Variable Angle Target Training System (V.A.T.T.S.)

Project Plans and Product Specifications Draft

Team 16
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1.0 Introduction

Military and law enforcement organizations have always attempted to simulate real life situations while training in order to be more prepared for real life situations. Targets that vary from simple paper and cardboard posters, to more complicated molded silhouette targets have been used to simulate real life situations where there is a need to distinguish between a hostile and a friendly entity. Coupling these target presentations with realistic spatial movements provides a robust model for what one might encounter in real life. There are various mechanisms available on the market that fully simulate an encounter where there is a need to discern friend from foe. One of those systems is the Stationary Infantry Target or SIT. The SIT system raises a concealed target up 90 degrees and presents the trainee with a target which can be either friend or foe. There are limitations of the SIT such as, the time to switch the physical target between a friendly target and a foe target, the manner in which the target is attached to the system is not universal for different, widely used targets, the target presented cannot rotate and is fixed in a fully presented position, limiting the realistic simulation of a quartering body.

The objective of this project is to implement a new target arm to the SIT, which alleviates many of the shortcomings of the original design. The new target arm shall make replacing used targets quicker and easier, accommodate various standard training targets, be able to rotate the target between a range of quartering angles once fully deployed in its upright position, as well as rotate a full 180 degrees to reveal a second, different presentation.

2.0 Project Scope

Team 16 plans is to develop a target turner for Lockheed Martin's Live Training organization for domestic and international militaries practices. An arm mechanism with turning function is for "pop-up/rotation" mechanism for various target presentations pictured below in Figure 3.

2.1 Background research

The Stationary Infantry Target, or SIT, has been used for many years and is a staple of live training equipment. They are primarily used in infantry platoon/squad battle courses but can also be used at gun ranges as well **[1]**. A picture of the mechanism can be seen below in Figure 1 **[2]**. The SIT mechanism has gone through many iterations over the years, making it more reliable, flexible, and simple to use. Therefore, the SIT systems that exist today are very robust. There are many different companies who design and market SIT systems, these companies include Strategic Systems, Meggitt, Lockheed Martin, and more. All the different SIT systems these companies produce essentially perform in the same way. Therefore, to incentivize organizations into buying their SIT systems, engineers are required to innovate and constantly improve their designs. These improvements are not just limited to the operation of the system but also to things such as portability, reliability, and cost **[3]**.

The competition between companies as well as increasing requirements from clients has given rise to complex SIT systems that provide more variable training. These variables add additional stress and also simulate real combat more closely giving rise to better trained personnel. Some examples include thermal targets which are used for night training, hit detection, and muzzle flash. However, the feature that the design team is primarily interested in is the rotation of a mounted target.Theissen already implements a friend/foe SIT on their MOUT (Military Operations in Urban Terrain) courses **[4]**. Also, Meggitt has a product called the MF-SIT which has the ability to raise and rotate the target a complete 360 degrees in less than a second **[2]**. This is of interest to the team since this feature is one of the goals of this project. Also, it can be seen that a rotating target has already been done and is currently in use.

It has been seen that SITs can vary in their combat simulation variability, but beyond these aspects, many systems follow a standard. For example, all SITs present the same basic targets. These include E-type, F-type, and Ivan-type targets. Also, all target systems run of FASIT 2.0 compliant firmware. FASIT is a set of regulations that helps simplify programming a training routine by keeping a universal set of commands among differing targets, and target manufacturer hardware on a range. More can be learned in the FASIT 2.0 Interface Control Document. The team will have to take these given factors into consideration in order to meet the project requirements.

Figure 1. Example of SIT

2.2 Need Statement

Lockheed Martin's Live Training organization specializes in training domestic and international ally militaries. Currently Lockheed supplies live fire "pop-up" targetry training systems for military target identification purposes. The new target training system requires the ability to rotate the target through various angles in either direction once the target has been lifted in order to present a friendly or foe target.

"Lockheed-Martin's current Stationary Infantry Target does not allow for suitable target presentations"

2.3 Goal Statement & Objectives

"To create a target system that can deploy a variety of targets from a resting position, and rotate to a friendly or foe position on command."

