

Digging for GOLD(en) (DOME)-

Timing Requirements for Advanced Defense Networks

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THE GOLDEN DOME: WHAT IS IT?

Strategic National Defense Initiative (E.O. 14186, May 2025)

Comprehensive, multi-layer missile defense system to protect the United States (including AK & HI) against ballistic, cruise & hypersonic weapons threats.

Complex, Interconnected Systems

Integrates multiple systems to detect, respond, and neutralize threats.

Technological Foundations

Leverages advances in communication, timing synchronization, and network topology for resilience.

Implementation Challenges

Understanding technological requirements & implementation strategies are key to realizing the Golden Dome vision by 2029.



Missile threats to the U.S. homeland will expand in scale and sophistication in the coming decade. **China** and **Russia** are developing an array of novel delivery systems to exploit gaps in current U.S. ballistic missile defenses, but traditional ballistic missiles—which are guided during powered flight and unguided during free flight—will remain the primary threat to the Homeland. **North Korea** has successfully tested ballistic missiles with sufficient range to reach the entire Homeland, and **Iran** has space launch vehicles it could use to develop a militarily-viable ICBM by 2035 should Tehran decide to pursue the capability. The majority of systems presented here have nuclear-capable variants.

Depicted are selected missile threats to the Homeland from notional launch points. Missiles from mobile platforms—aircraft, submarines and ships—can penetrate farther should the platform risk a closer approach to the United States. Numbers below are approximate inventory totals with the exception of submarine-launched ballistic missiles.

China Russia North Korea Iran

Intercontinental Ballistic Missile (ICBM)

A ground-based missile with a range exceeding 5,500 km that flies on a ballistic trajectory and is typically armed with a nuclear warhead or warheads. There is no part of the Homeland which cannot be struck by existing ICBMs.

Country	China	Russia	North Korea	Iran
Current	400	350	10 or fewer	-
2035	700*	400*	50	60

Submarine-Launched Ballistic Missile (SLBM)

A ballistic missile, typically carrying nuclear warheads, launched from a submarine. There is no part of the Homeland which cannot be struck by existing adversary SLBMs. Included below are maximum loadout numbers for current and future submarine fleets.

Country	China	Russia
Current	72	192
2035	at least 132	192

*Number includes FOBS

ICBM and FOBS Trajectories



Boosted Hypersonic Weapon

A highly maneuverable system that achieves hypersonic speed (Mach 5+); includes:

Aeroballistic Missile: A type of hypersonic missile carrying nuclear or conventional warheads that can be launched from air, sea, or ground platforms and combines aerodynamic maneuvers with phases of ballistic loft to extend range. Russia can currently strike portions of the Homeland with aeroballistic missiles launched from aircraft, ships, or ground launchers, and will probably add a launch capability from submarines.

Hypersonic Glide Vehicle (HGV): A maneuverable aerodynamic body that is typically delivered by a ballistic missile, achieves sustained hypersonic glide at altitudes of 15-50 km, and glides for at least half of its flight to its target. HGVs can be armed with a nuclear warhead, but China may have deployed a conventional HGV with sufficient range to strike Alaska.

Country	China	Russia
Current	600	200-300
2035	4,000	1,000

Land Attack Cruise Missile

A missile that flies through the atmosphere, potentially with reduced signatures, that can maneuver extensively in flight and be armed with a nuclear or conventional warhead; some may achieve hypersonic speeds. Russia can currently strike large portions of the Homeland with cruise missiles launched from aircraft, ground launchers, ships, or submarines, and China is beginning to field similar capabilities against Alaska, Hawaii, and the U.S. West Coast.

Country	China	Russia
Current	1,000	300-600
2035	5,000	5,000

Fractional Orbital Bombardment System (FOBS)

An ICBM that enters a low-altitude orbit before reentering to strike its target, with much shorter flight times if flying the same direction as traditional ICBMs, or can travel over the South Pole to avoid early warning systems and missile defenses. It releases its payload before completing a full orbit.

