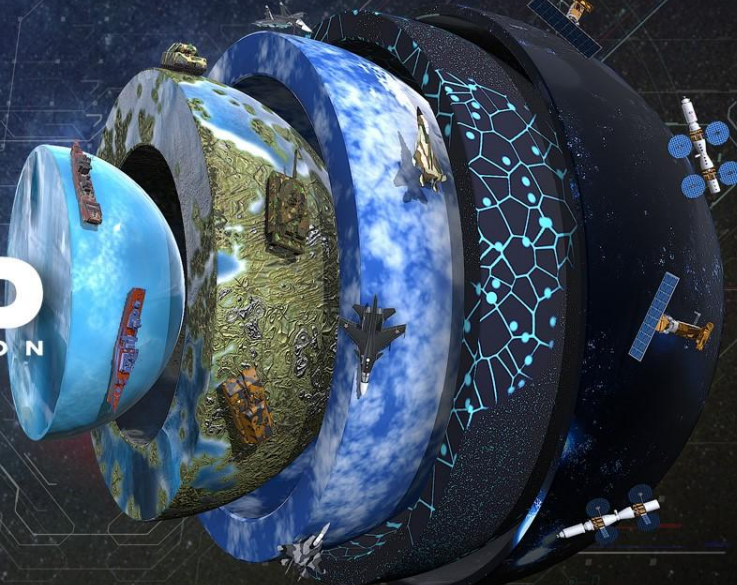




COMMAND

PROFESSIONAL EDITION



Wargaming Multi-Domain Operations with COTS Analytical Tools
Presented by **Iain McNeil** – CEO Slitherine / Matrix Pro Sims

INTRODUCTION

01

We work with major license holders like the History Channel, Sony Pictures (Starship Troopers), Universal Studios (Battlestar Galactica), Games Workshop under the Slitherine brand

02

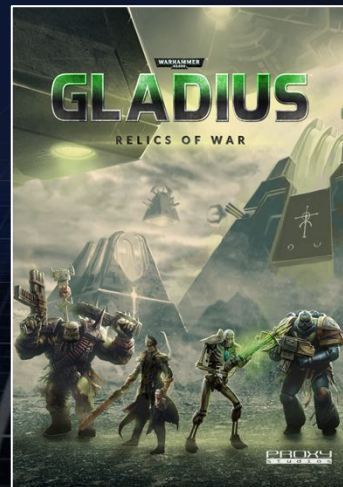
Matrix Games is the undisputed world-leading publisher of digital wargames.

03

Over 20 years experience developing strategy and wargames and 8 years in defence. Strong growth, reliable software, stable company.

04

Matrix manages a range of products that span every historical period and scale, from tactical to high-level operational and even strategic.



PROFESSIONAL PRODUCT LINE



Combat Mission

Tactical ground combat

Realistic physics and behaviour modelling

Full 3D

Realtime or turn-based execution

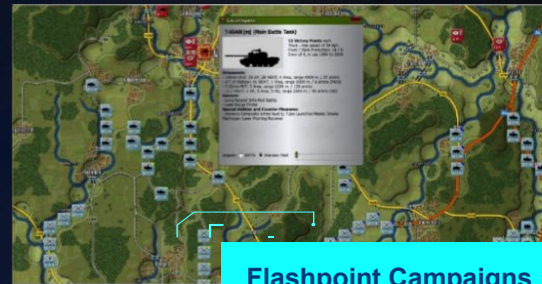
Extremely high-fidelity sub simulator

Built in Unity in 3D with full VR support

Multiple stations with real controls for group training

Integrates with Command PE

Modern Naval Warfare



Flashpoint Campaigns

Brigade-level ground combat

Effects-based top down model

OODA loop system

Realistic physics

COMMAND PROFESSIONAL EDITION (PE)

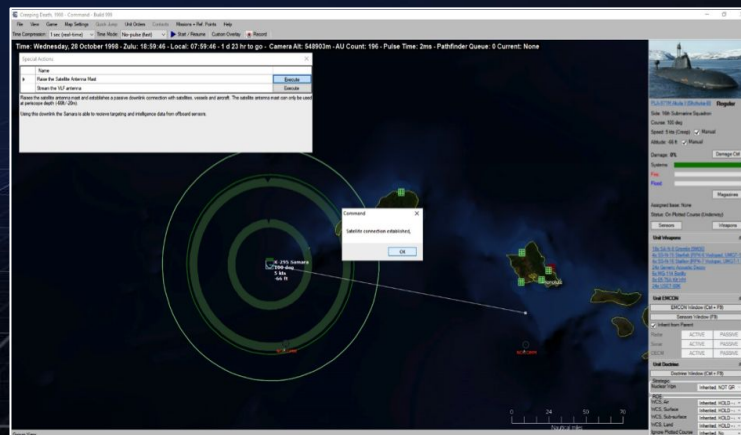
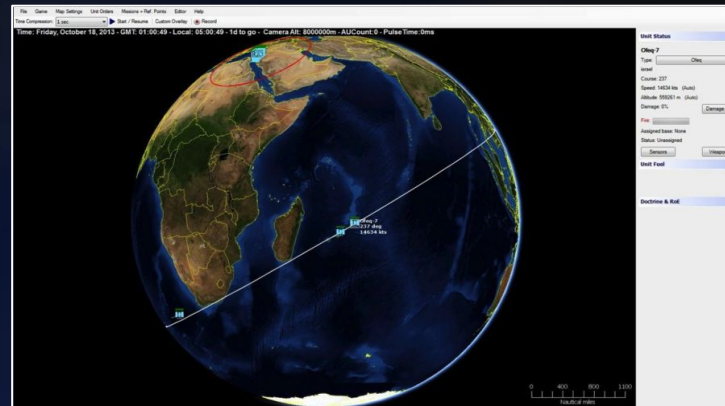
Multi-domain physics-based battlespace for air, sea, land, sub surface, space and cyber

