field of view on to an infrared focal plane array. In a projectile detection mode, the system searches for the infrared signature of the fast moving projectile. The telescope's field of view is steered in the azimuth by a step and stare mirror, and when a projectile is detected the system switches to a tracking mode and the mirror is steered to track the projectile. A short pulse high repetition rate laser in a laser radar system provides a pulsed laser beam which is optically coaligned with the telescope axis. Mirror angular position information, laser radar pulse travel time and the missile spot position on detector array are used by a computer to calculate bullet trajectory information and to determine the source or origin of the projectile using known ballistic trajectory methods.

SUMMARY OF THE INVENTION

According to a first aspect, there is provided an apparatus for at least one of sensing and emitting energy along an apparatus line of sight (LOS) with respect to said apparatus, comprising: at least two sensing/emitting units, each said unit adapted for at least one of sensing and emitting energy along a respective unit line of sight (ULOS); each sensing/emitting unit having an operative state, wherein the respective ULOS is pointed along said LOS for at least one of sensing and emitting energy, and a corresponding inoperative state, where the ULOS is pointed along a direction different from said LOS; a switching mechanism for switching between said units to selectively bring a desired unit exclusively into its respective operative state while concurrently bringing a remainder of said units each to a respective non-operative state; wherein a first said sensing/emitting unit is configured for at least one of sensing and emitting energy when an operational parameter associated with operation of said device is greater than an operational threshold and wherein a second said sensing/emitting unit is configured for at least one of sensing and emitting energy when said operational parameter is at or less than said operational threshold.

According to a second aspect, there is provided a method for at least one of sensing and emitting energy along an apparatus line of sight (LOS) with respect to a target, comprising: selectively aligning a unit line of sight (ULOS) of a first sensing/emitting unit with said LOS when an operational parameter is greater than an operational threshold; one of sensing and emitting energy along said LOS with said first sensing/emitting unit; switching to aligning a ULOS of a second sensing/emitting unit

along said LOS, when said operational parameter is at or less than said operational threshold; and one of sensing and emitting energy continuously along said LOS with said second sensing/emitting unit; wherein said first sensing/emitting unit and said second sensing/emitting unit are mechanically coupled.

According to a third aspect, there is provided an apparatus for at least one of sensing and emitting energy concurrently along each of at least two different apparatus lines of sight (LOS) with respect to said apparatus, comprising: an assembly comprising at least two sensing/emitting units, each said sensing/emitting unit adapted for at least one of sensing and emitting energy along a respective sensing/emitting unit line of sight (ULOS) via a respective sensing/emitting unit aperture, wherein said sensing/emitting units are mechanically coupled; said assembly having a plurality of operative states, including at least a first operative state wherein at least two ULOS are pointed one each along a respective said LOS for at least one of sensing and emitting energy with respect thereto, and at least a second operative state wherein at least one said ULOS is pointed along a LOS different from the LOS in which it was pointing during said first operative state; a switching mechanism for switching between said units to selectively bring said assembly into a desired said operative state.

According to a fourth aspect, there is provided a method for at least one of sensing and emitting energy along an apparatus line of sight (LOS) with respect to a target, comprising: selectively aligning a unit line of sight (ULOS) of a first sensing/emitting unit with said LOS; one of sensing and emitting energy continuously along said LOS with said first sensing/emitting unit; and selectively switching to aligning a ULOS of a second sensing/emitting unit along said LOS and one of sensing and emitting energy continuously along said LOS with said second sensing/emitting unit; wherein said first sensing/emitting unit and said second sensing/emitting unit are mechanically coupled.

According to at least some ~~aspects~~embodiments of the invention, an apparatus is provided for at least one of sensing and emitting energy along at least one desired apparatus line of sight (LOS) with respect to said apparatus.

According to ~~a first aspect~~an embodiment of the invention, an apparatus is provided for at least one of sensing and emitting energy along a desired apparatus line of sight (LOS) with respect to said apparatus, comprising:

an assembly rotatably mounted on a base with respect to a switching axis, said assembly comprising at least two sensing/emitting units, each said sensing/emitting unit adapted for at least one of sensing and emitting energy along a respective sensing/emitting unit line of sight (ULOS), each said sensing/emitting unit having an operative state, wherein the respective unit ULOS is pointed along said apparatus LOS for at least one of sensing and emitting energy along said LOS, and a corresponding inoperative state, where the respective unit ULOS is pointed along a direction different from said apparatus LOS;

a switching mechanism for rotatably switching between said sensing/emitting units with respect to said switching axis to selectively bring a desired said sensing/emitting unit exclusively into its respective operative state while concurrently bringing a remainder of said sensing/emitting units each to a respective non-operative state,

said assembly being configured for being accommodated within a predefined envelope having a maximum dimensional constraint associated with the switching axis, wherein said sensing/emitting units are configured for being enclosed within

said envelope in a compact arrangement wherein said respective ULOS are arranged to each point in different directions one from another, and wherein at least one said sensing/emitting unit is configured to provide optimal operation with respect to said maximum width dimension in its operative state while substantially avoiding interference with operation of each one of a remainder of said sensing/emitting units when the latter is in its respective operative state.

