

# Virtual Battlespace 3: Scenario Analyzing Capability and Decision Support based on Data Farming

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***Virtual Battlespace 3 (VBS3) is a flexible simulation training solution for scenario training, mission rehearsal and more. [...]***

***VBS3 was selected by the U.S. Army as its flagship product for its Games for Training program. VBS has become an industry standard in game-based military simulation.***

Bohemia Interactive Simulations (BISim)

## Our Research Interest

- **Decision support** and **optimization** are **gaining relevance** especially in **military context**. The quality of military decisions and standard practices have huge impact on military success.
- Does **VBS3** as a training modelling & simulations software have the **capability** for **scenario analysis** and **Data Farming** to **enhance** the development of **standard operations** and **decision making**?
- ➔ Our **focus**: taking a closer look to some of VBS 3' **models** and **analysing** their **ability powers** and **limitations** to **realism**
  - *What about weather, objects' speed, ballistic, etc.?*

## Outline

- Introduction
- **Constructive Approach**
  - Weapons
  - Soldiers
  - Vehicles
- Data Farming Approach
- Conclusion

# A Constructive Approach Study

- To explore the **analysis capability**, **usability** and **realism** of the software, we took a closer look to the software's models of:
  - **Soldiers**
  - **Vehicles**
  - **Weapons**
- Our **approach**:
  - Develop **testbeds** for series of **experiments**
  - Understand the software
    - **Ability powers**
    - **Limitations to realism**
    - **Analysis capacity**

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## Focus of **Weapons** Study

➔ *Are the software's models of weapon ballistics conforming to expectations?*

- Projectiles' flight paths
  - Ballistics
  - Influence of weather
- Sights of the H&K G36
  - Reflector sight
  - Telescopic sight

