# Integrated Analysis in a Synthetic Battle Space

Lessons from JPOW 2019

# Collaborative R&D Effort



**TNO Defence, Safety & Security**

**Royal Netherlands Armed Forces**

**German Air Force**

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# First Proof of Concept



## Integrated Analysis

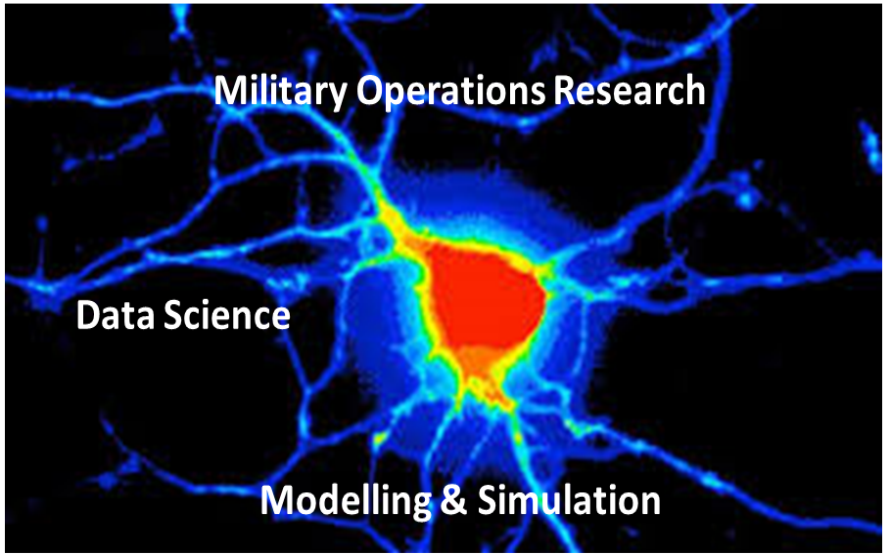
Objectives based analysis

Data driven analysis

Operations analysis

Technical analysis

Deep analysis



# Battle Space

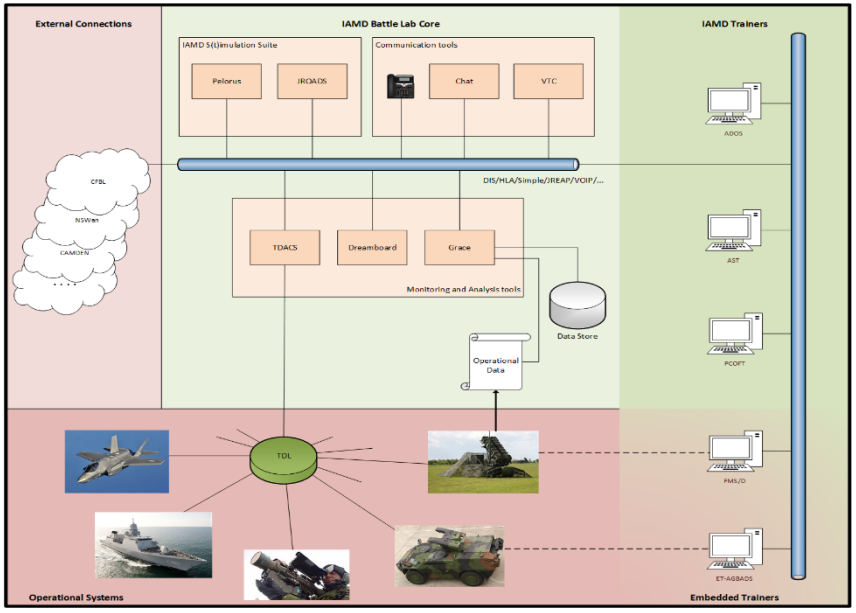
# Interoperability

# Synthetic Battle Spaces in IAMD



- Ad-hoc Synthetic Battle Space
  - JPOW Exercise Series
  - COW Exercise Series
  - MTDS

