



ACQUISITION RESEARCH PROGRAM SPONSORED REPORT SERIES

T2S and Sustainment Performance of Army Ground Combat Systems

September 2023

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Prepared for the Naval Postgraduate School, Monterey, CA 93943.

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ABSTRACT

This project examines a sampling of Army Acquisition Programs in “T2S” (Transition to Sustainment) and analyzes the similarities and differences between programs relative to their planning, execution, and results experienced in terms of Sustainment Phase Performance Metric impacts. This project includes a mixed-method analysis process. Methodology includes published Army policy documents, scholarly articles posted to the internet, published literature, program requirements and acquisition documents, and published program performance metrics. Methods include an analysis of published guidance as it pertains to the definition of T2S, as well as a breakdown of T2S into “macro” and “micro” activities for each program, identifying and categorizing program projects in each category. Methods also include a comparative analysis of the program factors pre-T2S, during T2S, and post-T2S, to include program funding, life-cycle sustainment strategies, program office structure, program and sustainment office interaction, and a breakdown of macro and micro T2S actions relative to their impact on sustainment metrics realized. This project also analyzes the evolving relevant guidance related to the T2S process during the timelines under consideration for each program.



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LIST OF ACRONYMS AND ABBREVIATIONS

AAE	Army Acquisition Executive
ACAT	Acquisition Category
A _m	Materiel Availability
AMC	Army Materiel Command
A _o	Operational Availability
AR	Army Regulation
ASA (AL&T)	Assistant Secretary of the Army for Acquisition, Logistics, and Technology
AWCF	Army Working Capital Fund
BFIST	Bradley Fire Support Team
BFVS	Bradley Fighting Vehicle System
CAP	Capstone Applied Project
CLS	Contractor Logistic Support
DM	Depot Maintenance
DOD	Department of Defense
DRRS	Defense Readiness Reporting System
ECP	Engineering Change Proposal
EE	Equipping
FOC	Full Operational Capability
FRP	Full Rate Production
GCS	Ground Combat System
IAW	In Accordance With
ICS	Interim Contractor Support
ILSM	Integrated Logistics Support Manager
IOC	Initial Operational Capability
IPS	Integrated Product Support
IPSM	Integrated Product Support Manager
KPP	Key Performance Parameter
KSA	Key System Attribute
LA	Logistics Assessment



LCMC	Life Cycle Management Command
LCSP	Life Cycle Sustainment Plan
MATDEV	Materiel Developer
MDT	Mean Down Time
MMDF	Materiel Master Data File
MRA	Manufacturing Readiness Assessment
MWO	Modification Work Order
NDAA	National Defense Authorization Act
NMCS	Non-Mission Capable Supply
ODS	Operation Desert Storm
OSR	Operational Sustainment Review
PD	Production & Deployment
PEG	Program Evaluation Group
PEO	Program Executive Officer
PICA	Primary Inventory Control Activity
PM	Program Manager
POM	Program Objective Memorandum
PSI	Product Support Integrator
PSM	Product Support Manager
PSP	Product Support Provider
SA	Supply Availability
SOP	Standard Operating Procedure
SORTS	Status of Resources and Training Systems
SS	Sustaining
SSTS	System Sustainment Technical Support
T2S	Transition to Sustainment
TLCSM	Total Life Cycle System Manager



I. INTRODUCTION

A. PROBLEM STATEMENT

The Department of Defense (DOD) acquisition process represents a multifaceted journey through the development and procurement of defense capabilities, with the Transition to Sustainment (T2S), or the point where a DOD acquisition program transitions from production to sustainment, standing as one of the most critical junctures in determining the overall success or failure in any defense program. The significance of the sustainment phase becomes evident when considering its profound impact on program costs throughout the acquisition life cycle. A successful T2S plays a pivotal role in allowing the DOD to maintain operational readiness rates for critical defense capabilities, while also effectively responding to evolving threat requirements and simultaneously ensuring a balanced DOD budget over time. Amidst various success stories, some programs have experienced negative consequences due to struggles and unplanned failures associated with the T2S process, leading to unplanned escalation of program costs or a marked inability to sustain readiness levels.

B. RESEARCH QUESTIONS

In this capstone applied project (CAP), we explore the T2S results for multiple Department of Army Ground Combat System (GCS) programs, looking to gain valuable insights into opportunities for the DOD to dive deeper into specifics of this critical DOD Acquisition System planning and execution process. By analyzing the process of T2S and the contributing factors associated with what constitutes a “successful” or “failed” transition, this research aims to shed light on the T2S performance of high visibility Army programs that may be used as examples for how to execute T2S while safeguarding the readiness of capabilities and achieving fiscal prudence in the ever-changing landscape of national security challenges.



C. RESEARCH METHODOLOGY

Given the availability of phase-specific guidance and data associated with reported defense program readiness postures over time, we examine possible impacts on how T2S was planned for and/or executed, relative to any reported readiness postures realized. Our approach is to analyze program results witnessed in proximity to the T2S guidance known at that time to gauge the Sustainment Performance Metrics realized before, during, and after T2S for each U.S. Army Ground Combat System (GCS) with available data.

D. RESEARCH SCOPE AND LIMITATIONS

The Acquisition Life Cycle that we know today still contains a somewhat vague definition of the timing of even the required actions that map to what we refer to as “T2S” planning and execution. As such, we were required to make some assumptions and acknowledge some limitations of our chosen scope to allow for an objective analysis based on a common set of available data for any DOD weapon system.

Our assumptions are as follows:

1. Product Support Strategy options prior to 2015 are similar to those after 2015.

- Prior to 2015, the baseline Product Support Strategy types fall within commonly referenced categories (Organic, Contractor Logistics Support [CLS], Interim Contractor Support [ICS], etc.); however, the unwritten “T2S” processes followed prior to this time period are assumed to be inconsistent and would require more time than we have to complete this paper to undertake a thorough analysis of every system.

Because a requirement for post-production Logistics reviews (beyond a Life Cycle Sustainment Plan (LCSP) or Supportability document update) was not found stated as a requirement directly or indirectly in any Acquisition Life Cycle guidance until 2015, we cannot objectively analyze the procedures followed for T2S without interviewing individuals



involved in the T2S time period for weapon systems that transitioned prior to 2015.

2. The percentage of Non-Mission Capable Supply (NMCS) systems reported is correlated to the Supply Availability (SA) (sub-metric of the mandatory metric of Materiel Availability or “Am”).

The NMCS metric tracked by each Life Cycle Management Command (LCMC) Product Support Provider (PSP) for the Supply Support Integrated Product Support (IPS) function for each weapon system is tracked closely over time. In absence of historical SA data for each GCS weapon system reviewed in this paper, we were required to assume a correlative relationship between the overall SA calculated for a particular weapon system over a period to the percentage of reported NMCS systems over that same period. While we understand that the percentage of NMCS systems reported does not necessarily directly track to the reported SA metric of the fleet of weapon systems, we do assume that the NMCS percentages to be a statistically significant measurable indicator of the overall performance of the Supply Support IPS Element (the IPS Element that is tied to the SA metric).

Because unit reporting and Standard Operating Procedures (SOPs) with regards to reporting the status of their equipment in accordance with the applicable guidance may vary, we wanted to acknowledge that the percentage of NMCS systems over a given period does not directly tie to a specific percentage of SA measured at that same time period, and we acknowledge that these numbers can be manipulated within the reporting process and systems themselves. Using NMCS percentages gives an indication as to the mandatory “Am” Sustainment Performance Metric, but they are not the only variable that contribute to that metric.



3. Direct interviews of key personnel would be best to dive deep into specifics.

Direct interviews and feedback from the lead logisticians (Integrated Logistics or Product Support Managers [ILSM and IPSM, respectively], Product Support Managers or “PSM’s,” or similar positions with different titles) responsible for executing the logistics planning from the PM/PEO side and LCMC side during the T2S (whether officially designated as T2S or not) time period would be best for understanding the exact planning and execution processes followed for all programs prior to 2015.

Our research relied on published Sustainment Performance Metric data, published acquisition system and policy guidance and historical data, modern systems and databases that transferred only specific time periods of data, and published professional articles, journals, and research papers. We chose not to do any interviews of individuals outside of the advisors we were required to have. We acknowledge that based on this decision, we were limited in our ability to access potentially significant data sources that may change the conclusions or deductions garnered based on the data we chose to present. This would potentially be a type of follow-on research for additional researchers to consider in the future.

4. Additional access to Logistics Planning Data would provide more answers to execution steps.

While Sustainment Performance Metric data (such as reported Equipment Readiness data) are available for most GCS systems as far back as 1994, much of the logistics planning data is not in a consistent enough format to make comparison and contrasting of similarities and differences very easy between programs within the time constraints we must complete our analysis.

We plan to present data that allows for follow-on research to be completed if additional researchers have more access to such data.



Additional “Micro T2S” data is required to analyze in depth impacts of Micro T2S actions.

Analysis of “Micro T2S” events would require a consolidation of Configuration Management data to identify where Engineering Change Proposals (ECPs) and Modification Work Orders (MWOs) associated with new materiel introductions to a fleet of fielded equipment, at a chosen point toward the end of the Production phase, occurred. This data could be aggregated by weapon system and correlated to a designated “T2S” date identified by the T2S Data Call data we do have presented in this paper. The current regulatory guidance (AR and AR 750-10) requires modifications to systems either in Production or no longer in Production to be applied in a specific fashion. The configuration management data would identify where this occurred and what Logistics impact assessments and subsequent planning was or was not done in conjunction.

5. The Impact of System Sustainment Technical Support (SSTS) Program Objective Memorandum (POM) Data Level of Detail Relative to Sustainment Performance Metrics

Early drafts of our research attempted to dive into funding requirements and shortages. However, we soon realized that this would exceed the scope of time we had to complete our research. For one reason, the SSTS POM data we received reflected a “family” of systems level of detail that made it difficult to draw a one-to-one comparison of requirements for specific variants within a family. For example, our SSTS POM Data lines reflected a “Bradley” submission with a subject description listing (i.e., in FY14 there is a mention of “BFVS A3, BFVS ODS, and M7 BFIST Logistics Functions”). However, the reported Readiness data we were provided lists “BFVS A2” and “BFVS A3.” Therefore, we cannot draw a direct correlation between the Sustainment funding requirements shown in the POM and the Sustainment Performance metrics reported without looking at additional data from the same time period specific to each



variant. While this data may be related in some fashion, it cannot be taken at face value as truly correlative to the T2S of individual variants or the Family represented by those variants without further investigating.

E. SUMMARY OF CHAPTERS TO COME

In summary, in the chapters that follow we attempt to examine the following questions in greater detail:

- Chapter II: What is T2S? How did T2S come about, and what decisions contributed to any results witnessed in the history of the development of the construct of the T2S process?
- Chapter III: How has T2S changed with changes in the acquisition life cycle definition of “Sustainment”?
- Chapter IV: What, if anything, can we learn from the T2S execution of specific Army Ground Combat System’s planning and execution of their respective T2S processes?



II. DEFINING T2S

The Department of Defense (DOD) Acquisition system, as defined by DODI 5000.02, *Operation of the Defense Acquisition System*, is a process by which all DOD weapon systems are acquired. This process governs the pathway by which the DOD delivers combat capabilities to meet current and future warfighter requirements, including requirements definition, system design, manufacturing, production, fielding, sustainment, and disposal. In the most basic sense, the term “T2S” or “Transition to Sustainment,” in reference to the DOD Acquisition System, most commonly refers to a time period in which a weapon system or warfighter capability completes the “Production and Deployment” or “PD” phase and enters the “Operations and Support” or “O&S” phase of its Acquisition Life Cycle. A depiction of the Major Capability Acquisition Life Cycle View, with the “T2S” period annotated in red, is shown in Figure 1.

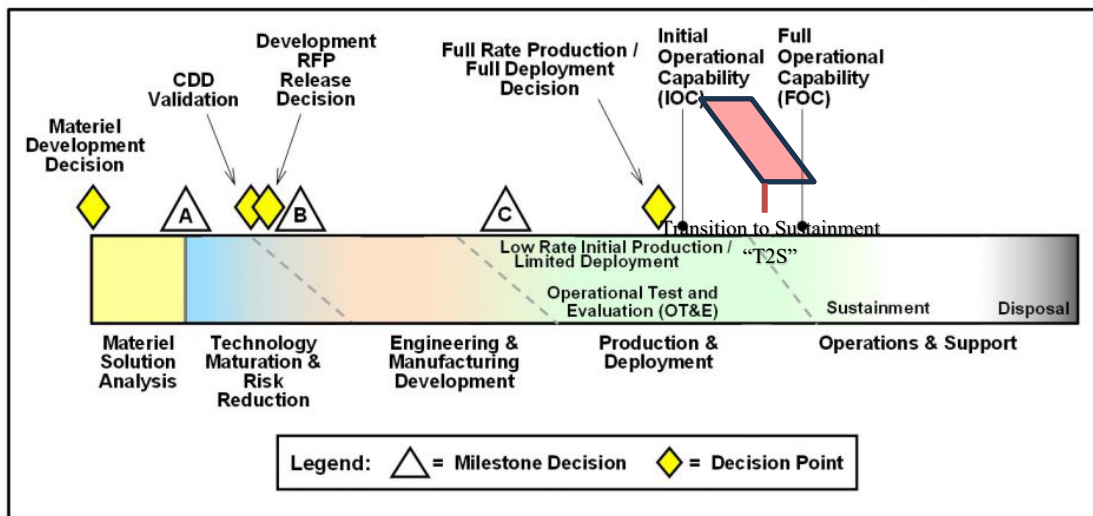


Figure 1. Major Capability Acquisition Model with T2S Period Identified.
Source: DAU (2019).

The PD Phase consists of two efforts: “Low-Rate Initial Production (LRIP) and Full-Rate Production (FRP)” (AcqNotes, 2021). The O&S Phase consists of all activities necessary for Life Cycle Sustainment and Disposal.



