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EP 0 551 667 B1

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Description

This invention relates to the control of a battery of weapons such as missile launch stations (fire units).

A battery of dispersed missile launch stations, sometimes called fire units, may be linked to a central command station which, for example, assigns different targets to respective fire units. Without this control, several fire units might engage the same target while other targets go unmolested. One known distributed launcher network is described in EP-A-431,892. This has a central command station which issues launch control orders to a plurality of fire units. Conceptually, the known arrangements have the control station as the hub of a radial array of fire units each with a respective communications link to the "hub". Thus, information such as target position and rate always goes from the fire units to the control station and the assignment decisions are then sent out from the control station to the fire units. As a result, the response time may be too great especially in a very demanding scenario such as that of a battery of ground to air missile launchers deployed to protect an installation which may be attacked by several or even many enemy aircraft at the same time.

The object of the invention is to provide a system with improved response times.

This invention thus consists of a:

distributed weapons system comprising:

a central communications station;
a plurality of weapon launch stations;
a communications link between each weapon launch station and the central communications station;

and characterised in that each weapon launch station includes:

- i) means for engaging a first target
- ii) means for transmitting data relating to the location of the first target to other weapon launch stations via the central communications station;
- iii) means for receiving from another weapon launch station via the central communications station data relating to the location of another target already engaged by said other weapon launch station,
- iv) means for inhibiting engagement of the target already engaged by said other weapon launch station.

Hence, certain significant control functions are executed at each fire unit rather than relying entirely on the central control station. Conceptually the control system then begins to have a mesh configuration although the actual communication between fire units may still rely on respective links between the fire units and the control station. The difference is that the control station now only re-transmits information passed to it.

Reference will now be made by way of example to the accompanying drawing, the single figure of which is a simplified diagram of a battery of four fire units arranged around a central communications station.

In the figure the four fire units 1 to 4 are each linked to a central communications station 5 by any suitable data transmission means, for example optical or electrical cable or by some form of wireless transmission link. Each fire unit transmits to the communications station 5 data concerning the position and rate of targets which it is presently tracking. This data is immediately retransmitted ie broadcast by the communications station 5 to all the other fire units (1-4). The communications station 5 also broadcasts data request signals to the fire units (1-4).

Each fire unit (1-4) comprises a computerised control system which incorporates a target sensor and tracker and which can respond to information passed to it to "lock out" particular targets which it might otherwise have engaged. The first sensor to see a particular target makes this known to the other fire units (1-4) which are then locked out from engaging that target although they continue to "see", ie track it. This action is subject to an overall control algorithm to be described later. The computing inherent in the control algorithm is done at the fire units (1-4) themselves. The central communications station 5 remains as a "dumb" element which serves only to re-transmit the information supplied by the fire units (1-4).

Note that if a target enters the viewing area of a particular fire unit while another fire unit (1-4) which has seen it previously is still trying to engage it, that engagement continues. In the following, it is assumed that any one fire unit only causes the other units to lock out one target but this need not be the case - if each fire unit has the capability for tracking and engaging two targets at once then correspondingly the algorithm could be modified so that those targets become locked out from the other fire units.

In addition, the system may incorporate anti-anti-radiation missile features such as a sequential switch off of the target trackers. Then to handle targets which appear while the system is partly switched off, the trackers of the fire units which are on can be given a degree of authority over those units which are switched off.

Referring now to the overall control algorithm, its tasks include:-

- a. prevention of the fire units (1-4) from engaging a target which is being engaged by another unit in the battery;
- b. enhancement of the performance, ie kill probabilities, of the Battery against large numbers of targets;
- c. the provision of information to a fire unit in the event that its surveillance sensor is incapacitated;
- d. improvement of the battery performance when operating in the presence of electronic counter-

measures; and

e. avoidance of performance degradation at each unit when the algorithm cannot be applied.

The algorithm is performed as an element of a target management system.

When a target is detected its track is predicted in a conventional manner and, if found to lead to a protected area, and "in cover", that is within missile intercept range, then its "threat" value is deduced and compared with other targets already in the threat table. The highest threat is "Allocated" to the fire unit trackers which then acquire the target. Shortly after lock on a missile is launched by an operator.

When a target is allocated and tracked by a fire unit 1 the following information is provided to the communication station 5:-

- a. Target Track;
- b. A FIRE UNIT STATUS flag; and
- c. A TARGET STATUS flag.

