United States Patent [19]

Lewis et al.

[11] **3,882,496**

[45] **May 6, 1975**

[54] **NON-DESTRUCTIVE WEAPON SYSTEM EVALUATION APPARATUS AND METHOD FOR USING SAME**

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[22] Filed: **Mar. 21, 1974**

[21] Appl. No.: **453,477**

[52] **U.S. Cl.** ..... **343/6 R;** 35/25; 343/7 ED

[51] **Int. Cl.** **F41g 3/26;** G01s 9/02

[58] **Field of Search** ..... 343/6 R, 6 A, 7 ED; 35/25

[56] **References Cited**

UNITED STATES PATENTS

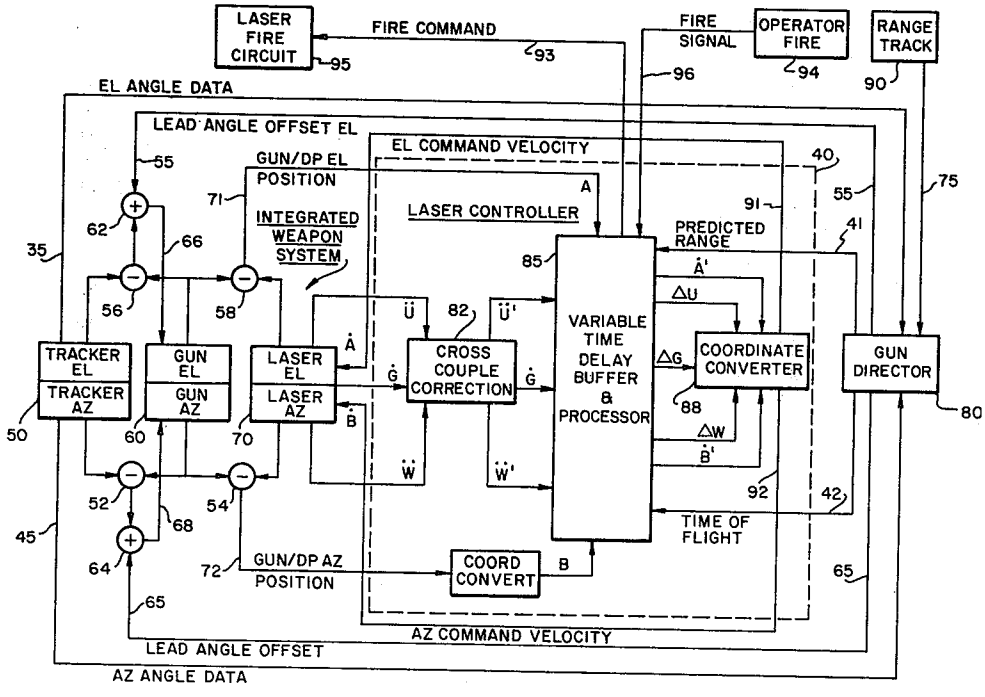
2,983,915	5/1961	Thornton	343/7 ED X
3,427,611	2/1969	Enenstein	343/6 R
3,697,992	10/1972	Kleptz et al.	343/7 ED
3,754,249	8/1973	Kearney	343/6 R
3,798,795	3/1974	Michelsen	35/25
3,813,795	6/1974	Marshall	35/25

Primary Examiner—Malcolm F. Hubler
Attorney, Agent, or Firm—Nathan Edelberg; Robert P. Gibson; Saul Elbaum

[57] **ABSTRACT**

A method and apparatus for nondestructively evaluating the performance of a weapon system. The unique concept embodied in the present invention provides nondestructive scoring of weapon systems during simulated battlefield testing and also provides a technique of nearly total simulation of the gun laying and firing of a real weapon system. In a preferred embodiment within the context of an integrated fire control weapon system, the present invention includes a gun, a laser, and a radar, all of which are mounted on separate and independently operable pedestals. The radar or tracking device supplies position and range information to the control device which computes the required lead angle and predicted range which, in turn, defines the point in space where projectile/target intercept will occur. The gun is then positioned by the control device in such a way that, if then fired, the projectile will then pass through the predicted point in space a time of flight thereafter. Utilizing the same information, a laser control device positions the laser pedestal so that at the end of time of the flight of the projectile, the laser will be positioned towards the predicted point. The laser is fired by the control device at the precise point in time corresponding to the predicted intercept time of the projectile and target. The resultant hit or miss information, which may, for example, be obtained by means of a laser receiver mounted on the target, is indicative of the total operational evaluation of the weapon system including the weapon's target acquisition and tracking devices, the prediction, gun laying, and projectile performance of the system.