Under the DOD Acquisition System of today, the primary stakeholders and responsible organizations in the T2S process are the Program Executive and Program Management Offices frequently described in all policy documents as the “Total Life Cycle System Managers,” or “TLCSM,” and the Major Subordinate Commands or “Life Cycle Management Commands” and their Integrated Logistics Support Centers (ILSCs) that provide integrated product support products and services.

A. HISTORY

The DOD Acquisition in 2023 has evolved from many evolutions of the Defense 5000 series acquisition regulations. The Acquisition process has developed incrementally over time, with numerous changes in regulatory requirements, initiatives to correct and refine issues, and evolution of thought processes as the changing defense requirements and priorities have changed.

Though not defined as an official Acquisition System phase within DODI 5000.02, the time period now defined by the acronym “T2S” is a process that has evolved in definition, length, and emphasis enough to constitute close examination of its history. Understanding the evolution of relevant DOD Acquisition policies, and specific T2S definitions, requirements, and impacts on typical “PD” or “O&S” phase activities is central to any attempts to examine a specific program’s respective execution of processes during this transitional period and any results experienced. Relevant major milestones and dates leading to the definition of T2S as it is defined today are shown in Table 1 (a summary of each date is included in the paragraphs that follow).



Table 1. Significant Developments along the History of the Construct of the T2S Process.¹

Year	Significant Milestone/Document Change/Action
1986	Goldwater–Nichols Act of 1986
1999	National Defense Authorization Act for Fiscal Year 1999
2004	Establishment of the LCMC
2009	DOD Weapon System Acquisition Reform: Product Support Assessment
2010	National Defense Authorization Act for Fiscal Year 2010
2011	DOD Logistics Assessment Guidebook Change
2011	AR 70-1 Change – PMs cited as TLCSM
2012	National Defense Authorization Act for Fiscal Year 2012
2013	National Defense Authorization Act for Fiscal Year 2013
2014	AR adds required Annexes to the LCSP
2015	AR 700-142 identifies LCMC and PM roles in TC/MR
2015	DOD Instruction 5000.02 – January 7, 2015 Change
2015	ASA (AL&T) Memorandum, Operations and Support Review
2017	Update to “Transition to Sustainment” Definition
2018	Refined Definition of Army Directive 2017-31 T2S Definition
2019	ASA (AL&T) announces plan to develop “Transition to Sustainment Guidebook”

1. 1986: Goldwater-Nichols Act of 1986

The foundation of the process known today as DOD “Sustainment” was laid by the Goldwater-Nichols Act of 1986 that, among other things, streamlined the organization of the military services to a single chain, while also establishing the Program Executive and Program Management Office functions by removing the Materiel Commands (such as the Army Materiel Command) from the Design and Acquisition roles within the DOD Acquisition process to focus solely on Sustainment.

Under this construct, Army Materiel Command (AMC) was removed from the same reporting and oversight chain as the Program Offices but still held responsibility for supporting Program Offices via matrix support arrangements. This change established the position of the “Army Acquisition Executive” (AAE) as the principal decision-maker in

¹ Dates and milestones between 1986 and 2015 adapted from Gross (2016). Dates between 2017 and 2019 are not part of Gross (2016) chronological efforts in support of similar research topics. Assembled into a table format in this paper for clarity of chronology.



the PM/PEO chain of command for all Acquisition Category (ACAT) I–III programs (Gross, 2016, p. 25).

This set the foundation for the Acquisition Life Cycle responsibilities seen today, serving as the seed for congressional appropriations to be allocated according to Acquisition Program Life Cycle Status.

2. 1999: National Defense Authorization Act for Fiscal Year 1999 (NDAA 1999)

In 1999, this NDAA directed the Secretary of Defense to establish a “comprehensive readiness reporting system” which can be used to measure the operational readiness of all DOD service capabilities (“Defense Readiness Reporting System,” 2023).

This addition created a means for the use of an overarching single objective measure that encompassed inputs and contributions of all lower-level metrics for acquisition program performance at a given point. Comprehensive readiness reporting of the fleet of fielded systems against a single requirement ultimately could now serve as a collective acquisition program stakeholder measurement, marrying the requirements input of the capability requirement owner to the capability developer provider against a single objective output.

3. 2004: Establishment of the LCMC

This change was followed by a subsequent subdivide of the Materiel Command responsibility in the Sustainment role, in 2004, with the establishment of the Life Cycle Management Command (LCMC) organization. At that time, the LCMC role was to unite the areas of Technology, Acquisition, and Sustainment not covered by the Program Offices (Gross, 2016, p. 26).

This establishment allowed for the possibility of a more focused set of plans and processes to be developed around the Production and Sustainment Phases of the Acquisition Life Cycle, allowing for delineation of much clearer roles and responsibilities for identifying Production Phase and Sustainment requirements to the lead Production stakeholder, the Program Offices, and the lead Sustainment stakeholder, the LCMC.



4. 2009: DOD Weapon System Acquisition Reform: Product Support Assessment

A 2009 DOD Weapon System Acquisition Reform Product Support Assessment update recommended that the department “create a post-IOC review led by DUSD (L&MR) and the respective Service(s) responsible for life cycle management” (Kobren, 2015). This reform marked the change to the requirements post the start of production for all acquisition programs, now deciding that “a formal post-IOC review is warranted to both assess operational performance and put back-pressure on existing acquisition reviews to be more disciplined in their attention to down-stream consequences” (Kobren, 2015).

On the heels of the relatively recent establishment of the LCMC as the lead Sustainment stakeholder, it became more possible than ever to identify commonality between lessons learned throughout the portfolio of Readiness Reporting fielded materiel currently being sustained by the lead sustainer, the LCMCs. In delineating key assessment criteria, it became possible to define requirements to continue to improve upon any assessed results.

5. 2010: National Defense Authorization Act for Fiscal Year 2010

The 2010 National Defense Authorization Act required that Program Management Offices assign “Product Support Managers (PSM) to all major weapon systems and outlined the roles and responsibilities that PSMs must perform, including developing and implementing a comprehensive product support strategy” (Gross, 2016, p. 51).

This would serve as a pivotal development in the timeline of actions and activities related to T2S, appropriation allocations, and the roles and responsibilities identified as a result. This assignment put primary Sustainment decision influence within the Program Office, as opposed to the lead Sustainment stakeholder, the LCMC. Logically, the inherent influence of Production Phase decisions on downstream Sustainment requirements served as the central premise for making this decision.

6. 2011: DOD Logistics Assessment Guidebook

In July 2011, the *Logistics Assessment Guidebook* stated:



Post-IOC LAs are conducted to assess if the Program Manager delivered to the user a system that is supportable per the planned requirements, was executed to the program planning documentation, is within the estimated ownership costs, and the status of progress addressing deficiencies noted during previous assessments or during operations, such as low reliability. It also assesses any Integrated Product Support elements where the planning was implemented to the requirement but the requirement itself was not adequate. ... *The initial post-IOC LA represents a key transition point between acquisition and sustainment in the system life cycle.* Assessment results can influence future requirements for modifications or upgrades to the system, as well as future capability needs met through successor acquisition programs. (US Department of Defense [US DOD], 2011, p. 21)

This guidebook would provide the infrastructure and architecture to systematically tie current Pre-MS B activities, planning, requirements, and performance measurements to fielded materiel Acquisition Program performance. This marked the first point where a specific time period within the Production Phase was identified as a critical contributor to Sustainment requirements, and first officially referenced the concept of a “Transition” of any type. This provided the scaffolding for appropriation requirement delineation in the future that would be central to the ultimate T2S construct (DAU, 2019).

7. 2011: AR 70-1 Change – PMs cited as TLCSM

In 2011, an update to AR 70-1 marks the first time PMs are identified as the “Total Life Cycle System Managers” (TLCSM) without the ability to shift this responsibility to any other organization, indicating “there are no transitions of life cycle management responsibilities” (USD AT&L, 2011).

8. 2012: National Defense Authorization Act for Fiscal Year 2012

The 2013 NDAA required:

The military departments to conduct an independent logistics assessment of each major weapon system prior to key acquisition decision points (including milestone decisions) to identify features that are likely to drive future operating and support costs, changes to system design that could reduce such costs, and effective strategies for managing such costs. (DAU, 2019)



9. 2013: National Defense Authorization Act for Fiscal Year 2013

The 2013 NDAA codified the roles and responsibilities of the PSM at Section 2337 of Title 10, U.S. Code (Russell, 2014).

10. 2014: AR adds required Annexes to the LCSP

This revision of AR added the “Sustainment Review” and “Independent Logistics Assessment” annexes as a requirement to the LCSP (Headquarters, Department of the Army [HQDA], 2014).

11. 2015: AR 700-142 identifies LCMC and PM roles in TC/MR

This revision of AR 700-142 sets the stage for the importance of T2S planning between the PM and LCMC. This revision places TC/MR strategy and execution responsibility on the PM; however, it names the “LCMC with the sustainment mission” as the MR Authority (HQDA, 2015).

12. 2015: DOD Instruction 5000.02 – January 7, 2015

The 2015 version of the DODI 5000.02 addressed what it calls “Post IOC Sustainment Reviews,” mandating that:

After IOC, the DOD Components will continue to conduct ILAs at a minimum interval of every 5 years. DOD Components will provide results to the Assistant Secretary of Defense for Logistics and Materiel Readiness. Assessments will focus on the weapon system-level product support performance in satisfying warfighter needs, meeting sustainment metrics, and providing best-value outcomes. (DAU, 2019)

13. 2015: ASA (AL&T) Memorandum, Operations and Support Review, Apr 2015

In 2015, Army Acquisition Executive (the Honorable Heidi Shyu) designated the Operational Sustainment Review (OSR) as:

The formal post-production decision review focusing on preparing the system to transition from procurement resourcing to sustainment resourcing, actual execution of the sustainment strategy, and future Operations and Support (O&S) planning and costs. At this time, a successful OSR documents the official transition of a system from



development and procurement to operation and sustainment. (Gross, 2016, p. 21).

14. 2016: First Definition and Creation of the Term “Transition to Sustainment – T2S”

2016 marked the first time the term “T2S” is used and defined as:

The transfer of a system that has been fully developed that has met its planned production goals to being sustained following preplanned maintenance activities that will maintain it in a fully mission-capable status to the end of its estimated useful service life. (Gross, 2016, p. 22).

15. 2017: Update to “Transition to Sustainment” Definition

In 2017, Army Directive 2017-31, updated the definition of “Transition to Sustainment” to:

The deliberate and predictable conditions-based transition of responsibility to execute sustainment from the program manager to USAMC, including operation and maintenance funding for equipment hardware and software life-cycle sustainment. The time period is bounded by initiating transition to sustainment at the full-rate production decision and is complete no later than initial operation capability plus 3 years. (HQDA, November 2017)

16. 2018: Refined Definition of Army Directive 2017-31 T2S Definition

In an AMC Brief to the Department of the Army and Vice Chiefs of Staff of the Army (October 29, 2018), the Army Directive 2017-31 definition is refined as follows:

From Initial Operational Capability + 3 years to a condition-based transition as defined above + 3 years or as directed (budget accommodation). (HQDA, October 2018).

17. 2019: ASA (AL&T) plan to Develop “Transition to Sustainment Guidebook.”

In the Sep-Oct 2018 issue of the “Army Sustainment” newsletter, AAE Dr. Bruce Jette of ASA (AL&T) mentions plans to release a “Transition to Sustainment Guidebook” in FY19 to assist PSMs and Product Support Integrators/Providers in effectively planning, implementing, and executing all required Transition to Sustainment processes (Jette, 2019).



B. CONTENT

As the above history indicates, the invention and definition of “T2S” has progressed significantly since its foundation in the Goldwater–Nichols Act of 1986. In parallel to the evolution and fine tuning of the overall DOD Acquisition System in response to the changes in warfighter requirements, the requirements of not only the systems being acquired but also the requirements of processes and systems created, rearranged, or replaced to manage each acquisition stage have evolved as well. However, as wide-ranging as the type of products and services acquired by the DOD Acquisition System are, so are the processes required to support and execute. Policymakers face significant challenges that make it difficult to quickly drive the depth of change required to implement the top-to-bottom changes in major policy documents, regulations, or lower-level organizational guidance enough to account for all possible tasks, conditions, standards, systems, or strategies.

In analyzing the progression of what is effectively becoming an unstated “Phase” of the Acquisition Life Cycle, the T2S process as it is defined to date still has many issues needing further clarification or definition. What follows are two areas yet to be clarified by the current definition and process that is T2S as of today, despite the recent changes, needed to truly analyze the respective Sustainment Performance of any Acquisition Category of Program:

What is in “Transition”?

What is “Sustainment”?

1. What Is Actually in “Transition”?

Prior to 2017, this foundational question was not clear as to what was under consideration when stating that a particular system was in “Transition to Sustainment.” In 2017, additional verbiage clarifying what was under consideration was added to the T2S definition. The transition did not refer to the transfer of a “system,” but rather to a transfer of “the responsibility to execute sustainment from the program manager to USAMC, including operation and maintenance funding for equipment hardware and software life-cycle sustainment.” (HQDA, November 2017)



In adding the above verbiage to the definition of the time period between the PD and O&S phases, the “Transition” portion of the T2S process from one phase to the next more clearly refers to execution of “sustainment.” Thus, what is really being planned and described is a transition not of the system itself, but of the “responsibility to execute sustainment.”

2. What Is “Sustainment”?

To fully understand what this transition of responsibility entails, we must further examine the full definition of “Sustainment” and what DOD’s definition of it entails.

