

**image**  
SYSTEMS  
**TEMA**  
CAMERA CONTROL

## Product information

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**image**  
SYSTEMS

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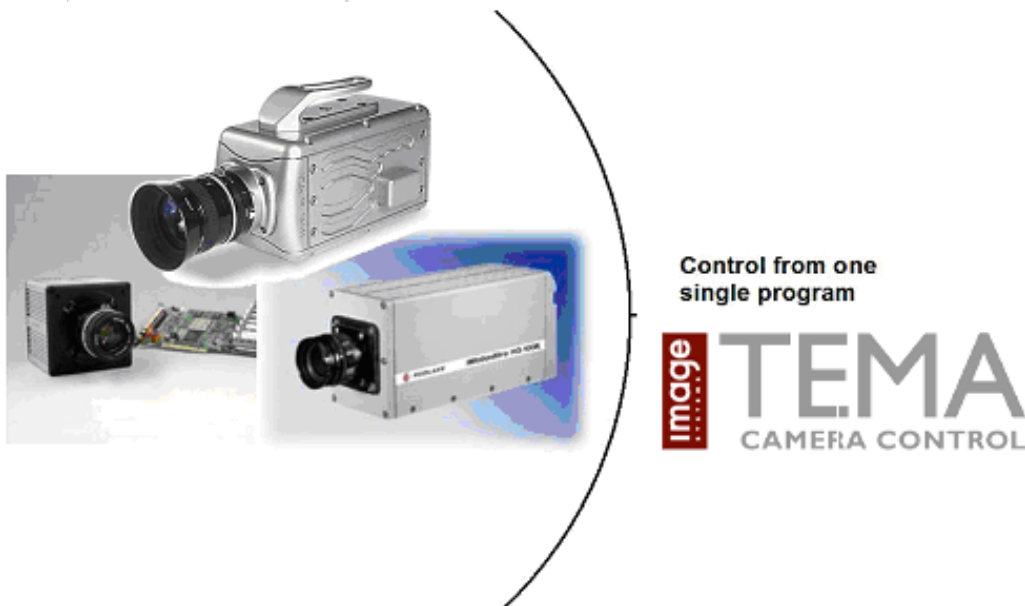


# Introduction

TEMA Camera Control is the leading software for controlling several different brands of high-speed cameras from one single program.

Users of high-speed cameras in applications like crash tests, airbag volume measurements, drop tests, military range tests and many others often use cameras of different models and from different vendors. The reasons can be several: Cameras have been upgraded due to new requirements, the test lab performs different types of tests where one vendor cannot supply all types of cameras needed, etc.

This situation creates problems for the user. Every camera has its own camera control software which means that the operator needs a long time for setting up a test and a lot of time for extra training to learn new software.



TEMA Camera Control is the solution to this problem. It can control all the major high-speed cameras on the market at the same time and from one user interface only.

The user-friendly interface makes it easy to record images, view live images, perform parameter settings, perform image enhancement and perform automatic downloading. All functions can be performed on multiple cameras simultaneously.

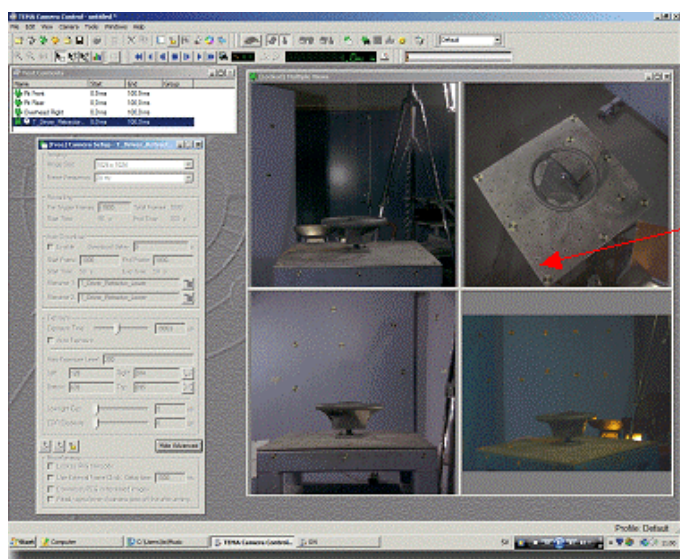
TEMA Camera Control can be fully integrated with TEMA Automotive or TEMA Motion for tracking and motion analysis. Tracking and analysis can be done directly after downloading an image sequence from a camera, thus shortening the total analysis time down to a minimum.