10 Claims, 5 Drawing Figures



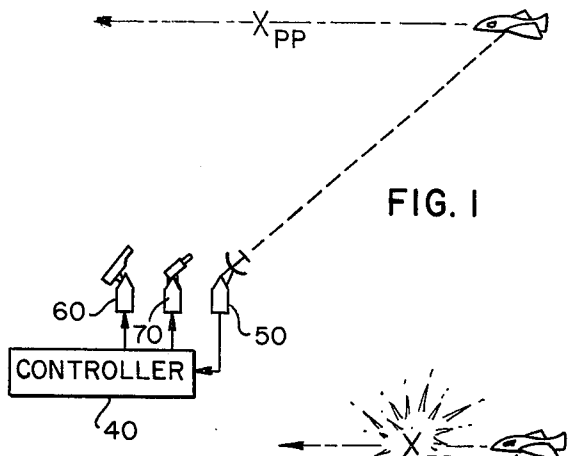


FIG. 1

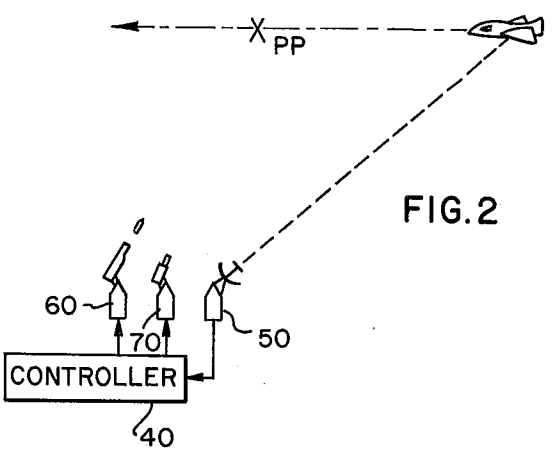


FIG. 2

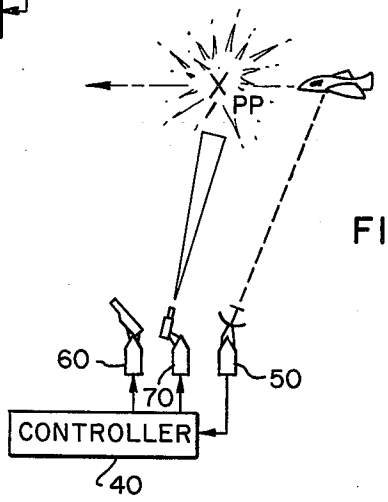
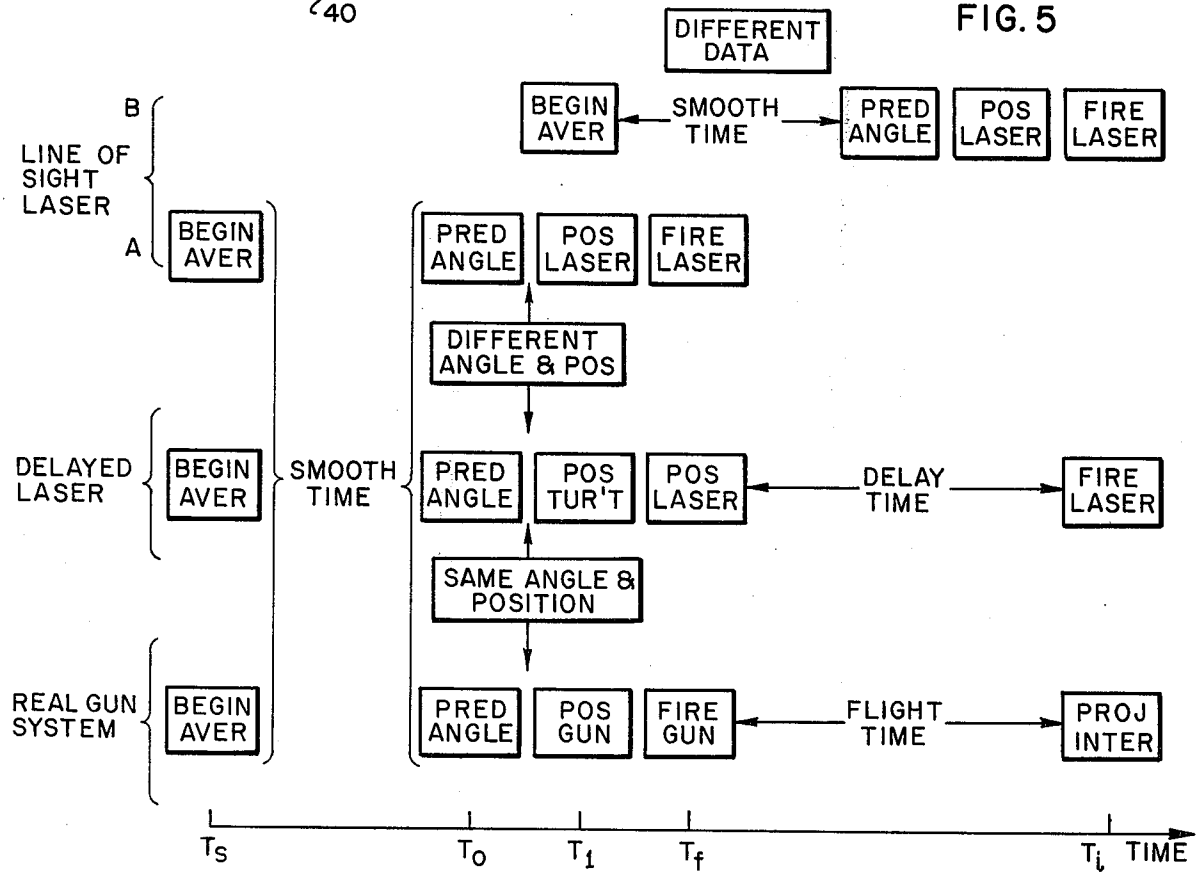


