

PrestoDecom: a portable software for house keeping telemetry decommutation

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Access to housekeeping telemetry is recurrent throughout the whole life of a satellite. Flight control teams, spacecraft manufacturer engineers and subsystem experts are all interested in accessing telemetry parameters to make sure that the satellite is running nominally. This is usually fulfilled by a traditional web server embedded within the control centre which performs extraction and calibration of the raw telemetry. However, this centralized solution is usually available only at the beginning of the operations preparation. The raw telemetry which is produced outside the control centres, e.g. at the satellite supplier premises or on launch pads, is rarely exploited by experts who may miss useful information because of the lack of widespread extraction means. Hence the idea of developing a universal portable application called PrestoDecom offering the same facilities as those inside a control centre, allowing work on raw telemetry archives anywhere, especially when the control centre is inaccessible. This innovative software was successfully used in 2003 to validate the satellite simulator on the PROTEUS multiplatform project. PrestoDecom has been rapidly adopted inside CNES by a growing user community conquered by its simplicity and efficiency. Today 2/3 of CNES satellite projects have already invested into PrestoDecom and this product has won acclaim not only outside the control centres but also inside where it is installed on all work stations. Its success has reached beyond CNES with major European satellite contractors using it. PrestoDecom makes web server or test bench telemetry processing completely independent of control centres. It is now possible to use the same product throughout the life of different satellites (from conception to deorbiting) without relearning because it is designed to be easily customized with a unique multi satellite PC and Linux code base. As a result, tests show at least a 10 fold reduction in telemetry handling.

Nomenclature

<i>AIT</i>	= Assembly, Integration & Testing
<i>AOCS</i>	= Attitude and Orbit Control Subsystem
<i>CC</i>	= Command and Control
<i>CNES</i>	= Centre National d'Etudes Spatiales (French Space Agency)
<i>COTS</i>	= Component Of The Shelf
<i>FCP</i>	= Flight Control Procedure
<i>GEO</i>	= Geostationary Earth Orbit
<i>GUI</i>	= Graphic User Interface
<i>HKTM</i>	= House Keeping TeleMetry
<i>IOV</i>	= In Orbit Validation
<i>LEO</i>	= Low Earth Orbit
<i>LEOP</i>	= Launch and Early Orbit Phase
<i>MCC</i>	= Monitoring and Control Centre
<i>MEO</i>	= Medium Earth Orbit

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<i>OBSW</i>	=	On-Board Software
<i>PC</i>	=	Personal Computer
<i>PRESTO</i>	=	PRoteus Engineering Simulator for Test and Operations
<i>PROTEUS</i>	=	Plate-forme Reconfigurable pour l'Observation de la Terre et les Usages Scientifiques
<i>PUS</i>	=	Packet Utilization Services
<i>SDB</i>	=	Satellite Data Base
<i>TAI</i>	=	International Atomic Time
<i>TC</i>	=	TeleCommand
<i>TM</i>	=	TeleMetry
<i>UTC</i>	=	Coordinated Universal Time

I. Overview

Access to housekeeping telemetry (HKTm) is recurrent throughout the whole life of a satellite. Such a need starts during the OBSW validation as soon as the first telemetry packets are available and continues until the satellite is switched off after final deorbiting. Many people are involved between these two milestones and one of the major challenges is to supply the teams with convenient software to handle HKTm which plays key role in analysing the satellite behaviour and especially critical situations.

Using the same software through the whole life of a satellite is a dream because several companies are involved in a space project. Even satellite manufacturers have a real job in getting all their teams working on the same project use the same products. For instance, people working on OBSW validation or on functional chain validation benches rarely use the same HKTm extraction tool as their colleagues in another business unit in charge of AIV activities. Needless to say that those operational teams which inherit the satellite are very likely to use yet another software. This statement of fact remains true when a new project sees the light and everyone is tempted to develop new pieces of software and start from scratch. This situation is of course a source of lucrative business for software developers. However it is definitely not convenient for end users such as spacecraft experts or operational engineers who move from a project to another and are permanently subjected to everlasting relearning of software.

The French Space Agency is not an exception to this rule. However, some initiatives have been taken recently internally in order to share software between several missions. As an illustration of this reuse policy, PrestoPlot² 2-D telemetry plotter is used today in more than 90% of CNES satellite monitoring and control centres.

A similar enterprise has been going on for nearly ten years in CNES with a CCSDS HKTm extracting application called PrestoDecom and this paper details the history of this software, as well as its major features.