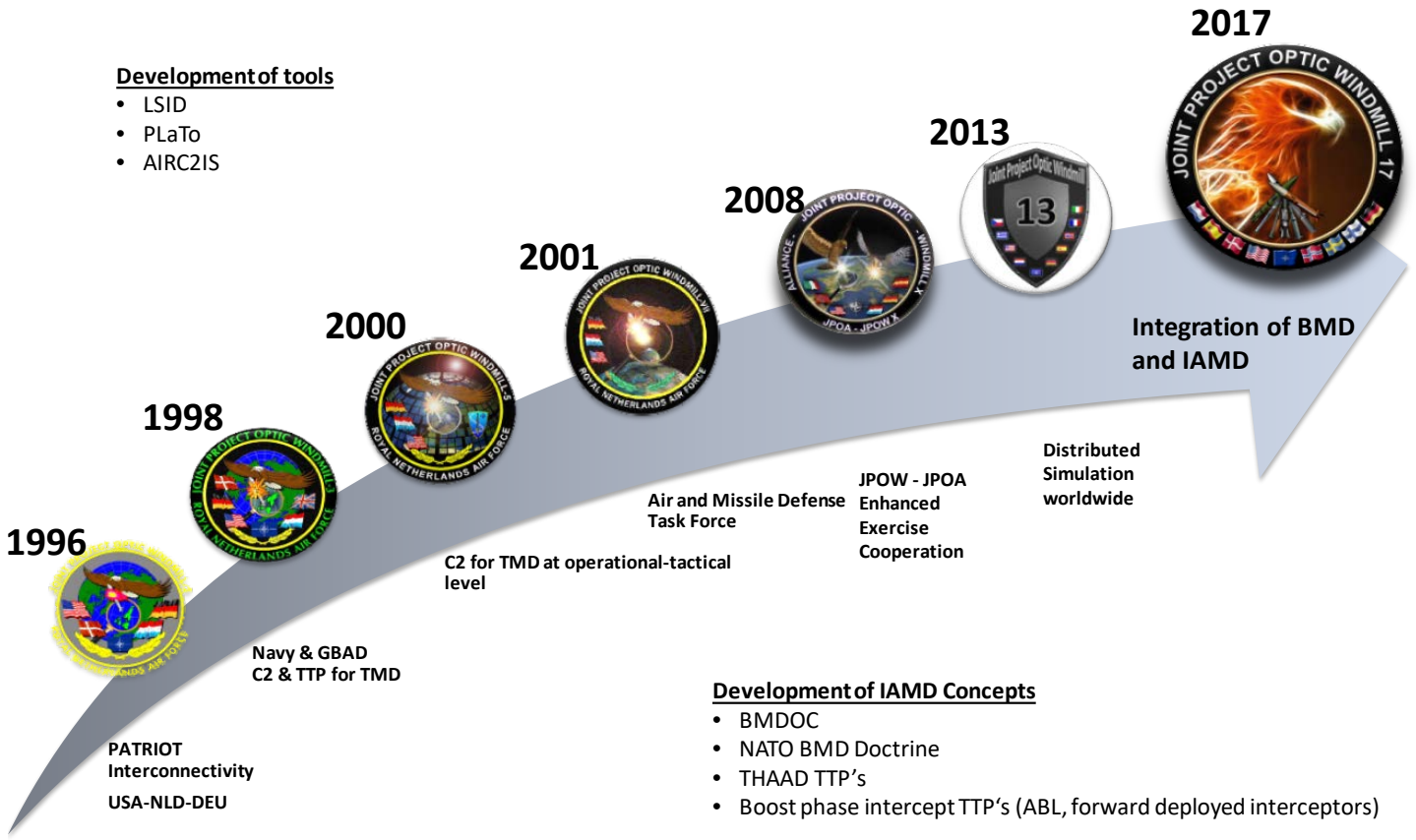
- Persistent Synthetic Battle Space
  - IAMD Battle Lab
  - Maritime Battle Lab
  - NATO ITB
  - Enhanced Battle Lab CCBAMD



# 1996

# Joint Project Optic Windmill





# Key JPOW Concepts

- Outlook to the future
- CD&E + Execution Phase
- Co-located & Distributed Set-Up
- LVC Players
- Operational & Tactical level
- Joint Analysis Effort

# JPOW19

Luftwaffe

# Participants JPOW19

**The Netherlands**
Air Force (AOCS NM, NDMC)
Navy (ADCF)
Army (AGBADS, PATRIOT) **(Live)**
TNO (Support)

**Norway**
NASAMS **(Live)**

**Denmark**
Navy / CD & E **(Live)**

**Finland**
CD & E **(Live)**

**Sweden**
CD & E **(Live)**

**C2 JAPCC**
Exercise Director

**C2 CC SBAMD**
**JPOW organisation**
EXCON / HICON Manning

**United States of America**
US STRATCOM
US 10th AAMDC (PATRIOT, THAAD)
USAFE
USEUCOM
MDA
IBCS (Northrop Grumman Mission Systems)

