

TREK

GETTING STARTED GUIDE



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1 Welcome

The Telescience Resource Kit (TReK) is a suite of software applications and libraries that can be used to monitor and control assets in space or on the ground.

1.1 About TReK

The TReK software provides support for various data interfaces including UDP and TCP. Data capabilities include support to receive, process, record, playback, forward, and display data. This includes support for creating, populating, and sending traditional CCSDS packets or user-defined IP packets. Support is included for both pre-defined and custom headers and packets. Data recording, data playback, and post processing support (such as extracting data from recorded data files) is also available. File transfer is supported using CCSDS File Delivery Protocol (CFDP). Command capabilities include support for creating, modifying, storing, and uplinking commands (traditional CCSDS packets or user-defined IP packets). They also include monitoring, recording, and tracking command activity. Metadata (packet definitions, limit information, etc.) can be stored in one or more databases or files. Various formats and mechanisms are provided to define, import, and export metadata including custom headers and packets.

TReK capabilities are provided through TReK applications and the TReK Application Programming Interface (API). The API provides the capability to write custom software for use onboard a spacecraft or on the ground utilizing just the capabilities needed for a particular operations concept.

TReK can be used throughout the development lifecycle to support all activities including development in a laboratory environment, testing, simulations, and flight operations.

1.2 About this Guide

This guide introduces the TReK applications and libraries available in this release. It also provides information about where the TReK software is installed, the documentation that is available, and suggestions for getting started with TReK.

2 Software Classification and Export Control

The TReK software is classified as EAR ECCN 9D515.a.

Information about Export Control of TReK Software

EAR ECCN 9D515.a

Export Administration Regulations (EAR) Notice

The TReK software is within the purview of the Export Administration Regulations (EAR), 15 CFR 730-774, and is export controlled. It may not be transferred to foreign nationals in the U.S. or abroad without specific approval of a knowledgeable export

control official, and/or unless an export license/license exception is obtained/available from the Bureau of Industry and Security, United States Department of Commerce. Violations of these regulations are punishable by fine, imprisonment, or both.

Information about Export Control of TReK Documents

Each TReK document title page specifies whether it is available for public release or is export controlled.

3 Technical Support

If you are having trouble installing the TReK software or using any of the TReK software, please contact us for technical assistance:

E-Mail: trek.help@nasa.gov

Messages sent to this address are automatically forwarded to the TReK team.

The HOSC Help Desk (256-544-5066) can provide assistance as needed and is available 24x7.

4 Overview

Each TReK software release is comprised of software, documentation, online help, and example programs. This section provides an overview of each component that makes up the TReK product.

4.1 Software

This section describes the TReK applications and libraries.

CFDP Application

The CFDP Application provides capabilities to perform file transfer functions using the CCSDS File Delivery Protocol (CFDP).

CFDP Console Application

The CFDP Console Application provides capabilities to perform file transfer functions using the CCSDS File Delivery Protocol (CFDP).

CFDP Console Background Application

The CFDP Console Application provides capabilities to perform file transfer functions using the CCSDS File Delivery Protocol (CFDP) as a background application (no interactive command line).

CFDP Library

The CFDP Library provides an application programming interface to perform file transfer functions using the CCSDS File Delivery Protocol (CFDP).

CFDP Service

A Windows Service that provides capabilities to perform file transfer functions using the CCSDS File Delivery Protocol (CFDP).

Command Application

The TReK Command application provides the capability to update, send, and track commands. Includes support for various types of command destinations and also includes the command bridge capability.

Command Library

The Command library provides an application programming interface to update, send, and track commands. It includes a C++ class and an ANSI C interface.

Command .NET Library

The Command .NET Library provides a Microsoft .NET interface to the Command Library.

Command Sequence Editor Application

The Command Sequence Editor Application can generate a series of multiple commands that can be executed with a single action.

Crypt Application

The TReK Crypt application provides the capability to create cryptography keys that can be used with TReK applications that provide cryptography services.

Data Application

The TReK Data application provides the capability to manage data services such as receiving data, processing data, recording data, forwarding data, and displaying data.