In at least some embodiments, the ULOS are angularly displaced from one another, and the switching mechanism is configured for selectively rotating the assembly through a discrete angular displacement corresponding to the angular displacement between a sensing/emitting unit that is currently in its operative state and a sensing/emitting unit that it is desired to bring to its operative state.

According to ~~this and other aspects~~embodiments of the invention, the apparatus may be configured for providing one or more of surveillance, viewing, locating, sighting, detection, recognition, identification, tracking, targeting, marking, homing, tracking and imaging of a target, and provides corresponding data. For example, data may be provided pertaining to surveillance, for example detection data may be provided (for example range and azimuth/elevation of a detected target), recognition data (for example imaging data that enables a target to be recognized – for example a geometric profile, or a heat signature, and so on, that is particular to a type of target), identification data (for example data that enable a target to be identified (for example visual data such as identification markings, symbols and so on), tracking data (for example, position and trajectory of a moving target), targeting data (for example for use in fire control)example.

According to ~~at least the first aspect~~an embodiment of the invention, the operation of at least one sensing/emitting unit may be optimized such as to provide the best sensing and/or emission performance for the given dimensional constraint associated with the envelope in which the sensing/emitting units are each to be accommodated in the envelope for their full range of operations, with little or no adverse influence or interference regarding the operation of the other sensing/emitting units. In other words, at least one sensing/emitting unit may be configured for providing optimal performance, as may be possible given the particular dimensional constraints defined by the envelope, in a substantially similar manner to what the case would be with a corresponding apparatus that only comprises the respective sensing/emitting unit.

According to ~~this aspect~~an embodiment of the invention, the apparatus may optionally further comprise one or more of the following features, in any desired combination:

(A) The said maximum dimensional constraint comprises a maximum width dimension of the envelope (which is a geometrical envelope), located generally coaxial with said switching axis, i.e. parallel to the switching axis, and at or close to the switching axis. Additionally or alternatively, said maximum dimensional constraint comprises a maximum cross-sectional area of the envelope located on a plane generally aligned with said switching axis, and this plane may be generally orthogonal to the LOS, for example when the LOS is pointing in a particular direction – such a dimensional constraint may be of particular relevance when the apparatus is to be mounted to a standard size pod or the like, and/or when it is desired to maintain a particular frontal area for minimizing drag, for example.

(B) The said envelope may comprise a generally spherical volume, having a diameter thereof substantially coaxial with said switching axis, and having another diameter thereof substantially coaxial with said apparatus LOS.

(C) The aforesaid dimensional constraint may be a physical limitation relating to the size and/or shape of the apparatus, and may include one or more of a one dimensional (linear), two dimensional (area) or three dimensional (volume) constraint related to the apparatus. Given a particular base configuration for mounting the assembly thereonto, the aforesaid physical limitations translate to a corresponding space constraint for the assembly itself. For example, the size of the apparatus may need to be kept within a particular geometric envelope to allow compatibility and/or retrofitability with respect to a particular standard pod size, and/or with respect to a particular off the shelf pointing mechanism, for example, or for other airborne applications in which it is desired to minimize drag and thus maintain the cross-sectional normal to the airflow and external exposed area to a minimum. The dimensional constraint may comprise, for example a linear dimension of said apparatus taken in a plane substantially orthogonal to said LOS, such as for example a diameter of the housing that may accommodate the sensing/emitting units, such as to fit within a radome, fairing, or the like, for example, while allowing the assembly housing to be pointed in any direction within the radome or fairing, in the associated field of regard (FOR). A field of regard is

mechanism comprises a pan and tilt mechanism, or any other suitable gimbals system, and in any case suitable servo means may optionally be provided for directing the pan and tilt mechanism or gimbals. Additionally or alternatively, there may be provided an internal gimbals mechanism for locally varying the direction of the ULOS of the respective sensing/emitting unit that is in its operative state and is thus aligned along the apparatus LOS, to thus enable the apparatus LOS to be selectively pointed in any desired direction.

(Z) Each said sensing/emitting unit may be configured for providing data associated with at least one of surveillance, viewing, locating, sighting, detection, recognition, identification, targeting, marking, homing, tracking and imaging of a target.

According to ~~the first aspect~~an embodiment of the invention, a system is also provided for at least one of sensing and emitting energy along a desired line of sight (LOS) comprising said apparatus as defined above, and optionally comprising any combination of features (A) to (Z), and further comprising a controller for controlling operation of said apparatus.

According to ~~this aspect~~an embodiment of the invention, the apparatus may optionally further comprise one or more of the following features, in any desired combination:

(a) The said system may be further configured for selective switching from aligning a ULOS of one said sensing/emitting unit with said LOS to aligning a ULOS of another said sensing/emitting unit with said LOS according to predetermined criteria. For example, said switching may be manual switching. Additionally or alternatively, for example, the system may be configured for aligning a first said sensing/emitting unit to point its respective ULOS along said LOS when a distance between a desired target and said system along said LOS is greater than a first distance, and wherein said system is further configured for automatically switching to aligning the respective ULOS of a second said sensing/emitting unit with said LOS when said distance is not greater than said first distance. Additionally or alternatively, for example, switching may occur after the first sensing/emitting unit has detected the presence of a target, and the second sensing/emitting unit is in its operative state thereafter until, at least, the target comes into the range of the second sensing/emitting unit.

