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INTEGRATED SOLUTION OF COMMUNICATION AND FAULT ALARMING SYSTEM FOR CHINA
SPACE STATION BASED ON BEIDOU SHORT MESSAGE SERVICE

Abstract

China's manned space flight has entered the space station stage. After the construction phase, China space station(CSS) will enter operation phase. In the operation phase, astronauts will continue to stay in the CSS. The communications between CSS and ground are established by tracking and data relay satellite sytem(TDRSS) and ground tracking, telemetry and commanding(TTC) system. The TTC coverage rate of CSS will be greatly reduced in long-term operation phase in consideration of TTC costs. When the CSS is out of TTC coverage, astronauts could not communicate with the ground and fault alarming message onboard could not be sent to the ground. This problem can be solved by exploiting the short message service(SMS) of Beidou III navigation satellite system. China's Beidou III navigation satellite system has successfully launched six satellites, and will achieve global coverage by 35 satellites around 2020. In addition to provide the navigation services, the Beidou III system also provide short message service, which can be used for communications between CSS and ground for global coverage. A integrated system is designed for CSS based on SMS of Beidou III system. The system can provide short message communications between astronauts in CSS and the ground. The urgent fault alarming message can be sent to the ground while the ground directions to deal with the fault can also be sent to CSS through the system. The onboard system consists of SMS terminals, handsets and antennas. The terminal performs the baseband and radio frequency(RF) procession of the short message data. It also receives the fault alarming message from housekeeping computer and sends them to the ground. The message from the ground is also received by the terminal and sent to the housekeeping computer. The size of the handset is the same as a mobile phone. The connection between the handset and the terminals is wireless. The astronauts can perform two-way short message communications by using the handset. Some applications(APP) can also be installed in the handset for entertainment of the astronauts. The T-R separate quadrifilar helical antennas are designed and the fied can reach 75 degrees. Simulation results shows that the coverage rate of the integration system is up to 99.5%. Hence, using this system, the astronauts in CSS can almost communicate with the ground at any time and emergency in CSS can be detected and deposed as early as possible, without additional TTC costs.