Data Library

The Data Library provides an application programming interface to work with packets. This library provides an easy way to create your own custom packets to use when communicating with your payload.

Device Services Library

The Device Services Library provides an application programming interface to perform functions such as creating sockets, sending data, receiving data, etc.

E-Mail and Text Library

Provides an ANSI C application programming interface to send texts, email messages and email file attachments to a designated group of one or more recipients by communicating with an Simple Mail Transport Protocol (SMTP) email server. The

library also provides the capability to create a dropbox that sends a file as a file attachment or sends the content of the file as a text or email message by moving the file to the dropbox.

ERIS Simulator Console Application

The ERIS Simulator Console Application simulates the capabilities provided by the POIC as defined in the Payload to Generic User Interface Definition Document (PGUIDD) SSP 50305.

EXPRESS Demo Payload Application

The EXPRESS Demo Payload Application simulates an ISS EXPRESS payload and exercises interfaces between the TReK EXPRESS library and the ISS EXPRESS Rack Interface Controller (RIC). This application can be used by commercial and international partners to support internal visiting vehicle and joint vendor/NASA testing. The source code for this program is provided as an example.

EXPRESS Library

The EXPRESS Library provides support for the following EXPRESS Payload to ISS C&DH System Ethernet interfaces as defined in SSP 52000-IDD-ERP: telemetry generation (including health and status), command handling, ancillary data, PEP bundle request, PEP procedure execution request, and data transfer over IP.

EXPRESS Simulator Console Application

The EXPRESS Simulator Console Application simulates the following capabilities provided by the EXPRESS Payload to ISS C&DH System Ethernet interfaces as defined in SSP 52000-IDD-ERP: telemetry generation (including health and status) and command handling.

Generator Application

The TReK Generator application provides the capability to generate data and send it to one or more destinations. Data values can be randomly generated or specified by user-defined data generation rules.

HOSC Login Application

The TReK HOSC Login application provides the capability to create a login session with the Huntsville Operations Support Center (HOSC) that can be shared across TReK applications (e.g. HPEG, Command).

HPEG Application

The HPEG Application provides access to the HOSC Payload Ethernet Gateway (HPEG) services.

HPEG Console Application

The HPEG Console Application provides capabilities to automate HOSC Payload Ethernet Gateway (HPEG) services.

HPEG Library

The HPEG library provides an application programming interface to retrieve HPEG status information contained in the HPEG application.

IONconfig Application

The IONconfig application provides the capability to generate ION configuration files and scripts. The scripts (Windows batch files and Linux shell scripts) can be used to start and stop ION.

IONizer Application

The IONizer application provides capabilities to start, stop, and monitor ION.

IONizer Console Application

Provides the IONizer application quick configure option in a console application. Automatically generates ION configuration files and launches ION.

IONizer Library

The IONizer library provides an application programming interface to start, stop, and monitor ION.

Metadata Application

The TReK Metadata application provides the capability to create and manage telemetry and command metadata. This includes support for creating databases and metadata files and translating between different types of metadata formats.

PEP Ethernet Demo Payload Application

The PEP Ethernet Demo Payload Application simulates an ISS payload that utilizes capabilities provided by the Payload Executive Processor on ISS as defined in Payload Software Interface Control Document Part 1, International Standard Payload Rack to ISS Document interfaces SSP 52050 Rev M. The application simulates the following: sending health and status, receiving S-band commands, access to Timeliner, ancillary data, and callbacks for payload unique processing. The source code for this program is provided as an example.

PEP Ethernet Library

The PEP Ethernet Library provides support for the following capabilities defined in Payload Software Interface Control Document Part 1, International Standard Payload Rack to ISS Document interfaces SSP 52050 Rev M: Sending health and status, receiving S-band commands, access to Timeliner, ancillary data, and callbacks for payload unique processing.

PEP Ethernet Simulator Console Application

The PEP Ethernet Simulator Console Application simulates the capabilities provided by the Payload Executive Processor on ISS as defined in Payload Software Interface Control Document Part 1, International Standard Payload Rack to ISS Document interfaces SSP 52050 Rev M.

Playback Application

The Playback application provides the capability to playback recorded data.

