The Use of Simulation in Flare Countermeasure Development

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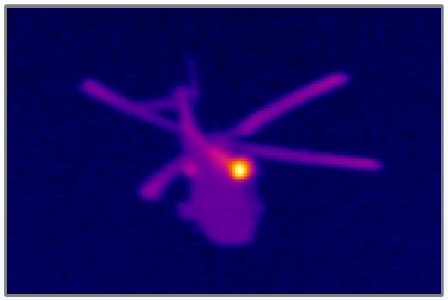
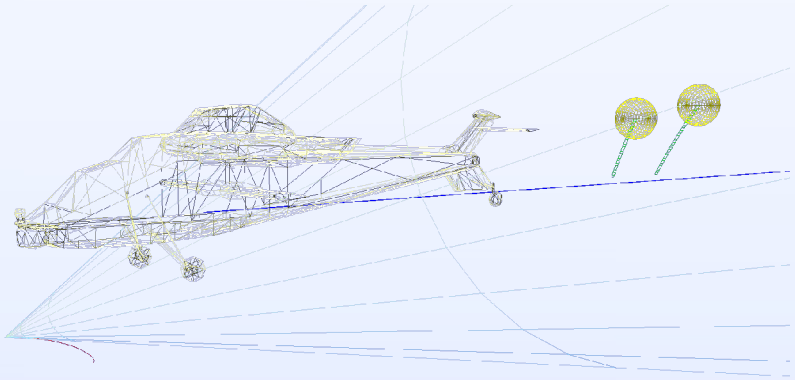
Overview

- **Scope**
  - Place in EW environment
  - Reasons for existence
- **Simulation Environment**
- **Models**
  - Simulation components
- **Scenarios**
  - Typical engagements
- **Outputs**
  - Visualisation
  - Demonstration
- **Conclusion**



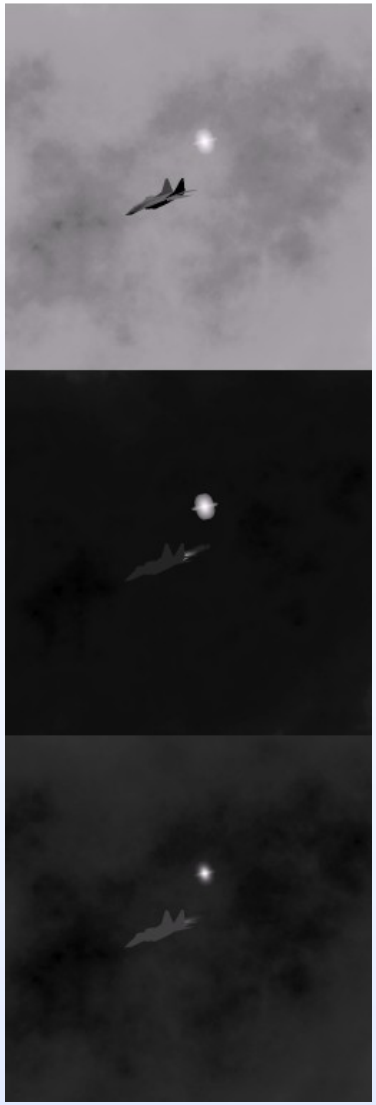


Scope

- **Focus**
  - Infrared spectral band
  - Shoulder launched / MANPAD threat
- **Motivation**
  - Aircraft protection
  - Countermeasure Flares
    - Evaluate and optimise effectiveness
    - Development
  - Provide inputs to experiments
    - Field trials, laboratory
  - Influence doctrine
  - Knowledge repository

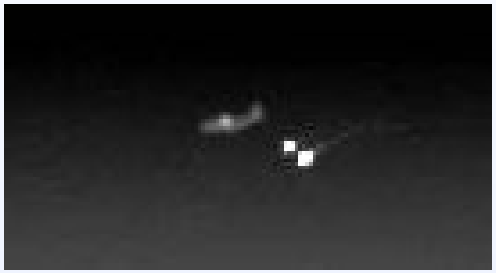
Simulation Environment

- **Synthetic infrared image generation**
  - Consumed by missile models
- **Evolution**
  - Relative radiometry, wide band
    - Assume enough flare energy
    - Questions addressed
      - Timing
      - Geometry
      - Dispense logic
      - Obscuration
  - Physics based, spectrally correct
    - Question addressed
      - Flare spectrum
      - Environmental influences



