPECTION, STATION RESUPPLY HIGHLIGHT DISCOVERY'S MISSION

The Return to Flight Space Shuttle mission will take America's flagship spacecraft back into orbit more than two years after the Columbia accident. The launch will be a dramatic display of smoke, fire, and sound -- and the fulfillment of a promise made to the families of the Columbia astronauts: that NASA would honor their memory by continuing their quest for knowledge.

Discovery is targeted for launch May 22 with a launch window that extends to June 3 from Launch Pad 39B at NASA's Kennedy Space Center.

Discovery's crew of seven astronauts is led by Commander Eileen Collins (Col., USAF, Ret.), America's first female spacecraft commander. Joining her will be Pilot James Kelly (Lt. Col., USAF), and Mission Specialists Soichi Noguchi (So-wee-chee Nah-gu-chee), representing the Japan Aerospace Exploration Agency (JAXA); Stephen Robinson and Andrew Thomas, both civilian mechanical engineers; Wendy Lawrence (Captain, USN); and Charles Camarda (Kah-mar-da), a civilian aerospace engineer.

Though a veteran astronaut, Collins will fly a mission like no other, a unique test flight that will serve as a foundation for every Shuttle mission to follow. The mission will debut and test new designs incorporated into the Shuttle's external fuel tank and processes that eliminate the likelihood that future Space Shuttle flights could suffer damage similar to Columbia. New cameras and techniques will photograph the tank during launch and after it is jettisoned from the Shuttle to allow engineers to evaluate the performance of those new designs.

The mission also will debut a variety of new techniques to ensure the health of the Shuttle heat shield can be confirmed in space. New ground and flight camera and sensor systems will observe the Shuttle environment during launch and in orbit. New techniques will be used for in-flight inspection. New methods under development for repair of the Shuttle's heat-shielding Thermal Protection System will be tested. Also, Discovery will deliver a pressurized cargo container full of supplies to the Space Station and a key spare part that Collins and her crew will install during one of the mission's three spacewalks.

Noguchi and Robinson will take those spacewalks. They'll test Shuttle heat shield repair material and techniques, replace one of the Station's control gyroscopes, restore power to another and install a work platform for future in-orbit construction.

Lawrence is in charge of the transfer of supplies and equipment to the Station. She and other crew members will operate the Shuttle and Station robotic arms. The arms are used to assist spacewalks, install equipment and inspect the orbiter's thermal protective tiles.

Thomas will be the primary operator for the Shuttle's robotic arm as it uses a new boom extension to perform an unprecedented inspection of the Shuttle's heat shield. He also will serve as the choreographer from inside the

Shuttle cabin during three spacewalks the STS-114 crew will perform.

Camarda will share Space Shuttle robotic arm duties with Thomas. He also will prepare rendezvous and navigation equipment and help Lawrence transfer supplies to and from the Station. Using both the Station's robotic arm and the Shuttle's robotic arm at times, the mission will involve some of the most complex space robotics work ever performed.

The mission itself goes by many names. Most commonly, it is called STS-114. STS stands for "Space Transportation System" -- an early moniker for the Space Shuttle Program -- and its number refers to the order in which the mission was planned. It also happens to be, in order of flight, the 114th mission in the history of the Space Shuttle Program.

Because of its role in supplying the International Space Station, the mission also is referred to as LF-1, or Logistics Flight 1. Discovery also has a second name; engineers inside NASA often refer to it as OV-103, which stands for Orbiter Vehicle-103.

The top priority of the flight is to inspect all of the Reinforced Carbon-Carbon (RCC) heat protection material on Discovery's wing leading edge panels. Another high priority is sending to the ground for evaluation data gathered during launch by 176 sensors mounted inside the wing panels.

En route to the Station the day after launch, the crew will use what will be a 100-foot-long robotic arm, the 50-foot Shuttle arm tipped with a 50-foot-long Orbiter Boom and Sensor System (OBSS), to inspect critical heat shield areas. The boom is tipped with two types of lasers and a high-resolution television camera. It will be used to inspect key areas of Discovery's wings and nose, the areas that are subjected to the most intense heat during re-entry, for damage.

Another inspection will be performed by the Station's crew as the Shuttle moves in to dock to the complex on the third day of the flight. About 200 yards away from the Station, Collins will fly the Shuttle through a slow backflip, allowing its underside to face the Station for a minute and a half. During that time, the Station crew will snap a precise set of still, digital images using high-magnification lenses to document the heat shield's condition. Soon after, those images will be transmitted to the ground for analysis.