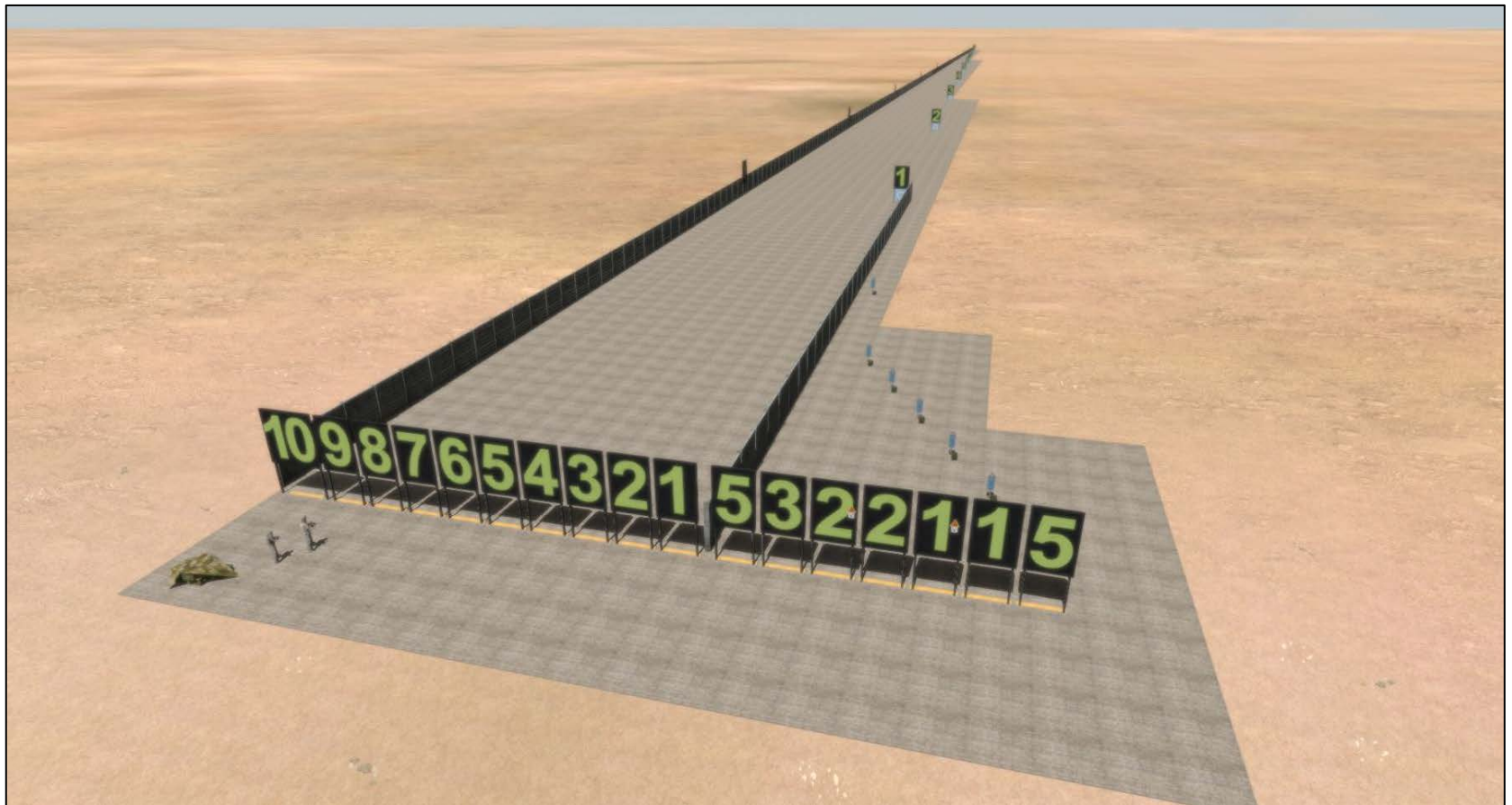


# Testbed of **Weapons** Study

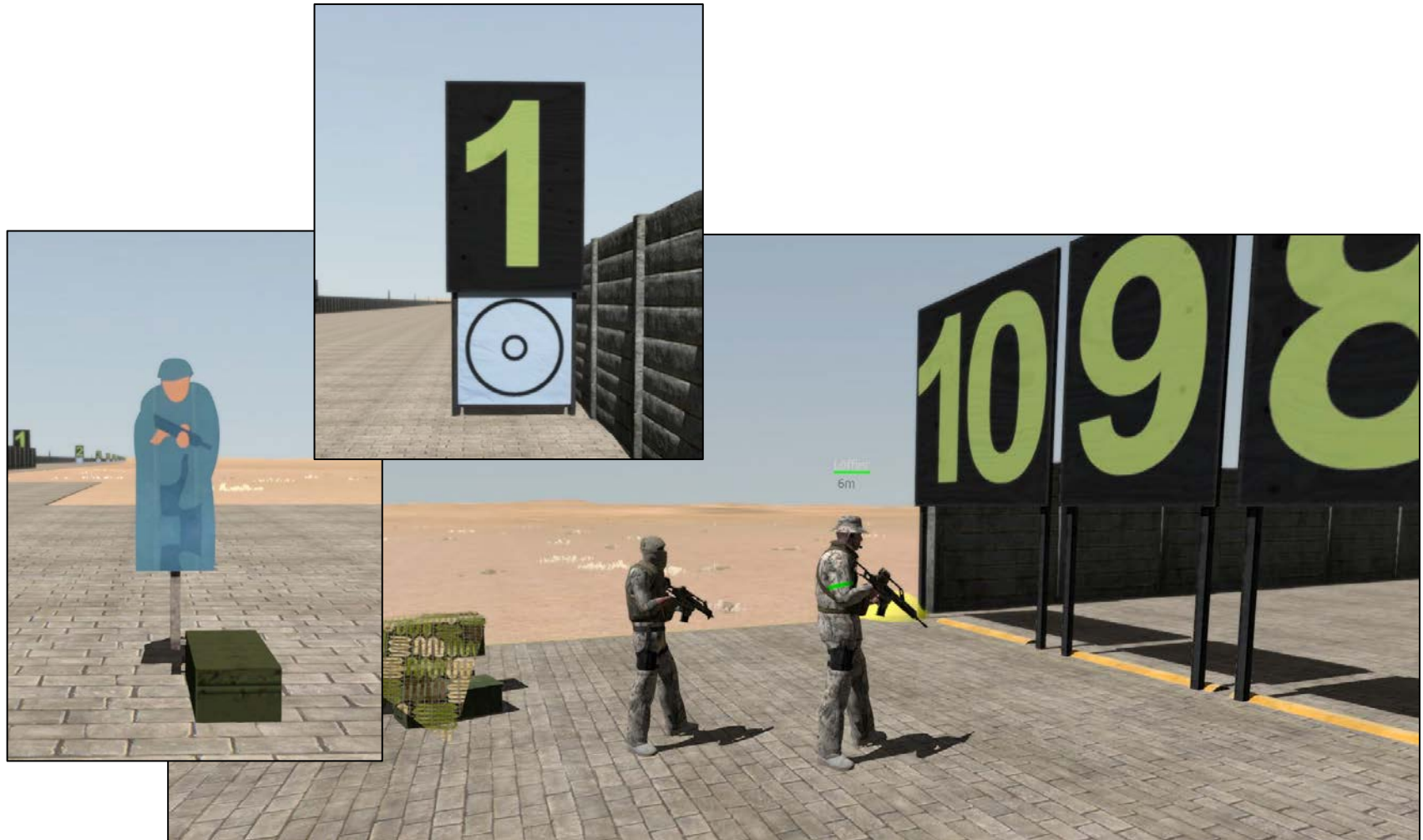




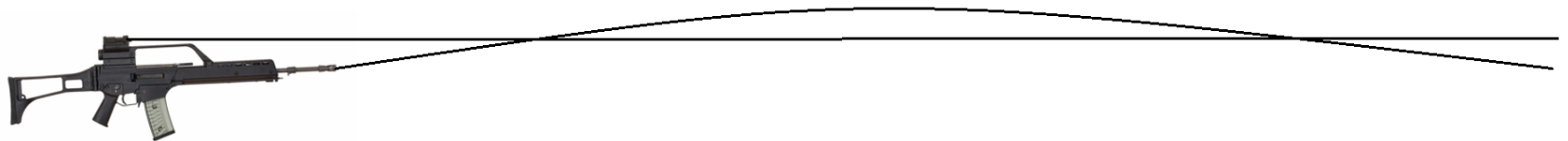