II. PrestoDecom birth and expansion

A. An individual initiative

PrestoDecom was initially designed to fulfil the modest needs of a team in charge of validating the satellite simulator of a multi project platform called PROTEUS (**P**late-forme **R**econfigurable pour l'**O**bservation de la **T**erre et les **U**sages **S**cientifiques) developed in partnership between Thales Alenia Space and CNES. Five satellites using this platform have already been launched: JASON1 (2001), CALIPSO (2006), COROT (2006), JASON2 (2008) and SMOS (2009). JASON3 should be the last one of this success story and shall be launched in 2014.

This fully numerical satellite simulator called PRESTO was designed for operational qualification tests before launch (especially dress rehearsals), training and rehearsal of in-orbit operations. It was developed in 2002 and an intensive validation was required for CALIPSO (NASA-CNES satellite launched in 2006 for observing clouds and aerosols) which was the first mission to use PRESTO. Unfortunately, at that time, CALIPSO MCC was not yet finished and no HKTm extraction means external to the control centre were available to support the simulator validation. So a software engineer on the validation team was asked to develop a quick tool for Microsoft Windows to provide easy off-line extraction, not only for the HKTm parameters, but also for the variables coming out of the simulator. And that is how the **PRESTO DECOM**mutation tool was born and was naturally named **PrestoDecom**.

B. A constantly growing user's community

When the first official version of PrestoDecom was released mid 2003, it appeared very quickly to be a simple and efficient extraction tool. So its reputation has rapidly exceeded the spacecraft simulator circle and other communities, such as spacecraft subsystem experts, spacecraft manufacturer engineers or flight control engineers, started showing great interest in the product and adopted it outside MCC. This decentralized solution for extracting house-keeping telemetry proved to be, not only more convenient, but also much quicker than the traditional centralized web server solution proposed in most of CNES MCC (especially for mini and micro satellites).

Under the pressure of users, PrestoDecom finally got its ticket inside all the MCC of CNES mini and micro satellites (know as PROTEUS and MYRIADE satellites) and it has been used by those flight control teams since 2004 for several satellites:

- JASON1 (2001) and JASON2 (2008): NASA-CNES oceanographic observation satellites
- DEMETER (2004): CNES micro satellite observing Earth seismic and volcanic activity
- PARASOL (2004): CNES micro satellite observing clouds and aerosols
- ESSAIM (2004): French military reconnaissance micro satellite constellation
- CALIPSO (2006): NASA-CNES mini satellite observing clouds and aerosols
- COROT (2006): ESA-CNES mini satellite searching for extrasolar planets
- SMOS (2009): ESA-CNES Soil and Moisture Observation Satellite
- PICARD (2010): CNES micro satellite observing solar activity
- ELISA (2011): French military reconnaissance micro satellite constellation

In addition to these satellites, PrestoDecom has also been used for several telecommunications satellite station acquisitions carried out by CNES for Thales Alenia Space (AMC12, APSTAR6, SYRACUSE3A, AMC23, ...) to study the dynamical behaviour of these platforms off-line. Furthermore the GALILEO program (30 satellites) has joined the PrestoDecom community in 2008 and this software was used intensively for the station acquisition of the first two satellites IOV1&2 launched in October 2011 for in-orbit validation. In 2010 the French earth observation project PLEIADES has decided as well to equip its MCC with PrestoDecom which is used every day for PLEIADES 1A launched in December 2011. Even payloads, such as IASI spectrometer put on METOP (ESA/EUMETSAT - 2012) or DORIS for precise orbit determination, use PrestoDecom.

Today 2/3 of CNES satellite projects have already invested into PrestoDecom and this product has won acclaim not only outside MCC but also inside where it is installed on all work stations.

PrestoDecom's success has reached beyond CNES boundaries and major European satellite contractors such as Thales Alenia Space has also invested in this tool: first for its latest telecommunication satellite platform SPACEBUS 4000 in 2004, then for GLOBALSTAR2 (48 satellites) in 2008 and very recently for SENTINEL3 (2 ESA environmental and climate monitoring satellites).

There are today several hundreds of PrestoDecom users, mainly in Europe. This active community keeps increasing with the addition of new projects every year since 2003.

C. Numerous fields of application

PrestoDecom is used in many areas, such as:

- OBSW validation,
- Functional Chain Validation on hardware benches,
- Spacecraft Assembly Integration and Validation,
- Last tests on launch pads,
- Operations preparation (especially during dress rehearsals),
- Launch and Early Orbit Phase,
- Station acquisition,
- In-orbit validation or assessment,
- In-orbit routine operations (station keeping),
- Spacecraft de orbiting.

