DARPA

DARPATech

2002 Symposium

Transforming Fantasy

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Program Manager

Transforming Fantasy

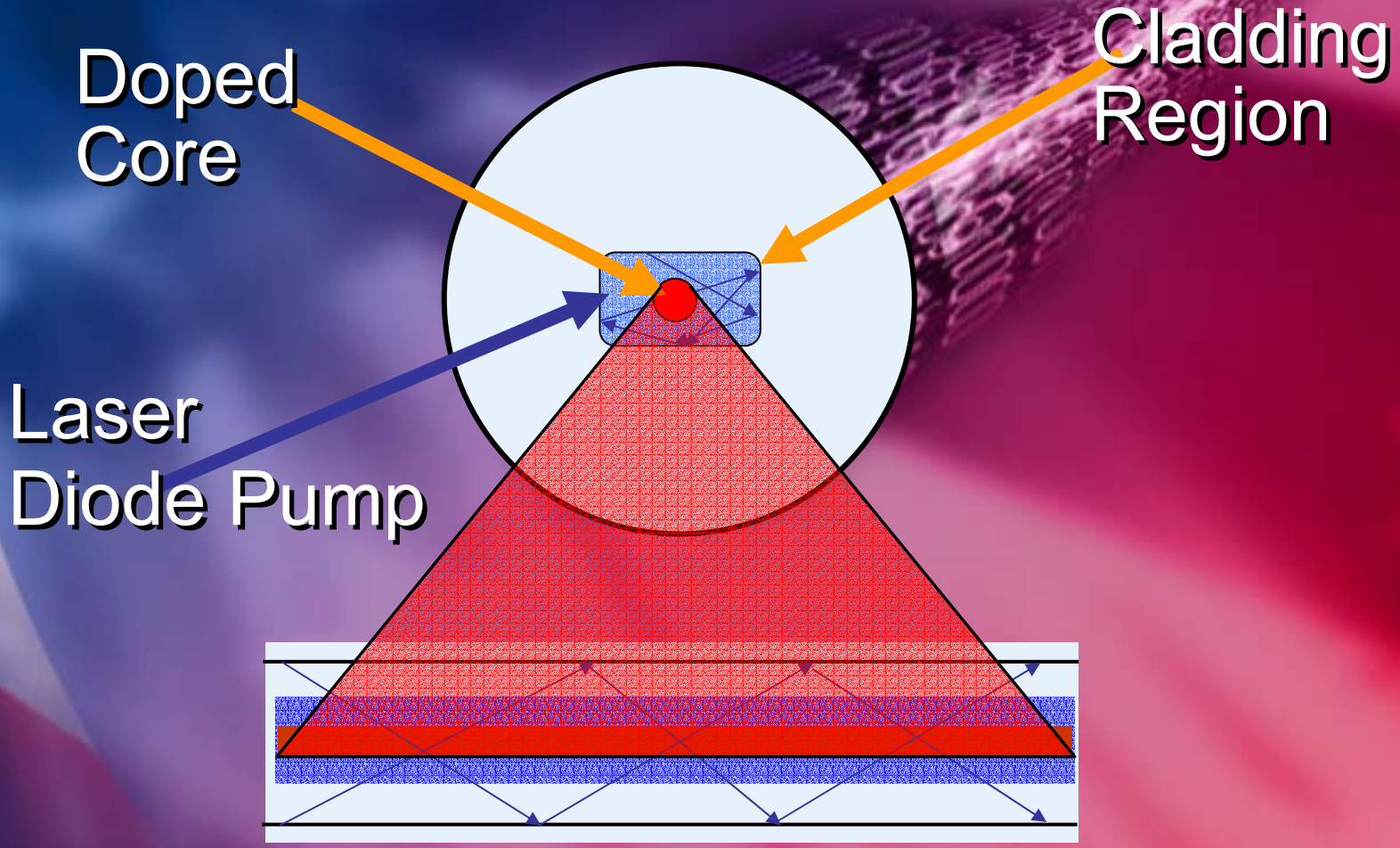
High Power Fiber Lasers

High Power Fiber Lasers

- Wall-plug efficiency ~ 20 to 30%
- Large surface to volume ratio
  - Efficient thermal management
- Robust Architecture/Compact Packaging

Distribution Statement A. Approved for public release; distribution is unlimited.

