The Role of the Cineflex MSII in the Power Transmission Industry

Introduction

It only takes the loss of one small part to bring an entire electricity distribution system to its knees. If a transmission company is charged with causing loss of life or infrastructure then litigation will follow. Even if loss of life is avoided and no bush fire starts the economic effects on the generating company, the transmission company and the businesses they serve can be catastrophic. Prevention is always better than cure.

Since the early 60's the power transmission industry has embraced aerial surveys as an efficient and effective way of patrolling their assets, both for regular scheduled patrols and in times of emergency. The Mark 2 Cineflex Multi Sensor camera system (Cineflex MSII) now brings a quantum leap in the benefits, and they can all be summed up in one word……Safety.

- Hugely increased stand-off distances translate into a safer flying environment.
- Full High Definition Electro Optical images introduce more comprehensive detection of faults.
- The Infra Red sensor significantly improves hot-spot detection, thoroughly reducing the risk of fire and network breakdown.

The Cineflex V14 was designed to achieve rock steady images from a moving helicopter. When first released in 2005 it immediately became the new standard as users became aware of just what an enormous step had been taken when compared to the older technologies of competing systems.

In early 2007 the company was bought by Axsys Technologies who brought to the party their wide capabilities in thermal imaging, resulting in the release of the V14 Multi Sensor system (V14MS). Axsys have decades of experience in specialised military and civilian optical systems and were the company who fixed the flaw on the Hubble Space Telescope. They have more recently been chosen as prime optical suppliers for the James Webb Space Telescope, the replacement for Hubble, and the company has been acquired by General Dynamics.

At the end of 2007 the Multi Sensor Mark 2 (MSII) was introduced bringing:-

- stabilisation to the roll axis.
- an increase in the IR definition to 640 x 512 pixels.
- a Sony HDC1500 HD daylight camera.
- a fully customisable suite of enhancements from Troll Systems.

Helicopter operators with a serious involvement in the patrol and inspection of distribution networks have found that the Cineflex MSII brings them extra work that previously would have been unthinkable. They are now able to cover areas that were previously subject to flight restrictions such as animal avoidance areas, air traffic restricted areas and areas of dense population.

The Cineflex MSII minimises the nuisance factor caused to residents and livestock along the inspection path by allowing flights to be conducted from a greater height. The weather factor is also significantly improved as flights can continue in wind

strengths and turbulence levels that would previously have reduced the effectiveness of the inspection or curtailed the inspection altogether.

Images like this one are enabling skilled observers to assess the condition of the insulator and conductor, to look for signs of rust or arcing, and to check that all bolts and pins are securely in place. Up to now it's been usual for employees of the power company to fly in the helicopter and use their experienced eyes to spot faults. Obviously this is still an option but it tends to be a hangover from the days when skilled eyes were the only means of assessment. Some companies are now choosing to contract aerial teams to capture the best possible imagery which is then observed and analysed by power transmission experts on the ground. There are several advantages to this:-

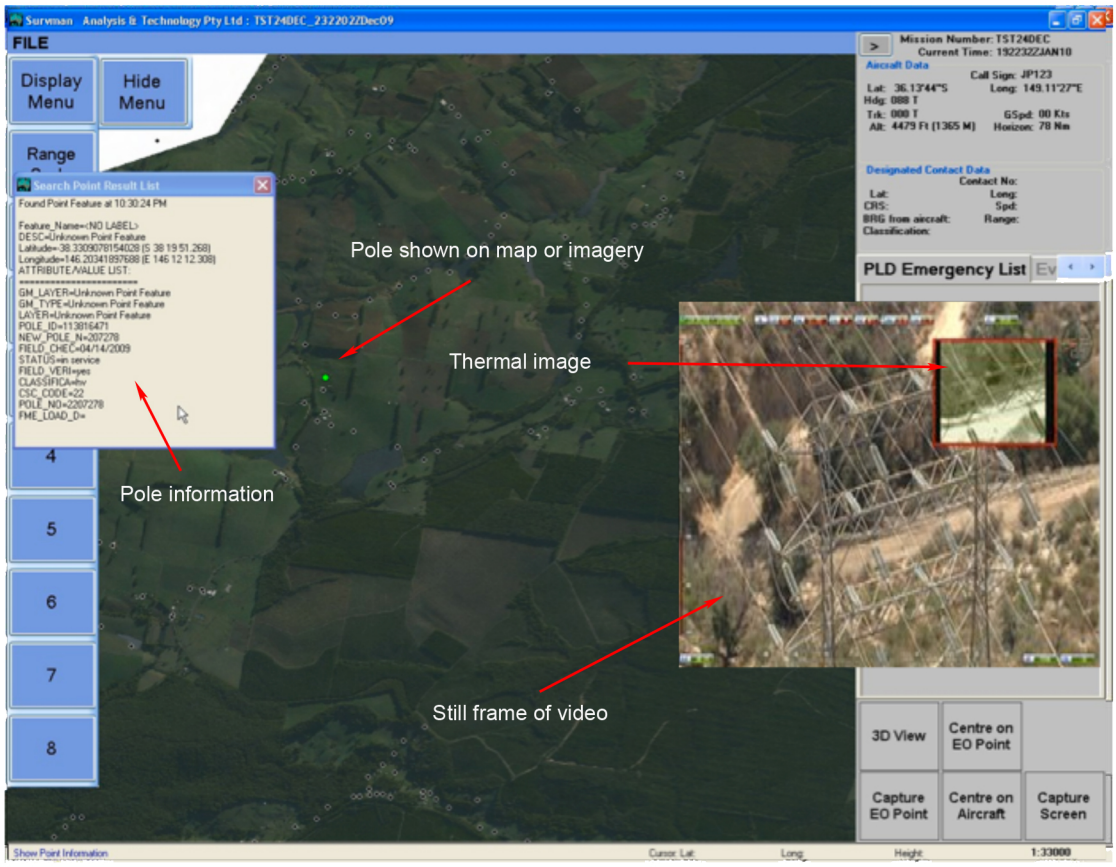
- Head to head comparative tests have shown that experts watching high definition images in a quiet and comfortable environment are significantly more likely to spot a fault as they would have done in the tiring and noisy environment of a helicopter.
- In these days of excessive litigation following any incident the power company have incontrovertible evidence that the line was properly inspected and visual proof of the state of the asset at that time.
- Comparative records are easily generated that can help with spotting trends.
- The power companies no longer need to expose their employees to the hazardous low level wire environment.

The extraordinary fact is that the previous image originated from a helicopter flying at 1,000 feet above the ground and 1 km laterally displaced from the power line being inspected. (Our movie clips demonstrate more astonishing zooms like this one).

But the more that we've worked with the companies responsible for transmitting electricity the more we've come to understand that a camera, however capable, is only the beginning of a work process that must seamlessly and efficiently flow into the existing IT infrastructure and work patterns of the client. It's no use producing reams of information in bespoke formats, and an image is utterly worthless if it has no associated metadata to pin it to a time and place. Enter the Asset Management

System (AssetMan) designed, built and supported by Canberra based Analysis & Technology Australia.

The AssetMan achieves the required seamless work flow and packages it as a total solution. The linesman inspecting the high definition and infra-red images now has a third screen at his disposal showing a time-locked map display of the exact point on the ground being inspected by the camera. If he chooses to rewind the imagery for a better look at something that's caught his eye then the mapping screen also rewinds, as does the imagery of the other sensor. Should he wish to record a line fault then he can fill out an online form and "paperclip" it to a still image, a detailed map or even a short piece of video. Alternatively all of this information can be combined into one file or image. The delight of the AssetMan is the way in which it's already designed to accommodate the bespoke and tailored requirements of different power companies.



In the pages that follow we have set out to give as much information as possible on the various facets of the combined image and mapping solution we're offering. In many cases this is set out in the form of the questions we've been asked and the answers we've been able to give. We invite you to consider the extraordinary power of the MSII camera system and the associated Asset Management System and to ask yourself whether your current inspection techniques can offer you this level of efficiency and protection.

We'd be glad to share our experiences with you and we'd particularly welcome the chance of a "fly-off" demonstration up against your existing aerial camera system, or any other you may be considering. We do so with the confidence that once you've seen what the MSII can do you'll be unable to turn your back on the exponential improvement in SAFETY.