Objectives:

- Lift and rotate targets on command
- Firmware interface with FASIT
- Create a universal mount for variety of targets
- Easily attach and detach various types of targets
- Withstand 35 mph cross winds
- The motor may not be back driven
- Motor will be unaffected by heat, sand, dust, and rain
- Use Figure 11, Ivan, "E" type and "F" type targets

3.0 Constraints

- The total cost may not exceed $3,000.
- Motor must meet FASIT requirements. **[5]**
- Distance from bottom of lifter to top of the arm shall be no more than 18 inches.
- Weight of lifter arm with turner motor shall be no more than 10 lbs.
- Time to install new target shall be less than 10 seconds
- Motor shall rotate the target up to 90 degrees in either direction within 1 second of receiving turn command.
- Motor housing shall be rated to at least IP67.
- Arm shall survive a loose cargo test (details TBD).
- Target arm shall operate -20^{o}C to 50^{o}C and shall have a minimum storage temperature range of -40^{o}C to 60^{o}C.
- Target arm shall accommodate an Ivan-style target (Figure 2a.), an E (Figure 2c.) and F-style (Figure 2d.) target, and a Figure 11 target (Figure 2a.) without reconfiguration.
- Target arm shall fit on the new Lockheed Martin Stationary Infantry Target (SIT) – part number 15721510G1 (dimensions provided).
- Arm shall not impede functionality of muzzle flash feature on the SIT.
- The new bracket and arm must be able to hold the target in wind conditions up to 35 miles per hour
- Firmware shall be compatible with all applicable FASIT 2.0 commands (Refer to Table 1)

Figure 2a.” Figure 11” Target Face

Figure 2b. “Ivan” Style 3D Target

Figure 2c. “E” Style Target

Figure 2d. “F” Style Target

Figure 2. Target Examples

Table 1. FASIT 2.0 PD IDC calls out ASPECT field: values 0 through 6

FASIT 2.0 PD IDC Command	Target Action
0	Concealed
1	Simple Hostile
2	Restricted Hostile Left
3	Restricted Hostile Right
4	Simple Neutral
5	Restricted Neutral Left
6	Restricted Neutral Right