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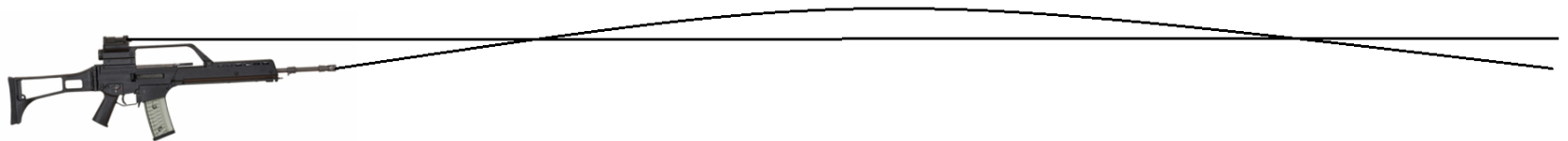
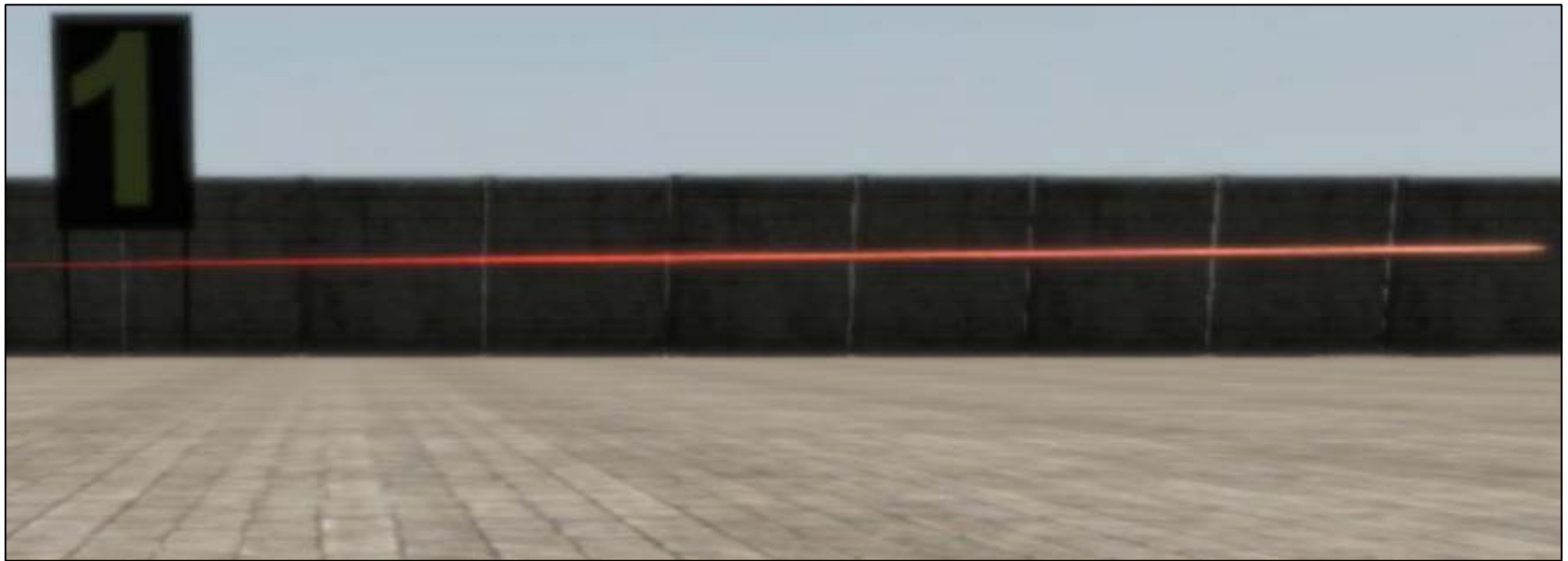
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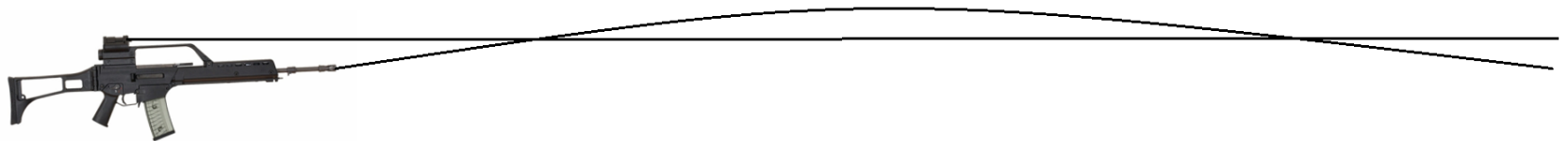
# Experiment of Weapons' Ballistics



