

Re: NASAspaceflight.com – Censors the John Young – Ares I Thread.

Source: <http://sci.tech–archive.net/Archive/sci.space.history/2007–06/msg00040.html>

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 - *Date:* Sat, 2 Jun 2007 21:26:40 GMT
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In article <so9163dp7lbomesub6gcvt762lkun0u718@xxxxxxx>, <pstanley55@xxxxxxxxxxxx> wrote:

Granted that Tycho is a very interesting place, is it worth one of the few remaining Apollo flights if (for example) you don't have enough payload to take a rover...

In these cases, was the CM in the same plane as the Earth and Moon, ie the simplest? Or was it manoeuvred to change it's orbit?

A counterintuitive but important fact is that for approaching the Moon, its motion is much more important than its gravity. To a rough first approximation, the Apollo spacecraft is almost motionless, up near the top of a highly elliptical transfer orbit, as the relatively–small Moon comes zipping up behind it. Only when you get quite close is the Moon's gravity very important. So a fairly small change in the transfer orbit will have the spacecraft making its closest approach to the Moon over the lunar equator, over a lunar pole, or anywhere in between. The range of accessible orbits wasn't unlimited even so, given Apollo's slim fuel margins, but it was fairly wide.

The plane of each flight's lunar orbit was chosen, roughly speaking, to pass over the landing site headed due west, so that a dawn landing would be coming down with a low sun directly behind the LM. This gave the crew a view of the LM's own shadow for scale, and made even small surface features highly visible because of their long shadows. So the orbital inclination (with respect to the Moon's equator) equaled the lunar latitude of the landing site.

I'm thinking it would take less overall fuel to keep the CM in the same plane each mission, and just spend fuel on manoeuvring the LM.

No, LM fuel reserves were considerably tighter than those of the CSM — hence the decision in the later flights to use CSM fuel to set up the LM's

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descent orbit. In fact, for the flights with long surface stays, quite noticeable amounts of CSM fuel were burned to rotate the plane of the CSM parking orbit, to keep it passing directly over the landing site so that an emergency ascent could be made at any time. (Abort cases quite often constrained Apollo planning much more than nominal cases.)

Were there places on the moon the LM could not reach?

Yes. Both high latitudes and longitudes well away from the central meridian were difficult, and the combination could make a landing impossible. Several constraints interacted, and subtle details of orbital dynamics could be important given the small margins, so the plot of which areas were accessible and which weren't was quite complicated. Some areas were reachable only in winter, or only in summer, or (like the Apollo 17 landing site) only with a night launch.

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