Per the most current copy of the DOD’s Product Support Manager Guidebook, PSMs are responsible for what the DOD calls Integrated Product Support (IPS) Elements. Appendix A of the PSM Guidebook references an additional guidebook specific to these IPS Elements to better define the possible aspects of Life-Cycle Sustainment for any acquired system, as follows:

Life-cycle sustainment planning and execution seamlessly span a system’s entire life cycle. It translates force provider capability and performance requirements into tailored product support to achieve specified and evolving life-cycle product support availability, reliability, and affordability parameters. The Performance Based Life Cycle Product Support approach to DOD sustainment relies on understanding and integrating all the functional components which are available to make up the required product support infrastructure. These functional components are grouped into twelve categories called the Integrated Product Support (IPS) Elements. (DAU, 2023a)

3. Chapter II Summary

In this chapter, we examined historical development of the construct and term “T2S” and what decisions may have been able to contribute to sustainment performance metrics of specific programs during before, during, or after each time period or change. The development of the construct of the T2S process plays a pivotal role in identifying why specific program’s Sustainment Performance Metrics may have been what they were and provides the foundation for diving deeper into the details of how “Sustainment” was defined and executed throughout the acquisition life cycle before, during, and after that period.



In the chapter that follows we dive deeper into how T2S changes have been made in parallel to the process changes in the acquisition life-cycle definition and execution of what is meant by “Sustainment.”



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III. THE ACQUISITION LIFE CYCLE, SUSTAINMENT, SUSTAINMENT PLANNING, AND “MACRO” VS. “MICRO” T2S

In this chapter, we deep dive into the components under consideration when discussing the construct of “T2S” by examining the following:

- IPS Elements and T2S
- Delineating “Macro” vs. “Micro” T2S
- Timing/Definition: When Does T2S Start and End, and How Is T2S Measured?
- Roles and Responsibilities: Who is “Responsible” and Who is “Accountable”?
- Applicable and Relevant Policy Document Gaps
- Relevant T2S Sustainment Performance Metrics

In this chapter, we explore each of the above in more detail to provide proper context into our overall research scope and methodology.

A. IPS ELEMENTS AND T2S

A detailed layout of the IPS Element requirements over the full Acquisition Life Cycle of any ACAT program can be found by following the URL in the references section of this thesis (DAU, 2023b). Noticeably absent from this source, given the history outlined above, is any reference the term “Transition to Sustainment,” “T2S,” or anything similar.

The designation of the available functional components of the DOD product support infrastructure as 12 IPS “Elements” allows for further analysis of the roles and responsibilities of all stakeholders, organic or commercial. The 12 IPS Elements that make up what is ultimately called “Sustainment” are listed below:



- Product Support Management
- Design Interface
- Sustaining Engineering
- Supply Support
- Maintenance Planning & Management
- Packaging, Handling, Storage, & Transportation
- Technical Data
- Support Equipment
- Training & Training Support
- Manpower & Personnel
- Facilities & Infrastructure
- Computer Resources. (US DOD, 2011)

Depending on the strategy for support identified at the time of the Life Cycle Sustainment Plan update or Product Support Plan update to support production and fielding approval, each program stakeholder will have a different level of responsibility prior to, during, and after entering production phase (US DOD, 2011). The requirements (funding, manpower resources, skill sets, roles, tools, equipment, facilities, material, etc.) associated with each IPS Element are the “responsibility” needing to be identified as “transitioning” during the T2S process. Referring to the “Transition” by this definition means a “handoff” of responsibility for “Integrated Product Support (IPS)” Element activities required in Sustainment from the “Product Support Provider (PSP)” or “Product Support Integrator (PSI)” in the production phase, to the corresponding PSP/PSI for each IPS Element in the operations and sustainment phase (US DOD, 2011). As of the start of FY19, guidance on IPS planning specific to T2S was still being developed at the highest levels of each stakeholder organization. In the SEP-OCT 2018 edition of the Army’s “Army Sustainment” newsletter, AAE Dr. Bruce Jette stated the intent for ASA (AL&T) to develop and release a “Transition to Sustainment Guidebook” in FY19 that would assist PSMs and all Sustainment stakeholders in executing T2S activities (Jette, 2018). Based on the current ASA (AL&T) guidebooks detailing the role of the PSM (in the “PSM Guidebook”), the IPS Elements (in the “IPS Guidebook”), and Logistics Assessments (in the “Logistics Assessment Guidebook”) it is expected that the “T2S Guidebook” will cover T2S guidance pertaining to all 12 IPS Elements applicable to every ACAT level program



and type of Product Support Strategy. As of the writing of this document (August 2023), the T2S Guidebook has yet to be released.

B. MACRO VS. MICRO T2S

On the surface, existing guidance related to IPS and the IPS Elements covers all areas of product support required to successfully sustain fielded configurations of materiel pertaining to a program of record under the portfolio management of a particular Program Manager and Program Executive Office. However, within all ACAT level programs, often modernization efforts, fielding analysis, or safety issues encountered in the PD Phase cause the completion of fielding of certain subsystems (i.e., secondary item individual components or assemblies) of a weapon system to trail the timeline of completion of fielding larger weapon system (i.e., major item) configurations initially fielded.

Up until the 2018 clarification provided in the AMC brief to the Department of the Army and Vice Chiefs of Staff of the Army, there was little in the way of references to any subsystem fielding as requiring separate consideration as it pertained to any T2S analysis. In a 2018 AMC brief, this situation is mentioned only as “Subcomponents may transition to sustainment separately from main system” (Headquarters, Army Materiel Command [HQ AMC], 23 October 2018).

To clarify these instances, and to provide a proper frame of reference when discussing the timeline of events relative to T2S for all ACAT level programs, it is necessary to identify each scenario by a different connotation. For clear delineation, we define T2S actions that breach the Materiel Release/Type Classification threshold (as defined in DA PAM 770-3) as “Macro” and T2S actions that do not require Materiel Release/Type Classification (as defined by DA PAM 770-3) process as “Micro” to best identify applicable differences pertaining to any planning or processes that may prove to be different between planning for T2S between Major Items and “subcomponent” IPS T2S requirements (HQDA, 2023b). For applicability and comparison to supply class descriptions by other services, the Army’s most current thresholds for Materiel Release/Type Classification requirements are shown in Figure 2, Figure 3, and Figure 4, extracted from DA PAM 770-3 (HQDA, 2023b).



Type classification and materiel release applicability and requirement — Continued

Materiel	Description	Requirement	
		TC	MR
Soldier portable SKOT.	Soldier portable SKOT; assemblages of non-developmental tools and supplied hand carried by Soldiers.	X	
Nondevelopmental support equipment.	Equipment including lathes, mills, drill presses, compressors, standalone welders or welding machines that do not introduce significant safety, suitability, transportability, or supportability issues. ^{4,5}	X	
Nondevelopmental cryptographic materiel.	Materiel using an algorithm certified by National Security Agency under the Commercial communications security (COMSEC) Evaluation Program.	X	
Software (Government-owned or non-developmental).	System, platform (embedded or remote), component, network, and information systems software and firmware, including programs, routines, and symbolic languages that control the functioning of the hardware and direct its operation and meets the criteria for software materiel release (SMR).		

Legend:

TOE—table of organization and equipment, MTOE—modified table of organization and equipment, TDA— table of distribution and allowances, JTA—joint table of allowances, CTA—common tables of allowances, line item number (LIN), COMSEC, DLA—Defense Logistics Agency, SKOT—sets, kits, outfits, and tools.

Notes:

¹ Some CTA items are exempt from TC and MR (see the exemptions listed in table 1–2).

² Another Service's fielded ammunition that has achieved a Milestone C, if adopted by the Army without configuration changes, requires a TC validation memo from the materiel developer (MATDEV) to the program executive officer (PEO) documenting this. A Catalog of Approved Requirements Document System number must be obtained to get a SLIN assigned and any Army unique issues must be addressed.

³ CIE acquired by U.S. Special Operations Command acquisition authority and provided to Army special operations forces is exempt from TC and MR. These items may be added to the CTA to capture authorizations (CTA 50–900).

⁴ The capability developer (CAPDEV) or Milestone Decision Authority (MDA) may elect to conduct MR activities on some programs.

⁵ The applicable functional authority (FA) or Materiel Release Authority (MRA) will determine when safety, suitability, transportability, and supportability issues are significant.

Figure 2. Type Classification and Materiel Release Requirements.
Source: HQDA (2021a).



Type classification and materiel release applicability and requirement — Continued

Materiel	Description	Requirement	
		TC	MR
Soldier portable SKOT.	Soldier portable SKOT; assemblages of non-developmental tools and supplied hand carried by Soldiers.	X	
Nondevelopmental support equipment.	Equipment including lathes, mills, drill presses, compressors, standalone welders or welding machines that do not introduce significant safety, suitability, transportability, or supportability issues. ^{4, 5}	X	
Nondevelopmental cryptographic materiel.	Materiel using an algorithm certified by National Security Agency under the Commercial communications security (COMSEC) Evaluation Program.	X	
Software (Government-owned or non-developmental).	System, platform (embedded or remote), component, network, and information systems software and firmware, including programs, routines, and symbolic languages that control the functioning of the hardware and direct its operation and meets the criteria for software materiel release (SMR).		

Legend:
TOE—table of organization and equipment, MTOE—modified table of organization and equipment, TDA— table of distribution and allowances, JTA—joint table of allowances, CTA—common tables of allowances, line item number (LIN), COMSEC, DLA—Defense Logistics Agency, SKOT—sets, kits, outfits, and tools.

Notes:

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⁴ The capability developer (CAPDEV) or Milestone Decision Authority (MDA) may elect to conduct MR activities on some programs.

⁵ The applicable functional authority (FA) or Materiel Release Authority (MRA) will determine when safety, suitability, transportability, and supportability issues are significant.

Figure 3. Type Classification and Materiel Release Requirements.
Source: HQDA (2021a).



Type classification and materiel release for modification, upgrade, and reprourement requirements — Continued			
Type of change	Description	Requirement	
		TC	MR
Engineering change proposal, preplanned product improvement, or MWO.	Changes either form, fit, or function.	X	X
	Changes model number.	X	X
	Alters transportability requirements.		X
	Results in a new basis of issue plan (BOIP).	X	X
	Results in a new associated support items of equipment (ASIOE).	X	
	Results in a new military occupational specialty or additional skill identifier.	X	X
	Adversely alters environmental, safety, or occupational health characteristics.		X
Incremental development.	Evolutionary acquisition program.	X	X
Reprourement (follow-on).	Materiel produced under a performance specification that was out of production for two or more years.		X
	Materiel produced under a performance specification that changes producers.		X
	Materiel produced using the complete technical data package (TDP). ¹		

Note:

¹ When the government uses a complete TDP for the reprourement of materiel, qualification testing will be used to ensure that the product conforms to the original design. In these cases, a new MR is not necessary.

Figure 4. Type Classification and Materiel Release Requirements.
Source: HQDA (2021a).

Furthermore, consideration was given to the type of change being fielded during a PD Phase effort. In categorizing Macro-T2S activities and Micro-T2S activities, we considered the requirements of AR 770-3, which provides guidance on materiel fielding thresholds that trigger the Type Classification or Materiel Release processes. Materiel fielding actions that required TC/MR are considered Macro-T2S actions in our research, whereas those that do not are considered Micro-T2S actions.

A summary matrix of our Micro/Macro T2S categorization is shown in Table 2.



Table 2. Micro vs. Macro T2S Definitions.

	CLASS VII	Non-Class VII
TC/MR Required	MACRO	MACRO
TC/MR Not Required	N/A	MICRO

C. RELEVANCE OF MACRO/MICRO CATEGORIZATION

In absence of the T2S Guidebook mentioned by the current ASA (AL&T) AAE, Dr. Bruce Jette, the most effective way of analyzing the Product Support planning and assessments done between the Acquisition and Sustainment organizations between the PD and O&S Phases is to leverage existing materiel fielding or materiel change Product Support Assessments already in place. The guidance describing the roles and responsibilities for assessing IPS Element impacts can be found in the following documents:

- AR 770-3: Type Classification and Materiel Release (July 16, 2021)
- AR 700-127 : Integrated Product Support (October 22, 2018)
- AR 750-10: Army Modification Program (October 23, 2019)
- Logistics Assessment Guidebook (DAU, 2023d)
- Product Support Manager (PSM) Guidebook (DAU, 2023a)

For Macro-T2S actions, this would mean adherence to the TC/MR requirements of AR 770-3 and DA PAM 770-3. For most TC/MR actions, even with all appropriate facts, documentation, and testing completed in advance of beginning the TC/MR process, the process requires a significant lead time. Because this lead time is very well known, materiel



fielding's expected to meet the threshold requirements of AR 770-3 are normally planned well in advance, allowing for proper planning by both the Acquisition and Sustainment organizations. Per AR 770-3, the "LCMC with the Sustainment mission" is the Materiel Release Authority (MRA) for materiel where the Army is the identified Primary Inventory Control Activity (PICA). However, the regulation describes significant roles for the Materiel Developer (MATDEV) (PM/PEO) in both TC and MR actions. Thus, close coordination and cooperation with the LCMC is required to deliver a "safe, suitable, and supportable" product or service to the field and to properly plan and execute T2S activity in accordance with the strategy outlined in the Life-Cycle Sustainment Plan or equivalent Integrated Product Support strategy document (HQDA, 2021a).

For Micro-T2S actions (those not meeting the AR 770-3 threshold requirements for requiring TC/MR level scrutiny) often a single person or small number of IPT members (typically representing both the MATDEV and LCMC) are still responsible for assessing the IPS implications of a particular materiel fielding or production effort. However, these assessments are less likely to be completed in-line with a planned update to a Product Support document (LCSP, Product Support Plan, Supportability Strategy, etc.) and thus, any changes in requirements to the previous Product Support Strategy at the start of the PD Phase may be different from the O&S Phase Product Support Strategy identified in the most recent Product Support document update (LCSP, Product Support Plan, Supportability Strategy, etc.). As such, any increases in requirements in the PD Phase may not be able to be maintained in the O&S Phase when the responsibility to fund particular IPS Element activities is not identified as a requirement early enough in the PD Phase to be available at the time of the activity's "Transition" to Sustainment.

D. RELEVANT GUIDANCE/POLICY GAPS

As indicated above, to date the IPS Element guidance specific to the T2S process (whether macro or micro) is still being developed. However, within the DOD Logistics Assessment Guidebook, there are references to Logistics Assessments that can effectively serve the intended purpose of evaluating the status of each IPS Element at various stages



within a system's Acquisition Life Cycle (i.e., a Post-IOC Assessment has different requirements for each element than a Post-FOC Assessment).