# System description

## User interface

The windows-based user interface of TEMA Camera Control gives a very flexible way of setting up a test. The operator can easily connect one or multiple cameras, record image sequences, make image improvements and save images to disk in several different image formats.

The operator has many options to choose a certain function or feature. The Menu bar, tool bar or key bindings will all give quick access to the wanted feature or function.



Multiple camera views  
in one window

The user interface gives options to view several cameras at the same time as well as comparing the camera views with earlier recorded image sequences loaded from disk. The parameter setting can be done in parallel for several cameras.

Image windows, camera setup windows and image enhancement windows can be made locked or free. In the new free state they immediately change contents to reflect changes in the selection of camera views, while if locked, they show the same contents all the time.

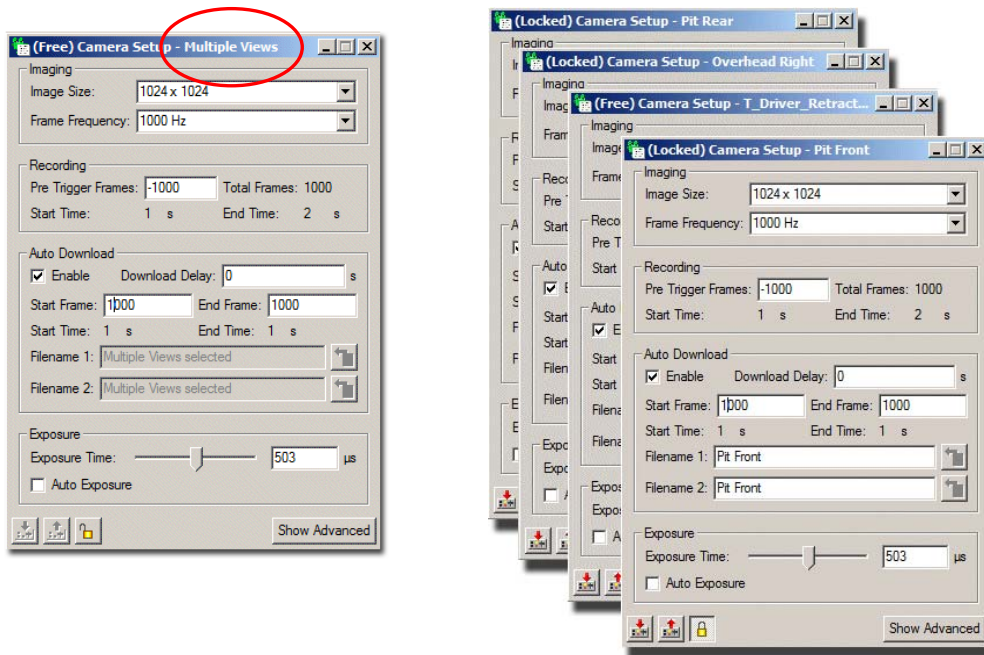
# Basic functionality

## Camera setup

TEMA Camera control can handle the setup of any number of cameras of mixed brands.

- The operator can set all major properties of the camera like: Image size, frame frequency, trigger options, exposure time and many more.
- The parameter set for a certain test can be stored and downloaded to the cameras later. Also the currently used parameter set can be uploaded from the camera.

The setup window, like any window, can be set to always display the settings from any selected camera or cameras in the test, i.e multiple cameras can be setup using one single setup window. A setup window can also be locked to one camera at all times, allowing another, new setup window to be opened for any other subsequent camera in the test.



Camera setup window variations; Multiple views (left), allowing parallel setting of multiselected cameras or one single setup window allowing the setup of individual cameras (right).

## Downloading images

After the high-speed camera has acquired an image sequence TEMA Camera Control downloads it to the computer. The downloading can be done manually after a command from the operator or automatically after a trigger signal.