Table 1 gives an overview of PrestoDecom fields of application with respect to the families of satellites and it can be noted that some projects have become PrestoDecom addicts, which means that experts working on those projects can use the same HKTMM extraction tool whenever they give some support (AIV, launch dress rehearsals, in-orbit validation etc...).

Project	OBSW validation	Functional Chain Validation	AIV	In-orbit acquisition & Station keeping
PROTEUS				
MYRIADE				
GALILEO				
PLEIADES				
IASI/METOP				
GLOBALSTAR II				
SPACEBUS 4000				
SENTINEL 3				

Table 1. PrestoDecom fields of application

III. Coding characteristics

A. Programming language

The programming language chosen for PrestoDecom was Tcl/Tk because the programmer had extensive experience using this scripting language and already benefited from a well-proven coding environment. Tcl/Tk really helps to implement applications faster than with other languages, especially if the application involves GUIs, string-handling or integration. Last but not least, Tcl/Tk fitted particularly well to an iterative and incremental development such as PrestoDecom because no compilation is required and an application built in Tcl/Tk can evolve rapidly to meet changing needs.

PrestoDecom's coding structure enables easy adaptation for new SDB structures and decommutation formats.

The GUI is based on tabs which permits parallel development between several projects. This particular organisation encourages new development without jeopardizing what has been already set up so far for former projects.

Finally, PrestoDecom was designed to be easily customized with a unique multi satellite PC and Linux code base. There is only one executable file for all projects. No branching was a strong requirement at the beginning of the development and it is very satisfactory to notice it is still topical ten years later.

B. An iterative development

As can be seen, PrestoDecom initial requirement process and development has not followed the classical waterfall model: redaction of a formal requirements document, analysis of the detailed design and verification of the compliance matrix proposed by the software developer, organization of milestone reviews to follow-up the implementation, redaction of the acceptance test objectives, etc.

It was more an iterative development within an integrated team merging a software developer and final users. This very close cooperation with very short iteration loops allowed the users to fully express their needs little by little. This creation and innovation process was of course incompatible with the stringent formalism imposed by "predictive" methods which often sterilizes the flow of ideas from the final users. Indeed it is generally very difficult for the final users to faithfully transcribe what they expect into a formal document. It is also very difficult for the programmers not involved in the project to fully comprehend the expectations of the final users and the specificities of their application field.

Some of the principles of this cooperation were actually very similar to what is referred to as Agile Software Development¹, which is a method based on:

- *iterative development*, i.e. very short lifecycle for each version, each iteration including all the phases of a classical software project: requirement analysis, design, coding, testing.
- *face-to-face communication*, rather than formal documentation redaction and review.
- *production of working software*, rather than extensive documentation to describe what does not work.

This "adaptive" method suited particularly well to the development of PrestoDecom as the requirements were often evolving and the efficient collaboration within the team resulted in a "resonance of creativity" thanks to the fact that ideas became reality sometimes only hours after their occurrence. Actually, the programmer delivered dozens of evaluation versions of PrestoDecom, allowing the users to immediately assess the adequacy of new developments with the expectations, eliminate inappropriate solutions, have a concrete discussion basis to imagine the future enhancements.

The increasing number of users justified in 2006 the need for industrializing PrestoDecom that is now managed by the ground segment software sub-directorate of CNES, the maintenance being done by SPACEBEL. However this iterative development method is still topical today for each new version and it helps to make sure that new users needs are fully satisfied.

C. Validation methods

When the first official version was released mid 2003, PrestoDecom had already been tested for months by the end users on an every day basis and the validation effort had been spread over a long period: validation had been carried out gradually on each evaluation version and non regression tests had been performed continuously by the end users throughout the whole development thanks to an iterative process. So the first official version did not require, as far as acceptance tests are concerned, immense work for both the final users and the software developer. Moreover PrestoDecom was not considered at the beginning as an operational tool, but as an additional facility. So there was obviously less pressure put at the beginning on PrestoDecom than on any other operational means which has to follow very thorough and stringent acceptance tests.

Since the industrialization of the product in 2006, the situation has changed and a particular stress has been put on non regression tests. Today SPACEBEL performs more than fifty million HKTM parameter extractions (for all active platforms) before releasing a new version.

IV. PrestoDecom main features

A. Portable

PrestoDecom is a 2 Mo portable application that you can carry around with you on a portable device (such as USB flash drive or portable hard drive) and use on any Windows computer as you would on your own PC. There is no software installer: you just put the executable file anywhere and go. It is that easy! This self contained program does not need any additional software like unzip software and it does not make any changes to the local PC (e.g. no registry settings). Moreover PrestoDecom settings are stored with, and can be carried around with, the software in local configuration files. This class of software makes life much easier on less-experienced users and can be distributed very easily within a team and also to partners on a project.