Fiber Laser Cross-section



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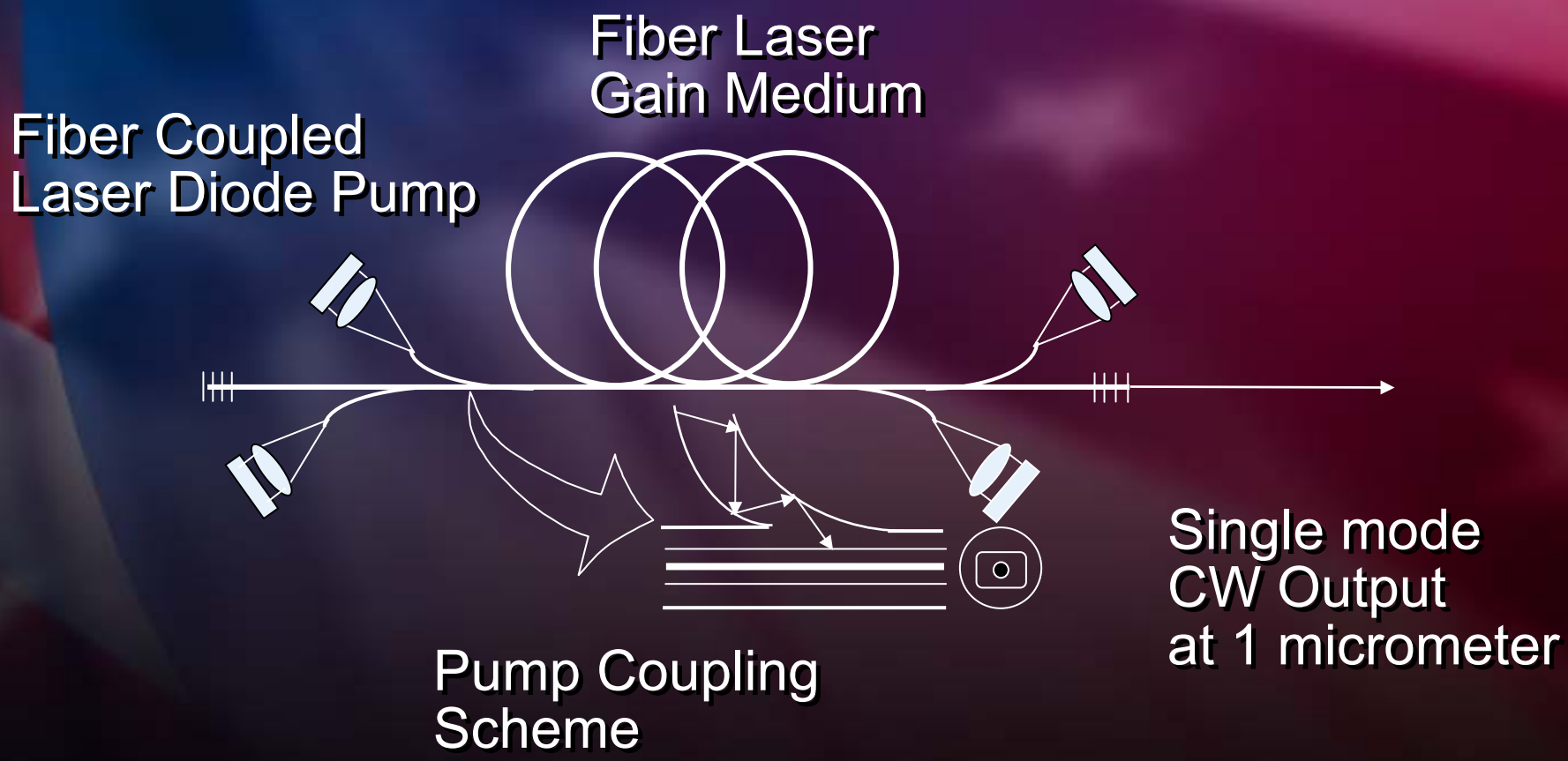
High Power Fiber Lasers