Database of the world's frontline Air and Maritime equipment from 1946 to near future (editable!)

Physics based, EW, UXV's, AI, Naval Mining, Littoral Operations, Amphibious landings, BM/ABM, lasers, hypersonic's, EMP, CHAMP

Includes logistics & fuel

Connect via DIS and Lua scripting



PROFESSIONAL CLIENTS

20 nations, 100+ clients, 2000+ users



USAF Air Mobility Command uses Command for fuel planning, replacing spreadsheets planning tools where it was impossible to simulate the effects of enemy action on fuel planning



Luftwaffe

The German Air Force trains all new Air Force officers using Command to bring Air Power concepts to life and transforming their education from a slide-based approach, to an interactive one.



US Air Force Research Laboratory uses Command for its physics-basis in innovation and research, showing both expected and emergent behaviours.

Command is the reference simulation in AFRL's "AI for Command" Challenge

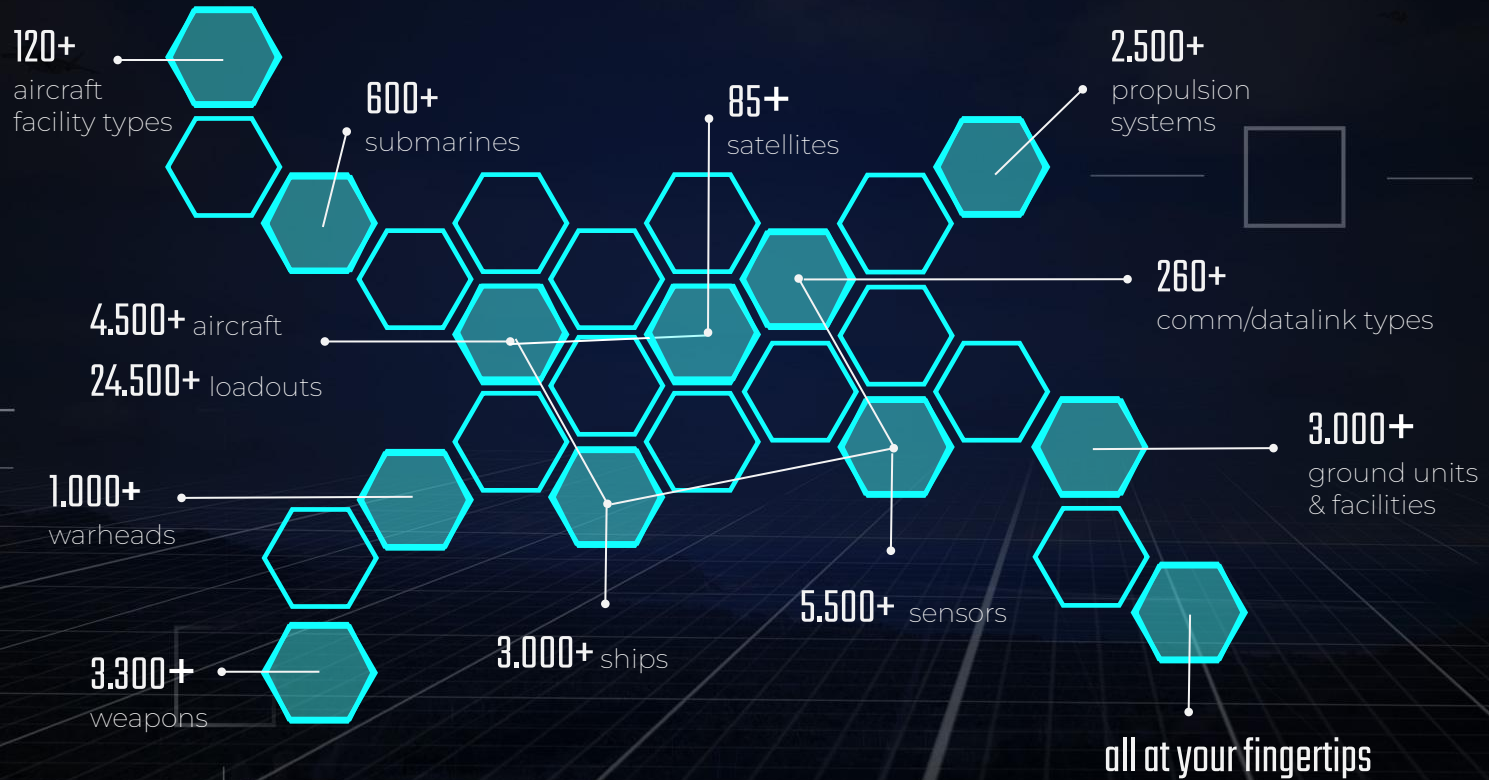


Marine Corps Warfighting Lab uses Command for future force analysis.

Marine Corps University's CSC and SAW schools use Command and other COTS for wargaming and student capstone events