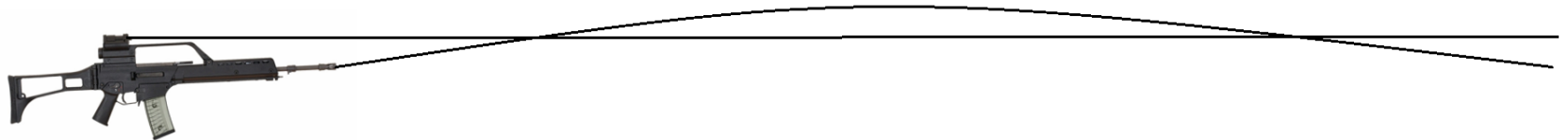
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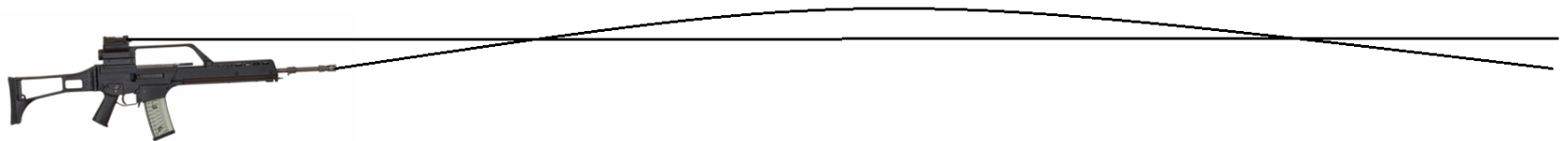
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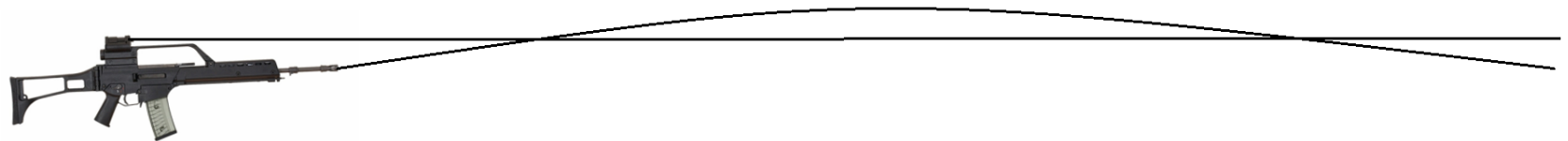
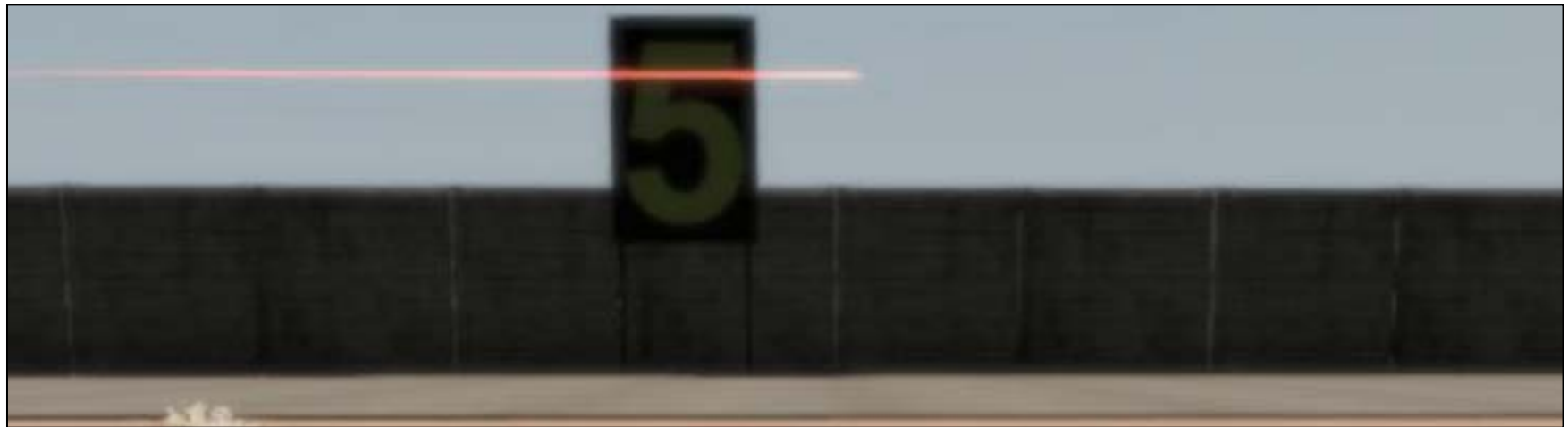
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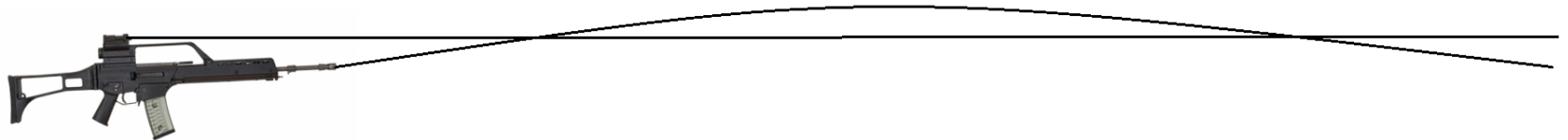