Compared to classical centralized extraction means, PrestoDecom offers a smart decentralized solution to extract HKTM parameters from any CCSDS binary archive, anywhere and at any time. Experts are keen on using their favourite software in their office, as well as on launch pads or inside satellite control rooms. People are free to use PrestoDecom whenever they want: they don't need to be connected to a HKTM data base or to a Web server offering extraction means. This saves a lot of time!

B. Easy to use and interactive

PrestoDecom GUI is ergonomic and intuitive. It takes only a few minutes to learn the tool: as a proof, no training sessions have been required for ten years of intensive use on dozens of satellites.

PrestoDecom addresses the needs of users working in various domains (expertise, tests, operations, etc.) and ease of use has been a strong requirement from the beginning. Moreover PrestoDecom GUI draws its strength from a close cooperation between the developer team and this multi cultural users community. Users have been given a central role in this development and they have been able to express their needs directly to the programmers, without any filters and that is probably one of the keys to success.

A strong point of PrestoDecom is the clear display of the packets inside a binary archive: before extracting HKTM parameters, there is no long wait of hypothetic packets as often happens when requesting from a data base server.

PrestoDecom is also fully interactive since decommutation results are available after a few seconds, either as a text file in a text editor or as graph in a telemetry plotter. This interactivity has really changed flight control teams habits: off-line analysis is no longer boring and is performed very rapidly after HKTM retrieval in MCC.

Finally, users appreciate controlling PrestoDecom externally thanks to Windows batch files or Unix shell scripts, as well as internally with PrestoDecom macro command files (simple text files). These files are particularly useful to select the right parameters (among thousands!) to monitor an operation. People working on the same project can share a library of command files and this feature plays an interesting role in knowledge management.

C. Multi platform and in constant evolution

PrestoDecom does not run only on a Windows environment, but also on a Linux environment which can be found in many MCC. This feature has been a great help for introducing the product in most of CNES MCC. PrestoDecom has even been adapted to enter a classified MCC and satisfy stringent security rules as far as message logging is concerned. As a result, users are very happy to find exactly the same product inside and outside a MCC. Thanks to its large users community, PrestoDecom is continuously evolving to meet new extraction standards (such as ESA PUS telemetry standard which provides a European standardization for the application process layer) or to add new functionalities. As an example, a plug-in was developed recently for the PLEIADES project in order to extract tables and dump from a packet binary archive. It could also be interesting to ask PrestoDecom to extract parameters from a frame binary archive and not only from a packet binary archive, but this is not yet implemented.

Any new project interested in PrestoDecom benefits from an already existing GUI and only needs to finance its specific extracting libraries. That is why PrestoDecom is most of the time an attractive HKTM extraction solution adaptable at a low cost.

D. Performance

In comparison with centralized remote HKTM data servers or satellite bench archiving systems, PrestoDecom offers a reactive way to decommute packet binary archives. Tests carried out on PROTEUS and PLEIADES MCC show at least a 10 fold reduction in parameter access. This is one of the reasons why PrestoDecom has been adopted so quickly.

However one must keep in mind that PrestoDecom is not a suitable solution for long term extraction performed over one month or several years (for monthly reports or trend analysis, for instance) and MCC extraction means are inescapable for such durations. That is why PrestoDecom and MCC classical means are really complementary and should in no way be opposed.

V. PrestoDecom user interface

A. Main GUI

PrestoDecom has one main window split into three parts (see figure 1):

- a standard windows menu bar,
- a notebook part which contains tabs for the multiple TM file extraction,
- a fixed part with a console display for system messages and a bar of action buttons,

TM extraction tabs are activated and deactivated automatically, depending on which Satellite Data Base is loaded.

Each tab contains four regions which allow the TM extraction to be modified:

- **'Archive File'** to select the archive file to use,
- **'Dates'** to select a range of dates to extract from the file,
- **'Packets'** to select which packet to extract from the file,
- **'Packet Data'** to select which data to extract from the packet.

B. Packet table

The Packets table shows the tree structure of the current TM file together with the Packet number and a count of the number of times they are present in the file. Selecting one of the rows in this table will update the Packet Data table with the contents of the selected packet.

PrestoDecom allows **packet data selection**, which means that sets of data selections may be pre-defined for any individual TM packet. This selection feature proves to be very handy for working in teams: all the selections can be shared as a library and each member of the team benefit from the other team members experience. Selections definitely improve efficiency and help saving a lot of time because any member of the team does not waste time any longer to choose the right parameters from the thousands available in order to monitor such or such operation performed on the satellite.

