



U.S. ARMY COMBAT CAPABILITIES DEVELOPMENT COMMAND AVIATION & MISSILE CENTER

▪ Responsible Use of AI to Improve Sustainability of Future Systems

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DEVCOM Aviation and Missile Center Mission

Develop, integrate, demonstrate, and sustain aviation and missile systems capabilities to support modernization priorities and improve readiness.

Focus Areas

- Enterprise Solutions
- Digital Engineering

- Need for large enterprise AI tools AND focused specialized AI tools
- Customized AI assist tools
- AI augmented modeling, simulation, and deep analysis

- Tactical Solutions
- Customer Needs

- Ensuring the safety, airworthiness, and reliability of AI/ML systems in weapon platforms is paramount to maintaining operational effectiveness and protecting lives.
- Deliver cutting edge capabilities to the warfighter

AI USE CASES – BASELINE USE



Offline GPT AI Assistants

- Open-Source Large Language Models connected to and trained on YOUR data
- LogLab developed a prototype Large Language Model (LLM) utilizing cutting edge open-source models trained on additional data
 - LogLab used GPU accelerated training to fine-tune base models to LogLab needs (software documentation for this use case)
- Tech document prototype model built by training models with technical documentation
 - Ability to interact with technical documentation
 - Ability to write with context from data repository
 - Model trained offline, so data can be contained within secure networks
 - Potential uses for training, document review, document writing
- Ability to compare documents such as requirements and vendor deliverables
 - Assess whether the deliverable addresses all of the requirements
 - Format large documents for distribution to various parties with varying need to know

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User: Describe the SoSAT External Conditions model

Upload your documents
Choose File No file chosen
Upload

Download Model Ingest Data

2to: The SoSAT external conditions model allows for the altering of primary element aging rates and downtimes, personnel fatiguing rates, consumables usage and generation rates, and combat damage models due to defined environmental conditions.

Source: \\nas01\documents\SoSAT_v3.0 Master Design Document.pdf

External Conditions

Overview:

The SoSAT external conditions model provides the capability to alter primary element aging rates and downtimes, personnel fatiguing rates, consumables usage and generation rates, and combat damage models. External conditions can be used to model the effect of environmental conditions (e.g., sandstorms, extreme temperatures, etc.) and to alter the rates at which systems are used during a particular mission segment. SoSAT also has the capability to model multiple external conditions in a single mission segment. For example, a system may be assigned a new combat damage model at the same time that a heavy thunderstorm is affecting a system's electronics. The external conditions model is flexible and allows for additional detail to be represented in a system's mission scenario.

Assumptions:

- The occurrence of an external condition during a particular scenario segment is determined at the beginning of the simulation based on the probability of the external condition occurrence.
- If multiple external conditions are applied to a single element, the probability value of the altered property will be the base value multiplied by the product of all external condition multipliers assigned to this item.
- If an external condition is applied to a system and several elements on the external condition list are not defined for the system, then the system will only apply external condition values to those items that exist on the system.

Requirement Coverage:

ReqID	Requirement Description
RQMT_263	SoSAT shall provide the capability to apply multiple external conditions to a given mission scenario segment.
RQMT_264	SoSAT shall multiply the product of all applied external conditions with the base value, if the base value has multiple external conditions applied.
RQMT_265	SoSAT shall apply external condition multipliers to modify system component behavior.
RQMT_266	SoSAT shall apply user designated combat loss chance definitions to enable

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User: What is the SoSAT Footprint?

Upload your documents
Choose File No file chosen
Upload

Download Model Ingest Data

2to: Based on the context, the SoSAT Footprint appears to be a tool that calculates the logistic footprints of a SoSAT model. It allows users to import details from a SoSAT model and define user assumptions to create and assign systems that exist in SoSAT. The results can be viewed by system type, force structure, or final footprint roll up.

Source: \\nas01\documents\SoSAT_v3.0 Master Design Document.pdf

Log FootPrint

SoSAT v3.0 Note: Log FootPrint was part of SoSAT v2.0 but is not included in SoSAT v3.0. Its design documentation, provided in the following sections, is maintained here for reference purposes.