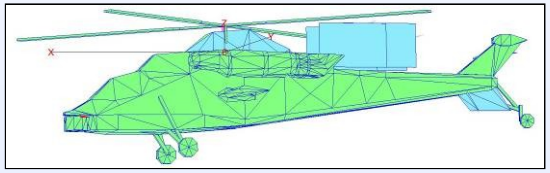
Simulation Models

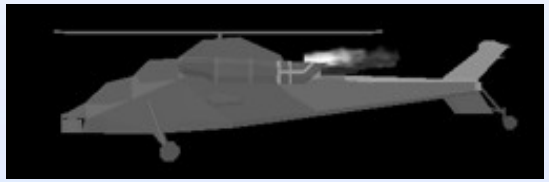
- **Platforms**
- **Flares**
- **Seekers**
- **Environment**
  - Terrain
  - Background
  - Atmosphere

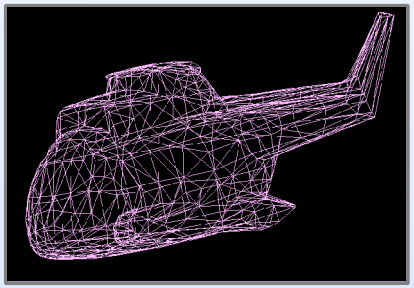


Platform Measurement & Modelling

- **Wireframe manipulation**
- **Radiometric mapping**
  - Temperature
  - Spectrum
- **Behaviour**
  - Flight
  - Engine settings
  - EW suite, e.g. MAW

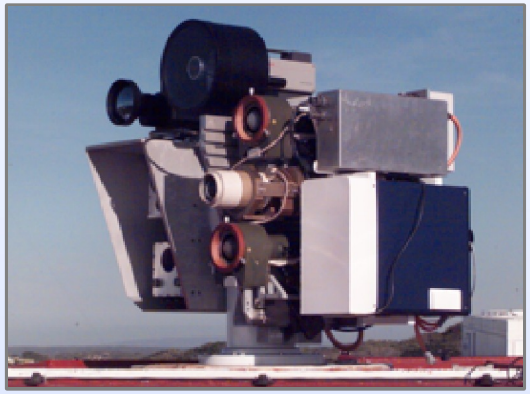


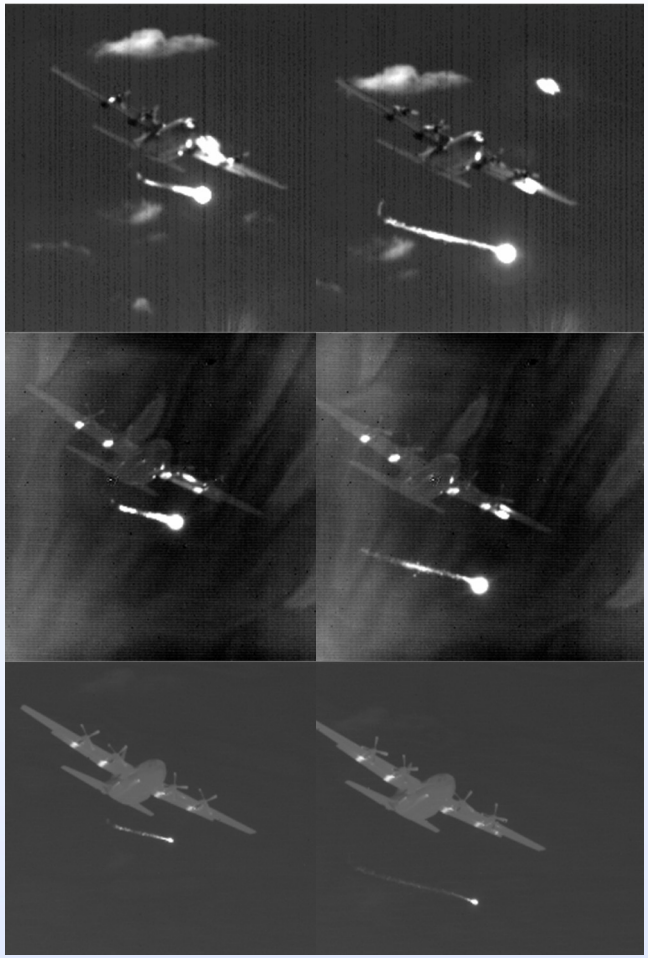




Flare Measurement & Modelling

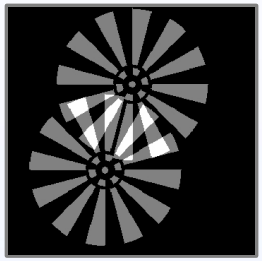
- **Trajectories**
  - Ejection velocities
  - Drag
- **Temporal behaviour**
  - Size
  - Spectral output

