Proceedings of the Annual General Donald R. Keith Memorial Conference
West Point, New York, USA
April 23, 2026
A Regional Conference of the Society for Industrial and Systems Engineering

Driving Data Discipline: Improving Data Quality in AI2C's Centaur Application

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Author Note: The research team is composed of Marcus Sebastian, Carson Kellogg, Jared Cohen, Clayton Moorhouse, and Kennison Harmon, all undergraduate students in the Department of Systems Engineering at the United States Military Academy. We want to thank our capstone advisor Colonel Matthew Dabkowski for his constant assistance and mentorship throughout the last year of work on this project, as well as our client - the Army Artificial Intelligence Integration Center. The views expressed herein are those of the authors and do not reflect the position of the United States Military Academy, the Department of the Army, or the Department of War.

Abstract: This work seeks to increase the effectiveness of the Army Artificial Intelligence Integration Center's (AI2C's) Centaur platform by improving the quality of data entered into the Global Combat Support System–Army (GCSS-Army), the primary data source for Centaur. Envisioned as a way to improve the logistical readiness of the Army's operational units. Centaur was released to the Army in 2024. Despite its novel capabilities and significant promise, the application is not living up to its full potential. Using the Systems Decision Process, the team refined the initial problem statement and identified systemic, addressable data quality issues within GCSS-Army. Subsequent work built a value model for AI2C that was used to generate potential solutions, including the use of incentives and audits as the primary mechanisms for improving and sustaining data quality. This paper describes this effort, offers a recommendation for AI2C, and discusses limitations and areas for future work.

Keywords: Artificial Intelligence, Army Artificial Intelligence Integration Center (AI2C), Global Combat Support System - Army (GCSS-Army), Predictive Maintenance.

1. Introduction

The United States Army's desire to operationalize artificial intelligence (AI) in sustainment has grown its dependence on enterprise logistics data to enable predictive decision-making. Paramount to this endeavor is the Global Combat Support System-Army (GCSS-Army), the Army's logistics enterprise resource planning (ERP) system. As the Army's system of record for supply and maintenance data, GCSS-Army is a critical source of information for AI-enabled software like Centaur, a predictive maintenance system for ground vehicles released by the Army Artificial Intelligence Integration Center (AI2C) in 2024. While Centaur has potential to enhance readiness, its effectiveness is constrained by consistent data quality issues within GCSS-Army. Inconsistent, inaccurate, and incomplete reported maintenance data limits model performance and subverts user trust, suggesting a systemic challenge that expands beyond technical model design. This research incorporates the Systems Decision Process (SDP) to identify and examine GCSS-Army data quality issues and analyze potential mechanisms for improvement. Focusing on audits and incentives as central levers for behavior change, this study produces a value-based recommendation for AI2C to enhance and sustain data quality, thereby improving the impact of predictive maintenance throughout the Army.

2. Background

The following section summarizes our research team's (hereafter referred to as the team) overall literature review for this project. It covers the most applicable aspects of the background, such as ERPs, GCSS-Army, AI2C, and Centaur, facilitating the readers understanding of our candidate solutions for solving data accuracy issues within GCSS-Army.

2.1. Enterprise Resource Planning Systems

The earliest predecessors of ERPs date back to the 1960s. These original ERPs were mainly created to manage inventory and control manufacturing in large-scale businesses. Throughout the 1970s and into the 1990s, additional elements were added to manage other sectors of a business. With the advent of more powerful computing in the 2000s, ERPs began to integrate most, if not all, of an organization's functions (Goldston, 2020).

Today, ERPs enable an organization to maintain a single database, a single application, and a standard graphical user interface for managing all its information and transactions (Candra, 2012). In other words, ERPs create an all-in-one, end-to-end solution for managing an entire business or organization. ERPs are typically implemented to replace multiple legacy systems, which are often disconnected, leading to costly, inefficient, and inaccurate data transfers to individuals throughout the organization (Inbound Logistics, 2023). Through this consolidation, ERPs centralize an organization's operations on a single platform, ensuring that everyone has access to the same accurate information.