On the fourth day of the mission, more than 2½ years since a Shuttle has delivered supplies to the Station, the crew will use the Station's robotic arm to lift an Italian-built cargo module named Raffaello, technically known as a Multi-Purpose Logistics Module (MPLM), out of the Shuttle cargo bay and attach it to the Station. They then will begin to transfer several tons of supplies and equipment to the Station for use by the Station's Expedition 11 Crew, Commander Sergei Krikalev and Flight Engineer John Phillips. This will be the third trip to the Station for Raffaello, the second of three such cargo carriers to be put into service. Raffaello flew aboard Endeavour on STS-100 and STS-108 in 2001. In addition, Discovery and its crew will transfer water to the Station for use in a variety of applications.

The first spacewalk will take place on the fifth day of the mission. Each of the three spacewalks scheduled for Robinson and Noguchi is planned to be 6 1/2 hours long. The first spacewalk will include a demonstration of techniques for repairing two types of Shuttle heat shield materials: the RCC segments that protect the Shuttle's nose cone and wing edges and the thermal tiles that provide heat protection for the spacecraft's bottom. Another technique for repairing RCC will be tested inside the Shuttle. Two additional heat shield repair techniques under evaluation will be carried aboard Discovery, but not tested on the first mission. During the first spacewalk, the crew also will

make connections that will restore power to a Station gyroscope that has been out of service since a circuit breaker failed in February.

A second spacewalk will take place on the seventh day of the flight and be dedicated to the replacement of one of the Station's four Control Moment Gyroscopes (CMGs). Each spinning almost 10 million times a day, the gyroscopes provide a method of maintaining the Station's orientation in orbit using electrical power instead of rocket thrusters. Noguchi and Robinson will remove from the Station a washing machine-sized gyroscope that experienced a mechanical failure of its spin bearing on June 8, 2002. Mounted inside the Station's central Z1 Truss, the gyroscope will be replaced with a new unit delivered on Discovery in a protective canister called the Mission Peculiar Equipment Support Structure (MPESS). With this new gyroscope installed, and the gyroscope repowered on the first spacewalk, all four of the Station's gyroscopes will be restored to operation. Although the Station has operated well with only two functioning gyroscopes, all four will be needed as its assembly resumes and its size increases. Each CMG is four feet in diameter, weighs 620 pounds and consists of a large, flat wheel rotating at a constant speed of 6,600 revolutions per minute.

TIMELINE OVERVIEW

FLIGHT DAY 1:

- Following launch, Discovery's crew sets up the on-board laptop computer network, checks out the Shuttle Remote Manipulator System (SRMS) and conducts Detailed Test Objective (DTO) 850, Water Spray Boiler Cooling with Water/PGME Antifreeze.
- The crew plays back handheld launch video of the External Tank (ET) and loads digital ET photos and data from Discovery's Wing Leading Edge (WLE) sensors into a laptop computer for downlink.
- Overnight, Mission Control will downlink data from the WLE sensors for analysis by engineers looking for sites of potential debris impacts during launch.

FLIGHT DAY 2:

- The Shuttle crew completes SRMS checkout, if necessary, and installs the centerline camera in the Orbiter Docking System.
- The crew grapples and unberths the Orbiter Boom & Sensor System (OBSS) and conducts an SRMS/OBSS survey of Discovery's wing leading edges and nose cap.
- The crew begins a checkout of the rendezvous tools.
- The crew conducts photography of the Orbital Maneuvering System (OMS) pods
- Orbiter Docking System (ODS) is extended.
- The crew performs system checks on the Extravehicular Mobility Unit (EMU) spacesuits and tools in preparation for upcoming spacewalks.
- The crew berths the OBSS.
- The crew surveys Discovery's upper surfaces and the crew cabin using the SRMS.

FLIGHT DAY 3:

- The crew begins the final stage of rendezvous operations as Discovery closes in for docking with the International Space Station.
- Discovery performs the Rendezvous Pitch Maneuver, enabling the Space Station crew to photograph Discovery's thermal protection systems.
- Discovery docks with the Space Station.
- The Shuttle and Station crews open the hatches and shake hands.
- The crews begin transferring cargo from Discovery to the Station.
- The crew uses the Space Station RMS (SSRMS) to grapple the OBSS and hand it off to the SRMS.

FLIGHT DAY 4:

- The crew grapples the Raffaello Multi-Purpose Logistics Module (MPLM) with the SSRMS, unberths the MPLM from Discovery and installs it on the Unity module's Common Berthing Mechanism (CBM).
- The SSRMS ungrapples from the MPLM and begins its walk-off to the Mobile Base System (MBS).
- The crew uses the OBSS to conduct a survey of Discovery's heat-protection tiles.
- The crew activates the MPLM and ingresses.
- The crew configures tools for the first spacewalk and begins Extravehicular Activity (EVA) pre-breathe.
- Crewmembers conduct an in-flight interview.

