

*DETECTING NORTH KOREA: AN
EXAMINATION OF THE EAST ASIAN MISSILE
DEFENSE ARCHITECTURE*

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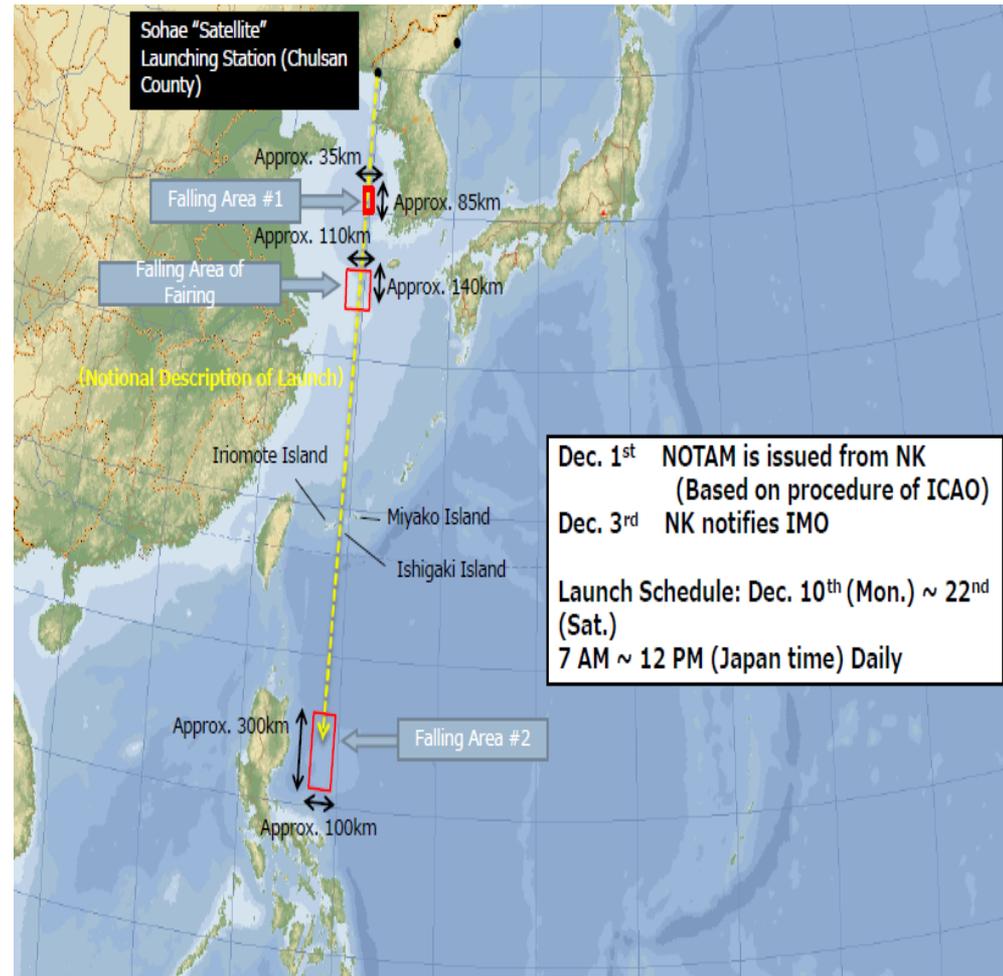