(g) For example, the system may be adapted for use in fighter aircraft or the like, for example, and may also be suitable for use in other airborne platforms, such as for example UAV's, cargo aircraft and so on.

According to ~~the first aspect~~an embodiment of the invention, the sensor/emitter units are enclosed in a restricted space or volume, referred to herein as an envelope or as a geometrical envelope, and are configured to maximize use of the volume, by angularly offsetting the individual unit LOS (ULOS) from one another with respect to the switching axis, and making use of the switching feature that mechanically brings the full aperture of each unit, exclusively, in line with the desired apparatus LOS. This enables the aperture of at least one of the units to be maximized while not overlapping or interfering with the aperture of the other units, and to thus optimize operation of the unit while not interfering with operation of the other unit(s).

In embodiments in which the apparatus comprises a pan and tilt mechanism, a spherical geometrical envelope is a useful feature associated with the feature of being able to have the assembly rotate about an axis normal to the switching axis (i.e., rotation about the pod axis, when the apparatus is mounted to a pod for example), to give it one of its degrees of freedom while a "gimbal" rotation about the switching axis provides the second degree of freedom. At the same time this envelope profile does not effectively change the frontal area of the apparatus to exceed that of the pod, which is also an aerodynamic feature.

According to ~~a second aspect~~an embodiment of the invention, an apparatus is provided for at least one of sensing and emitting energy along a desired discrete apparatus line of sight (LOS) with respect to said apparatus, comprising

at least two sensing/emitting units, each said sensing/emitting unit adapted for at least one of sensing and emitting energy along a respective unit line of sight (ULOS) via a respective sensing/emitting unit aperture, said sensing/emitting units being mechanically coupled;

each sensing/emitting unit having an operative state, wherein the respective ULOS is pointed continuously along said LOS for at least one of sensing and emitting energy, and a corresponding inoperative state, where the respective unit operating axis is pointed along a direction different from said LOS;

a switching mechanism for switching between said sensing/emitting units to selectively bring a desired sensing/emitting unit exclusively into its respective operative

state while concurrently bringing a remainder of said sensing/emitting units each to a respective non-operative state.

According to the ~~second aspect~~above embodiment of the invention, which thus provides a stop and stare capability for sensing and/or emitting energy along a desired apparatus LOS, at least one said sensing/emitting unit may also be configured for providing optimal operation with respect to a dimensional constraint of the apparatus and along said LOS independently of the other said sensing/emitting unit(s), and the sensing/emitting units may be comprised in an assembly, rotatable about a switching axis, substantially as disclosed above for the ~~first aspect~~above embodiment of the invention, *mutatis mutandis*.

Furthermore, the apparatus according to the ~~second aspect~~above embodiment of the invention may optionally further comprise one or more of the features (A) to (Z) disclosed above for the ~~first aspect~~above embodiment of the invention, *mutatis mutandis*, in any suitable combination.

According to the ~~second aspect~~above embodiment of the invention, a system is also provided for at least one of sensing and emitting energy along a desired line of sight (LOS) comprising said apparatus as defined above according to the ~~second aspect~~above embodiment of the invention, *mutatis mutandis*, and further comprises a controller for controlling operation of said apparatus, and may optionally further comprise one or more of the features (a) to (g) disclosed above for the system according to the ~~first aspect~~above embodiment of the invention, *mutatis mutandis*, in any suitable combination, as applied to the apparatus according to the ~~second aspect~~above embodiment of the invention, *mutatis mutandis*.

According to the ~~second aspect~~above embodiment of the invention, a method is also provided for at least one of sensing and emitting energy along an apparatus line of sight (LOS) with respect to a target, comprising selectively aligning a sensing/emitting unit line of sight (ULOS) of a first sensing/emitting unit with said LOS and one of sensing and emitting energy continuously along said LOS with said first sensing/emitting unit, and further comprising selectively switching to aligning a ULOS of a second sensing/emitting unit along said LOS and one of sensing and emitting energy continuously along said LOS with said second sensing/emitting unit, wherein said first sensing/emitting unit and said second sensing/emitting unit are mechanically coupled.

The method according to the ~~second aspect~~above embodiment of the invention may be carried out using the apparatus and/or system as disclosed herein according to the ~~second aspect~~above embodiment of the invention, and may comprise additional corresponding method steps.

According to the ~~second aspect~~above embodiment of the invention, the LOS of the apparatus may be pointed in one desired direction and kept there, and the particular sensing/emitting unit aligned with the LOS, as desired, enabling the apparatus to operate as a staring or tracking apparatus, for example. In embodiments comprising a pan and tilt mechanism, which are functionally and/or structurally different from the switching mechanism (in this and other ~~aspects~~embodiments of the invention), pan and tilt feature allows the LOS to be pointed in other directions, enabling the apparatus to operate as a surveillance apparatus, for example.