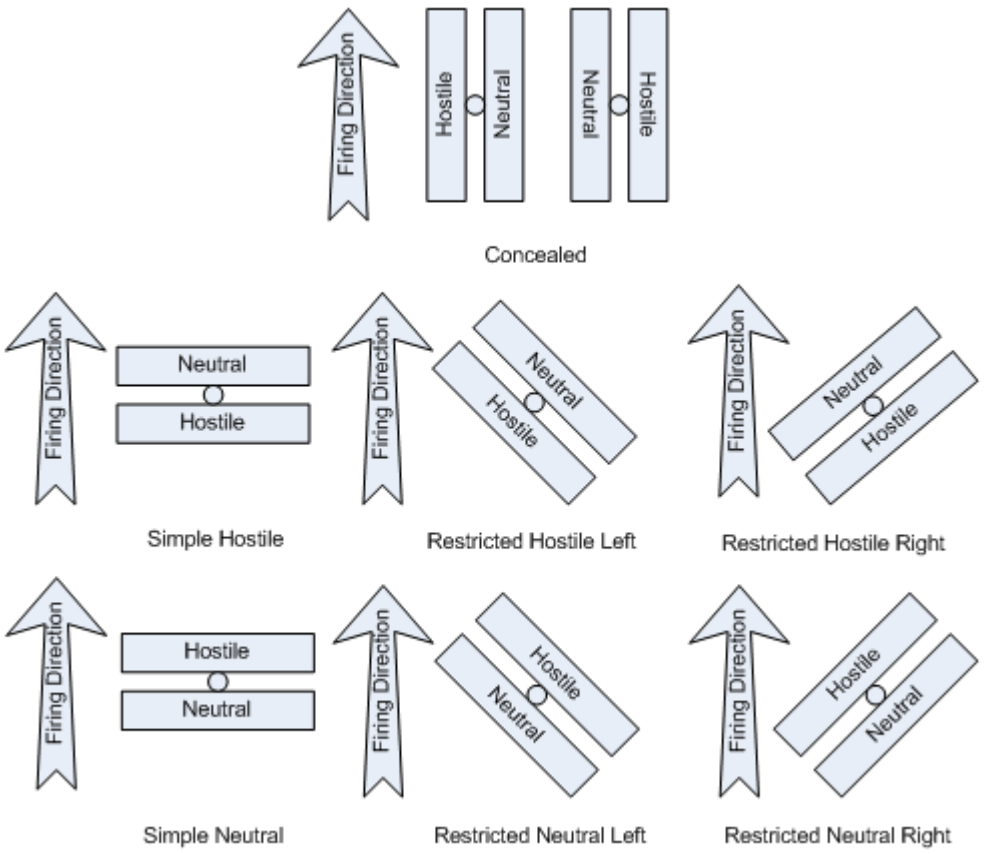

Figure 3. FASIT Target Actions

4.0 Methodology and Approach

Currently the team meets with each other on a weekly basis. The team also meets with the sponsor, Chris Isler, on a weekly basis via conference call. Anything that is discussed about in the meeting is written down by the historian, Andrew Bellstrom. Also, any documents that are given to us by the sponsor goes to the team leader directly who can then decide to delegate it among the members. This way, information sharing is more streamlined.

The team produced a Gantt chart to help plan out the nine months left to work on this project. The time allotted to work on deliverables are concrete due to deliverable deadlines. The time allocated to the design process is more flexible, but will be followed as stringently as possible. The Gantt chart should provide a general idea of the project's status on a given day.

4.1 Gantt Chart

ID	Task Name	Duration	Start	Finish
2	**Code of Conduct**	4 days	Tue 9/8/15	Fri 9/11/15
3	**Needs Assessment**	4 days	Tue 9/22/15	Fri 9/25/15
4	**Project Plans and Product Specs**	**3 days**	**Wed 10/7/15**	**Fri 10/9/15**
5	Gantt Chart Scheduling	1 day	Thu 10/8/15	Thu 10/8/15
6	Methodology and Approach	1 day	Thu 10/8/15	Thu 10/8/15
7	Assign Resources	1 day	Thu 10/8/15	Thu 10/8/15
8	Product Specifications	1 day	Thu 10/8/15	Thu 10/8/15
9	**Design Ideation**	**7 days**	**Thu 10/8/15**	**Fri 10/16/15**
10	Brainstorming	2 days	Fri 10/9/15	Mon 10/12/15
11	Functional Analysis	2 days	Tue 10/13/15	Wed 10/14/15
12	Concept Selection	1 day	Thu 10/15/15	Thu 10/15/15
13	Mentor Review	1 day	Fri 10/16/15	Fri 10/16/15
14	**Initial Web Page Design**	4 days	Mon 10/12/15	Thu 10/15/15
15	**Midterm Presentation I: Conceptual Design**	**3 days**	**Fri 10/16/15**	**Tue 10/20/15**
16	Construct Presentation	2 days	Fri 10/16/15	Sun 10/18/15
17	Practice Presentation	1 day	Mon 10/19/15	Mon 10/19/15
18	**Midterm Report I**	8 days	Wed 10/21/15	Fri 10/30/15
19	**Peer Evaluation**	2 days	Mon 11/2/15	Tue 11/3/15
20	**Midterm Presentation II: Interim Design Review**	**9 days**	**Thu 11/5/15**	**Tue 11/17/15**
21	Product Specifications and Research	6 days	Thu 11/5/15	Thu 11/12/15
22	Parts Selection	5 days	Mon 11/9/15	Fri 11/13/15
23	Mentor Review	5 days	Mon 11/9/15	Fri 11/13/15
24	Budgeting	4 days	Tue 11/10/15	Fri 11/13/15
25	Create Presentation	1 day	Fri 11/13/15	Fri 11/13/15
26	Practice Presentation	1 day	Mon 11/16/15	Mon 11/16/15
27	**Parts Ordering**	16 days	Tue 11/10/15	Tue 12/1/15
28	**Peer Evaluation**	2 days	Mon 11/23/15	Tue 11/24/15
29	**Final Web Page Design**	3 days	Fri 11/20/15	Tue 11/24/15
30	**Final Design Poster Presentation**	7 days	Mon 11/23/15	Tue 12/1/15
31	**Final Report**	7 days	Mon 11/23/15	Tue 12/1/15
32				