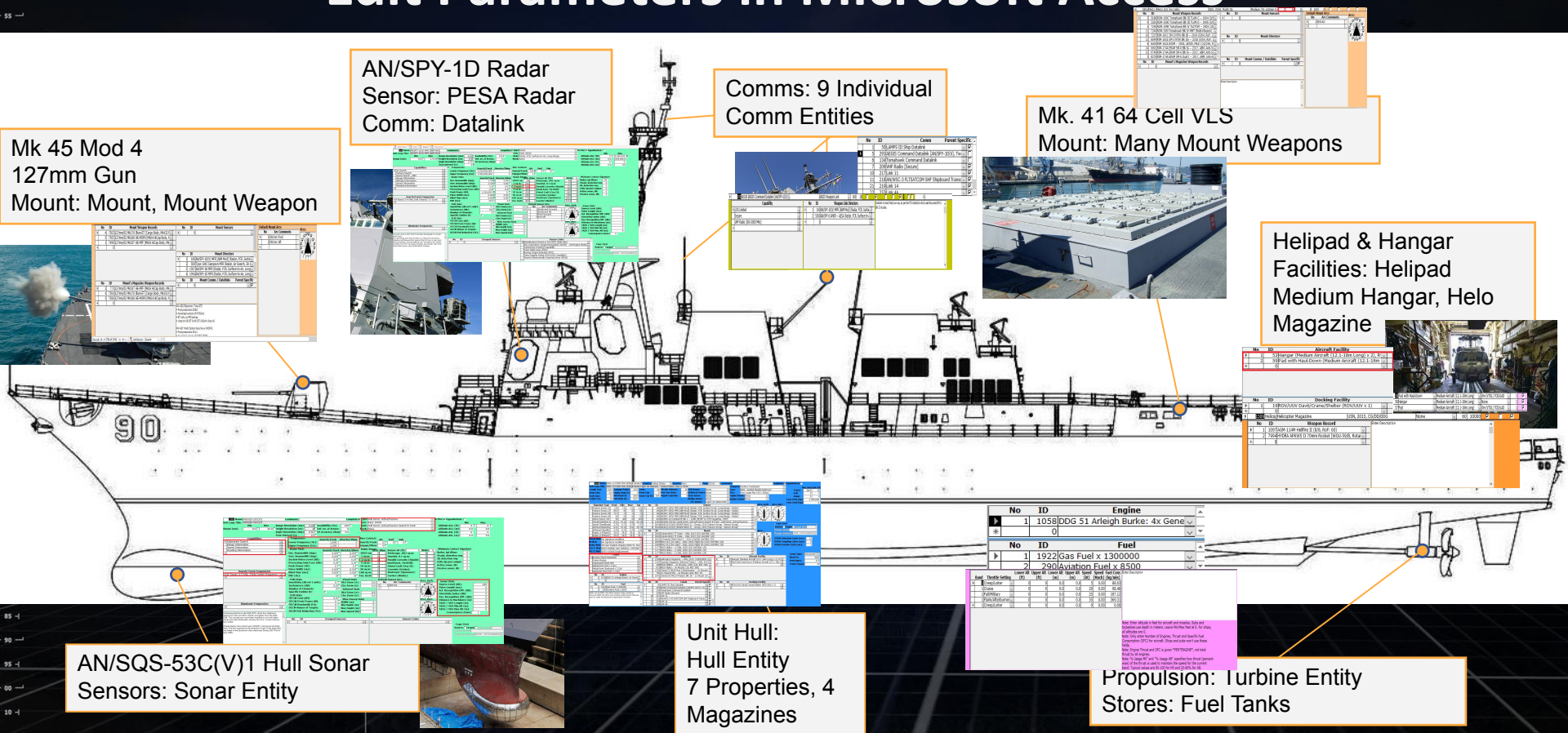


COMMAND DATABASE & EDITOR



ARLEIGH BURKE DDG - PARTIAL ENTITY BREAKDOWN

Edit Parameters in Microsoft Access



Mk 45 Mod 4
127mm Gun
Mount: Mount, Mount Weapon

AN/SPY-1D Radar
Sensor: PESA Radar
Comm: Datalink

Comms: 9 Individual
Comm Entities

Mk. 41 64 Cell VLS
Mount: Many Mount Weapons

Helipad & Hangar
Facilities: Helipad
Medium Hangar, Helo
Magazine

AN/SQS-53C(V)1 Hull Sonar
Sensors: Sonar Entity

Unit Hull:
Hull Entity
7 Properties, 4
Magazines

Propulsion: Turbine Entity
Stores: Fuel Tanks