**NATO**
**SHAPE**
**JFC Brunsum**
**ACC Ramstein**
**COAC Uedem**
**DACC Poggio Renatico**
**MARCOM Northwood**
**SFN**
NATO C&I Agency

**Germany**
Air Force ( PATRIOT, SAMOC) **(Live)**
Navy (F124 Sachsen class frigates) **(Live)**
ASACS (CRC Element)
IABG (Saapes, Simburg)
LinkSystems (PACTOS)
MBDA
German National Data Link Cell

**Spain**
PATRIOT
NASAMS

**France**
SAMP/T **(Live)**
JFACC Manning

**Greece**
PATRIOT
JFACC Manning

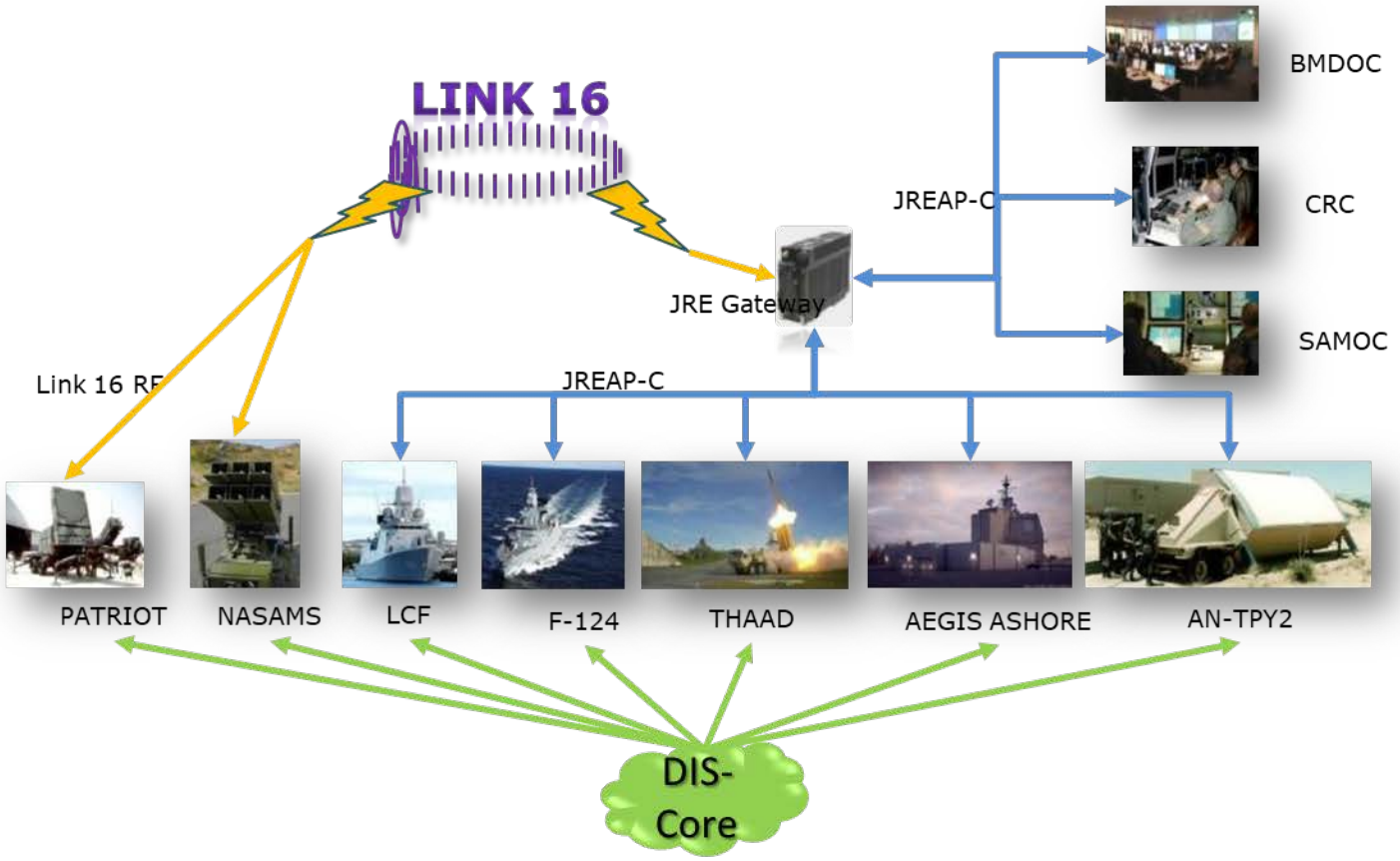
**Poland**
JFACC Manning
AMD C2 CPs (Live)