Country	China	Russia
Current	-	-
2035	60	fewer than 12



THREAT OVERVIEW

KEY COMPONENTS

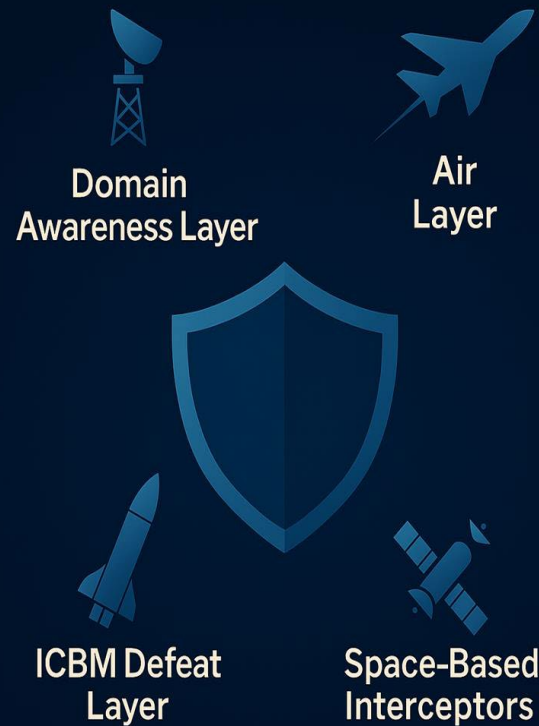
Domain Awareness Layer: Advanced sensors and radar systems. Provides persistent global tracking of all threat types from launch to impact. Proliferated Warfighter Space Architecture (PWSA) constellation

AI Enabled C2: Fusing sensor data, discriminating decoys, assigning interceptors in real time, cross domain AI battle management

Space-Based Interceptors: Intercept threats in space.

Air Layer: Defense against cruise missiles and aerial threats.

ICBM Defeat Layer: Ground-based interceptors: Aegis Weapon System (AWS) (Afloat & Land-based), Terminal High Altitude Area Defense (THAAD), etc.



RESILIENT & ASSURED PRECISE PNT

Importance of Precise Timing

Precise timing ensures coordinated defense operations with sub-microsecond accuracy across all network nodes.

Advanced Timing Technologies

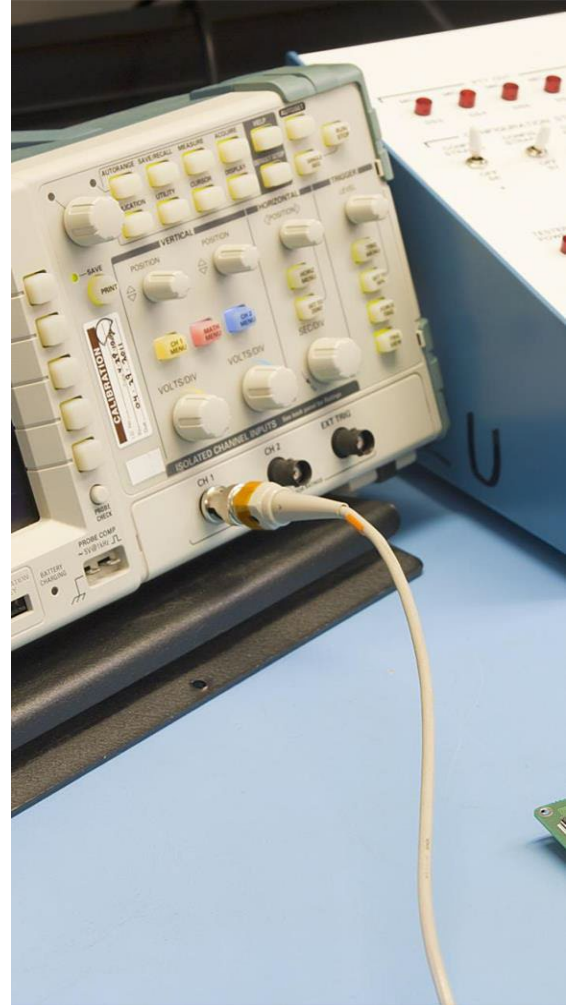
Atomic clocks and GPS-based timing sources provide reliable, consistent time references for the network.

Timing Protocols

Protocols like PTP and NTP maintain synchronization and prevent timing drift in the network.

Strategic Significance

Accurate timing prevents miscommunication and delays, ensuring security and operational success.



NETWORK REQUIREMENTS

High-Speed Secure Communication

The network must support fast, resilient, and secure links for real-time data exchange across multiple nodes.