A context menu on the Packet table rows displays available pre-selections of packet data: figure 2 shows that 'Selection1' is a data selection of three parameters IBAT, MODECC and VDHU belonging to the packet called POM.

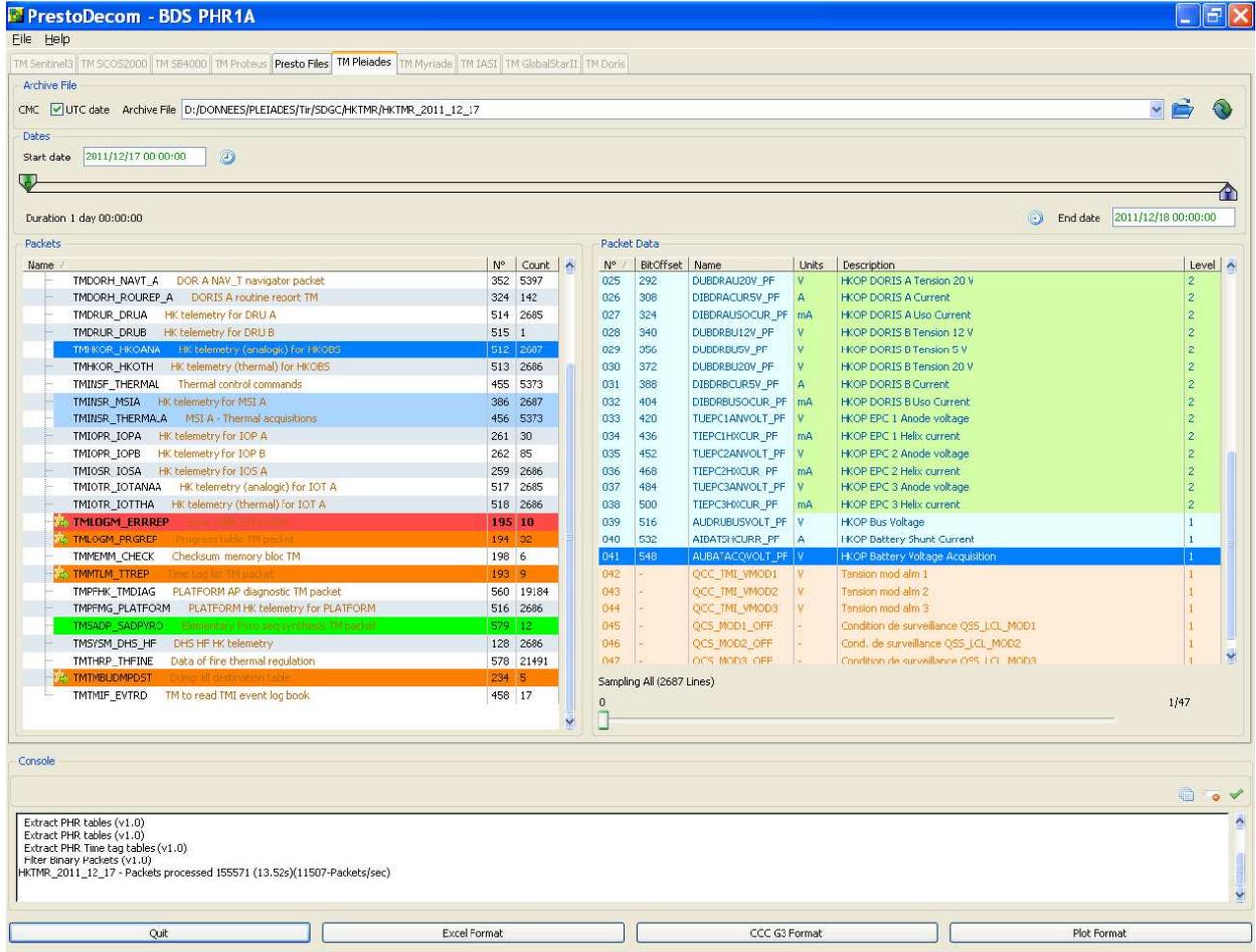


Figure 1. PrestoDecom main user interface.