Would your current technique have found this bird's nest……

……. at this height and distance?

If not then we suggest it's time to consider the Cineflex MSII.

MSII Camera System

Overview

The MSII comes with a Sony HDC1500 High Definition Camera and a Fujinon 25 x 16.5mm lens. These are not interchangeable.

The MSII additionally includes a 640 x 512 Infra Red sensor for thermal or low light imaging.

Both sensors are incorporated in a 5 axis gimbal. The images they generate are fed into the cabin of the helicopter, or fixed wing aircraft, where they are processed, monitored and recorded.

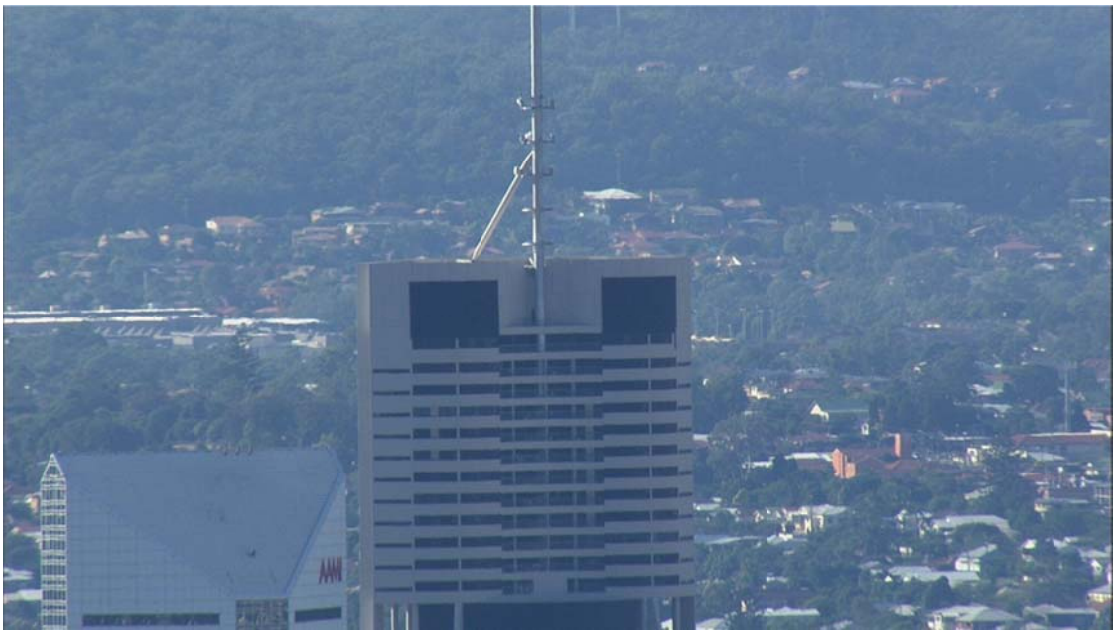
What are the significant differences between the MSII and other systems I've seen or used?

There are two significant differences; lens stability, and the ability to blend the normal daylight image and the IR image together to provide the maximum amount of information into one frame. Both of these features are unique to Cineflex systems.

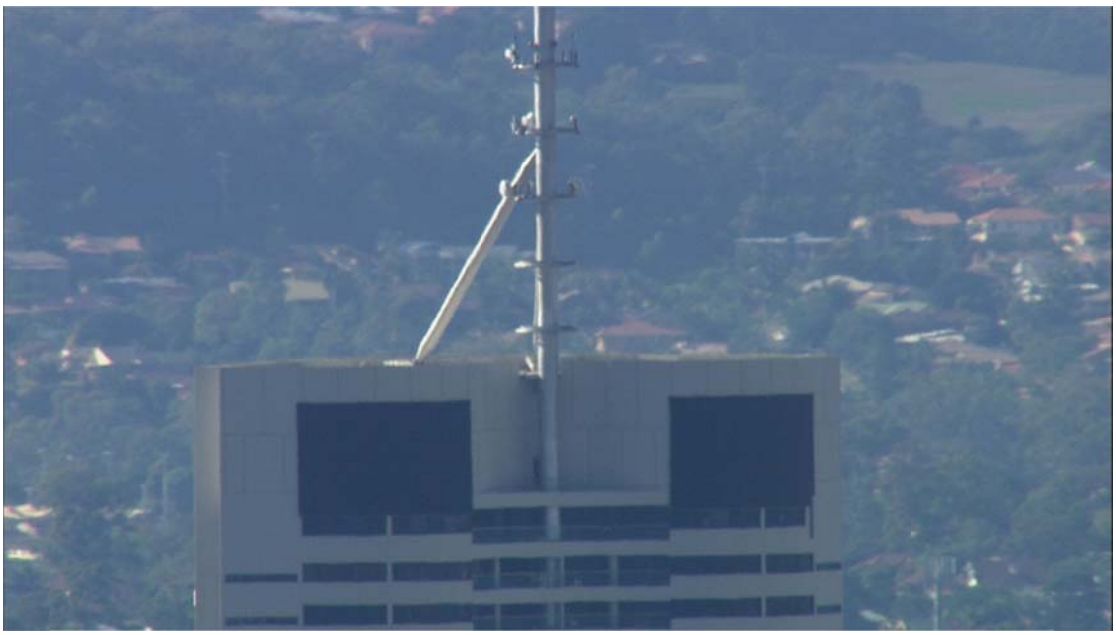
Other products offer some form of gyro stabilization but experienced operators highly value the way in which the Cineflex zooms continuously, not in steps, and goes on zooming to distances that were previously thought impossible to achieve from a moving aircraft. The Cineflex MS2 employs a gyro sensing and feedback system of such supreme accuracy that we haven't yet found its limits. The more stable the platform, the longer the lens that can be used.

This image shows the CBD of Brisbane, shot from about 8kms distance. In the middle of the CBD is a building with a tower on top.

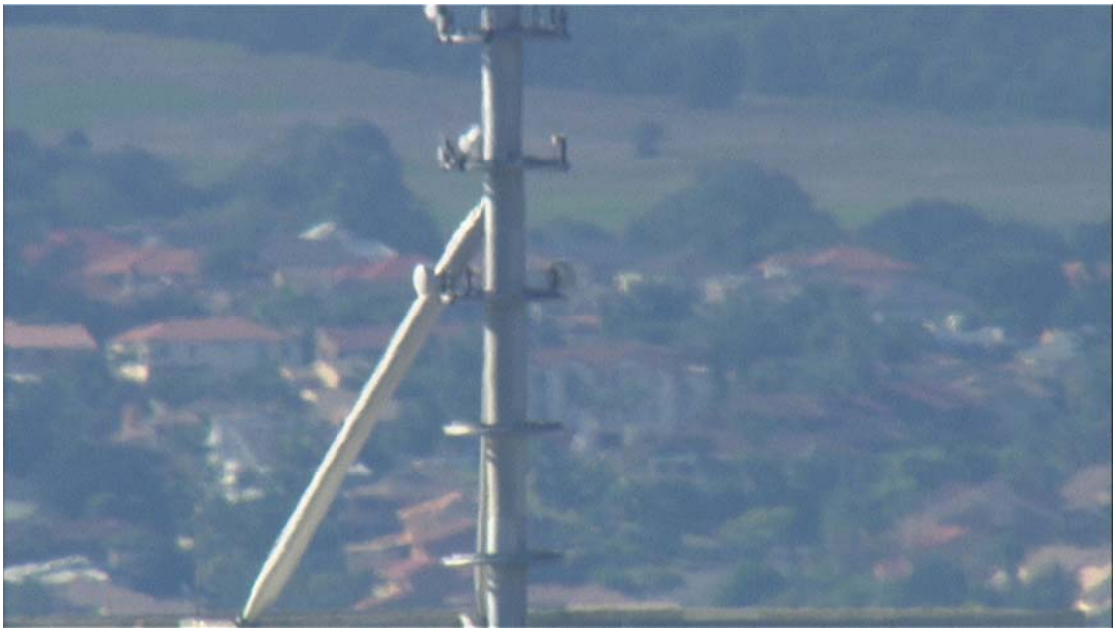
Here's what that tower looks like at the other end of the continuous zoom.