### Auto Download

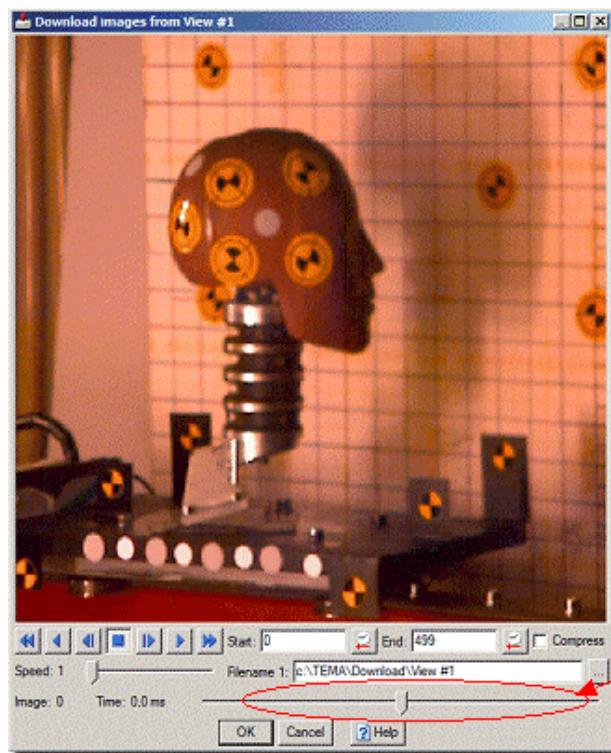
After a trigger the program performs an automatic download of a pre-selected range of images from each camera to a pre-defined destination file or files on the disk. Multiple file formats can be requested.

The auto download can be set for any interval of time including pretrigger frames.

View	Camera	Filename 1	Filename 2	Status	DL Start	DL End
Overhead Right	Sim_V5_11_1	C:\Public\DL1\S2\Overhead Right	C:\Public\DL2\S2\Overhead Right	Download Completed	-10	300
Pit Front	Sim_V5_13_3	C:\Public\DL1\S2\Pit Front	C:\Public\DL2\S2\Pit Front	Download Completed	-10	300
Pit Rear	Sim_V5_12_2	C:\Public\DL1\S2\Pit Rear	C:\Public\DL2\S2\Pit Rear	Download Completed	-10	300
T_Driver_Retractor_Lower	Sim_V5_10_0	C:\Public\DL1\S2\T_Driver_Retra...	C:\Public\DL2\S2\T_Driver_Retra...	Download Completed	-10	300
T_Dummy_Kinematics_Velocity_Left	Sim_V5_14_4	C:\Public\DL1\S2\T_Dummy_Kin...	C:\Public\DL2\S2\T_Dummy_Kin...	Downloading: 26	-10	300

### Manual Download

The manual download command can always be done, regardless if auto download has been done or not. The manual download can be done for all available image on the camera.



All available images in camera including pre trigger frames

TEMA Camera Control can also acquire real time live images or snap shots from the cameras and display them in the camera view windows. This can be done for all connected cameras simultaneously. Previously recorded image sequences can be loaded from disk to a parallel camera view window for comparison with the live images.

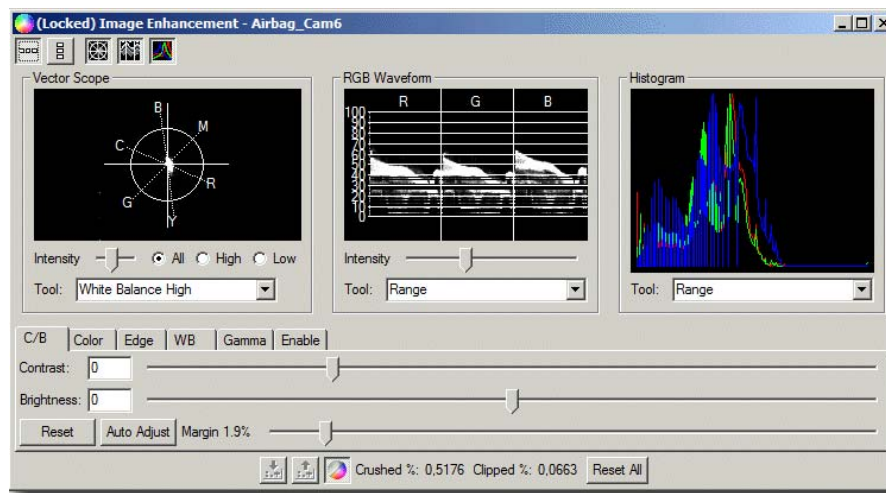
## Features

### Measurements tools

TEMA Camera Control has a set of tools for measurements in the images. Properties like distances and angles between points be quickly be measured by “click and drag” in the camera view window.