According to ~~a third aspect~~an embodiment of the invention, there is provided an apparatus for at least one of sensing and emitting energy along a desired apparatus line of sight (LOS) with respect to said apparatus, comprising:

at least two sensing/emitting units, each said unit adapted for at least one of sensing and emitting energy along a respective sensing/emitting unit line of sight (ULOS);

each sensing/emitting unit having an operative state, wherein the respective ULOS is pointed along said LOS for at least one of sensing and emitting energy, and a corresponding inoperative state, where the respective ULOS is pointed along a direction different from said LOS;

a switching mechanism for switching between said sensing/emitting units to selectively bring a desired said sensing/emitting unit exclusively into its respective operative state while bringing a remainder of said sensing/emitting units each to a respective non-operative state; and

wherein said apparatus is configured for selectively changing a direction of said LOS, during operation of the apparatus, with respect to at least two degrees of freedom when each one of said units is exclusively in its operative state, i.e., independently of which one of said units is exclusively in its operative state.

According to the ~~third aspect~~above embodiment of the invention, the direction of the LOS may be selectively changed with respect to at least two degrees of freedom when each one of said units is exclusively in its operative state and is operating to sense and/or emit energy along said LOS. Thus, operation of one or the other respective unit that is in its operative state can proceed while at the same time selectively changing the direction of the LOS in two or more degrees of freedom.

According to the ~~third aspect~~above embodiment of the invention, at least one said sensing/emitting unit may also be configured for providing optimal operation with respect to a dimensional constraint of the apparatus and along said LOS independently of the other said sensing/emitting unit(s), and the sensing/emitting units may be comprised in an assembly, rotatable about a switching axis, substantially as disclosed ~~above for the first aspect~~in the above embodiment of the invention, *mutatis mutandis*. Furthermore, the apparatus according to the ~~third aspect~~above embodiment of the invention may optionally further comprise one or more of the features (A) to (Z) disclosed above for the ~~first aspect~~above embodiment of the invention, *mutatis mutandis*, in any suitable combination.

According to the ~~third aspect~~above embodiment of the invention, a system is also provided for at least one of sensing and emitting energy along a desired line of sight (LOS) comprising said apparatus as defined above according to the ~~third aspect~~above embodiment of the invention, *mutatis mutandis*, and further comprises a controller for controlling operation of said apparatus, and may optionally further comprise one or more of the features (a) to (g) disclosed above for the system according to the ~~first aspect~~above embodiment of the invention, *mutatis mutandis*, in any suitable combination, as applied to the apparatus according to the ~~third aspect~~above embodiment of the invention, *mutatis mutandis*.

According to ~~a fourth aspect~~an embodiment of the invention, there is provided an apparatus for at least one of sensing and emitting energy along an apparatus line of sight (LOS) with respect to said apparatus, comprising

(I) at least two sensing/emitting units, each said unit adapted for at least one of sensing and emitting energy along a respective unit line of sight (ULOS);

(II) each sensing/emitting unit having an operative state, wherein the respective ULOS is pointed along said LOS for at least one of sensing and emitting energy, and a corresponding inoperative state, where the ULOS is pointed along a direction different from said LOS;

(III) a switching mechanism for switching between said units to selectively bring a desired unit exclusively into its respective operative state while concurrently bringing a remainder of said units each to a respective non-operative state;

(IV) wherein a first said sensing/emitting unit is configured for at least one of sensing and emitting energy when an operational parameter associated with operation of said device is greater than an operational threshold and wherein a second said

sensing/emitting unit is configured for at least one of sensing and emitting energy when said operational parameter is at or less than said operational threshold.

The following features may be provided. For example, the switching mechanism may be configured for automatically and/or reversibly switching between said units to bring said first unit or said second unit into its operative state, respectively, according to whether said operational parameter is greater than or not greater than said operational threshold. For example, the operational parameter includes a distance to said target, and wherein said operational threshold is a first distance. In another example, the operational parameter includes a visibility range along said LOS, and wherein said operational threshold is visibility correlated with adverse weather conditions; for example, the operational threshold may be zero visibility conditions.

Thus, in at least one variation, feature (IV) comprises:

wherein one said sensing/emitting unit is configured for at least one of sensing and emitting energy when a distance to said target greater than a first distance and wherein another said sensing/emitting unit is configured for at least one of sensing and emitting energy when said distance is at or less than said first distance.

In another variation, feature (IV) may be replaced with:

(V) wherein one said sensing/emitting unit is configured for at least one of sensing and emitting energy within a maximum first distance therefrom, and wherein another said sensing/emitting unit is configured for at least one of sensing and emitting energy within a maximum second distance therefrom, said first distance being significantly greater than said second distance.

According to the ~~fourth aspect~~above embodiment of the invention, at least one said sensing/emitting unit may also be configured for providing optimal operation with respect to a dimensional constraint of the apparatus and along said LOS independently of the other said sensing/emitting unit(s), and the sensing/emitting units may be comprised in an assembly, rotatable about a switching axis, substantially as disclosed above for the ~~first aspect~~above embodiment of the invention, *mutatis mutandis*. The sensing/emitting units are also mechanically coupled, and each said unit is adapted for at least one of sensing and emitting energy along a respective unit line of sight (ULOS) via a respective sensing/emitting unit aperture.