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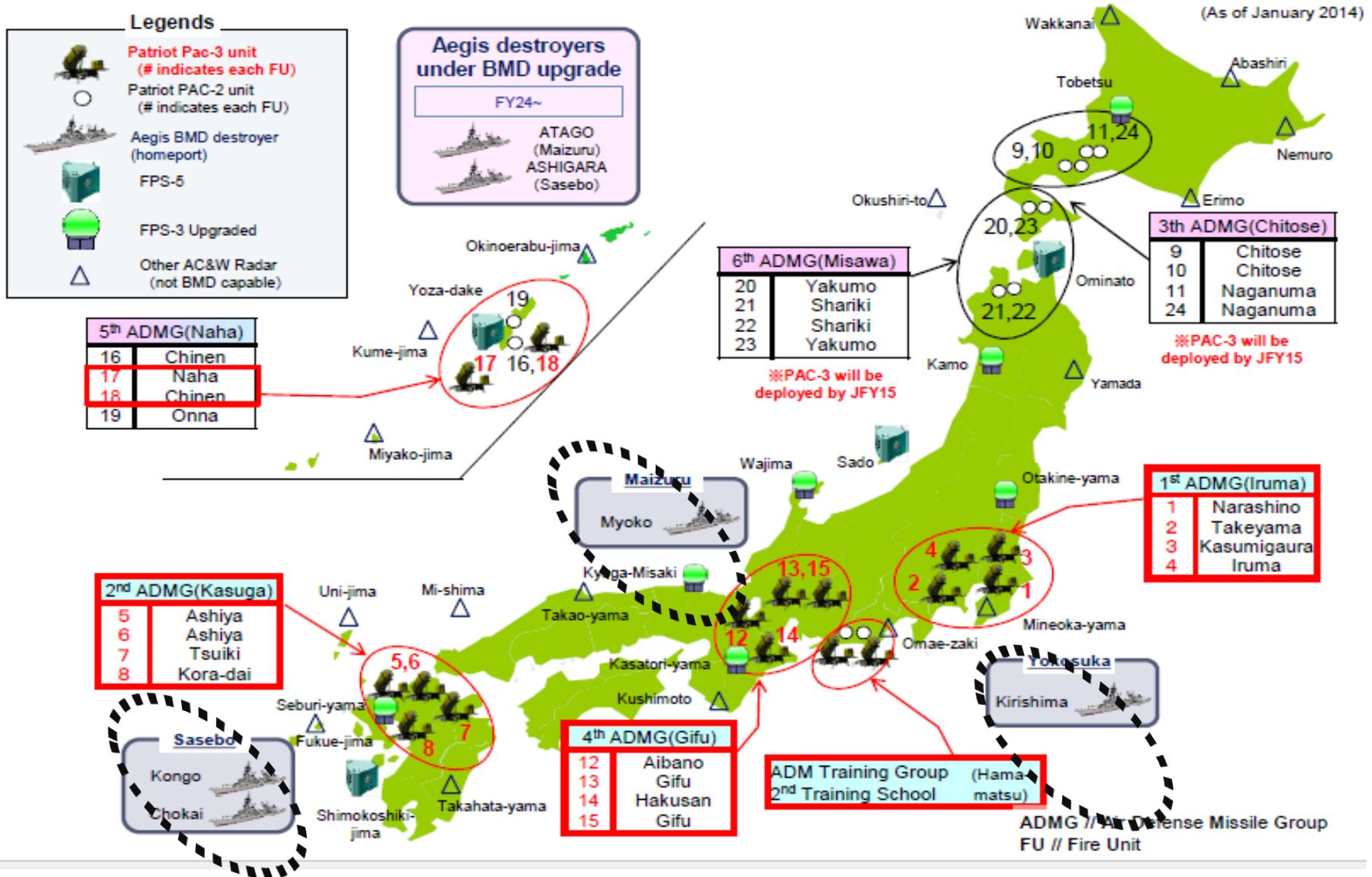
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The Two Crystallizing Events.....