No	ID	Entity	Parent Specific
1	1058	DDG 51 Arleigh Burke: 4x Gene	
1	1922	Gas Fuel x 1300000	
1	2900	Aviation Fuel x 8500	

No	ID	Entity	Parent Specific
1	1058	DDG 51 Arleigh Burke: 4x Gene	
1	1922	Gas Fuel x 1300000	
1	2900	Aviation Fuel x 8500	

No	ID	Entity	Parent Specific
1	1058	DDG 51 Arleigh Burke: 4x Gene	
1	1922	Gas Fuel x 1300000	
1	2900	Aviation Fuel x 8500	

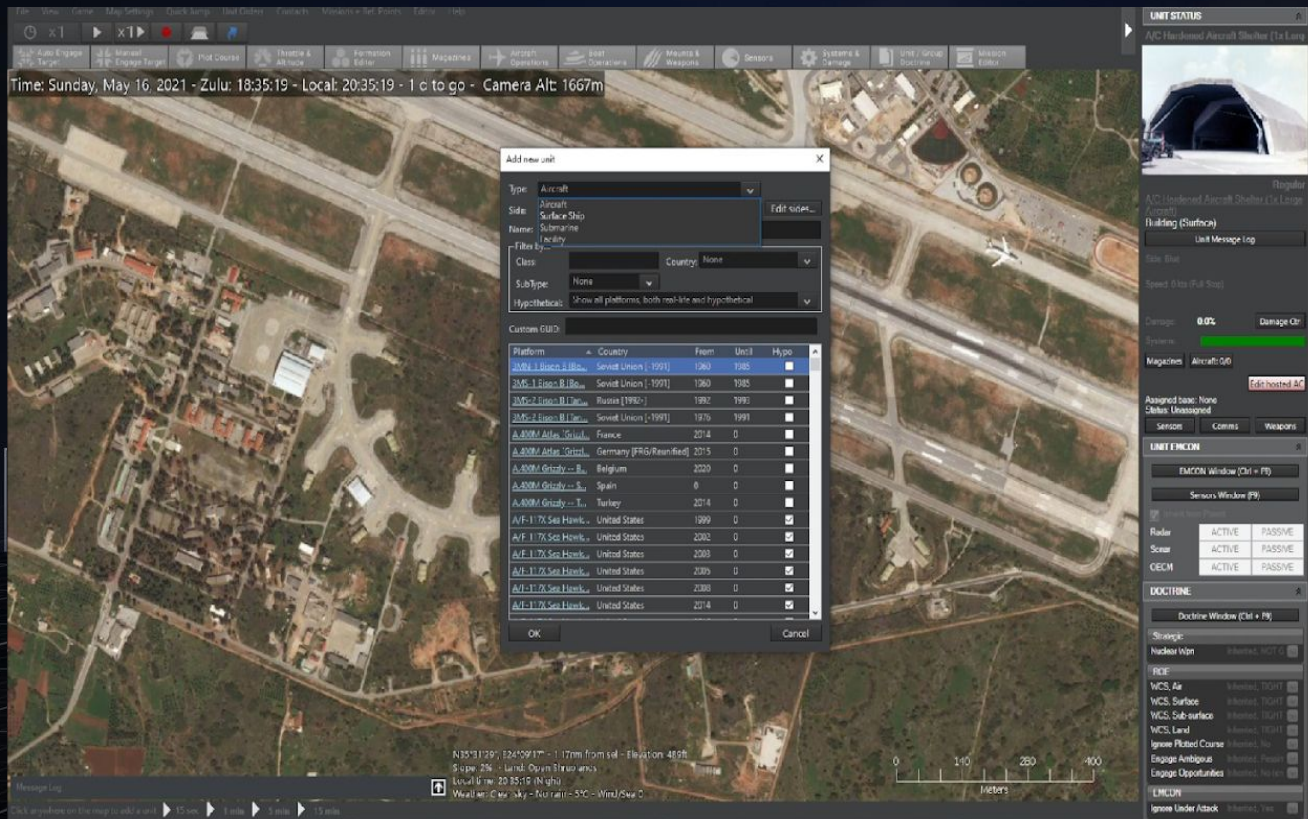
No	ID	Entity	Parent Specific
1	1058	DDG 51 Arleigh Burke: 4x Gene	
1	1922	Gas Fuel x 1300000	
1	2900	Aviation Fuel x 8500	