Furthermore, the apparatus according to the ~~fourth aspect~~above embodiment of the invention may optionally further comprise one or more of the features (A) to (Z) disclosed above for the ~~first aspect~~above embodiment of the invention, *mutatis mutandis*, in any suitable combination.

According to the ~~fourth aspect~~above embodiment of the invention, a system is also provided for at least one of sensing and emitting energy along a desired line of sight (LOS) comprising said apparatus as defined above according to the ~~second aspect~~above embodiment of the invention, *mutatis mutandis*, and further comprises a controller for controlling operation of said apparatus, and may optionally further comprise one or more of the features (a) to (g) disclosed above for the system according to the ~~first aspect~~above embodiment of the invention, *mutatis mutandis*, in any suitable combination, as applied to the apparatus according to the ~~fourth aspect~~above embodiment of the invention, *mutatis mutandis*.

According to the ~~fourth aspect~~above embodiment of the invention, a method is also provided for at least one of sensing and emitting energy along an apparatus line of sight (LOS) with respect to a target, comprising selectively aligning a unit line of sight (ULOS) of a first sensing/emitting unit with said LOS when a distance to said target greater than a first distance (also referred to as a threshold distance), and one of sensing and emitting energy along said LOS with said first sensing/emitting unit, and further comprising switching to aligning a ULOS of a second sensing/emitting unit along said LOS, when said distance is at or less than said first distance, and one of sensing and emitting energy continuously along said LOS with said second sensing/emitting unit, wherein said first sensing/emitting unit and said second sensing/emitting unit are mechanically coupled. The method may further comprise features parallel to those disclosed above for the apparatus according to the ~~fourth aspect~~above embodiment of the invention *mutatis mutandis*.

The method according to the ~~fourth aspect~~above embodiment of the invention may be carried out using the apparatus and/or system as disclosed herein according to the ~~fourth aspect~~above embodiment of the invention, and may comprise additional corresponding method steps.

According to ~~a fifth aspect~~an embodiment of the invention there is provided an apparatus for at least one of sensing and emitting energy concurrently along each of at least two different apparatus lines of sight (LOS) with respect to said apparatus, comprising:

an assembly comprising at least two sensing/emitting units, each said sensing/emitting unit adapted for at least one of sensing and emitting energy along a respective sensing/emitting unit line of sight (ULOS) via a respective sensing/emitting unit aperture, wherein said sensing/emitting units are mechanically coupled;

said assembly having a plurality of operative states, including at least a first operative state wherein at least two ULOS are pointed one each along a respective said LOS for at least one of sensing and emitting energy with respect thereto, and at least a second operative state wherein at least one said ULOS is pointed along a LOS different from the LOS in which it was pointing during said first operative state;

a switching mechanism for switching between said units to selectively bring said assembly into a desired said operative state.

According to the ~~fifth aspect~~above embodiment of the invention, at least one said sensing/emitting unit may also be configured for providing optimal operation with respect to a dimensional constraint of the apparatus and along each said apparatus LOS independently of the other said sensing/emitting unit(s), and the sensing/emitting units may be comprised in an assembly, rotatable about a switching axis, substantially as disclosed above for the ~~first aspect~~above embodiment of the invention, *mutatis mutandis*. Furthermore, the apparatus according to the ~~fifth aspect~~above embodiment of the invention may optionally further comprise one or more of the features (A) to (Z) disclosed above for the ~~first aspect~~above embodiment of the invention, *mutatis mutandis*, as appropriate, in any suitable combination.

According to the ~~fifth aspect~~above embodiment of the invention, a system is also provided for at least one of sensing and emitting energy along at least two desired lines of sight (LOS) comprising said apparatus as defined above according to the ~~fifth aspect~~above embodiment of the invention, *mutatis mutandis*, and further comprises a controller for controlling operation of said apparatus, and may optionally further comprise one or more of the features (a) to (g) disclosed above for the system according to the ~~first aspect~~above embodiment of the invention, *mutatis mutandis*, as appropriate in any suitable combination, as applied to the apparatus according to the ~~fifth aspect~~above embodiment of the invention, *mutatis mutandis*.

According to the above or other ~~aspects~~embodiments of the invention, a number of apparatuses are provided, for sensing and/or emitting energy along one or more desired apparatus line of sights (LOS) with respect to the respective apparatus. In at least one embodiment, the apparatus includes an assembly that is rotatably mounted on a base with respect to a switching axis. The assembly has two or more sensing/emitting units, each having a respective sensing/emitting unit line of sight (ULOS). Each sensing/emitting unit has an operative state, wherein the respective unit ULOS is pointed along a LOS of the apparatus for sensing and/or emitting energy along the LOS, and a corresponding inoperative state, where the respective unit ULOS is pointed along

a direction different from this LOS. A switching mechanism enables switching between the sensing/emitting units to selectively bring a desired sensing/emitting unit exclusively into its respective operative state while concurrently bringing a remainder of the sensing/emitting units each to a respective non-operative state. Corresponding systems and methods are also provided.

