18th ICCRTS

"C2 in Underdeveloped, Degraded and Denied Operational Environments"

Title of Paper:

Architecture Concerns of Time Sensitive Targeting (TST) and NATO TST Tool

Topics:

Topic 7: Architectures, Technologies, and Tools

Topic 5: Experimentation, Metrics, and Analysis

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Report Documentation Page

Form Approved
OMB No. 0704-0188

1. REPORT DATE	2. REPORT TYPE	3. DATES COVERED
JUN 2013		**00-00-2013 to 00-00-2013**

4. TITLE AND SUBTITLE	5a. CONTRACT NUMBER
Architecture Concerns of Time Sensitive Targeting (TST) and NATO TST Tool	5b. GRANT NUMBER
	5c. PROGRAM ELEMENT NUMBER
6. AUTHOR(S)	5d. PROJECT NUMBER
	5e. TASK NUMBER
	5f. WORK UNIT NUMBER
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) **NATO Communications and Information Agency,The Hague, Netherlands,**	8. PERFORMING ORGANIZATION REPORT NUMBER
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)	10. SPONSOR/MONITOR'S ACRONYM(S)
	11. SPONSOR/MONITOR'S REPORT NUMBER(S)

12. DISTRIBUTION/AVAILABILITY STATEMENT
Approved for public release; distribution unlimited

13. SUPPLEMENTARY NOTES
Presented at the 18th International Command & Control Research & Technology Symposium (ICCRTS) held 19-21 June, 2013 in Alexandria, VA. U.S. Government or Federal Rights License

14. ABSTRACT
Time Sensitive Targeting (TST) is a microcosm of military operations that employs the full range of operations and resources in order to efficiently detect, identify, target, engage and assess emerging targets in the Area of Responsibility (AOR); it requires cooperation and/or coordination among Services or components to successfully engage. Any proposed system architecture to execute TST process needs to smoothly cope within underdeveloped and degraded operational environments due to the nature of TST process. The FAST Tool has been implemented as a coordination and collaboration tool to aid in the tracking and prosecuting of Time Sensitive Targets by addressing environmental and architectural concerns.

15. SUBJECT TERMS

16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
a. REPORT **unclassified**	b. ABSTRACT **unclassified**	c. THIS PAGE **unclassified**	**Same as Report (SAR)**	**9**	

Architecture Concerns of Time Sensitive Targeting (TST) and NATO TST Tool

ABSTRACT

Time Sensitive Targeting (TST) is a microcosm of military operations that employs the full range of operations and resources in order to efficiently detect, identify, target, engage and assess emerging targets in the Area of Responsibility (AOR); it requires cooperation and/or coordination among Services or components to successfully engage. Any proposed system architecture to execute TST process needs to smoothly cope within underdeveloped and degraded operational environments due to the nature of TST process. The FAST Tool has been implemented as a coordination and collaboration tool to aid in the tracking and prosecuting of Time Sensitive Targets by addressing environmental and architectural concerns.

Index Terms — Collaboration, Coordination, Information Exchange, Time Sensitive Targeting

1. INTRODUCTION

An infusion of human decision making has resulted in a system that has helped U.S. forces and their coalition partners dominate the battlefield in Iraq. Known as time-sensitive targeting -- TST for short -- this rapid response system is building a new level of flexibility into combat for allied forces. When targets emerge on the battlefield, time is critical. The TST cell may have only minutes to properly identify a target, determine the best action and send in the appropriate combat power. Military planners spent days planning one combat strike against one fixed target. TST gives friendly forces the option of striking targets minutes after they are identified. [1]

Time-Sensitive Targets (TST) are defined as those targets requiring immediate response because they pose (or will soon pose) a danger to friendly operations or are highly lucrative, fleeting targets of opportunity. The time available does not allow for the standard targeting process to be followed. [3] [4]

Some examples of potential TSTs are mobile rocket launchers (MRLs), mobile high threat surface-to-air missile systems (SAMs), mobile C2 vehicles and facilities, naval vessels, military or civilian which pose a threat and demand an immediate action to neutralize, Loaded transporter, erector, launchers (TELs), deployed theatre ballistic missiles (TBMs), weaponized WMD assets, previously unidentified C2 nodes (requiring an immediate Info Ops response), fixed targets (e.g. a previously untargeted bridge that is about to be crossed by an enemy armoured counterattack force rapidly becomes time-sensitive), terrorist leadership, and mobile radio/TV broadcast stations. [3] [4].

