

Rappahannock Astronomy Club

Minutes, April 19, 2017, Meeting

In attendance:

Jon Bachman
Bart & Linda Billard
Don Clark
Gary Forjan
Glenn Holliday

Mary Kay Howard
Jerry Hubbell
Dick Mumford
Elizabeth Piersall
Tim Plunkett

The meeting began at about 7:00 p.m. with introductions. Eleven were present, including 5 visitors. Glenn Holliday substituted for Scott Lansdale and also presented the program.

Program

Glenn presented "Your Next Home, Your Next Planet—Mars." He said he would describe some comparisons between Mars and Earth, saying each difference contributed to the challenge of going to Mars (both arriving and living there). Mars has a radius half of Earth's, one-tenth the mass, and a third of the surface gravity. Glenn gave a temperature range of -200 F to 100 F (rounded) and noted temperatures were mostly on the cold end. Mars started out hot like Earth, and also differentiated like Earth, with heaviest metals in the core and lighter rocks in the mantle and crust. Because of its size, it cooled faster than Earth, leading to a thicker crust. However, there is good evidence the core is still at least partially liquid. Mars' geology could still be alive. Valles Marineris, with a length one-fifth the planet's circumference the longest valley on Mars, might be a boundary between two tectonic plates. Straight lines of volcanoes and shearing of an old crater basin rim suggest these plates have moved past each other on a fault line.

Glenn said Mars had two moons compared with Earth's one and described how odd they were. Phobos (11 km radius) and Deimos (6.2 km) are both too small to be round. Their gravity is very low from our perspective. Multiple theories of their origin remain in contention. He listed three: formed from the protoplanetary disk; captured asteroids; or results of debris from an impact on Mars. Glenn went into some detail on the strangeness of Phobos. It orbits across the Martian sky 47 degrees in an hour—three times faster than stars move across our sky. The result is Phobos is seen to rise in the west and set in the east. Glenn said its orbit decayed 2 cm per year, and tidal forces would eventually break it up into a ring. Theoretically it could then eventually reform into a smaller moon. In fact, Glenn said, its composition was essentially a pile of rubble, suggesting it might have been through a ring phase before.

Although a lot of evidence indicates ancient Mars had flowing rivers, lakes, and seas, the atmospheric pressure now is only 6 millibars, compared with 1,013 millibars on Earth. Surface water can no longer exist on Mars because it evaporates as soon as it is exposed to the low pressure. Glenn said the atmosphere once must have been much thicker, and evidence from rocks found on Mars indicated it had more oxygen and less carbon dioxide when they formed compared with today's mostly carbon dioxide atmosphere. He said now the atmosphere was cold, and when winter came to either polar region, 16 percent of the atmosphere fell there as carbon dioxide snow. Long ago, the thicker atmosphere with more oxygen could have been habitable to humans. He asked, "Why do we need space suits there today?"

Glenn discussed the possibility it was because of the lack of a magnetic field like Earth's. The magnetic field surrounding Earth deflects the solar wind, protecting us from radiation. He said it might also protect our atmosphere by reducing the heating of upper air molecules by the solar wind. These air molecules only need a small amount of energy to reach escape velocity. The effect of the magnetic field deflecting the solar wind could mean fewer air molecules leak out into space. Glenn noted some researchers questioned the importance of this mechanism. One critic suggested the oxygen loss from Earth, Venus, and Mars was not very different, and proposed the explanation of Earth's oxygen level was its replenishment by life

Maybe life formed on Mars around the time it did on Earth. Glenn discussed what evidence we had. In 1976, the Viking lander looked for chemistry that life could cause. It found something, but the cause was

ambiguous. Glenn discovered results of a recent experiment using samples of soil from Antarctica and deserts. Although the samples definitely contained life, the Viking test did not detect it. In 1996, NASA scientists studying a meteorite identified as originating from Mars reported finding features that could be fossils of Martian bacteria. Following the report, other explanations were proposed and most scientists have not accepted the interpretation of the features as remains of life. Glenn said Mars satellites and rovers have periodically found spikes of methane and formaldehyde, both of which were most commonly caused by life on Earth. On the other hand, he said, both might have other non-living causes.

