September 14, 2016 Meeting

The September, 2016 Waterloo Technical Society (WTS) meeting was called to order by President Gary Dorhout at 7:20 pm.

A total of 45 were in attendance.

Treasurer's Report. Ken Friend reported the treasury had a beginning balance of $850.17 with $60 income from dues and expenses of May's speakers' dinners of $54 leaving a balance of $856.17. A total of 8 honorary and 6 paid members gave a membership roster of 14 members. Steve Lang moved, Steve Crouse seconded, to accept the Treasurer's Report. Motion carried.

Old Business. No old business was discussed.

New Business. No new business was discussed.

Guest Speakers. Renowned space scientist Dr. Donald Gurnett from the University of Iowa gave his firsthand account of working on instrumentation that is still operating on the Voyager 1 spacecraft. Dr. Gurnett continues teaching at the University of Iowa. He has worked on several space projects with the late world-famous Dr. James Van Allen who is credited with discovery of the Van Allen Radiation Belts.

Dr. Gurnett titled his presentation Voyager 1 Mission to Outer Planets and Interstellar Space 30 Years Later. Dr. Gurnett graduated high school in 1957, the year of the Russian Sputnik launch on October 4, 1957. Dr. Gurnett was very interested in his hobby of radio-controlled model airplanes which used vacuum tubes in its circuits. The United States rocket program was a response to the Soviet success. Explorer 1 was launched on February 4, 1958. Injun 1 through 5 followed in the years 1961-1968 then the Hawkeye launch on June 3, 1974.

Dr. Gurnett worked on the creation of a digital data system which was a 256 bit "shifter" counter. Projects landed in the ocean and all hardware was lost, so each new launch had to start from scratch. These shifters had errors due to bit flips. Dr. Gurnett invented error correcting code to prevent this bit flipping. Injun 3 had a loop antenna to detect whistles caused by lightning. Mariner 1 and 3 ended in the ocean. Mariner 2, launched on August 27, 1962, went to Venus and Mariner 4, launched on November 28, 1964, went to Mars.

The Voyager mission was proposed in 1969. Jupiter, the nearest planet, would pull the space craft with its gravitational attraction, providing acceleration to the space craft. Each succeeding planet in the mission (Saturn, Uranus and Neptune) would do the same. This method had the risk of trapping Voyager but was needed to allow a 30 year voyage to be completed in 12 years. The alignment of these planets would happen only once in every 179 years. Once Voyager passed Neptune it would be traveling in interstellar space.

Some statistics on the Voyager 1 space craft. It weighed 1790 pounds. It was powered by Plutonium 238 to provide 470 Watts of power. During its travel this would diminish to 260 Watts. The computer was a 68 kilobyte memory device. It had two cameras, one with a 115 kilobit per second and one with a 40 bit per second image capture rate. Gas jets were available to orient the craft. There were three gyros onboard to orient Voyager.

Voyager 2 launched on August 20, 1977 before Voyager 1 which launched on September 5, 1977. There was only a two-week window in order to take advantage of the planetary alignment to reach Jupiter. Voyager 1 did not go to Neptune.

Some space bodies are made of gases. Titan, moon of Saturn, had a methane atmosphere. Jupiter, Saturn, Uranus and Neptune are gas planets. Whistlers are due to lightning. Higher frequencies are due to traveling faster. Jupiter has lightning, Saturn has lightning storms. Titan's atmosphere is full of hydrocarbons with methane the predominant gas. Elemental nitrogen gas is also present in its atmosphere. The surface has ice with lakes but no oxygen in the atmosphere. Voyager 2 accomplished its mission. The mission has now been restated as interstellar travel.

Voyager overcame its technical challenges. Radio communication required a 70 plus meter antenna. Plutonium 238 has a half-life of 87.7 years, decreasing power by four Watts per year. By 2020 there will not be enough power to operate all particle and field instruments. By 2025 there will be insufficient power to operate the spacecraft.

Voyager 1 became the first human-made space craft to enter interstellar space. By today's standards it is a very crude craft, but its pioneering achievements paved the way for eventual human space travel.

For more information on this program and other NASA programs visit http://www.nasa.gov/mission_pages/voyager/index.html.

Next Meeting. Our October 12, 2016 meeting features Dr. Thomas Nagle, explaining applications of technology in signage.

Meeting adjourned at 9:15 pm.

Respectfully submitted,

James R. Stevenson, Vice President and Secretary