(57) Abrégé/Abstract:
An imaging system wherein two field-of-views (FOVs) images of a scene are obtained and displayed as a single image so that both FOVs can be viewed simultaneously by an observer. This imagining system is particularly directed to infrared (IR) imaging of a scene which is useful for search-and-rescue (SAR) operations. One IR image sensor provides a low resolution, high sensitivity, wide field-of-view (WFOV) image of the scene which is displayed as a large, low resolution, WFOV image on a display apparatus. A second IR sensor provides a high resolution narrow field-of-view (NFOV) image of a selected portion of the scene wherein the second sensor's NFOV optics can be directed to any particular area within the WFOV. That smaller NFOV image is also displayed, by the display apparatus, within the WFOV displayed image and it is displayed at the same area in the
(57) Abrégé(suite)/Abstract(continued):
WFOV image as that actually covered by the NFOV, the NFOV image displacing the WFOV image of that area with the two images being fused together into a single image by the display apparatus. This is rather similar in operation to an observer's eye which has a high resolution central NFOV vision and a very large FOV peripheral vision that has low resolution but a high sensitivity to detection of any anomaly. By using an eye movement tracking system to aim the NFOV image detector and the position that the NFOV image is displayed, an observer's central vision can always be directed to the high resolution NFOV image with that observer's peripheral vision simultaneously viewing the WFOV low resolution image.
ABSTRACT

An imaging system wherein two field-of-views (FOVs) images of a scene are obtained and displayed as a single image so that both FOVs can be viewed simultaneously by an observer. This imagining system is particularly directed to infrared (IR) imaging of a scene which is useful for search-and-rescue (SAR) operations. One IR image sensor provides a low resolution, high sensitivity, wide field-of-view (WFOV) image of the scene which is displayed as a large, low resolution, WFOV image on a display apparatus. A second IR sensor provides a high resolution narrow field-of-view (NFOV) image of a selected portion of the scene wherein the second sensor's NFOV optics can be directed to any particular area within the WFOV. That smaller NFOV image is also displayed, by the display apparatus, within the WFOV displayed image and it is displayed at the same area in the WFOV image as that actually covered by the NFOV, the NFOV image displacing the WFOV image of that area with the two images being fused together into a single image by the display apparatus. This is rather similar in operation to an observer's eye which has a high resolution central NFOV vision and a very large FOV peripheral vision that has low resolution but a high sensitivity to detection of any anomaly. By using an eye movement tracking system to aim the NFOV image detector and the position that the NFOV image is displayed, an observer's central vision can always be directed to the high resolution NFOV image with that observer's peripheral vision simultaneously viewing the WFOV low resolution image.
FIELD OF THE INVENTION

The present invention relates to an imaging system and in particular to an infrared imaging system having two field-of-views (FOVs) displayed as a single image, one FOV being a wide field-of-view (WFOV) infrared (IR) image having a low resolution and the other FOV being a narrow field-of-view (NFOV) high resolution infrared (IR) image which is displayed within the WFOV image at the same area in the WFOV image as that covered by the NFOV, the NFOV image replacing the WFOV image at that area with the two FOV images being fused together in the displayed image.

BACKGROUND TO THE INVENTION

In Search and Rescue (SAR) operations, a search is normally performed visually from airplanes or helicopters. However, that type of visual search is commonly interrupted at night or when adverse weather conditions exist. The capability of SAR operations at night or during adverse weather conditions can be made more practical and greatly improved by the use of special equipment such as infrared (IR) or thermal imagers. However, the performance of existing systems is limited by the current technology that is presently in use. Current airborne IR systems, for instance Forward Looking Infrared (FLIR) systems, use a scanning mechanism which has to be compatible with a standard video format. These IR systems usually possess two fields-of-view (FOV) imagers, a wide FOV (WFOV) one for search and detection which has a low resolution and a narrow FOV
(NFOV) one with a high resolution which is used for recognition and/or identification. However, since the scanning mechanism for these IR systems must be compatible with the standard video format, these IR detector's dwell time (i.e. exposure time) is limited to a few microseconds. This fixed integration time combined with the lower resolution of the WFOV mode reduces the system sensitivity which leads to a decreased detection probability and detection range. The NFOV mode inherently performs better than the WFOV for detection but only if it is looking in the right direction. Since the NFOV only covers a small search area, its use increases the search time required to cover the same area as that provided by a WFOV whereas the use of a low resolution WFOV imaging system decreases the probability of detection.