FIG. 3

FIG. 5



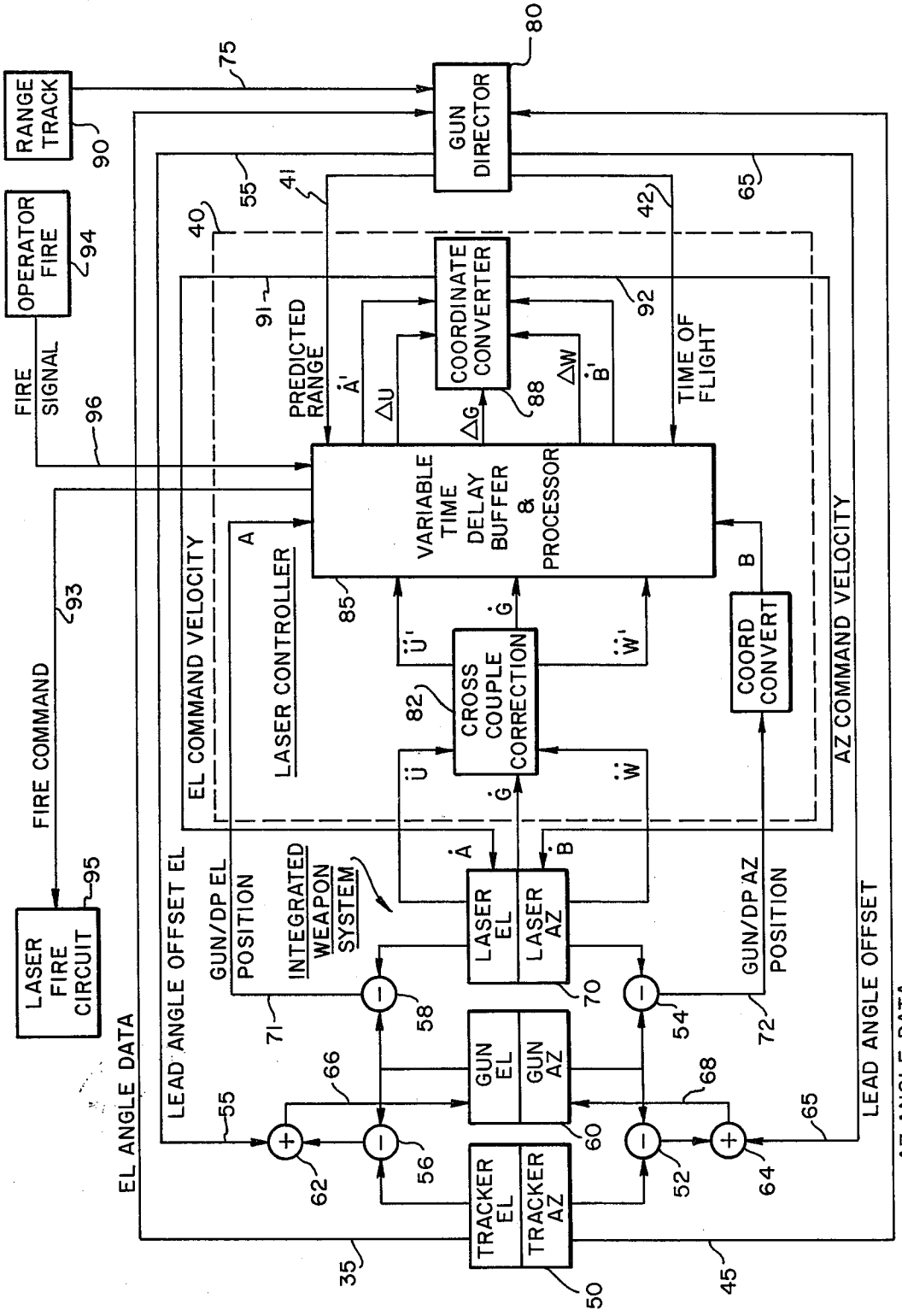

RANGE TRACK
90
75
GUN DIRECTOR
80
OPERATOR FIRE
94
FIRE SIGNAL
96
55
41
40
42
65
91
PREDICTED RANGE
COORDINATE CONVERTER
92
TIME OF FLIGHT
88
ΔU
ΔG
ΔW
VARIABLE TIME DELAY BUFFER & PROCESSOR
85
EL COMMAND VELOCITY
LASER CONTROLLER
A
B
AZ COMMAND VELOCITY
FIRE COMMAND
93
82
CROSS COUPLE CORRECTION
COORD CONVERT
LASER FIRE CIRCUIT
95
LEAD ANGLE OFFSET EL
GUN/DP EL POSITION
INTEGRATED WEAPON SYSTEM
LASER EL
LASER AZ
GUN/DP AZ POSITION
71
58
70
54
72
LEAD ANGLE OFFSET
EL ANGLE DATA
66
68
GUN EL
GUN AZ
60
62
56
52
64
TRACKER EL
TRACKER AZ
50
35
45
AZ ANGLE DATA

FIG. 4

NON-DESTRUCTIVE WEAPON SYSTEM EVALUATION APPARATUS AND METHOD FOR USING SAME

RIGHTS OF THE GOVERNMENT

The invention described herein may be manufactured, used, and licensed by or for the United States Government for governmental purposes without the payment to us of any royalty thereon.

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to weapon performance evaluation systems, and more particularly to a nondestructive performance evaluation of a weapon system which utilizes a laser as a primary component thereof.

2. Description of the Prior Art

It is often very useful to be able to evaluate the performance of a weapon system, such as an integrated fire control weapon system, without the expense and hazard involved in the actual firing of real weapons and the subsequent destruction of a target.

Present techniques utilized for such nondestructive evaluation of weapon systems are, however, limited to the evaluation only of the tracking device of the system. For example, one such system presently in wide use for such nondestructive evaluation tests is commonly referred to as a line-of-sight (L.O.S.) laser system. When utilized in an integrated anti-aircraft artillery system, the LOS laser is fired when the operator presses the gun firing mechanism of the weapon. The laser emits a beam in a direction along the line of sight to the target as defined by the tracking device. Since a laser can be characterized as a virtually instantaneous device, no lead angle or gravity correction is necessary to aim it accurately; hence the laser may be mounted directly on the tracking device, or, alternatively, the gun-aiming commands of the weapon may be by-passed and the laser mounted directly on the gun itself. It is readily apparent that in either of the foregoing cases, total system evaluation is not possible inasmuch as misses cannot be evaluated since there is no means of determining the degree of error involved in a miss. Accordingly, the primary purpose of the LOS laser scoring is of a psychological nature rather than a physical