TST prosecution constitutes one important aspect in any Joint Force Commander’s campaign. However, this process highlights cross Component coordination and planning

more than any other event, requiring agility in order to bring desired effects within the timelines that these types of targets usually require. Results must be usually achieved in a limited period of time and lack of preparation is immediately apparent. [2][5]

The purpose of the paper is to outline the TST process, to explain system architecture concerns regarding to the TST process and to describe how the NATO TST tool with the state of the art underlying technology can effectively support the TST process.

2. TST PROCESS IN JOINT TARGETING

Joint Targeting is the process of determining the effects necessary to achieve the Commander's objectives, identifying the actions necessary to create the desired effects based on means available, selecting and prioritizing targets, and the synchronization of fires with other military capabilities and then assessing their cumulative effectiveness and taking remedial action if necessary. It is both an operational and Component level command function. [4]

Targeting falls into two general classes [3]: Deliberate and Dynamic.

> **Deliberate Targeting**: Prosecutes targets known to exist in an operational area with actions scheduled. Examples range from targets on joint target lists in the applicable campaign plan, to targets detected in sufficient time that can be listed in the air tasking order (ATO), mission-type orders, or fire support plans.
>
> **Dynamic Targeting**: Prosecutes targets that have been identified too late, or not selected for action in time to be included in the deliberate targeting cycle, and therefore have not been scheduled.

TSTs are prosecuted using either Deliberate Targeting or Dynamic Targeting. Since TSTs are time-sensitive, and often fleeting or emerging, they tend to be prosecuted via Dynamic Targeting process.

TST prosecution can be considered the most difficult part of targeting because TSTs do not allow for the standard targeting time line to be followed and Commanders are faced with a complex judgment that requires an immediate response.

The TST process is part of the Joint Targeting process (Figure 1) which is essentially a cyclic process that begins with the Joint Force Commander's (JFC's) guidance and objectives and sequentially steps through target development, weaponeering assessment, force applicable, execution planning and force execution, and combat assessment.

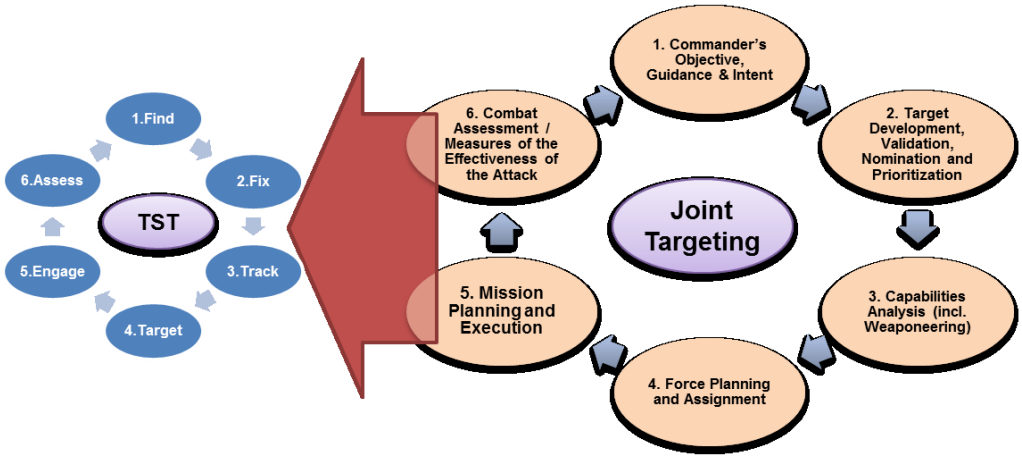

Figure 1: Joint Targeting Cycle and TST

The TST process (Figure 2) consists of six stages as Find, Fix, Track, Target, Engage and Assess (F2T2EA). It is a deliberate process based on previously determined information that can be stored in readily accessible databases for immediate retrieval. With access to the right information systems, much of the pre-mission planning and portions of the targeting process can be completed beforehand, in collaboration with other forces, and stored for later retrieval to effectively compress the targeting sequence for TSTs. Final strike planning that cannot be completed until target details are known (e.g., identification and location) can be done in parallel using near-real-time (NRT) information-sharing to further compress planning-to-execution timelines.