Features of the invention disclosed above for one or more said ~~aspects~~embodiments of the invention may also apply, *mutatis mutandis*, to one or more other ~~aspects~~embodiments of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

In order to understand the invention and to see how it may be carried out in practice, embodiments will now be described, by way of non-limiting example only, with reference to the accompanying drawings, in which:

Fig. 1 is an isometric see-through view of a first embodiment of the apparatus of the invention, in which one sensing/emitting unit is aligned with a desired system line of sight.

Fig. 2 is an isometric see-through view of the embodiment of Fig. 1, in which another sensing/emitting unit is aligned with a desired system line of sight.

Fig. 3 is a side view of the embodiment of Fig. 1, in an application wherein the apparatus is comprised mounted to a pod.

Fig. 4 is a side view of the embodiment of Fig. 1, in an application wherein the apparatus is comprised mounted directly to a vehicle.

Fig. 5 is a front cross-sectional view of the embodiment of Fig. 1 taken along Q-Q.

Fig. 6 is an isometric view of a variation of the embodiment of Fig. 1, in which one sensing/emitting unit is aligned with a desired system line of sight.

Fig. 7 is an isometric view of the embodiment of Fig. 6, in which another sensing/emitting unit is aligned with a desired system line of sight.

Fig. 8 is an isometric view of the embodiment of Fig. 6, in which a set of three sensing/emitting units are aligned with three respective desired system lines of sight.

CLAIMS:

1. Apparatus for at least one of sensing and emitting energy along an apparatus line of sight (LOS) with respect to said apparatus, comprising

at least two sensing/emitting units, each said unit adapted for at least one of sensing and emitting energy along a respective unit line of sight (ULOS);

each sensing/emitting unit having an operative state, wherein the respective ULOS is pointed along said LOS for at least one of sensing and emitting energy, and a corresponding inoperative state, where the ULOS is pointed along a direction different from said LOS;

a switching mechanism for switching between said units to selectively bring a desired unit exclusively into its respective operative state while concurrently bringing a remainder of said units each to a respective non-operative state;

wherein a first said sensing/emitting unit is configured for at least one of sensing and emitting energy when an operational parameter associated with operation of said device is greater than an operational threshold and wherein a second said sensing/emitting unit is configured for at least one of sensing and emitting energy when said operational parameter is at or less than said operational threshold.

2. Apparatus according to claim 1, wherein said switching mechanism is configured for automatically reversibly switching between said units to bring said first unit or said second unit into its operative state, respectively, according to whether said operational parameter is greater than or not greater than said operational threshold.

3. Apparatus according to claim 1, wherein said operational parameter includes a distance to said target, and wherein said operational threshold is a first distance.

4. Apparatus according to claim 1, wherein said operational parameter includes a visibility range along said LOS, and wherein said operational threshold is visibility correlated with adverse weather conditions.

5. Apparatus according to claim 4 wherein said operational threshold is zero visibility conditions.

6. Apparatus according to claim 1, wherein a first said sensing/emitting unit comprises at least one radar system configured for at least enabling detecting a target along its respective ULOS.
7. Apparatus according to claim 1, wherein a second said sensing/emitting unit comprises at least one electro-optical device.
8. Apparatus according to claim 7, wherein said second sensing/emitting unit is configured for at least one of: enabling providing images in at least one of the visible, infra red and ultraviolet electromagnetic spectrum; night vision; enabling providing pulsed laser designator for targeting; enabling any suitable form of thermal imaging.
9. Apparatus according to claim 1, said first sensing/emitting unit comprising a first said radar system having a first ULOS and said second sensing/emitting unit comprising said electro-optical system having a second ULOS, wherein said first and second ULOS are angularly displaced one from the other with respect to said switching axis.
10. Apparatus according to claim 9, further comprising a second said radar system having a third ULOS in a direction substantially opposed to said first ULOS.
11. Apparatus according to claim 1, further comprising a suitable pointing mechanism, configured for enabling selectively defining said LOS in a desired direction at least within a field of regard (FOR), enabling a said sensing/emitting unit having its respective ULOS aligned with said LOS to be selectively pointed in said desired direction therewith.
12. Apparatus according to claim 1, wherein each said sensing/emitting unit is configured for providing data associated with at least one of surveillance, viewing, locating, sighting, detection, recognition, identification, tracking, targeting, marking, homing, tracking and imaging of a target.
13. Apparatus according to claim 1, wherein said apparatus is configured for first detecting a target by means of one said sensing/emitting unit, and further configured for at least one of recognizing and identifying the target by means of another said sensing/emitting unit.
14. Apparatus according to claim 1, wherein one said sensing/emitting unit comprises a radar system configured for at least detecting the target, and another

said sensing/emitting unit comprises an electro-optical sensing unit for at least one of recognizing and identifying the target.

15. Apparatus according to claim 1, wherein the apparatus is further configured for determining the type of target detected or for detecting the presence of a target, and comprises a said sensing/emitting unit configured for detecting and interpreting ESM, COMINT or ELINT signals emitted by the target.