### Image enhancement

TEMA Camera Control contains a complete Image Enhance functionality. Vector scope, RGB waveform diagram and Histogram helps to improve properties like colour balance, contrast, brightness and gamma correction in the image. The enhanced image sequence can be saved or imported to other image formats after adjustments.



The vector scope displays the image in a color space. The image data is displayed as a three dimensional histogram. The user can perform operations like expanding color dynamic, adjusting white balance and turning color space (change colors)

The RGB Wave form displays the wave form for each color separately. The user can adjust intensity, gamma and dynamic range color by color

All calculations are made with high bit depth and headroom through the whole chain, which avoids the cutting of peaks and it preserves the image quality.

## Low Light mode

TEMA Camera Control has Low Light mode. This enable a temporarily longer exposure time on all cameras to allow camera adjustments in the test lab without the requirements for all test light to be turned on.

## Image export

The images can be exported to a number of different image formats such as: MPEG, AVI and multiple TIFF and JPEG. The Image Export can be extensively customized:

- Settable image size, format, sequence time range and skip count.
- A title slate can be added, acting as the first frame of the exported sequence. This can be specified with any describing text.
- Text box overlays on the exported sequence, including text and interactive information like the time for each frame, operator name etc.

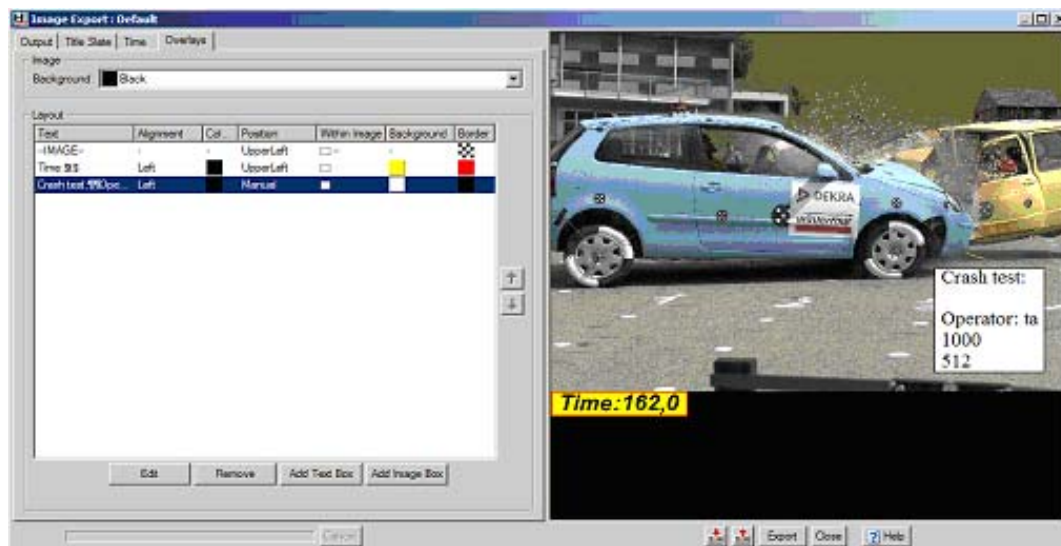


Image export dialog



# TEMA Enterprise Edition

TEMA Enterprise Edition adds a set of new features to TEMA Camera Control, which are important for larger test facilities distinguished by:

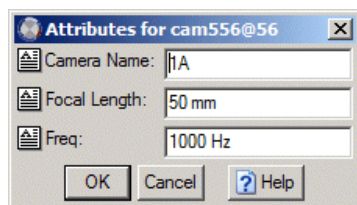
- Pre-defined processes: Larger facilities often have well defined processes for carrying out operations. Any product used must adapt to these procedures.
- Test planning systems. Systems to administrate test and resources are often used and any test program used should be able to communicate with this system.
- Subdivision of tasks: Different departments of a corporation can be responsible for exercising different parts of a test. For instance: Different departments for image capture, tracking and analysis.
- Data storage models: Data storage must often conform to certain regulations.
- High throughput of tests. A larger facility often means that several tests are run in one day.
- Repetitive tests: Often the same department makes the same types of tests repeatedly.

