Archive-name: space/schedule

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Shuttle operations are discussed in the Usenet group sci.space.shuttle, and Ken Hollis (gandalf@pro-electric.cts.com) posts a compressed version of the shuttle manifest (launch dates and other information) periodically there. The manifest is also available from the Ames SPACE archive in SPACE/FAQ/manifest. The portion of his manifest formerly included in this FAQ has been removed; please refer to his posting or the archived copy. For the most up to date information on upcoming missions, call (407) 867-INFO (867-4636) at Kennedy Space Center. Official NASA shuttle status reports are posted to sci.space.news frequently.

The following answer and translation are provided by Ken Jenks (kjenks@gothamcity.jsc.nasa.gov).

The "Ascent Guidance and Flight Control Training Manual," ASC G&C 2102, says:

"During the vertical rise phase, the launch pad attitude is commanded until an I-loaded V(rel) sufficient to assure launch tower clearance is achieved. Then, the tilt maneuver (roll program) orients the vehicle to a heads down attitude required to generate a negative q-alpha, which in turn alleviates structural loading. Other advantages with this attitude are performance gain, decreased abort maneuver complexity, improved S-band look angles, and crew view of the horizon. The tilt maneuver is also required to start gaining downrange velocity to achieve the main engine cutoff (MECO) target in second stage."

This really is a good answer, but it's couched in NASA jargon. I'll try to interpret.

1)We wait until the Shuttle clears the tower before rolling.

2)Then, we roll the Shuttle around so that the angle of attack between the wind caused by passage through the atmosphere (the "relative wind") and the chord of the wings (the imaginary line between the leading edge and the trailing edge) is a slightly negative angle ("a negative q-alpha").This causes a little bit of "downward" force (toward the belly of the Orbiter, or the +Z direction) and this force "alleviates structural loading."

We have to be careful about those wings -- they're about the most "delicate" part of the vehicle.

3)The new attitude (after the roll) also allows us to carry more mass to orbit, or to achieve a higher orbit with the same mass, or to change the orbit to a higher or lower inclination than would be the case if we didn't roll ("performance gain").

4)The new attitude allows the crew to fly a less complicated flight path if they had to execute one of the more dangerous abort maneuvers, the Return To Launch Site ("decreased abort maneuver complexity").

5)The new attitude improves the ability for ground-based radio antennae to have a good line-of-sight signal with the S-band radio antennae on the Orbiter ("improved S-band look angles").

6)The new attitude allows the crew to see the horizon, which is a helpful (but not mandatory) part of piloting any flying machine.

7)The new attitude orients the Shuttle so that the body is

more nearly parallel with the ground, and the nose to the east (usually). This allows the thrust from the engines to add velocity in the correct direction to eventually achieve orbit. Remember: velocity is a vector quantity made of both speed and direction. The Shuttle has to have a large horizontal component to its velocity and a very small vertical component to attain orbit.

This all begs the question, "Why isn't the launch pad oriented to give this nice attitude to begin with? Why does the Shuttle need to roll to achieve that attitude?" The answer is that the pads were leftovers from the Apollo days. The Shuttle straddles two flame trenches -- one for the Solid Rocket Motor exhaust, one for the Space Shuttle Main Engine exhaust. (You can see the effects of this on any daytime launch. The SRM exhaust is dirty gray garbage, and the SSME exhaust is fluffy white steam. Watch for the difference between the "top" [Orbiter side] and the "bottom" [External Tank side] of the stack.) The access tower and other support and service structure are all oriented basically the same way they were for the Saturn V's. (A side note: the Saturn V's also had a roll program. Don't ask me why -- I'm a Shuttle guy.)

I checked with a buddy in Ascent Dynamics.He added that the "roll maneuver" is really a maneuver in all three axes: roll, pitch and yaw. The roll component of that maneuver is performed for the reasons stated. The pitch component controls loading on the wings by keeping the angle of attack (q-alpha) within a tight tolerance. The yaw component is used to determine the orbital inclination. The total maneuver is really expressed as a "quaternion," a grad-level-math

concept for combining all three rotation matrices in one four-element array.

NASA SELECT is broadcast by satellite. If you have access to a satellite dish, you can find SELECT on Satcom F2R, Transponder 13, C-Band, 72 degrees West Longitude, Audio 6.8, Frequency 3960 MHz. F2R is stationed over the Atlantic, and is increasingly difficult to receive from California and points west. During events of special interest (e.g. shuttle missions), SELECT is sometimes broadcast on a second satellite for these viewers.

If you can't get a satellite feed, some cable operators carry SELECT. It's worth asking if yours doesn't.

The SELECT schedule is found in the NASA Headline News which is frequently posted to sci.space.news. Generally it carries press conferences, briefings by NASA officials, and live coverage of shuttle missions and planetary encounters. SELECT has recently begun carrying much more secondary material (associated with SPACELINK) when missions are not being covered.

The following are believed to rebroadcast space shuttle mission audio:

W6FXN - Los Angeles

K6MF - Ames Research Center, Mountain View, California

WA3NAN - Goddard Space Flight Center (GSFC), Greenbelt, Maryland.

W5RRR - Johnson Space Center (JSC), Houston, Texas

W6VIO - Jet Propulsion Laboratory (JPL), Pasadena, California.

W1AW Voice Bulletins

Station VHF 10m 15m 20m 40m 80m

W5RRR transmits mission audio on 146.64, a special event station on the

other frequencies supplying Keplerian Elements and mission information.

W1AW also transmits on 147.555, 18.160. No mission audio but they transmit voice bulletins at 0245 and 0545 UTC.

Frequencies in the 10-20m bands require USB and frequencies in the 40 and 80m bands LSB. Use FM for the VHF frequencies.

[This item was most recently updated courtesy of Gary Morris (g@telesoft.com, KK6YB, N5QWC)]

Reference: "Shuttle Flight Operations Manual" Volume 8B - Solid Rocket Booster Systems, NASA Document JSC-12770

Propellant Composition (percent)

Ammonium perchlorate (oxidizer)69.6

Aluminum16

Iron Oxide (burn rate catalyst)0.4

Polybutadiene-acrilic acid-acrylonitrile (a rubber) 12.04

Epoxy curing agent1.96

End reference

Comment: The aluminum, rubber, and epoxy all burn with the oxidizer.

NEXT: FAQ #10/15 - Historical planetary probes