TREK

GETTING STARTED GUIDE

July 2022

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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, TCP, Bundle Protocol (BP), and serial interfaces. 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). TReK also provides support for Delay Tolerant Networking. Data can be transferred in packets using Bundle Protocol (BP) or as files using CFDP over BP. 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:

TReK Help Desk E-Mail, Phone & Fax:

E-Mail: trek.help@nasa.gov
Telephone: 256-544-3521 (8:00 a.m. - 4:00 p.m. Central Time)
Fax: 256-544-9353

If you call the TReK Help Desk and you get a recording please leave a message and someone will return your call. E-mail is the preferred contact method for help. The e-mail message is automatically forwarded to the TReK developers and helps cut the response time. 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 including POIC, Suitcase Simulator, PRCU, RAPTR, and UFO. It 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.

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 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 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.

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.

Migration Guide
The Migration Guide provides information about migrating from the TReK 3.x or TReK 4.x software to the TReK 5.x software.

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.