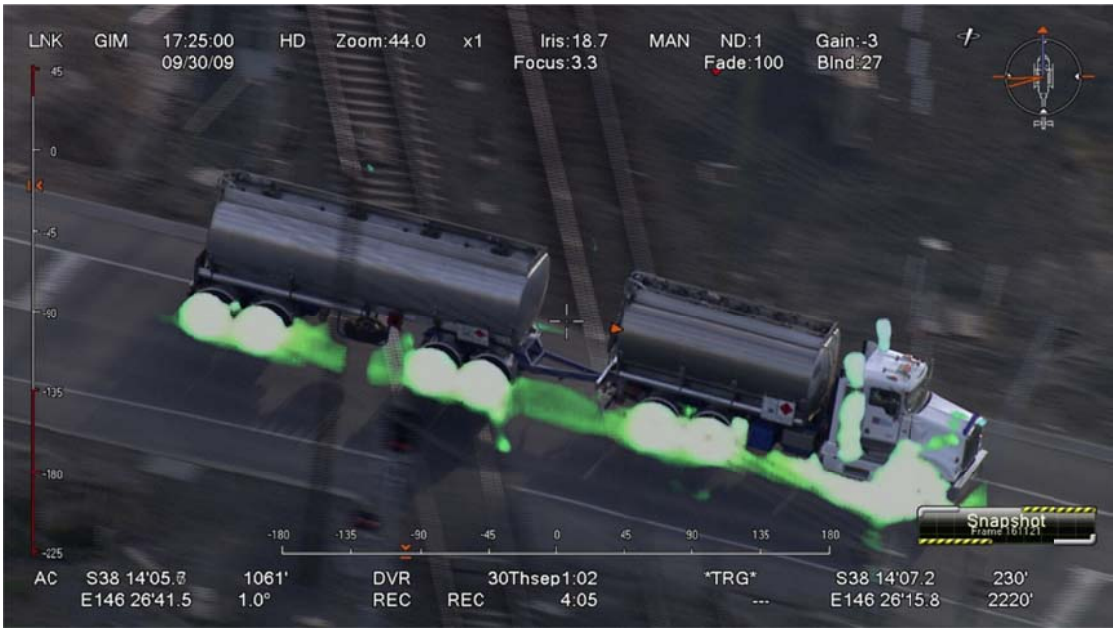
But there are two more steps we can take to look more closely at that tower. First we can use an "optical doubler". This is simply a piece of optical glass that moves in front of the main lens and quite literally doubles the magnification of the image. Notice that we are still looking at a pure optical image in true 1920 x 1080 High Definition. We haven't yet even begun to zoom digitally.



Finally, we can artificially zoom by using the digital doubler. Here is the image at 2x. We have 5x available but rarely need to use it and actively avoid using it unless we have to since any form of digital enhancement takes us out of the realms of true high definition and will begin to pixelate the image



The second unique feature we mentioned is the video blending between the Electro Optical (daylight) image and the Infra-Red (thermal) image. Here is an example of that technique.



Notice how we can not only see the hot tyres, engine and exhaust stacks but we can also see the hot air passing beneath the truck. The level of thermal imagery that's superimposed on the daylight image is entirely controllable by the camera operator. When inspecting transmission lines the operator will set this to a level that will alert him to a potential fault. He will then switch across to a pure thermal image in order to assess and record the fault more thoroughly.

What are the standard functions on an MSII?

1. HD annotation overlay on video image.
This is the third of our three image layers and it contains a huge amount of factual information concerning the moment at which the image was captured. The most important of these is the position and it's that information which is used by the AssetMan to map every step of the flight. Take a look at image below and notice how the aircraft geographical position is shown in the lower left hand corner of the screen, while the geographical position that the camera cross-hairs are looking at is displayed in the lower right hand corner. When you're often recording the detail of assets that are several kilometres away from the aircraft it's no longer sufficient to just know where the aircraft is.

2. Picture in Picture. (PIP)
This refers to the ability to select the way in which the HD daylight image and the IR image are perceived on screen at any given moment. For example, one might normally choose full screen for the HD image with a 1/8th size IR thumbnail in the top right corner as illustrated.

(Notice also how the relative heights and distances have been displayed in this image. The aircraft is flying at 2,087'. The camera is looking at a point on the ground which is 820' above sea level, and the slant distance from aircraft to the burnt field is 4,172')

3. Up-scaling and Down-scaling
In order to achieve the PIP facility, and the ability to lay one layer over the top of another, there obviously has to be an adjustment to at least one of the layers to bring it into complete compatibility with the others. It also accommodates varying size (in pixel dimensions) of monitors within the aircraft.

4. Scan conversion
True HD is 1920 x 1080 (known as 1080i or 1080P, depending on frame refresh type). The other common format, for broadcast or downlink, is 720i or 720P. The HDC1500 captures at full 1080. When considering live downlinks to a command centre there may well be times when one would choose to downlink in 720, not 1080.

This is because it takes far more power, bandwidth and expensive equipment to downlink in 1080 than it would in 720.

5. Video switching
There are two channels within the aircraft; one with graphics and one without graphics. So, everybody in the aircraft will see the same composite (daylight and IR) image that the operator has chosen at the time, but they could each choose whether or not to see the graphics.

6. Power conditioning
The MSII includes a complete power conditioning system that takes in the potentially "dirty" aircraft power, splits it into three separate power channels and conditions each channel to ensure that each facet of the system is getting the amount and quality of power that it likes.

7. HD digital zoom 5x
The MSII features a 5 x digital zoom. The MSII has such extraordinary optical zoom capabilities that there are very few occasions when one would use the digital zoom beyond the 3x. It would only really be if there were a very fine detail that one was in doubt about, couldn't resolve visually, and wanted to have a bit of extra confirmation.

As mentioned earlier, once one begins to zoom digitally one is beginning to leave the realm of true full HD, but since digital zooming allows for a certain amount of interpolation (what was a boundary between a black pixel and a white pixel will have a grey pixel artificially inserted as one zooms) the quality of the picture does not halve as one doubles the zoom. The 5x digital zoom is in 1% increments.

8. TCC500 Laptop Controller
The MSII is designed to be totally customisable in the field, through a simplified touch screen menu.

9. Freeze Frame
We're all familiar with the ability to freeze the frame when using a recording device but we can also do so from within the camera system. This enables the main picture to be frozen on screen for as long as a crew member may need it. He might, for example want a little extra time to record a fault on a power pole. In the meantime the camera operator can be using the PIP to continue his inspection. This capability introduces particularly efficient and time saving work flows in the role of asset inspection.

What other functions are available from within the MSII?

When purchasing an MSII there is a range of optional functions**,** with associated extra costs. When contracting an MSII for a specific period of work you can expect the system to have many, but probably not all, of the following functions

Option - Geo Pointing
This gives the ability to ask the gimbal to point the camera at a particular point on the surface of the earth. It's one of the most complex things to achieve as it has to take in so much information from a variety of sources, process them, combine them and resolve the equation to a high standard of accuracy. In order to work there is an additional requirement for an external or internal IMU/GPS.

Option – Mapping Interface
This interface is required in order to take advantage of mapping equipment. At Helifilms we work closely with Canberra based Analysis & Technology to ensure an entirely seamless workflow for the operator.

Options – Video Blending
As illustrated earlier, this is the means by which the HD image and the IR image are combined. It's not a stepped process; one has complete control over the opacity between the two layers from 0 – 100%.

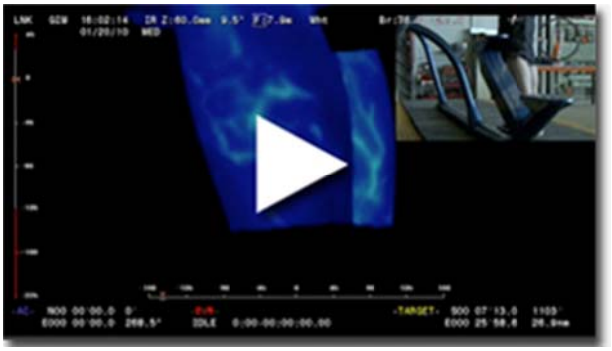
Option – Auto Tracker
This is designed mainly for Law Enforcement applications, particularly in the pursuit role or when the helicopter is required to loiter over a given target. A specific object on the ground, a car for example, can be bracketed on screen. The gimbal will automatically track that object and keep it in centre of frame. It will even predict ahead when a moving target travels, for example, under a bridge or behind a building (This is known as "coast" mode). When inspecting power poles this feature can be usefully employed to lock onto a pole and briefly release the camera operator from full attention to the screen at times of high cockpit workload.