New IR detectors or sensors, which are now available, can solve the inherent problems associated with scanning mechanism used in current IR systems. These recently developed sensors are known as Focal Plane Arrays (FPA) and allow for the simultaneous recording of all the pixels forming the image of a scene over a period of time for one frame of the image, as in a photographic camera. This is in contrast to building up an image by the sequential scanning of a single or a combination of detectors across the scene since the integration time for each pixel in the scanning process is dependent on the scanning rate. These FPA sensors mode of operation dramatically increases the sensitivity of the IR imaging systems because of the increased
signal integration time for each pixel as compared to the integration time for scanning systems.

The optimization of SAR operations involves selecting search patterns for maximizing the search area with the minimum loss of detection probability. These search patterns are dependent on an aircraft speed and flight altitude which have to be determined from atmospheric conditions and the system's search FOV. Those are factors which determine the area that should be covered on each airplane pass. This optimization of SAR operations also involves the close relationship between the search pattern imposed onto the imaging system, so as to cover as wide an area as possible and reduce the search time, and the visual search process of the human observer on the type of display presenting the information from the imaging system. In any given SAR operation, different parameters must be optimized in order to ensure that the imaging and human observer interface in a manner to perform properly together. The parameters chosen are ones which minimize the search time and optimize the visual search process of the human observer, i.e. the information displayed to the observer must not be overloading.

A factor to be considered on interfacing a human observer with a display arrangement is that the human eye has basically two FOVs, a narrow central one and a large peripheral FOV. The human eye is provided with a narrow (~7%) central FOV with a high resolution along with a very large (~180°) peripheral FOV of low resolution but very high sensitivity, particularly in the dark. That high resolution narrow central
FOV is used to examine, recognize and identify objects. The peripheral, low resolution, FOV is used for the detection of any anomaly or new object coming into a scene since this peripheral vision is very sensitive to any movement that takes place in its FOV.

U.S. Patent 5,262,871 by Joseph Wilder et al recognized that the human eye is able to foveate, or focus its attention, on a region of interest in its field of view at a high resolution while absorbing information at low resolution in areas peripheral to that region and describes an image sensor with those properties that is useful in high speed processing of visual data for industrial tasks such as inspecting bottles which are passing a high speed filling line. In the image sensor described by Wilder et al, the device includes a means to randomly address individual pixels wherein relatively large groups of pixels can be read out simultaneously to provide high speed data capture although at a lower resolution. This reduces the amount of data that has to be processed in an inspection task and is useful to rapidly scan a scene being viewed in order to locate an area of interest. The random addressing of pixels enables the readout of pixels located in selected regions of interest and, once an area of interest is located, the number of pixels read out at a time may be reduced to provide a higher resolution, lower speed, readout of the areas of interest. This image sensor array can be selectively operated so that selected portions can be read out with varying resolution levels.

Although U.S. Patent 5,262,871 recognizes and uses a sensor with
some features similar to an eye, its image sensor operates by selectively varying the readout rate for the various pixels or groups of pixels in order to obtain a selective resolution on particular regions.

**SUMMARY OF THE INVENTION**

It is an object of the present invention to optimize the close relationship between an imaging system and its interface with the visual search process of a human observer on a display which presents images of information from the imaging system to the observer.

An imaging system, according to one embodiment of the present invention, includes at least one imaging device to obtain a low resolution wide field-of-view (WFOV) image of a scene and means to simultaneously obtain a high resolution narrow field-of-view (NFOV) image of a selected portion of the scene wherein that selected portion can be selectively directed to any area within the WFOV, the system including an image display arrangement with a means to display the low resolution WFOV image, a means to display the high resolution NFOV image within the WFOV displayed image at the same area in the WFOV image as that covered by the NFOV and a means to blank out that portion of the WFOV displayed image in which the NFOV image is present with the two images being fused together in a single image by the display apparatus.