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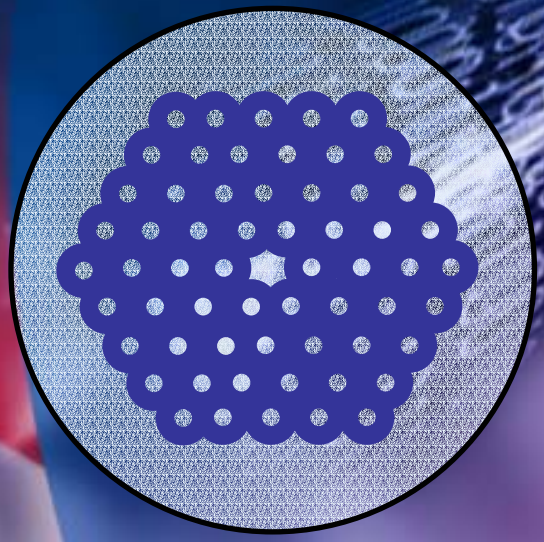
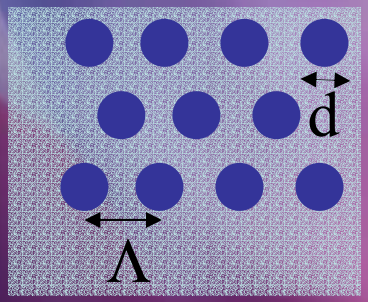
Photonic Crystal Fibers

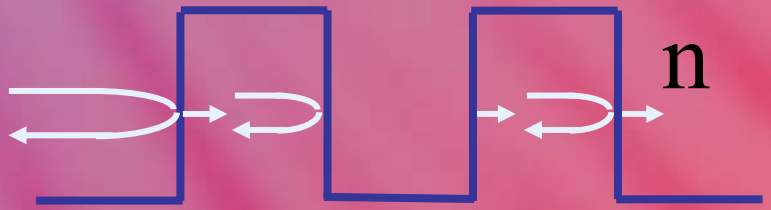


- Single mode operation
- Doped hollow or solid core

The holes act as fiber cladding



Periodically arranged air holes act as Bragg gratings and confine light



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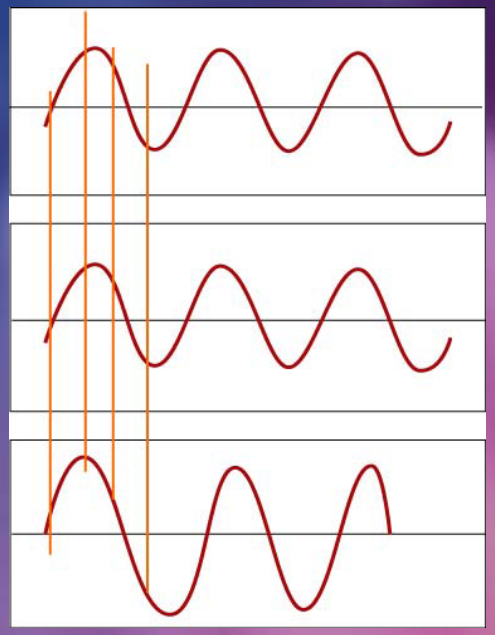
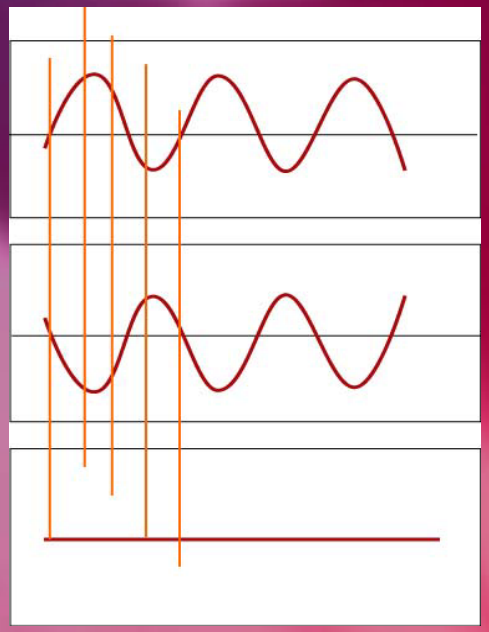
Constructive and Destructive Interference