one. The only parameter which may be physically evaluated is the performance of the tracking device which can be accomplished in terms of the number of hits obtained for each encounter. Accordingly, it is seen that the use of the LOS laser technique results in a performance evaluation of the tracking system only, and fails to take into consideration the essential characteristics of the gun laying and trajectory performance characteristics of the weapon under test.

It is seen, therefore, that the LOS laser system falls far short of accomplishing a total operational evaluation of the weapon system, which includes not only the performance of the weapon's target acquisition and tracking devices, but also the prediction, gun laying, and projectile performance of the system. Accordingly, a great need exists for a technique and apparatus which would allow total evaluation of integrated fire control systems under tactical battlefield conditions which approximates the performance and operation of the real weapon.

SUMMARY OF THE INVENTION

Accordingly, a primary object of the present invention is to provide a nondestructive technique for the evaluation of the performance of a weapon system which takes into account not only the target tracking capability of a system, but also utilizes, on a projectile-to-projectile basis, the ballistic and trajectory information supplied by the controlled subsystem of the weapon.

Another object of the present invention that is to provide a technique for nondestructively evaluating the performance of a weapon system which approximates the performance and operation of the real weapon to a very high degree.

An additional object of the present invention is to provide a novel and unique method and apparatus for use in the nondestructive evaluation of the performance of a weapon system which allows total evaluation of integrated fire control weapon systems under tactical battlefield conditions.

A still additional object of the present invention is to provide a method and apparatus for nondestructive evaluation of the performance of a weapon system which may be easily and inexpensively adapted to existing laser scoring systems presently in use and which is adaptable to the evaluation of any type of weapon system that requires prediction or guidance of the weapon to intercept its intended target.

An additional object of the present invention is to provide a technique for evaluating the total performance of a weapon system that provides nearly total simulation of the gun laying and firing of a real weapon system without the expense and hazard involved in the firing of real weapons and the subsequent destruction of the target.