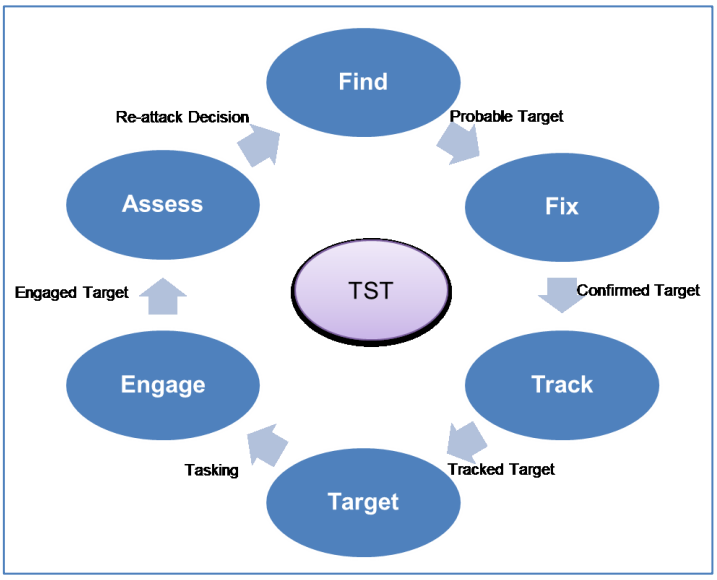

Figure 2: TST Process Cycle

The TST process is a cyclic process; therefore, depending on the assessment and decision done in last step, the process can start again for the same target. The TST process steps are explained below.

Find: This step involves Intelligence Preparation of the Battlespace (IPB), traditional Intelligence, Surveillance and Reconnaissance (ISR) (collection) and non-traditional ISR (e.g.

radar warning receiver indication, special operations forces, etc.) and provides initial detection of a potential TST. Potential TSTs, when detected, trigger actions to determine if the particular event warrants further attention or deviation from the existing plan and leads to initiation of the TST targeting cycle.

Fix: This step focuses sensors to identify and geo-locate a TST (typically via cross-cueing and intelligence fusing) and supports an initial risk assessment. The output of this step is an approved TST in accordance with the JFC guidance.

Track: Sensors are assigned and track of the TST is maintained. Tracking is a continuous process and runs from the Fix step to the successful prosecution of the target and its kill assessment.

Target: Restrictions including Collateral Damage Estimate (CDE), Rules of Engagement (RoE), restricted/no-strike targets of the Joint Targets List (JTL) and de-conflictions are satisfied during this step. The Target step matches attack assets against the desired effect (weaponeering), completes a risk assessment, and determines the required force packaging. Final approval for TST engagement is made during the Target step, and the output is a tasking to the selected component engagement system.

Engage: The TST engagement is ordered and transmitted to the selected weapon system. The engagement is monitored, and the output is the actual target engagement.

Assess: The collection (Battle Damage Assessment, BDA) and assessment of information about the results of the TST engagement is conducted to determine whether the objectives or desired effects have been achieved.

The TST process is a team effort. Multiple people with different functional backgrounds (e.g. intelligence officer, targeteer, TST chief and attack coordinator) together form a (JFC) TST Cell. These people are referred to as participants. It should be noted that the JFC TST cell can be located at any level in the chain of command, and the tool to prosecute TSTs must provide the flexibility necessary to support the TST process participants at any level. When a new target emerges that is determined to be a TST, a number of predefined tasks need to be performed such as target PID and CDE. It is necessary that the participants coordinate, in a structured manner, TST process activities. For coordination to be effective it is essential that the participants also collaborate¸ i.e. discuss TST related issues in free format. [5]

3. TST SYSTEM ARCHITECTURE CONCERNS

Due to the fleeting nature of time sensitive targets, a highly capable tool for supporting the command and control (C2) processes necessary to successfully engage and destroy these targets is needed. TSTs need to be prioritised, categorized, coordinated, de-conflicted, and directed for engagement by the joint force.