Scalability and Coverage

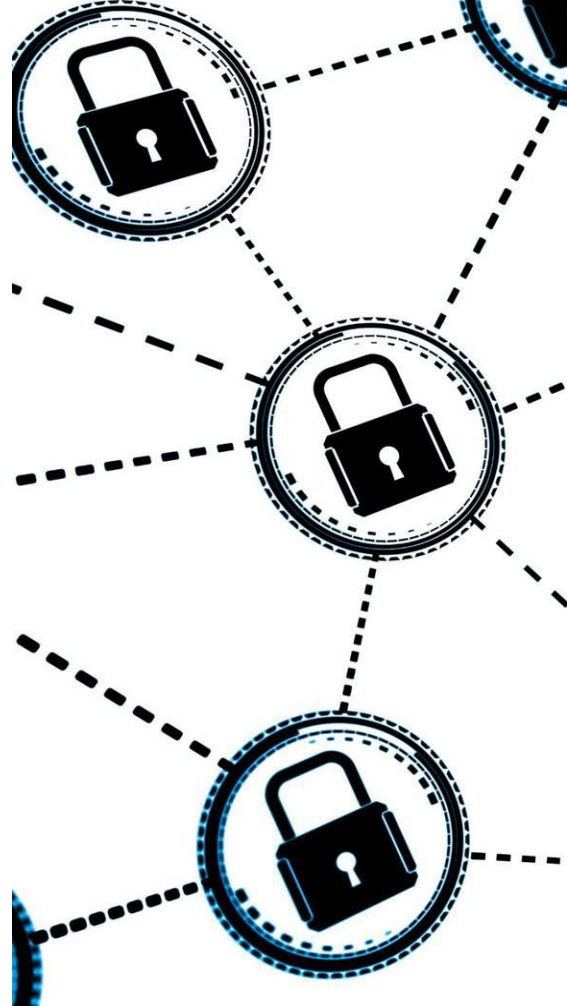
The infrastructure must scale to cover large areas while maintaining consistent network performance.

Redundancy and Fault Tolerance

Redundancy and fault tolerance ensure continuous service despite failures or external disruptions.

Cybersecurity and Integration

Advanced encryption and seamless integration with military and civilian systems protect sensitive data and improve coordination.



NETWORK TOPOLOGY

Hierarchical Network Layout

The network uses a hierarchical layout with central hubs managing regional nodes, enhancing control and local responsiveness.

Mesh Connectivity for Resilience

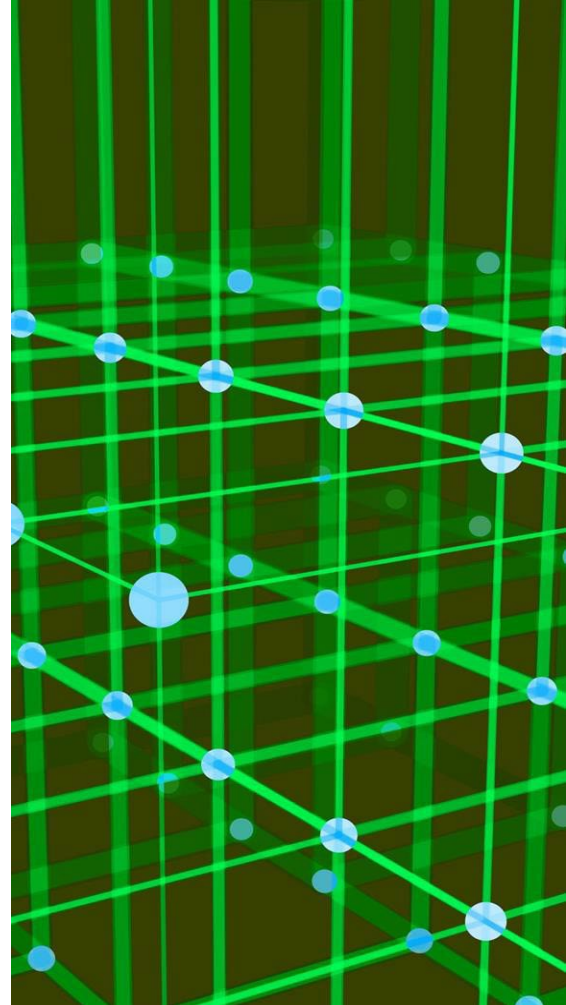
Mesh design provides multiple data pathways, ensuring rerouting and fault tolerance during node failures.