Option – Remote Gimbal Control
This is not usually used in a helicopter but may be necessary in UAV applications, on cranes, or in hazardous circumstances.

Option – Laser Pointer, Laser Rangefinder, Laser Illuminator.
These products are available but are subject to extra export restrictions and safety regulations, depending on the role they are to be used in.

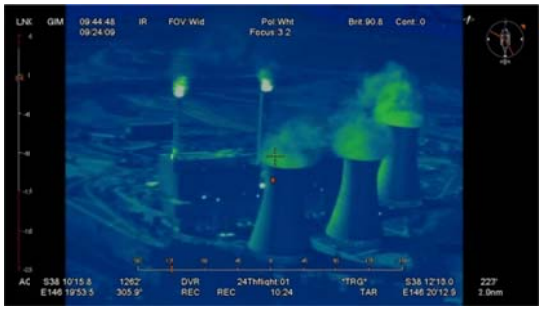
How sensitive is the IR camera?

The sensitivity is 0.2ºC. Here's a screen shot in which the cameraman in the hangar is looking at the blood vessels in his own legs! Of course this sensitivity gradually diminishes with distance.

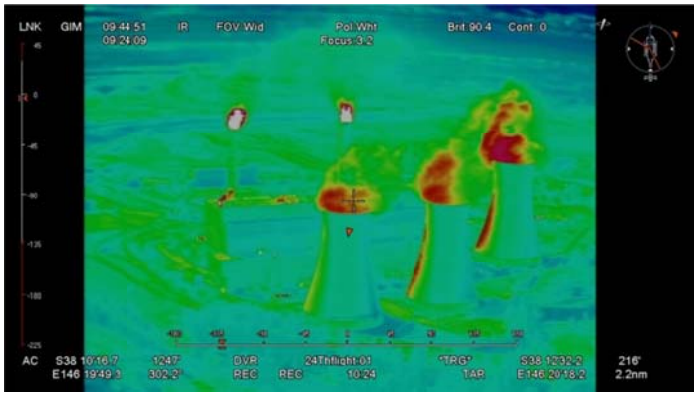


Are there any other capabilities to be aware of?

The MSII uses eight colour palettes to illustrate the thermal image and we've found that different palettes will yield different information. Here are three images of a power station. First there is the classic black and white scale which is not particularly helpful. In the second palette we can see the steam of the cooling towers more clearly.



But here we can actually see temperature gradients within that steam…….



We are currently conducting trials into the aerial detection of termites and other wood pole infestations that can bring down live lines into tinder dry forests. Early indications are that the Cineflex MSII is more than up to the task.

AssetMan System

Overview

The AssetMan software application is housed on a ruggedised 3U MaxVision (www.maxvision.com) dual quad core Intel processor motherboard system that has been developed and qualified from existing systems for NASA. Although based on "commercially available" hardware, the various MaxPac systems are designed to be operated in extremely harsh environments and have innovative solutions to overcoming issues such as board and plug retention in high vibration situations. The use of commercially available components enables the system to be utilized in demanding high end processing and video intensive tasks such as those encountered during inspection flight operations where searching, manipulating and updating of database information on potentially millions of assets can be achieved whilst displaying and recording camera HD video, at the same time as displaying and updating high definition imagery and maps as part of the underlying moving map.

The AssetMan software has been developed around an extremely flexible and adaptable GIS engine that provides system compatibility with virtually all military and commercial maps, charts and imagery types or formats as well as compatibility with other system file sharing formats. This means that underlying mapping and display data can be imported or exported without the need for additional conversion utilities. Asset data can also be imported into the system via a number of different formats, the simplest are via ESRI Shapefiles or standard CSV files. This provides a system that is directly compatible with some of the import and export formats of other commonly used GIS software including GE SmallWorld.

The system has been designed to import and export asset information without the need to provide it to a third party for conversion or manipulation. The system has the capability for customers' personnel to upload and download the data with a minimum of personal intervention.

How are the Cineflex MSII and the AssetMan integrated?

The AssetMan is designed to be fully integrated with the MSII. AssetMan receives both data and video from the camera system, and sends data to the camera system.

With respect to data, AssetMan is connected to the camera system via an RS-232 serial port. AssetMan receives and uses, as a minimum, the following data generated by the camera:

- Aircraft information
  - Latitude
  - Longitude
  - Altitude
  - Heading (T)
- Camera aim point information
  - Latitude
  - Longitude
  - Elevation (ground position AMSL)

AssetMan can send, on command, the following data to camera gimbal for pointing:

- Latitude
- Longitude
- Elevation
- Target designation or name

Additionally, AssetMan can take a video feed from the camera system (in either HD/SD SDI, or SD analogue) that can be displayed on the AssetMan screen as a picture in picture (PIP) of virtually any size up to full screen. The AssetMan operator can then capture this PIP along with the underlying map and asset information as a JPEG for post flight analysis and reconstruction purposes. The AssetMan system can also record the video for later replay if required.

AssetMan has a underlying GIS software application that provides the geo-referenced display elements of AssetMan however AssetMan as a system provides significantly more that just the display of data. It is more akin to a spatial and infrastructure data management system where a database of assets and associated attributes including maintenance data can be recorded and manipulated through a visual front end. This front end provides geo-referenced display of the asset position against maps and other landmarks to permit ease of identification and validation of the correct asset. It also provides a quick and easy method to identify assets that are missing from the database and to capture their position for later validation and inclusion into the company asset listings.

Asset information is held in various tables within SQL databases and relationship is maintained through the unique asset identification number. Tables include such data as, but not limited to:

- asset ID,
- asset position,
- asset attributes (e.g. type {pole, tower}, description {metal, wood, H, single etc}),
- outstanding work orders,
- new defects,
- inspection dates,
- report raised etc.

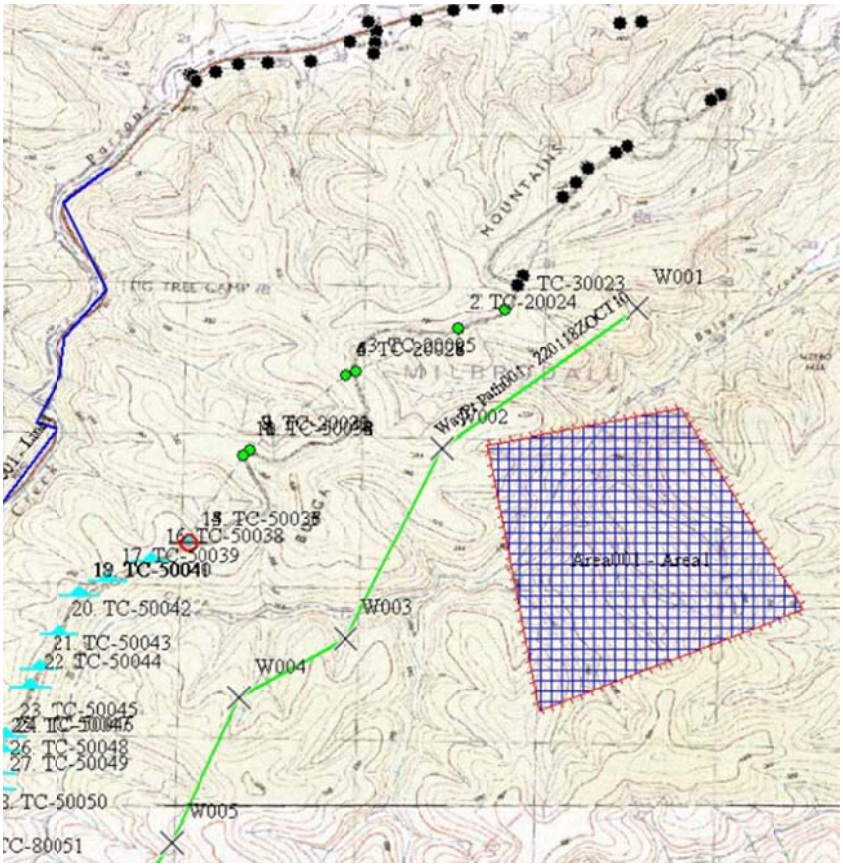
The actual tables and the associated input/output files and formats can be tailored to meet the customer's specific requirements. Certain fields within the tables are required to be provided (asset ID, latitude and longitude) however in general the other fields are flexible and can be changed by the customer at any time given that a new database table is loaded over the existing one if additional attributes are added. The operator can search, select and centre on any asset contained within the database and then bring up the attributes etc for that asset.

