

# **U.S. BMD Programs**

## Theater Defense

### Lower-tier TMD

- Patriot PAC-3
- Navy Area Theater Defense
- Others: MEADS, Arrow

### Upper-tier TMD

- THAAD (Theater High-Altitude Area Defense)
- Navy Theater-Wide Defense
- Boost-phase concepts (airborne or space-based laser, KKV on UAV or fighter)

## Strategic Defense

- “3 plus 3” NMD program

## Advanced Sensors

- Space-Based Infrared System (SBIRS)
- Space and Missile Tracking System (SMTS)

# Lower-Tier TMD Systems

## Patriot PAC-3

- Replace Patriot missile with ERINT missile with hit-to-kill interceptor
- Defended area 5–10x larger than PAC-2

## Navy Area Theater Defense (“lower tier”)

- Modified Standard anti-aircraft missile
- Protect ports, coastal airfields, U.S. forces
- Defended area similar to PAC-3
- To be deployed on 50 AEGIS cruisers beginning in 2001; ≈35/ship

## Medium Extended Air Defense System (MEADS)

- Replacement for Hawk, Patriot; mobile, 360° air/missile defense for maneuver forces
- Joint program with Germany, Italy
- Deployment decision 2003–05

## Arrow

- Joint U.S.–Israeli program; high-speed endo

## Upper-Tier TMD

### Theater High-Altitude Area Defense (THAAD)

- mobile, ground-based system
- high endo- and exo-atm. hit-to-kill intercept
- program stretched out; all 3 failed tests
- U.S.–Russian ABMT agreement
  - interceptor: 3 km/s max. speed
  - target: 5 km/s, 3500 km range
  - CBMs: data, notifications, deployments

### Navy Theater-Wide Defense (“upper tier”)

- Standard missile w/booster; AEGIS radar
- LEAP kill vehicle: exo-intercept
- Other missiles, KVs under consideration
- Congress trying to accelerate
- Both intercept tests failed
- No agreement on ABMT compliance

## TMD Boost-phase concepts

- Air-borne Interceptor (ABI) on F-15 or UAV
  - Most mature concept
  - \$25 million/yr
- Air-borne Laser (ABL) on Boeing 747
  - 3 MW Chemical O-I Laser (COIL)
  - $\approx$ 400 km range; fuel for  $\approx$ 40 shots
  - \$100 million/yr (highest funding)
  - \$5 billion to deploy 7 ABL in 2006–08
- Space-based Laser (SBL)
  - \$30 million/yr
  - clearly violates ABMT

# National Missile Defense (NMD)

- Under pressure from Congress, administration developed “3 plus 3” plan in 1996
- During next three years (96–99), develop system capable of intercepting  $\approx 5$  ICBMs
  - 20–100 GBIs with EKV (intercept test in 98)
  - GBR at Grand Forks (testing to begin in 99)
  - 5 upgraded EWRs and new radar in Alaska
  - “intended” to be ABMT compliant
- If warranted by threat, deploy system during next three years (by 2003); cost:  $\approx$ \$10 billion
- If not, continue development and testing of system to permit deployment in three years
- Army, Air Force, and BMDO have proposed systems they claim could be deployed sooner, cheaper; system based on NUT also discussed
- Republican alternative: require 50-state defense by 2003 with more layers added later; CBO estimate: \$30–60 billion, plus \$2–4 billion/yr

# Advanced Space Sensors

## Space-Based Infrared System (SBIRS)

- four satellites in GEO, two in elliptical polar orbits to replace DSP, HERITAGE
- deployment beginning in 2002
- life-cycle cost: \$12 billion

## Space and Missile Tracking System (SMTS)

- formerly “Brilliant Eyes”
- ≈24 satellites in LEO
- SWIR for boost-phase, LWIR for RVs in mid-course
- test satellite in 1999; IOC 2008
- Congress increased budget from \$115 to \$250 million; 2003 IOC.
- Deployment cost: ≈\$5 billion

## Limited NMD and the ABMT

Can limited, nation-wide NMD be deployed under the ABMT?

Treaty permits 100 interceptors at a single site, but...

- only for defense of an “individual region”
- Treaty prohibits “defense of territory” or providing a “base for such a defense”
- ABM radars at single site cannot see RVs launched against all U.S. targets; Treaty prohibits “substitutes” (e.g., EWR, SMTS)
- ABM interceptors at single site cannot defend coasts against short-range SLBMs, or Alaska or Hawaii.
- Clinton Administration vetoed “Defend America Act” because it required a 50-state defense, not possible under ABMT

# **Variables Affecting Defended Area**

## Incoming RV

- range (3,500 vs. 10,000 km)
  - speed (5 vs. 7 km/s), angle (40 vs. 22°)
- radar cross section (0.05 vs. 0.005 m<sup>2</sup>)

## Interceptor

- speed (2.6 to 4.5 km/s)
- acceleration (7 to 16 g)
- minimum intercept altitude (40 to 80 km)

## Sensors

- site radar (500 to 750 kW-m<sup>2</sup>)
- DSP satellites: launch-point cueing
- early-warning radar cueing
- SMTS: cueing; control intercept?

## Engagement

- Single-shot or barrage vs. shoot-look-shoot

## Summary of U.S. TMD Programs

System	Quantities			FY97 Funding (million \$)		Life- cycle cost  (billion)	Deployment Date	
	Radars	Launchers	Intrcptrs	Request	Budget		UOES	IOC
PAC-3	56	140	1200	600	600	6.0		'99
NLT	50	50	1800	310	310	5.6	'99	'01
THAAD	14	80	1400	480	620	17.	'98	'06
NUT	50	50	?	60	300	7.6	'02?	?