Python Library

The TReK Python Package includes access to the Telemetry and Command capabilities of TReK using Python. This package is layered atop the existing C++ APIs.

Record Library

The Record library provides an application programming interface to record data.

Settings Application

The Settings application displays information about TReK settings.

Telemetry Library

The Telemetry library provides an application programming interface to retrieve telemetry data. It includes a C++ class and an ANSI C interface.

Telemetry .NET Library

The Telemetry .NET Library provides a Microsoft .NET interface to the Telemetry Library.

TReK Assistant

The TReK Assistant provides online help for all TReK applications and libraries.

User Calibrator Generator Console Application

The User Calibrator Generator Console Application creates files needed for writing your own calibration code.

4.2 Documentation

The TReK documentation set is comprised of user guides, tutorials, and reference documents. The Getting Started Guide should be read first followed by the tutorials. The user guides are helpful when you are looking for information about a specific capability. Each document is described below.

CFDP Console User Guide

The CFDP Console User Guide provides information about the TReK CFDP Console application.

CFDP Tutorial

This tutorial provides an introduction to CFDP and describes how to transfer a file using Native CFDP.

CFDP User Guide

The CFDP User Guide provides information about the TReK CFDP application.

CFDP Service Quick Guide

This Quick Guide provides overview information about the CFDP Service available for Windows.

Command Database Definition Document

This document is a reference document that contains detailed information about the TReK Command Database.

Command Sequence Editor User Guide

The Command Sequence Editor User Guide provides information about the Command Sequence application.

Command Tutorial

This tutorial provides an introduction to the TReK Command application. It describes how to configure the application to communicate with a command destination and how to update, send, and track commands.

Command User Guide

The Command User Guide provides information about the TReK Command application.

Concepts Document

This document provides a high-level introduction to concepts associated with telemetry and commanding, processing and building packets, conversion, calibration, and alarms (limit sensing). It includes an overview of the TReK Data Application Programming Interface (API). This includes an introduction to the Data API classes and examples showing how to use the classes to perform telemetry and command functions.

Crypt User Guide

The Crypt User Guide provides information about the TReK Crypt application.

Cryptography Services Tutorial

This tutorial provides information about cryptography services available in TReK applications.

Data Tutorial

This tutorial provides an introduction to the TReK Data application. It describes how to configure the application to perform various data related tasks such as receiving data, processing data, recording data, forwarding data, and displaying data.

Data User Guide

The Data User Guide provides information about the TReK Data application.

DTN Tutorial

This tutorial provides a high-level introduction to Delay Tolerant Networking. It includes a discussion on the DTN network in place to support International Space Station users.

EXPRESS Demo Payload Application User Guide

The EXPRESS Demo Payload Application User Guide provides information about the TReK EXPRESS Demo Payload application.

EXPRESS Example Tutorial

This tutorial describes how to set up a TReK EXPRESS library example program and use it with the EXPRESS Simulator Console Application.

Getting Started Guide

The document you are currently reading. This document provides information about getting started with TReK.

Generator User Guide

The Generator User Guide provides information about the TReK Generator application.

HOSC Login User Guide

The HOSC Login User Guide provides information about the TReK HOSC Login application.

HPEG Tutorial

This tutorial provides an introduction to the HOSC Payload Ethernet Gateway (HPEG) service. It describes how to activate the HPEG service and obtain a proxy IP address.

HPEG User Guide

The HPEG User Guide provides information about the TReK HPEG application.

HPEG Console User Guide

The HPEG Console User Guide provides information about the TReK HPEG Console application.

IONconfig User Guide

The IONconfig User Guide provides information about the TReK IONconfig application.

IONizer User Guide

The IONizer User Guide provides information about the TReK IONizer application.

Metadata Tutorial

This tutorial provides an introduction to the TReK Metadata application. It describes how to create a user defined packet and generate a metadata file that can be used with other TReK applications.

Metadata User Guide

The Metadata User Guide provides information about the TReK Metadata application.

PEP Ethernet Library Tutorial

This tutorial describes how to set up a TReK PEP Ethernet library example program and use it with the PEP Ethernet simulator.