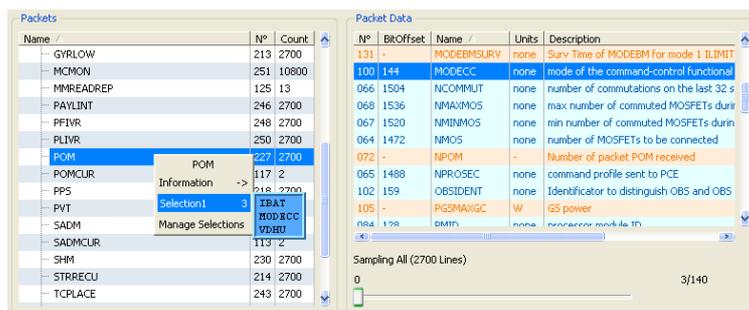


Figure 2. Selection of pre selected data.

This context menu gives also access to the ‘Selection Management’ dialog window to delete or edit the pre-selections for the current packet. PrestoDecom can also import a file containing a set of selections to add to the current set.

Another interesting feature is **packet highlighting**. PrestoDecom allows the user to select a list of packet names which will be displayed in the Packet table using different colours or a different font to make them stand out from the rest, typically this can be used for asynchronous error packets which should be easily visible. The same management has been set up as for TM parameter selection, which allows highlight sets to be shared between users.



Figure 3. *Highlight* section of the Preferences dialog window.

C. Packet Data table

The Packet data table shows the list of data for the currently selected Packet. Each data is displayed with its position, bit offset, name, units and description. TM data is displayed in blue, Ground Computed (GC) data is displayed in orange.

N°	BitOffset	Name /	Units	Description
039	-	FRACGYRHIGH	s	second fractions of packet GYRHIGH
034	-	FRACTION	s	second fractions
013	96	FRACTION1	s	MSB of second fractions
014	112	FRACTION2	none	LSB of second fractions
085	-	FRACTIONGY	s	second fractions
049	240	FRACTIONGY1	s	MSB of second fractions
050	256	FRACTIONGY2	none	LSB of second fractions
094	-	G120MEGAX	rd/s	Angular speed X sat axe (Gyros 1,2)
095	-	G120MEGAY	rd/s	Angular speed Ysat axe (Gyros 1,2)
096	-	G120MEGAZ	rd/s	Angular speed Zsat axe (Gyros 1,2)
097	-	G120MEGAY	rd/s	Angular speed Y sat axe (Gyros 1,2)

Sampling All (2700 Lines)

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Figure 4. Packet Data table.

A context menu on the Packet Data rows displays more complete information for this data element: this feature makes PrestoDecom a very convenient SDB viewer giving one click access to the TM decommutation plan.

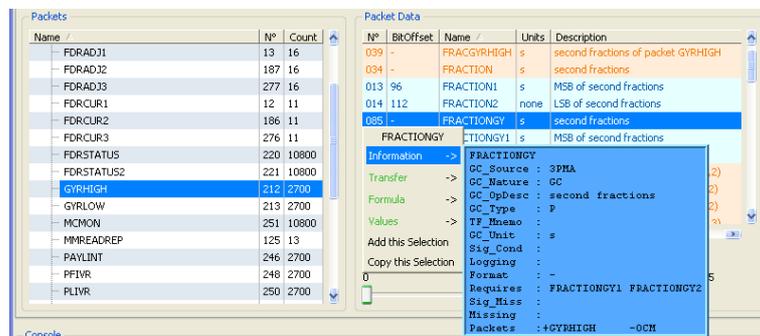


Figure 5. Display of information about the current parameter.

Pointing to the 'Values' entry will display a window containing a table of the first/last data values for this data element, to make sure the first packets are correct before extracting all the packets from the archive.

VPACK1 (First 10)	PRVPACK1	Raw	Physical	SigCond
2008/01/01 03:18:11.601		26232	4.017138	2
2008/01/01 03:18:43.601		26188	4.010400	2
2008/01/01 03:19:15.601		26240	4.018363	2
2008/01/01 03:19:47.601		26220	4.015300	2
2008/01/01 03:20:19.601		26224	4.015913	2
2008/01/01 03:20:51.601		26216	4.014688	2
2008/01/01 03:21:23.601		26220	4.015300	2
2008/01/01 03:21:55.601		26216	4.014688	2
2008/01/01 03:22:27.601		26224	4.015913	2
2008/01/01 03:22:59.601		26224	4.015913	2

Figure 6. Display of the first data values extracted dynamically.

This context menu also allows the creation of a pre selection containing the list of currently selected elements.

D. Packet date management

For some platforms, it is possible to choose the date source: either the dates from the on board clock embedded within the packets or the dates added to the packets by the ground segment. For PLEIADES, the ground date added ahead of each packet is a UTC date calculated from the on-board software.

