

Cognitech® TriSuite¹⁴ Feature List

*Items marked with a hashtag (#) indicate unique forensic video capabilities that are proprietary **ONLY** to Cognitech, Inc. due to issued and pending US and International patents of Cognitech, Inc.

*Items marked with marking  indicate the new or highly improved forensic video capabilities that are part of the release.

Cognitech® TriSuite¹⁴ Items marked with an asterisk () are designated computational design capabilities that are the leading edge of forensic video technology and are not commonly available to other competitors in the field.

General

1. Cognitech is the first and oldest forensic video company, with **25 years of experience** in providing software and hardware solutions for law enforcement and forensic professionals.
2. Cognitech is **constantly evolving** its primary software package, Cognitech® TriSuite, by providing end-users with features such as FrameFusion® Reconstruction (#) and 3D Multi-View Measure (#).
3. Customers demand the best in forensic video products so Cognitech is constantly developing **new innovative technology** like Cognitech's patented 3D modeling FaceFusion3D™ (#)  and 3D RAMA® Panorama Measure (#) .
4. Cognitech holds by far **more video processing algorithm patents** than anyone else in the forensic video field.
5. All functions in Cognitech® TriSuite® have been **tested in both peer review scientific publications and the Court of Law**, nationally and internationally.
6. Cognitech® TriSuite® was developed for professional forensic expert use and meets the **repeatability** required for expert witness testimony.
7. The workflow in Cognitech® TriSuite® is completely **lossless**. Unlike traditional video capture solutions, the VideoActive® software provides real time lossless capture ensuring that you get the best evidence possible.
8. Cognitech TriSuite enables unprecedented **flexibility** in video processing by allowing the end-user to apply different filter parameters to any portion of any frame in a video.
9. Rapidly moving casework requires immediate evidence turnaround without compromising quality. Cognitech TriSuite algorithms utilize **parallel processing** with the latest **GPU CUDA**

technology (*)  which cuts even the most complex evidence processing time by tenfold or more.

10. Cognitech's **hands-on training program and customer support** provide the end-user with the skills and support to handle any casework.
11. Cognitech has been **serving the forensic community since 1988** and prides itself on **excellent customer service**.

Supported File Formats and Accurate Video Playback

12. Most **image and video file formats** are supported including: COG, CFF, 3GP, 3G2, ASF, AVI, BMP, CAL, CMP, CUR, DCM, FLV, FPX, GIF, ICO, IMG, J2K, JPG, M2TS, MAC, MKV, MOV, MP4, MPEG, MSP, MTS, MTV, OGV, PCD, PCT, PCX, PGM, PNG, PSD, RAS, RM, SCT, SWF, TGA, TIFF, TS, VOB, WBMP, WEBM, WMF, WMV, WPG.
13. Streaming video is decoded and converted into a **frame accurate** format that can be processed and analyzed frame by frame.
14. Cognitech's patented lossless COG (#) encoding provides at least **50% file size reduction** to raw video **without any loss of content or quality** and is 100% reversible.
15. **Cognitech® CogPlayer** provides proprietary lossless COG (#) and CFF playback on any computer with Windows Media Player, which enables court presentations on any computer.
16. **32-bit floating point (*)** image and video content is supported for more numerical accuracy. All filter computations are done in floating point, maintaining the highest level of quality throughout the signal chain.
17. Cognitech® Video Investigator® and VideoActive® provide **frame based video playback** allowing for easier and more accurate frame-by-frame analysis than traditional time based video playback software.

Cognitech VideoActive®

Video Acquisition & Real-time Processing (VideoActive®)

Design

18. Cognitech VideoActive's **modular design** allows the end-user to choose a pre-defined configuration or user-defined signal processing chain.
19. VideoActive® modules can be easily combined to produce a **user-defined processing pipeline** from live sources or locally stored files, all in real-time.

Video Capture

20. **Analog acquisition** can be obtained from any RCA or S-Video source.
21. **Real-time lossless analog video acquisition** captures frame accurate video from analog sources without any loss of information.