In Phase



Out of Phase



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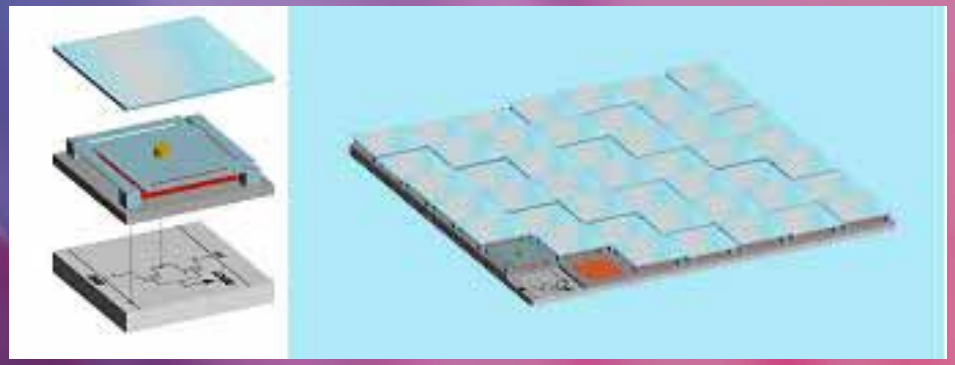
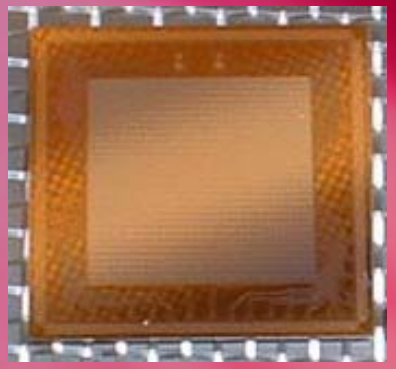
Spatial Light Modulators (SLMs)

- 1024x1024 pixels
- Pixel flatness ~ $\lambda/50$, 98% fill factor
- 8 bits phase resolution (256 levels)
- 10 μs response time





32x32 SLM

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Technical Challenges

- Eliminate nonlinear effects in large mode area fibers
- Polarization maintenance
- Launching of high power diode pump power
- Precise control of the phase of multiple fiber lasers for coherent combining