No	ID	Entity	Parent Specific
1	1058	DDG 51 Arleigh Burke: 4x Gene	
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1	2900	Aviation Fuel x 8500	

No	ID	Entity	Parent Specific
1	1058	DDG 51 Arleigh Burke: 4x Gene	
1	1922	Gas Fuel x 1300000	
1	2900	Aviation Fuel x 8500	

Unit Hull:
Hull Entity
7 Properties, 4
Magazines

COMMAND EDITOR



Full world geography – create a scenario anywhere in the world.

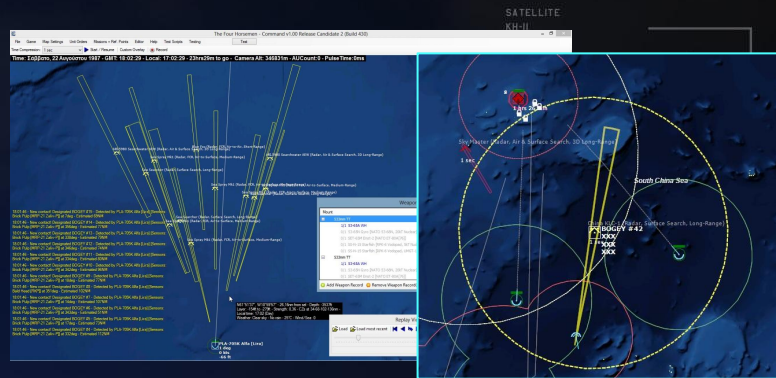
Every nation in the world represented.

Equipment from every nation included.

Build & test scenarios in minutes not days or weeks.

Souda Bay Crete

ANALYSIS: INTERACTIVE & MONTE-CARLO



Run any scenario 10 times or 100,000 times depending on need

High-performance simulation engine generates speedy results

Put your multicore supercomputer to good use with parallel execution

NEW IN v1.15: Command-line interface for superfast automated analysis

Use "butchers bill" to assess losses and weapon expenditures, or drill-down deeper to examine events and their causes

LUA SCRIPTING & PLUGIN API

Go beyond the graphical interface

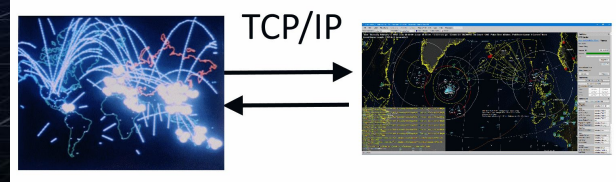
Built-in Lua console provides direct access to the internals of the running simulation

```

ScenEdit_AttackContact("AttackerName001", "ContactName001", 10010)
6
7 Mc_CornerLon = -60000000000001 --Longitude= -63.6352948083
8 SE_CornerLon = -49999999999999 --Longitude= -49.8888134131817
9
10 TargetSide = "Natura" --Change string value to match biological side name
11 TargetMission = "Whale Patrol" --Change string value to match desired mission
12
13 --counter initialised at zero
14 TargetNumber=math.random(1,13) --change parameters to increase min and max number of whales
15
16 repeat
17     count=1 --counter step up increment (1 here)
18     a=1 --resets counter to new value
19     SegName="Whale " .. count --Sequentially numbered name for created whale
20
21     ScenEdit_AddWhale({
22         type = "Submarine",
23         side = TargetSide,
24         name = SegName,
25         dbid = "0", --dbid for 'whale' in DB000
26         latitude = (math.random(SE_CornerLat,Mc_CornerLat) / 1e13), --produces a random number between the SE corner latitude and the Mc corner
27         longitude = (math.random(Mc_CornerLon,SE_CornerLon) / 1e13), --produces a random number between the SE corner longitude and the Mc cor
28     })
29
30     ScenEdit_AssignUnitToMission(SegName, TargetMission)
31
32 until count == TargetNumber --Finishes loop when 'count' reaches 'TargetNumber'
33
34 TargetSide = "Natura" --Change string value to match biological side name
35 TargetMission = "Whale Patrol" --Change string value to match desired mission
36
37 --counter initialised at zero
38 TargetNumber=math.random(1,18) --change parameters to increase min and max number of whales
39
40 repeat
41     count=1 --counter step up increment (1 here)
42     a=1 --resets counter to new value
43     SegName="Whale " .. count --Sequentially numbered name for created whale
  
```

TCP/IP socket access to Lua API – remote-control Command from any external console or application

Script commands can be either human- or machine-driven (HAL or WOPR/Joshua as adversary!)