2.2. GCSS-Army

GCSS-Army is a web-based ERP system that has altered how the US Army oversees financial and logistical operations (Deaton, 2016). Over the past ten years, GCSS-Army has replaced many legacy "stovepipe" systems with an embedded platform for accountability, overseeing the supply chain, financials, and maintenance at the tactical echelon. The Army's use of GCSS-Army and other ERP systems has changed how Army logistics works behind the scenes. It has significantly simplified the tracking of the Army's vehicles, their statuses, and their supplies. GCSS-Army has also reduced maintenance costs and is projected to further reduce them by 12 billion dollars by 2027 (Merritt, Gosling, Ellingston, & Melton, 2015).

At the unit level, supply personnel, maintainers, and clerks populate GCSS-Army with data by transferring observed equipment faults and transactions into digital records. Mechanics and operators pinpoint problems during Preventative Maintenance Checks and Services (PMCS) and document them on DA Form 5988-E, which are then authenticated and inputted into GCSS-Army by the maintenance control section, connecting repair parts to specific equipment faults (Larimer, 2026). This data is utilized across many echelons, allowing platoon leaders to track readiness, commanders to oversee equipment statuses, and sustainment personnel to manage resources and parts. Its effectiveness, however, hinges on command emphasis; inconsistent data entry, dependence on parallel systems, and delayed reporting often reduce data quality. These problems demonstrate broader cultural obstacles, where precise documentation is not regularly emphasized (Moorhouse & Wang, 2024).

2.3. AI2C and Centaur

AI2C was established in 2018, co-located with Carnegie Melon University as the "Army's Artificial Intelligence Task Force." The purpose of this center was to "lead, integrate, and synchronize the Army AI strategy and implementation plan" (Easley, 2019). In 2021 the Army shifted its focus and renamed the AI center to AI2C. The organization shifted its original mission focus from experimentation to creating and distributing AI programs to improve mission performance.

AI2C previously developed an AI predictive maintenance program for aviation called "Griffin," which demonstrated promising success. Based on that performance, Army senior leaders requested that its foundation be expanded to ground vehicles with an application called Centaur (A. Knapp, personal communication, January 22, 2026). Over the past year, the team worked alongside AI2C to identify ways to incentivize more accurate data collection within GCSS-Army, which is the principal source of Centaur's data and the focus of the team's data quality improvement efforts.

3. Methodology

To solve AI2C's problem, the team leveraged the Systems Decision Process (SDP), an iterative four-step process that facilitates sound decision making. The process begins with problem definition, the longest and most important phase. The purpose of problem definition is to create a shared understanding of the needs and requirements of the stakeholders. It ends with a revised problem statement that clearly outlines the goals of a project. The next phase is solution design, where various candidate solutions are generated. Following solution design is decision making. Leveraging the criteria developed in the problem definition phase, candidate solutions are scored and compared. Based on the results, a decision is made regarding which candidate solution will be implemented. This phase is followed by solution implementation, which is outside the scope of this project. The following sections outline this methodology and its outputs in detail.

3.1. Problem Definition

3.1.1. Initial Problem Statement

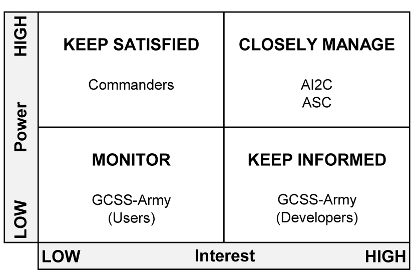
AI2C's Centaur predictive maintenance application depends on precise and timely data from GCSS-Army. Nevertheless, soldiers habitually "work around" GCSS-Army due to high operational tempo, training gaps, cultural norms, and user interface complications. This deteriorates the completeness, quality, and stability of maintenance data, limiting Centaur's capacity to produce reliable predictive analytics and diminishing its operational impact.