Playback Tutorial

This tutorial provides an introduction to the TReK Playback application. It describes how to configure and run a playback of recorded data.

Playback User Guide

The Playback User Guide provides information about the TReK Playback application.

Settings User Guide

The Settings User Guide provides information about the TReK Settings application.

Telemetry Database Definition Document

This document is a reference document that contains detailed information about the TReK Telemetry Database.

4.3 Online Help

The TReK Assistant application provides integrated online help for all TReK applications and libraries. It includes documents described in section 4.2 and online help for TReK APIs including code examples. All TReK applications also include application specific help.

4.4 Example Programs

Example Programs are provided to show how to use TReK APIs. Some examples target a specific API and others show how to use multiple TReK APIs together. Documentation for examples can be found in the TReK Assistant. Source code for examples can be found in the TReK installation examples directory.

5 Directory Structure

This section provides information about the TReK software installation.

5.1 TReK Installation Directories

The following directories are installed on both Windows and Linux unless otherwise specified. The TReK menu refers to the TReK menu item on the Windows Start menu or the Red Hat Enterprise Linux Applications menu.

The bin Directory

The bin directory contains all of the executables (and dlls on Windows) for the TReK software. This directory contains the applications that are found on the TReK menu and other executables that are needed by these applications.

The config Directory

The config directory contains any configuration files needed by TReK applications.

The dll Directory (Windows only)

The dll directory on Windows contains the dll files you need to run your program with TReK on Windows. There are subdirectories for each supported development environment. The dll directory is only installed on Windows.

The doc Directory

The doc directory contains TReK documentation. You can open all of the TReK documents from the TReK menu.

The example Directory

The example directory contains subdirectories for each TReK example. Documentation for the examples can be found in the TReK online help.

Note: Due to file privileges, you may need to copy example files located in the TReK installation directory to a user directory for editing or compiling.

The extras Directory

The extras directory provides additional (or extra) components or items for TReK. For example, this is where you can find the TReK Python Package for Telemetry and Command API.

The help Directory

The help directory contains binary files needed to support TReK online help.

The include Directory

The include directory contains the include files you need to use the TReK API libraries.

The lib Directory

The lib directory on Windows contains the import libraries you need to link your program with TReK libraries. There are subdirectories for each supported development environment. The lib directory on Linux contains the shared object files you need for linking and running.

The licenses Directory

The licenses directory contains license files for third-party products used by the TReK software.

The menu Directory (Linux only)

The menu directory is only installed on Linux. It contains files needed to support the TReK menu on the Red Hat Enterprise Linux Applications menu.

The metadata Directory

The metadata directory contains any files needed by TReK applications and libraries to supply metadata information. Subdirectories exist for each type of metadata.

The script Directory

The script directory contains any script files needed by TReK.

The template Directory

The template directory contains template files used by TReK applications and libraries.

The third_party Directory

The third_party directory contains third-party software used by the TReK software.

The workspace Directory

The workspace directory contains directories and files that will be copied to the user's home directory to allow user specific data to be separate (e.g. databases, metadata files, etc.).

5.2 User Directories

User directories are created for each user and allow user specific data to be separate. The User directories are created automatically by applications that use them. Not all applications need access to user directories. The user directories are copied from the TReK installation directory and installed under the user's home directory for the user account. The top level directory for the user directories is called "trek_workspace". The location of this directory is different based on the operating system. On Windows, the directory will most likely be: C:\Users\<username>\trek_workspace. On Linux, it would most likely be /home/<username>/trek_workspace. Once the user directories exist, the TReK software will not overwrite any existing files within the directories.

Please note that it is possible for the user directories to be on another partition. If you do not see the directory, look for the same name on another drive.

5.3 TReK Help Cache

When you run the TReK Assistant, cache files will be stored in the following location:

windows: C:\Users\<username>\AppData\Local\gov.nasa.msfc.trek

Linux: /home/<username>/local/share/gov.nasa.msfc.trek

The cache files are used to store information needed to support the TReK Assistant. In general there is nothing you need to do with this directory. However, if you ever find the

TReK Assistant behaving oddly, you can try deleting the `gov.nasa.msfc.trek` folder to see if this fixes the problem.