A still further object of the present invention is to provide a technique for nondestructively evaluating the performance of the weapon system which accomplishes the same psychological function as the prior art LOS laser scoring method, and in addition takes into account the total system performace from target acquisition to projectile/target intercept.

The foregoing and other objects are attained in accordance with one aspect of the present invention for the provision of apparatus for nondestructively evaluating the performance of a weapon system, which comprises a weapon for launching a projectile intended to intercept a moving target, a tracker for obtaining position and range data of the target while in flight, and a gun director which is responsive to the data from the tracker for computing the lead angle and predicted range of the target which defines a point in space where the projectile, if then launched, will intercept the target. The apparatus further includes a laser and a laser control device which is responsive to the gun director for positioning the laser toward said point in space and which activates the laser at the end of a predetermined time interval corresponding to the time of flight of the projectile whereby the laser beam will intercept the above-described point in space and provide an indication of a hit or a miss condition taking into account not only the tracking capability of the system but also the ballistic and trajectory information supplied by the gun director. The laser is mounted on a pedestal which may be positioned by the laser control device independently from the tracking portion of the system. To obtain this

evaluation data, a recording camera could be mounted on, or in parallel to, the laser pedestal. The camera, if bore sighted with the laser, would provide a qualitative indication of tracking and/or prediction errors to be available for post-mission analysis. The laser control device provides incremental position and/or velocity commands to the laser pedestal over a predesignated period of time. At the end of this period, the laser will have been directed to a predicted point in space and fired, consequently illuminating the projectile/target intercept point. A preferred embodiment of such a laser controller is presented within the context of a self-contained fully integrated weapon system capable of firing on the move.

BRIEF DESCRIPTION OF THE DRAWINGS

Various objects, features and attendant advantages of the present invention will be more fully appreciated as the same becomes better understood from the following detailed description of the present invention when considered in connection with the accompanying drawings, in which:

FIGS. **1** through **3** are sequential schematic representations helpful in understanding the principles of operation of the system of the present invention;

FIG. **4** is a block diagram illustrating a preferred embodiment of an integrated weapon system incorporating the novel delayed position laser of the present invention; and

FIG. **5** is a schematic representation on a time scale which illustrates a comparison between the delayed laser of the present invention, the prior art line-of-sight laser, and the operation of a real weapon system.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to the drawings, wherein line reference numerals designate identical or corresponding parts throughout the several views, and more particularly to FIGS. **1** through **3** thereof, there is depicted therein time sequence schematic diagrams embodying the principles of the present invention in an integrated fire control weapon system which comprises a gun **60,** a laser **70,** a radar or tracking device **50,** all of which are mounted on separate pedestals, and which are interconnected by means of a controller **40.** Controller **40** may comprise, for example, a computer. Alternatively, the controller could comprise a digital or mechanical-analog device such as the one explained in more detail hereinafter with reference to FIG. **4.** One purpose of controller **40** is to provide incremental position and/or velocity commands to the laser **70** over a predesignated period of time in response to information received from tracking device **50.** The gun **60** may represent any of a number of conventional weapons, such as an anti-aircraft artillery gun. Laser **70** is designated to emit a nondestructive laser beam when activated by controller **40.** The beam width of laser **70** is set to correspond to the dispersion of the particular weapon **60** to be simulated. Laser **70,** when fired, is pulsed at the fire rate of the simulated weapon and, although the firing sequence is initiated by the gunner using the regular gun firing mechanism, the actual firing of laser **70** is accomplished by controller **40.** Laser **70** is mounted on a pedestal which may be positioned by controller **40** independently from the tracking device **50.** In most practical systems, the laser pedestal may be the gun mount itself. The tracking device **50,** which may comprise a conventional radar, maintains track of the target, in this instance an aircraft, and supplies position and range data to controller **40.**

Referring now more specifically to the time sequence illustrated in FIG. **1,** radar **50** is seen to be locked on to the target aircraft to provide position and range data to controller **40.** The gun director within controller **40** computes the required lead angle and predicted range which defines the point in space (PP) where projectile/target intercept will occur. Referring now to FIG. **2,** controller **40** then supplies gun **60** with the proper commands to position gun **60** in such a manner that when the gun is fired, the projectile will pass through the predicted point in space (PP) a time of flight of the projectile later. During the same time frame as depicted in FIG. **2,** and utilizing the same information, controller **40** positions the laser pedestal **70** so that at the end of the time of flight of the projectile, the laser will be pointed at the predicted point (PP). Referring now to FIG. **3** in the sequence, the projectile burst will occur at the predicted point when the time of flight has expired. Rather than actually fire gun **60,** however, at the end of this predetermined time of flight interval, the laser, having previously been aimed to this same point in space, will be actuated by controller **40** so that the laser illumination will occur simultaneously with the simulated projectile burst at the predicted point. Gun **60,** as seen in FIG. **3,** will already have been positioned for the next projectile; accordingly, in real time, laser **70** will lag gun **60.** If no errors occur, laser **70** will track the target using information supplied a time of flight of the projectile prior to its firing.