For Macro-T2S actions, this would be timed in conjunction with the timeline of a TC/MR action, and any associated actions required (i.e., MWO, MAM, etc.). For Micro-T2S actions, this would be timed in conjunction with the integration or application of MWOs (as ECP actions or Production changes not developed into MWOs would not be clearly discernible relative to the timing of fielding of such changes).

E. DEFINING THE TIMING OF T2S: WHEN DOES T2S START AND END? HOW IS T2S MEASURED?

In reviewing the history of the T2S concept and developing process guidance, the actual timing of T2S is a key component in determining when specific planning or execution of actions, handoffs, or transfers of responsibility should or should not occur. Relative to the specific T2S-related verbiage referenced by a specific time period, the T2S definition could mean any one of the following definitions found in Table 3, based on when those programs started or ended their PD Phase:



Table 3. T2S Definitions over Time

Year	Definition
2009	“ <i>Post-IOC</i> review”
2011	“Post-IOC LA”
2012	“Independent logistics assessment ... prior to key acquisition decision points (including milestone decisions)”
2015	“ <i>Post IOC</i> Sustainment Reviews,” mandating “... <i>after IOC</i> , the DOD Components will continue to conduct <i>ILAs</i> at a minimum interval of every 5 years”
2015	“Operational Sustainment Review (OSR) as the formal <i>post-production</i> decision review focusing on preparing the system to transition from procurement resourcing to sustainment resourcing”
2016	“fully developed that has met its planned production goals”
2017	“ <i>initiating transition to sustainment at the full-rate production decision and is complete no later than initial operation capability plus 3 years.</i> ”
2018	“from Initial Operational Capability + 3 years to a condition based transition as defined above + 3 years or as directed (budget accommodation).”



F. ROLES AND RESPONSIBILITIES: WHO IS “RESPONSIBLE” AND WHO IS “ACCOUNTABLE”?

Sustainment stakeholders perform one of the following roles in executing the 12 IPS Elements associated with Product Support:

- Product Support Manager
- Product Support Integrator (PSI)
- Product Support Provider (PSP). (DAU, 2023a)

Per the most current DOD PSM Guidebook (DAU, 2023a), the definitions for each are as follows:

The PSM, is responsible for developing and implementing a comprehensive, outcome-based PSS. (p. 13)

The PSI’s role is assigned within the scope, direction, and oversight of the PSM. (Note that a PSI is assigned at the discretion of the PSM. Not all programs will require a PSI. Some programs may use multiple PSIs). PSIs accomplish their product support role through use of one or more PSPs. Integrators are responsible for the activities and output of one or more PSPs within a specific product support element or across product support elements. A PSI may also perform the function of a PSP. (p. 15)

The PSPs are assigned responsibilities to perform and accomplish the functions represented by the IPS Elements that, per the BCA process and consistent with statute and policy, comprise the range of best value or statutorily assigned workloads that achieve the Warfighter support outcomes. (p. 15)

Figure 5 shows an example of this type of analysis applied to a current Army Program, the 105mm M119A3 Towed Howitzer.



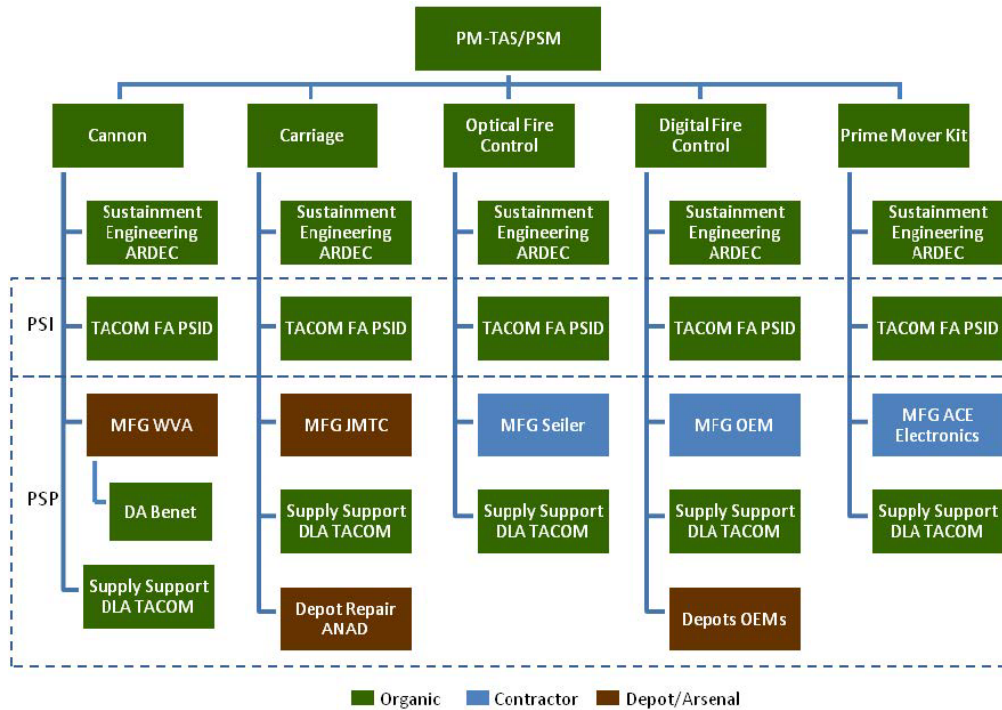


Figure 5. Sample Product Support Manager (PSM), Product Support Integrator (PSI), and Product Support Provider (PSP) Organization & Relationship. Source: Muskeyvalley (2018).

G. CHAPTER III SUMMARY

In this chapter, we examined how T2S has changed with changes in the acquisition life-cycle definition of the process and components included in the process and phase of “Sustainment.”

The way in which “Sustainment” has been defined has ultimately determined how “Sustainment” has been executed before, during, and after the period defined as “T2S” for each program under consideration in our research. Knowing the differences that existed at different points allows us to better understand contributing factors to the metrics realized to provide context as to any applicability to recommendations or future research.

In Chapter IV, we dive deeper into the data analysis of T2S execution of specific Army Ground Combat Systems relative to documented sustainment performance metrics realized.

IV. DATA AND ANALYSIS: A METHOD FOR ASSESSING “MACRO T2S” – SUSTAINMENT PERFORMANCE METRICS IN GROUND COMBAT SYSTEMS (GCS)

Our research has aimed to outline the historical construct of the “T2S” process to understand the development of the current metrics that can be used to gauge T2S Planning and Execution. This chapter analyzes relevant common metrics associated with T2S to draw conclusions and comparisons as to T2S performance of specific programs.

In the absence of expressed T2S-specific metrics as of the writing of this document, we posit to assess “Macro T2S,” as defined in Table 1, execution using the most readily available sustainment performance metrics common to all acquisition programs. Analysis of these metrics will provide a means of assessing Macro T2S Performance against an established standard or set of standard metrics.

The most logical metrics to gauge T2S performance are those required of all Product Support Strategies in Sustainment, per the existing guidance for Integrated Product Support (DAU, 2023c). The mandatory Sustainment Performance metrics of all Product Support Strategies are shown below:

1. [Sustainment Key Performance Parameters] (KPP): with two subcomponents, materiel availability [A_m] and operational availability [A_o]
2. Reliability [Key System Attributes] (KSA)
3. [Operations and Sustainment] (O&S) cost KSA
4. Mean Down Time [MDT]
5. Logistics footprint
6. Other metrics tailored to each program, as required. (DAU, 2023c)

For our research, we have limited our analysis to the sustainment KPP A_o , and the sub-metrics that feed both A_m and A_o , equipment readiness (Non-Mission Capable [NMC] rates).

For equipment readiness (aka A_o), our analysis centers on reported unit readiness from historical DRRS (Defense Readiness Reporting System) “R-Level” data for U.S. Army and Army National Guard (ARNG), Ground Combat System (GCS) Systems, in



accordance with AR 220-1, retrieved from Global Combat Support System-Army (GCSS-A) Equipment Status Report (ESR) data.

For supply availability, our analysis will utilize two data sources: historic Non-Mission Capable Supply (NMCS) rates reported via the DRRS and Inventory Management reports pulled from the TACOM Life Cycle Management Command (LCMC) Supply, Maintenance, and Cost Analysis Tool (SMCAT).

A. SUSTAINMENT PERFORMANCE METRIC DEFINITIONS

For the purposes of this research and further analysis of all available data, the understanding the sustainment performance metric meanings pertaining to overall program performance data provided is imperative. The definitions of the sub metrics chosen for this research are below (definitions sourced from Farlex, n.d.):

Fully Mission Capable (FMC): Material condition of any piece of military equipment, aircraft, or training device indicating that it can perform all of its missions. Also called FMC.

Non-Mission Capable Supply (NMCS): Material condition indicating that systems and equipment are not capable of performing any of their assigned missions because of maintenance work stoppage due to a supply shortage. Also called NMCS.

Non-Mission Capable Maintenance (NMCM): Material condition indicating that systems and equipment are not capable of performing any of their assigned missions because of maintenance requirements. Also called NMCM.

B. WHAT U.S. ARMY GCS SYSTEMS HAVE TRANSITIONED TO SUSTAINMENT?

In August 2018 and July 2019, in response to a tasker from Army Materiel Command (AMC), TACOM LCMC put out a data call for information on all Acquisition Programs supported by TACOM LCMC and under the Portfolio of the Program Offices located at the Detroit Arsenal.

Table 4 shows an extract of the results of the data call showing the current PEO GCS programs supported by TACOM LCMC and program data relevant to our T2S analysis.



Table 4. 2018 TACOM PEO GCS T2S Data Call Tasker Results.

Program Long Name	Program Short Name	NSN	ACAT	LIN	T2S COMPLETE? YES/NO	T2S DATE	SORTS System?	MR DATE 1	MR DATE 2	MR DATE 3
Bradley Fighting Vehicle Systems	BRADLEY A4		I		NO		YES			
Bradley Fighting Vehicle Systems	BRADLEY A3	2350-01-436-0005	IC		YES	2012	YES		2000	2005
Bradley Fighting Vehicle Systems – ODS	BRADLEY ODS	2350-01-405-9886	IC		YES	2012	YES	2004	2010	
Bradley Fire Support Vehicle	BFIST	2350-01-432-1526	III		YES	2012	YES			
M109A7 Paladin Self Propelled Howitzer	M109A7		I		NO		YES			
M109A6 Paladin Self Propelled Howitzer	M109A6	2350-01-305-0028	II		YES		YES			
PALADIN/ Field Artillery Ammunition Support Vehicle	A2 FAASV	2350-01-368-9500	II		NO		YES			
PALADIN/ Field Artillery Ammunition Support Vehicle	A1 FAASV	2350-01-352-3021	I		YES		YES			
Stryker – Flat Bottom	STRYKER Flat-Bottom Family of Vehicles	Multiple	IC		NO		YES			
	MCV	2355-01-505-0871		M53369				2005	2017	
	FSV	2355-01-528-1274		F86821				2010		
	ESV	2355-01-481-8570		J97621				2013		



Program Long Name	Program Short Name	NSN	ACAT	LIN	T2S COMPLETE? YES/NO	T2S DATE	SORTS System?	MR DATE 1	MR DATE 2	MR DATE 3
	ICV	2355-01-481-8575		J22626				2010		
	RV	2355-01-481-8572		R62673				2010		
	ATGM	2355-01-481-8576		A83852				2010		
	MEV	2355-01-481-8580		M30567				2013		
	CV	2355-01-481-8573		C41314				2010		
	MGS	2355-01-481-8577		M57720				2013		
	NBCRV	2355-01-481-8579		N96543				2008	2011	
Stryker - Double V Hull	Stryker-Double V Hull Family of Vehicles	Multiple	I		NO		YES			
	MCVV	2355-01-587-2320		M05032				2017		
	FSVV	2355-01-587-2321		F05013				2017		
	ESVV	2355-01-587-2312		E05010				2017		
	ICVV	2355-01-586-8140		J05009				2014		
	ATVV	2355-01-587-2326		A05037				2017		
	MEVV	2355-01-587-2323		M05033				2017		
	CVV	2355-01-587-2316		C05052				2017		
M1A2 ABRAMS Tank SEPv2	M1A2 SEPv2	2350-01-328-5964	IC		YES		YES			
M1A2 SEPv3 – Abrams	M1A2 SEPv3		IC		NO		YES			



Program Long Name	Program Short Name	NSN	ACAT	LIN	T2S COMPLETE? YES/NO	T2S DATE	SORTS System?	MR DATE 1	MR DATE 2	MR DATE 3
Tank Modernization										
M1A1 – Abrams Tank	M1A1	2350-01-087-1095	IC		YES		YES			
M777 155mm Towed Howitzer	M777A2	1025-01-445-0991	II		Yes		YES			
M119A3 105mm Towed Howitzer	M119A3	1015-01-598-4568	III		YES		NO			

For this research, our analysis focuses on the U.S. Army Ground Combat Systems (GCS) that are identified as reportable per the Army Maintenance Master Data File (MMDF) as of 2019. SORTS systems are systems that have the most readily available and complete set of Sustainment Performance metrics and Sustainment Performance Strategy data required to analyze T2S processes, procedures, constraints, and enablers. GCS SORTS System Program T2S Timelines and relevant Sustainment Performance metrics reported from FY00 to FY18 are shown in Figure 7





Figure 6. U.S. Army GCS Weapon System Sustainment Performance Realized (2000–2018).

Based on this data, it is difficult to discern a statistically significant relationship between pre or post MACRO T2S actions for all systems. However, a relationship appears

to be possible between the identified T2S Fiscal Year (FY) and both NMCM and NMCS percentages.

Relative percentage changes are shown graphically to highlight the relative magnitude of the change in proximity to the specific program milestone or actions. T2S and Non-Mission Capable Maintenance (NMCM) Relationship

C. T2S FY VS. NMCM

Within 3 years immediately following the T2S FY, all systems other than the Bradley A2/A3, and M1A1 Abrams saw an increase in average NMCM percentage.