Lua I/O (optional) – use any of Lua’s built-in input/output abilities to facilitate information import & export

AI & ML

200 Quadrillion Variants Examined

Run multiple instances in parallel to generate huge amounts of data.

Run in Command Line Interface for faster performance.

**NORTHROP
GRUMMAN**

[Who We Are](#) | [What We Do](#) | [Careers](#)

"Anyone could have found these parameterizations of the car," McKendrick said. "I developed a deeper knowledge of what to do. I had access to information that others might not have had."

DARPA awarded the Gamebreaker contract to Northrop Grumman in May, and now McKendrick, Cherry and other colleagues are using AI models to discover the edge found in a game. Their team works closely with two companies, Hazardous Software and Slitherine Software's Matrix Games, to model and break the natural balance within a highly complex war simulator environment called "Command: Modern Operations."

They've created their own game within the game of Command, introducing more than **200 quadrillion options** that aim to find causal models within the game which can be used to create advantages. "A lot of the platform is based in reality, and we took that and made it into a chess game," McKendrick said.

On top of the usual play of Command, the team added layers of more offensive capabilities with bombers, submarines, and surface-to-air and Tomahawk missiles. The additions introduce complexity to stretch the limits of "Command" so that the AI models can figure out the many unfair ways to play, keeping in mind the potential requirements of customers to incorporate data from a wide variety of sources.

AI Tools & Chat GPT

```

TimelineD,Time,UnitID,UnitName,UnitClass,UnitSide,CycleAction,ContactID,ContactName,C
7248ea25-c1f9-4d3b-8af8-14bd68e2fe12,03/21/2023 03:01:07.000,CL126G-0HMPP9R8I9RNM,
0HMPP9R8I9RNM,FKR Petri Veliky [Pr:1144.2 Orlan, Ex-Yuri Androvo],FKR Petri Veliky [Pr:
7248ea25-c1f9-4d3b-8af8-14bd68e2fe12,03/21/2023 03:01:27.000,CL126G-0HMPP9R8I9RNM,
Androvo] #11, -46.554079095799,37.4617519815706,22.12854,22,12905,CL126G-0HMPP9R8I9RNM,
[Pr:1144.2 Orlan, Ex-Yuri Androvo] - Determined as Hostile [Classification by: Eagle #1 (Mer
7248ea25-c1f9-4d3b-8af8-14bd68e2fe12,03/21/2023 03:01:47.000,CL126G-0HMPP9R8I9RNM,
0HMPP9R8I9RNOU,RedAir #1,Ka- 27M Helix A,OPFOR,Designated: BOGEY #2,
7248ea25-c1f9-4d3b-8af8-14bd68e2fe12,03/21/2023 03:01:48.100,CL126G-0HMPP9R8I9RNM,
#2, -46.3677800378223,36.79794660049153,62.94599,62.94614,1,CL126G-0HMPP9R8I9RNOU,Re
7248ea25-c1f9-4d3b-8af8-14bd68e2fe12,03/21/2023 03:02:07.000,CL126G-0HMPP9R8I9RNM,
#2, -46.449417170271,37.0990605631162,44.44783,44.44801,CL126G-0HMPP9R8I9RNOU,Red
Reaper] at Estimated 44 nm)
7248ea25-c1f9-4d3b-8af8-14bd68e2fe12,03/21/2023 03:06:38.500,CL126G-0HMPP9R8I9RNM,
#3, -46.602053211817,37.7123521096205,5.004181,5.004191,cl126g-0hmp9r8i9r9u,SS-N-11
7248ea25-c1f9-4d3b-8af8-14bd68e2fe12,03/21/2023 03:06:39.500,CL126G-0HMPP9R8I9RNM,
#3, -46.602053211817,37.7123521096205,4.996463,4.996472,cl126g-0hmp9r8i9r9u,SS-N-11
[Sensor: IRAS [CCD]] at 4.7 nm)
7248ea25-c1f9-4d3b-8af8-14bd68e2fe12,03/21/2023 03:06:41.500,CL126G-0HMPP9R8I9RNM,
#4, -46.6020249623512,37.7124240908498,4.977011,4.97702,cl126g-0hmp9r8i9r9u,SS-N-11
7248ea25-c1f9-4d3b-8af8-14bd68e2fe12,03/21/2023 03:06:41.500,CL126G-0HMPP9R8I9RNM,
#5, -46.598656211847,37.6981570840194,5.847821,5.847829,cl126g-0hmp9r8i9r9u,SS-N-
7248ea25-c1f9-4d3b-8af8-14bd68e2fe12,03/21/2023 03:06:42.500,Player,Assigning new w
0HMPP9R8I9RTM4,Weapons assigned: 1x Aster 30 PAAMS [GWS.45 Sea Viper] [DBID: 133], SI
7248ea25-c1f9-4d3b-8af8-14bd68e2fe12,03/21/2023 03:06:42.500,CL126G-0HMPP9R8I9RNM,
#4, -46.6020249623512,37.7124240908498,4.969292,4.969301,cl126g-0hmp9r8i9r9u,SS-N-1
[Sensor: IRAS [CCD]] at 4.7 nm)
7248ea25-c1f9-4d3b-8af8-14bd68e2fe12,03/21/2023 03:06:42.500,CL126G-0HMPP9R8I9RNM,
#5, -46.598656211847,37.6981570840194,5.840101,5.840109,cl126g-0hmp9r8i9r9u,SS-N-
[Sensor: IRAS [CCD]] at 5.6 nm)
7248ea25-c1f9-4d3b-8af8-14bd68e2fe12,03/21/2023 03:06:54.500,Player,Dropping contac
Granit],OPFOR,
7248ea25-c1f9-4d3b-8af8-14bd68e2fe12,03/21/2023 03:08:14.500,cl126g-0hmp9r8i9rtmvu,
0HMPP9R8I9U0EG, -46.4962649763466,37.1201066788884,7.284016,7.409724,CL126G-0HMF
7248ea25-c1f9-4d3b-8af8-14bd68e2fe12,03/21/2023 03:08:47.500,Player,Dropping contac
7248ea25-c1f9-4d3b-8af8-14bd68e2fe12,03/21/2023 03:12:06.500,Player,Dropping contac
Granit],OPFOR,
7248ea25-c1f9-4d3b-8af8-14bd68e2fe12,03/21/2023 03:12:18.500,Player,Dropping contac
Granit],OPFOR,

