The Objective View

January 1999

Newsletter of the Northern Colorado Astronomical Society

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Meetings first Thursday of each Month

Next Meeting:  January 7  7:30 pm  Discovery Center
Fort Collins
"Mauna Kea ... Without Oxygen " by Randy Moench
** Club Business will precede the program, 7-7:30 pm **

December 3 Program:  Mars Direct: Humans to Mars in a Decade, by Brad Jarvis

Traditional approaches to putting people on Mars have involved huge, expensive interplanetary spacecraft, assembled in orbit around the Earth, and powered by speculative rocket propulsion systems. These missions, and the infrastructure required to support them, have been costed into the hundreds of billions of dollars, and considered both too expensive and too difficult to do with any reasonable period of time. Also, they’ve been aimed at short duration stays at Mars, and have not been tied to any strategies for placing a permanent human presence on the Red Planet.

Mars Direct changes all that. This plan for getting to Mars is so revolutionary that it’s changed the thinking at the highest echelons of NASA and the space industry. It’s also relatively inexpensive: as compared to the $450 billion price tag of NASA’s Space Exploration Initiative plan, Mars Direct would cost $20 billion for initial development, which would last about 10 years, and $2 billion per mission afterwards.

The premise is simple: instead of bringing everything with you, you make what you can at your destination: Mars. The less you carry on your trip, the less fuel you need, because you don’t have to fight as hard against gravity when you’re light. Part of what you need to carry is the fuel you’ll use during the trip. Until Mars Direct, ships were expected to not only carry the fuel they needed to get to Mars, but also enough fuel to get back to Earth. This was expensive, because they had all this dead weight on the way out, and needed extra fuel just to haul it! Also, instead of building huge, unreliable, on-orbit construction facilities and lunar bases, you launch directly to Mars from the Earth, with 10% instead of 100% new technology. Also, the same technology can be used on the Moon, with minor modifications.

Mars Direct begins by launching two spacecraft to Mars, each two years apart. The same launch vehicle handles both launches. This vehicle, called “Ares,” uses Space Shuttle solid rocket boosters, main engines, and external fuel tank. It can put 140 metric tons into low-Earth orbit (or LEO), similar to what the Saturn V booster did in the 1960’s. But instead of entering LEO after shedding its lower stages, the Ares heads directly to Mars.

The first of the two spacecraft is unmanned. This Earth Return Vehicle, or ERV, will ultimately take astronauts home from Mars. In addition, the ERV carries a propellant factory, a light truck, and hydrogen to mix with the Martian air to make fuel.

When it gets to Mars, the factory is deployed. It makes all the fuel the astronauts will need on their return trip, as well as the fuel for the cars they’ll use to explore Mars. It uses state of the art 1890’s technology which has been updated for our purposes. As an added bonus, the factory can make enough oxygen and water for the surface stay, so they don’t have to bring those either.

After the fuel is made and a landing site is scouted out by robots carried in the ERV, four astronauts take off from Earth on a six month voyage to Mars, taking a route which itself saves fuel, and allows them to spend the most time at Mars.

The astronauts travel inside a habitat, or “Hab,” essentially a tuna can-shaped house, which they’ll live in during the 500 days that they’re on Mars. The Hab is spacious, with about 1000 square feet spread over two decks. In addition, the Hab carries a ground rover which the astronauts can use to explore up to 1000 kilometers from their landing site, and three years worth of consumables.
Having propelled itself and the Hab into an orbit that intersects with Mars, the burnt-out upper stage of the Ares rotates with the Hab, attached by a 1.5 km tether, in order to simulate Martian gravity, which is about 4/10 that of Earth. This prepares the astronauts for their Mars stay, and limits any ill effects from zero-gravity. An aeroshell connected to the Hab will be used to brake the Hab into orbit around Mars after the Ares stage and tether have been jettisoned. The Hab will then enter the Martian atmosphere, shed the aeroshell, and land by parachute within driving distance of the ERV, which landed on Mars the same way.

Here is what a Mars Direct base might look like: The Hab will sit probably within sight of the ERV. Off in a crater will be the fuel factory. A rover will be around, which uses the methane-oxygen propellant mixed with carbon dioxide from the air. The light truck used to haul the fuel factory away from the ERV is also used by the astronauts for transportation. An inflatable greenhouse will be used to investigate how to grow plants on Mars. We might find a balloon, which will carry a small, remotely controlled robot to help astronauts that stay at the base to explore large areas without the pesky time delay of control from Earth.

So, we've gone to all this trouble to put a few people on Mars. What are they going to do when they get there? Well, they're going to have two main objectives: First, to find out what's NOW on Mars, and second, to find out how humans can permanently live in THE FUTURE on Mars.