Overview:

SoSAT-Footprint is a new addition to the SoSAT Tool Set that can calculate the logistic footprints of a SoSAT model. SoSAT-Footprint will allow the user to import details from a SoSAT model, define user assumptions, and create and assign systems that exist in SoSAT. The results can be viewed by system type, force structure, or final footprint roll up.

Assumptions:

- The base SoSAT project file must be in version 2.0.0.12 format or newer.
- Weight calculations are represented in SoSAT-Footprint as short tons (STON). One STON is equivalent to 2,000 lb.
- Maximum capacity is used to calculate all inventory items to an assumed fully loaded inventory.
- Average total weight of a supply item for a system type is used as the total weight for the item in supply inventory for each system that is part of that system type.
- Meals Ready to Eat (MRE) that are required for each personnel (per day) are no longer calculated in the System Gross Weight as before in the footprint worksheet.

Requirements Coverage

ReqID	Requirement Description
RQMT_917	SoSAT-Footprint shall allow the user to create a new project from an existing SoSAT project.
RQMT_918	SoSAT-Footprint shall allow the user to save logistic footprint details into the existing SoSAT project.
RQMT_919	SoSAT-Footprint shall be able to import system definitions from a SoSAT project.
RQMT_920	SoSAT-Footprint shall maintain the original SoSAT data from the existing SoSAT-Simulation Project.
RQMT_921	SoSAT-Footprint shall be able to import structure definitions from a SoSAT

AI can provide a common-sense, natural language interface to your organization's data.

AI USE CASES – CAPABILITIES POWERING ANALYSIS



AI Database/Code Assistant Prototype

- Extending beyond simple text to text interactions with AI – querying databases and generating analysis
 - Still in your local environment
 - Access to data no longer requires specific technical knowledge
 - Simple analysis functions are easy for the AI to write
- LogLab developed a prototype Large Language Model (LLM) designed to interface with databases or other types of code platforms in Natural Language
- SQL Query Prototype built to showcase the possibility of interacting with databases and code tools in Natural Language
 - Ability to interact with SQL Database using English query
 - Ability to write code that works with a formatted backend (such as a SQL database)
 - Model developed using offline open-source model custom built for SQL writing tasks
 - Part of a modularized multi-model architecture

Model: gpt-4 Max Token: 4000 Temperature: 1 Top-p: 1 Presence Penalty: 0 Frequency Penalty: 0

User: Using oLogisticServiceSummary, what were the top 5 largest wait times for a service?

Assistant: "Tables considered: (oLogisticServiceSummary)"

```
sql
SELECT oLogisticServiceSummary.ServiceID,
       oLogisticServiceSummary.TotalWaitTime
FROM oLogisticServiceSummary
ORDER BY oLogisticServiceSummary.TotalWaitTime DESC NULLS LAST
LIMIT 5;
```

ServiceID	TotalWaitTime
21	71217
21	71268
21	71009.5
21	70939.5
21	70925.1

User: Which service has serviceid 21?

Assistant: "Tables considered: (services;SystemTypeElements;SystemTypeElements;SystemTypePersonnel;SystemTypeGroups;SystemTypeGenerations;SystemTypeFunctionCutSets;SystemTypes)"

```
sql
SELECT lServices.name
FROM lServices
WHERE lServices.id = 21;
```

Name
MOD 151ICE

User: Tokens: 259 (0.08807)

