

Hi this is Steve Nerlich from Cheap Astronomy www.cheapastro.com and this is *Project Constellation – The manned spacecraft*.

This is the second of two podcasts on NASA's Project Constellation intended to fly to the Moon and beyond.

In the last episode we covered the Ares launch rockets proposed for Project Constellation. In this episode we'll look at the bits that are proposed to be stuck on the top of those rockets – particularly the manned spacecraft that will carry astronauts.

Before I get started it's worth noting that the term manned is the agreed technical term here – possibly because the term crewed has its own problems – and personned has never really caught on.

The conceptual approach proposed within the Constellation Project harks back to the days of Apollo, where once again there will be a command module currently called Orion with an associated service module that will be launched atop an Ares I rocket into low Earth orbit.

If the mission is to remain in Earth orbit, perhaps to dock with the International Space Station, then Orion can carry up to six crew. If the intention is to fly to the Moon, then the crew will be reduced to four to reduce weight – including the weight of the consumables required to keep people alive for a mission duration of around 21 days – a considerable extension over Apollo's lunar missions of around 13 days.

The Orion command module is intended to be reusable – though the thermal protection system won't be. The silicon ceramic tiles used on the space shuttles are not favoured for Orion and NASA is apparently returning to the Avcoat ablative heat shields used in Apollo – which, given that ablative means most of it burns away never to be seen again, are most definitely not re-usable.

If all of this sounds a bit like *Back to the Future*, well it probably is – but the Russian Soyuz spacecraft which commenced flying back in 1966 and remains in operation today also uses an ablative heat shield. In fact, so did Shenzhou. I mean... it works.

Incidentally, the Soyuz design which was modified for develop the Shenzhou, introduces a tangential idea into the established Apollo model. Rather than centre everything around a command module – Soyuz has its roughly spherical orbital module where everything of a command-type nature is situated and attached to this is a smaller compact re-entry module, based on the philosophy that when it's time to re-enter, well – all you really have to do is re-enter – and all that command stuff can just be left behind to burn up in the atmosphere.

Anyway, if a moon mission is planned, a four person crew will be launched into low Earth orbit atop Ares 1 and then the heavy lifting Ares V rocket will deliver an Earth Departure Stage – or EDS – and a lunar module, which is called the Altair.

As you may be aware, Altair is the name of the brightest star of the Aquila constellation – which is Latin for Eagle. Cute, huh.

Currently Orion 1 is scheduled to launch on an Ares 1 rocket in 2014. The Ares V's maiden flight is not planned before 2019 – and the first Altair planned to launch on a real Moon mission is scheduled for 2020.

If the names don't change before then, it will be Orion 15 that launches aboard an Ares 1 rocket and an Ares V will deliver an unmanned Altair 3 into low Earth orbit until the Orion 15 docks with it and the Earth Departure Stage (or EDS) also delivered by the Ares V. And then, in what will be almost 50 years since Apollo 17 in December 1972, humans will leave low Earth orbit as the EDS is fired up to send the co-joined Orion15/Altair 3 on a translunar trajectory to the Moon.

Mind you, that almost 50 year timeframe assumes the Russians or the Chinese or the Indians – or heck maybe even the Australians – don't do something themselves before 2020.

Anyway, on arrival at the Moon, and in a departure from the Apollo model, all four Orion astronauts will transfer from the Orion to the Altair, leaving Orion unmanned in lunar orbit, while the crew descend to the surface in the Altair lunar module. Like the Apollo lunar module, Altair is composed of a descent stage which lands the craft and an ascent stage where the crew are situated – and which will launch off the descent stage at the end of the surface mission.

The supplies aboard Altair will support a four member crew a seven day stay on the surface – although once a lunar base is built the unmanned craft could remain on the surface for over six months before being fired up again to return a long stay crew home. To build that base, there will also be unmanned Altair flights which can ship around 15 metric tonnes of cargo – to either await, or be unloaded by, a team of astronauts on the surface.

When their job on the surface is done the astronauts return on Altair's ascent stage to the Orion that's been waiting patiently in orbit. Then they fire up an unnamed engine at the back of the service module and return to Earth. There they aerobrake down through Earth's atmosphere – and then the Orion will parachute down to an ocean splashdown – once again, just like Apollo.

And that's about all the detail there is at the moment. You'll be pleased to know that the Altair team will utilise an innovative 'risk-informed design' process – which is NASA's way of saying they won't just be cobbling something together from whatever bits happen to be lying around.

It all sounds jolly exciting – and something to look forward to as Kennedy Space Centre seems likely to going a bit quiet in the near future. With STS 128 having launched in August 2009, the threatened retirement of the space shuttle fleet now fast approaches with only six more flights scheduled.

After that there's nothing scheduled for Project Constellation until Ares 1-Y, which is an unmanned test flight following on from Ares 1-x in October 2009, but 1-Y won't launch until 2013, itself preceding the first return to manned flight mission of the Orion 1, which will hopefully go ahead in 2014. But even these somewhat distant timeframes look to be slipping already widening the gap between space shuttle and Orion even further.

Unless of course those whispers of a space shuttle program extension come to something... but that's not looking likely given there's already been staff layoffs. Current planning involves the US purchasing flights from Russia to fly their astronauts to the ISS – an arrangement which does have a certain irony, given all that space race business we covered back in Cheap Astronomy Podcast No. 1.

Thanks for listening. This is Steve Nerlich from Cheap Astronomy, www.cheapastro.com. Cheap Astronomy offers an educational website where outsourcing is just another word for space exploration. No ads, no profit, just good science. Bye.