

The Integration of Artificial Intelligence to Enhance Construction Engineering in the Federal Government

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Abstract — *This article chronicles an investigation into the practical application of Artificial Intelligence (AI) within the administrative framework of a federal construction engineering entity. The project was initially conceived with ambitious objectives to leverage AI for a wide range of functions, including administrative assistance, project scheduling, and proposal analysis, with the aim of addressing a noted research gap at the intersection of AI in construction and government. To test this potential, the CAMO GPT platform, an AI tool operating on the secure NIPR Network, or Non-classified Internet Protocol Router Network (a private network used by the U.S. Department of Defense (DoD) to exchange unclassified information, such as emails and documents, and to provide access to the public internet), was assessed. The findings revealed a significant disparity between technology's potential and its current capabilities. While the platform excelled at text-based administrative tasks, such as information retrieval and redaction, it demonstrated critical limitations in data manipulation and analysis, failing to meet the project's original objectives for scheduling and quantitative analysis. This article synthesizes the initial proposal, a literature review, and the practical assessment to provide a realistic framework for AI integration, highlighting its current utility as a specialized assistant rather than a comprehensive project management tool.*

Key Terms — *Artificial Intelligence, Construction Engineering, Data Analysis, Federal Government.*

INTRODUCTION

The integration of Artificial Intelligence (AI) holds transformative potential for the construction industry, promising to alleviate administrative

burdens and optimize project inefficiencies. The literature confirms that AI is widely applied in the private construction sector to enhance scheduling and management [1], while in public administration, it is used to boost operational efficiency. However, a distinct research gap exists regarding the specific application of AI within the unique administrative and regulatory framework of a federal construction engineering entity.

This project was designed to address that gap. The initial proposal outlined a broad vision: to investigate AI as a multi-faceted tool capable of acting as an administrative assistant, optimizing project scheduling, analyzing construction proposals, and automating internal government processes. The goal was to develop a comprehensive framework for integrating AI into the workflow of a government entity, such as the US Army Corps of Engineers. This article details the journey from that initial intent to the practical, hands-on assessment of the CAMO GPT platform, presenting the findings and analyzing the significant gap between technology's theoretical promise and its current, real-world capabilities.

CONTEXT FROM THE LITERATURE REVIEW

A review of existing research established the foundation for this project. In the construction industry, AI applications are mature, enhancing nearly all project phases by improving accuracy, automating tasks, and providing predictive insights to mitigate risks. Pan, Han & Zhang explained: "A broad overview of the field shows that AI is being applied across nearly all aspects of construction, from the initial design phase to final project management" [2].

Specifically, machine learning has proven effective for forecasting project events and creating more resilient schedules by analyzing variables like weather and supply chain disruptions. Wang, Ma & Li discussed this: “A systematic review of machine learning for project schedule management highlights its potential to create more accurate and resilient project timelines” [3].

Simultaneously, the adoption of AI within the U.S. federal government is accelerating. A Government Accountability Office (GAO) report notes that agencies have significantly increased their use of AI for tasks such as improving communication and tracking programs: "Many uses focus on mission-enabling functions, and nearly half of all reported AI uses are developed in-house by the agencies themselves" [4]. The potential for AI to automate routine administrative tasks, such as document processing and drafting communications, is a recurring theme that aligns with this project's goal of utilizing AI as an administrative assistant.

This established potential in two separate domains—construction and public administration—formed the basis of our research question. The literature shows that private industry leverages AI for complex analytical tasks, such as creating resilient project timelines by analyzing variables like weather and supply chain disruptions [3]. In contrast, government adoption often focuses on mission-enabling functions that enhance administrative efficiency, like using Robotic Process Automation (RPA) as a "tireless assistant" for repetitive contracting tasks or drafting routine communications [5].

The challenge, therefore, lies in synthesizing these two approaches. While the principles from the private sector are applicable, federal agencies operate under unique regulatory, procurement, and bureaucratic constraints that demand a more nuanced implementation. My review confirmed a clear gap in research that specifically addresses the implementation of AI within the administrative and project management framework of a federal construction engineering entity [6]. Thus, the core research question emerged: how can the advanced predictive capabilities proven in private construction

be adapted and integrated into the administrative workflows of a federal engineering entity, ensuring compliance and addressing the unique operational environment of public service?