16. Apparatus according to claim 1, wherein the apparatus is further configured for targeting a target, and one said sensing/emitting unit comprises a laser designator for acquiring the target, or, wherein one said sensing/emitting unit is configured for jamming or otherwise electronically incapacitating a target.

17. Apparatus according to claim 1, wherein said apparatus is configured for surveillance and one said sensing/emitting unit an electro-optical unit having a wide angle field of view, and another said sensing/emitting unit comprises an electro-optical sensing/emitting unit having a narrower field of view with greater resolution.

18. A method for at least one of sensing and emitting energy along an apparatus line of sight (LOS) with respect to a target, comprising selectively aligning a unit line of sight (ULOS) of a first sensing/emitting unit with said LOS when an operational parameter is greater than an operational threshold, and one of sensing and emitting energy along said LOS with said first sensing/emitting unit, and further comprising switching to aligning a ULOS of a second sensing/emitting unit along said LOS, when said operational parameter is at or less than said operational threshold, and one of sensing and emitting energy continuously along said LOS with said second sensing/emitting unit, wherein said first sensing/emitting unit and said second sensing/emitting unit are mechanically coupled.

19. Method according to claim 18, further comprising reversibly switching between said units to bring said first unit or said second unit into its operative state, respectively, according to whether said operational parameter is greater than or not greater than said operational threshold.

20. Method according to claim 18, wherein said operational parameter is a distance to said target, and wherein said operational threshold is a first distance.

21. Method according to claim 18, wherein said operational parameter includes a visibility range along said LOS, and wherein said operational threshold corresponding to a visibility correlated with adverse weather conditions.

22. Method according to claim 21 wherein said operational threshold is zero visibility conditions.

23. Apparatus for at least one of sensing and emitting energy concurrently along each of at least two different apparatus lines of sight (LOS) with respect to said apparatus, comprising:

an assembly comprising at least two sensing/emitting units, each said sensing/emitting unit adapted for at least one of sensing and emitting energy along a respective sensing/emitting unit line of sight (ULOS) via a respective sensing/emitting unit aperture, wherein said sensing/emitting units are mechanically coupled;

said assembly having a plurality of operative states, including at least a first operative state wherein at least two ULOS are pointed one each along a respective said LOS for at least one of sensing and emitting energy with respect thereto, and at least a second operative state wherein at least one said ULOS is pointed along a LOS different from the LOS in which it was pointing during said first operative state;

a switching mechanism for switching between said units to selectively bring said assembly into a desired said operative state.

24. Apparatus according to claim 23, wherein at least one said sensing/emitting unit may be configured for locally varying the direction of its respective ULOS, to provide at least one degree of freedom for the or each respective sensing/emitting unit.

25. A method for at least one of sensing and emitting energy along an apparatus line of sight (LOS) with respect to a target, comprising selectively aligning a unit line of sight (ULOS) of a first sensing/emitting unit with said LOS and one of sensing and emitting energy continuously along said LOS with said first sensing/emitting unit, and further comprising selectively switching to aligning a ULOS of a second sensing/emitting unit along said LOS and one of sensing and emitting energy continuously along said LOS with said second sensing/emitting

unit, wherein said first sensing/emitting unit and said second sensing/emitting unit are mechanically coupled.

CLAIMS

1. An apparatus for at least one of sensing and emitting energy along an apparatus line of sight (LOS) with respect to said apparatus, comprising:

at least two sensing/emitting units, each said unit adapted for at least one of sensing and emitting energy along a respective unit line of sight (ULOS);

each sensing/emitting unit having an operative state, wherein the respective ULOS is pointed along said LOS for at least one of sensing and emitting energy, and a corresponding inoperative state, where the ULOS is pointed along a direction different from said LOS;

a switching mechanism for switching between said units to selectively bring a desired unit exclusively into its respective operative state while concurrently bringing a remainder of said units each to a respective non-operative state;

wherein a first said sensing/emitting unit is configured for at least one of sensing and emitting energy when an operational parameter associated with operation of said device is greater than an operational threshold and wherein a second said sensing/emitting unit is configured for at least one of sensing and emitting energy when said operational parameter is at or less than said operational threshold.

2. The apparatus according to claim 1, wherein said switching mechanism is configured for automatically reversibly switching between said units to bring said first unit or said second unit into its operative state, respectively, according to whether said operational parameter is greater than or not greater than said operational threshold.

3. The apparatus according to claim 1, wherein said operational parameter includes a distance to said target, and wherein said operational threshold is a first distance.

4. The apparatus according to claim 1, wherein said operational parameter includes a visibility range along said LOS, and wherein said operational threshold is visibility correlated with adverse weather conditions.

5. The apparatus according to claim 4 wherein said operational threshold is zero visibility conditions.

6. The apparatus according to claim 1, wherein a first said sensing/emitting unit comprises at least one radar system configured for at least enabling detecting a target along its respective ULOS.

7. The apparatus according to claim 1, wherein a second said sensing/emitting unit comprises at least one electro-optical device.