An imaging system, according to a further embodiment of the invention, wherein the imaging device to obtain the WFOV
image is a camera with a low resolution, high sensitivity, infrared (IR) image sensor and the means to simultaneously obtain a high resolution NFOV image is a second, high resolution, IR image camera with optics that can be directed towards said selected portion by servo-mechanisms.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention will now be described in more detail with reference to the accompanying drawings, in which:

Figure 1 illustrates the operation of an imaging system according to the present invention having a narrow field-of-view detector covering a smaller area of a scene which is being viewed by a wide field-of-view detector;

Figure 2 is a perspective view of a narrow field-of-view imaging device that could be used in Figure 1 in accordance with one embodiment of the present invention and a steering mechanism for the device;

Figure 3 is a schematic diagram, parts being in cross-section, of a top view of the narrow field-of-view image device shown in Figure 2; and

Figure 4 illustrates an image viewing apparatus according to one embodiment of the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

The optimization of the search process aboard an aircraft is an aspect of any Search and Rescue (SAR) operation that is required in order to save effort and reduce the search
time. Different parameters must, therefore, be optimized to ensure that the search imaging system and the human observer will operate together in an integrated manner. This involves the optimization of the close relationship between the search pattern imposed onto the imaging system in order to cover as wide an area as possible and the visual search process of the human observer on the display presenting the information from the imaging system. The aircraft's speed and flight altitude, which depend on atmospheric conditions, the imaging system search FOV and the area to be covered in each airplane pass are factors which all have to be considered in the optimization of search patterns to maximize the search area with a minimum loss of detection probability.

In the visual search process of the human observer, a factor that should be considered is that the human eye has essentially two fields-of-view (FOV), a narrow central FOV and a very large peripheral FOV. The central FOV covers an angle of about 7° and has a high resolution which is used to examine, recognize and identify objects whereas the peripheral vision FOV extends ~180°, but has a low resolution. However, the very large peripheral vision FOV, although having a low resolution, has a very high sensitivity (particularly in the dark) for the detection of any anomaly or new object coming into the scene since it is very sensitive to any movement which occurs.

Figure 1 illustrates the basic operation of an imaging system according to the present invention wherein scene 100 represents a wide area of search and 200 is a small narrow
region of interest inside of 100. The image of scene 100 is obtained by an infrared (IR) image sensor 1 (3 to 5 µm or 8 to 12 µm operating wavelength) and optical lens 2 but at a low resolution in order to cover this wide field-of-view (WFOV). That low resolution image sensor's data is then processed and presented to a display such as illustrated in Figure 4 where it can be observed by an operator. The IR WFOV imaging device has a field-of-view (FOV) of 60° or more with low resolution but high sensitivity achieved by an operator controlled integration or staring time for the IR focal plane array (FPA) sensor 1. That staring time could be up to 1 second if compensation is provided for platform movement. Image processing algorithms can be implemented to improve the detection of movements in the WFOV.

The image of the narrow field-of-view (NFOV) area 200 of the scene is obtained by an IR FPA image sensor 10 and optical imaging device 12. This NFOV covers a much smaller area (e.g. about 8°) with a high resolution using currently available IR FPA of 256 x 256 detectors. That high (enhanced) resolution can be obtained with the implementation of known techniques, to the sensor, such as a microscanning technique to increase the number of samples within the image and cover the gaps between the detectors. One microscanning technique is described in a paper entitled "Sampling effects in CdHgTe focal plane arrays-practical results" by R.J. Dann et al which was published in SPIE, Vol. 685, Infrared Technology XII (1986) on pages 123 to 127. That microscanning technique will be described in more
detail later and is generally illustrated in Figure 1 by the arrows Mx and My. Other techniques to increase image resolution could be used such as a dithering motion of an image sensor as described in U.S. Patent 5,301,042 which issued to D.L. Blanding on 5 April, 1994.

The NFOV is displaceable within and moveable over the entire large search WFOV area under control of an operator through rotation (steering) of NFOV reflecting mirror 14 about two axis shown by arrows Rx and Ry. The steering mirror 14 reflects an image of a portion 200 of the WFOV search area 100 in Figure 1 to the high resolution NFOV image sensor 10. The NFOV image sensor 10 can, as a result of rotation of mirror 14, obtain a NFOV image of any particular portion 200 of the scene 100 simultaneously with a WFOV image of scene 100 being obtained by the WFOV low resolution image sensor 1. The portion of the scene 100 towards which the NFOV image sensor is directed is under the control of an operator either through a joystick, via servomechanisms, or through coupling the control of the steering mechanism to the observer's eye movements when viewing the displayed images by means of an eye motion tracking system. The latter technique is preferred since displacement of the NFOV must be done at a speed adequate to match eye movements in order to minimize discomfort to the observer. The WFOV and NFOV images are obtained simultaneously and presented to the same display screen with the NFOV image displacing the same portion of the scene in the WFOV image as that observed by the NFOV.