It is therefore apparent, in accordance with the above brief description, that controller **40** utilizes not only the tracking data provided by radar **50** but the prediction data on each projectile based on the lead angle and time of flight which is supplied by the gun director in accordance with the information supplied by radar **50.** In this manner, the system of the present invention in evaluating system performance takes into account not only the target tracking capability but the ballistic and trajectory information so essential to a complete performance evaluation of the system. In brief summary, controller **40** positions laser **70** such that when the time of flight for each projectile has expired, laser **70** is pointed at that point in space where the gun director has predicted projectile/target intercept. At this point in time, the controller fires the laser obtaining a hit/no hit condition based on total weapon performance. To obtain this evaluation data, a recording camera could be mounted on, or in parallel to, the laser pedestal. The camera would preferably be bore sighted to the laser thereby providing a qualitative indication of tracking and/or prediction errors for postmission analysis.

Depending upon the weapon to be simulated, the subsystem required to control the laser can be relatively simple in its general operation, and its function could be performed, for example, by either a digital or mechanical-analog device. In general, the purpose of the laser controller is to provide incremental position and/or velocity commands to the laser pedestal over a predesignated period of time. At the end of this period, the laser will have been directed to a predicted point in space and actuated, consequently illuminating the projectile/target intercept point.

Referring now to FIG. **4**, there is depicted a block diagram of a self-contained, fully integrated weapon system capable of firing on the move which incorporates the laser controller **40** in a preferred embodiment incorporating the principles of the present invention. The system includes a tracking device **50**, a gun mount **60**, and a laser pedestal **70**, all of which are capable of independent motion. The tracking and laser pedestals may be mounted on the gun mount. Each of the three pedestals are gyro-stabilized, not only for vehicle motion, but also for compensation for the relative motion between the tracker and laser pedestals and the gun mount. The system as depicted in FIG. **4** is also seen to comprise a laser controller indicated generally within the dotted outline at **40**, a gun director **80**, a laser fire circuit **95**, and a range tracker **90**. A number of adders and subtracters, indicated generally at **52**, **54**, **56**, **58**, 62, and **64** interrelate the positional coordinates of tracker **50**, gun **60**, and laser **70** in a manner to be described in more detail hereinafter. The tracking and gun laying functions are based on inertial coordinates relative to the bore sight of the tracking device **50**. The gun mount **60** is slaved to the tracking device **50** by means of subtracters **52** and **56**, adders **62** and **64**, and lines **66** and **68**. Lead angle offsets for both elevation and azimuth are provided to the gun mount **60** by the gun director **80** by means of lines **55** and **65** to properly aim the gun (i.e., the predicted lead angles are added to the slave servos of the gun mount).

During each sample period, the gun director **80** receives angle and range information from the angle tracker **50** and range tracker **90** along lines **35**, **45**, and **75**, respectively. For the sake of simplicity, we may assume that the sample rate is equal to the firing rate of the particular gun to be simulated. In on actual operating system, however, the sample range would be much higher (on the order of **100** samples per second) in order to improve the positioning accuracy of the system, but the functions of the controller **40** to be described hereinafter would be identical. The gun director **80**, after receiving the angle and range information, feeds the predicted range and time of flight information to the controller **40** along lines **41** and **42**, respectively. Controller **40** receives the lead angle information (A and B) directly according to the relative position of the laser pedestal **70** and the gun pedestal **60** along lines **71** and **72**. Accordingly, the actual distance through which the laser pedestal **70** must move during the time of flight is determined, and, together with the position corrections and predicted range, is processed and stored in a variable time delay buffer and processor **85**. The acceleration of the axes $\ddot{U}$ and $\ddot{W}$ of the laser pedestal **70** are received by the controller **40** along with the rate of roll $\dot{G}$ of the axes. Cross-coupling correction factors of the acceleration and rate of roll of the axes are obtained from device **82**, and the resultant velocity and acceleration factors, $\dot{G}$, $\ddot{U}'$, and $\ddot{W}'$ are stored in buffer **85**. During each sample period, the stored velocity in buffer **85** ($\dot{A}'$ and $\dot{B}'$) is combined with the stored position corrections (ΔU, ΔW, ΔG) in a coordinate converter **88** to produce an incremental velocity command, $\dot{A}$ and $\dot{B}$, along lines **91** and **92** which is equivalent to the position change required to move the laser pedestal **70** to the proper position during the next time interval.