The Bradley A2 saw a slight decrease in year 2 after post T2S but saw a return to the year 1 post T2S average NMCM percentage in year 3.

The Bradley A3 and M1A1 Abrams maintained the average NMCM percentage identified at the completion of the T2S FY.

D. MACRO T2S VS. NMCM

All systems other than the M777A2 Towed Howitzer (initial T2S date submitted was FY12) saw a decrease in average NMCM percentage within 2 years of each identified Macro T2S action.

E. T2S AND NON-MISSION CAPABLE SUPPLY (NMCS) RELATIONSHIP

1. T2S FY vs. NMCS

All systems other than the M109A6 Self-Propelled Howitzer saw an increase in average NMCS percentage within 3 years immediately following the T2S FY.

2. MACRO T2S vs. NMCS

All systems other than the Stryker Family of Vehicles showed a decrease in average NMCS percentage within 3 years immediately following Macro T2S actions. The Stryker Family of Vehicles showed an increase after Macro T2S actions in FY11, FY13, and FY17.



F. T2S AND REPORTED READINESS RELATIONSHIP

1. T2S FY vs. Readiness

The M1A1 Abrams saw a decrease in reported average Readiness Rate from the Readiness Rate during T2S FY to 3 years post T2S FY. All other systems maintained the average Readiness Rate reported during the T2S FY within 3 years post-T2S point.

2. MACRO T2S Action and Reported Readiness Relationship

Most systems showed no change in Readiness in proximity to the identified Macro T2S action, with a few exceptions:

M109A6 Self-Propelled Howitzer: The M109A6 saw a decrease in average reported Readiness after the FY08 Macro action but saw an increase in average reported Readiness after the FY15 Macro action.

Stryker Family of Vehicles: The Stryker FOV saw a decrease in Readiness after the FY13 Macro action.

M777A2 Towed Howitzer: The M777A2 saw a decrease after the FY14 Macro action.

G. FUNDING DECISION IMPACTS ON T2S PLANNING, EXECUTION, AND SUSTAINMENT PERFORMANCE METRICS

The most critical factors in T2S planning and execution are:

1. Defining Sustainment Performance requirements.
2. Translating and synchronizing these requirements into associated POM submissions.
3. Funding approval and execution.

The key stakeholders in T2S planning and execution are the Program Executive Offices and LCMCs. These offices are the leaders for defining the T2S requirements for each Materiel Release action for systems within their respective portfolios, now being targeted to T2S, far enough in advance to adjust POM submissions so Sustainment requirements and Sustainment Performance impacts narratives are properly translated to



the appropriate POM categories. T2S activities identified as critical to sustaining Sustainment Performance metrics demonstrated during and at the end of the Production Phase must be translated to respective POM activities that identify necessary handoffs between Equipping (EE) Program Evaluation Group (PEG) funded and Sustaining (SS) PEG funded actions.

Without proper definition of Sustainment Performance requirements, when individual system requirements are “racked and stacked” among all Army requirements at levels above the Program Executive Office (PEO) and LCMC, systems may be unfunded, underfunded, or improperly prioritized relative to broader strategic objectives (i.e., Modernization, etc.). Without proper requirements translation, the SS PEG funded activities critical to sustaining Sustainment Performance metrics demonstrated during the end of Production like System Sustainment Technical Support (SSTS), Army Working Capital Fund (AWCF), and Depot Maintenance (DM) funds, may not be adequately allocated to avoid negative impacts to the warfighters.

H. THE IMPACT OF SUSTAINMENT POM FUNDING DECISIONS AND STRATEGIC FUNDING PRIORITIZATION ON PRE-POST T2S SUSTAINMENT PERFORMANCE

One critical factor in any Acquisition Program’s ability to execute actions and processes against requirements is the level of funding provided versus the identified level of funding required and requested from Congress at any given point throughout the Acquisition Life Cycle. Acquisition Programs project current and future funding requirements against capabilities and Program Office execution requirements using the annual Program Objectives Memorandum (POM) process, which is part of the “Programming” portion of the Acquisition Life Cycle Programming, Planning, Budgeting, and Execution (PPBE) process.

In our efforts to define and assess T2S Performance of GCS Acquisition Programs against T2S planning and requirements, it is critical to review the level of funding provided at a given point in the T2S (Pre and Post) process. Doing so will allow us to form a better understanding of the influence funding decisions may have had on the assessed T2S Performance metrics realized at a given point.



To examine this potential impact of funding, we chose to overlay the previous Readiness reporting timelines and metrics with the allocated funding amounts for the respective Program Evaluation Group (PEG) over the same or similar time periods. The two PPBE PEGs central to the T2S construct are the Army Sustaining PEG (SS PEG) and the Army Equipping PEG (EE PEG). T2S serves to align requirements that exist for any Acquisition Program between identified EE PEG funding allocation requirements, or Production Phase requirements, that will “Transition” and remain requirements in the Sustainment Phase, requiring SS PEG funding allocations.

T2S, ultimately, is an attempt by the DOD to balance, filter, and streamline funding allocations against identified requirements from and to both PEGs for any Acquisition Program.

To support similar conversations surrounding Sustainment Performance of GCS Program in 2018, TACOM LCMC assessed the demonstrated Sustainment Performance (Readiness and Demands) of all TACOM-managed SORTS systems against the requested and approved SS PEG funding lines (SSTS, DM) from 2013–2018 to show the impacts of specific funding decisions (see Figures 8 through 14). Each figure shows the negative impacts of unfunded or underfunded SS PEG activities at specific points in the Life Cycle for each SORTS system.

Considering the GCS SORTS systems under review for T2S discussions in this paper, when the reported T2S FY and T2S Point of each system is overlaid, it is possible to see how SS PEG funding requests and allocations align to T2S timelines and potential relationships between these funding decisions and Pre/Post T2S Sustainment Performance metrics (Readiness, Demands, SA, and NMCS/NMCM rates). The implication is that unfunded or underfunded SS PEG activities have a definite negative impact to some or all of each system’s Sustainment Performance.

In Section H., a thorough analysis of the T2S timing, funding requests/approvals, and demonstrated Sustainment Performance for each GCS SORTS System is presented for more in-depth analysis of individual program metrics.



I. M2A2 BRADLEY FIGHTING VEHICLE T2S PLANNING AND EXECUTION

M2A2 Bradley Fighting Vehicle was reported to T2S at the end of FY12. The M2A2 Bradley Fighting Vehicle relevant T2S metrics and funding prior to and after FY12 are shown in Figure 8.

According to the SS PEG funding charts, the M2A2 only received 2.4% of required SSTS funding in FY13 and never more than 5% of the required amount from FY14–FY18. This indicates that the majority of the T2S requirements either were not adequately identified early enough in the POMs leading up to the actual T2S FY or that the risk of executing T2S in absence of available SS PEG funding was deemed an acceptable risk by senior leadership.

1. Readiness

The M2A2 fell below the goal of 90% Fleet Readiness in 2015, which continued through 2018 while overall Demands increased 122% from FY13 to FY18.

2. NMCM

NMCM rates for the M2A2 oscillated between 2% and 6% from FY13–FY16 but climbed to 10–12% in FY17 and FY18. In terms of Sustainment support, this may be a lagging indicator of deferred maintenance activities Pre and Post T2S (identifying the need to update procedures, updating procedures, updating PMCS requirements, etc.).

3. NMCS

NMCS rates for the M2A2 oscillated between 2% and 6% from FY13–FY16 but climbed to 6–8% in FY17 and 10–12% in FY18. In terms of Post T2S Sustainment support, this may be a lagging indicator of deferred support activities in response to increasing demands. An increase in NMCS would indicate a reduction in LCMC Supply Availability metrics. This could be due to several factors, including a lack of the appropriate funding for personnel to execute Supply Support forecasting and execution in response to demand increases.



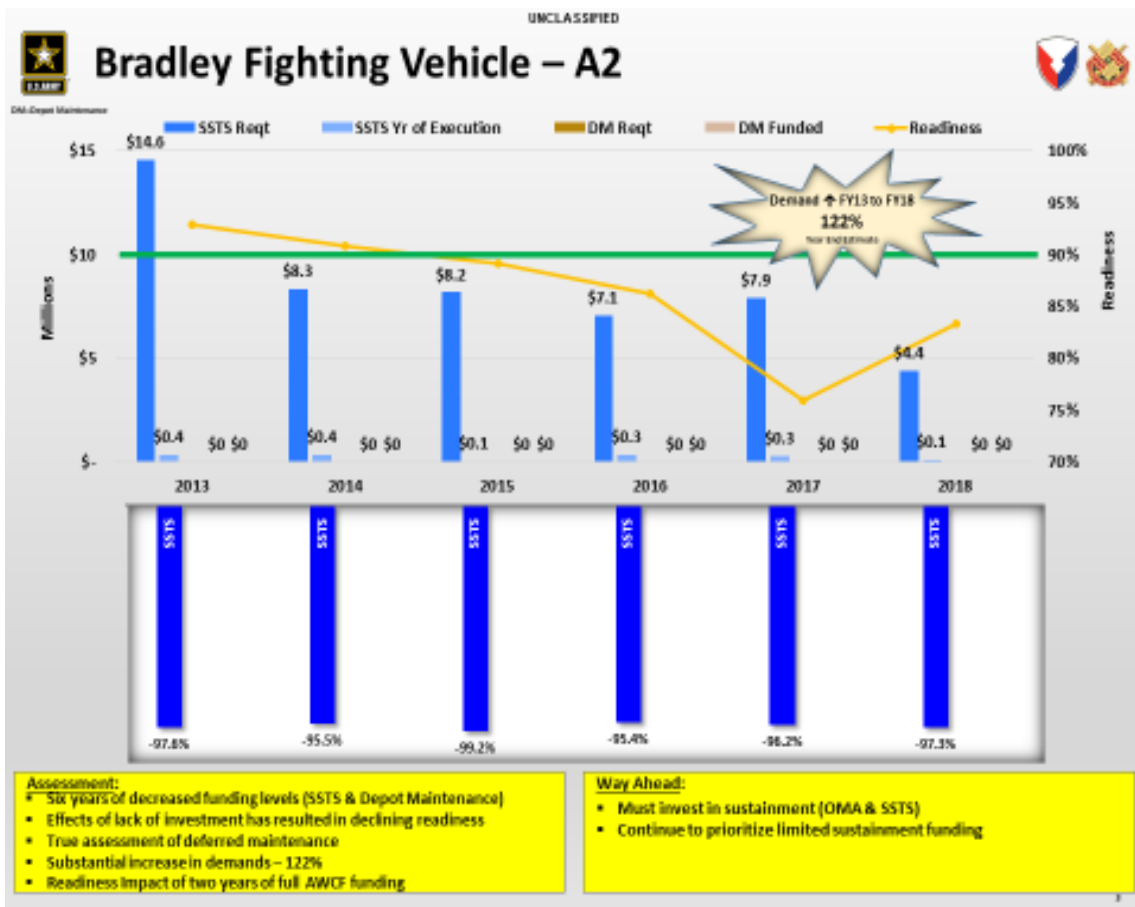
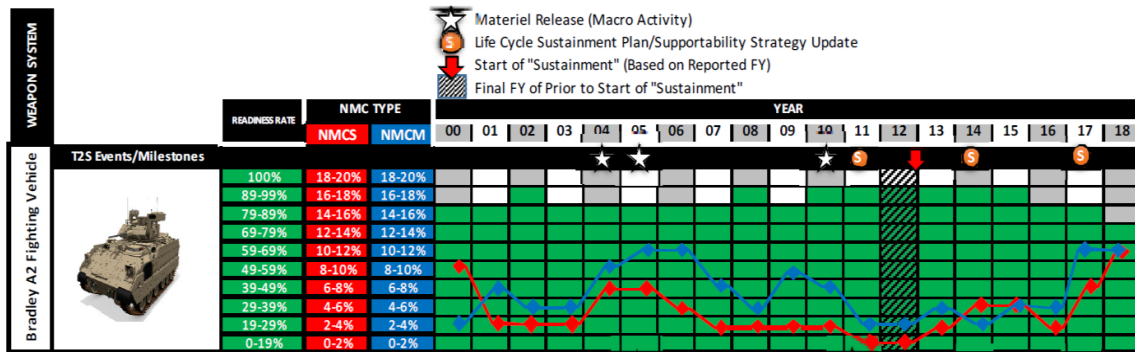


Figure 7. A2 Bradley Fighting Vehicle T2S Actions (2000–2018) and Funding Timeline (2013–2018).

J. M2A3 BRADLEY FIGHTING VEHICLE T2S PLANNING AND EXECUTION

M2A3 Bradley Fighting Vehicle was reported to T2S at the end of FY12. The M2A3 Bradley Fighting Vehicle relevant T2S metrics and funding prior to and after FY12 are shown in Figure 9.

According to the SS PEG funding charts in Figure 7, the M2A3 only received 2.4% of required SSTS funding in FY13 and never more than 5% of the required amount from FY14–FY18. This indicates that the majority of the T2S requirements either were not adequately identified early enough in the POMs leading up to the actual T2S FY or that the risk of executing T2S in absence of available SS PEG funding was deemed an acceptable risk by senior leadership.

Depot Maintenance funding for the M2A3 in FY13 was approved at roughly 90% of the identified requirement. As a modernized version of the M2A2, the M2A3 DM requirement in FY13 likely represented the aging portion of the M2A2 fleet converted to M2A3 but still requiring significant Sustainment Level maintenance simply due to the age of the equipment. The DM requirement increased from FY14 to FY15 but dropped significantly in FY16 and remained relatively consistent in FY17 and FY18. For modernization efforts, this indicates a very high likelihood of Materiel Release Sustainment planning not including an accurate estimate of the increase in SS PEG requirements to the existing fleet being Sustained both Pre and Post T2S, as most modernization funding estimate requirements focus primarily on the EE PEG portion required to complete design and integration of the required capability. However, for T2S to occur without impact to Sustainment Performance, accurate estimates of the increased SS PEG requirement at modernization completion are critical to T2S execution and planning.