The system is unique in that it can operate in a fully "manual" mode for defect recording whereby the inspector selects the asset from visual reference on the display and enters/updates any information before moving to the next asset, or via a linked mode whereby AssetMan is linked to a camera system that provides a metadata feed which can be used to semi-automate some of the processes. In this mode when an asset is selected on the AssetMan screen, the positional data is passed to the EO system for pointing of the camera whilst the maintenance information on the pole is shown on the Assetman screen in order that it may be updated or additional defects raised.

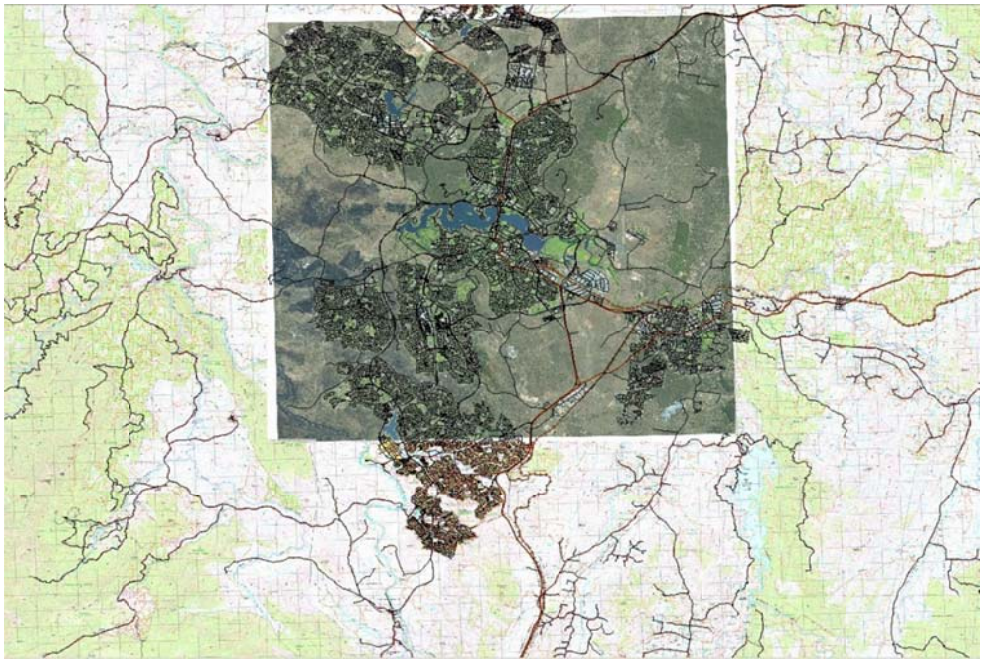
How are the terrain, infrastructure landmarks and other structures displayed?

AssetMan can provide the operator with a number of display options for both the underlying reference data (map, chart, imagery etc) and for the display of data with respect to colors, shapes, symbology, hidden etc. Example 1 shows a base topographical map with a vector line (in dark blue), individual un-inspected assets (black dots), inspected assets (green dots), un-inspected assets in a operator designated inspection sequence (aqua dots on lines), selected waypoints and flight route (black crosses with green line) and an operator drawn area (red perimeter with blue cross hatching). This is a small example of possible combinations.

Example 1



Example 2 shows a 1mtr imagery tile overlaid on a topographic map. Overlaying this are highways, major roads, streets and railroads all with separate colour coding.

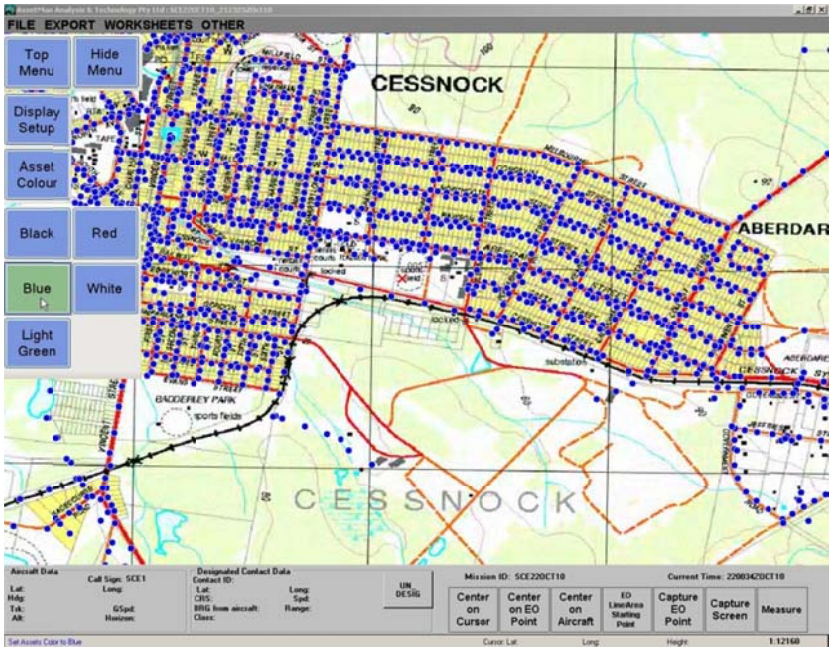


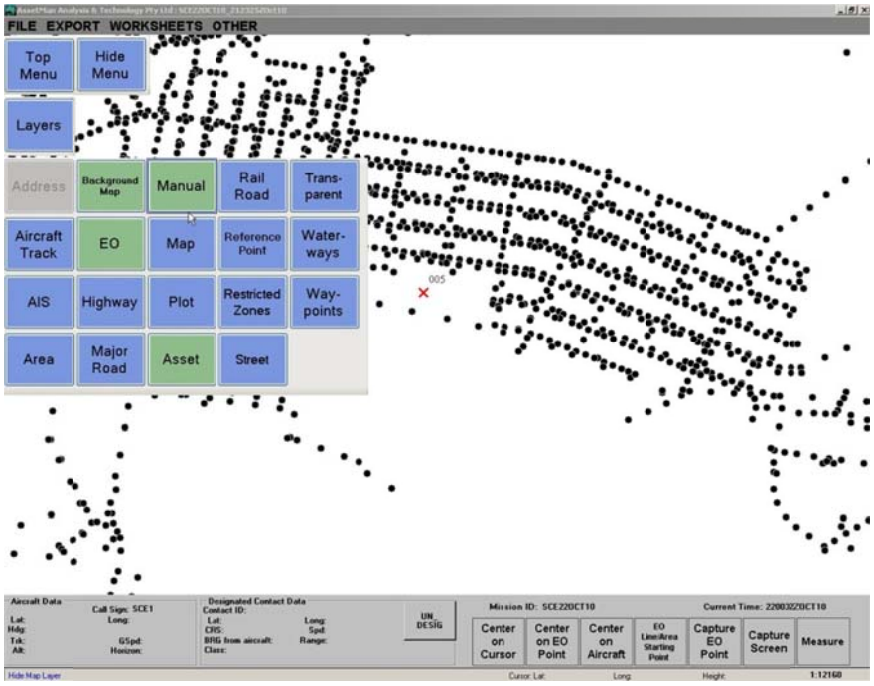
Example 2

Example 3 shows a static 3D snap shot (not dynamic for fly-throughs at this point) of the screen providing the operator with a quick view of the terrain overlaid on the elevation data and where assets , points, lines and areas are with respect to the terrain. For example does the asset line follow a valley or cross a ridge and so on can be seen easily by the operator in this mode.