In the foregoing manner, the laser pedestal **70** is positioned over the time of flight interval, taking into account the corrective positions due to the motions of the gun mount **60** during the interval, so that at the end of the interval the laser is directed at the point in space previously predicted by the gun director **80**. Additionally, during each sample period the controller **40** determines if any previous projectile delay time has expired and checks the stored fire indicator received from **94** along line **96** corresponding to that projectile. If the time has expired, and the fire indicator was activated, controller **40** emits a fire command signal along line **93** to the laser firing circuit **95**.

A laser receiver, not shown, mounted on the target, provides an indication of a hit or a miss of the laser beam thus activated. In systems where laser receivers cannot be mounted on the target, a laser transmit/receiver device could be utilized wherein the predicted range information could be utilized to gate the laser receiver portion so that a hit/no hit indication could be obtained.

To obtain this evaluation data, a recording camera could be mounted on, or in parallel to, laser pedestal **70**. The same outputs of controller **40** as described above may be used to control the parallel camera if it were mounted on a separate pedestal. Obviously, the range information is not needed for the camera, but the laser fire command along line **93** may be used to trigger an indicator within the camera's field of view so that information pertaining to the activation of the laser would be available for post-mission analysis.

FIG. **5** is helpful in illustrating a comparison between the prior art line of sight laser, the delayed position laser of the present invention, and a real gun system. The vertical labels on the left-hand side of FIG. **5** represent the two conditions (A and B) under which a firing sequence might occur for the LOS laser, the firing sequence for the delayed position laser of the present invention, and the firing sequence for a real gun system. The horizontal axis represents time, each block representing an instant in time during which the indicated event may be initiated or performed, as the case may be. All devices are assumed to be mounted independently on their own pedestals. Obviously, in real time, some of these events may occur nearly simultaneously, but for the purposes of illustration, such events are represented by consecutive time frames.

Referring first to the real gun system, the data to be used by the gun director is gathered or smoothed over some period of time T_s to T_o. The gun director calculates the predicted angle at time T_o then commands the gun position at time T_1 whereafter the gun fires the projectile at time T_f. After the projectile has been fired, there exists a period of time (projectile time of flight) which is unique to each projectile. This time of flight is represented by the time period from T_f to T_i. At the expiration of this time interval at time T_i, projectile/target intercept occurs at the point in space previously predicted (assuming no error) by the gun director.

Referring now to the firing sequence for the line of laser, sequences A and B depict two possible conditions under which the LOS laser might be fired. Sequence A begins at the same point in time T_s as that of the real gun system. the data gathering period from time T_s to T_o may be the same, but the predicted angle and position of the laser is not. Since the LOS laser does not require a lead angle (i.e., it is customarily mounted on or in parallel with, the tracking device), it requires only the data supplied to the tracking pedestal to maintain

a direction toward the target. Therefore, at time T_o and T_1, the LOS laser sequence deviates from the gun sequence completely. Accordingly, when the laser is fired at time T_f, even though it may illuminate the target, all that is accomplished is an evaluation of how well the tracking device has followed the target. With respect to sequence B, if the laser is fired so that it illuminates the point in space where the protectile would have intercepted the target (this would occur strictly by coincidence, since no projectile time of flight is calculated in the LOs laser scoring technique), it has not used the same data as the gun utilized to establish its position commands. Accordingly, the use of the LOS laser technique results in a performance evaluation of the tracking system only, and does not take into consideration the gun laying and trajectory characteristics of the weapon under test.

The delayed position laser firing sequence according to the present invention performs identically to the real gun system up to and including the positioning of the gun. The same data is utilized for the prediction from time T_s to T_o. The same predicted angle and gun position is output by the gun director at times T_o and T_1. Only at time T_f does the sequence deviate from that of the real gun system, and that deviation is relatively minor. At time T_f, instead of firing the laser, the technique of the present invention initiates the laser controller **40** (of FIG. **4**) which positions the laser during the delay time from T_f to T_i, the identical interval of time as the projectile time of flight in the real gun system. Accordingly, at time T_i, the laser will be directed at the point in space where the projectile/target intercept will occur. This is the same point in space described above with reference to the real gun system. At time T_i, a laser controller will fire the laser and the beam therefrom will illuminate the intercept point.

Accordingly, it is seen that we have provided a method and apparatus for nondestructively evaluating the performance of a weapon system which takes into account not only the target tracking capability of the system, but also utilizes, on a projectile-to-projectile basis, the ballistic and trajectory information supplied by the director subsystem of the weapon. Since the system of the present invention utilizes the same data used in the actual firing of the weapon, the present technique approximates the performance and operation of the real weapon to a degree heretofore unobtainable. Accordingly, the present invention allows total evaluation of integrated fire control systems under tactical battlefield conditions. It will be understood by those skilled in the art that with the addition of a controller to the laser scoring systems presently in use, the present invention may be utilized to evaluate a wide range of weapons from anti-aircraft artillery systems to self-contained mobile missile systems, that is, any type of weapon that requires prediction or guidance to intercept its intended target.