1. Readiness

The M2A2 fell below the goal of 90% Fleet Readiness in 2015, which continued through 2018 while overall Demands increased 122% from FY13 to FY18.



2. NMCM

NMCM rates for the M2A2 oscillated between 2% and 6% from FY13–FY16 but climbed to 10–12% in FY17 and FY18. In terms of Sustainment Performance, this may be a lagging indicator of deferred maintenance activities Pre and Post T2S (identifying the need to update procedures, updating procedures, updating PMCS requirements, etc.).

3. NMCS

NMCS rates for the M2A2 oscillated between 2% and 6% from FY13–FY16 but climbed to 6–8% in FY17 and 10–12% in FY18.

In terms of Post T2S Sustainment support, this may be a lagging indicator of deferred support activities in response to increasing demands. An increase in NMCS would indicate a reduction in LCMC Supply Availability metrics. This could be due to several factors, including a lack of appropriate funding for personnel to execute Supply Support forecasting and execution in response to demand increases.



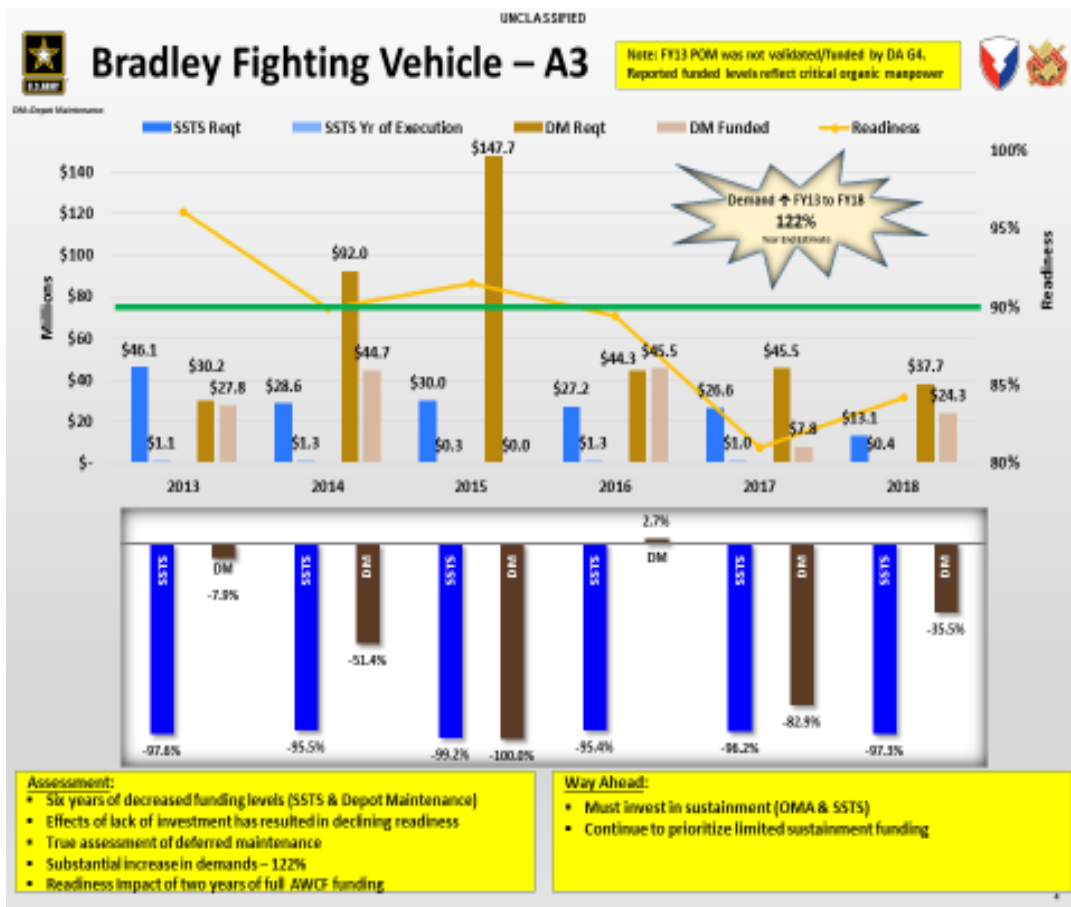
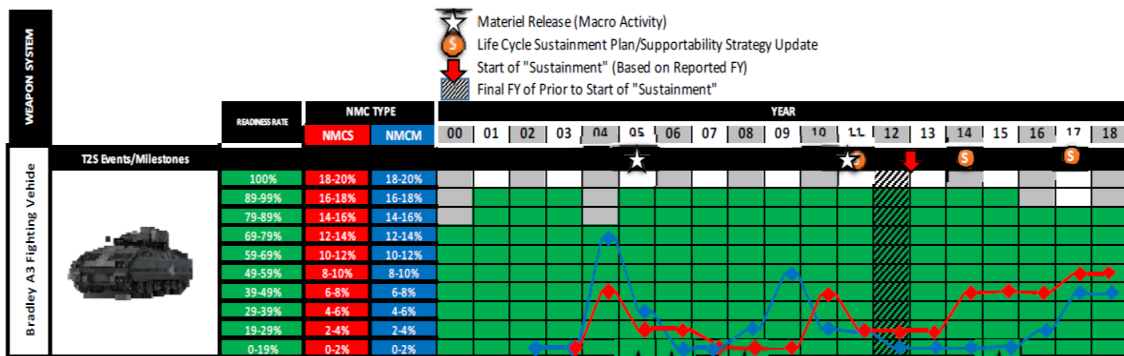


Figure 8. A3 Bradley Fighting Vehicle T2S Actions (2000–2018) and Funding Timeline (2013–2018).

K. M109A6 PALADIN T2S PLANNING AND EXECUTION

M109A6 Paladin Self-Propelled Howitzer was reported to T2S at the end of FY04. The M109A6 Paladin Self-Propelled Howitzer relevant T2S metrics and funding prior to and after FY04 are shown in Figure 10.

1. SS PEG Funding

Due to the lack of available data, we were unable to assess the SS PEG funding for the M109A6 near the reported date of T2S. However, the analysis of a system further from the reported date of T2S can give an indication as to any gaps in Sustainment Performance further into the Sustainment phase.

2. Readiness

The M109A6 remained below the goal of 90% Fleet Readiness from FY04–FY18 for each year except FY08. Overall Demands increased 84% from FY13 to FY18.

3. NMCM

NMCM rates for the M109A6 oscillated between 2% and 6% from FY13–FY16 but climbed to 10–12% in FY17 and FY18.

In terms of T2S Sustainment Performance, this may be a lagging indicator of deferred maintenance activities Pre and Post T2S (identifying the need to update procedures, updating procedures, updating PMCS requirements, etc.).

4. NMCS

NMCS rates for the M109A6 climbed to 6–8% in FY04 but dropped to below 2% from FY04 to FY12. Beginning in FY13, NMCS rates increased to 12–14% from FY13–FY18. In terms of T2S Sustainment Performance, this may be a lagging indicator of deferred support activities in response to increasing demands. An increase in NMCS would indicate a reduction in LCMC Supply Availability metrics. This could be due to several factors, including a lack of appropriate funding for personnel to execute Supply Support forecasting and execution in response to demand increases.



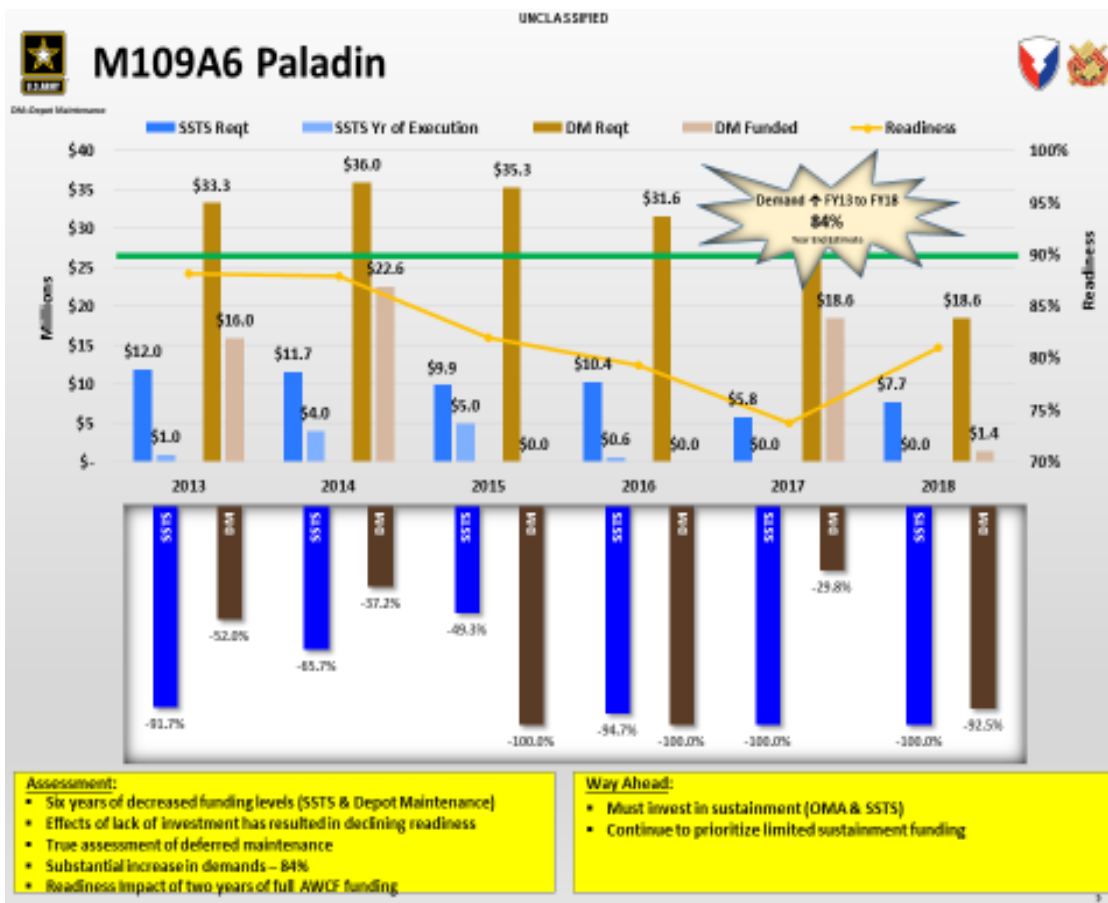
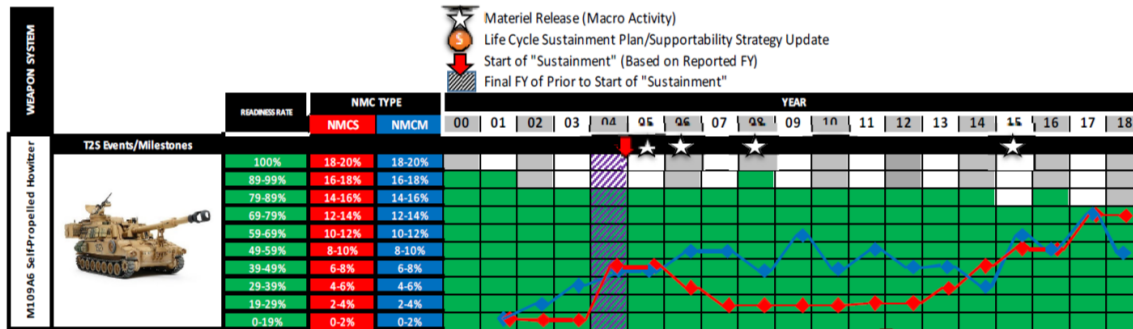


Figure 9. M109A6 Paladin Self-Propelled Howitzer T2S Actions (2000–2018) and Funding Timeline (2013–2018).

L. M1A1 ABRAMS T2S PLANNING AND EXECUTION

The M1A1 Abrams Tank was reported to T2S at the end of FY11. The M1A1 relevant T2S metrics and funding prior to and after FY11 are shown in Figure 11.



1. SS PEG Funding

Due to the lack of available data, we were unable to assess the SS PEG funding for the M1A1 directly after the reported date of T2S. However, analysis of the M1A1 SS PEG funding beginning in FY13 is assumed to be close enough to be relevant to T2S Sustainment Performance analysis.

From FY13 to FY18, the M1A1 received 0–1% of the requested SSTS funding requested and neither requested nor received DM funding.

2. Readiness

The M1A1 maintained a Readiness level between 79–89% in the two FYs prior to, during, and three FYs after the reported T2S date (FY11). Readiness declined first in FY15 then again in FY16, remaining the same between FY17 and FY18. Remaining below the goal of 90%, Fleet Readiness pre and post T2S implies that very little changed in terms of T2S impacts on reported Readiness in the immediate years prior to and after T2S and deeper problems existed that could not be addressed by changes in T2S planning or execution. Overall Demands increased 75% from FY13 to FY18.

3. NMCM

NMCM rates for the M1A1 rose from 4% to 12% from FY08 to FY10 but dropped to 6–8% from FY12 to FY14, then climbed to 12–14% from FY15–FY18. In terms of T2S Sustainment Performance, this may be a lagging indicator of deferred maintenance activities Pre and Post T2S (identifying the need to update procedures, updating Preventative Maintenance Checks and Services [PMCS] requirements, etc.).

4. NMCS

NMCS rates for the M1A1 were consistently 2–4% from FY08 to FY10 but increased sharply directly after FY11, going from to 4–6% in FY12 to 18–20% by FY18, increasing consistently on an annual basis. In terms of T2S Sustainment Performance, when considering the 75% increase in demands from FY13–FY18 the sharp, continual annual increase in NMCS over the same time period indicates an unplanned Sustainment



Performance requirement that would justify further analysis as it pertains to determine the root cause. From a T2S, Supply Support–specific, standpoint, this would suggest that unplanned Supply Support actions were required, or the unexpected demand increases were more than the existing personnel or processes could respond to. Additional research and analysis as to the specific demands and Supply Support requirements would be required to draw definitive conclusions.