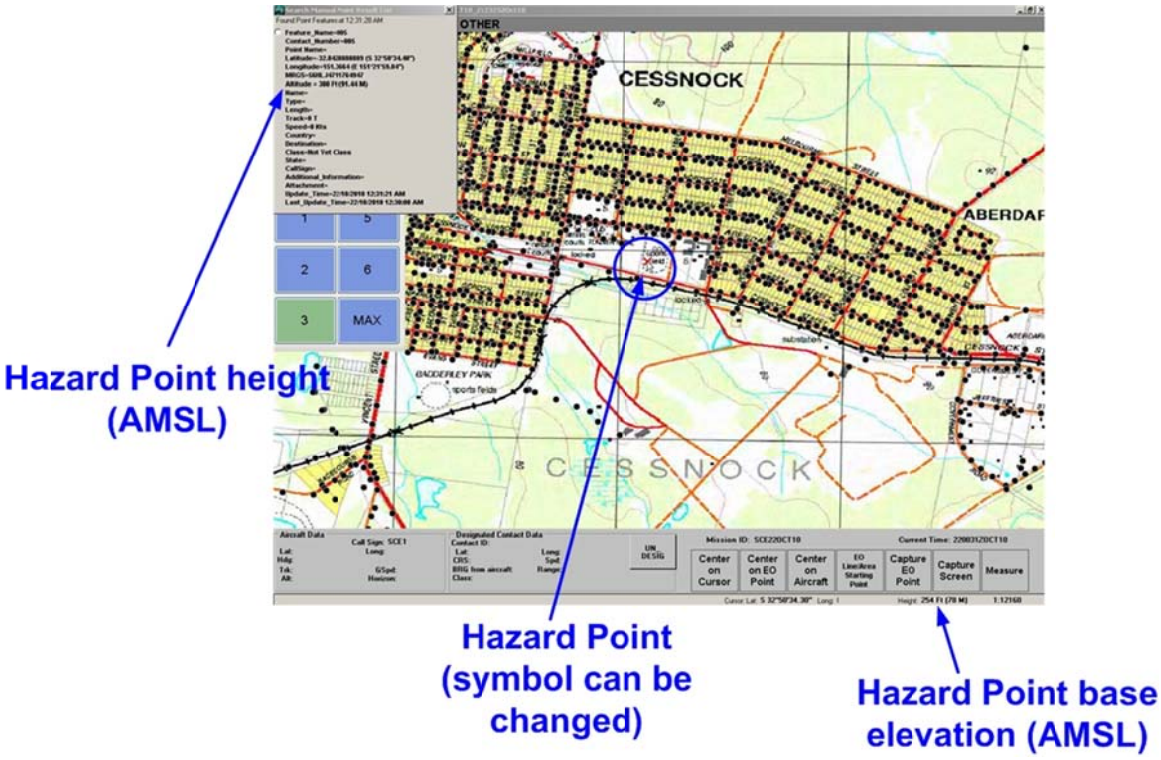
Example 3

To further assist in display item identification the operator may hide or display any of the layers (see blue and green push buttons middle left) including the underlying map in order to de-clutter the display, if required.





If a structure point or hazard is selected, the height can be seen as one of the attributes. As the pointer is hovered over the symbol, the base elevation is shown down in the bottom right of the screen along with the hazard latitude and longitude. The hazard label can also include description and height (i.e. Radio Mast 300 mtrs) giving the operator a quick visual reference if the label is turned on.



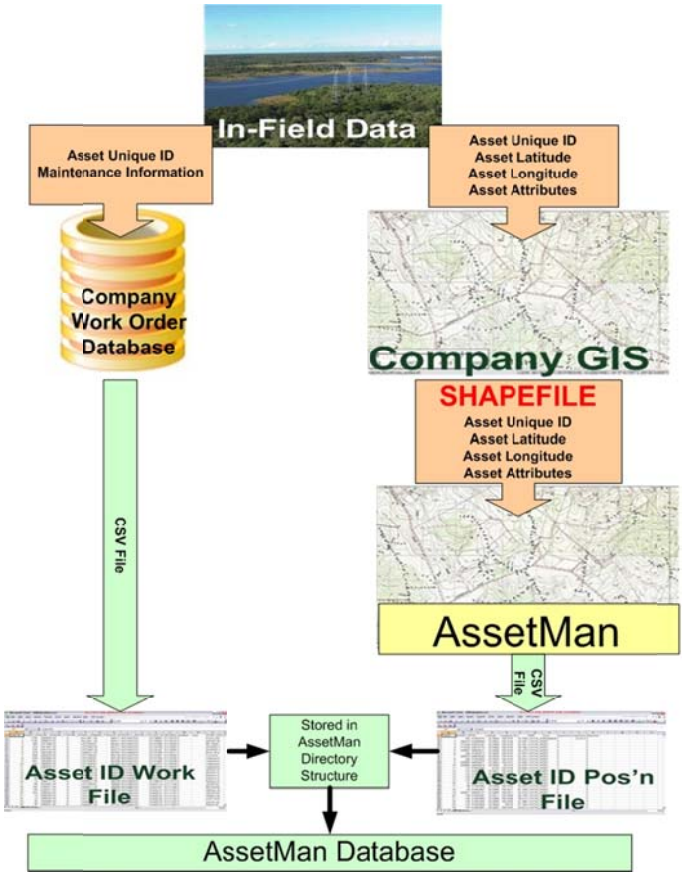
How does AssetMan allow for downloading capability to existing mapping systems via a ground based terminal?

AssetMan can download various sets of asset information/data or geo-referenced mapping or point/line/area data as required by the operator. In some cases the downloads (such as Shapefiles) are compatible with other standard GIS software and GE SmallWorld and as such may be downloaded direct to these systems even during flight via 3G or satellite communications.

Data that can be downloaded post flight currently include such things as:

- All asset defect data
- All asset data
- All new unknown asset data (not in existing database)
- Only inspected asset data (may have been previously reported)
- Only modified asset defect data (may have been previously reported)
- Inspected asset data since last report
- Modified asset defect data since last report
- Unknown asset data since last report
- Pre-defined event reports if required
- Operator generated weather reports if required
- Shapefiles of operator entered points (such as hazards, points of interest etc)
- Shapefiles of areas and lines

What would be a typical work flow for importing customer assets to the AssetMan?



Although this can be altered to suit individual company requirements and methodology, the concept and work process flow are basically common. The company GIS division would generate a Shapefile of the assets. The Shapefile subset of files would include a *.dbf file with selected attributes but it must have at least one attribute; that being a unique asset identifier (ie Pole_No, Pole_ID etc). The operator would start AssetMan and through the File menu select ***Create Asset Data CSV File from Shape File***. The operator would then browse to and select the appropriate Shapefile and the system would generate a CSV file of all of the asset data that is ready for direct load into the database. This may take a number of minutes depending on the number of assets and the number of attributes.

The maintenance (work order) CSV would be generated from the maintenance database and the only requirement is that the same unique asset identifier be used so that the relationship of the two tables can be established. When both CSVs have been generated they can be loaded directly into the AssetMan database ready for operations. All of this can be completed by company personnel, meaning that corporate sensitive data never needs to be released to a third party.

How does AssetMan allow for uploading from existing mapping systems via a ground based terminal?

As mentioned earlier AssetMan can automatically upload virtually any format of geo-referenced maps/charts (raster or vector) or imagery for use as the underlying visual reference display. AssetMan can also upload such formats as Shapefiles for the display of points/lines and areas. This includes such things as landmarks, roads, waterways, railroads, assets, hazards and address layers etc. If unusual data is to be uploaded and the data has not been geo-referenced or requires some other transformation for uploading, then in general this can be completed on a ground based terminal and exported from the terminal in a suitable format. The most common transformation requirement relates to an aerial photograph or scan of a map that has not been geo-referenced such as a standard JPEG etc. These can be readily geo-referenced on a ground based terminal and saved as say an ECW or GeoTiff that can be readily imported into AssetMan.

Is it easy for the customer to update or modify their asset lists?

AssetMan is designed to enable as much flexibility as possible whilst still maintaining configuration management. From our understanding from other power companies, the asset data (position, description etc) may be held and maintained from a configuration control point of view by the company GIS section whilst the maintenance requirements and outstanding work orders are maintained by a separate maintenance section.

This said, it is also important that the airborne operator and/or inspector can record changes in the data and new data in the air in a simple but fully cross referenced manner without impacting upon the validity of the original data held in the database. The operator can:

- update the status of maintenance/work orders in the air following visual inspection,
- add additional maintenance/work requirements on existing assets via “new work orders”,
- add comments on existing assets via a “free form” comments field on the associated work form (i.e. provide updated positional data if they consider that the coordinates are incorrect), and
- capture positional data on any assets that are found that are not in the existing database.