Successfully engaging TSTs requires centralized planning and decentralized execution. Centralized planning occurs at the joint force level with JFC guidance and intent, target prioritisation, and establishing the criteria for what constitutes a TST and the actions to be

taken against them. Decentralized execution consists of delegating engagement authority to joint force component commands -either directly, or through joint force target coordinating agencies. [3]

The TST process should support coordination and collaboration. Both coordination and collaboration are performed by multiple participants. Coordination part is considered to be the core of the TST process. Collaboration is an unstructured process, whereas coordination involves the performance of well-defined, structured tasks. In addition to supporting coordination and collaboration, other functionalities are necessary for successful execution of the TST mission such as providing situational awareness of the "neighbourhood" of an identified TST and killbox management.

Communication within the cell can be a problem due to the number of participants in a cell, the remoteness of some participants and the time sensitivity of the target.

Participants can survive to operate with old stated data using other communication means (i.e. phone) in case of no network connection; therefore, resistance to a single point of failure is highly important for the design of any TST tool and participants should maintain their own system state/data and share them with others.

As the TST process requires many participants who are located in multiple command levels (joint force, component command, tactical), the TST tool shall be able to run over a wide area network with different network bandwidth and speed limitations.

Due to the operational sensitivity of targeting data, the protection of TST data and keeping track of any changes for audit logging purposes are very important.

To streamline the communication process, participants should communicate and collaborate with each other and possibly with other cells. This communication/collaboration should be visible to all parties involved, so duplicate discussions amongst different cell members can be avoided. This collaboration should cover both textual and graphical (white boarding) means.

Situational awareness as a supporting capability needs to be available during the execution of TST process, for example on-going missions, order of battles or other targets in the vicinity of the TSTs.

4. NATO TST TOOL ARCHITECTURE SUPPORTING TST PROCESS

Due to the high importance assigned to TSTs and the frequently very compressed timelines involved in successfully engaging them, a computer-based tool to support access to critical data and the exchange of information between personnel participating in the TST process is essential. The FAST (**F**lexible, **A**dvanced C2 **S**ervices for NATO (Joint) **T**ime Sensitive Targeting) Tool has been implemented to provide these capabilities as a coordination and collaboration tool, designed to aid in the tracking and prosecuting of Time Sensitive Targets.

The FAST Tool consists of two components (Figure 3), FAST Coordination and FAST Collaboration as well as multiple modules that perform specific functions and that interface with other FAST modules and components as well as with external sources to exchange data.

The primary functions of the FAST Coordination Component are to:

- Provide an overview at a glance of the status of all active TSTs and individual tasks assigned to the participants in the TST process
- Assign TST tasks and update status of task performance
- Keep records of all transactions