- **May 1993:** DPRK test of medium range Nodong missile fired in the direction of Japan's Noto Peninsula. The missile landed in the Sea of Japan
 - This event led to initial Japanese interest in Missile Defense
- **Dec 2012:** DPRK satellite launch led to the forward deployment of 3 Aegis BMD ship and PAC-3 batteries with termination orders
 - This event was the first time Missile Defense forces were deployed on active duty with termination orders



Current Ballistic Missile Defense Architecture

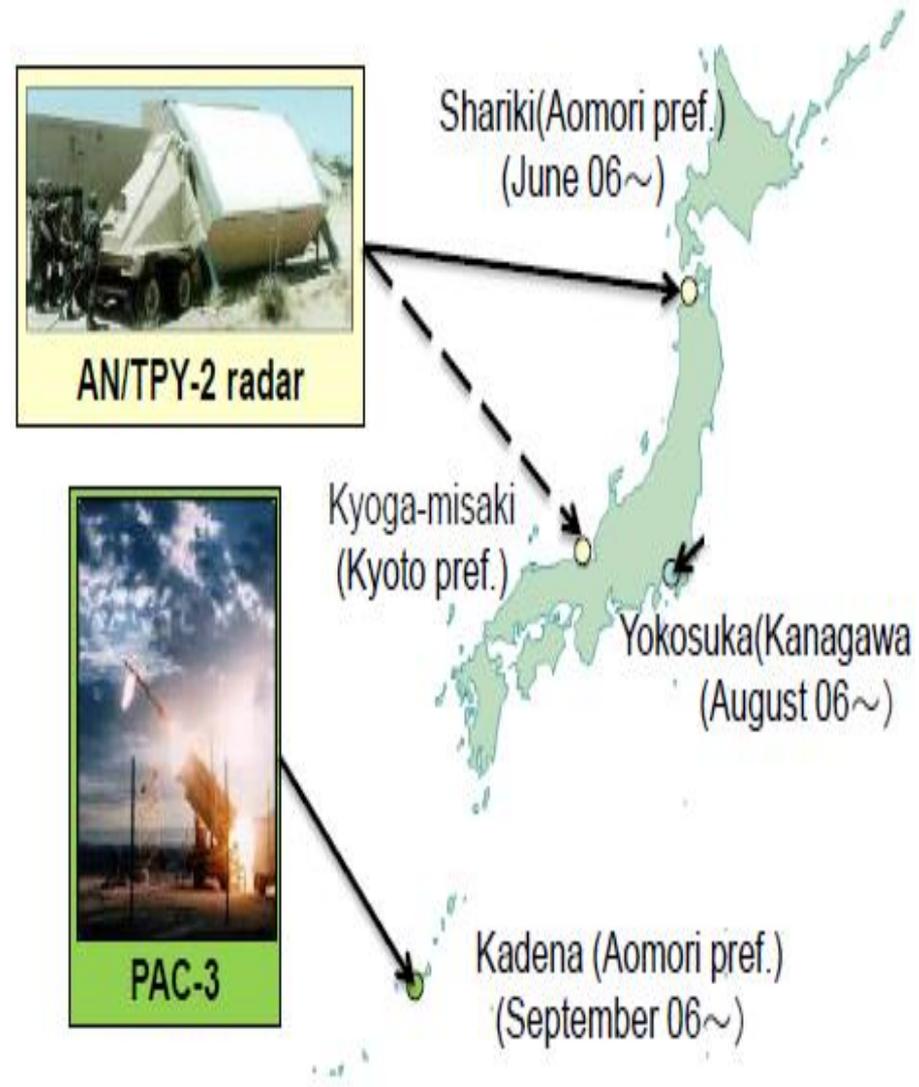


Source: Mai Yaguchi, "Japan's BMD Update," Defense Policy Bureau, Ministry of Defense, Japan, March 19, 2014, <http://www.slideshare.net/RUSIEVENTS/ms-mai-yaguchi>; and Ministry of Defense, "Japan's BMD," Ministry of Defense, Japan, http://www.mod.go.jp/e/d_act/bmd/bmd.pdf