```

Describe the events in this log. Do not explain the format of the log, rather use the log to dis



In this data, several events are recorded during a simulated naval engagement. The data includes events such as the detection of new contacts, the classification of detected contacts, and the assignment of weapons to target contacts. The data is formatted in a CSV-like structure and contains a header row with column names, followed by rows of data.

In this scenario, "Eagle #1," a Merlin HM.2 aircraft, detects and classifies several contacts. "D 32 Daring [Type 45 Batch 1]" detects incoming guided weapons and assigns an Aster 30 PAAMS [GWS.45 Sea Viper] to target one of the contacts.

Notable events in the data include:

1. Detection of new contacts by Eagle #1 and D 32 Daring [Type 45 Batch 1].
2. The classification of detected contacts by Eagle #1 and D 32 Daring [Type 45 Batch 1].
3. The assignment of a weapon salvo by D 32 Daring [Type 45 Batch 1] to target a Ka-27M Helix A.
4. The eventual dropping of contact with the targeted Ka-27M Helix A and several guided weapons.

This simulated engagement involves units from both the Player and OPFOR sides, with the Player side primarily attempting to detect, classify, and engage hostile targets.



Provide more detail, give a timeline of events. Who detected who first?



Here is a detailed timeline of the events, highlighting who detected whom first:

1. 03/21/2023 03:01:07.000: Eagle #1 (Merlin HM.2) on the Player side detects an unknown surface contact and designates it as SKUNK #1.
2. 03/21/2023 03:01:27.000: Eagle #1 classifies the contact as RKR Petri Veliky [Pr:1144.2 Orlan, Ex-Yuri Androvo], an OPFOR unit.
3. 03/21/2023 03:01:47.000: Eagle #1 detects an unknown air contact and designates it as BOGEY #2.
4. 03/21/2023 03:01:48.100: D 32 Daring [Type 45 Batch 1] on the Player side begins targeting BOGEY #2.
5. 03/21/2023 03:02:07.000: Eagle #1 classifies BOGEY #2 as Ka-27M Helix A, an OPFOR unit.
6. 03/21/2023 03:06:38.500: D 32 Daring [Type 45 Batch 1] detects an unknown air contact and designates it as VAMPIRE #3.
7. 03/21/2023 03:06:39.500: D 32 Daring [Type 45 Batch 1] classifies VAMPIRE #3 as a Guided Weapon (SS-N-19 Shipwreck [P-700 Granit]).
8. 03/21/2023 03:06:41.500: D 32 Daring [Type 45 Batch 1] detects two more unknown air contacts, designating them as VAMPIRE #4 and VAMPIRE #5.
9. 03/21/2023 03:06:42.500: D 32 Daring [Type 45 Batch 1] classifies VAMPIRE #4 and VAMPIRE #5 as Guided Weapons (SS-N-19 Shipwreck [P-700 Granit]).
10. 03/21/2023 03:06:42.500: D 32 Daring [Type 45 Batch 1] assigns an Aster 30 PAAMS [GWS.45 Sea Viper] missile to target Ka-27M Helix A #2 (RedAir #1).
11. 03/21/2023 03:06:54.500: The Player side drops contact with GuidedWeapon #3 (VAMPIRE #3).
12. 03/21/2023 03:08:14.500: Aster 30 PAAMS [GWS.45 Sea Viper] #6 begins targeting RedAir #1 (Ka-27M Helix A).
13. 03/21/2023 03:08:47.500: The Player side drops contact with Ka-27M Helix A #2 (RedAir #1).
14. 03/21/2023 03:12:06.500: The Player side drops contact with GuidedWeapon #5 (VAMPIRE #5).