3.1.2. Stakeholder Analysis

The team organized the various types of stakeholders, both involved or affected by the project, by defining and sorting them through a Power Interest Grid (Figure 1, left panel) and a Commitment Assessment Matrix (Figure 1, right panel). The Power Interest Grid categorizes each stakeholder into four groups to determine how closely the team should monitor each stakeholder's satisfaction and how often the team should update each stakeholder with its progress. The primary stakeholder is AI2C. It alone has been developing the AI predictive maintenance programs that derive their data from GCSS-Army. Throughout the project, the team has been closely monitoring the satisfaction of the AI2C team. The other client primarily involved in this project is the Army Sustainment Command (ASC). ASC provides strategic logistic capabilities to combatant commanders to maintain unit operational readiness; therefore, it depends on the quality of data in GCSS-Army to assess and prioritize its activities based on operational readiness (Army Sustainment Command, 2026).

The Commitment Assessment Matrix was developed to visualize the level of support and engagement each stakeholder has toward the project. Figure 1 (right panel) compares each stakeholder's current level of commitment with the level of commitment desired by the team. In most cases, the team identified a need for stronger stakeholder support to enable successful implementation of proposed changes. Unit commanders were identified as particularly influential stakeholders because they shape the culture surrounding maintenance reporting and accountability. As a result, their desired commitment level is significantly higher than their current assessed level. Similarly, GCSS-Army users and developers must actively support proposed improvements to ensure effective adoption. Neutral engagement from these stakeholders neither facilitates nor accelerates system change. Increased commitment is, therefore, necessary to support successful implementation of the candidate solutions.

Other stakeholders connected to this project include the Army as a whole, but more particularly, the soldiers who utilize GCSS-Army on a regular basis, whether that be for inputting data into the system or for analyzing data already entered into the system. Additional stakeholders who are important to keep satisfied are commanders, as accurate materiel status directly impacts the distribution of resources, maintenance actions, unit readiness, and, ultimately, mission execution. Finally, GCSS-Army developers are stakeholders, as they play a critical role in ensuring the ERP is designed to facilitate accurate data entry.



Legend C = Current D = Desired		Stakeholder Groups				
		AI2C	ASC	GCSS-Army (Users)	GCSS-Army (Developers)	Commanders
Level of Commitment	Strongly Support	C, D				D
	Support		C, D	D	D	
	Neutral			C	C	C
	Opposed					
	Strongly Opposed					

Figure 1: Power Interest Grid (left panel) and Commitment Assessment Matrix (right panel)

3.1.3. Value Modeling

The value model is based on the functional hierarchy (Driscoll, Parnell, & Henderson, 2022). A functional hierarchy identifies what the system must be able to do but does not specify how the system should do it. The functions are written in the form of verb-object to mitigate the risk of solutions arising in the hierarchy (Driscoll et al., 2022). This ensures that solutions match the functions, rather than the functions being written to fit solutions that may not yield the most value to stakeholders. It also allows for greater creative freedom in solutions because designers are not constrained to a small set of alternatives.

The qualitative value model reflects a value-focused decision-making approach that prioritizes stakeholder values rather than predefined alternatives (Driscoll et al., 2022). By building on the functional hierarchy, the model defines how system performance will be measured to support objective comparison of candidate solutions. The hierarchy distills the fundamental objective – Improve data accuracy in GCSS-Army to fully realize the benefits of AI2C's Centaur software – into functions, objectives, and value measures, which together allow the team to evaluate how effectively each alternative satisfies stakeholder priorities (Driscoll et al., 2022). The final value model is shown in Figure 2.

