Master Clock and Time Distribution System for the NASA Deep Space Network

J. Lauf, M. Calhoun, P. Kuhnle, R. Sydnor, and R.L Tjoelker

Jet Propulsion Laboratory,
California Institute of Technology
Pasadena, California 91109

NASA's Deep Space Network (DSN) consists of more than 20 antennas located at three ground communications facilities globally spaced approximately 120 degrees (Goldstone, CA; Madrid , Spain; Canberra, Australia). Each complex simultaneously operates multiple antennas for communication with NASA's interplanetary spacecraft, for spacecraft navigation, and to detect microwave radiation from distant deep space radio sources for radio astronomy and long baseline interferometry.

Local generation and distribution of precise time and frequency reference signals comprise an essential component of the infrastructure at each complex. Within each complex synchronized timing references are required by approximately 100 users located at distances up to 30 kilometers from the central control center and station Master Clock. Since the DSN is mission critical and simultaneously tracks several missions the timing system must be available at all times and downtime cannot be afforded. This paper describes a highly modular, hot-swappable, and expandable system design for generation and delivery of highly precise and stable timing signals over fiber optic cables to multiple users spread over several kilometers. Operability issues including the design approach to the operator interface, time setup and recovery, redundancy, fault diagnosis, and maintenance will be presented.

This work was carried out by the Jet Propulsion Laboratory, California Institute of Technology, under contract with the National Aeronautics and Space Administration.