8. The apparatus according to claim 7, wherein said second sensing/emitting unit is configured for at least one of: enabling providing images in at least one of the visible, infra red and ultraviolet electromagnetic spectrum; night vision; enabling providing pulsed laser designator for targeting; enabling any suitable form of thermal imaging.

9. The apparatus according to claim 1, said first sensing/emitting unit comprising a first said radar system having a first ULOS and said second sensing/emitting unit comprising said electro-optical system having a second ULOS, wherein said first and second ULOS are angularly displaced one from the other with respect to said switching axis.

10. The apparatus according to claim 9, further comprising a second said radar system having a third ULOS in a direction substantially opposed to said first ULOS.

11. The apparatus according to claim 1, further comprising a suitable pointing mechanism, configured for enabling selectively defining said LOS in a desired direction at least within a field of regard (FOR), enabling a said sensing/emitting unit having its respective ULOS aligned with said LOS to be selectively pointed in said desired direction therewith.

12. The apparatus according to claim 1, wherein each said sensing/emitting unit is configured for providing data associated with at least one of surveillance, viewing, locating, sighting, detection, recognition, identification, tracking, targeting, marking, homing, tracking and imaging of a target.

13. The apparatus according to claim 1, wherein said apparatus is configured for first detecting a target by means of one said sensing/emitting unit, and further configured for at least one of recognizing and identifying the target by means of another said sensing/emitting unit.

14. The apparatus according to claim 1, wherein one said sensing/emitting unit comprises a radar system configured for at least detecting the target, and another said sensing/emitting unit comprises an electro-optical sensing unit for at least one of recognizing and identifying the target.

15. The apparatus according to claim 1, wherein the apparatus is further configured for determining the type of target detected or for detecting the presence of a target, and comprises a said sensing/emitting unit configured for detecting and interpreting ESM, COMINT or ELINT signals emitted by the target.

16. The apparatus according to claim 1, wherein the apparatus is further configured for targeting a target, and one said sensing/emitting unit comprises a laser designator for acquiring the target, or, wherein one said sensing/emitting unit is configured for jamming or otherwise electronically incapacitating a target.

17. The apparatus according to claim 1, wherein said apparatus is configured for surveillance and one said sensing/emitting unit an electro-optical unit having a wide angle field of view, and another said sensing/emitting unit comprises an electro-optical sensing/emitting unit having a narrower field of view with greater resolution.

18. A method for at least one of sensing and emitting energy along an apparatus line of sight (LOS) with respect to a target, comprising:

selectively aligning a unit line of sight (ULOS) of a first sensing/emitting unit with said LOS when an operational parameter is greater than an operational threshold;

one of sensing and emitting energy along said LOS with said first sensing/emitting unit;

switching to aligning a ULOS of a second sensing/emitting unit along said LOS, when said operational parameter is at or less than said operational threshold; and

one of sensing and emitting energy continuously along said LOS with said second sensing/emitting unit; wherein said first sensing/emitting unit and said second sensing/emitting unit are mechanically coupled.

19. The method according to claim 18, further comprising reversibly switching between said units to bring said first unit or said second unit into its operative state, respectively, according to whether said operational parameter is greater than or not greater than said operational threshold.

20. The method according to claim 18, wherein said operational parameter is a distance to said target, and wherein said operational threshold is a first distance.

21. The method according to claim 18, wherein said operational parameter includes a visibility range along said LOS, and wherein said operational threshold corresponding to a visibility correlated with adverse weather conditions.

22. The method according to claim 21 wherein said operational threshold is zero visibility conditions.

23. An apparatus for at least one of sensing and emitting energy concurrently along each of at least two different apparatus lines of sight (LOS) with respect to said apparatus, comprising:

an assembly comprising at least two sensing/emitting units, each said sensing/emitting unit adapted for at least one of sensing and emitting energy along a respective sensing/emitting unit line of sight (ULOS) via a respective sensing/emitting unit aperture, wherein said sensing/emitting units are mechanically coupled;

said assembly having a plurality of operative states, including at least a first operative state wherein at least two ULOS are pointed one each along a respective said LOS for at least one of sensing and emitting energy with respect thereto, and at least a second operative state wherein at least one said ULOS is pointed along a LOS different from the LOS in which it was pointing during said first operative state;

a switching mechanism for switching between said units to selectively bring said assembly into a desired said operative state.

24. The apparatus according to claim 23, wherein at least one said sensing/emitting unit may be configured for locally varying the direction of its respective ULOS, to provide at least one degree of freedom for the or each respective sensing/emitting unit.

25. A method for at least one of sensing and emitting energy along an apparatus line of sight (LOS) with respect to a target, comprising:

selectively aligning a unit line of sight (ULOS) of a first sensing/emitting unit with said LOS;

one of sensing and emitting energy continuously along said LOS with said first sensing/emitting unit; and

selectively switching to aligning a ULOS of a second sensing/emitting unit along said LOS and one of sensing and emitting energy continuously along said LOS with said second sensing/emitting unit;

wherein said first sensing/emitting unit and said second sensing/emitting unit are mechanically coupled.