# JPOW19 Organisation

Luftwaffe

# Typical JPOW Network





# Main Lessons Identified

Luftwaffe

# The Need for Deep Analysis…

Luftwaffe

# Integrated Analysis?



## Definitions

- Trading and investment
  - consider as many perspectives as possible
  - rapid assessment of large volumes of data
  - identifying additional sources of risk and opportunity
  - contributing to better overall investment decision-making
- Psychology Methods
  - ‘the simultaneous analysis of multiple data sets’.
- US National Oceanic and Atmospheric Administration - Fishery:
  - Stock assessment methodology
  - to integrate multiple sources of data into a single estimation framework
  - fit a variety of observation types and model predictions

# Integrated Analysis Approach



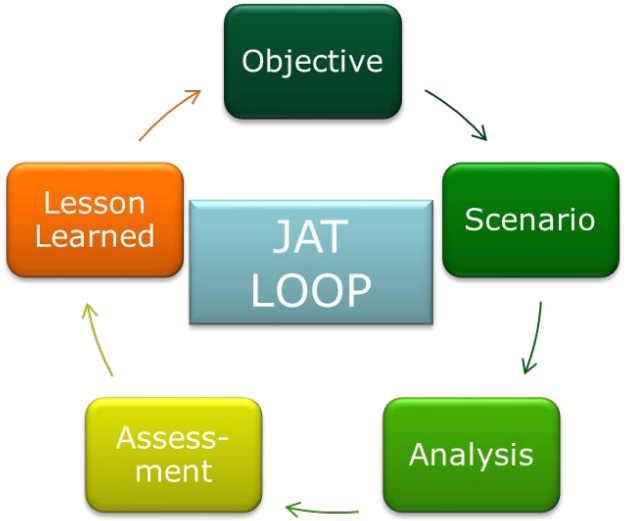
**Main requirements**

- handle large amounts of different types of data
- monitor and analyse (near) real-time
- post-event (off-line) analysis
- compare observations against (M&S) predictions
- assess solutions against multiple criteria
- synthesise and/or perform meta-analysis
- support decision making
- support (organisational) learning

# Objectives Based Analysis



- Participant Objectives
  - Input for the scenario development
  - Focus for analysis by Joint Analysis Team
- Data collection and analysis plan
  - Metrics
    - MOE/MOP
  - Observation forms
    - NATO Lessons Learned format



# Data Driven Analysis



- Comprehensive
- Synthesis
- Meta-analysis
- Focus on joint level

- Variety of
  - Control groups and expertise involved
  - Qualitative data: observation forms, defence designs, …
  - Quantitative data: data loggings, ....

# Integrating Analysis



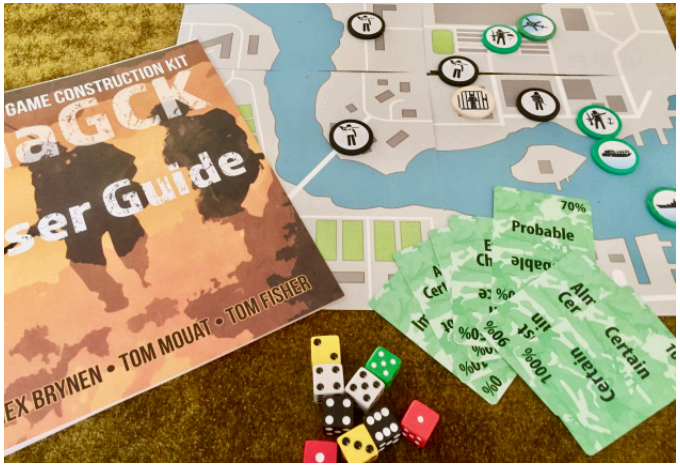
- Objectives Based & Data Driven analysis
- Technical & Operations analysis
- Qualitative & Quantitative analysis
- Air Defence & Missile Defence analysis
- Daily process & Excercise loop