The changes and the new asset data do not change the existing data but are tagged for download to the relevant authorities to verify and update the master database and for reissue by that authority. The operator can recall and view modified and existing data but cannot overwrite or change the original data.

At any time the operator can generate (export) reports of inspection and maintenance data as well as information on any unknown assets that have been found. These data reports are sent to the respective customer authority for validation and database update and reissue.

A new asset (poles, towers etc) database can be loaded at any time into the AssetMan system via shapefile or csv file as can a new defects database. If, for some reason, there is existing modified information in the aircraft database that has yet to be downloaded, then the operator will be warned about this prior to uploading new databases.

How does AssetMan allow for identification, marking and recording of new objects and hazards from the aircraft system controller?

AssetMan can be used to plot and record positional and other data on designated points or assets. The operator can either enter positional data into AssetMan manually or can use a one press button whereby the position of the EO camera is used as the position. This also applies to lines and areas that can designated manually or captured through the use of the EO camera. The operator can then add attributes to the object position data and later export the data for inclusion in new databases for the company or other agency GIS for information.

Example 1: If anyone in the aircraft saw a new hazard (a new unreported ham radio tower that has been erected by the land owner) that could impact upon safe line inspection or maintenance flying, then the operator could either enter the position manually (overfly for accurate GPS position) or use the camera to point to the base of the new radio tower and automatically capture the position. The tower position would be displayed on the AssetMan screen and the operator could also add attributes that would be recorded in the databases against the object. This data can be exported for further company or other agency use.

Example 2: A scrub fire is spotted whilst an aircraft is on an inspection flight. The camera operator can outline the fire boundary and points along this boundary can be recorded and automatically joined to form an outline of the fire area. A Shapefile of the area can be exported and "emailed" from the aircraft using 3G or satcom for use by emergency services as the Shapefile can be automatically uploaded into their GIS to provide accurate data on the position and area size. Additionally this file can also be uploaded by the company GIS section to ascertain if any company assets are under threat.

Does the mapping system stay with the craft on centre?

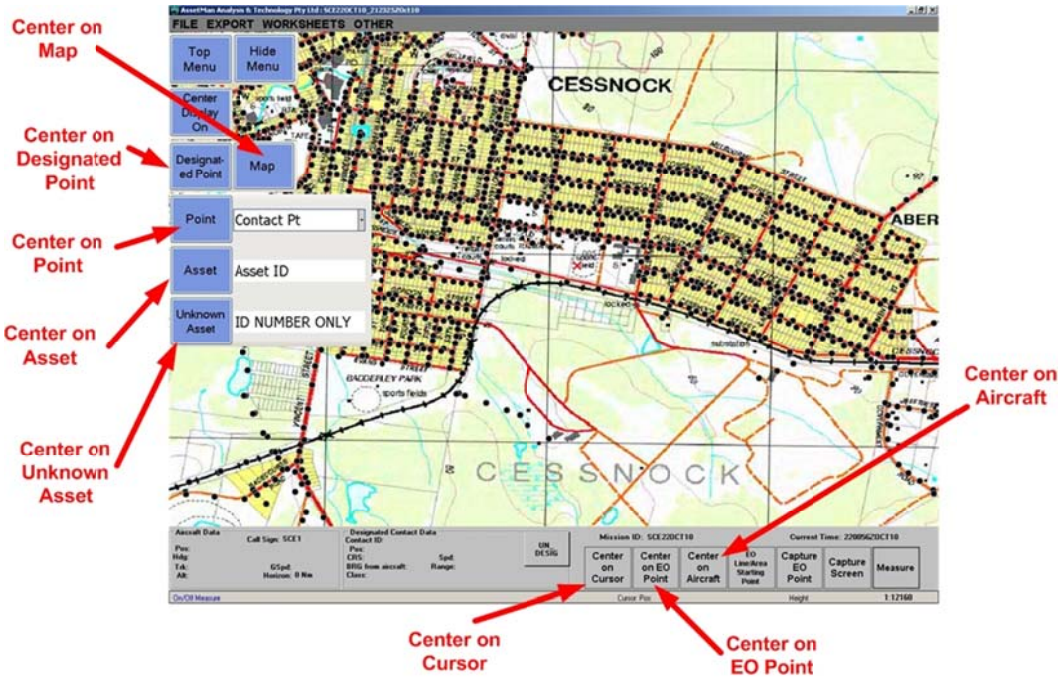
AssetMan can be modified to operate in this mode (aircraft stabilized) however the use of ground stabilization with North up is a more natural way for operators to view maps or imagery that are used as the underlying reference in most cases. Additionally, in an aircraft centered mode, the computer resources needed to continually update underlying maps, asset positions, hazards, lines, areas and the EO camera position etc will significantly impact upon the ability of the system to carry out some of the tasks in a timely manner.

A&T Australia has however implemented in AssetMan a mode that maintains the ground stabilization picture with the aircraft symbol transiting across the display in synchronization with the actual aircraft, however when the symbol approaches any edge of the displayed area, the aircraft symbol will automatically re-center on the display with the map and all plotted data updating accordingly. This continues unless the operator de-selects the auto-center mode whereby the aircraft symbol can "fly" off the screen. On the bottom right of the display is a touch button whereby the operator can, through one touch, at any time center the display on the aircraft or the EO Camera symbol position.

Can AssetMan provide the camera operator with the ability to center on any loaded asset for rapid search and fly-to or tracking?

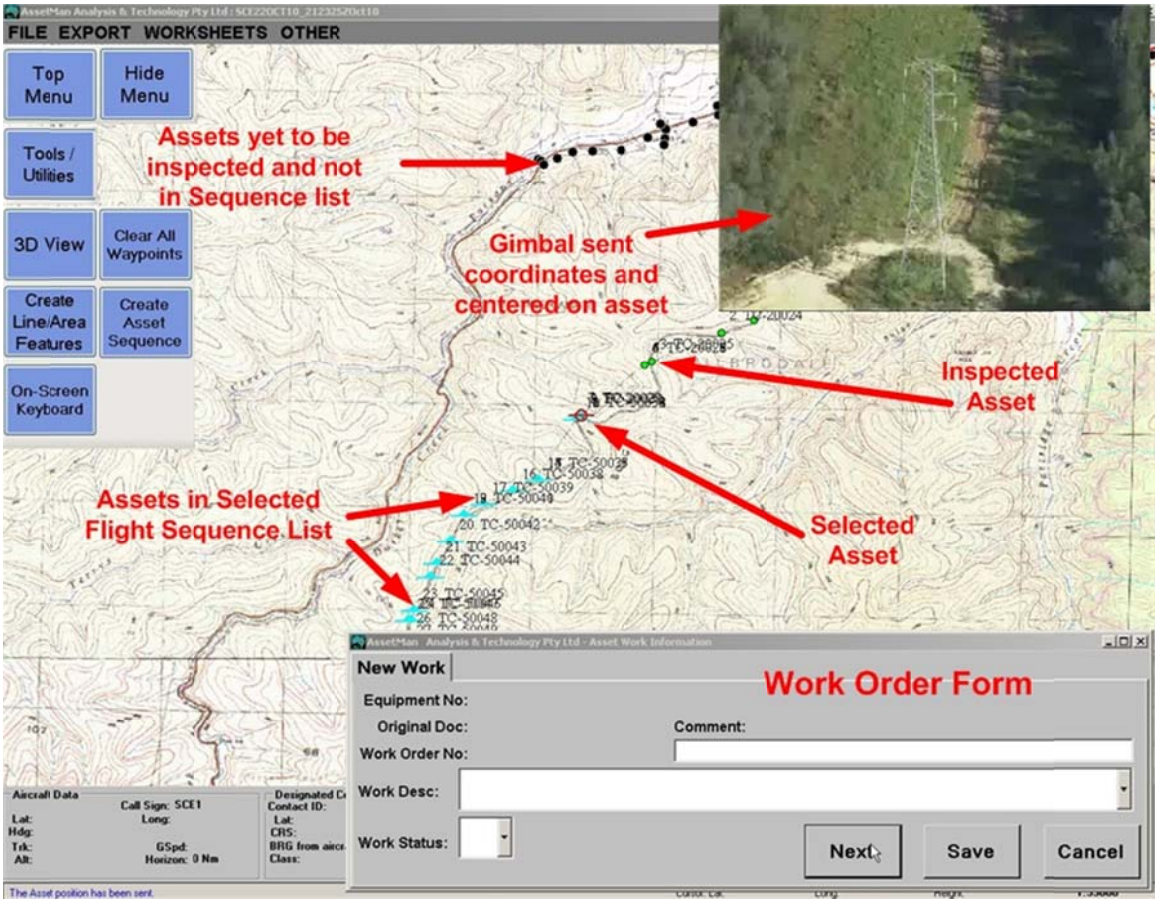
AssetMan has facilities for the operator to center on:

- Map (loaded map)
- Designated Point (currently designated point)
- Point (from pull down list - such as waypoint, hazard etc)
- Asset (operator types in ID and system will search and center)
- Unknown Asset (assets that have been identified as not being in initial database and have been entered during sortie)
- Cursor
- EO point
- Aircraft
-



Can AssetMan provide camera operators with the ability to automatically direct the camera to a designated asset position and show open work orders associated with that asset?

