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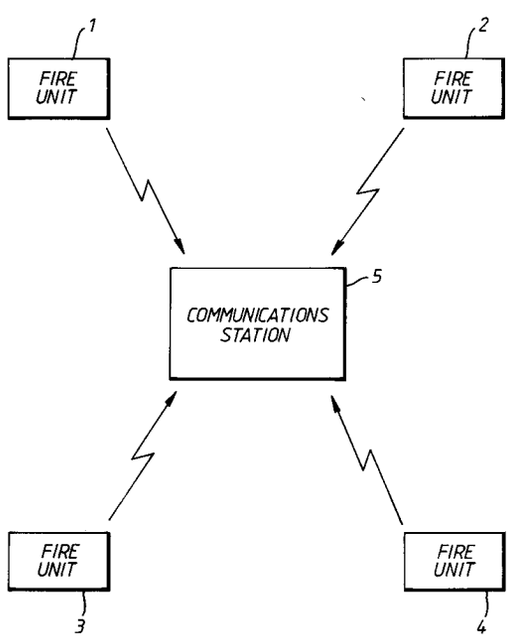
(54) Weapons.

(57) A battery of dispersed missile launch stations (1-4) are linked to a central communications station (5) which assigns different targets to respective launch stations. The communications station ensures that only one launch station engages each target.



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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. 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 in which 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 another weapon launch station 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 a second target; and

iv) means for inhibiting engagement of the second target.

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 retransmits 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 (14-).

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

countermeasures; 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);

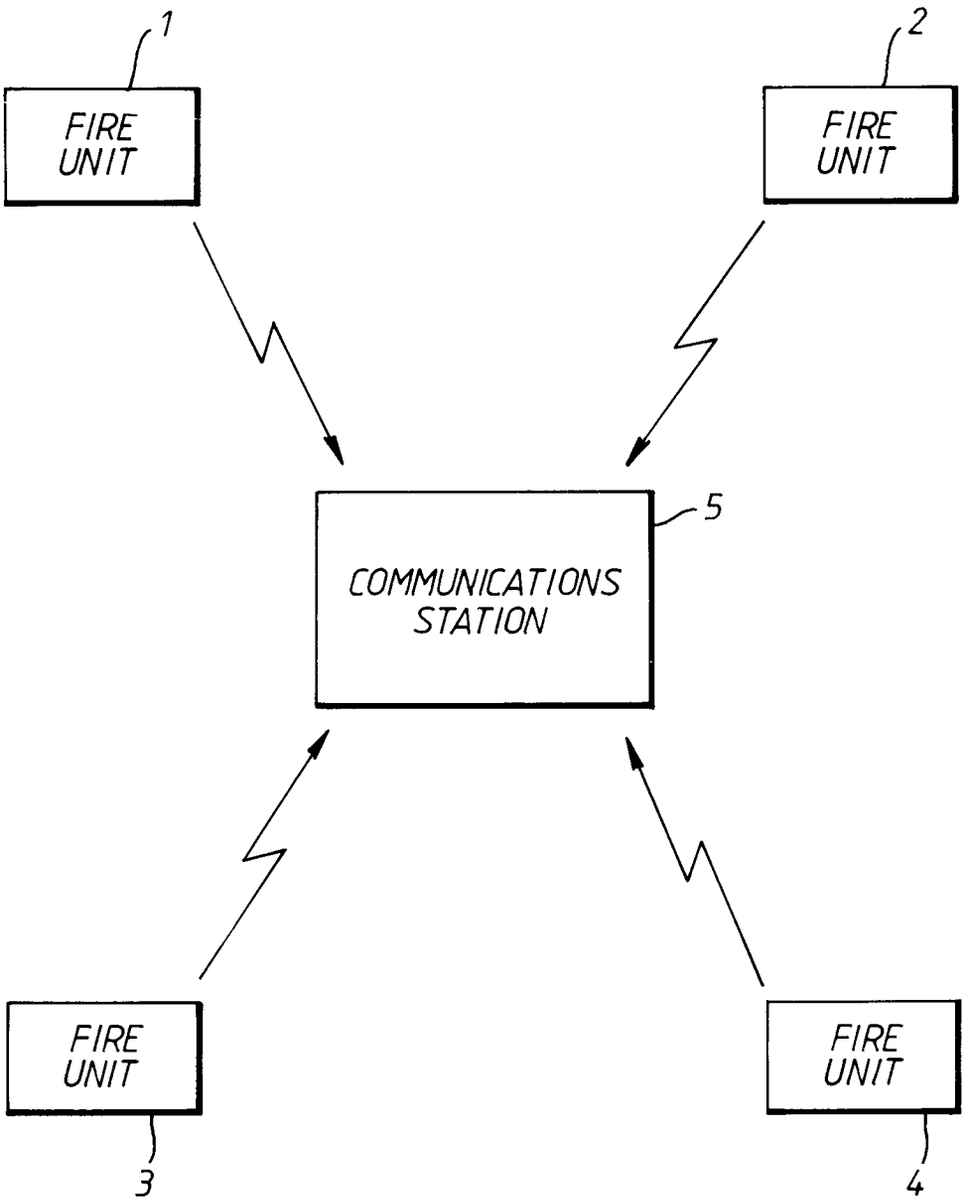
and in which each weapon launch station includes

(i) means for engaging a first target,

(ii) means for transmitting data relating to the location of the first target to another weapon launch station 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 a second target, and

(iv) means for inhibiting engagement of the second target.


1
FIRE UNIT
2
FIRE UNIT
5
COMMUNICATIONS STATION
FIRE UNIT
3
FIRE UNIT
4

European Patent Office

EUROPEAN SEARCH REPORT

Application Number

DOCUMENTS CONSIDERED TO BE RELEVANT

EP 92200102.9

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
X	GB - A - 2 148 465 (DAROGA) * Fig. 1,3,4; abstract; page 1, lines 27-42; claims * --	1	G 05 D 1/12 F 41 G 7/20
X	EP - A - 0 354 608 (HOLLANDESE SIGNAALAPPARATEN) * Fig. 1-7; column 12, line 52 - column 13, line 34; column 2, lines 10-31 * --	1	
P,X	EP - A - 0 431 892 (HUGHES) * Fig. 1; abstract; column 3, lines 7-44 * --	1	
Y	US - A - 4 274 609 (FERRIER) * Fig. 1-8; abstract; column 11, lines 29-58 * --	1	
Y	US - A - 4 267 562 (RAIMONDI) * Fig.; abstract; column 11, lines 20-38 * ----	1	TECHNICAL FIELDS SEARCHED (Int. Cl.5) G 05 D 1/00 F 41 G 7/00 H 04 N 7/00

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
VIENNA	10-03-1993	KRAL

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document