

# Technological Implications of the 2006 Quadrennial Defense Review



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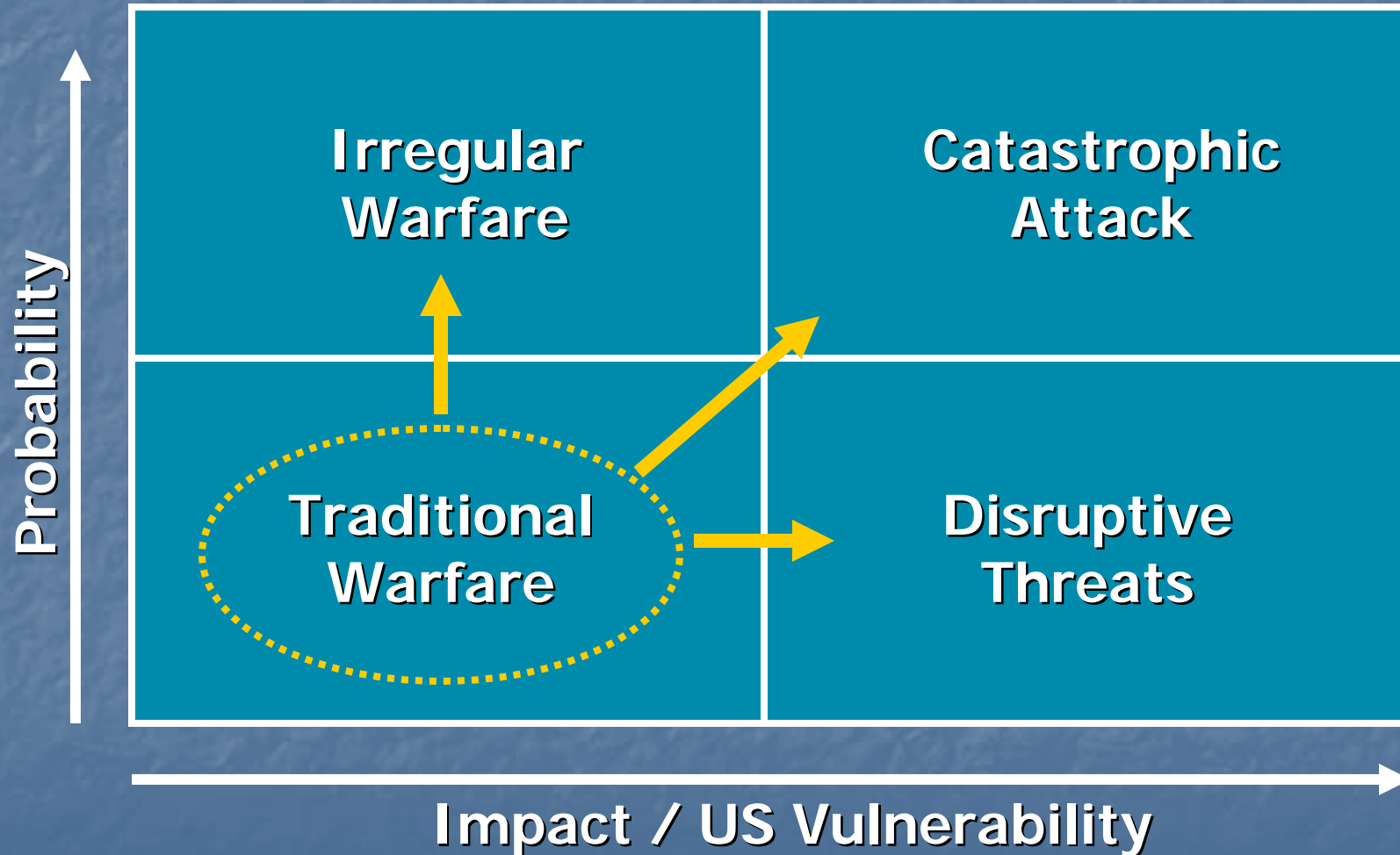
## Overview

- **The 2006 Quadrennial Defense Review (QDR) Overview:**
  - Context
  - *National Defense Strategy*
  - Four priorities
  - Key decisions
- **Technological Implications of the 2006 QDR**