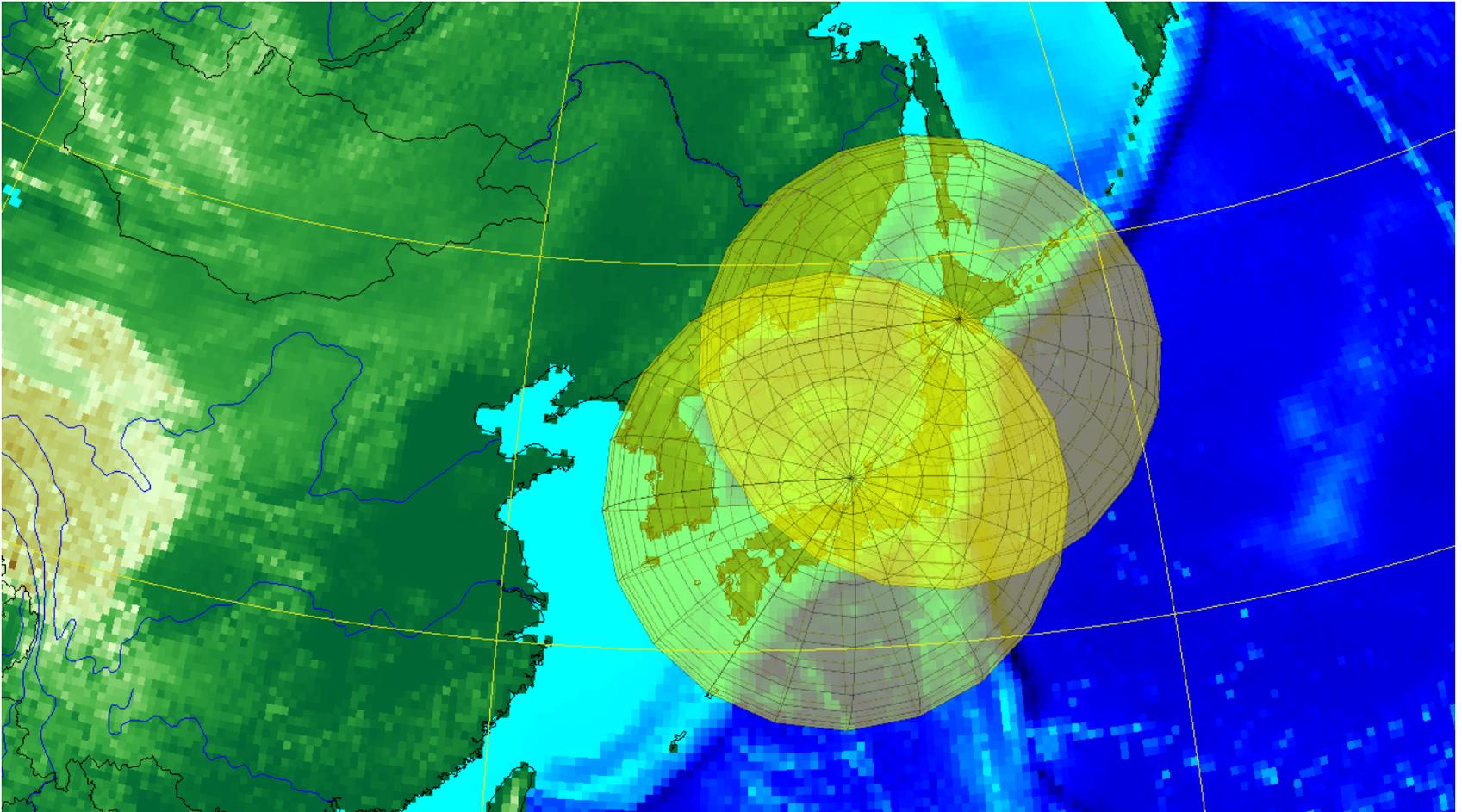
U.S. Assets Contributing to Japanese Defense

U.S. BMD assets have been deployed to Japan over time in a step-by-step fashion to strengthen the security of Japan and the region:

1. **June 2006:** Missile detection radar FBX TPY-2 deployed to Shariki Air Base
2. **August 2006:** USS Shiloh with missile intercept capabilities arrived at Yokosuka naval base
3. **Sep 2006:** PAC-3 battalion deployed to Kadena Air Base at Okinawa
4. **Dec 2013:** Kyoga-Misaki chosen as 2nd site for additional FBX TPY-2 radar



Unique Value of U.S. Assets to Japanese Defense



- *Complete national coverage of Japan provided by U.S. forward based X-Band AN/TPY-2 radars*
- *X-Band radars provide much higher resolution and discrimination of target missile*
- *Japanese missile defense systems might also have access to U.S. early warning satellite data*