- Requires organisational & technological innovation

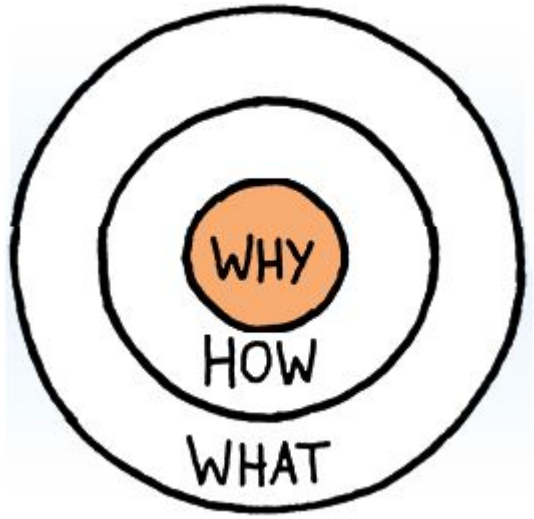
# Organisational Innovation



- Adjudication Cell
  - Wargaming
  - Focussing on engagement results (What)




- Integrated Analysis Cell
  - Supporting root-cause analysis (Why)
  - Improving training value
  - Enhancing the EXCON organisation



# Expanding the Toolset



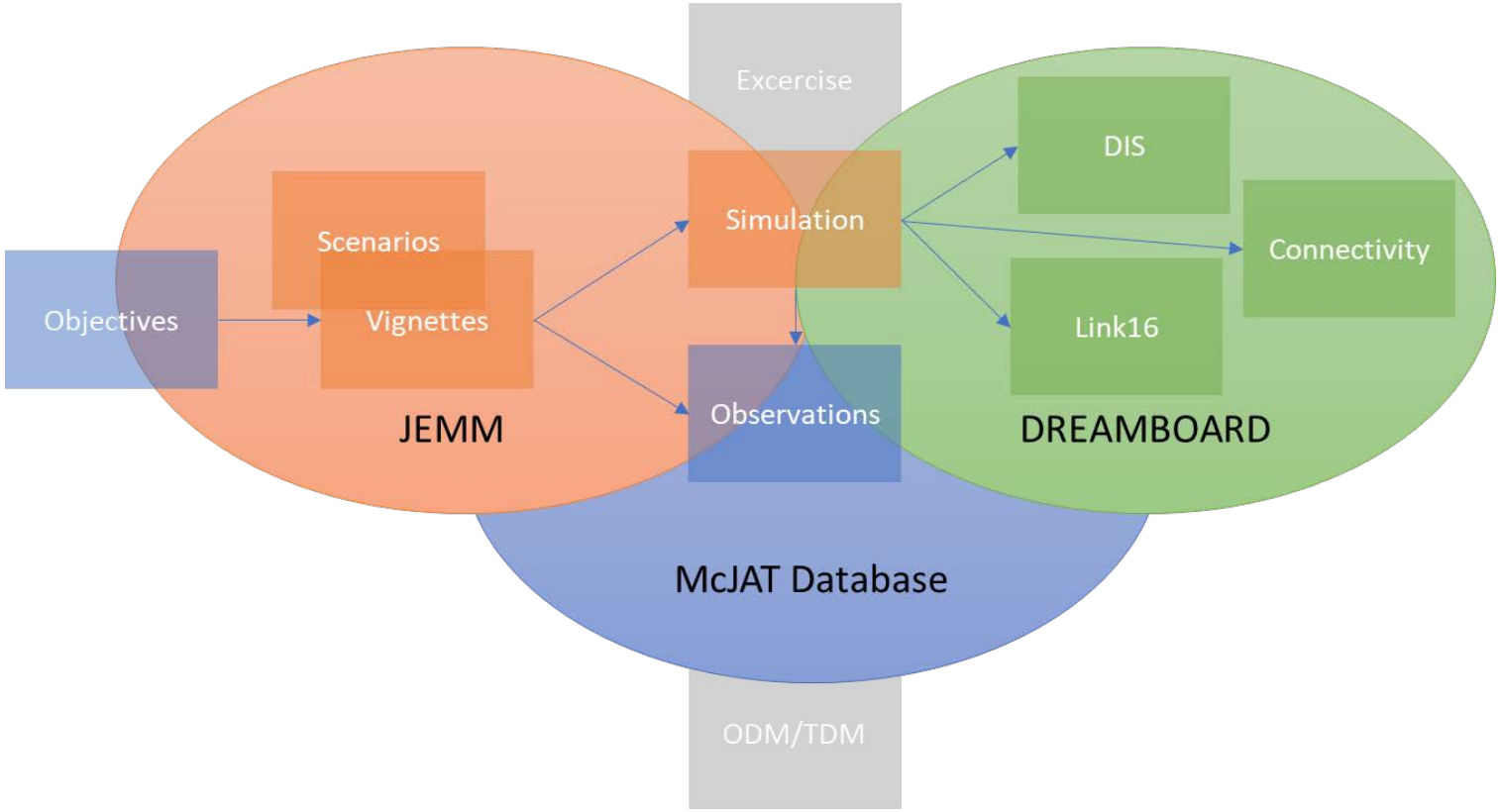
## Building on existing and specialised efforts