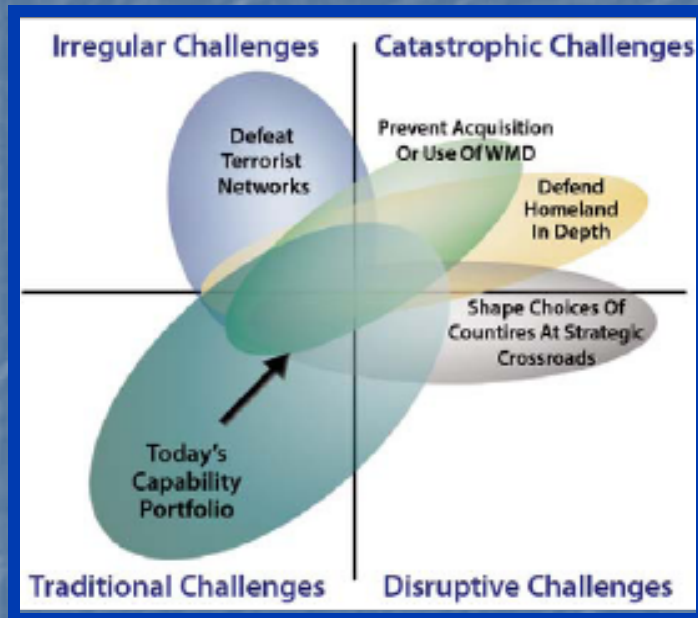
## The 2006 QDR: Context

- Congressionally mandated review of defense strategy and plans, conducted every four years.
- The 2006 QDR was the first review to be conducted while the nation was at war.
- It seeks to “operationalize” the *National Defense Strategy*, released in March 2005.

# National Defense Strategy: The Quad Chart



# QDR's Four Priorities



**Defeat Terrorist Networks**

**Defend Homeland in Depth**

**Shape Choices of Countries at Strategic Crossroads**

**Prevent Acquisition or Use of WMD**

# Technology Implications of the 2006 QDR:

- Defeating Terrorist Networks
- Shaping Choices of Countries at Strategic Crossroads
- Defending Homeland / Preventing Acquisition or Use of WMD

# Defeating Terrorist Networks: Key Challenges

- Finding and fixing terrorists
- Operating in denied areas
- Countering extremist ideology
- Interdicting critical resources
- Improving general purpose force (GPF) capabilities for counter-insurgency (COIN) and irregular warfare

# Finding and Fixing Terrorists

## ■ Challenges

- Identifying unknown terrorists
- Locating known terrorists in unknown locations
- Tagging and tracking terrorists (and associated equipment/supplies) once located
  - Covert tag emplacement
  - Long tag shelf-life
  - Low-risk of enemy detection
  - Stand-off tracking
- Maintaining wide-area, persistent surveillance of ungoverned areas and littoral zones

## ■ Potential Technology Areas

- Database fusion and mining
  - Natural language processing
  - Pattern recognition
- HUMINT targeting support
- Biometrics:
  - Facial/ear-pattern/gait recognition
  - Voice identification and keystroke dynamics
- Tagging
  - Motes ("smart dust")
  - Dynamic optical tags
  - Covert radar tags
- Long-endurance, unmanned sensor platforms
- Unattended ground sensors
- See-through-wall radar

# Operating in Denied Areas

## ■ Challenges

- Inserting and extracting personnel covertly / clandestinely
  - Rapidly and over long distances
- Countering adversarial individual identification and tracking systems
- Penetrating into denied facilities/urban areas

## ■ Potential Technology Areas

- Broad spectrum, all-aspect signature reduction (including visual stealth)
- Multispectral camouflage / signature masking
- Counter-tags
- Counter-biometrics
- Counter-data mining
- Semi-autonomous micro-air vehicles (MAVs) and microrobots
- Motes and nano-scale devices

# Countering Extremist Ideology / Interdicting Critical Resources

## ■ Challenges

- Monitoring, manipulating, and exploiting “open” enemy communications
  - Internet e-mail
  - Jihadist websites and chat rooms
  - Cell phones
- Disrupting terrorist organizations and their transnational links
- Penetrating, manipulating, and exploiting denied / closed communications and computer networks
  - Including financial networks

## ■ Potential Technology Areas

- Rapid decryption and automated natural language processing
- Database fusion, pattern recognition, and mining
- Offensive IO
  - Computer network attack
  - Tools for SF covert IW teams
  - Voice / video override
- Low-level communications intelligence (COMINT)
  - Cluttered urban environments – cell phone and microwave intercept
  - Exploiting fiber-optic landlines
  - Automated voice-pattern recognition
- Other disruption technologies

# Improving GPF Capabilities for COIN and Irregular Warfare

## ■ Challenges

- Providing enhanced force protection – especially in urban areas
- Controlling large, hostile crowds
- Developing relevant skill sets
- Measuring progress

## ■ Potential Technology Areas

- Counters for:
  - Improvised explosive devices (IEDs)
  - Vehicle-borne explosive devices (VBEDs)
  - Snipers
  - Mines
  - MANPADS
- Non-lethals
- High-fidelity modeling and simulation systems
  - Provide realistic COIN training
  - Refine concepts, tactics, techniques, and procedures
  - Analyze social group cohesion and identify leverage points
  - Develop metrics for measuring progress
- Aids for rapid training of indigenous forces

# Shaping the Choices of Countries at Strategic Crossroads: Key Challenges

- Generating survivable, persistent surveillance coverage over an expansive land mass
- Carrying out prompt, global conventional strikes
- Conducting sustained, 24-7, conventional precision strikes over very long distances in a high-end threat environment
- Protecting US space systems and denying adversaries access to space
- Ensuring US undersea superiority
- Conducting large-scale, SOF-intensive war in an anti-access environment

*Goal is to shape – shift investment, impose costs, and complicate planning – in addition to deterring/defeating a future potential adversary*