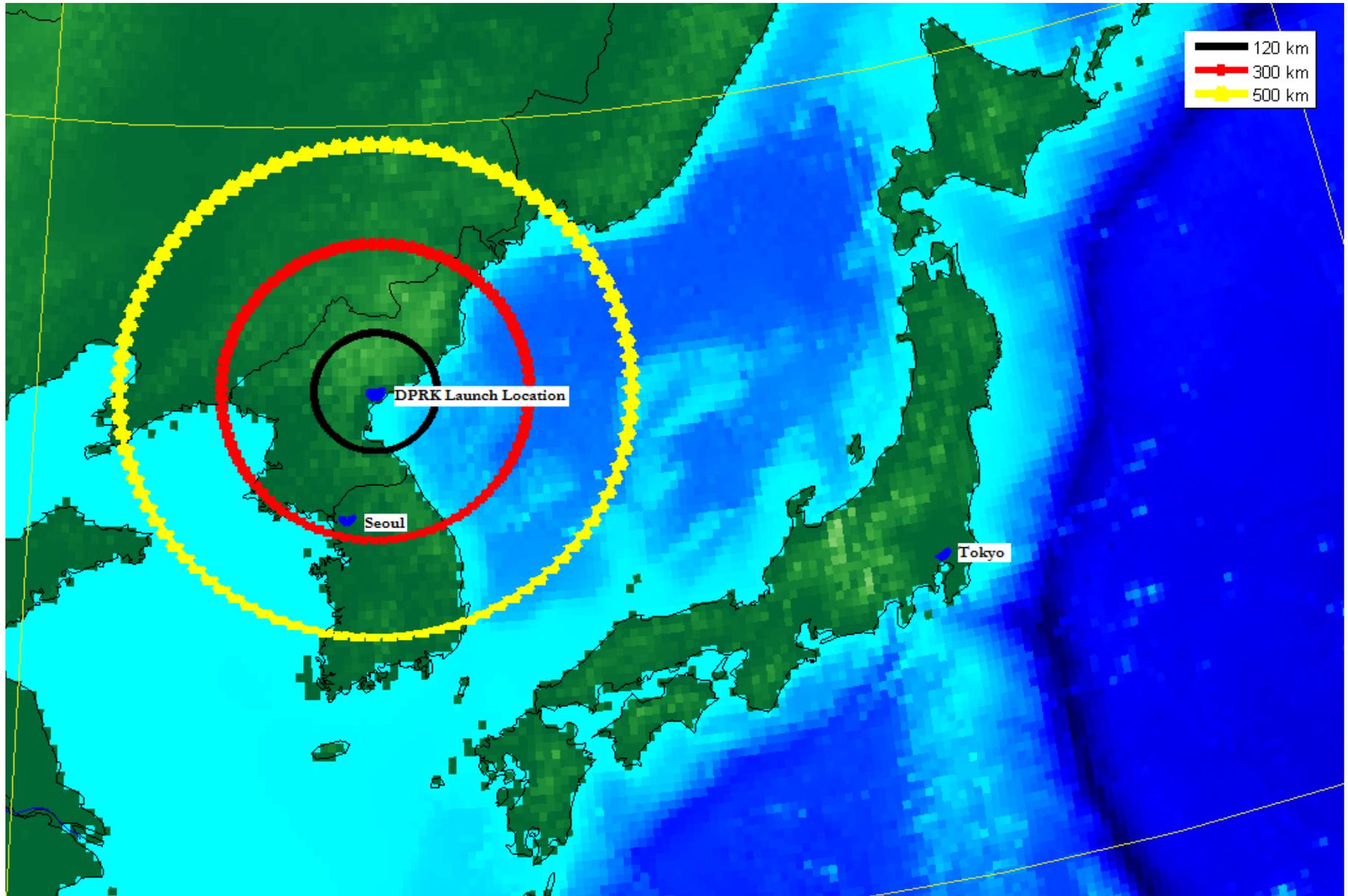
North Korean Missile Capability

Category	Number of Launchers*	Missile	Propellant	Number of stages	Deployment Mode	Max Range (km)
SRBM	Less than 100	Toksa (KN-02)	Solid	1	Road-mobile	120
		SCUD B (Hwasong -5)	Liquid	1	Road-mobile	300
		SCUD C (Hwasong-6)	Liquid	1	Road-mobile	500
IRBM	Less than 50	SCUD D (Hwasong-7/SCUD ER)	Liquid	1	Road-mobile	700-995
		No Dong	Liquid	1	Road-mobile	1,250
		Taepodong-1 (Paektusan-1)	Liquid/Solid	2/3	Road-mobile	1,600+
		Musudan (BM-25/No Dong-B)	Solid	1	Road-mobile	2,500+