In this timeline, the Player side (Eagle #1) first detected the OPFOR unit (SKUNK #1, later classified as RKR Petri Veliky [Pr:1144.2 Orlan, Ex-Yuri Androvo]). Following this, Eagle #1 detected an unknown air contact (BOGEY #2), which was later



We experimented with feeding the log files from Command to Chat GPT4. We asked Chat GPT4 to explain the events in the log and then prepare a timeline and the results were incredible useful and impressively accurate. The image on the left is a snippet of the log and in the middle is the overview and on the right is a timeline.

Live Operational Integration



One partner is constructing a future live exercise in Command Professional Edition to help the planning process.

During the live event, Command will be run in parallel to the live operation.

Comparisons between performance in simulation and real world will be reviewed to improve future performance.

The exercise will be later this year and we will be allowed to discuss it after it has occurred.

COMMAND HUB



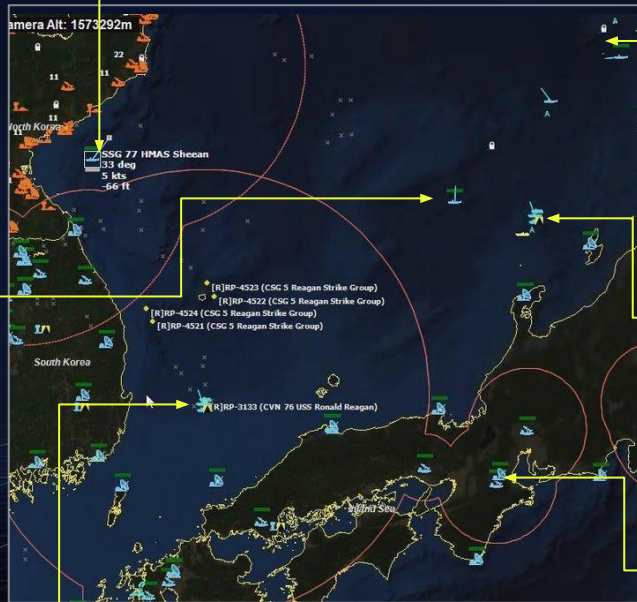
Ship simulator



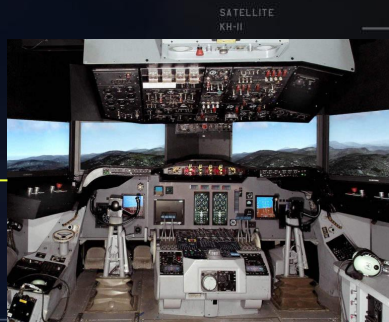
Submarine Simulator



UXV simulator



Use Command to link high fidelity but low breadth simulations together in a LVC way to create a multi domain battlespace using DIS and TCP/IP LUA socket.



P3 AEW simulator



KC135 Tanker simulator



Exata Comms Modelling

CURRENT TRAINING FOCUS

Infantry

Pilots & Weapons Officers

Drivers / Gunners



HOW DO SENIOR LEADERS TRAIN?



- Plan COA on paper or in planning tools but don't see the results
- Wargaming is almost exclusively manual
Very few opportunities, 0-2 times a year
- The more senior the less opportunity
- Very expensive to arrange, lots of people and time
- Not scalable
- Very public
- Risk of failure, peer pressure, dissuade experimentation

CULTURE CHANGE REQUIRED



The technology exists, but to use it requires a culture change.

Fight Club is a grassroots organization who aims to do this. It wants professional military personally to wargame throughout their career.

Encourage competition to promote engagement and learning.

DSTL also using it as a resource to collect innovative plans and COA's to research further or to seed ML/RL activities.

Branches in UK, US, Czech, Netherlands and Italy. Currently no French branch of Fight Club.

Organisations Training with Command Now

NATO COE Confined & Shallow Waters

Chilean Naval Academy

US Marine Corps University

Naval Postgraduate School

UK Navy Command (Information Warfare)

Air University Maxwell AFB

Royal Danish Defence College

Westpoint

Bell Flight

Helmut Schmidt University

Iowa State ROTC

Naval Personnel Training Group

Royal Danish Defence Forces

Maritime Warfare Centre



John Hopkins Applied Physics Laboratory

Georgia Tech Research Institute

University of Dayton Research Institute

MIT Lincoln Labs

MITRE

Taiwan Institute for National Defence

USAF Air Education and Training Command



SATELLITE
KH-II

For Live Demos or more information please visit us

STAND E11

Next to the Surface Fleet networking zone

www.matrixprosim.com

Presented by **Iain McNeil** –Slitherine / Matrix Pro Sims

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