- The crew performs a checkout of the Simplified Aid for EVA Rescue.
- The hatches between Discovery and the Space Station are closed and Discovery's cabin is depressurized to 10.2 pounds per square inch (psi) in preparation for the first spacewalk, to be done from the Shuttle airlock.

FLIGHT DAY 5:

- Final preparations begin for the first spacewalk.
- The SSRMS walks off the MBS, grappling Destiny.
- The Shuttle crew begins the first spacewalk from the Shuttle airlock.
- Hatches between Discovery and the Space Station are opened. Two crewmembers move to the Station to perform SSRMS EVA support. Transfer activity resumes.
- The spacewalkers perform Shuttle Thermal Protection System Emittance Wash Applicator (EWA) and NOAX (Non-Oxide Adhesive eXperimental) sample repair DTO 848 in Discovery's payload bay.
- The External Stowage Platform-2 (ESP-2) Attachment Device (ESPAD) is unberthed from Discovery and installed onto Quest.
- The GPS antenna is removed and replaced on the S0 Truss.
- The crew uses OBSS to scan damaged reinforced carbon-carbon samples on the DTO pallet.
- The Shuttle and Station hatches are closed, and the spacewalking astronauts ingress Discovery's airlock.
- Shuttle and Station hatches are reopened.
- The Station crew makes preparations for the Control Moment Gyroscope (CMG) removal and replacement.

FLIGHT DAY 6:

- Transfers continue from Discovery to the Space Station.
- Crewmembers participate in two separate in-flight interviews.
- Procedures are reviewed for the second spacewalk and EVA pre-breathe begins.
- Hatches between Discovery and the Space Station are closed and the Shuttle cabin is depressurized to 10.2 psi.

FLIGHT DAY 7:

- The second spacewalk begins.
- Hatches between Discovery and the Station are reopened. Two crewmembers move to the Station to perform EVA SSRMS support, and transfers resume.
- Spacewalkers remove and replace CMG 1, then Mission Control performs a checkout of the new CMG.
- Shuttle and Station hatches are closed and the spacewalkers ingress the Shuttle airlock.
- New Station CMG 1 is started.
- Shuttle and Station hatches are opened.

FLIGHT DAY 8

- Transfers resume between Discovery and the Station.
- Discovery's crew begins its off-duty period.
- The Shuttle crew reviews procedures and begins pre-breathe for tomorrow's third spacewalk from the Shuttle airlock.

- Shuttle and Station hatches are closed. The Shuttle cabin is depressurized to 10.2 psi in preparation for third spacewalk.

FLIGHT DAY 9:

- The third spacewalk of the mission begins.
- Hatches between Discovery and the Station are opened.
- Spacewalkers install an external camera and illuminator on P1 Truss.
- SSMRS grapples and unberths ESP-2 from Discovery's payload bay.
- Two MISSE experiments are retrieved from the Quest airlock, and a new MISSE is installed at the top of the P6 Truss.
- SSRMS delivers ESP-2 to ESPAD, and spacewalkers install.
- Transfers continue between Shuttle and Station.
- SSRMS ungrapples ESP-2 and maneuvers to MPLM.
- Hatches between Discovery and Station are closed, the spacewalkers re-enter the Shuttle airlock and the third EVA ends.
- Hatches between Discovery and the Station are opened.
- SSRMS grapples MPLM for tomorrow's unberth from Unity.

FLIGHT DAY 10:

- The crew egresses and deactivates MPLM.
- MPLM is uninstalled from Unity.
- Rendezvous checkout begins.
- The MPLM is berthed in Discovery's payload bay.
- The SRMS maneuvers the OBSS to handoff position.
- SSRMS grapples the OBSS from the RMS.
- SSRMS berths OBSS in Discovery's payload bay.

FLIGHT DAY 11:

- Discovery and Station crews bid farewell and close their hatches.
- Centerline camera is reinstalled.
- Discovery undocks and separates from the Station.
- Shuttle crew off-duty period begins.

FLIGHT DAY 12:

- Discovery crew performs Flight Control System checkout and begins cabin stowage in preparation for tomorrow's landing.
- Crew performs Reaction Control System hot fire and reviews tomorrow's deorbit timeline.
- KU Band antenna is stowed.

FLIGHT DAY 13:

- Discovery's crew begins deorbit preparations.
- Payload bay door is closed for entry.
- Deorbit burn occurs.
- Landing occurs at Kennedy Space Center.