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Program Development Plan

Phase I

Task 1

Develop large mode area (LMA), polarization preserving fiber designs

Demonstrate single mode 100 watt fiber lasers

Task 2

Develop designs for coherent combining of 100's of fiber lasers

Demonstrate greater than 1 kilowatt output power

Phase II

Demonstrate single mode 1 kilowatt fiber lasers

Demonstrate 10's of kilowatts output power

Demonstrate greater than 100 kilowatt output power

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High Power Fiber Lasers

- Simplified logistic tail
- Deep magazine
- Compact foot print

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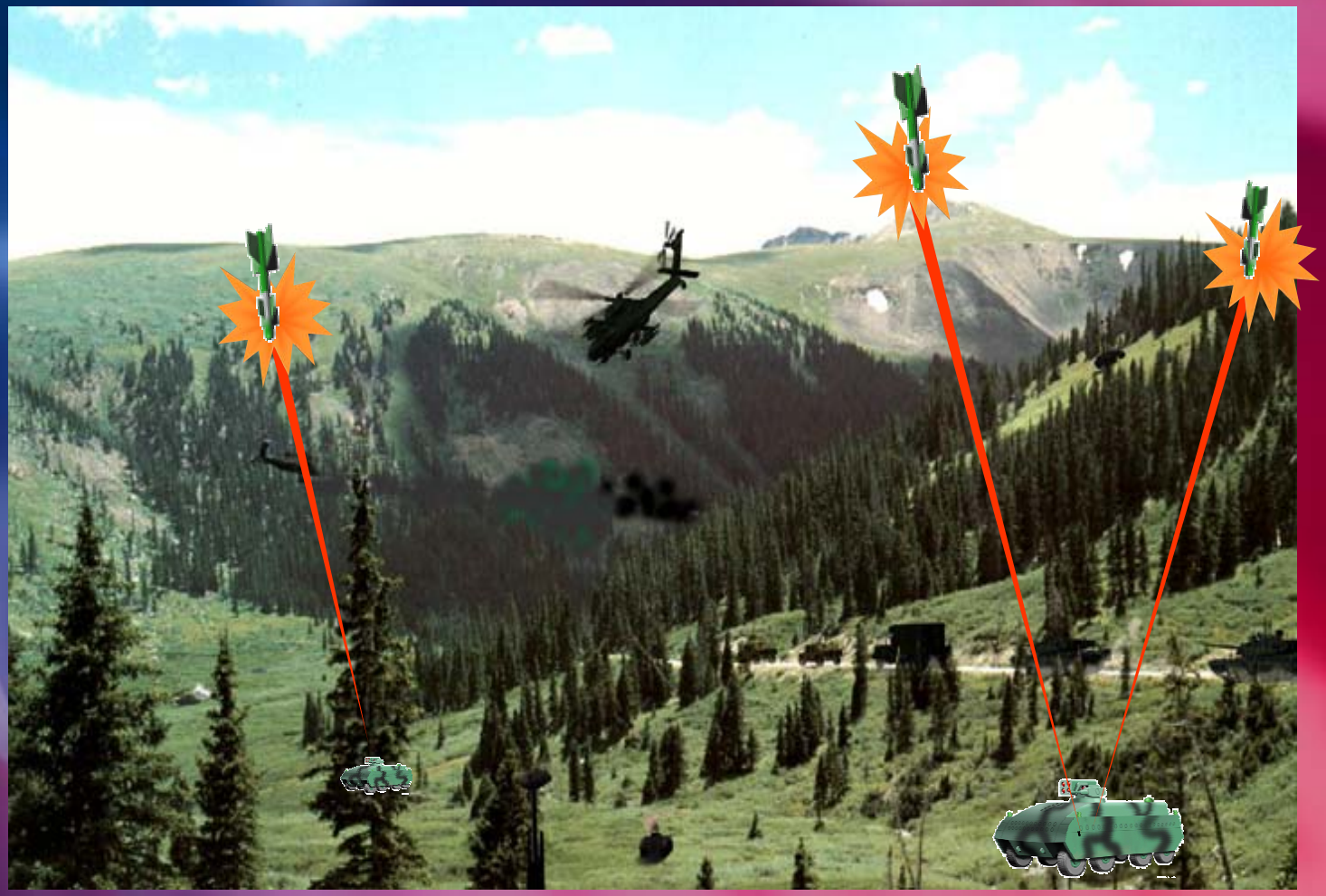
Theater/Area Defense