The NFOV and WFOV images are fused together on the same display,
thus constantly keeping the large low resolution WFOV image of a search area within the eyesight of an observer while the observer may use the high resolution NFOV to view details of an area of interest in the WFOV once a detection, such as motion, has been observed. A system for displaying a NFOV and WFOV to an observer simultaneously is illustrated in Figure 4. A perspective view of a NFOV imaging system, i.e. camera, and steering mechanism, according to one preferred embodiment of the invention, is illustrated in Figure 2 with a top schematic view of the NFOV opto-mechanical layout and lens system being shown in Figure 3. The NFOV optical view 200' is reflected by a steering mirror 14, rotatable about two axis x and y, through a lens L1 to a 45° - folding mirror M2 having central aperture 16. The two-axis steering mirror 14 allows IR radiation from any NFOV portion (about 8°) of the WFOV scene to enter the NFOV optical system from anywhere within the WFOV of a search scene. The use of a single steering mirror for a two axis positioning reduces the number of optical components at the costs of image rotation around the elevation axis x which is parallel to the optical axis. This image rotation necessitates the use of an image-derotator M1 which can be a simple 90° roof mirror that is rotatable about an axis 15 in directions shown by arrows Rₜ. The folding mirror M2 with aperture 16 reflects the image to the image-derotator and is necessary since the use of a mirror image-derotator M1 sends optical IR rays back along the optical axis. These reflected rays, from the image-derotator, are directed through aperture 16 of mirror M2 where they are focused
by lenses L2 and L3 onto the detector’s input lens L4 for the image sensor. The main imaging optics is constituted by an afocal telescope formed by lenses L1, L2, L3 and the detector’s input lens L4. This telescope arrangement allows for adjustment of the NFOV through the interchange of one of the lenses L1 or L3 without modifying the detector’s input lens L4 which, in this embodiment, is fixed to a microscanning mechanism.

A two-mirror steering system could be designed which would not produce any image rotation such as that caused by the use of a single steering mirror 14 with two axis positioning. However, a two mirror system would require an intermediate field lens in order to reduce the size of one of the mirrors because of the wide angle coverage. This would increase the number of refractive surfaces as well as making the optical system larger and more cumbersome. Other types of steering mechanism could be used such as counter-rotating prisms or split cubes. However, these types have less desirable chromatic characteristics and their costs of fabrication are generally higher. Other types of mirror image-derotator, i.e. refractive types of derotators, could be used rather than a roof-mirror M1. However, a simple 90° roof mirror image-derotator is preferred in the sense that this type represents only two reflecting surfaces, can be made of large aperture at low costs, possesses a large angular coverage and does not introduce any chromatic aberration into the optical system.

The lenses L1, L2 and L3 direct the NFOV rays from steering mirror 14 and image derotator M1 to the input lens L4.
for the NFOV IR image sensor. The input lens L4 is fixed to a microscanning mechanism, which is used to increase the resolution of the sensor, and has a focal length compatible with the distance between the dewar window 60 and the actual detector array (10' in Figure 3) position within the dewar. L2 is a field lens to keep L3 and L4 within reasonable dimensions and above all to position the optical exit aperture at the entrance aperture of the detector cold shield to avoid vignetting.

A microscanning arrangement is used to increase the resolution of the high resolution NFOV IR image sensor which is accomplished by allowing multiple images to be formed on a mosaic of the image sensors detector elements with a small displacement being created between each of the images. In microscanning arrangements, an image scene is displaced by some fraction of a pixel pitch on the detector array for each field. This displacement of the image with respect to the array may be done by small movements of either the lens that focuses the image on the image sensor or by small movements of the image sensor. If a 2 x 2 microscan is applied, for instance, the first field records the image at a first reference position on the pixel array. The image is then displaced, with respect to the array, by half a pixel pitch to the right to record a second image and then a half a pixel pitch vertically to record a third image. In this 2 x 2 microscan, the image is next displaced by half a pixel pitch to the left in order to record a fourth image and then half a pixel pitch vertically to return the image to its original, first reference, position. These four microscan
images are then merged together as interlaced fields to form a regular full frame image containing the four fields. In a similar manner, the image could be displaced by one third of a pixel pitch for each step to implement a 3 x 3 microscan or one fourth of a pixel pitch for a 4 x 4 microscan. These microscan patterns have been described in the previously mentioned paper by R.J. Dann et al wherein a single plane mirror actuated by piezo-ceramic transducers was used for image displacement.