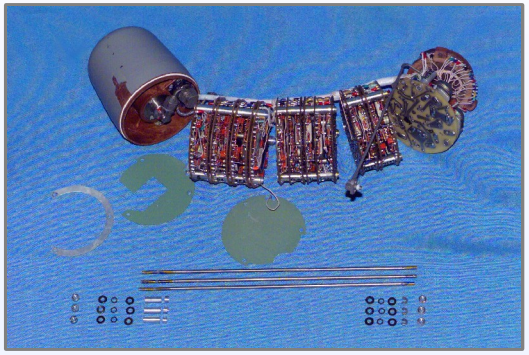


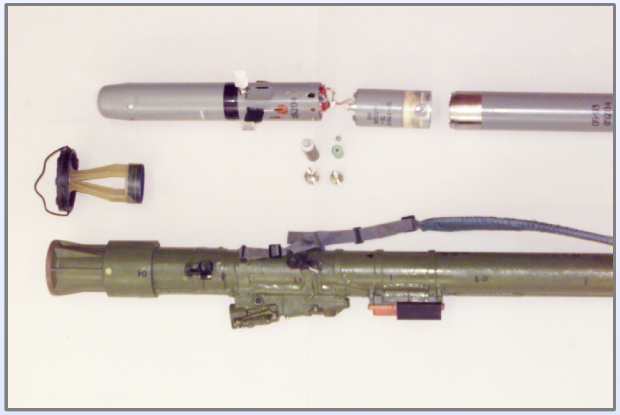


Seeker Exploitation & Modelling

- **Optics**
  - Reticles
- **Electronics**
  - Tracking
  - Counter-countermeasures
- **Aerodynamics**

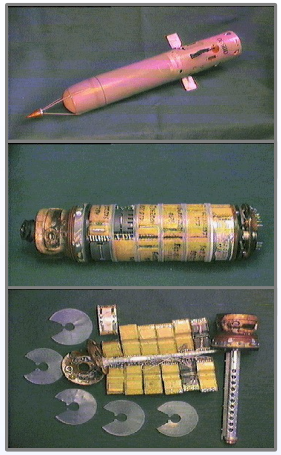


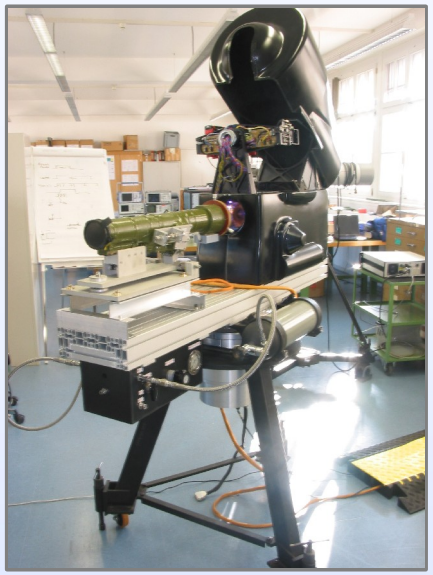


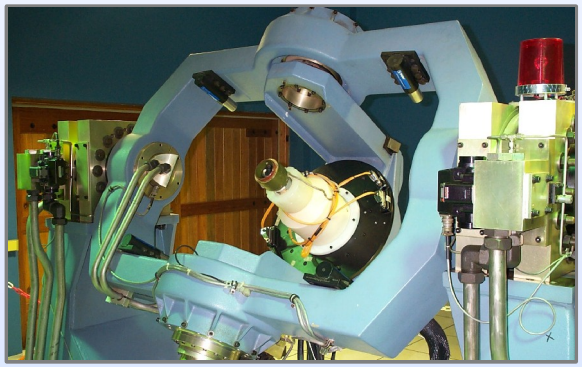


Seeker Exploitation

- **Reverse Engineering?**
  - Yes, but, understand the workings
  - Not with the aim to build clones
- **Methods**
  - Intrusive
    - Take apart
  - Non-intrusive
    - Look at behaviour
    - Treat as a black-box (HIL)