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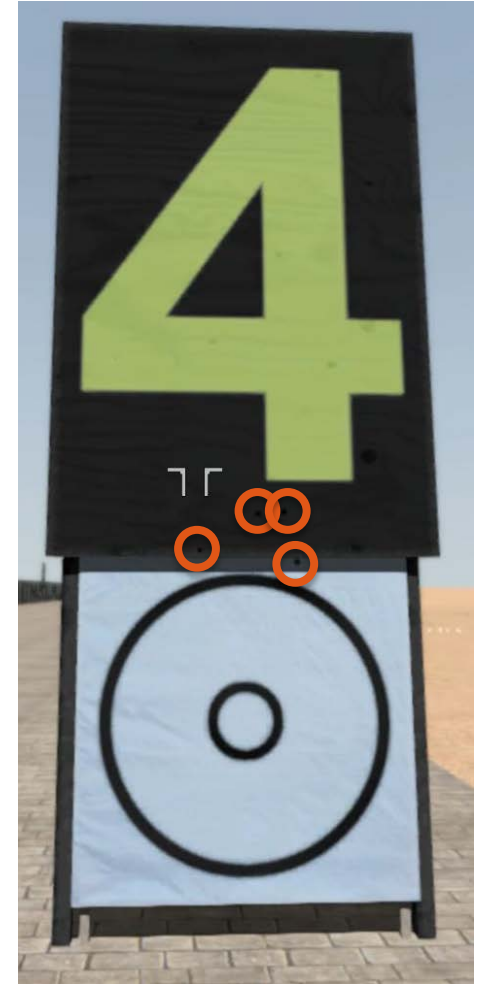




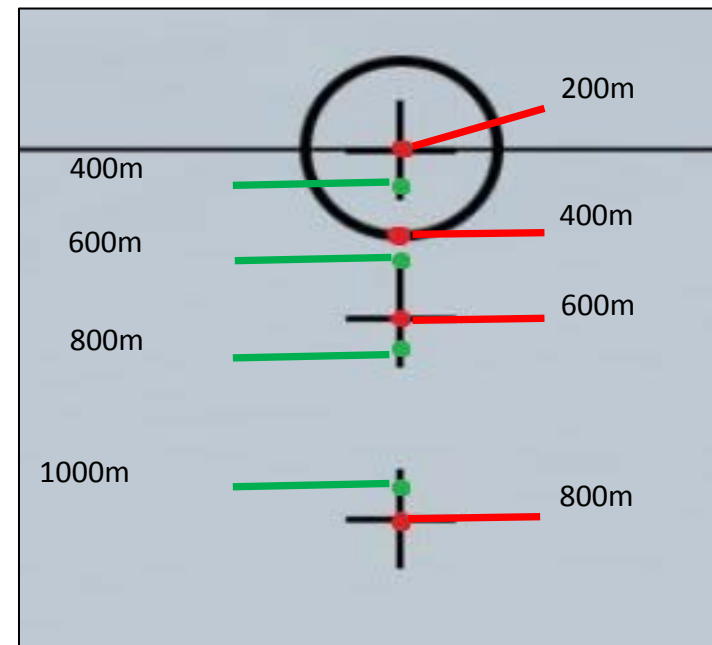
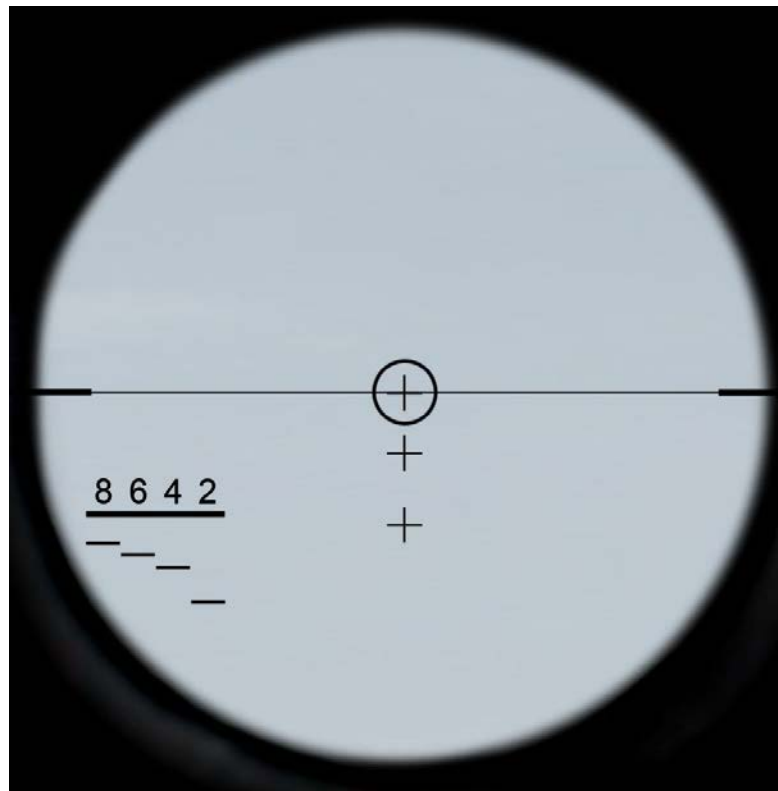
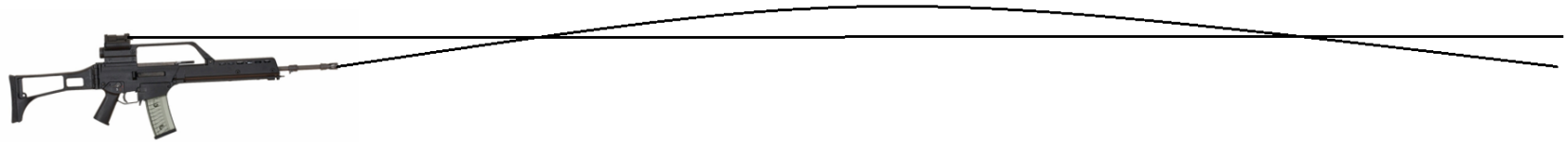
# Experiment of Weapons' Ballistics