An opto-mechanical component, according to one embodiment of the present invention, establishes a two-axis microscanning of the image over the NFOV detector array using an appropriate holder and precision sliding of the lens L4 (see arrows Mx and My in Figures 1 and 2) with piezoelectric elements being used for micro-positioning the lens. The holder and opto-mechanical mechanism preferably have a step rate requirement for positioning the lens at 240 Hz with a rest time of >3ms between steps.

An image display arrangement, according to one embodiment of the invention, for displaying and fusing together a NFOV image and a WFOV image into a single image by a display device so that both images can be viewed simultaneously, by an observer, is illustrated in Figure 4.

The low resolution WFOV image signals are electronically processed in a signal processor 20 with its WFOV signal output being directed, along transmission line 22, to a WFOV image projector 25 as shown in Figure 4. In that WFOV image projector 25, a projection light source 31 is directed
towards a liquid crystal display (LCD) screen 30, to which the WFOV processed image signals are applied, and projects a WFOV image from LCD screen 30 through a lens 40 onto a diffuser screen 60. That WFOV, low resolution, image projected onto screen 60 can then be viewed by an observer 50 through a bi-ocular lens 46. A bi-ocular lens is one in which both eyes of an observer looks through the same large lens and these are used, for example, in night vision goggles or driver’s periscopes. The low resolution WFOV image on screen 60 will, to the observer, appear through the bi-ocular lens 46 as a virtual image in the plane 110. A circle 112 in the WFOV image projected onto screen 60 will, therefore, appear as an enlarged circle 112' in the virtual image plane 110.

The high resolution NFOV image signals are electronically processed in signal processor 20 with its NFOV signal output being directed, along transmission line 21, to the NFOV image projector 24. In that NFOV projector 24, a projection light source 33 is directed to a high resolution LCD screen 32 (1024 x 1024 pixels required for a 4 x 4 microscan with a 256 x 256 IR FPA), to which the high resolution processed NFOV image signals are applied. Light source 33 projects a high resolution NFOV image from LCD screen 32 through an image-derotator 34 and lens 42 to a steering mirror 44. The steering mirror 44 is rotatable about two axis, shown by arrow R_x and R_y, by servomechanisms under control of signals from the signal processor transmitted to the NFOV projector 24 via transmission line 21'. The mirror 44 reflects and directs the NFOV projected
image onto a selected portion 210 of the screen 60. That NFOV image 210 can then be viewed, by the observer 50, through the bi-ocular lens 46 as a NFOV virtual image 210' in the virtual image plane 110. That virtual image 210' will appear, to the observer, as a NFOV image inside of the observed WFOV image with the signal processor blanking out the portion of the WFOV image in which the NFOV image appears. The signal processor 20 can rotate steering mirror 44, under control of observer 50, to project the NFOV image 210 onto any portion of the screen 60.

The use of a single steering mirror 44 will cause image rotation which is counteracted, in this case, by an image-derotator 34 formed by rotating prisms 34 that are rotatable in the directions of arrows R, under control of the signal processor 20. Various types of image-derotators could be used, as previously mentioned in the description of the NFOV image camera, including electronic modifications of the NFOV image signals applied to LCD 32. The image-derotator 34 and steering mirror 44 will be located outside of the WFOV projection beam's path. The LCD screens and projection lamps in the WFOV and NFOV projections illustrate one type of system but projection cathode ray tubes (CRTs) could be used instead.

Although a joystick has been mentioned as one means for positioning the NFOV image, the use of an eye motion tracking system 26 with LEDs and detectors 28, as illustrated in Figure 4, is preferred since it frees the observer 50 from the need to manually position the NFOV image. Signals from the eye motion tracking system 26 are applied, by transmission line 23, to the
signal processor 20 which then positions the steering mirror 44 and image-derotator 34 to project a NFOV image onto a selected portion of screen 60 in accordance with those signals. The signal processor 20 will also, at the same time, direct the optics (steering mirror 14) of the NFOV image camera to that selected portion of the WFOV scene. The eye motion tracking system 26 will, as a result, allow the position of the NFOV image, as seen by observer 50, to be moved synchronously with any movements of the observer’s eyes so that the observer’s central, high resolution, vision is always directed to the NFOV displayed image while the observer’s peripheral vision is simultaneously viewing the low resolution WFOV image.