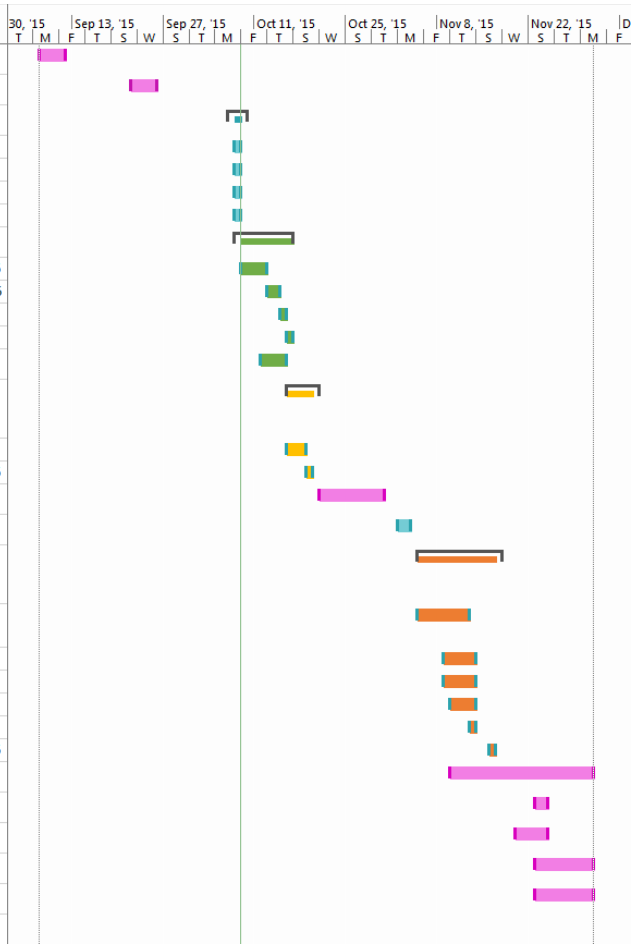

Figure 4. Fall 2015 Semester Gantt Chart

5.0 Assign Resources

Table 2. Assignment of Tasks based upon Fall 2015 Gantt Chart

Tasks	Engineers				
	Ryan	Jordan	Andrew	Ashar	Fernando
Design Ideation	X	X	X	X	X
Concept Selection	X				
Initial Web Page Design			X		
Midterm Presentation **	X	X	X	X	X
Midterm Report	X	X	X	X	X
Midterm Presentation 2 **	X	X	X	X	X
Ordering Parts					X
Final Web Page Design	X	X	X	X	

** Members presenting is to be determined

6.0 Product Specifications and Performance

To ensure the product meets all constraints and specifications listed above. The following features will be measured, calculated and designed to meet all goals. The torque and angular velocity of our motor will be calculated to insure the target moves at the proper speed, with a desired amount of torque. The overall size and weight of the unit will not interfere with the SIT, and will accommodate all needs. The provided lifter, shown in Figure 5, along with the proprietary CAD drawings will be used to allow proper pairing with the SIT and the design of the mechanisms. The stresses experienced by the design are relatively low but a structural analysis will be performed to insure proper material selection. Using these design specifications the expected performance characteristics will meet all needs.

Figure 5. Provided Lockheed-Martin SIT

7.0 Conclusion

The SIT system is part of Lockheed martin live training exercises. Used for training domestic and ally international militaries. This system is being improved upon by the addition of a rotational feature that will allow a single unit be potentially be a friendly or foe target. This design will follow all specifications set by the sponsor. In order to establish a smooth build process a schedule has been created. Through establishing a weekly meeting time with the sponsor, as well as with the Senior Design advisors, the team hopes to meet its goals.

8.0 References

[1]Infantry Squad Battle Course, Army Engineers
[2]Meggitt MF-SIT Specification Document
[3] MS Instruments Stationary Infantry Target Specifications
[4]Theissen GSA Federal Supply Schedule Price List
[5] Future Army System of Integrated Targets: Presentation Devices Interface Control Document 2.0