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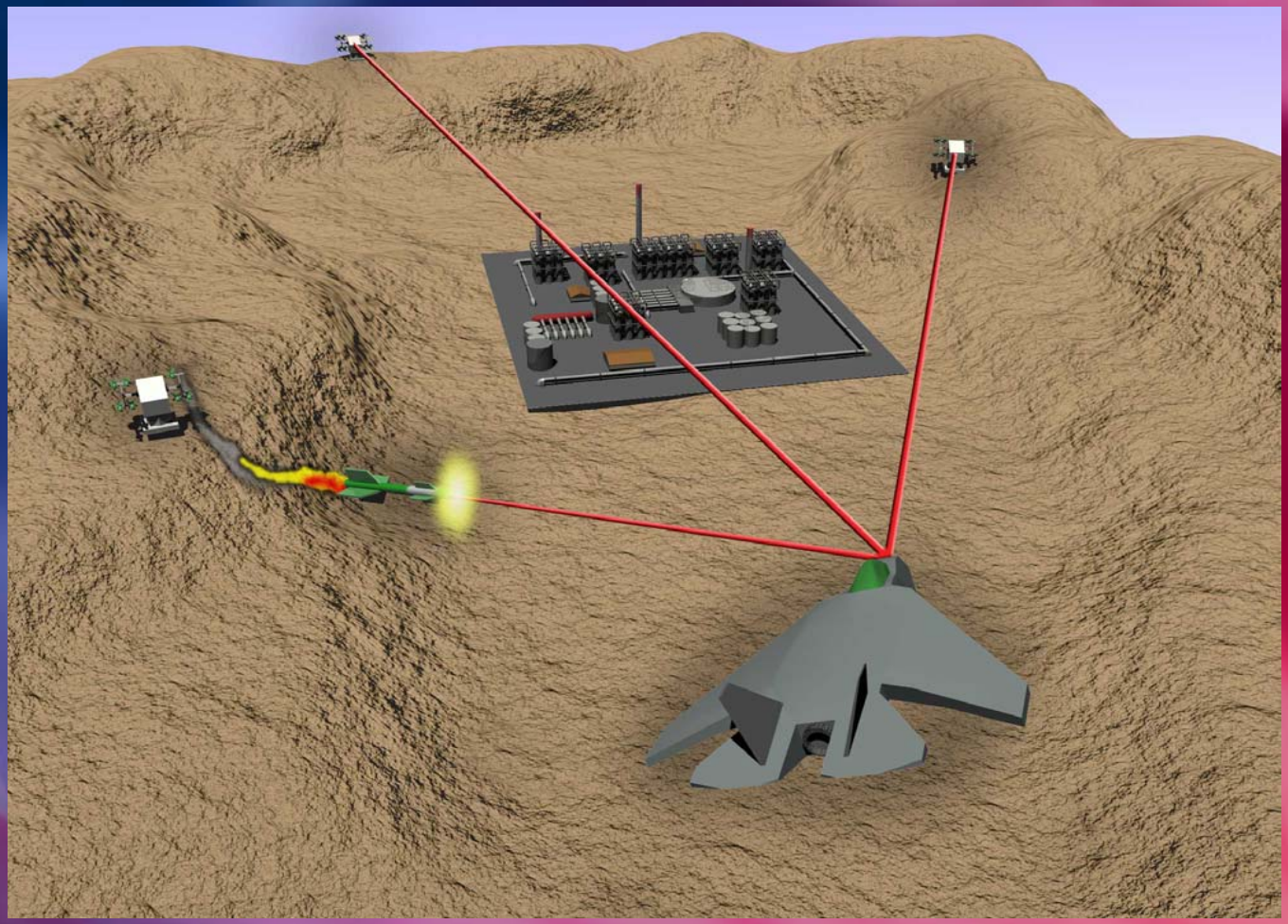
Self-protection of Combat Platforms