In the first function (F.1 - Identify Bad Data), the team focused on validating the data already entered into GCSS-Army (F.1.1 - Validate Inputs). The objective is to optimize audits, and this will be measured by fault accuracy verification, audit effort expended, and mission capability verification. In the second function (F.2 - Improve Data Quality), the team targeted incentivizing users to enter accurate data into GCSS-Army (F.2.1 - Incentivize Accuracy). The two objectives for this function

ISBN: 97819384962-5-7

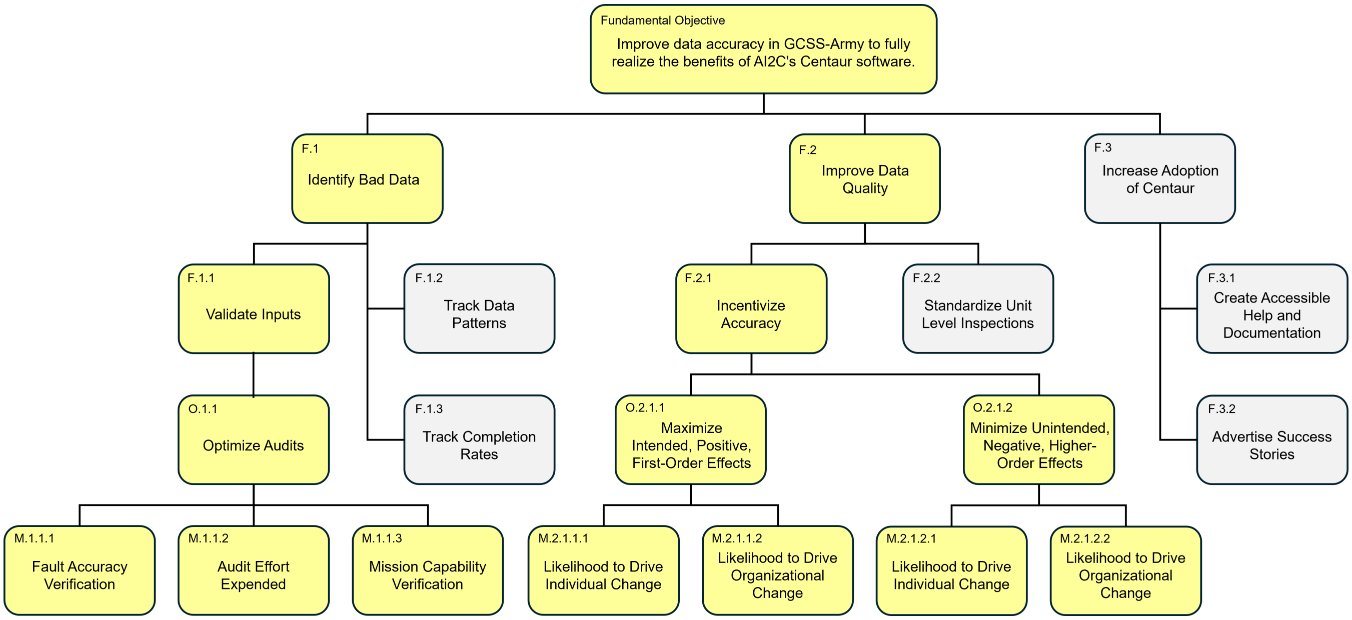


Figure 2: Condensed Value Hierarchy (yellow-shaded boxes denote elements that are within the project's scope)

are to maximize intended, positive, first-order effects and to minimize unintended, negative, higher-order effects. These are measured by the perceived likelihoods to drive individual change and organizational change. The third function (F.3 - Increase the Adoption of Centaur), as well as the remaining subfunctions in Figure 2 denoted in light gray, were deemed outside the scope of the team's effort. Specifically, this project focuses on mechanisms that drive accountability and behavior change without restructuring GCSS-Army's infrastructure or modifying its user interfaces.

3.1.4. Redefined Problem Statement

AI2C's Centaur application is not being used to its maximum capability because the accuracy of the data it uses is questionable. Specifically, soldiers appear to be "working around" GCSS-Army, the system of record that feeds Centaur data, limiting Centaur's potential to provide reliable, trustworthy insights. To remedy this, the Army needs to build a culture that values and ensures the entry of accurate maintenance data into GCSS-Army.