## System Description

### Test Metadata

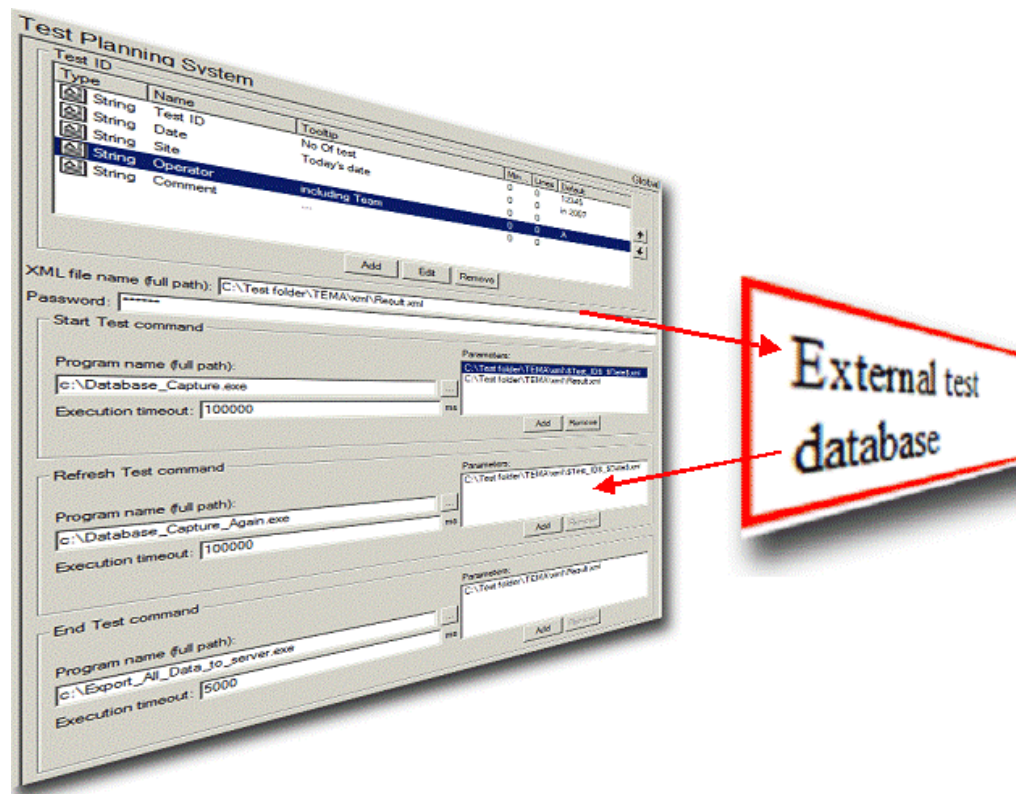
TEMA Enterprise Edition allows an administrator to define any number of metadata fields on the Test and Camera View levels.

Operators can then enter values for these fields for tests. These values are stored in the test file and can be output as overlays on exported images.



## Test Planning System Interface

For enterprises where the overall planning of crash tests is performed in a computerized system a fully configurable interface function is included. This allows TEMA tests to be automatically set up. The only thing the operator does is enter the test identification. Then TEMA inquires the test planning system for all relevant information for the test. This includes the list of camera views. These camera views are setup automatically. Test Metadata is also read from the test planning system if available.