METHODOLOGY AND ASSESSMENT OF FINDINGS

The project employed a mixed-methods approach, beginning with the literature review and a needs assessment, followed by the practical application and testing of a selected AI tool. The CAMO GPT platform, a generative AI operating within a secure government network, was chosen for simulation. Its performance was measured against the core objectives outlined in the initial project proposal.

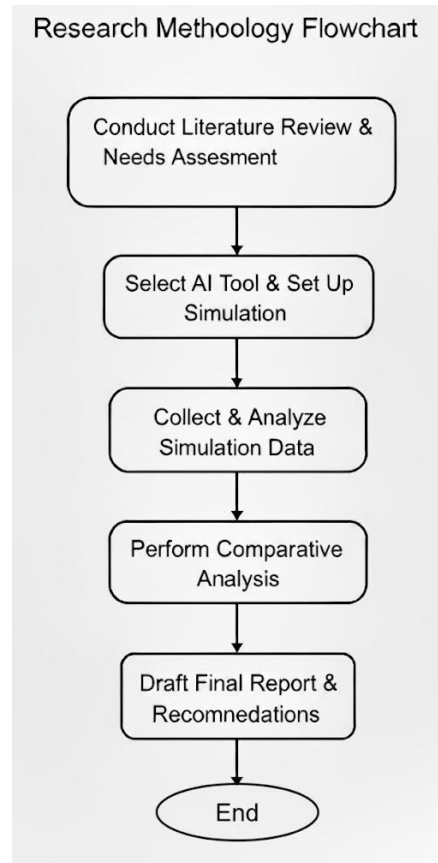


Figure 1
Methodology Flowchart

Methodology Description

Phase 1: Foundation and Planning - This initial phase focused on establishing the theoretical and operational context for the research. A

comprehensive literature review was conducted to analyze existing research on AI in both the construction industry and public sector environments. Concurrently, a needs assessment of the US Army Corps of Engineers, Contract Administration Branch, was performed to understand current workflows and identify specific administrative bottlenecks that AI could potentially address.

Phase 2: Practical Application and Testing - The second phase involved hands-on testing of AI technology. The CAMO GPT platform was selected as the test tool, and simulated scenarios were created to evaluate its effectiveness against the project's objectives, such as document searching and data analysis. During these simulations, both quantitative data (e.g., time saved on tasks) and qualitative data (e.g., user experience feedback) were collected to provide a holistic view of the platform's performance.

Phase 3: Synthesis and Analysis - In the final phase, the collected data were analyzed to draw meaningful conclusions. A comparative analysis was conducted to evaluate the efficiency and accuracy of AI-enhanced methods in comparison to traditional, manual processes, thereby quantifying the benefits and identifying critical limitations. The results were then synthesized into a final report that summarized the findings and formulated a set of actionable recommendations for implementing AI within the context of federal construction engineering.

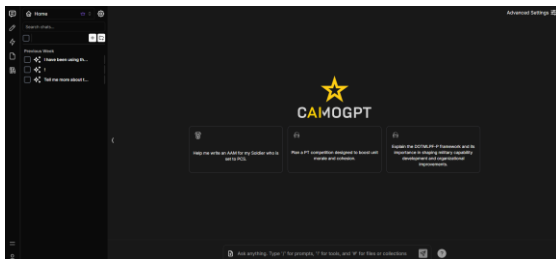


Figure 2
CAMOGPT Homepage

Assessment of Data Analysis and Scheduling

A primary objective was to evaluate AI for optimizing project scheduling and risk management using CAMO. This required robust data analysis

capabilities. However, the assessment revealed significant limitations:

- Spreadsheet Manipulation: Attempts to use the platform's "Panda AI" tool to modify spreadsheet data were unsuccessful. The system could not edit the data, a critical failure for any analytical task.
- Data Comparison and Summarization: The system failed to identify repeated scenarios within a dataset and was unable to summarize the differences between spreadsheets.