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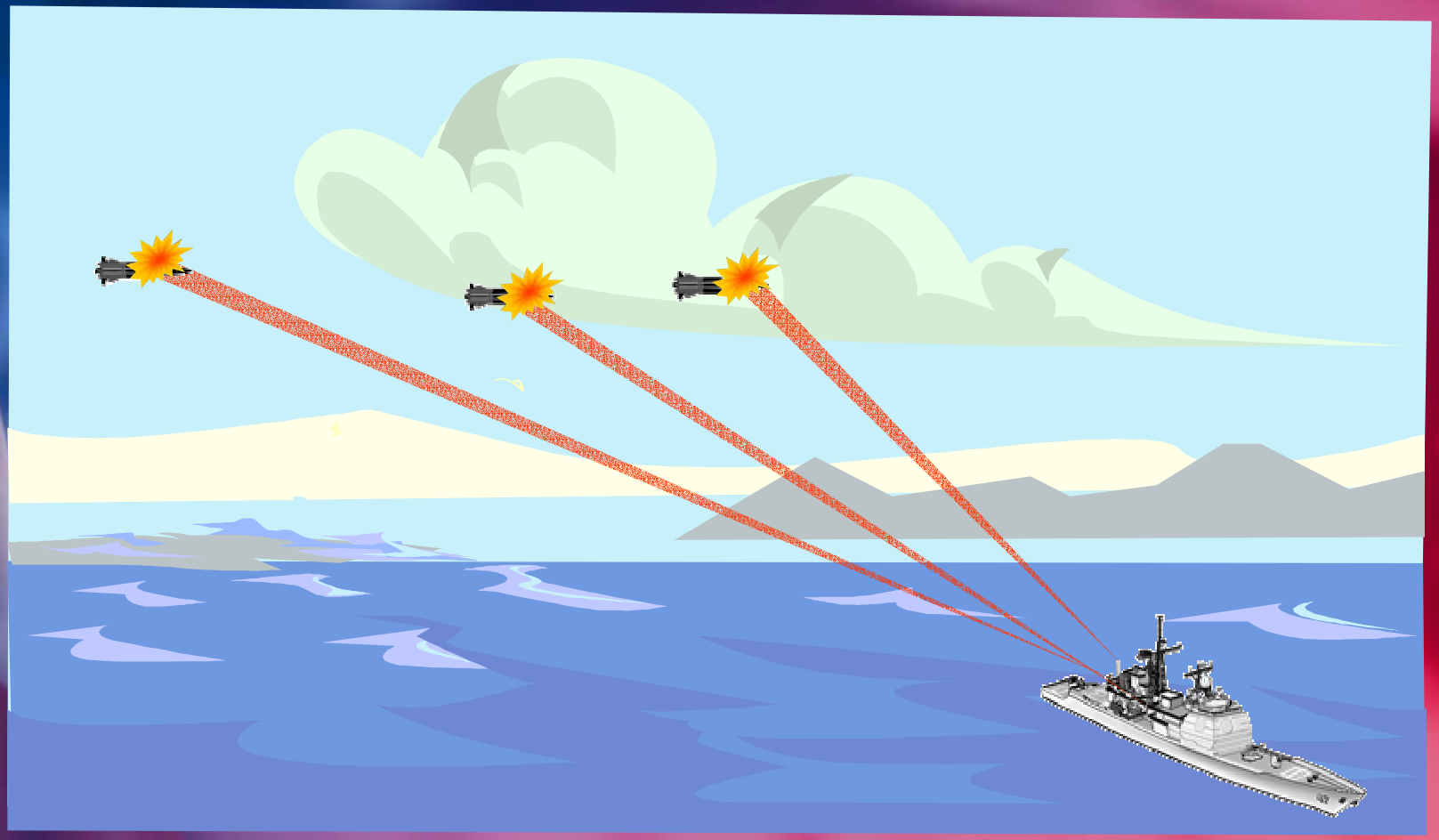
Defense Against Anti-Ship Missiles



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