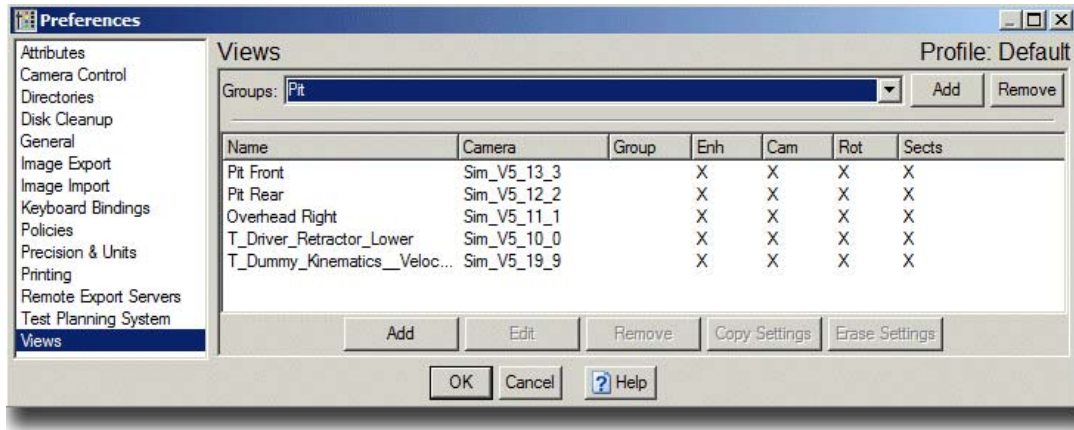


When the test is finished the resulting state can be pushed back into the Test Planning System so that the requester can immediately view the resulting metadata after operator entry, and the resulting filenames for image files, among other things.

## Camera View List

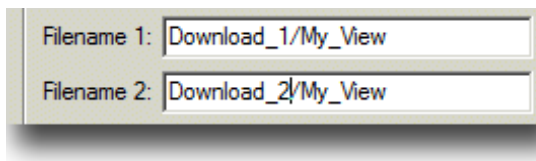
Even if a Test Planning System is not available TEMA can hold its own list of camera view names. These names are distinct from the physical cameras and their names. Each camera view can have setups associated to it, in order to preset as much of all settings for the camera view as can be known in advance.

Some of the views in the list may have default connections to cameras, which would be useful for instance for overhead or pit cameras which are seldom changed.



## Dual Download Destinations

It is possible to specify two filenames for the download of image files from cameras. The image data is transferred from the camera only once and stored in parallel in two separate files which may be on different disks on different computers.

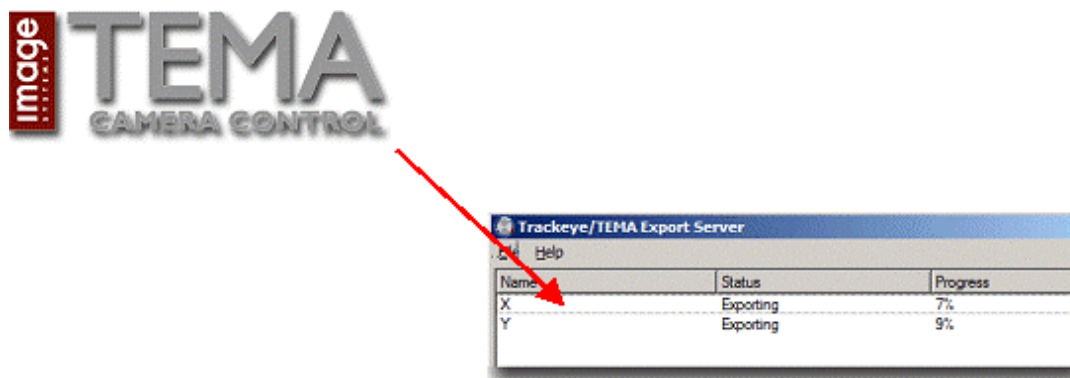


## Filename patterns

All filenames can be controlled by filename patterns. These patterns can contain various inserted fields, for instance Test Metadata fields, View names etc. In this way the filenames can be set once and for all, avoiding typing work and error sources.

## Image Export Server

To remove the processing burden of converting the image sequences to the destination format, such as AVI or MPEG, it is possible to define that a separate server computer should perform this task. The server works like a printer queue, so the client computer is immediately available for other tasks, while the server runs the export jobs in a queue fashion. Power loss of the export server will not cause its job queue to be lost. The export server has a user interface where progress can be monitored, and export jobs cancelled.