It will be appreciated by one skilled in the art that, with the exception of gun vibration and perturbation of the flight path of each individual projectile by the environment, the real gun system has been totally simulated by the technique and apparatus of the present invention on a projectile-to-projectile basis. The target has been allowed the same amount of time as it would have against a real gun to maneuver or evade the weapon during the projectile time of flight. In some cases where a relatively long time of flight and a highly maneuverable target are involved, this time factor could be of great significance in the tactical evaluation of a weapon system. Prior art scoring systems take the foregoing into account only on a general basis during post-mission processing and analysis. It is also apparent that the perturbation of the flight path of each projectile could be successfully simulated by inserting a random error into the positioning servo for each projectile; accordingly, the effects of the environment and the gun vibration on the projectile path can be made to approach those of the real weapon.

We wish it to be understood that we do not desire to be limited to the exact details of construction shown and described, for obvious modifications can be made by a person skilled in the art. It is therefore to be understood that within the scope of the appended claims the invention may be practiced otherwise than as specifically described herein.

What is claimed as new and desired to be secured by Letters Patent of the United States is:

1. Apparatus for nondestructively evaluating the performance of a weapon system, which comprises:
- weapon means for launching a projectile intended to intercept a moving target;
- tracking means for obtaining position and range data of said target;
- first control means responsive to said data for computing the lead angle and predicted range of said target to define a point in space where said projectile, if then launched, will intercept said target;
- laser means for illuminating said point in space with a laser beam; and
- laser control means responsive to said first control means for positioning said laser means at said point in space and for activating said laser means at the end of a predetermined time interval.

2. The apparatus for nondestructively evaluating the performance of a weapon system according to claim **1**, further comprising servo means responsive to said first control means for positioning said weapon means such that said projectile, if then fired, will pass through said point in space at the end of said predetermined time interval.

3. The apparatus for nondestructively evaluating the performance of a weapon system according to claim **2**, wherein said predetermined time interval corresponds to the time of flight of said projectile from said weapon means to said point in space.

4. The apparatus for nondestructively evaluating the performance of a weapon system according to claim **1**, further comprising means for recording information as to whether or not said laser beam has struck said target at said point in space.

5. The apparatus for nondestructively evaluating the performance of a weapon system according to claim **3**, further comprising first and second pedestal means for mounting said weapon means and said laser means, respectively, said first pedestal means being responsive to said servo means and said second pedestal means being responsive to said laser control means whereby said second pedestal means is activated during said predetermined time interval; and a third pedestal means for mounting said tracking means.

6. The apparatus for nondestructively evaluating the performance of a weapon system according to claim **5**, wherein said first control means comprises gun director means for accepting information from an angle tracker

and a range tracker which comprise said tracking means, said gun director means providing lead angle offset information to said laser control means.

7. The apparatus for nondestructively evaluating the performance of a weapon system according to claim **6,** wherein said laser control means comprises variable time delay buffer and processor means responsive to said predicted range and time of flight information from said gun director means for generating incremental velocity commands to said second pedestal means, which velocity commands correspond to the position change required to move said second pedestal means to the proper position during said predetermined time interval.

8. The apparatus for nondestructively evaluating the performance of a weapon system according to claim **4,** wherein said information recording means includes a laser receiver mounted on said moving target.

9. The apparatus for nondestructively evaluating the performance of a weapon system according to claim **4,** wherein said information recording means includes a laser transceiver as comprising said laser means, and means for gating said transceiver in response to said predicted range data from said first control means.

10. In a system which includes weapon means for launching a projectile intended to intercept a moving target, means for tracking the target, laser means, and means for controlling said weapon means and said laser means in response to said tracking means, a method for nondestructively evaluating the performance of said system which comprises the steps of:

feeding position and range data of said target obtained by said tracking means to said control means;

computing the predicted lead angle and range by means of said control means which defines the point in space where said projectile will intercept said target if then fired;

positioning said weapon means in response to said computed lead angle and range such that if said weapon means is then fired, said projectile will pass through said point in space a predetermined time of flight of said projectile thereafter;

positioning said laser means during said predetermined time such that at the end of said predetermined time said laser means is aimed at said point in space;

activating said laser means by said control means at the end of said predetermined time such that said laser means emits a beam which illuminates said point in space; and

recording information as to whether said laser beam has or has not struck said target at said point in space

whereby the operation of said tracking means, said weapon means and said control means may be concommitantly evaluated.

* * * * *