Consolidated Prediction and Data Formats: Supporting New Technology

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For the Data Formats and Procedures Working Group

Introduction

- **Consolidated prediction format (CPF) developed as single format for all laser ranging targets, including transponders**

- **Due to technology changes (kilohertz systems and transponders), we also need to develop a new consolidated data format**

Consolidated Prediction Format

- **CPF provides a method of ranging to different types of targets using one format**
- **Allows cross-technique ranging attempts**
- **Does not rely on on-site gravity model, tuning, or separate Earth Orientation series, drag and time bias functions**
- **Tabular format containing un-tuned state vectors at appropriate intervals**
- **Typically in ITRF**

Consolidated Prediction Format: Implementation Status

- **In use in at least 22 out of 37 ILRS SLR stations**
- **In use at one currently operating LLR station, with other stations experimenting**
- **Working on CPF predictions for LRO**
- **SLR predictions are seen to be much more accurate: "90% of passes within +-20ns and 99% within +-100ns"**
- **Now: turn our attention to the data format...**

Consolidated Laser Data Format: Motivation

- **Transponder data will not fit into old data formats**
  - **Need one way ranges**
  - **Need more digits of accuracy in epoch**
  - **Need clock information**
  - **Need spacecraft calibrations**
- **Kilohertz ranging data creates cumbersome full rate data files.**

Consolidated Laser Data Format: Overview

- **Encompass full rate, quicklook, and normalpoints in one format**
- **Similar in structure to CPF**
  - **Header and data records**
  - **Building block approach**
  - **Expandable and flexible**
  - **ASCII**
- **Can potentially mix all data types and multiple colors in one file**

Example: header

- Basic header 1
  - H1 CDF 1 MLRS   2006 9 27 17 0 ENVISAT   test file
  - Note station and satellite names
- Basic Header 2
  - H2 200901 6179   0 2003 11 11 5 31 24 2003 11 11 5 32 2 52954 7080 24 19 1 0 6 7 2 0
  - Note begin and end time and mjd of first data record
  - Note satellite and station numeric IDs
- Laser color record
  - H4 1 532.0
  - One for each color
- Pass Information
  - H5 1 -650   0   82 82
  - Statistical record
- End of Header
  - H9
- Additional headers for transponders and full rate information
- Headers are fixed format

Example: Data records

- Range
  - 10 1 2   19880.8466929 1 2   0.010936014472   0
  - Second long field is either range or receive time
- Meteorological record
  - 20   19880.8466929 802.50 288.10   69
  - Written only when fields change
- Point angles
  - 30   19880.8466929 1 281.1890 22.4030
  - For quicklook and fullrate data; written only when field changes "enough"
- Corrections
  - 40   19880.8466929 1 2   0   0   -650   0
  - Refraction, center of mass, system delays
- Range (with normalpoint fields)
  - 10 2 2   19884.7472085 1 2   0.010985288919   0   15   37   73 0.0
- Date records are in free format

Consolidated Laser Data Format: Status

- **Version being developed with input from DF&P Working Group members and the LRO Laser Ranging team and kilohertz stations**
- **Transponder fields are being identified, added**
- **With draft version, full rate file size should drop by 55-65% at 500 returns/sec and 25-30% at <10 returns/sec**
- **Preliminary version to be used with LRO must be completed within a few months due to mission deadlines**

Timetable

- **LRO: ASAP**
- **Stations to implement as needed**
  - **Kilohertz stations**
  - **LLR stations**
  - **Others**
- **Analysts to be shielded until a critical mass is reached**
- **Convert historical data…**

Summary

- **The new prediction format is successfully being implemented**
- **A new data format is being developed to encompass fullrate, quicklook, and normalpoint data for SLR, LLR, and TLR**
- **Progress is driven by a transponder mission's deadlines and kilohertz systems**