22. Analog video can be acquired at the **frame level** for progressive video or **field level** for interlaced video.
23. **Digital acquisition** can be obtained from any DVI or HDMI source.
24. **Real-time lossless digital acquisition** captures frame accurate video from digital sources without any loss of information.
25. **Analog VGA video sources** can also be captured losslessly unlike traditional scan converters.
26. VideoActive® supports both major analog formats, **NTSC and PAL** up to 10 bit per pixel per color, allowing 1024 levels per color as opposed to the standard 256 levels, i.e. 4 times more levels per color (*).
27. Video can be captured losslessly from a local screen with **Screen Capture**.
28. Screen Capture can also be obtained from an external source using a DVI or VGA connection.
29. **Comprehensive proprietary DVR file format support** with screen capture provides a simple lossless capture without the limitation of **digital overlay** like traditional screen capture software.
30. **DV Capture** allows for camera DV output acquisition at the highest possible quality.
31. **Simultaneous Audio and Video Capture** preserves audio from video sources that contain audio.
32. Audio can be played in Video Dominant Mode (optimal audio sync for frame accurate video) or Audio Dominant Mode (optimal video sync for time accurate audio).

Processing Modules (Real-time Algorithms)

Demultiplexing

33. **Real-time demultiplexing (#)** converts multiple camera video source streams, such as multiplexed CCTV footage, into individual digital camera channels that can be stored, processed or viewed, individually or together.
34. **Automatic demultiplexing (#)** intelligently determines how to separate demultiplexed frames into individual camera channels with no human interaction for any number of channels.
35. **Manual demultiplexing** sorts demultiplexed video according to user-defined key frames allowing for more customized demultiplexing.
36. Demultiplexed video can be further sorted with Cognitech Video Investigator's **Video Scene Integrator** tool.

Multi-Channel Fusion (#)

37. Multi-Channel Fusion (#)  combines two or more videos from different viewpoints together using perspective correction and fuses information from different cameras together.
38. Multi-Channel Fusion (#)  can **accurately combine CCTV video with an overhead photomap (*)** (e.g. Google Maps, etc.) allowing for video playback with accurate geographic matching.
39. **Live video reverse projection photogrammetry (#)**  makes onsite height measurement of evidence images easy with active playback of live video overlaid on the evidence image.

Camera Calibration & Real-time Lens Correction

40. The automatic **Camera Calibration (#)**  module assists the end-user in calibrating a camera with constant user feedback for use in the Cognitech AutoMeasure software.
41. **Real-time Lens Correction (#)**  removes geometric lens distortion in real-time for an undistorted video capture.

Other Processing Modules

42. **Digital VCR playback control** protocol allows the end-user to control supported VCRs through VideoActive®.
43. Video Conversion allows for **lossless conversion** of difficult to read files to a usable format.
44. Video Playback allows for detailed video investigation with **real-time frame accurate playback** or frame by frame analysis.

Cognitech Video Investigator®

Image/Video Processing and Analysis (Video Investigator®)

Basic Functions

45. Video Investigator's Active Interface GUI enables the user to execute the integrated plug-ins in a highly interactive mode with real-time results (*) which are seen in a video preview. This advanced video processing interface allows the user to find the most optimal set of video processing parameters in a highly interactive way.
46. Video Investigator's Active Interface (*) provides the user the capability to adaptively estimate the best set of processing parameters for any part of a video frame and vary these parameters if needed from frame to frame, or from a set of frames in a time-interval to another time-interval, yet processing the entire video in a single processing pipeline. This **frame-adaptive video processing** (*) feature accelerates the user's ability for time-space-adaptive processing of the entire video without first extracting each individual frame and individual parts of frames. An example of using the **frame-adaptive video processing** is when **deblurring the video in which different objects and subjects are blurred differently due to the time-varying motion blur and space-varying defocus blur**.
47. The Movie Controller provides **advanced video playback** with audio support allowing the end-user to adjust which frames of video to playback, how frames are played back, and even synchronize multiple videos.
48. **Image sequence compilation** converts a set of images into video for analysis or court room presentation.
49. The **Record function** (*), when enabled, records every action the end-user makes and produces a script that can **replay the exact actions and settings the end-user used**. Unlike traditional report functions that only produce a PDF of parameter values, Video Investigator® Record

scripts can be replayed at any time allowing the end-user to see exactly how the result was created.