Type a message or click ⌘ for prompts

Generate Save

Download Chat Post on ShareGPT Clone Chat

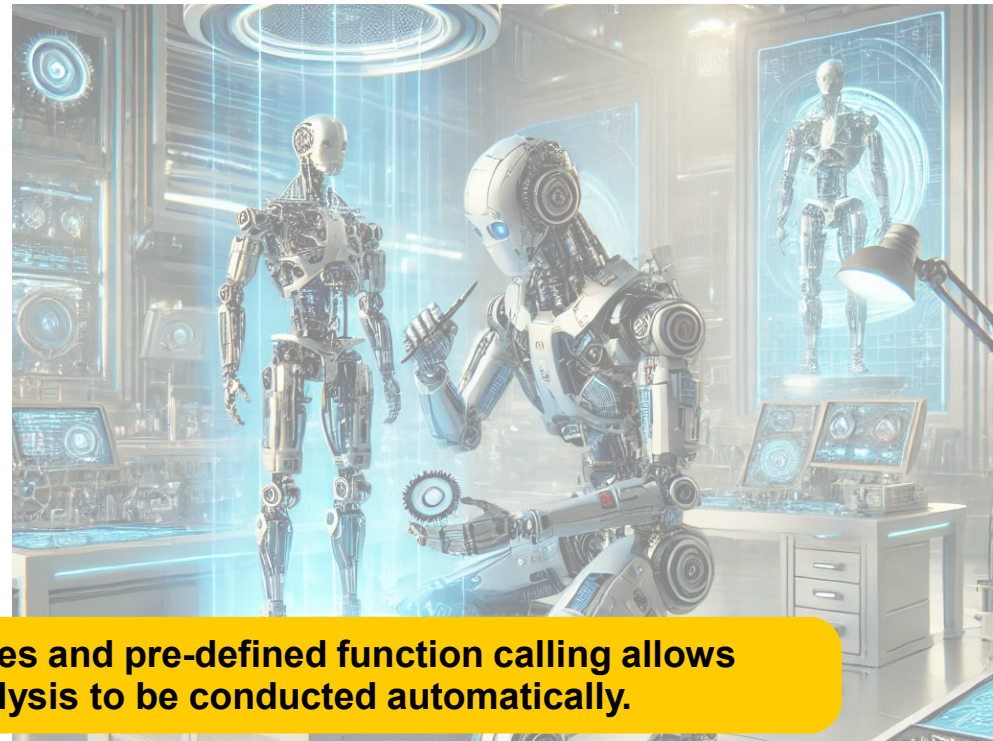
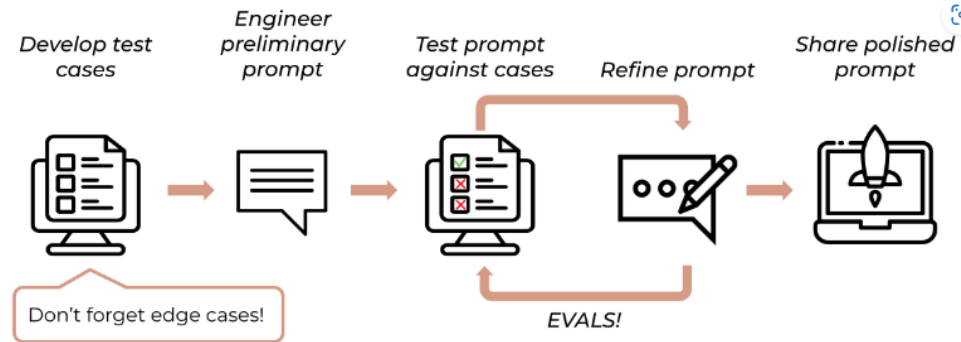
AI not only allows interactions with text data, but with data stores and code.

AI USE CASES – MODELING, SIMULATION, DEEP ANALYSIS



AI Designing Experiments and Running Code

- Currently, many of the large AI platforms offer the ability to define code functions that the AI has access to
 - AI can call pre-defined user code to run on data
 - Structured prompting strategies can maximize AI ability to use developed code bases for analysis
- LogLab developed a prototype Large Language Model (LLM) designed to interface with other LogLab tools for analysis
 - Baseline model repository defined and attached to AI data (similar to documents)
 - Code functions for modifying and running models defined to AI assistant
 - Structured prompts instruct AI to create a series of recommended model changes and simulation runs to implement a design of experiments
 - AI can then modify a base model and run analysis of the modified base model to collect data for the experiment