While there, the astronauts will do an extensive study of Martian geology, focusing initially on the availability of water, which is believed to exist in abundance as permafrost below the surface, and which might be found in deep underground lakes. They will also look for signs of life, past and present, which at least in the form we know, it is likely found near sources of water and heat. That heat, near recently active features such as volcanoes, could some day be a source of geothermal power for a permanent base or colony.

Now, obviously, just one mission isn't going to solve the problems of the world. The people on it won't even get to see most of it, though the area they will be able to explore will be larger than the state of Texas. The Mars Direct mission plan in fact calls for a sequence of landings on the Red Planet. Each successive landing site will be about 800 km from the others, which is within one-way driving distance of at least one other, providing backup if something goes wrong. Mars is a big place: It has the same surface area as the land on the Earth. The Mars Direct mission sequence easily supports a systematic exploration program. In the first year, the first ERV is launched. At the next launch opportunity two years later, the Hab going to the first landing site is launched, along with a second ERV destined for a new landing site. Note that the very first set of astronauts has two ERVs at their disposal. At the following opportunity, a Hab is launched toward the second site, and a third ERV is sent to a new destination.

This pattern continues until a suitable site is found to build a larger, permanent base. There will be ample supplies of water and energy available, and research can shift into high gear toward developing technologies for helping large numbers of people live on Mars. Several successive missions will land at this site, and share resources. New building construction approaches will be tried, along with metal extraction technologies and power generation techniques. The base will also continue to support exploration of the planet. Ultimately, the stage will be set for the next big step: Colonization.

Now this plan, which you can read about in more detail in Robert Zubrin's book "The Case for Mars," is not etched in stone. It simply proves that it is possible to launch a vigorous program of human exploration of Mars within a decade, with a better chance of success and for less than a tenth the cost of other plans which are considered prohibitively expensive.

Humanity can get to Mars in our lifetimes. It's not only possible, it's DOABLE.
1999 NCAS Officers Nominated

President   David Chamness
Vice President   Bob Carlson
Treasurer   Gerry Reynolds
Secretary   Dee Wanger
Ken Vanlew

Election is at the January 7, 1999 meeting.

January 7 NCAS Meeting Directions
Discovery Center, 703 E Prospect Rd, Fort Collins
From Loveland go North on US 287 to Prospect Rd in Fort Collins, go East about 0.5 miles. Look for the Discovery Center sign on the South side of the street.
From I-25, take Exit 268, head West into Fort Collins. Continue past Lemay Ave about 0.5 miles and see the Discovery Center on the left.

NCAS Star Party, January 16 or 23, Pawnee Grasslands
The site is on undeveloped prairie about 8 miles west of Briggsdale. Take Colorado Highway 14 East from I-25. At 17 miles East of Ault, just after milepost 170, take Road 65 (dirt) North one mile. At the curve West, stop. Go through the gate on the right (no road), close gate and set up. Beware of the cactus! If the weather is bad on the 16th we can try at this location on Jan 23rd. Call Tom Teters with questions about the star party status, site or dates, 482-5702, or Email tjteters@ezlink.com.

NCAS Events, from Randy Moench, President
January 7   Elections

Starwatch at the Discovery Center
Next date is Friday, January 22 at 7PM. Let Dan Laszlo know if you can come, 498-9226. Set up in the parking lot south of the Discovery Center.

Subsequent dates for 1999:
February 26   7 PM
March 26   7 PM
April 23   8:30 PM
May 21   8:30 PM

Best Looks

Moon   Near Regulus 1/5 am
       Near Jupiter 1/21
       Near Venus 1/18

Aldebaran occulted from 02:46 to 03:45 AM on 1/27

Mercury   Predawn in SE after 12/11, by Antares
Venus   Low in SE at sunset.
Mars   In S before dawn
Jupiter   In SW eyes
Saturn   In S, eyes

Mir in January.   Best passes are underlined.

Times are MST, Fort Collins/Loveland. Az is compass direction, N=0, E=90, S=180, W=270. Elevation above horizon, 10 degrees, about a hand-width at arm’s length.

Mir Complex

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International Space Station in December. Times may be off by 10 minutes, especially near the end of the month. Up to date predictions can be obtained at the GSOC website. http://www2.gsoc.dlr.de/sawis/.

ISS

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Iridium Satellite Flares

The intensity of these flares is very sensitive to your position, so please try to know your coordinates as accurately as possible. A position error of 10km on the ground can change the flare intensity by several visual magnitudes. Accurate time is also critical. Observer's Location: Near Lemay and Trilby in Fort Collins CO (40.50°N, 105.05°W). Local Time: Mountain Standard Time (GMT - 7:00)

Current Mir and Iridium predictions are available on the Web at:
http://www2.gsoc.dlr.de/scripts/satvis/satvis.asp?
Lat=40.58&Lng=-105.0500&Loc=Fort+Collins&TZ=MST
Site now gives directions for maximum Iridium flare magnitude.

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From:
c/o Dan Laszlo
2001 S Shields St Building H