The communication station 5 transmits this information to all other fire units (2,3,4). When received the fire units (2,3,4) will take the data and do the following with it:-

- a. STORE AND TAG THE TRACK;
- b. put a "window" around the TRACK data to encompass all predictable errors;
- c. compare target data in the threat tables with the "windowed" target;
- d. any target that fits into the window is given a low threat level, depending upon the FIRE UNIT STATUS and TARGET STATUS flags; and
- e. if the target is being tracked by a receiver fire unit 1 then either:-

- i. firing of a missile will be prohibited; or
- ii. if there is another threat the tracker will be unlocked and slewed to engage it.

Setting a low threat value ensures that if there are other targets available the receiver fire unit will engage them, but if this is the only target then the receiver fire unit will commence engagement of it. The level at which the engagement is arrested depends upon the FIRE UNIT STATUS FLAG and the TARGET STATUS FLAG.

For the given example, the target co-ordinates must be cartesian, the same as those used in geographical alignment. They are Northings, Eastings, and altitude.

The FIRE UNIT STATUS flag indicates EITHER TRACKING or MISSILE FIRED.

The TARGET STATUS flag indicates:-

- a. IN COVER, APPROACH; or
- b. IN COVER, RECEDE; or
- c. OUT OF COVER.

The response to the FIRE UNIT STATUS flag is as follows:-

- a. IF FLAG = MISSILE FIRED, then PROHIBIT FIRING AT THE WINDOWED TARGET by receiver fire unit; and
- b. IF FLAG = TRACKING, then use this flag in conjunction with TARGET STATUS FLAG.

The response to the TARGET STATUS flag is as follows:-

- a. IF FIRE UNIT STATUS FLAG = TRACKING, then;
- b. IF TARGET STATUS FLAG = INCOVER/APPROACH then set THREAT VALUE to MINIMUM. PROHIBIT FIRING AGAINST THE WINDOWED TARGET, by receiver fire unit;
- c. IF TARGET STATUS FLAG = INCOVER/RECEDE then set THREAT VALUE TO NORMAL;
- d. PROHIBIT FIRING AGAINST THE WINDOW TARGET BY receiver fire unit; and
- e. IF TARGET STATUS FLAG = OUT OF COVER, then set THREAT to NORMAL, REMOVE FIRING INHIBIT.

Claims

1. A distributed weapon system comprising:

- a central communications station (5);
- a plurality of weapon launch stations (1-4);
- a communications link between each weapon launch station (1-4) and the central communications station (5);

characterised in that each weapon launch stations includes

- (i) means for engaging a first target,
- (ii) means for transmitting data relating to the location of the first target to other weapon launch stations via the central communications station,
- (iii) means for receiving from another weapon launch station via the central communications station data relating to the location of another target already engaged by said other weapon launch station,
- (iv) means for inhibiting engagement of the target already engaged by said other weapon launch station.

2. A distributed weapon system as claimed in claim 1, in which the receiving means comprises means for receiving a target track, means for establishing a window around said track to compensate for pre-

dictable errors; and

means for comparing said windowed track with target data in threat tables.

3. A distributed weapon system as claimed in claim 2 in which each weapon launch station includes means for assigning a low threat level to any target represented by target data in said threat table which falls within said windowed track;

means for determining whether a different target is available; and

means for engaging said different target when said determination means determines that said different target is available; and

means for prohibiting firing of a missile at said target represented by target data in said table when said determining means determines that no different target is available.

4. A distributed weapon system as claimed in any preceding claim in which the target location data comprise tracking data on the position and rate of travel of the target.

5. A distributed weapon system as claimed in claim 4, in which said tracking data comprises a target track, a fire unit status flag, and a target status flag.

Patentansprüche

1. Ein verteiltes Waffensystem, welches folgende Teile umfaßt:

eine zentrale Kommunikationsstation (5);

mehrere Waffen-Abschußstationen (1 - 4);

eine Kommunikationsverbindung zwischen jeder Waffen-Abschußstation (1 - 4) und der zentralen Kommunikationsstation (5);

dadurch gekennzeichnet, daß jede Waffen-Abschußstation folgende Teile umfaßt:

(i) Mittel zur Erfassung eines ersten Ziels;

(ii) Mittel zur Übertragung von Daten, die sich auf den Ort des ersten Zieles beziehen nach einer anderen Lenkwaffen-Abschußstation über die zentrale Kommunikationsstation

(iii) Mittel, um von einer weiteren Lenkwaffen-Abschußstation über die zentrale Kommunikationsstation Daten zu empfangen, die sich auf die Lage des anderen Zieles beziehen, das bereits durch die andere Lenkwaffen-

Abschußstation erfaßt war;

(iv) Mittel, die eine Bedrohung des Ziels verhindern, das bereits durch die andere Lenkwaffen-Abschußstation erfaßt war.