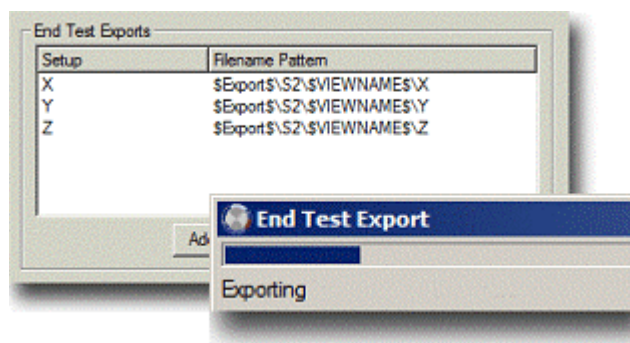


## Automatic disk cleanup

This function allows TEMA to automatically remove selectable files from selectable directories a certain number of days after they are created. This prevents accidental filling of disks with temporary image files.

## End Test Command

Once a test is completed an End Test Command can be run. This will automatically perform any number of predefined Image Export operations for each camera view. Each of these exports has a separate filename pattern and a separate Export Setup which contains information about the output file format, overlay data and title slate data.



The End Test command will also save the final TED file, push final test information to the test planning system if available, and close the test.

### **Digital Signature**

A special option is to protect exported image files with a digital signature. If a signature is placed in an image file TEMA can subsequently be used to authenticate the file contents. This will detect any tampering with the file and also the user name of the operator performing the export and the time stamp of this operation.

### **Color Balance Calibration**

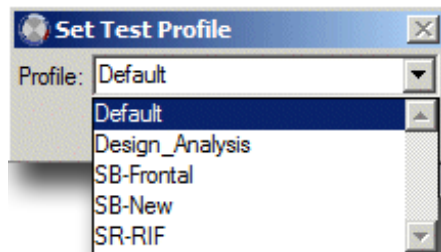
Some types of high speed cameras have individual color balance errors for different physical cameras. Using the color balance calibration function these offsets can be removed which allows cameras to be interchanged for camera views (which contain color balance values taking care of the illumination imperfections). This reduces the need for fine tuning color balance of camera views due to differences between camera individuals.

### **Preference Profiles**

In TEMA Enterprise Edition any number of Profiles can be defined for the program.

The preference settings such as Image Export setups, Camera View list and Metadata fields can be made profile specific. This means that different test types can have their own lists of view names, metadata fields and title slates.

It is also possible to define that settings are operator specific, machine specific or global. This choice is made per type of setting.



### **Test Templates**

It is possible to define templates for common types of tests. This includes pre-setting the combination of camera views to use, but also contains information of which windows to open, including positioning etc. Starting a test from a template also selects a Preference Profile for the test.

