

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

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

For the first time in over 20 years something other than an STS space shuttle stack has been assembled in NASA's ginormous Vehicle Assembly Building at Kennedy Space Centre in Florida. Scheduled for a first test launch in October 2009, the Ares I-x rocket is a prototype of the proposed Ares I which is intended to launch manned spacecraft into low Earth orbit.

The name Ares is ancient Greek for Mars – which is a long-term aspirational goal here – and is pronounced the way you do when naming the star Antares, as opposed to naming the zodiac constellation Aries – but it remains to be seen if commentators will stick with this convention.

The Ares series of rockets are a key part of Project Constellation which will develop a set of launch systems, as well as manned and unmanned spacecraft – none of which will be called Constellation, but all of which will represent a new system of components designed to get the United States back into space after the Space Shuttle fleet is retired in 2010.

Project Constellation aims to adapt technologies from the Space Shuttle as well adapting ideas used back in the Apollo program. Much of the project's proposed suite of launch systems are termed Shuttle Derived Launch Vehicles – being modified derivatives of the current space shuttle solid rocket boosters and the orange fuel tank. One wonders if this is more do with meeting tendering specifications than practical thinking – it seems likely that doing some things from scratch will be needed to really make the project a reality.

Anyhow, Ares I-x, is scheduled to conduct a sub-orbital flight and test some of the flight dynamics of the proposed Ares I rocket – which, all going well, will be launching a crew of astronauts into low Earth orbit by 2014.

The proposed Ares I is a two stage rocket, the first stage being a solid rocket booster (or SRB), similar to – though larger than – the twin SRBs currently used to launch space shuttles. There is some debate about the feasibility of launching a crew atop an SRB given their greater tendency for vibration than liquid fuelled rockets. The Ares I-x test flight should establish a no or no-go on this issue early on – although it will be using a space shuttle SRB with four fuel segments, while the Ares I specifications are for a larger five segment SRB.

This larger SRB should be able to launch the Ares I to more than 50 kilometres altitude after which the SRB drops away and the upper stage of Ares I ignites a liquid hydrogen/oxygen fuelled J-2X engine – which is actually derived from the J2 engines used to power the second and third stages of Apollo's Saturn V rocket.

Assuming, it all works out - the first thing the Ares I will probably do is to launch a crew into low Earth orbit to dock with the International Space Station. The Ares I-x being launched in October certainly can't do this. Its four segment SRB, with a dummy fifth segment, will just launch a dummy upper stage – and a dummy payload, where a manned capsule would sit

on the real Ares I. But hey, even if this test flight sends Project Constellation back to the drawing board – as a first step taking place a year ahead of the Shuttle fleet being retired in 2010, it's encouraging progress.

As well as borrowing concepts from the Shuttle program, the Ares I launch system will also include an Apollo-like escape tower able to jettison a command module away from the main rocket in the event of an explosion. This had always been a feature of US manned spacecraft prior to the space shuttle – and potentially avoids the catastrophe that killed the crew of the Challenger back in 1986.

But for Ares 1, there's some debate here - about whether the escape tower could allow the crew to escape the explosion of a solid rocket booster the size of that proposed for Ares I, which could create a cloud of 2,200 degree centigrade fragments that would melt the command module's parachute. But again, hopefully this is just another teething issue and a reliable, fully tested solution will be arrived at.

It's also worth noting that with the command module and its heat shield sitting above the launch system, the risk of heat shield damage from falling ice or foam debris, which killed Columbia's crew in 2003, is also avoided.

To enable a moon mission – Project Constellation also proposes a huge unmanned heavy lifting rocket, the Ares V, to launch both a lunar module and an Earth Departure Stage – roughly equivalent to the third – though usually termed the S-IVB – stage of the Saturn V rocket. The idea is that a crew is launched into low Earth orbit on Ares I and can then rendezvous with additional heavy components launched into orbit aboard Ares V. Essentially, Ares V is Thunderbird 2 – but without Virgil.

The Ares V will stand taller than the Saturn V at 116 m, instead of the Saturn's 110m and (at least on paper) is intended to transport a payload of over 70 metric tonnes onto a translunar trajectory, well exceeding the Saturn V's 47 metric tonnes capability.

The Ares V has some similarities to the current space shuttle stack with two solid rocket boosters flanking a liquid hydrogen/oxygen fuelled rocket powered by six RS-68B engines – a variant of the existing RS-68 engines – which are currently the largest hydrogen/oxygen fuelled engines in the world.

As well as being involved in a Moon mission, the Ares V may also launch components required for a mission to a near Earth asteroid – and may also launch the proposed anywhere from 8-16 metre Advanced Technology Large-Aperture Space Telescope – with the apt acronym of ATLAST, since this telescope is proposed for launch sometime after 2025.

There's also an Ares IV proposed – which combines the functional aspects of the Ares I and the Ares V by sitting a manned command module atop a monster rocket of a similar scale to Ares V – so it will be Thunderbird 2 with Virgil.

Of course, all this planning and development goes on in the background of the current *Review of United States Human Space Flight Plans Committee* established in May 2009.

This committee aims to ensure that the US is on 'a vigorous and sustainable path to achieving its boldest aspirations in space'. If we'd been asked, Cheap Astronomy would have suggested 'to boldly achieving its aspirations in space...', but never mind.

Speaking of cheap though, it is the case that all this inspiring stuff is footnoted with the ominous statement, 'providing these objectives are met within a defined budget profile'. The committee is due to report in September 2009 – which is a month before the scheduled Ares I-x launch. We live in interesting times.

Thanks for listening. This is Steve Nerlich from Cheap Astronomy, www.cheapastro.com. Cheap Astronomy offers an educational website where the future lies within a defined budget profile. No ads, no profit, just good science. Bye.