3.2. Solution Design

Armed with an approved redefined problem statement, the team transitioned into the Solution Design phase of the SDP, which is composed of three primary sub-tasks: idea generation, alternative generation, and cost analysis.

3.2.1. Zwicky's Morphology

The team used Zwicky's Morphological Box (simply referred to as Zwicky's) to organize its ideas and assemble them into alternatives (Driscoll et al., 2022). Methodologically, Zwicky's takes design decisions that satisfy system functions, organizes them as columns of a matrix, lists ideas for the design decisions in rows, and combines the ideas to generate alternatives. Given the team's focus on functions F.1.1 and F.2.1, it used Zwicky's to build two independent sets of alternatives - one for validating inputs and one for incentivizing accuracy (the top and bottom panels of Figure 3, respectively). The box labeled Audits contains eight design decisions: (1) the frequency of the inspections, (2) whether the inspector is internal or external to the unit being inspected, (3) the primary metric(s) to assess, (4) how the inspection is initiated, (5) the inspector's required expertise, (6) the inspector's required rank or position, (7) the amount of the unit's materiel to inspect, and (8) the amount of the unit's personnel to inspect.

ISBN: 97819384962-5-7

Audits								
Theme	Frequency	Inspector	Metrics	Initiation Method	Inspector Expertise	Inspector Ranks	Materiel Inspection Amount	Personnel Inspection Amount
Preparation	Event-based	External	Operational readiness (OR) rate	Requested	Platform	Company commander or higher	100%	100%
Random	Random	Internal or external	Accuracy	Directed	Process	Next higher echelon	20%	20%
Continued Emphasis	Time-based	Internal	Accuracy, quantity	Scheduled	Platform	Platoon leader or higher	10%	10%
Corrective	Event-based, then time-based	External	Tied to deficiency (OR rate, accuracy)	Directed	Tied to deficiency	Echelon dependent	Scaled according to improvement	Scaled according to improvement

Incentives				
Theme	Individual Recognition	Organizational Recognition	Individual Corrective Measure	Organizational Corrective Measure
Carrots (recognition)	Official badge, monetary bonus, day of leave	Guidon streamer, DONSA, BDE recognition, new equipment	None	None
Sticks (corrective measures) for logisticians	None	None	Forced MOS reclassification or branch transfer out of logistics	Retraining, loss of block leave
Sticks for non-logisticians	None	None	Forbidden from transferring or reclassifying into logistics, barred from command	Weekend motor pool rodeo, loss of block leave, retraining

Figure 3: Zwicky's Morphological Box for Audits and Incentives

3.2.2. Solution Themes

As seen in Figure 3, the team developed four themes for audits and the incentives using Zwicky's. The first audit theme is "preparation" audits. Preparation audits are distinct in that they emphasize verifying maintenance accuracy prior to major training events, such as Joint Readiness Training Center (JRTC) or National Training Center (NTC) rotations. This approach should encourage units to achieve the highest possible maintenance accuracy at critical points in their training schedule, but it could also reduce their incentive to prioritize maintenance during periods of lower operational activity.

The second type consists of "random" audits. These are defined by their perceived unpredictability, which ensures that units must maintain a consistent level of accuracy at all times, regardless of where they are in their training cycle, since they can be inspected without prior notice. Because of this randomness, inspectors are usually drawn from within the unit. However, this can introduce potential conflicts of interest that may reduce the objectivity and accuracy of the audit. To limit the impact on operations, these inspections would also be capped at a maximum of 20% of the unit's equipment and personnel.

The third audit theme is "continued emphasis." These audits are scheduled ahead of time and units are given advanced notice. With only 10% of materiel and personnel being checked, they are similar to cyclic inventories. The inspector will be internal, which might affect the reliability of the audits. Effectively, the goal of this auditing strategy is to integrate them into the normal schedule of a unit and, by constantly checking a random 10% of equipment and personnel, ensure that the unit is being honest in its reporting.