- 50. The **Zoom filter** resizes images with confidence with several innovative zoom algorithms that retain the highest clarity and edge definition (#).
- 51. Several images or video can be combined together in layers to form a **video composition** (*) where every element can be relatively repositioned in the window and in time.
- 52. The **Command Window** provides an alternate entry point for executing commands for those who prefer to apply filters in the command line.
- 53. The **Highlight filter** focuses the viewer on a user defined area of interest.
- 54. If required by law, portions of images can be tracked and concealed or made unrecognizable to **cover sensitive information** with pixilation, blur or histogram adjustment.

Data Visualization

- 55. The **RGB Profile Plot** plots the line scans of RGB channels separately, allowing for independent 2D numerical visualization.
- 56. The **3D Profile Plot** displays a 3D plot of the entire image or video in time with a plot elevation corresponding to the image intensity allowing for 3D numerical visualization.
- 57. The **Elevation Plot** allows for the numerical visualization of images as 2D plots of linear image slices.
- 58. The **Matrix Tool** provides a detailed quantitative look at the pixel values in an image.
- 59. The **Video Scene Integrator** provides a method of manually sorting video frames to make event timeline (e.g. following a subject from camera to camera).
- 60. The **Component Information Window** provides a detailed description of all images and video in Video Investigator including image dimension, color space, data format, and other important metadata.

Denoise

- 61. A **large assortment of denoise filters** (#) provide both traditional and the most advanced methods for removing image noise without reducing clarity and features in evidence video (e.g. sensor noise and poor weather conditions).
- 62. **Deblocking** (#) reduces compression blocking and ringing artifacts related to harsh compression without reducing clarity and preserving fine features.
- 63. The **pattern removal filter** (#) is an advanced filter that removes pattern noise from images such as latent prints on textured surfaces.
- 64. The **Average Frames filter** generates an image by combining together multiple frames of the movie sequence, removing dynamic noise from stationary objects in the video.
- 65. The **FrameFusion® Denoise filter** (#) is a state of the art method of removing noise from an image or video with Cognitech's patented algorithm that preserves sharp edges and fine textures imbedded in noise.
- 66. The **Median filter** removes pixels that deviate from the median pixel value such as salt and pepper noise.

67. The **Remove Extrema filter** is an advanced filer that removes spurious shapes from an image that are due to noise distortions.
68. The **Total Variation Denoise filter (#)** is a general method, discovered by Cognitech, for removing noise from an image using the Total Variation Minimization technique; retaining edges and minimizing visual artifacts associated with any image processing.

Deblur

69. A **large assortment of deblur filters** options provide tools for every type of blur problem including motion, defocus, optical, Gaussian averaging, and custom.
70. The **Adaptive Blur filter (#)** computationally estimates the blur from a blurred image and allows the end-user to remove complex non-linear blur from any evidence image leading to highly accurate blur removal.
71. The **Motion Deblur filter (#)** automatically determines the motion direction and length from velocity estimation and removes the estimated motion blur.
72. The **Sharpen filter** is a simple enhancement solution for producing sharper, clearer images.
73. The **Wiener Deblur filter** applies any of the available deblur kernels using the Wiener method for fast and accurate blur removal.
74. The **Total Variation Deblur filter (#)** is a general method, discovered by Cognitech. This filter applies any of the available deblur kernels using the Total Variation method in order to retain edges and minimize visual artifacts, such as ringing, which are commonly associated with traditional blur removal.

Histogram-Based Enhancement

75. **Automatic histogram equalization** provides three different methods of automatically enhancing images and video to obtain the best histogram levels locally or globally (e.g. Morpho-Local Equalization (#) will equally enhance features in both under and over exposed regions of the image and in the presence of haze degradation).
76. The **Manual Histogram Editor** provides user-defined adjustments for better visualization of low dynamic range content such as night time video.
77. **Color correction** can enhance hue and saturation of video.

Reconstruction

78. The **FrameFusion® Reconstruction filter (#)** is a Cognitech patented **Super-Resolution** technique that not only removes noise from video but actually integrates adjacent frame information to form a higher resolution result and works with moving subjects unlike the traditional Video Averaging filter (e.g. license plate number clarification).
79. The **Stabilization Reconstruction filter** utilizes Cognitech's advanced velocity calculation algorithms to accurately track and stabilize an entire video or particular object (e.g. vehicle dash cam and handheld camera footage).