# Experiment with Telescopic Sight



# Experiment with Telescopic Sight



# Experiment with Reflector Sight

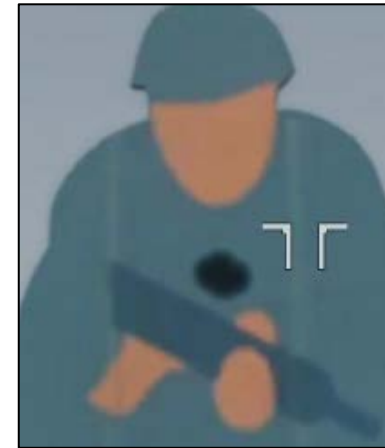
5m



10m



15m



20m



25m



30m

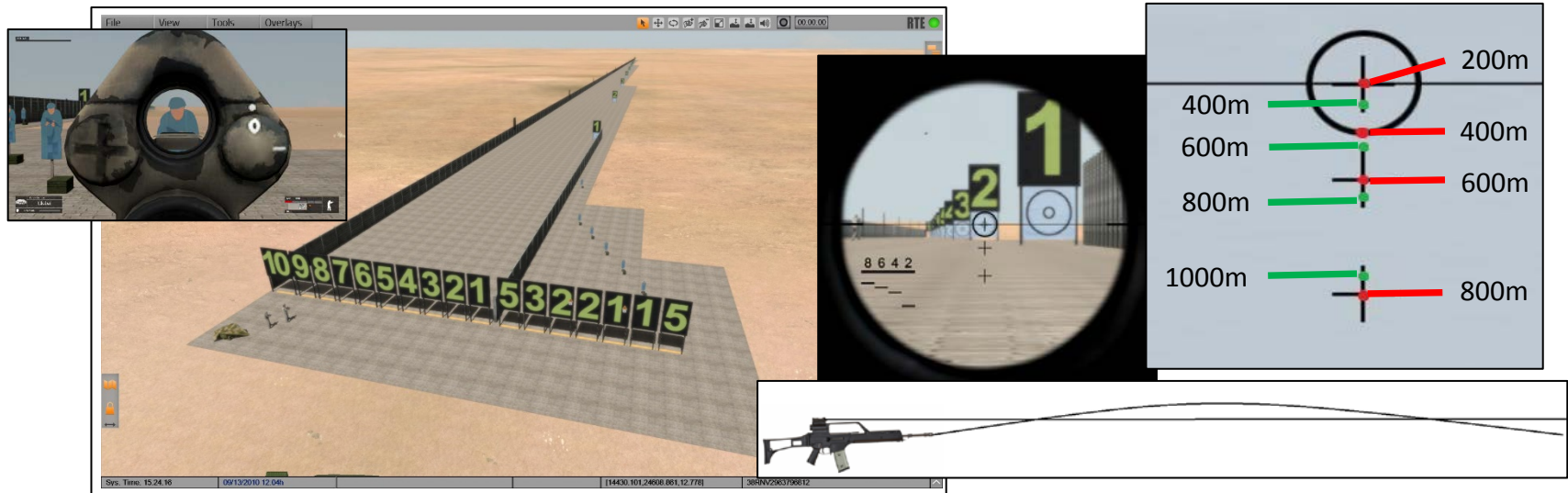


50m



# Aim and Results of Weapons Study

- *Are the software's models of weapon ballistics conforming to expectations?*
- In focus we tested the **correctness of projectiles' flight paths** and if both sights (telescopic & reflector) of the H&K G36 are presented correctly. For doing so we built up a dedicated firing range for distances up to 1000m.



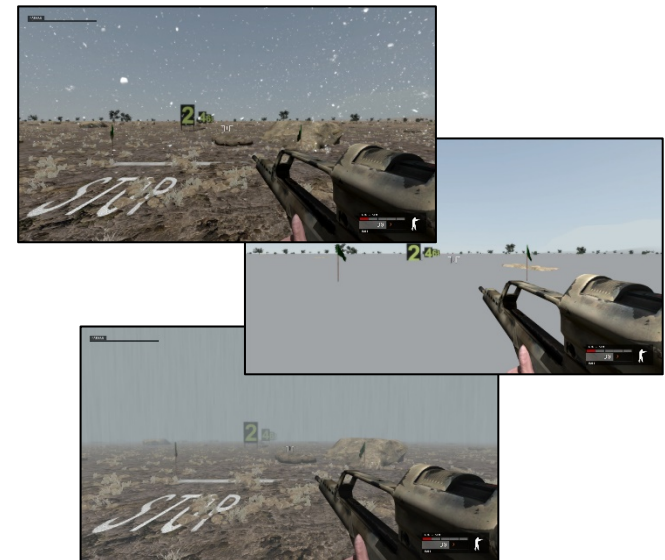
➔ Results: the weapon **ballistics model behaves accordingly to reality** (only exception: weather conditions (rain and wind) do not have any influence on the flight path), but the **H&K G36's telescopic sight is slightly not true to scale.**

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# Aim and Results of **Soldiers Study**

- *What are the dependences of a soldier's running speed and exhaustion?*
- We tested the influences of **weather** (fog, rain, snow), **terrain** (street, countryside, snow), **weapon carry mode** and the **equipment weight** by changing these parameters one by one on a dedicated racetrack of 100m.



➔ Results: **weather, terrain, weight load and weapon carry mode barely influences** soldier's movement & exhaustion (only exception: 1,50m snow)

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# Aim and Results of **Vehicles** Study

- *What are the dependences of a vehicle's general movement and speed?*
- We tested the influences of different **terrains** (street, lawn, gravel, sand, snow) and **weather** (wetness, snow) on three different **sorts of vehicles**.
- Small tyres (*Wolf*), big tyres (*Fennek*), tracked vehicle (*Panzerhaubitze 2000*)



➔ Results: weather conditions **do not have any influence** on vehicles' movement (only exception: 1,50m snow); **no groove tracks** on wet terrain; maximum speed of vehicles with tyres decreases from street to lawn/gravel to sand; **maximum speed of tracked vehicles does not decrease** due to terrain

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# Data Farming Approach

Master thesis of Maximilian Ströbel and Stefan Luther:

→ *Can VBS 3 in combination with Data Farming be used for decision support?*



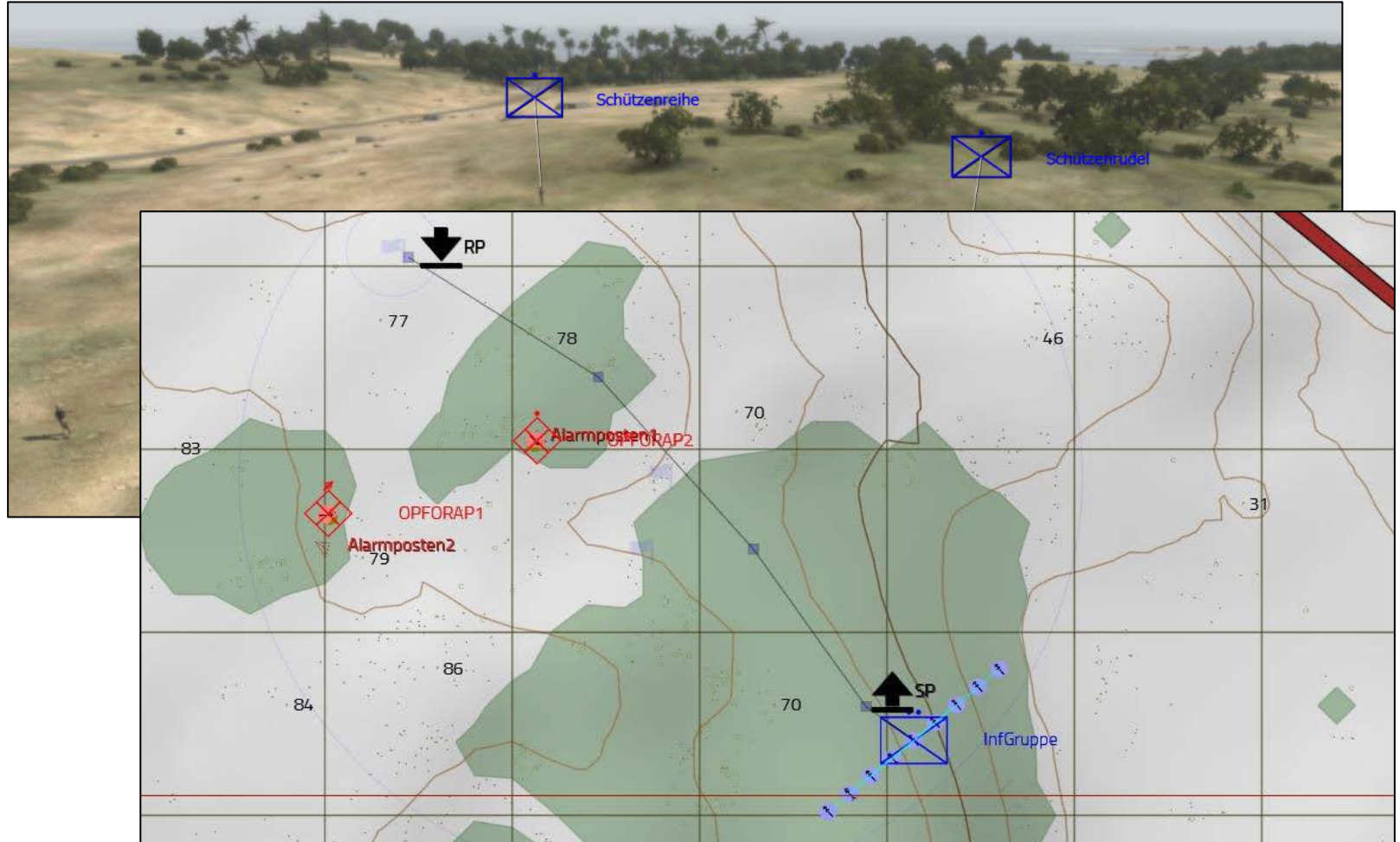
# Data Farming Approach

- To explore the **analysis capability** and **decision support** of the software in combination with Data Farming, we took a closer look at:
  - A **standard operating procedure** of **military scenarios**
  - **Usability of Data Farming** in VBS 3
  - Comparison of analysed data with **joint service regulation and military practical experience**
- Our **approach**:
  - Develop **two test scenarios** for series of **experiments**
  - Develop a **Data Farming tool** realised as a **VBS Fusion plugin**
  - Using **Data Farming** to run through the scenario **several times**
  - **Analysing the data** in a **statistical way**
  - Compare the **results** with the **military expectations**

# Scenario: Crossing of a Forest Aisle



# Scenario: Crossing of a Forest Aisle



# Experimentation

- **Parameters** used for the experiment design were: training, experience, cautions, formation, distance, daytime, different weather conditions.
- **Nearly Orthogonal Latin Hypercube (NOLH)** was used for the experiment design, which consists of a  *$n \times k$  matrix*:
  - *n* stands for the number of **design points** (varying simulation runs)
  - *k* stands for the number of different **parameters** used
- **NOLH** allows “**gap-filling**” for the entire solution space, using a small amount of design points.
  - ➔ The **scenario** “Crossing a forest aisle” contained **33 design points** which have been **executed 30 times** to obtain **statistic usable data!**

# Results of **Data Farming** Study

- The **Data Farming tool** allowed to collect data running the scenario **automatically** 30 times with 33 different design points.
  - **Manually analysing** and **validating** this data occupied much time in order to achieve **usable data**.
  - **Analysed results** are matching with the directions of the **joint service regulation** and **military practical experience**.
- In this particular **analysis question: VBS 3** in combination with **Data Farming** can be used for **decision support!**



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## Summary of the **Study Results**

- **Complex software** suitable for many and diverse analysis
- **Involving** already a very large amount of **details**, but **maturity** of weapons', soldiers' and vehicles' models is quite **differing**
- **Data Farming** is possible with a high investment of time
  - ➔ **Being aware of VBS3 ability powers and individual models' challenges, it can be used for scenario analysis and Data Farming for decision support!**

Virtual Battlespace 3:

Scenario Analyzing Capability and

Decision Support based on Data Farming

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**THANK YOU FOR YOUR ATTENTION!**