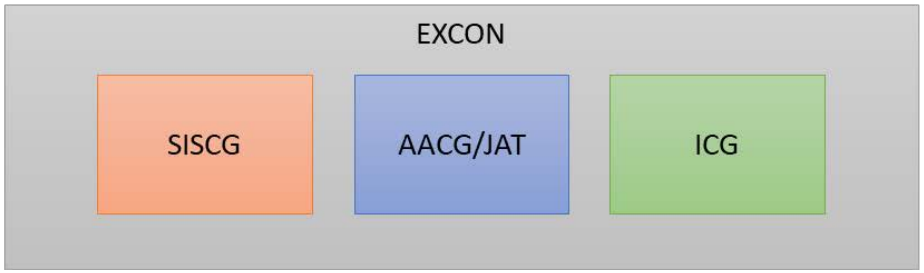
- Extensive toolset
  - Typical for ad-hoc synthetic battle spaces
  - Mixture of scientific, industrial, and NATO tools
  - Different purposes
    - monitoring and analysis
    - operations and technical analysis

- EXCON support tools
  - Baseline
  - PELORUS, JROADS, GRACE, GAMEBOARD, JODA, TDACS, and ADIVS

# Integrated Analysis Concept



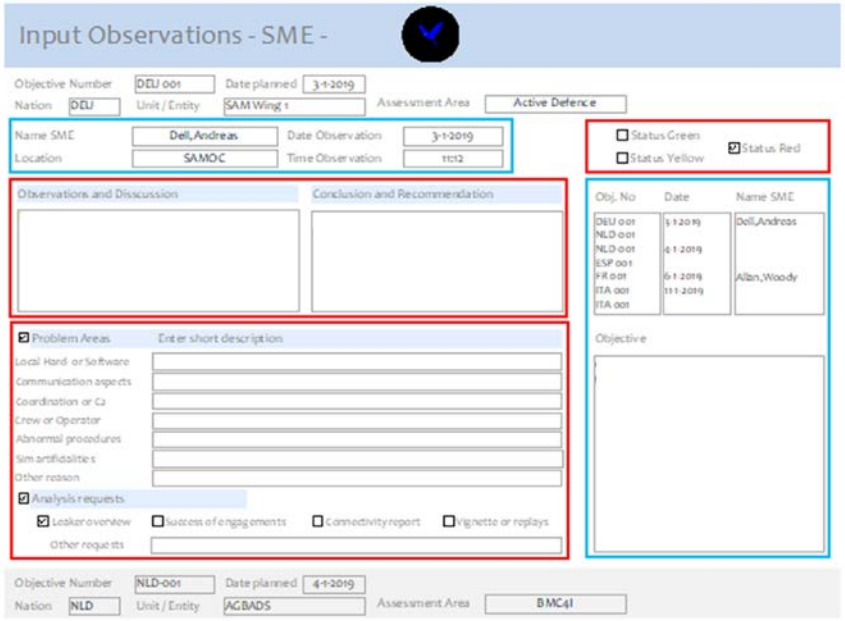


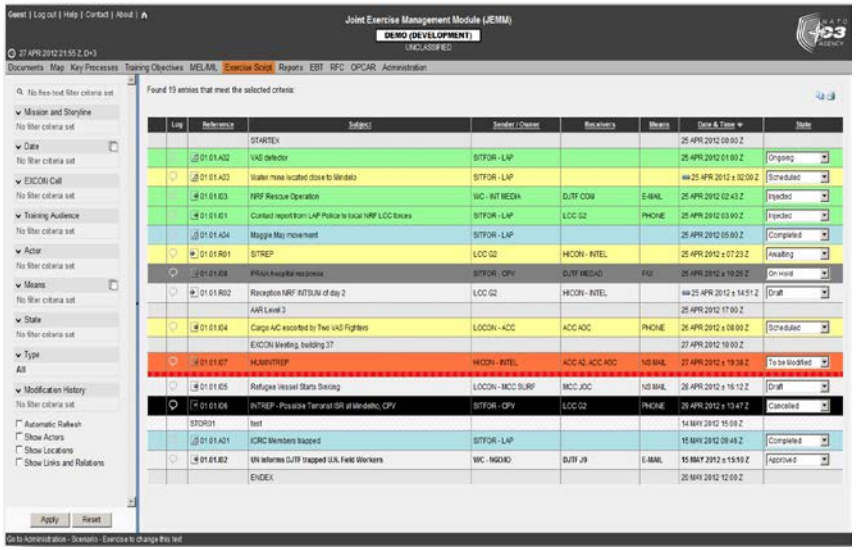



# Newly introduced tools



- McJAT
  - Observation forms
  - NATO LL format: ODCR
  - MS Access database, accessible on SharePoint
- JEMM
  - NATO Scenario Management Tool
  - Improving EXCON situational awareness on scripted scenario events and injects
- DREAMBOARD
  - Database
  - Analysis Application
  - Dashboard