At the same time, the platform represents a complex challenge when uploading the files to work or analyze, given the fact that the review process, for security reasons, delays the availability of files, see Figure 3.

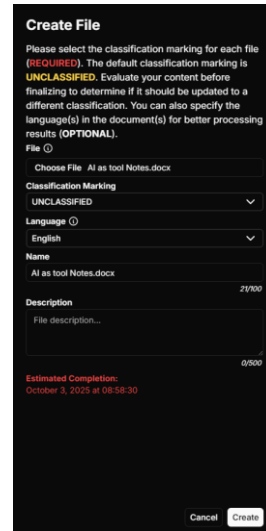


Figure 3
File Upload Screen

Assessment of Administrative Functions

The proposal also aimed to use AI as an administrative assistant and proposal analysis. Here, the results were more positive but still nuanced.

- Search Functionality: The platform performed exceptionally well as a search tool, quickly retrieving specific information from large documents. This is a clear benefit for administrative efficiency.
- Redaction Capabilities: The tool is capable of redacting sensitive information from memoranda, a valuable feature for maintaining security protocols.

While CAMO GPT proved useful for specific administrative support tasks, its analytical deficiencies prevent it from being used for the deeper task of analyzing construction proposals for compliance or risk, as initially hoped.

ANALYSIS: RECONCILING EXPECTATIONS WITH REALITY

The results of this study highlight a crucial gap between the broad potential of AI described in the literature and the functional reality of a specific tool available within a secure government environment. The literature suggests that mature AI can handle complex scheduling and analytics, an expectation that drove our initial project objectives. Our findings indicate that CAMO GPT has not yet achieved this level of capability, particularly in its core data-handling functions.

However, the platform's success in text-based tasks aligns perfectly with the documented use of AI in public administration for streamlining workflows and automating routine communications. The tool is not the all-encompassing project management solution we first set out to investigate, but it is a highly effective administrative assistant for specific, language-oriented tasks. This practical finding addresses the research gap by defining a realistic, immediately applicable role for this class of AI in a federal construction context.

PRACTICAL USE CASES AND RECOMMENDATIONS

Given the disparity between the initial goals and the tested capabilities, the primary outcome of this project shifted from designing a broad integration framework to defining a set of targeted, practical applications and recommendations.

Validated Use Cases

While the initial assessment revealed limitations in quantitative analysis, the CAMO GPT platform proved to be a powerful tool for language-based administrative tasks. The following use cases leverage its demonstrated strengths to improve workflow efficiency and security compliance:

- **Rapid Information Retrieval:** In federal construction engineering, projects are governed by vast quantities of documentation, including multi-volume contracts, technical specifications, engineering regulations (ERs), and procedural manuals. Manually searching these dense documents for a specific clause, material specification, or procedural guideline is a time-consuming and often frustrating task.

CAMO GPT excels as a high-speed search engine for this exact purpose. An engineer can upload a 500-page contract and, instead of manually scanning the table of contents or using basic keyword searches, simply ask the platform a direct question like, "What are the specified curing times for concrete in Section 03 30 00?" or "Locate the clause pertaining to differing site conditions." The platform can parse the document and provide the exact relevant text in seconds. This capability offers a significant reduction in research time, enabling personnel to quickly access the necessary guidance for project planning and execution.

- **Memorandum & Correspondence Redaction:** Handling sensitive information is a daily reality in the federal government. Project documents, memoranda, and official correspondence often contain information classified up to Controlled Unclassified Information (CUI), such as cost data, contractor proprietary information, or internal deliberations. Before sharing these documents with external partners or distributing them more widely, this sensitive information must be properly redacted to comply with security protocols.

CAMO GPT demonstrated high proficiency in this redaction process. A user can upload a memorandum and instruct the tool to remove all names, budget figures, or specific project identifiers. The tool automates what would otherwise be a meticulous manual process, streamlining document preparation and significantly reducing the risk of accidental information leaks. This is a valuable function for maintaining compliance and protecting project information.