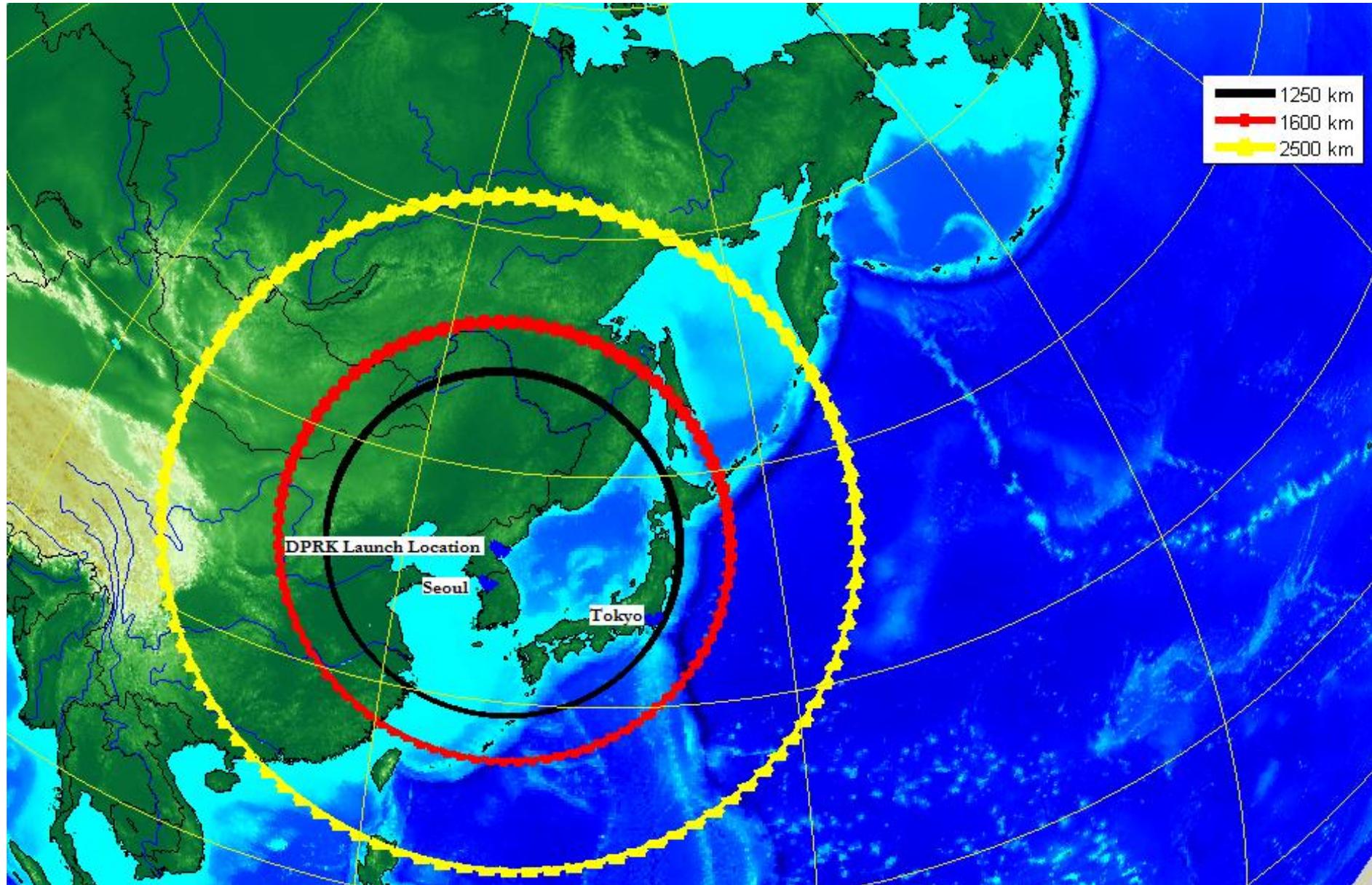
* The missile inventory can be presumed to be larger than the number of launchers. North Korea's current missile inventory is assumed to be around 1,000. Also note that the North Korean has not been subject to rigorous testing.

Source: National Air and Space Intelligence Center (NASIC), "Ballistic & Cruise Missile Threat," NASIC-1031-0985-13, National Air and Space Intelligence Center, Wright-Patterson Air Force Base, OH, 2013; John Schilling and Henry Kan, "The Future of North Korean Nuclear Delivery Systems," US-Korea Institute at SAIS, US, 2015; and Markus Schiller, "Characterizing the North Korean Nuclear Missile Threat," RAND Corporation, Santa Monica, CA, 2012.