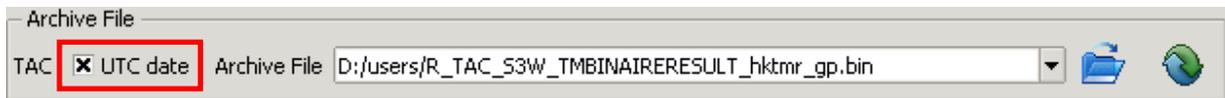


Figure 7. Date source selection.

The display of all the dates in the GUI is adjusted dynamically depending on the chosen date source.

This feature is particularly useful during LEOP when the on-board date is calculated from the processor module clock (date since OBSW boot) and is not yet referenced to a TAI or UTC date (coming from the on-board GPS receiver, for instance). The same situation may happen when a satellite goes back to Safe Hold Mode. Satellite experts appreciate to work with the ground date because it is ever increasing and does not spoil the display of telemetry.

E. SDB management

PrestoDecom compiles the satellite telemetry database files into a single SDB file which is used by PrestoDecom to extract TM data.

The compiled SDB files are managed through the Preferences dialog window.

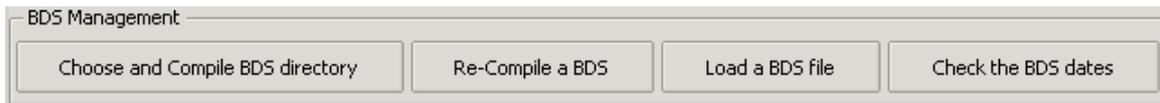


Figure 8. SDB section of the Preferences dialog window.

It is worth noting that PrestoDecom is able to handle several platform SDB as well as several versions of a SDB, which is very useful for testing TM extraction modifications before they are implemented in a SDB official version.

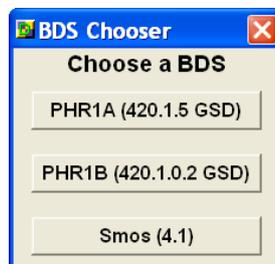


Figure 9. BDS chooser.

F. Output files

PrestoDecom offers two formats of output files:

1. CCC G3 files

This tab separated file contains a selection of data from one data packet with a set of comments describing the packet. The data zone contains one line for each packet with each line containing, the date and three entries for each data value 'Physical Value', 'Raw Value', 'Condition Flag'.

Here is an example of such a file (which can be sent either to a text editor or PrestoPlot 2D plotter):

```
# Parameters : » DEFICIT » MODEBM
# APID : » POM
# N° APID : » 281
# Sampling : » 1
# Label values : » MODEBM » I LIMIT » 0 » V LIMIT » 1 » TRICKLE » 2
# Parameter unit : » A.s » none
# Archive Start Date : » 2003/05/12 00:00:12.330
# Archive End Date : » 2003/05/12 23:59:40.416
# Description : » DEFICIT » charge deficit
# Description : » MODEBM » power management mode (Vlimit, Ilimit)
# Start Date : » 2003/05/12 00:00:12.000
# End Date : » 2003/05/12 23:59:41.000
2003/05/12 00:00:12.330 » 2085.415039 » 2085.415039 » 2 » 0 » I LIMIT » 2
2003/05/12 00:01:16.330 » 2754.121582 » 2754.121582 » 2 » 0 » I LIMIT » 2
...
```

2. Simplified Data File Format

This tab separated file contains a selection of data from one data packet with a two line header giving the column titles and units. The file contains one line for each packet with each line containing, the date and the physical or raw data values.

Here is an example of such a file (which can be opened with Microsoft Excel):

```
Time » DEFICIT » MODEBM » VBAT
JAPAN.UTC » A.s » none » V
2003/05/12 00:00:12.330 » 2085.415039 » I LIMIT » 32.967064
2003/05/12 00:00:44.330 » 2418.724121 » I LIMIT » 32.883087
2003/05/12 00:01:16.330 » 2754.121582 » I LIMIT » 32.778000
2003/05/12 00:01:48.330 » 3088.918945 » I LIMIT » 32.693558
2003/05/12 00:02:20.330 » 3425.762695 » I LIMIT » 32.589401
```

G. Command Files

PrestoDecom can be controlled externally from the command line, from within a Windows batch file or a Unix shell script, as well as internally with PrestoDecom *dcf* files (Decom Command File).

All these command files may be constructed from the history of recent actions thanks to a dedicated dialog window (see figure 10).