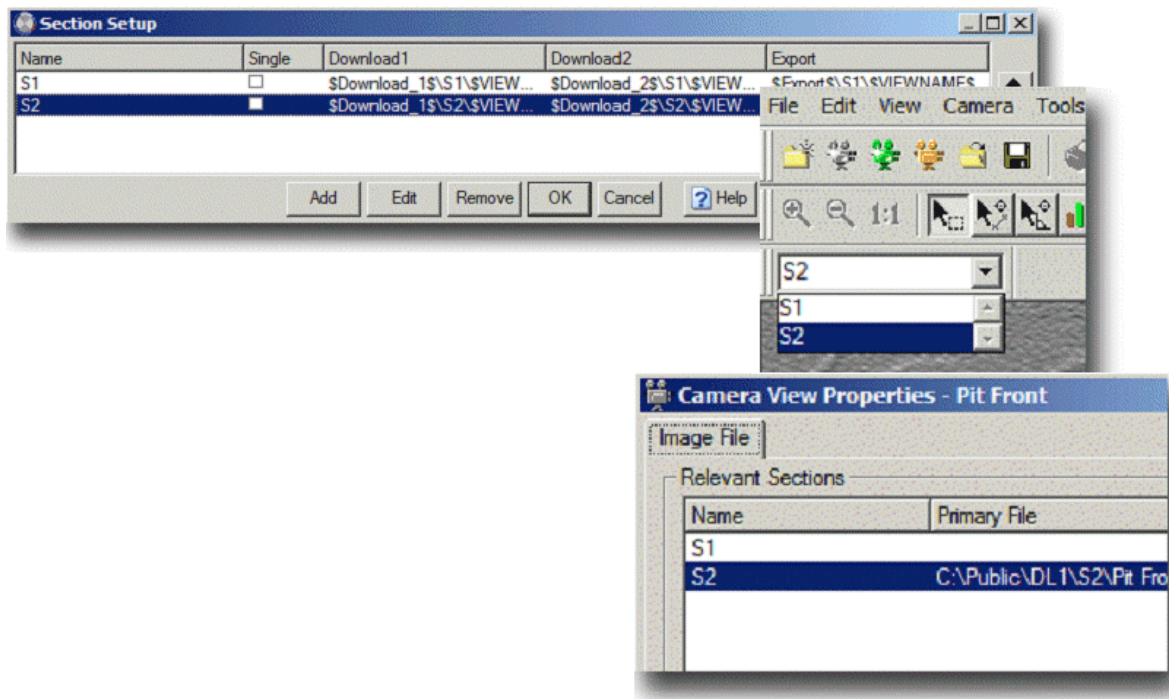
## Policies

To prevent accidental change of critical settings and to reduce the risk of operator error a number of policy settings have been added. These can open warning dialogs, password protect or entirely forbid certain operations and settings changes.

## Test Sections

TEMA Enterprise Edition allows a test to be subdivided into several sections. A section is one timed event, as seen by all or a subset of the cameras. This feature is very useful for instance to capture reference images for 3D calibration or pre-crash reference images.

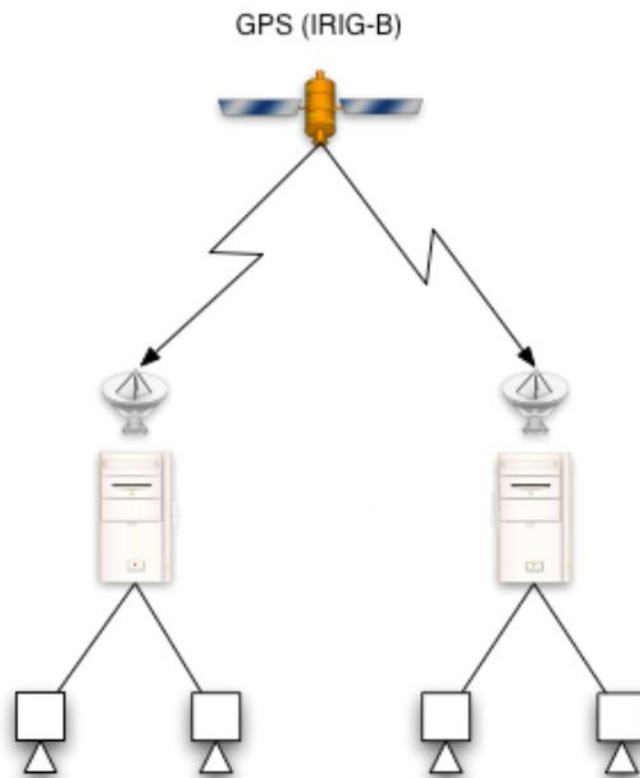
Each test section has separate filename patterns so that the downloaded imagery for each section can be stored in separate files. The exports to be performed by the End Test command can also be specified on a per section basis.



# System integration

Together with the software capability described above Image Systems can engineer the complete system of cabling, junction boxes, individual computers and the inter-computer communications.

The TEMA Enterprise Version can be customized at both ends of the process. The project meta-data can be imported from a test control database, as can the camera views and individual camera setup requirements. This gives the test engineer full control of the imaging parameters and reduces the possibility of setup errors. The image and data file output can be automated to feed directly into the network system.



Courtesy of Boeing

Above is a system on a project where multiple cameras were controlled on two computers via Ethernet. Note that all cameras were synchronized using GPS-time.

Image Systems together with its partner IMC in USA did in this case perform the full installation and acceptance testing.