- **Initial Draft Generation:** While CAMO GPT is not a replacement for the expertise of an engineer or project manager, it can serve as an effective tool for overcoming the initial hurdle of routine writing tasks. Generating first drafts of progress updates, informational memos, or responses to routine inquiries can be automated, providing a solid foundation that can then be refined.

For example, an engineer could provide the AI with bullet points summarizing the week's progress and instruct it to "Generate a draft of a weekly progress report in a professional tone." The crucial caveat, as identified in the research, is that all AI-generated output must be thoroughly reviewed and validated by qualified personnel. The AI may not grasp the full context or nuance required. However, by handling the initial composition, it frees up government employees to focus on the more strategic and technical aspects of their work, ensuring the final product is both accurate and well-written.

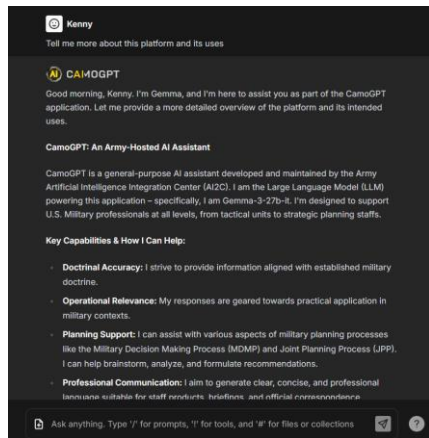


Figure 4
CAMOGPT Uses

RECOMMENDATIONS AND CONCLUSION

For the platform's developers, development efforts should prioritize enhancing spreadsheet functionality. This is the most critical area for improvement needed to unlock the broader potential envisioned in our proposal and the literature.

For users within federal agencies, it is crucial to focus on information-centric tasks where the tool has proven strengths and to integrate it as a supplemental

tool, not a replacement for existing analytical processes. We initiated this research with a proposal to investigate how AI can transform federal construction engineering. Our practical assessment of CAMO GPT provided a clear answer: in its current form, it is not a transformative analytical engine, but it is a valuable tool for enhancing administrative efficiency. This study successfully bridges the gap between theoretical potential and applied reality, offering an actionable path for leveraging AI in the federal government today.

According to communications issued by USACE, a version of Microsoft Copilot is expected to be released this fall. Based on the following table and the results of this research, it should be considered the primary AI tool for federal agencies going forward.

Table 1
CAMOGPT vs Microsoft Copilot

Feature	CamoGPT	Microsoft Copilot
Hosting & Security	Hosted on a dedicated NIPR Network. Processes data up to CUI.	Typically cloud-based (Azure). Security posture dependent on Microsoft's environment and user configuration.
Internet Access	No internet access. Relies solely on pre-trained data (as of Fall 2024).	Has internet access. Can retrieve and process real-time information.
Data Privacy	Designed with a focus on data security within a controlled military environment. No user-specific data retention.	Data usage governed by Microsoft's privacy policies. Potential for data logging and usage analysis.
Doctrinal Focus	Specifically designed to provide doctrinally accurate and operationally relevant information for military users.	General-purpose AI assistant; doctrinal accuracy not a primary design goal.

Feature	CamoGPT	Microsoft Copilot
Military Planning Support	Tailored to support military planning processes (MDMP, JPP).	Can assist with general planning tasks, but lacks specific military process integration.
Tool Integration	Includes tools like PandasAI for data analysis.	Integrates with Microsoft 365 suite (Word, Excel, PowerPoint, Teams).
Customization /Finetuning	Open source implementation, not finetuned.	Offers some customization options within the Microsoft ecosystem.
Access & Availability	Available to authorized U.S. Military personnel through the Army A2C.	Widely available through Microsoft subscriptions.
Data Sources	Trained on a broad range of publicly available data, with a knowledge cut-off of Fall 2024.	Leverages a vast and constantly updated knowledge base from the internet.
File Processing	Supports file uploads for Retrieval-Augmented Generation (RAG).	Supports file uploads and processing within the Microsoft 365 environment.
PII Handling	Strictly prohibited from processing PII.	PII handling subject to Microsoft's policies and user controls.

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