Various modifications may be made to the preferred embodiments without departing from the spirit and scope of the invention as defined in the appended claims. Imaging systems, for instance, such as a helmet mounted display could be used wherein the IR WFOV image detector and display is coupled to the observer’s head movements and the high resolution IR NFOV image detector and display is coupled to the observer’s eye movements. Although, the invention has been described with respect to IR imaging for an SAR operation, the same principle could be used for other purposes in which it is necessary to view an image such as in ultrasonic examination or inspection systems.
THE EMBODIMENTS OF THE INVENTION IN WHICH AN EXCLUSIVE PROPERTY OR PRIVILEGE IS CLAIMED ARE DEFINED AS FOLLOWS:

1. An imaging system comprising at least one imaging device to obtain a low resolution wide field-of-view (WFOV) image of a scene and means to simultaneously obtain a high resolution narrow field-of-view (NFOV) image of a selected portion of the scene wherein that selected portion can be selectively directed to any area within the WFOV, the system including an image display arrangement with a means to display the low resolution WFOV image, a means to display the high resolution NFOV image within the WFOV displayed image at the same area in the WFOV image as that covered by the NFOV and a means to blank out that portion of the WFOV displayed image in which the NFOV image is present with the two images being fused together in a single image by the display apparatus.

2. An imaging system as defined in Claim 1, wherein said imaging device to obtain the WFOV image is a camera with a low resolution, high sensitivity, infrared (IR) image sensor and the means to simultaneously obtain a high resolution NFOV image is a second, high resolution, IR image camera with optics that can be directed towards said selected portion by first servo-mechanisms.
3. An imaging system as defined in Claim 2, wherein the NFOV displayed image position in the WFOV displayed image is controlled by movements of the high resolution display’s position under the control of second servomechanisms, control of the first and second servomechanisms being slaved to an eye motion tracking system with the first and second servomechanisms movements being synchronized.

4. An imaging system as defined in Claim 2, wherein the NFOV displayed image position in the WFOV displayed image is controlled by movements of the high resolution display’s position under the control of second servomechanisms, a joystick controlling the first and second servomechanisms whose movements are synchronized.

5. An imaging system as defined in Claim 2, wherein optics associated with said second, high resolution, IR image camera contain a steering mirror to direct an image from said selected portion to a second IR image sensor, the steering mirror’s position being determined by said first servomechanisms.

6. An imaging system as defined in Claim 5, wherein the steering mirror directs a NFOV image from said selected portion through a lens to a 45° folding mirror having a central aperture, the folding mirror reflecting the NFOV image to an image-derotator which reflects the NFOV image back through said aperture and through further lenses to an input lens for said second IR image sensor.
7. An imaging system as defined in Claim 6, wherein said input lens is fixed to a microscanning mechanism that can displace the NFOV image by a fraction of a pixel pitch with respect to the second IR image sensor.

8. An imaging system as defined in Claim 6, wherein the image-derotator is a 90° roof mirror image-derotator.

9. An image system as defined in Claim 8, wherein the input lens is fixed to a microscanning mechanism that can displace the NFOV image by a fraction of a pixel pitch with respect to the second IR Image sensor.

10. An imaging system as defined in Claim 6, wherein the NFOV displayed image position in the WFOV displayed image is controlled by movements of the high resolution NFOV display's position under the control of second servomechanisms, control of the first and second servomechanisms being slaved to an eye motion tracking system with the first and second servomechanisms movements being synchronized.

11. An imaging system as defined in Claim 1, wherein the image display arrangement comprises a signal processor for electronic processing of WFOV signals from said one imaging device and further NFOV signals from the means to simultaneously obtain a high resolution NFOV image; processed WFOV signals from said signal processor being directed to a WFOV image projector having a first lens that projects a WFOV image onto a viewing
screen, processed NFOV signals from said signal processor being directed to a high resolution NFOV image projector having a second lens that projects a NFOV image to a steering mirror that is rotatable about two axis by servomechanisms which are controlled by signals from said signal processor, the steering mirror reflecting the NFOV projected image onto a selected portion of said viewing screen where both images can be viewed simultaneously, the NFOV projected image's position being applied to said signal processor which blanks out a portion of the WFOV projected image that corresponds with the area covered by the NFOV projected image on the viewing screen.