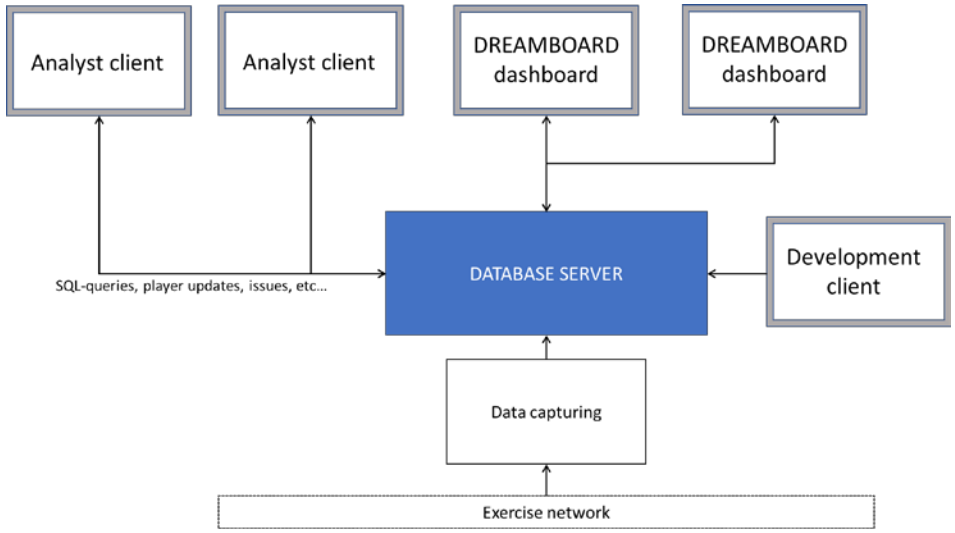


# DREAMBOARD

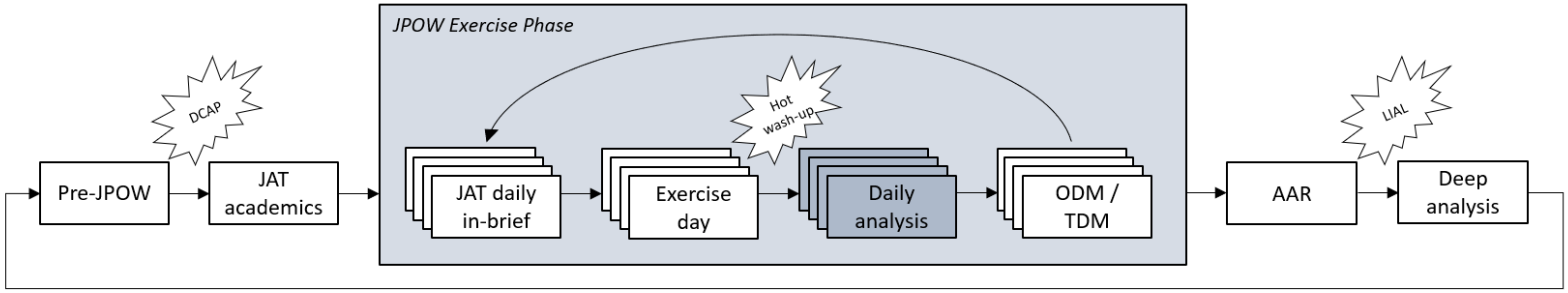


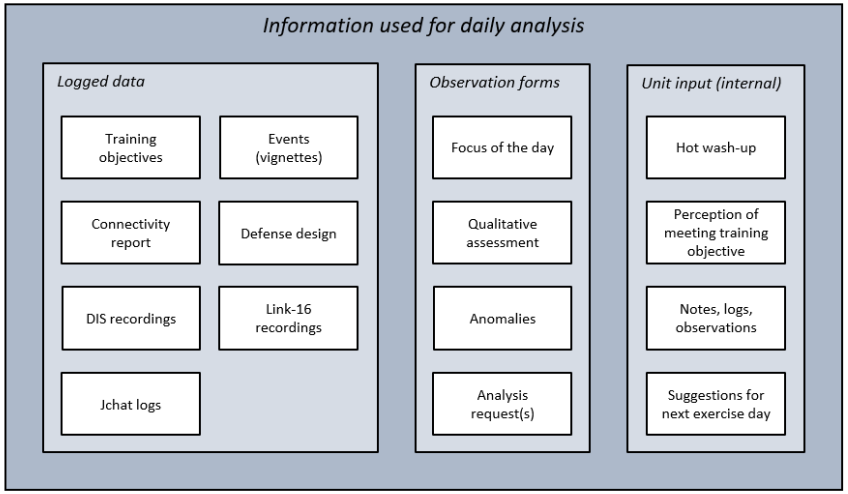
- Iterative and multi-disciplinary development
  - Ongoing developments, based on user feedback, were also directly implemented during JPOW19
- Data capturing
  - Timeseries and spatial
- Querying
  - Improves traceability
  - Near real-time analysis
- Dashboarding
  - Improving EXCON shared situational awareness



# Integrated Analysis Process





# Lessons Identified



- Proof of concept

*'via integrated analysis it is possible to translate zeros and ones*

*into common operator language'*