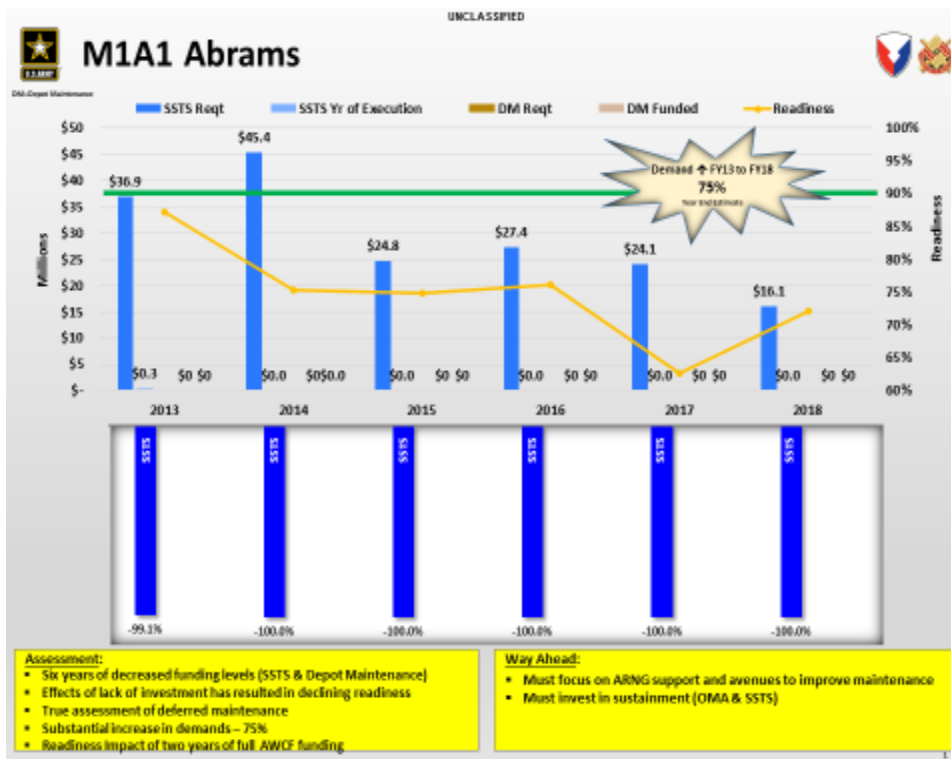
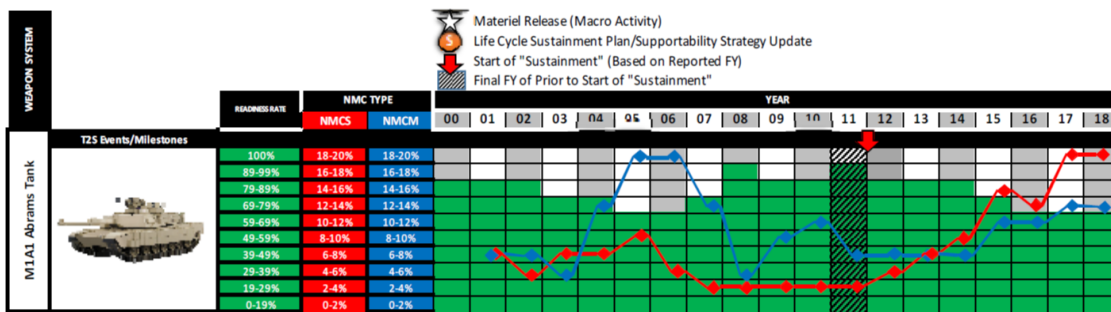


Figure 10. M1A1 Abrams T2S Actions (2000–2018) and Funding Timeline (2013–2018).

M. M1A2 ABRAMS T2S PLANNING AND EXECUTION

The M1A2 Abrams Tank was reported to T2S at the end of FY14. The M1A2 Abrams Tank relevant T2S metrics and funding prior to and after FY14 are shown in Figure 12.

1. SS PEG Funding

From FY13 to FY15, the M1A2 received 0% of the requested SSTS, and submitted no additional SSTS funding requests from FY16–FY18. DM funding requests began in FY14, funded at 45% of requested, but funded at 0% of the requested amount from FY15–FY18.

2. Readiness

The M1A2 maintained a Readiness level between 89–99% in the two FYs prior to T2S but dipped to 79–89% during the T2S FY, and two FYs after. Readiness declined first in FY14, then rose slightly in FY15, then declined again in FY16, increased slightly in FY17, but declined again in FY18. T2S showed a significant impact on reported Readiness in the immediate years prior to and after T2S for the M1A2, primarily due to the lack of DM funding provided. Overall Demands increased 68% from FY13 to FY18.

3. NMCM

NMCM rates for the M1A2 declined from 6–8% in FY12, prior to T2S, to 2–4% during T2S. Post T2S, NMCM rates rose to 12–14% by FY16. In terms of T2S Sustainment Performance, this may be a lagging indicator of deferred maintenance activities Pre and Post T2S (identifying the need to update procedures, updating procedures, updating PMCS requirements, etc.).

4. NMCS

NMCS rates for the M1A2 were consistently 2–4% in FY12 but rose to 4–6% in FY13. Rates continued to rise to 8–10% in FY14 and FY15. From FY16–FY18, this trend continued, rising each year, topping at 14–16% in FY18. In terms of T2S Sustainment Performance, when considering the 68% increase in demands from FY13–FY18, the



continual annual increase in NMCS over the same time period indicates a definite unplanned Sustainment Performance requirement that would justify further analysis as it pertains to determine the root cause. From a T2S, Supply Support–specific, standpoint, this would suggest that unplanned Supply Support actions were likely required. Additional research and analysis as to the specific demands and Supply Support requirements would be required to draw definitive conclusions.

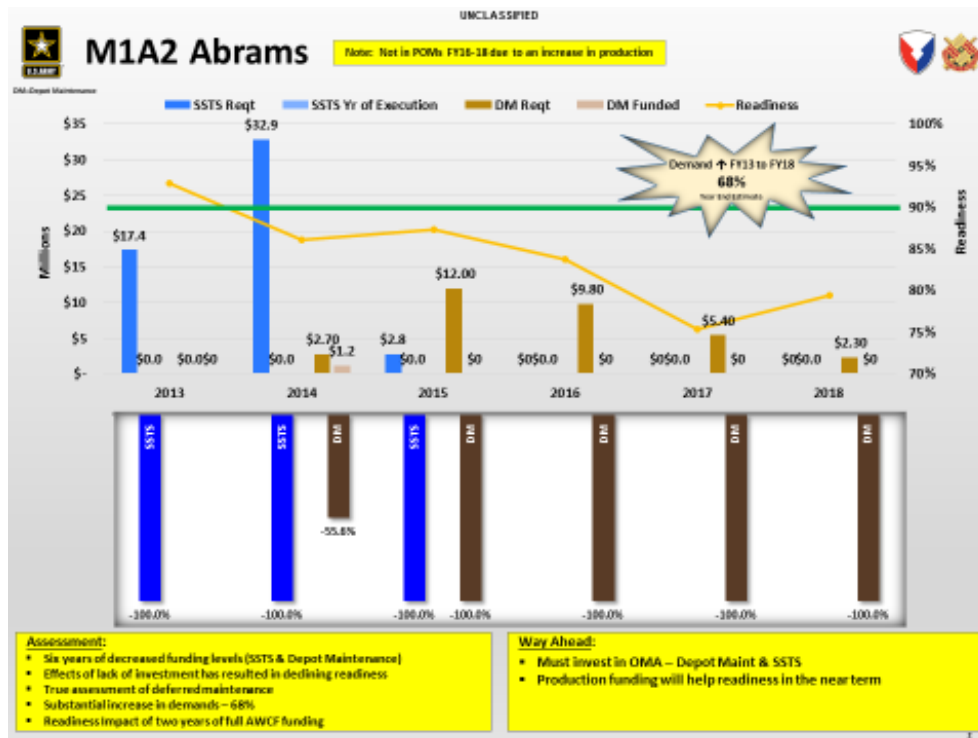
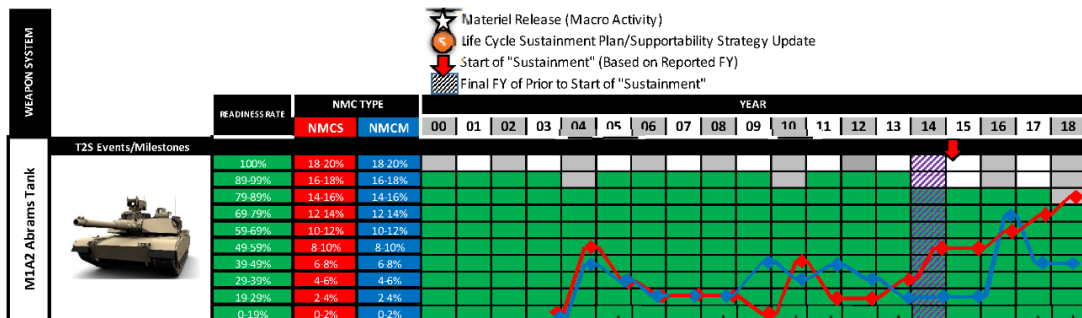


Figure 11. M1A2 Abrams T2S Actions (2000–2018) and Funding Timeline (2013–2018)



N. STRYKER T2S PLANNING AND EXECUTION

The Stryker Family of Vehicles (FoV) were reported to T2S at the end of FY15. The Stryker FoV relevant T2S metrics and funding prior to and after FY15 are shown in Figure 13.

1. SS PEG Funding

SSTS funds were only requested in FY13, FY14, and FY16 for the Stryker FoVs, but none were received from FY13 to FY18. DM funding requests were made in each year from FY13 to FY18, but funds were provided at 3%, 20%, and 80% in FY13, FY14, and FY16, respectively.

2. Readiness

The Stryker FoVs maintained a Readiness level between 89–99% in the two FYs prior to and during the T2S FY (FY13, FY14). Readiness declined to 79–89% during the T2S FY (FY15), and three FYs after. T2S showed a minimal impact on reported Readiness in the immediate years prior to T2S but may have had some impact on Readiness after T2S, suspected primarily due to the lack of DM funding provided. Overall Demands increased 245% from FY13 to FY18.

3. NMCM

NMCM rates for the Stryker FoVs held steady at 2–4% in the two FYs prior to and during T2S. In FY16, NMCM rates rose to 4–6%, and rose again to 8–10% in FY17 and dropped to 6–8% in FY18.

In terms of T2S Sustainment Performance, this may be lagging indicator of deferred maintenance activities Pre and Post T2S (identifying the need to update procedures, updating procedures, updating PMCS requirements, etc.).

4. NMCS

NMCS rates for the Stryker FoVs held steady at 4–6% in the two FYs prior to T2S, but rose to 6–8% during T2S. In FY16, NMCS rates rose to 8–10%. In FY17, these rates remained at 8–10% and rose again to 10–12% in FY18.



In terms of T2S Sustainment Performance, when considering the 245% increase in demands from FY13–FY18, the continual annual increase in NMCS over the same time period indicates a definite unplanned Sustainment Performance requirement that would constitute further analysis as it pertains to determining the root cause. From a T2S, Supply Support–specific standpoint, this would suggest that unplanned Supply Support actions were likely required but most were able to be absorbed by the existing Supply Support plan in place. Additional research and analysis as to the specific demands and Supply Support requirements would be required to draw definite conclusions.

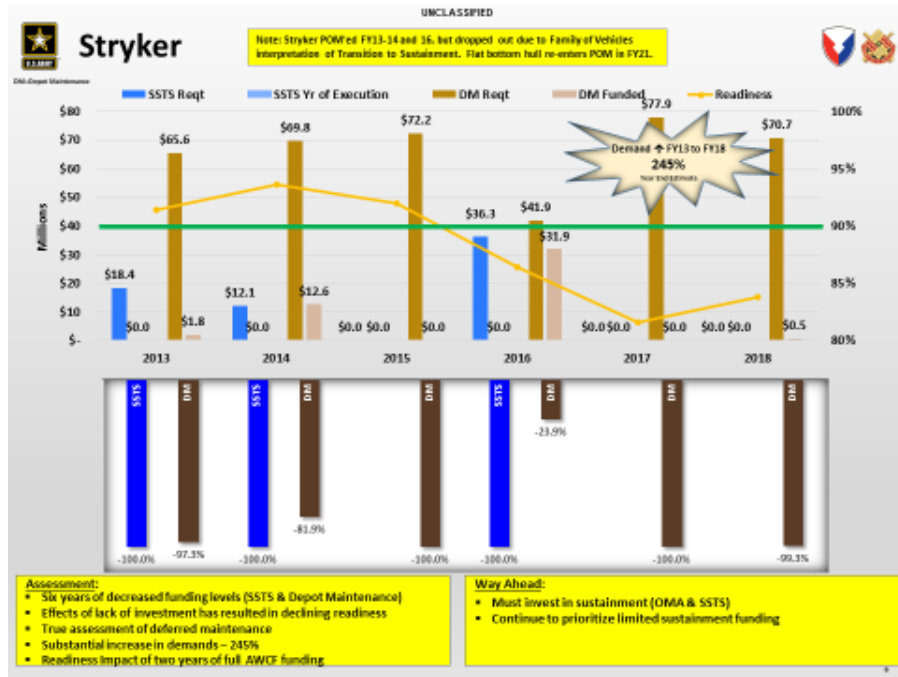
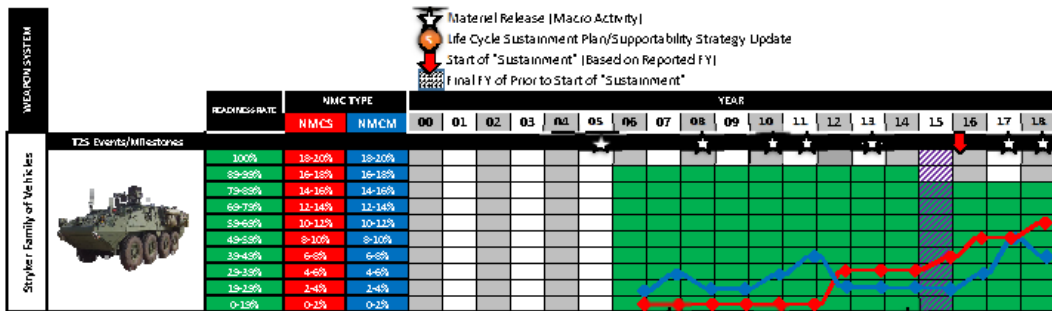


Figure 12. Stryker FoV T2S Actions (2000–2018) and Funding Timeline (2013–2018).