12. An imaging system as defined in Claim 11, wherein an image-derotator is located between the NFOV image display projector and said second lens in the NFOV image projector, the NFOV projected image being directed to the image-derotator and from the image-derotator to said second lens, the image-derotator being controlled by said signal processor from signals of said NFOV projected image’s position.

13. An imaging system as defined in Claim 12, wherein the WFOV image projector comprises a low resolution liquid crystal display (LCD) screen to which the processed WFOV signals are applied and a first projection light source directed to that LCD screen to project a WFOV image from the low resolution screen to said first lens and the NFOV image projector comprises a high resolution LCD screen to which the processed NFOV signals are applied and a second projection light source directed to the
high resolution LCD screen to project a NFOV image from that screen to said second lens.

14. An imaging system as defined in Claim 13, wherein an eye motion tracking system is directed to an observer of said viewing screen and signals from said eye motion tracking system are applied to said signal processor which controls, in accordance with those signals, the servomechanisms that position the NFOV image projector's steering mirror such that the projected NFOV image's position on said viewing screen is located at an area towards which the observer's eye are directed, the signal processor simultaneously directing the means to obtain a NFOV image to a selected portion of the scene which corresponds to that of the NFOV projected image area in the WFOV projected image on the viewing screen.

15. An imaging system as defined in Claim 2, wherein the image display arrangement comprises a signal processor for electronic processing of WFOV signals from said one imaging device and further NFOV signals from the means to simultaneously obtain a high resolution NFOV image; processed WFOV signals from said signal processor being directed to a WFOV image projector having a first lens that projects a WFOV image onto a viewing screen, processed NFOV signals from said signal processor being directed to a high resolution NFOV image projector having a second lens that projects a NFOV image to a steering mirror that is rotatable about two axis by servomechanisms which are controlled by signals from said signal processor, the steering
mirror reflecting the NFOV projected image onto a selected portion of said viewing screen where both images can be viewed simultaneously, the NFOV projected image’s position being applied to said signal processor which blanks out a portion of the WFOV projected image that corresponds with the area covered by the NFOV projected image on the viewing screen.

16. An imaging system as defined in Claim 15 wherein an image-derotator is located between the NFOV image display projector and said second lens in the NFOV image projector, the NFOV projected image being directed to the image-derotator and from the image-derotator to said second lens, the image-derotator being controlled by said signal processor from signals of said NFOV projected image’s position.

17. An imaging system as defined in Claim 16, wherein the WFOV image projector comprises a low resolution liquid crystal display (LCD) screen to which the processed WFOV signals are applied and a first projection light source directed to that LCD screen to project a WFOV image from the low resolution screen to said first lens and the NFOV image projector comprises a high resolution LCD screen to which the processed NFOV signals are applied and a second projection light source directed to the high resolution LCD screen to project a NFOV image from that screen to said second lens.

18. An imaging system as defined in Claim 17, wherein a eye motion tracking system is directed to an observer of said
viewing screen and signals from said eye motion tracking system are applied to said signal processor which controls, in accordance with those signals, the servomechanism that position the NFOV image projector's steering mirror such that the projected NFOV image's position on said viewing screen is located at an area towards which the observer's eye are directed, the signal processor simultaneously directing the second, high resolution, IR image camera's optics to a selected portion of the scene which corresponds to that of the NFOV projected image area in the WFOV projected image on the viewing screen.

19. An imaging system as defined in Claim 3, wherein the image display arrangement comprises a signal processor for electronic processing of WFOV signals from said one imaging device and further NFOV signals from the means to simultaneously obtain a high resolution NFOV image; processed WFOV signals from said signal processor being directed to a WFOV image projector having a first lens that projects a WFOV image onto a viewing screen, processed NFOV signals from said signal processor being directed to a high resolution NFOV image projector having a second lens that projects a NFOV image to a steering mirror that is rotatable about the axis by servomechanisms which are controlled by signals from said signal processor, the steering mirror reflecting the NFOV projected image onto a selected portion of said viewing screen where both images can be viewed simultaneously, the NFOV projected image's position being applied to said signal processor which blanks out a portion of
the WFOV projected image that corresponds with the area covered by the NFOV projected image on the viewing screen.

20. An imaging system as defined in Claim 19, wherein an image-derotator is located between the NFOV image projector and said second lens, the NFOV projected image being directed to the image-derotator and from the image-derotator to said second lens, the image-derotator being controlled by said signal processor from signals of said NFOV projected image's position.