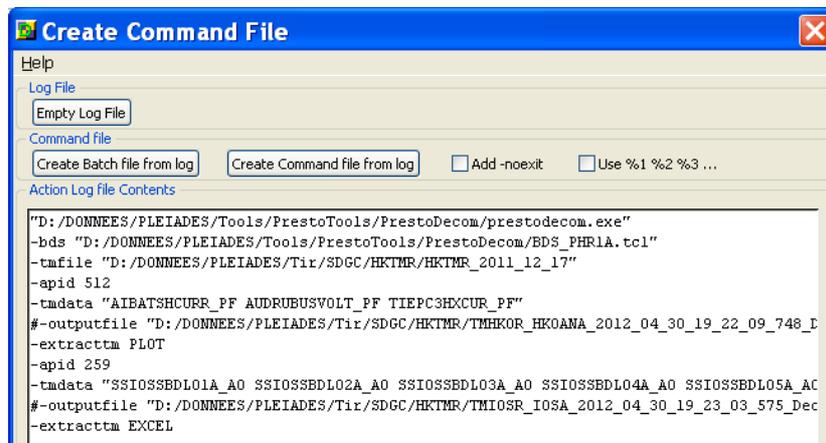


Figure 10. Command File dialog window.

H. TM Archive Formats

PrestoDecom can read a dozen of TM archive formats (coming from MCC, simulator, test and validation means) and automatically detects which of them is opened:

- **RAW**: binary TM packets one after the other with no other information.
- **G1**: SPACEBUS4000, GLOBALSTAR2, PROTEUS and MYRIADES.
- **G3, SW3**: PROTEUS and MYRIADES.
- **VCF**: functional chain validation benches from Thales Alenia Space.
- **RAPID, SCOS, CCSDS**: GALILEO SCOS2000.
- **TAC, DRPPC, CMC**: PLEIADES.
- **PACKET**: SENTINEL3.
- **PDS**: DORIS payload data segment.
- **ARCRAW**: IASI

Once detected the format is displayed on the left side of 'Archive file' region.

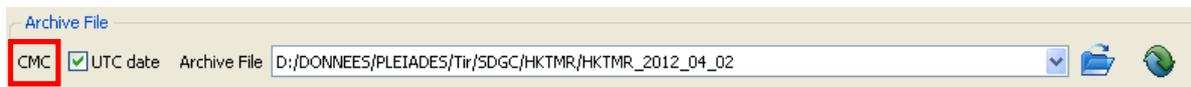


Figure 11. Display of the archive format.

VI. Conclusion

PrestoDecom is a portable COTS developed by CNES and SPACEBEL for extracting house keeping telemetry data from a CCSDS binary packet archive. This user-friendly portable tool is used today on every kind of platform (LEO, GEO and MEO). PrestoDecom has undeniably boosted HKTM post processing and more generally, it has helped to democratize telemetry exploitation at all stages of a satellite cycle from ground validation to de orbiting. This decentralized tool has also proved to be a real timesaver for HKTM off-line analysis with respect to traditional centralized extraction means in MCC (at least a 10 fold reduction). This 2 Mo executable file is unique for all projects (no branching) and focuses the advances brought by all the users for the last ten years.

It has become very popular among various populations such as OBSW validation teams, AIV teams, spacecraft experts, flight control teams, mission scientists, etc. Its native link with PrestoPlot² 2D telemetry plotter is of course an appreciable asset.

PrestoDecom has also benefited from the remarkable stability of the SPACEBEL team in charge of the development since the beginning of this success story ten years ago. This situation has helped to remain faithful to the Agile iterative and incremental process which was set down when the project started. Moreover this kind of integrated team which was created initially with the software engineer responsible for the development and the final users allowed a lot of flexibility and was definitely one of the keys to converge rapidly and successfully towards a fully appropriate product.

PrestoDecom users community today contains several hundreds of members working not only for the French Space Agency, but also for Thales Alenia Space (which has become a major contributor) and EADS Astrium (especially through the GALILEO program). Furthermore PrestoDecom has imposed itself in CNES as a reference HKTM extracting tool which is used every day, especially by the flight control teams of 2/3 of CNES satellites. And finally the large distribution of this tool inside and outside MCC has made technical exchanges between spacecraft experts and operational teams much easier.

PrestoDecom is distributed since 2006 by Spacebel and it is easily adaptable at a low cost to any satellite telemetry database files: any project is welcome to join the user community!

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References

- ¹Larman, C., Basili, V. R., "Iterative and Incremental Development: A Brief History", IEEE Computer, June 2003.
- ²Picart, G., Smith, M., "PrestoPlot®: boost your offline telemetry processing!", AIAA, SpaceOps 2008 Conference, Heidelberg, Germany, May12-16, 2008.