*'via such an integrated approach the investigation, analysis, and common understanding of why certain events in the scenario played out in the way they did, can be done in a comprehensive manner'*

# Lessons Identified

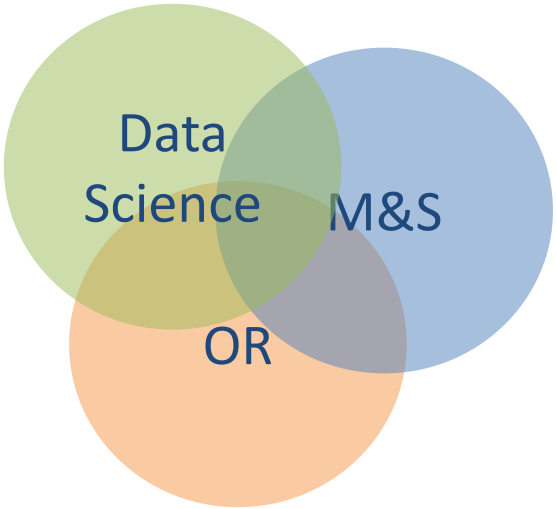


- Quick realisation at relative low cost and risk, due to:
  - Combination of proven technologies and technological innovations
  - Iterative, collaborative, and multidisciplinary R&D approach
- Focus on integrating the analysis effort, and not necessarily on integrating all tools into one common toolset.

# Way Ahead



- Further development of the Integrated Analysis Concept & Toolset
- Advancements
  - IAMD domain
  - OR, M&S, Data Science
- Using the DREAMBOARD Database
- Implementation in IAMD Battle Lab – creating persistent IAMD Battle Spaces



# Questions?