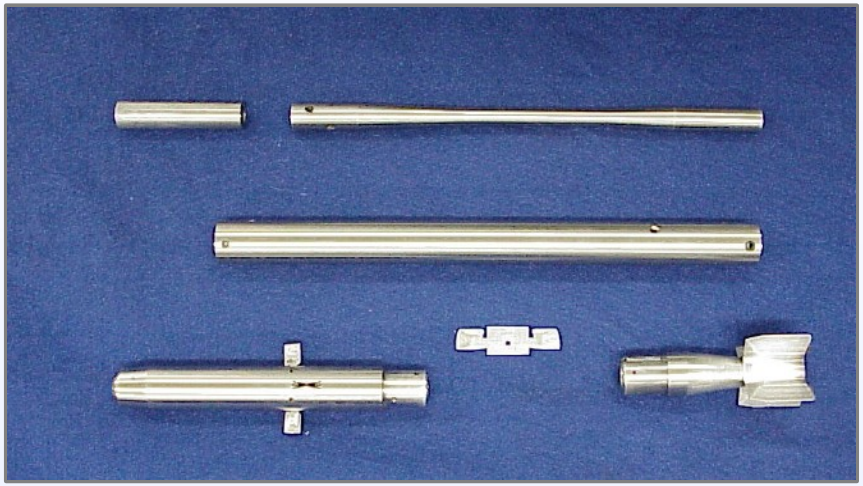


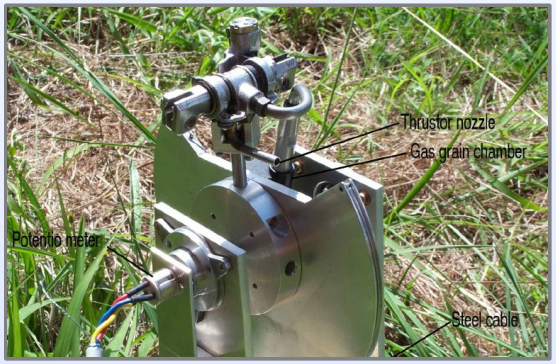




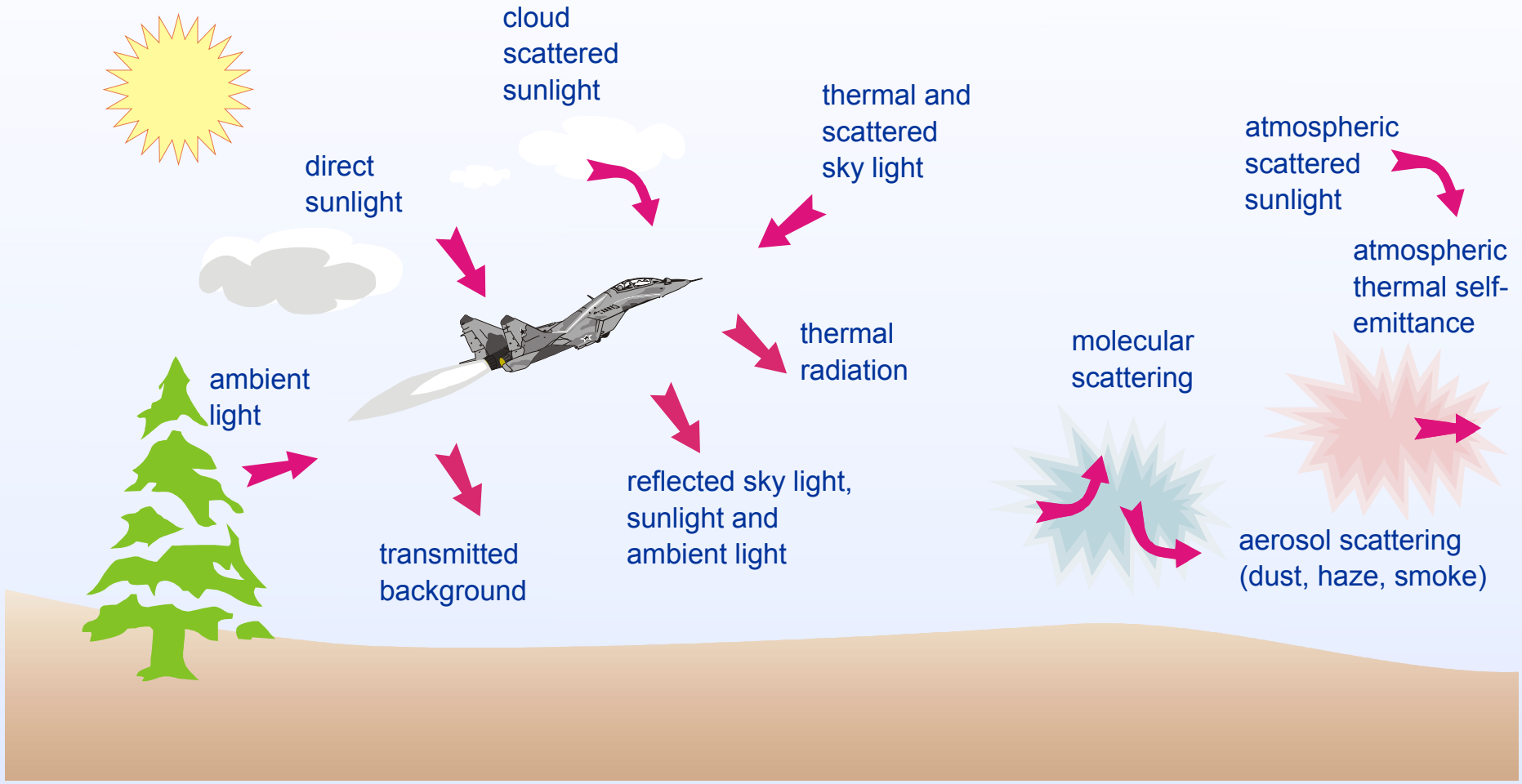
Aerodynamic Measurement & Modelling

- **Wind tunnel measurements**
- **Live firings**
- **Thrust measurements**



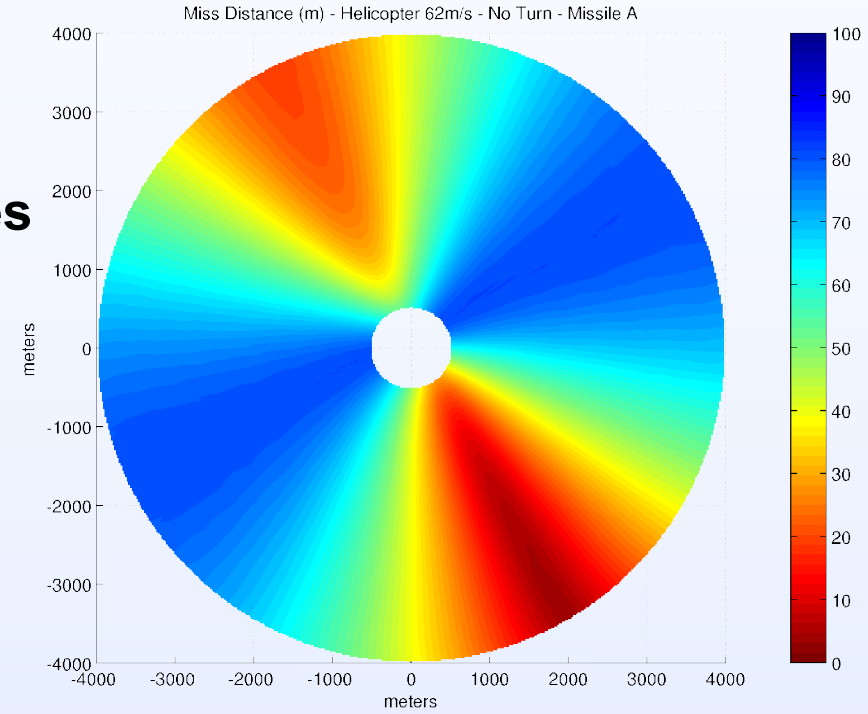


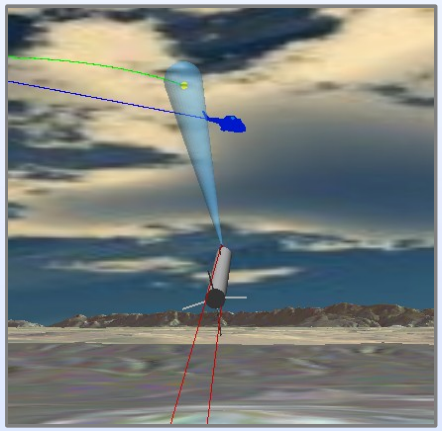
Environment Modelling



Engagement Scenarios & Simulations