The next topics were getting to Mars and how to survive there. Glenn said he found more competitors than you might think, each with a different plan to get there. NASA has had more than one plan. An early 2000s plan to return to the Moon on the way to Mars with a \$500 billion budget died and was succeeded by a more recent plan mandated by Congress to use Apollo-style rockets. Its budget has been reduced to \$450 billion, and the first arrival would be in the 2030s. Elon Musk and SpaceX have proposed colonizing Mars: "... be more than a single-planet species." The plan would involve a spacecraft capable of carrying 100 people per flight. A \$10 billion budget appears to be supplemented by a possibility of a \$100,000 ticket price. Blue Origin has plans to build a rocket that can reach the Moon and beyond, with a goal of commercializing space. The budget is \$1 billion a year. The plan of the United Arab Emirates makes the SpaceX 10-year plan and NASA 20-year plan look optimistic. The UAE plan is to establish a colony on Mars in 100 years, and Glenn said, "They have the money." He also talked about the status of the Mars One plan, which got a lot of attention by accepting applicants worldwide to be one-way colonists to Mars, with first arrival in 2032. A reality TV show was supposed to finance it, but TV sponsorship has ended. Mars One recently started letting applicants purchase a higher priority of being chosen. Announcement of final crews and crew training is behind schedule. On colonists surviving, Glenn said challenges included life support, radiation protection, and living with 1/3 gravity. We will have to build a home that can make its own air, water, and food and not need a maintenance call. NASA's twin astronaut study of Mark and Scott Kelly showed unexpected changes in the brain and DNA. All the colony proposals call for putting the living space underground because of radiation. We know of harmful effects on human bodies of living long term in microgravity, but much less about long-term effects of gravity 1/3 of Earth's. Glenn noted that colonies would mean the likelihood of a first human being born on Mars, but we don't know whether human pregnancy and childbirth will work out in 1/3 gravity.

Glenn's last topic was possibilities of terraforming Mars and the ethical questions raised by terraforming. One approach suggested by NASA would provide Mars with a protective magnetic field using a 2 Tesla magnetic field generator orbiting at Mars' L1 point. It would provide radiation protection and might reduce the erosion of Mars' atmosphere by solar wind. If Mars could then hold its atmosphere, the atmosphere would thicken and warm enough in 40 years to begin returning carbon dioxide frozen in the polar caps back to the atmosphere and create further warming. Elon Musk has separately proposed melting the poles to try to warm the planet using the greenhouse effect. Glenn said it might require first warming the entire planet above the freezing point of carbon dioxide to keep it in the atmosphere long enough for the greenhouse effect to really change the climate.

Another suggestion is colonizing Mars with microbes. Glenn said it would require a large habitat to support the diversity of an entire ecosystem. We live with thousands of other life forms. Although one NASA project proposes building Earth's entire biome on Mars from the ground up, current research only addresses which microorganisms could survive on Mars if we introduced them now.

Radically terraforming Mars could destroy any native Martian life that might exist. Almost universally, people would consider that unethical, and we might lose the feature of Mars we are most interested in. Some suggest terraforming Mars would be like destroying our national parks. On the other hand, making Mars habitable might be the only option for a Plan B if Earth should be destroyed.

Glenn's summary asked, "Why go?" He listed adventure, exploration, new knowledge, Earth 2, "because we can," commercialization of Martian resources, and "add your reasons here...." Don Clark asked whether any other countries were interested. Glenn was not aware of any others, but said several countries such as China were interested in the Moon. He thought there might be interest in an international project. Jon Bachman asked how well international cooperation was going with the International Space Station. Glenn thought it was going pretty well. He said the United States paid the maintenance costs for half the Space Station and Russia for the other half. Someone asked the same about Antarctica, and Glenn was not sure. Jerry Hubbell thought cooperation in Antarctica was working fairly well because much of the work there involved scientists who were familiar with cooperation. Glenn said the pdf of his presentation included a bibliography and was available on the club website ([here](#)).

