

PDF - TELEMEDICINE IN SPACE MEDICINE AND EXTREME TERRESTRIAL ANALOGS. -

researchcub.info Telemedicine and telehealth have been around for quite some time. They have been applied in all sorts of conditions and situations, from disasters to patients' homes to healthcare facilities to battlefields to space. Each application is similar, yet each is unique. We have reported to you many of the findings from research over these past two decades. This does not mean that there was not a large body of work before 1995. Indeed, there was. Telemedicine in human spaceflight is probably the first large-scale use of the concept that has become known as telemedicine, beginning in the late 1950s. As World War II was winding down, Germany's rocket scientists had developed and used rockets as offensive weapons. In order to better understand their performance, they developed tools to monitor rocket performance during the flight phase. This technology, primitive multiplexed radio signals, which they referred to as "Messina," was used to monitor rocket engine performance during flight. Similar technology developed in the late 19th Century also proved useful in monitoring the docks and water levels of the Panama Canal in the early 20th Century. The German scientists who were captured by the U.S. Army or the Soviet Army became key participants in further developing many aspects of space exploration, including telemetry and space medicine in both nations. On the U.S. side, these scientists were integrated into American engineering, science, and medicine through Operation Paperclip. This simple need to monitor something at a distance helped shepherd in the concept of wireless monitoring of a distant patient (astronaut), which we refer to as telemedicine. Many of these individuals had a role in America's race to the moon in the 1960s and in the development of the necessary medical systems needed to support astronauts, which is known as space medicine. The first use of telemetry in monitoring a living being was by the Soviet Union on *Cytoj-2* (Sputnik 2) on November 3, 1957. A dog named Laika will forever be remembered as the first mammalian species to be sent into space. Using a telemetry system, Laika's physiological parameters were down-linked to the Earth at timely intervals. Prior to this event, National Aeronautics and Space Administration's (NASA's) precursor agency, the National Advisory Committee for Aeronautics, which was convened in 1915, sent a variety of animal species into the upper atmosphere on sounding rockets but never into low Earth orbit beginning in the early 1950's. It was December 13, 1958, when NASA sent a primate named Gordo into space on a U.S. Army Jupiter missile and recorded biomedical data indicating that the primate could withstand the launch and ballistic reentry. This valuable information helped physicians and medical researchers understand the impact that humans might experience during all phases of spaceflight. As the race to the Moon heated up, America and the Soviet Union developed the necessary systems to launch humans into space and monitor not only their health but also the environmental parameters of the spacecraft. Although many may recognize how telemetry was used in recent Hollywood productions of *Apollo 13* or *Gravity*, it is a fact that astronauts on the Moon were monitored from Mission Control Center—Houston in near real-time (e.g., cardiac problems during *Apollo 15*) and were able to provide medical guidance. This concept of telemedicine was further developed when Joe Kerwin, America's first

physician in space, lived on the Skylab, the first American Space Station. The Soviet space program was utilizing telemedicine as well. It was just not called telemedicine in the 1960s. The work by both nations led to the development of the medical care systems used during the Space Shuttle Program and the International Space Station. The technology developed for remote sensing, computer technologies, communication systems, materials, and a whole litany of innovations found their way into military applications and into our everyday life. In space, telemedicine is part of the daily routine. Of course, ground-based research activities were also underway in many places around the world in the 1960s and 1970s. In our editorial in last month's issue, we mentioned DeBakey's surgical work in 1964 with Early Bird and NASA's ground-based Space Technology Applied to Rural Papago Advanced Health Care (STARPAHC) (1974) project in Arizona. Furthermore, the Kenneth Bird Lecture Series of the American Telemedicine Association (ATA) is named after Dr. Bird for his early work at the Massachusetts General Hospital (in the 1960s). These early activities are aptly highlighted in Bashshur and Shannon's history of telemedicine textbook. As space medicine was developed in the years following World War II and the subsequent space race, there was a need to evaluate technologies, protocols, and procedures prior to using them in the extreme environment of space. Thus, the concept of a terrestrial testbed was established. A testbed can be characterized as a laboratory in a unique setting. For instance, the Russians recently finished the Mars 500 experiment, where six individuals from the European Space Agency, Russian Space Agency, and China lived in a small, self-contained complex in Moscow at the Russian Academy of Sciences' Institute for Biomedical Problems for 500 days to simulate an exploration mission to Mars.

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