The fourth and final audit theme is "corrective." The purpose of this audit is to assess accuracy when a level of readiness is breached. This triggers a 100% audit. Following the first 100% audit, the frequency of audits and the percentage of equipment is reduced as improvements are made. Inspectors would be from an external and impartial source outside of the normal unit structure of the Army, such as a unit stood up for the purposes of auditing unit logistical accuracy.

The second set of solution themes focuses on incentives designed to influence both individual and organizational behavior. These incentives are evaluated based on their perceived likelihood of improving maintenance reporting accuracy while minimizing unintended consequences. Individual incentives include recognition through an official badge, an additional day of leave for personnel in units achieving the highest maintenance accuracy within a division, and professional consequences for persistent inaccuracies such as forced military occupational specialty (MOS, i.e., job) reclassification, restrictions on transferring into logistics roles, or limitations on officer command eligibility. Organizational incentives include guidon streamers, days of no scheduled activity (DONSAs), or brigade-level recognition for units demonstrating the highest reporting accuracy. Corrective measures may include reduced prioritization for new equipment fielding, mandatory retraining on the system of record, or weekend maintenance events.

3.3. Decision Making

To score each alternative on the value measures seen at the bottom of Figure 2, the team developed a survey that was sent to the client for distribution to relevant stakeholders. The survey was developed in Microsoft Forms with questions designed to quantify subjective views on incentives. There are four sections that measure the intended positive and unintended negative consequences of individual and organizational incentives. This can be seen in Figure 4 which gives the user interface that shows each of these incentives will be assessed using a Likert scale. Because it is linked to an Excel document, the team will be able to take those raw scores and transform them into values before global weights are applied to them. Once this process is complete, the team will perform sensitivity analysis on the value measures' weights and individual survey responses to assess the robustness of the highest scoring candidate solution. After this, the team will conduct a cost analysis that will better inform AI2C on the cost and value tradeoff for the candidate solutions. Based on this analysis, the team will select a preferred candidate solution and present the results to AI2C for its decision.

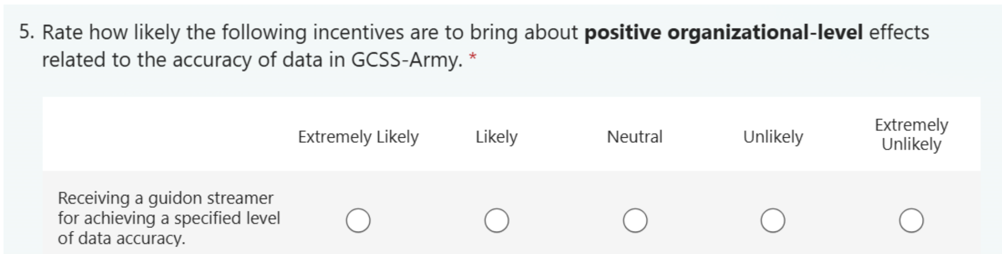


Figure 4: Example survey question to assess the perceived likelihood an incentive achieves positive organizational effects

4. Conclusion and Future Work

The effectiveness of predictive maintenance tools such as Centaur depends on the quality of the maintenance data recorded in GCSS-Army. Using the Systems Decision Process, the team examined the behavioral and organizational factors contributing to inaccurate data entry and identified audits and incentive mechanisms as practical levers for improving reporting practices. Strengthening accountability and encouraging consistent data entry can improve the reliability of GCSS-Army data and increase the operational value of predictive maintenance systems. Improving data quality at the point of entry will be essential for enabling the Army's broader transition toward data-driven sustainment and AI-enabled decision making. Future work will focus on completing stakeholder survey data collection, finalizing the scoring of proposed alternatives using the developed value model, and refining implementation recommendations for AI2C and Army sustainment leaders.

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