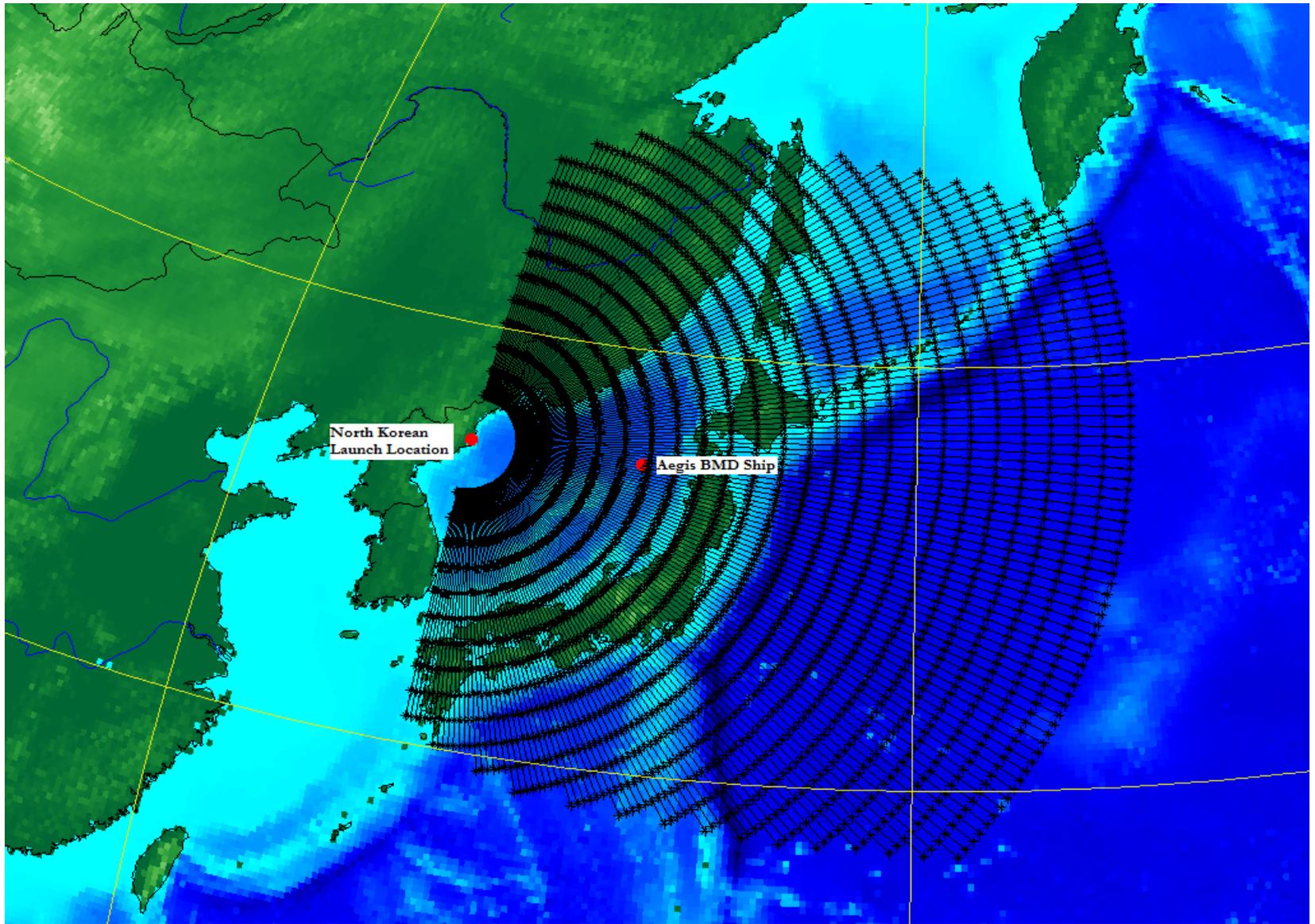
Range of North Korean Short-Range Missiles