80. The **FaceFusion3D Reconstruction filter (#)**  is the newest Cognitech patented technique that combines the principles of FrameFusion® with 3D facial models allowing for the Super-Resolution reconstruction of images and videos of human faces in **full 3D rotational motion**.
81. The **Mosaic Reconstruction filter** combines multiple frames into a single panoramic picture by accurately stitching common information between frames.
82. The **Reconstruction Wizard (*)** automates the video stabilization and mosaic reconstruction process for standard use cases.

Interlacing

83. **Interlacing** and **de-interlacing** functionality allows for lossless conversion between interlaced and progressive video.
84. The **Frame Align** operation aligns interlaced frames that are recorded at sequential points in time, doubling the resolution of the objects in the image.

Transform

85. The **Geometric Lens Correction filter (#)**  corrects for geometric lens distortions automatically without any knowledge of the source camera.
86. The **Fourier filter** computes the 2D discrete Fourier transformation of images for frequency representation.
87. The **Geometric filter** provides an interactive interface for any perspective transformation of video frames.
88. The **Mirror Image filter** is an interactive tool to rotate an image or video 90, 180,-90 degrees and flip horizontally or vertically.
89. The **Automatic Rectification filter** rectifies an image to correct a perspective distortion due to camera angle, based on user-defined points.
90. The **Manual Rectification filter** provides an interactive 3D graphic interface for real-time perspective correction.
91. The **Wavelet filter** computes the 2D dyadic wavelet transform for spline wavelets of minimal support on a rectangular domain for advanced mathematical analysis.

Velocity

92. The **Correlation Matching filter** estimates the global motion between any set of paired frames (motion patterns) of a movie and produces accurate velocity vectors used to properly account for motion, which is utilized in FrameFusion Reconstruction, Stabilization Reconstruction, etc.
93. The **Shape Matching filter (#)** estimates the dominant motion between consecutive frames of a movie and produces velocity vectors used to properly account for motion, which is utilized in FrameFusion Reconstruction, Stabilization Reconstruction, etc. Shape matching will work when multiple object motions are present in the video (e.g. foreground and background motion).
94. The **Interactive Manual Matching filter (*)** manually matches motion between any set of paired frames (motion patterns) of a movie and produces velocity vectors used to properly account for

motion, which is utilized in FrameFusion Reconstruction, Stabilization Reconstruction, etc. Manual Matching will always work when automatic methods may not work due to the complexity of motion.

Segmentation

95. The **Segmentation filter (#)** provides an image analysis technique which automatically partitions an image into regions of similar intensity/color used for extracting tattoos.
96. The **Edge Detection filter** allows the end-user to extract edge features for extracting vehicle markings or license plates in a video.

Cognitech AutoMeasure® (#)

Photogrammetry (AutoMeasure®)

General

97. Cognitech® AutoMeasure® is a **general photogrammetric tool-set (*)** for measuring any subject or crime scene captured in at least one or several images/video frames.
98. The **automated visual workflow** interface in Cognitech® AutoMeasure® provides step-by-step instructions.
99. Steps are color coded according to completion and keep the end-user aware of current progress.
100. Since Cognitech® AutoMeasure® provides step-by-step instructions; **advanced knowledge of photogrammetry is not needed** in order to utilize the software.
101. **Contextual Feedback** provides constant instruction on the next step to be taken.
102. Evidence images with measurements can easily be exported in standard image formats.
103. **Advanced point placement** functionality provides a flexible method of placing, dragging & dropping and meta-tagging corresponding points of interest in order to simplify the process of multi-view stereo matching.

Automatic Camera Calibration (#)

104. Cognitech's patented automatic test pattern recognition method, **Automatic Camera Calibration**, detects a calibration pattern (designed by Cognitech) in test images.
105. Once a calibration pattern has been detected, Automatic Camera Calibration **accurately removes camera lens distortion** and **estimates internal camera parameters** (such as focal length and optical center deviation), which provides more accurate results than traditional camera test pattern methods.

Single Frame Measure

106. Single Frame Measure provides the height of a subject in a single evidence image from several 3D crime scene measurements using the Single Frame Metrology Method, **even when the original camera source has been shifted or removed**. The traditional Reverse Projection

technique cannot provide the same accuracy. More importantly, Reverse Projection technique is not possible if the original camera source has been shifted or removed.