Old Business

- Treasurer's Report for March 31, 2017—Tim Plunkett reported four dues payments including an advance payment for 2018 and one payment with dues for the optional Astronomical League membership. We now have 20 paid members for 2017 and 2 paid for 2018.
- Events—Glenn said Fredericksburg Academy asked for support of an April 28 event at a Spotsylvania Farm. He said Scott Lansdale committed to supporting it, and others were welcome to join. He did not have the specific information about the location.

May 6–7 are the dates for the Stratford Hall weekend event. Glenn said the location is darker than Caledon and was off Route 3 about 45 minutes east of Fredericksburg. Tom Watson was not sure but hoped to be there. He brought the club solar telescope for the Sunday morning solar viewing. Glenn said he and Scott would be there. He was not sure whether he was expected to go in costume. Dean Howarth will be there as a historical interpreter, and Glenn could have had a debate in character about heliocentrism with Howarth as Tycho Brahe. However, Howarth is scheduled to portray colonial astronomer David Rittenhouse. Don brought in the large set of solar glasses provided for the club by Night Sky Network. He suggested we could offer some at Caledon events ahead of the August solar eclipse.

Glenn talked about this year's Renaissance Faire. He has been portraying Thomas Digges for the last 3 years and had a booth for promoting the club and handing out brochures. This year, he said he would be going around as a cast member, with the opportunity of contacting a wider range of the Faire patrons. However, he found out that it means he would not be able to promote the club because it would be out of character. We would need another volunteer to staff a booth if we wanted a club presence. It would not have to be for all the days the Faire was open. Tom was interested in going at least a day or two and asked about when it starts. The answer was the weekend of May 13–14. Jerry mentioned that Scott Busby had just uploaded files of the club logo that could be used for signs.

- Expectations for Outreach Versus Doing Astronomy—Glenn said the club lists both activities in its purpose. He said Caledon has in the past served as a dark sky place for members to go, but with visitors welcome. Some members would be willing to talk with visitors and share views of the night sky while some others wanted to concentrate on doing astronomy. We have had other events intended more specifically for outreach. Jerry mentioned Ron Henke's description of the club in Tucson. It is larger than ours but not as big as NOVAC. Ron said there were separate groups for members who do outreach and members who concentrate on astronomy.
- Website Status and Communications Committee Business—Don said he had completed conversion to the newer theme, fixed a font problem in the editor, and set up use of secure sockets for login. It automatically provides the secure login. Don suggested modifying the website to better inform potential members about the availability of loaner equipment as an opportunity to learn about possible equipment choices. Tim suggested the site could include a tutorial on telescope types with notes on loaner equipment available for each type. Glenn said the website already had something of the sort that could be used as a start.

Glenn said he was checking through the Yahoo calendar. He said Glenn Faini passed along a request via the club Facebook account. When he contacted the person about the telescope help desired, it was someone who thought a club member would make a trip there to help him, and Glenn was unable to provide the help wanted. Glenn Faini concluded it was time to hand over responsibility for the Facebook account to someone else. Ryan Rapoza seemed like the person to take it over. Tom commented that Twitter has seemed to work for getting people to star parties but not club meetings.

New Business

- Newsletter Status—Linda said she had all the submissions she needed and was expecting to get the issue out May 1 on schedule.
- 2017 U.S. Solar Eclipse—Glenn recommended checking out the current issue of *Sky & Telescope* about eclipse viewing.

Next Meeting

The next meeting is on Wednesday, May 17, 2017, at the Central Rappahannock Heritage Center.