Integration and Interoperability

The topology integrates military and civilian infrastructure for resource sharing and seamless communication.

Dynamic Network Management

Advanced routing protocols and tools monitor performance, detect anomalies, and optimize traffic flow dynamically.



TIMING REFERENCES

Global Positioning System (GPS)

GPS provides high accuracy timing and widespread availability essential for defense network synchronization.

Atomic Clocks for Precision & Holdover

Atomic clocks offer unmatched precision and stability, serving as master time references in defense systems.

Network Time Protocols

NTP and PTP distribute timing information, ensuring synchronization for both general and sensitive operations.

Multi-layered Timing Approach

Combining multiple timing sources and protocols creates a robust, resilient synchronization infrastructure.



WHERE'S THE GOLD?

Overall lead: US Space Force, 4-Star General in charge

Agency/Contract lead: Missile Defense Agency (MDA)

Contract Vehicle: Scalable Homeland Innovative Enterprise Layered Defense (SHIELD)

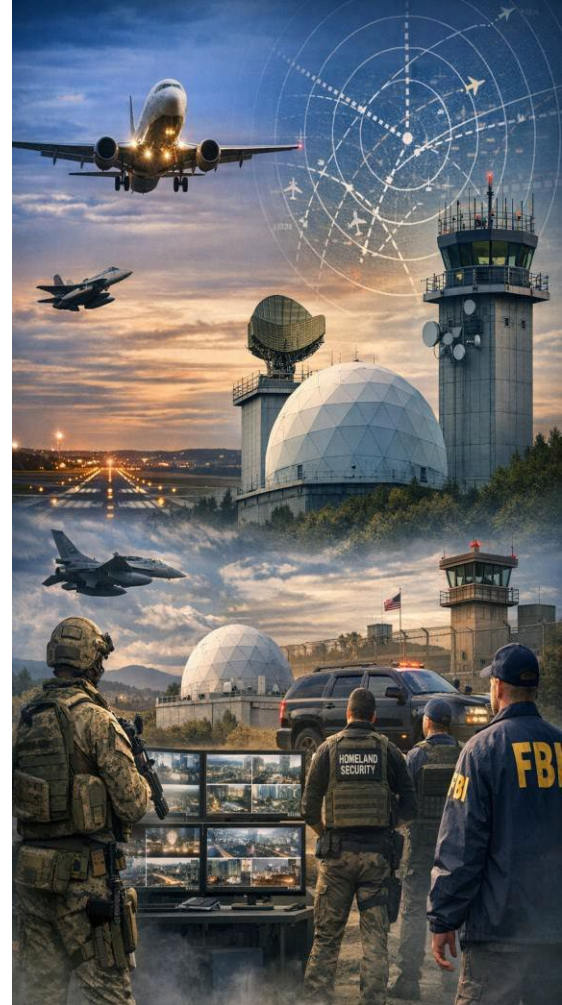
- Multiple award IDIQ
- 10-year POP
- Fast track acquisition
- Supports AI/ML, rapid prototyping, modeling and digital engineering, and faster sensor-to-shooter linkages
- Ceiling: \$151 billion (one of the largest ever)
 - Long term estimates range from \$175 billion to over \$3 trillion
 - \$25-37 billion near-term funding currently in-play

Over **2,400 companies** have been awarded SHIELD contracts or “seats” including large primes, emerging tech firms and aerospace leaders



WHERE TIMING VENDORS FIT

- Golden Dome is not possible without assured, resilient time
- Time = The Invisible Backbone of Golden Dome
- Timing = Combat Effectiveness
- GPS Is Necessary—But Not Sufficient. PNT is NOT optional, it is foundational
- Prime Opportunity Areas for Industry:
 - ✓ High-stability atomic clocks
 - ✓ GNSS-independent and multi-source timing solutions
 - ✓ PTP-optimized timing distribution for space and terrestrial networks
 - ✓ Holdover, monitoring, and timing assurance technologies
 - ✓ Secure time transfer and anti-spoofing solutions
- **Bottom Line: Companies specializing in precise timing and synchronization are critical infrastructure partners whose technology underpins the Golden Dome's ability to detect, decide, and defeat advanced threats at a national scale**



QUESTIONS?



Thank you!

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