When the operator selects an asset for inspection, there are a number of events that happen automatically. If the gimbal is set to receive directions from AssetMan it will slew to the position of the asset that has been passed to it by AssetMan, and additionally it will display the unique identifier of the asset on the camera monitor so that all captured video and stills can be easily associated with the asset. At the same time AssetMan will place a cursor over the asset to indicate that it is the one under inspection and it will also display any open work orders and/or will have a new work order form open ready to be completed if necessary. If there is work that needs to be raised the operator can enter it in the form or otherwise, if there is no requirement, the operator can select next to go to the next asset in a sequence list or just to close the form if no sequence list is in place. The asset symbol will change colour indicating that it has been inspected. If it is the wrong asset, the operator can just press cancel and it will close the box ready for the operator to designate the correct asset.



The on-board operator can add new defects through the New Work tab on the work order form. This can be in the form of a set defect selected from the pull down list or a free form comment. On saving, this new entry is recorded to the database against the asset identifier for later download. More than one new defect can be added against an asset.

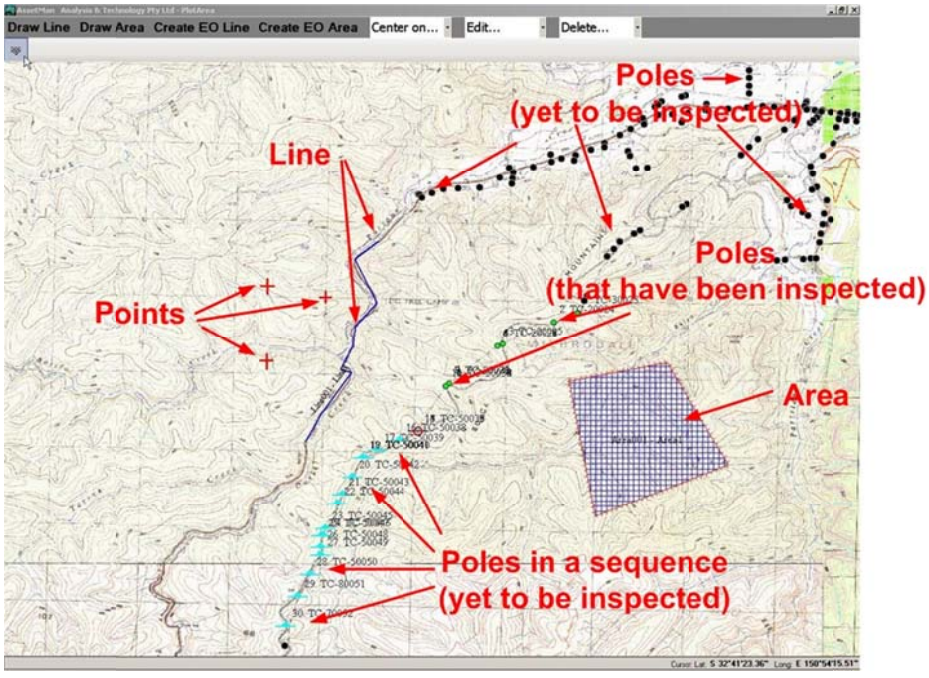
Additionally if the operators identify an asset that is not in the onboard database they can easily add it by pointing the EO camera at its position and then double clicking on any free spot on the AssetMan screen (i.e. not near another asset). This will bring up a form on which comments and defects can be raised then saved. This new asset information is saved into a separate database for downloading and validation before it is entered into the company GIS and hence updated onto a new version of the aircraft database.

Please explain the ability to draw lines, points and set a polygon to indicate an impacted area using the camera reticule?

AssetMan provides the operator with the capability to:

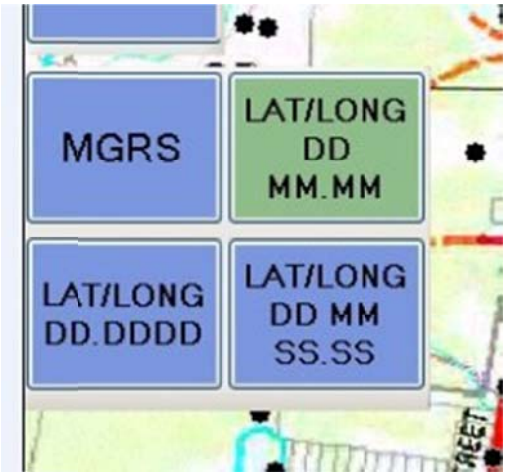
- Draw lines
  - manually using point and click on map
  - through dropping points on the map (entering Lat & Long) and connecting through a snap-to-point feature
  - by using the EO cursor to define points to be automatically joined as a line on completion
- Enter/draw points
  - manually using point and click on map
  - through entering Latitude & Longitude
  - by using the EO cursor to define points to be captured and plotted
- Draw areas (polygon)
  - manually using point and click on map
  - through dropping points on the map (entering Lat & Long) and connecting through a snap-to-point feature to create area
  - by using the EO cursor to define points on the perimeter of the area to be automatically plotted on completion
- Import lines, points and areas via file from other external GIS.

All points, areas and lines can be saved into text (*.txt) or ESRI Shapefiles for export during flight or after flight for uploading into other GIS software applications. AssetMan can output the Shapefile with the desired attributes listed in the associated dbf file. The files may be exported during flight using 3G or Satcom or after flight using conventional methods of file transfer.

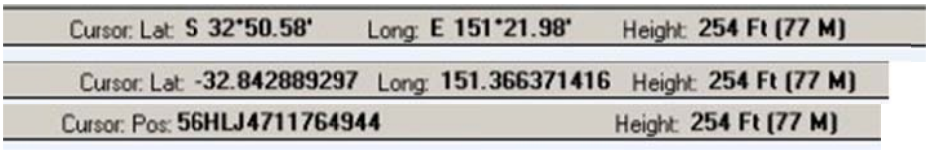


How does AssetMan display Latitude and Longitude?

The operator may select the coordinate system for display from Military Grid Reference System (MGRS) to three different forms of Latitude and Longitude through the touch screen icons under the pull down menu.



The coordinates of the cursor position are displayed on the right bottom of the display including height of the ground at that point above mean sea level.



The position and altitude of the aircraft are continually shown in the left bottom of the screen.

Additionally, if required, Assetman can be configured to show coordinate grid on the display.

What monitors would normally be used in the aircraft?

The system can be used with virtually any standard high resolution monitor but through experience Analysis & Technology Australia has found that the use of the 17 inch Navpixel NPD1744 Sunlight Readable Marine Display has proven to be the optimum due to the fact that it is slightly lower in weight, is sunlight readable, provides multiple video inputs (all selectable for full screen or picture-in-picture), is reliable and is commercially available at reasonable cost.

Conclusion

We very much hope that you've found this guide helpful.

Both of our systems are of course designed for moving imagery so it's hard to do them justice in this static medium. We would therefore encourage you to either visit one of our facilities for a more in-depth briefing or to invite us to yours to give a detailed presentation. We have many video examples of our work to date and we'd be happy to show them to you in full 1920 x 1080 HD.

Please don't hesitate to contact us if other questions have occurred to you while reading this guide.

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