# Survivable, Wide-Area Persistent Surveillance

## ■ Challenges

- Evading detection and attack by current and projected IADS
- Finding & tracking mobile targets (missile launchers)
- Defeating advanced C3D2 techniques
- LPD/LPI broadband connectivity

## ■ Potential Technology Areas

- Space radar constellation
  - AMTI/GMTI from space
- Stealthy, high-altitude, long-endurance UAVs
  - Near-autonomous operation
  - Broad-spectrum, all-aspect stealth (including visual)
  - Novel propulsion
  - Morphing materials
  - Advanced sensors and automated target recognition
- Laser communications (i.e., TSAT)

# Prompt, Global Conventional Strike

## ■ Challenges

- Striking targets over intercontinental distances rapidly and without warning
  - Launch responsiveness
  - Time of flight
- Compensating for target location error (mobile target problem)
- Defeating hardened and deeply buried targets

## ■ Potential Technology Areas

- Conventionally armed SLBMs
  - Short-term: converted D-5s with GPS-assisted INS and maneuvering RVs
  - Long-term: lower cost system exploiting advances in miniaturization and high-energy density propellants
- Reusable SLVs and common aero vehicles (CAVs)
- Hypersonic cruise vehicles (space planes)
  - Advanced propulsion and materials

# Survivable, Sustained Conventional Precision Strike

## ■ Challenges

- Overcoming potential lack of close-in bases
  - Political-military coercion / military anti-access threats
  - Limited basing options in western Pacific
- Evading detection and attack by current and projected SAMs and other "area denial" systems
- Penetrating into and maintaining persistent coverage in the interior of a country with enormous strategic depth
- Finding, tracking, and engaging mobile targets
- Defeating hardened and deeply buried targets
- Sustaining a protracted precision-strike campaign

## ■ Potential Technology Areas

- Stealthy, long-endurance UCAVs
  - Near-autonomous operation
  - Broad-spectrum, all-aspect stealth (including visual)
  - Highly efficient supersonic propulsion
  - Morphing materials
  - LPD sensor systems (including AESA)
- Enhanced electronic warfare
- Directed-energy attack and self-defense
- Munitions
  - Super-enhanced HE warheads
  - HPM warheads
  - "Brilliant" loitering PGMs with ATR
  - Deep-earth penetrators
- Stealthy refuelers?

# Space Superiority

## ■ Challenges

- High-fidelity, real-time space situational awareness
- Robust defensive space control
- Assured offensive space control
- Survivable, rapid reconstitution

## ■ Potential Technology Areas

- Space-based space surveillance
- Rapid attack identification, detection, and reporting
- Passive satellites defenses
  - Stealth, miniaturization, and networking
  - Increased on-orbit agility (and on-orbit refueling)
  - Shielding, shutters, and baffles
- Active satellite defenses
  - Electronic countermeasures
  - End-game defenses: jamming, HPM, and kinetic
- Offensive space control
  - Jamming, spoofing, and electronic attack
  - Mobile high-energy lasers (HELs)
  - Proximity-operations microsattellites
- Robust, lightweight replacement satellites
- Responsive, dispersed space launch options

# Undersea Superiority

## ■ Challenges

- Increasing size and capability of adversarial SSK/SSN fleets
- Adversarial development and fielding of:
  - UUVs
  - Sensor networks
  - Smart mines
- Potential emergence of disruptive capabilities
  - Very-long-endurance UUVs
- Geographic factors
  - Adversary has extended littoral and direct access to Pacific
  - Bastions
- Growing importance of undersea warfare
  - Anti-surface threat
  - Resource interdiction/security

## ■ Potential Technology Areas

- Undersea communications at depth and speed
- Signature reduction
  - Electric-drive (shaftless propulsion)
  - Active nullification / MEMS
  - New hull designs (sail elimination)
- Enhanced wide-area, distributed ASW
  - Hull-adaptable sonar
  - Rapidly deployable sensor arrays
  - Airborne hyperspectral sensing
  - Remote, ultra-low lighting imaging
- Force multipliers
  - Mission-reconfigurable UUVs and UAVs
  - Novel payload strategies
    - External, hull-conforming weapon storage and launch
    - Buoyant, self-contained capsules for launching a variety of missiles
    - Free-flooding "bomb bays"
  - Towable, undersea strike modules

# Defending the Homeland in Depth / Preventing Acquisition or Use of WMD

## ■ Challenges

- Comprehensive domain awareness
  - Monitor air, maritime, and land approaches
- Securing foreign WMD
- Detecting and interdicting the global movement of WMD
- WMD defense and consequence management

## ■ Potential Technology Areas

- High-altitude airships / long-endurance UAVs
- Database fusion, pattern recognition, and mining
- Shipping-container tracking and integrity-monitoring tools
- Improved CBW sensors with very low "false positive" rates for 24-7 environmental monitoring
- Broad-spectrum antibiotic and anti-viral medicines
- Stand-off WMD detection
- Surety systems
- Enhanced "render safe" capabilities