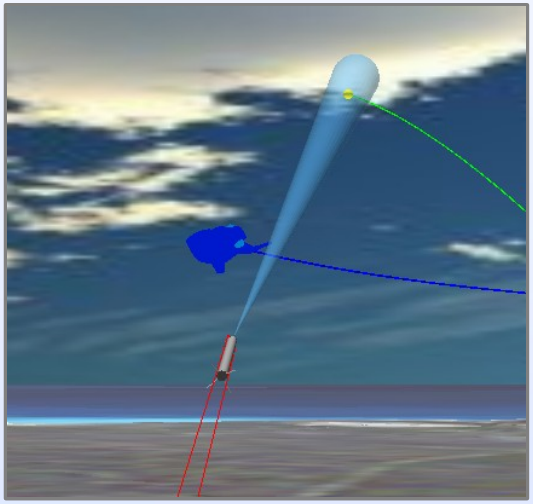
- **Aircraft with flares versus missile**
  - Flight conditions
  - Flare dispense logic
  - Flare pod placement, angles
- **Multitude of simulated launches**
- **Visualisation**
  - Aggregated results
  - 3D replay of single simulation run

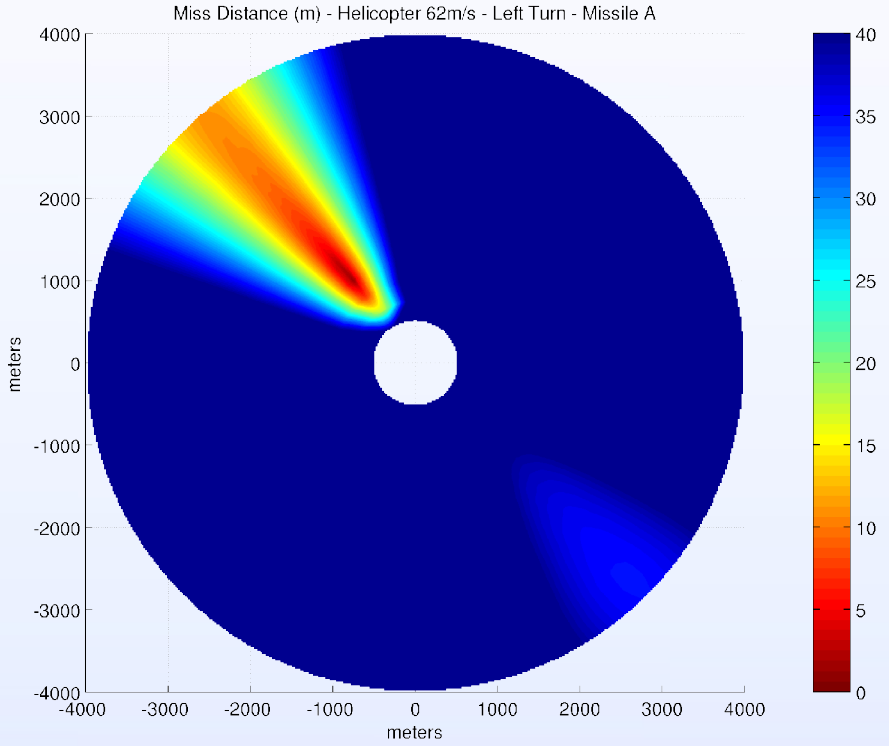




Example Engagement Outputs

- **Geometric separation problems**
- **Manoeuvering**
- **Obscuration**
- **Flare intensity problems**
- **Flare burn time problems**





Conclusion

- **Invaluable tool**
  - Flare countermeasure effectiveness
    - Evaluation
    - Optimisation
  - Flare countermeasure development
  - Aid to thought
- **Dependent on proper fidelity models**
  - Dependent on measurements