107. With Single Frame Measure, **accurate camera position** is internally computed and used to determine projection geometry of the visible scene with respect to the camera.
108. Any image point XYZ coordinates can be determined by clicking a point on the evidence image, specifying any one of its coordinate components, such as X, and obtaining the two other coordinate components (Y and Z).

3D MultiView Measure (#)

3D MultiView Measure tools are described in the Measurement Tools Section.

109. 3D MultiView Measure provides the same, or higher, accuracy as the Single Frame Measure since it **only requires a single scale measurement** instead of manual measurements of the XYZ positions of all reference points. 3D MultiView Measure provides more accurate measurement results when using multiple images.
110. 3D MultiView Measure provides height, area, and distance measurements of objects from a single scale measurement, **whether or not the original camera source is available**.
111. 3D MultiView Measure **does not require that any linear structures** be visible in the evidence image (i.e. no vanishing points are required).
112. Additional photos required for MultiView Measure can be taken at any time as long as there are enough similar features present from the evidence image. This process increases measurement accuracy and allows measurements to cover larger crime scenes.
113. MultiView Measure is designed to be used not just for measuring the height of an individual in the evidence image, but also to **measure any geometric attributes of the crime or accident scene (*)** captured in multiple images.

Panorama Builder (#)



114. Panorama Builder accurately produces up to a full 360° **stitched panorama** from fisheye images
(*) (#)
115. The stitched panoramas are unwrapped and rectified for normal **rotational viewing**.
116. Panorama images produced in Panorama Builder can be used in 3D RAMA® Panorama Measure
(#) as well as providing accurate 360° crime scene photography.

3D RAMA® Panorama Measure: Measuring in the Entire 360° Visual Sphere of View



3D RAMA® Panorama Measure tools are described in the Measurement Tools Section.

117. 3D RAMA® Panorama Measure  utilizes a different advanced photogrammetric method than the MultiView Measure, allowing for much more flexible measurements of people, objects, accidents and crime scenes.

118. With 3D RAMA® Panorama Measure , the evidence image can be matched to multiple test images without the careful positioning of the test image camera in order to capture as many points in common as possible. This significantly simplifies crime scene data collection and eliminates point omission errors.

119. 3D RAMA® Panorama Measure  provides the ability to measure all the same geometrical quantities as in 3D MultiView Measure, e.g. height, area, and various distance measurements. However, measurement points do not need to belong to the same captured image, thus allowing the distances between the points, that are separated by occlusions (e.g. walls, trees) and large distances, to be measured.

120. The 3D RAMA® Panorama Measure  method provides the most efficient method of capturing scene images and producing accurate measurements.

121. **Ricoh's Theta 360° full panoramic camera data**  is seamlessly integrated for viewing an entire real-world 360° sphere of view.

122. **By taking two or more panoramic images with Ricoh's Theta 360° camera and using**

3D RAMA® Panorama Measure , the user can perform all geometric measurements that the 3D MultiView Measure provides with the added convenience of **operating and measuring in the entire 360° visual sphere of view (#)** .

Measurement Tools (*)

123. Cognitech® AutoMeasure® provides **automatic error feedback (#)**, which helps the end-user to determine and correct inaccurate point placements and increase measurement accuracy.
124. The Base Triangle allows the end-user to define a 3D plane by clicking any three points in the image. This 3D plane can be used to compute the XYZ coordinates of any point that lies on the plane by just clicking on that point.
125. The **Virtual Ruler Height Measurement Tool (*)** provides a real-world perpendicular **digital ruler tool** to measure the height of any object or individual whose base can be seen.
126. When points and planes are defined by clicking the image, real-world distances can be measured with the **Distance Measure Tools (*)** from point to point, plane to point, or plane to plane. This capability of measuring distances and therefore angles (through simple trigonometry) is useful in **crime scene ballistics investigations**.

127. By simply clicking the sequence of points in the image and delineating the area, any real-world region can be measured with the **Area Measure Tool (*)**. This is often useful in **blood spatter analysis**.
128. A **digital magnifying glass** is provided in the Cognitech AutoMeasure® software allowing for detailed point placement.
129. The **World Coordinate Tool** allows the end-user to manually set a known coordinate system, which allows the end-user to incrementally unify coordinates of all measured points in all images under a single 3D coordinate system.

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Cognitech TriSuite¹⁴ Feature List

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