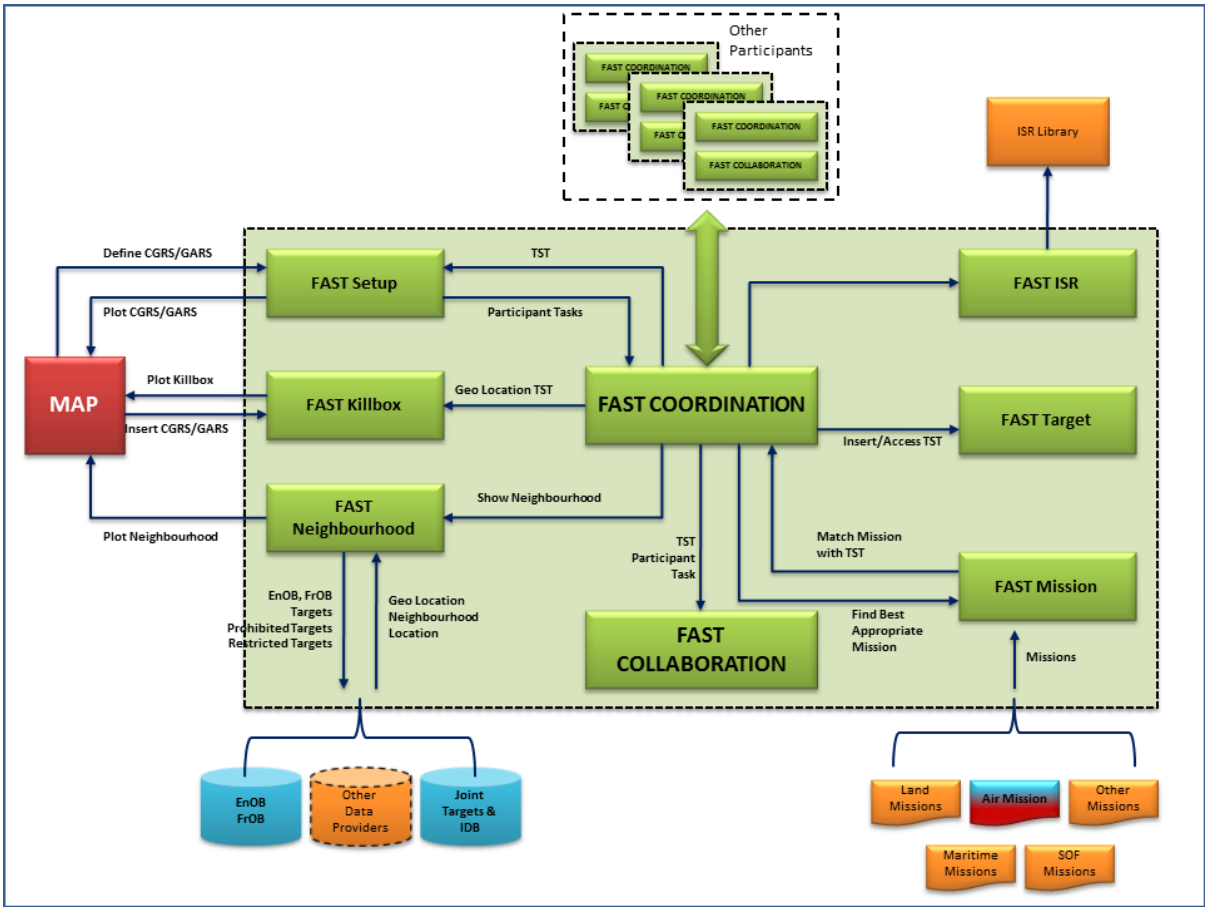

Figure 3: FAST Architecture

The FAST Collaboration Component provides the Joint Chat (JChat) capability that is used for informal information exchange both within the TST Cell and with external groups. While FAST Coordination provides for structure information exchange, FAST Collaboration supports the exchange of free-text information to supplement the structured processes.

The central part of the FAST, the Joint Time Sensitive Targeting (JTST) dashboard, has been designed to present the large amount of data pertaining to the current state of target prosecution in a condensed, yet easy-to-understand, way. Communication within the cell can be a problem due to the number of participants in a cell, the remoteness of some

participants and the time sensitivity of the target. To streamline the communication process, the FAST tool has a built-in chat client. This client allows participants to communicate with each other and possibly with other cells. This communication is visible to all parties involved, so duplicate discussions amongst different cell members can be avoided.

Because of TST requirements a solution has been chosen without a central database. All FAST users do connect to a central TST Data Server to share data. The server itself does not have any data state; it merely acts as a data rely on station between different FAST users. The server is placed somewhere on a Local Area Network (LAN) or Wide Area Network (WAN). Typically the server will be placed on a mission network.

Because there is no central storage on the network all FAST clients maintain their own system state (in the form of XML files); the FAST application makes sure that all users will have the same state at all times when they are connected to the server. One of the advantages of not having central data storage is that in case of any malfunctioning of the TST Data Server it is only a matter of starting another server at another machine, or even at another site. Since the server has no data state the operations can in this case continue immediately. In future versions it might even be possible to have an automatic fall-over to another predefined backup server. In that case the user will not even notice that the original server went down.

For completeness, it needs to be mentioned that FAST can also safeguard continuity of operations in another way. FAST also has an integrated JChat client which supports up to three JChat rooms. In case the TST Data Server malfunctions, but the JChat server still works, it is still possible to use FAST to communicate with all participants using the integrated JChat client. When the JChat server malfunctions, but the TST Data Server still works, it remains possible to use FAST coordination, and send participants messages, because FAST does have its own instant messaging application.

5. CONCLUSION

Time Sensitive Targeting can be considered as the most difficult part of Joint Targeting process since TSTs do not allow for the standard targeting time line to be followed. Successfully engaging TSTs requires centralized planning and decentralized execution. Any system architecture proposal to execute TST process needs to cope with challenging operational requirements such as underdeveloped and degraded operational environments.

The FAST tool has been implemented as a coordination and collaboration tool to support access to critical data and the exchange of information between personnel participating in the TST process as coordination and collaboration tool; it addresses challenging architecture concerns (data de-centralisation, bandwidth, time-sensitivity, continuity…) to facilitate TST process run smoothly.

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