Range of North Korean Medium-Range Missiles



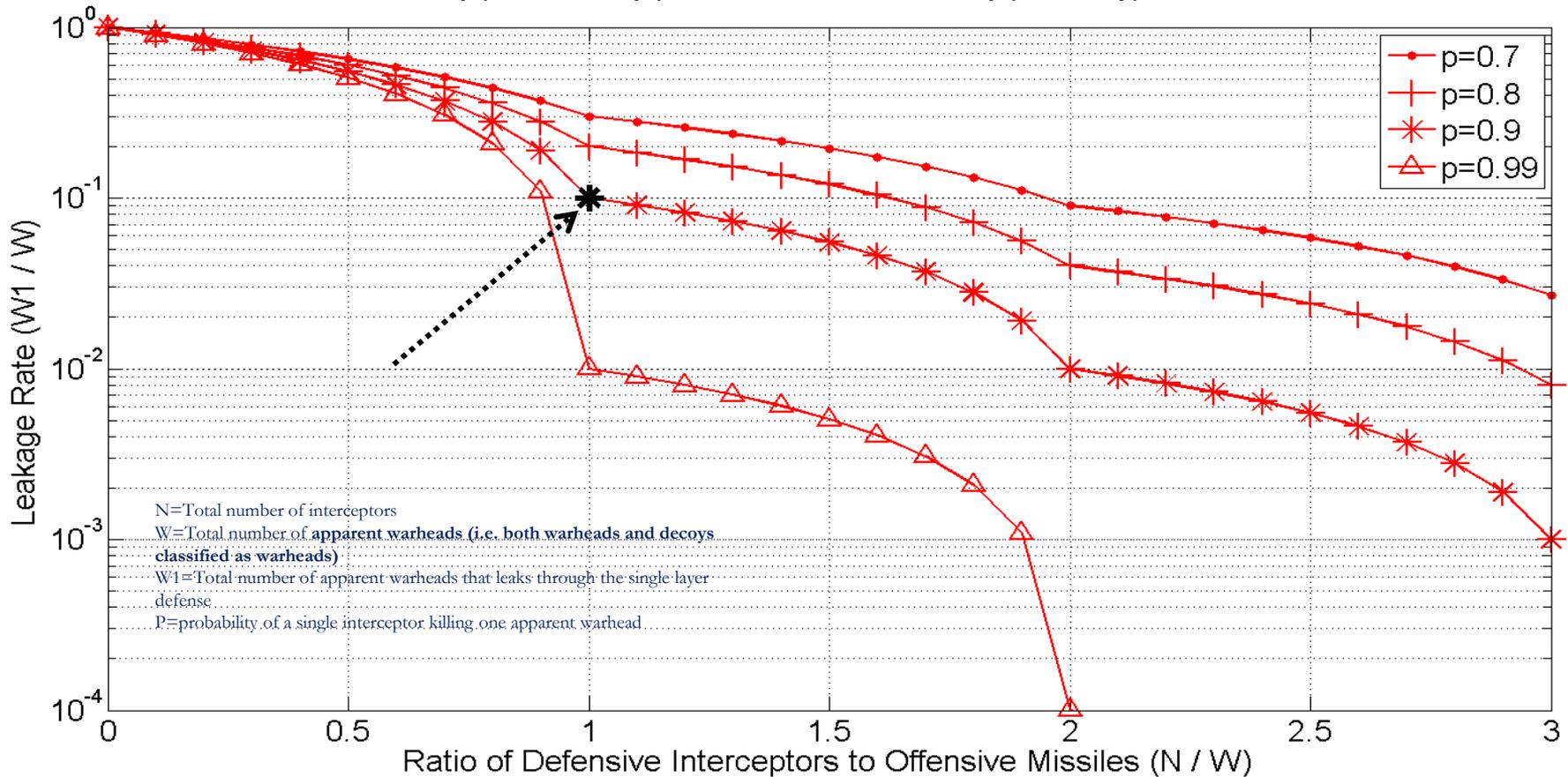
East Asian Missile Defense Effectiveness



180 seconds time delay. No countermeasures. Ubiquitous sensors and persistent tracking after 180 seconds. Flight time of North Korean target missiles varies from 296s (4.94 minutes) to 775.5s (12.93 minutes).

Systems Level Considerations

Barrage Firing Doctrine - Single Layer



- The black marker indicates that when the number of interceptors is equal to the attack size of apparent warheads (i.e. $N/W=1$), 1 in 10 warhead leaks through.
- However, in reality, it is never possible to have a $N/W=1$. A North Korean Scud costs $\sim \$2M$, while a SM-3 interceptor costs $> \$10M$.
- When the number of interceptors is equal to one half the attack size of apparent warheads, more than half the warheads leak through ($W1/W=0.55$).

CONCLUSION

The East Asian joint missile defense system deployed by the U.S. and Japan is very effective at intercepting North Korean missiles

However, against a large number of threat missiles, missile defense might not provide complete protection. Under such conditions, missile defense may not be sufficient

The BMD ships apparently use a legacy configuration that do not allow Aegis combat systems to operate as BMD defense platforms and as anti-air warfare ships simultaneously. Hence, Japan is considering using Aegis-Ashore configuration