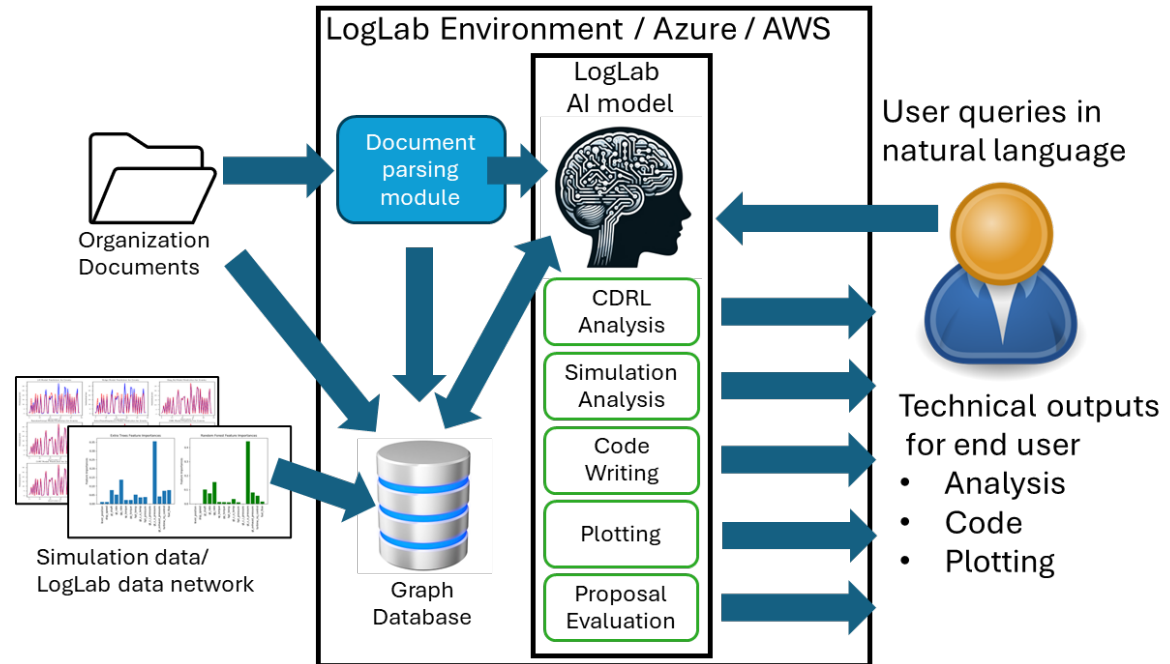
Expanding AI with prompting structures and pre-defined function calling allows advanced trade studies and analysis to be conducted automatically.

DIGITAL TRANSFORMATION



The Sum of these developing capabilities leads to radical digital transformation

- Imagine being able to access any of your organization's data with a simple query.
- Imagine asking AI to make variations of an established system model and analyze results.
- Imagine having requirements, vendor deliverables, and third-party analysis in the same place.
- Imagine being able to explore system requirements and their effects on key performance metrics as the system is developed.



Careful use of AI technologies can transform your Digital Engineering and Business workflows across the board.

CHALLENGES



Building Trust

How do we use AI in a way where we can be sure the outputs are valid?

- Craft Your Use Cases Carefully – Choose small measurable tasks to tackle with AI.
 - Document Sorting
 - Structuring text
 - Data query
- Keep the human in the loop – Let the people have the final say.
 - Develop accept/reject mechanisms for AI outputs
 - Use real-world feedback to fine tune models
 - Don't tackle a job, tackle steps in a workflow
- Keep your data security in mind – Ensure the tools you deploy are appropriate for the domain.
 - Classified or Proprietary data **MUST** not be sent to commercial AI services

Minimizing Cost

Large-scale AI is incredibly expensive to train and maintain.

- Start small – Open-source models can be very performant for specific tasks.
 - Models used for small, specific tasks can run on less hardware
- Use all the tools available – Some commercial tools are very inexpensive to use on tasks with publicly available data.
 - Cloud deployments offer various levels of security and pay-as-you-go options.
- Make hardware purchases with extensibility in mind.
 - Think about how future funds can be used to build on available hardware rather than replace it.



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