O. M777A2 MEDIUM TOWED HOWITZER T2S PLANNING AND EXECUTION

The M777A2 Towed Howitzer has not executed T2S as of the writing of this paper. For analysis purposes, we review the M777A2 as though T2S is to occur sometime after FY18. The M777A2 Towed Howitzer–relevant T2S metrics and funding prior to and after FY18 are shown in Figure 14.

1. SS PEG Funding

SSTS funds were only requested throughout each FY from FY13–FY18; however, no funds were received until FY15. Roughly 50% of the requested amounts were funded each year from FY15 to FY18. DM funding requests were made in each year from FY13 to FY18, funded at ~20% in FY13, ~50% in FY14, 30% in FY15, ~180% in FY16, ~130% in FY17, and 0% in FY18.

2. Readiness

The M777A2 maintained a Readiness level between 79–99% from FY13–FY18. Readiness was maintained between 89–99% from FY13–FY15 and declined to 79–89% during the FY16–FY18. Overall Demands increased 81% from FY13 to FY18.

If T2S were to occur in proximity to FY18, a focus on understanding the critical factors contributing to the Readiness decline would be necessary to ensure T2S activities did not negatively impact reported Readiness and could be used to try to improve upon any existing issues.

3. NMCM

NMCM rates for the M777A2 held steady at 2–4% from FY13–FY16. In FY17, NMCM rates rose to 6–8%, but declined to 6–8% in FY18.

4. NMCS

NMCS rates for the M777A2 held steady at 4–6% from FY13–FY15. In FY16, NMCS rates declined to 2–4%, but rose to 6–8% in FY17, and increased further to 10–12% in FY18.



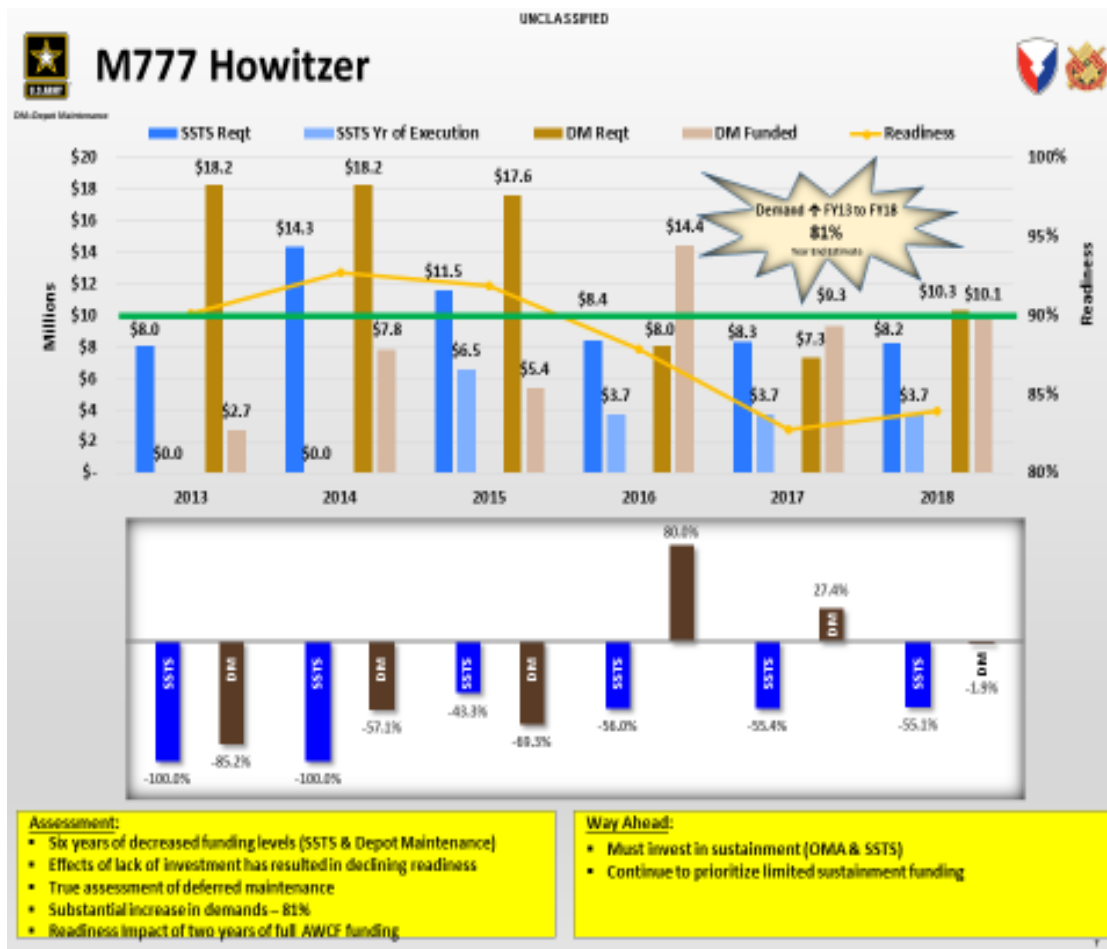
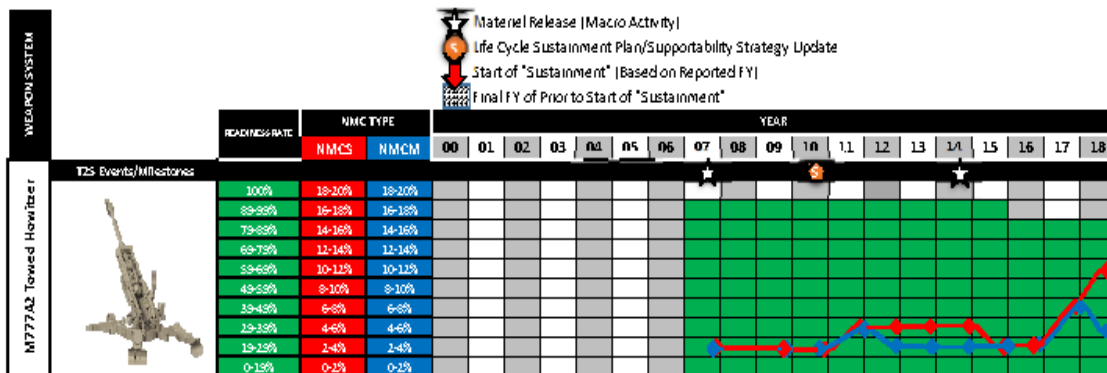


Figure 13. M777A2 Medium-Towed Howitzer T2S Actions (2000–2018) and Funding Timeline (2013–2018).

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V. SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

A. GENERAL SUMMARY OF RESEARCH FINDINGS

In summary, our research and analysis has examined the following questions:

Chapter II: What is T2S? How did T2S come about, and what decisions contributed to any results witnessed in the history of the development of the construct of the T2S process?

Chapter III: How has T2S changed with changes in the acquisition life cycle definition of “Sustainment”?

Chapter IV: What, if anything, can we learn from the T2S execution of specific Army Ground Combat System’s planning and execution of their respective T2S processes?

In Chapter II, our thorough review of the history of T2S, the history of the definition of Sustainment, and supporting data as to the contribution of each to the objective sustainment performance metrics has allowed us to take an eagle-eye view of T2S as it pertains to U.S. Army GCS impacts and execution.

In Chapter III we reviewed how the definition of “Sustainment” may have impacted the definition of T2S, however, to further analyze the specific changes in T2S that may have impacted each individual GCS programs included in this paper, additional research could dive deep into each program and available data to support specific factors leading to the results documented here. Not having that detailed info did not prevent us from arriving at cursory conclusions based on the available data and is still valuable to anyone studying T2S or Acquisition Life Cycle improvement initiatives in the near or distant future.

In Chapter IV we reviewed how the T2S definition timing and changes in parallel to the sustainment definition timing and changes occurred relative to sustainment performance metrics for U.S. Army GCS systems that existed from 2000 to 2018. However, our analysis of funding decision and allocation impacts was limited to data only available from 2013–2018, and thus any decisions made between 2000 and 2013 that



impacted the sustainment performance metrics reported during that time period could not be analyzed or summarized in our conclusions. What follows are the summary conclusions and recommendations resulting from analysis of the declared T2S timing of each GCS system and the respective component sustainment performance metrics reported (i.e., NMCS, NMCM)

B. T2S VS. NMCS CONCLUSIONS AND RECOMMENDATIONS

Program specific conclusions related to T2S impacts on NMCS rates reported were included in Chapter IV. In terms of the general NMCS changes seen across programs in proximity to Macro T2S actions, a possible explanation for this relationship is that at this point systems would have been in the field for a long enough time to reach the point where many components may begin to fail or be used heavily enough to cause damage to components unexpectedly. Though Program Management Offices aim to maximally identify components most likely to fail or be damaged and subsequently require replacement prior to fielding of new materiel to preposition and preplan supply support and maintenance activities, often unanticipated failures are experienced, with a lagging response in both adjustments to maintenance practices and changes or adjustments to supply support pipelines to meet the unplanned emergent requirements. When emergent requirements are experienced during fielding, unless the criticality necessitates an immediate design change, often the fielding teams replace equipment with planned fielding spares to avoid negative impacts to unit Operational Readiness. However, a second-order impact to this activity is that it delays the registering of demands within the supply system required to adequately forecast and execute supply support actions to avoid future NMCS/NMCM reports. This means any T2S planning activities surrounding supply support would not include supply support replacement rates for these components. Instead engineering estimates, or analogous failure rates from previous systems would drive the overall supply support manpower estimates. Furthermore, for digital components, activities such as obsolescence surveillance to sustain procurable tech data configurations are often overlooked but have a major impact on the ability to execute supply support repair and buy actions. These activities have a lagging impact on supply support but are often “soft costs”



not used in things like “Concept Plans” and “Manpower Requirements Studies” that accompany T2S planning and execution as it is executed today.

A recommendation for future research would be to dive deeper into the specifics of the NMCS issues and specifics surrounding the programs that showed an increase in NMCS rates in the years following T2S (i.e., Bradley A2 and A3, M1A1 and M1A2 Abrams, and Stryker). A closer review of the specific NMCS drivers around the time of NMCS percentage increases for systems showing these increases may allow a review of contributing factors as well as any analysis of causative or correlative comparisons between programs.

C. T2S VS. NMCM CONCLUSIONS AND RECOMMENDATIONS

Program specific conclusions related to T2S impacts on NMCM rates reported were included in Chapter IV. From this analysis, one general recommendation is to further identify and analyze acquisition and sustainment strategy decisions that may impact NMCM rates reported in proximity to T2S timing. For systems like the M777A2 Towed Howitzer and Stryker Family of Vehicles that have sustainment strategies that incorporate a performance-based logistics (PBL) concept, field service representatives (FSRs) are heavily relied on to both train and perform critical maintenance functions (by contract they are not to do this on a regular basis, though they will in many situations). The FSRs are incentivized to minimize unit downtime based on PBL contract metrics tied to specific failures and some measure of unit downtime within the fleet of fielded equipment. If emergent requirements occur that are beyond the scope of unit maintainers to quickly resolve, they must often rely on contractor FSRs to train them or perform specific maintenance actions required to return the NMC equipment to an FMC status.

When this is done during the fielding period, it creates a situation where units unintentionally rely on the FSR at the expense of their pool of maintainers. This isn't much an issue when units are CONUS in a training status, but when deployed, current restrictions prevent FSRs from deploying to combat environments. This means a unit must rely on their own maintainers or logistics assistance representatives (LARs) only, that may or may not



have the requisite knowledge to troubleshoot faults or perform critical maintenance tasks in the same fashion that an FSR did when CONUS.

A recommendation for future research would be to conduct a follow-on detailed review of the locations and numbers of systems at a specific location within the density of a specific fielded model to examine contributing factors associated with the increases in average NMCM percentage around the time period of T2S (i.e., Paladin M109A6, M1A2 Abrams, and Stryker). This may reveal additional similarities or differences that could highlight opportunities for other DOD programs to be aware of or for reforms of contributing policies and procedures leading to these results.

D. OVERALL CONCLUSIONS AND RECOMMENDATIONS

The significance of the sustainment phase in any DOD acquisition program life cycle in terms of managing program costs and program success throughout the acquisition life cycle cannot be overstated. While not a foundational component of the acquisition life cycle, our research has highlighted that a successful T2S process directly impacts the DOD's ability to plan for and utilize critical defense capabilities against near term and long-term threat forecasts. We believe the in-depth analysis of critical U.S. Army Ground Combat Systems T2S processes has highlighted opportunities for the DOD or future researchers to further define and improve T2S lessons learned as T2S continues to be defined as a required planning process within the acquisition life cycle. We believe this represents a tremendous opportunity for the DOD to review the current processes, guidance, and decision points that support T2S. The DOD could then apply some lessons learned from programs that have shown to be more successful than others at sustaining reported metrics and potentially apply a similar analysis to other programs with similar available data to look for additional opportunities to improve not only the U.S. Army's ability to respond to evolving threat requirements while simultaneously balancing the Army budget over time, but also improve the DODs ability to apply any lessons learned available from this type of analysis being applied to current DOD service acquisition programs and any programs to come in the future.



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