2. Verteiltes Waffensystem nach Anspruch 1, bei welchem die Empfangsvorrichtung Mittel aufweist, um eine Zielspur zu empfangen und Mittel vorgesehen sind, um ein Fenster um diese Spur herum zu schaffen, damit vorhersehbare Fehler kompensiert werden, und es sind Mittel vorgesehen, um die im Fenster liegende Spur mit Zieldaten in Bedrohungstabellen zu vergleichen.

3. Verteiltes Waffensystem nach Anspruch 2, bei welchem jede Lenkwaffen-Abschußstation Mittel aufweist, um einen Niedrig-Bedrohungspegel jedem Ziel zuzuordnen, welches durch Zieldaten in der Bedrohungstabelle repräsentiert sind, die außerhalb der Spur im Fenster liegen;

Mittel zur Bestimmung, ob ein anderes Ziel vorhanden ist; und

Mittel zur Erfassung des anderen Zieles, wenn die Bestimmungsmittel erkennen lassen, daß ein anderes Ziel vorhanden ist; und

Mittel, die den Abschluß einer Lenkwaffe auf das Ziel verhindern, das durch Zieldaten in der Tabelle repräsentiert ist, wenn die Bestimmungsmittel feststellen, daß kein anderes Ziel vorhanden ist.

4. Verteiltes Waffensystem nach einem der vorhergehenden Ansprüche, bei welchem die Ziellagedaten Nachführdaten für die Position und die Flugeschwindigkeit des Ziels umfassen.

5. Verteiltes Waffensystem nach Anspruch 4, bei welchem die Nachführdaten eine Ziel-Nachführungs-Flag, eine Abschluß-Einheits-Status-Flag und eine Ziel-Status-Flag umfassen.

Revendications

1. Système d'armes disséminées comportant :

une station centrale de communication (5), plusieurs stations de lancement d'armes (1 à 4),

un lien de communication entre chaque station de lancement d'armes (1 à 4) et la station centrale de communication (5),

caractérisé en ce que chaque station de lancement d'armes comporte

comportent une trajectoire de cible, un drapeau de statut d'unité de tir, et un drapeau de statut de cible.

- i) des moyens pour ouvrir le feu sur une première cible, 5
 - ii) des moyens pour transmettre des données relatives à l'emplacement de la première cible vers d'autres stations de lancement d'armes, via la station centrale de communication, 10
 - iii) des moyens pour recevoir en provenance d'une autre station de lancement d'armes, via la station centrale de communication, des données relatives à l'emplacement d'une autre cible déjà prise sous le feu desdites autres stations de lancement d'armes, 15
 - iv) des moyens pour inhiber l'ouverture du feu sur la cible déjà prise sous le feu desdites autres stations de lancement d'armes.
2. Système d'armes disséminées selon la revendication 1, dans lequel les moyens de réception comportent des moyens pour recevoir une trajectoire de cible, des moyens pour établir un encadrement autour de ladite trajectoire pour compenser les erreurs prévisibles, et 20
- des moyens pour comparer ladite trajectoire encadrée aux données de cible contenues dans des tables de menaces. 25
3. Système d'armes disséminées selon la revendication 2, dans lequel chaque station de lancement d'armes comporte des moyens pour assigner un niveau de menace faible à une cible quelconque représentée par des données de cible, dans ladite table de menaces, qui tombent sur ladite trajectoire encadrée, 30
- des moyens pour déterminer si une cible différente est disponible, et 35
- des moyens pour ouvrir le feu sur ladite cible différente lorsque lesdits moyens de détermination déterminent que ladite cible différente est disponible, et 40
- des moyens pour empêcher la mise à feu d'un missile vers ladite cible représentée par les données de cible contenues dans ladite table lorsque lesdits moyens de détermination déterminent qu'aucune cible différente n'est disponible. 45
- 50
4. Système d'armes disséminées selon l'une quelconque des revendications précédentes, dans lequel les données d'emplacement de cible comportent des données de trajectoire relatives à la position et à la vitesse de déplacement de la cible. 55
5. Système d'armes disséminées selon la revendication 4, dans lequel lesdites données de trajectoire

