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Missile Defence in Cross Domain Competitions

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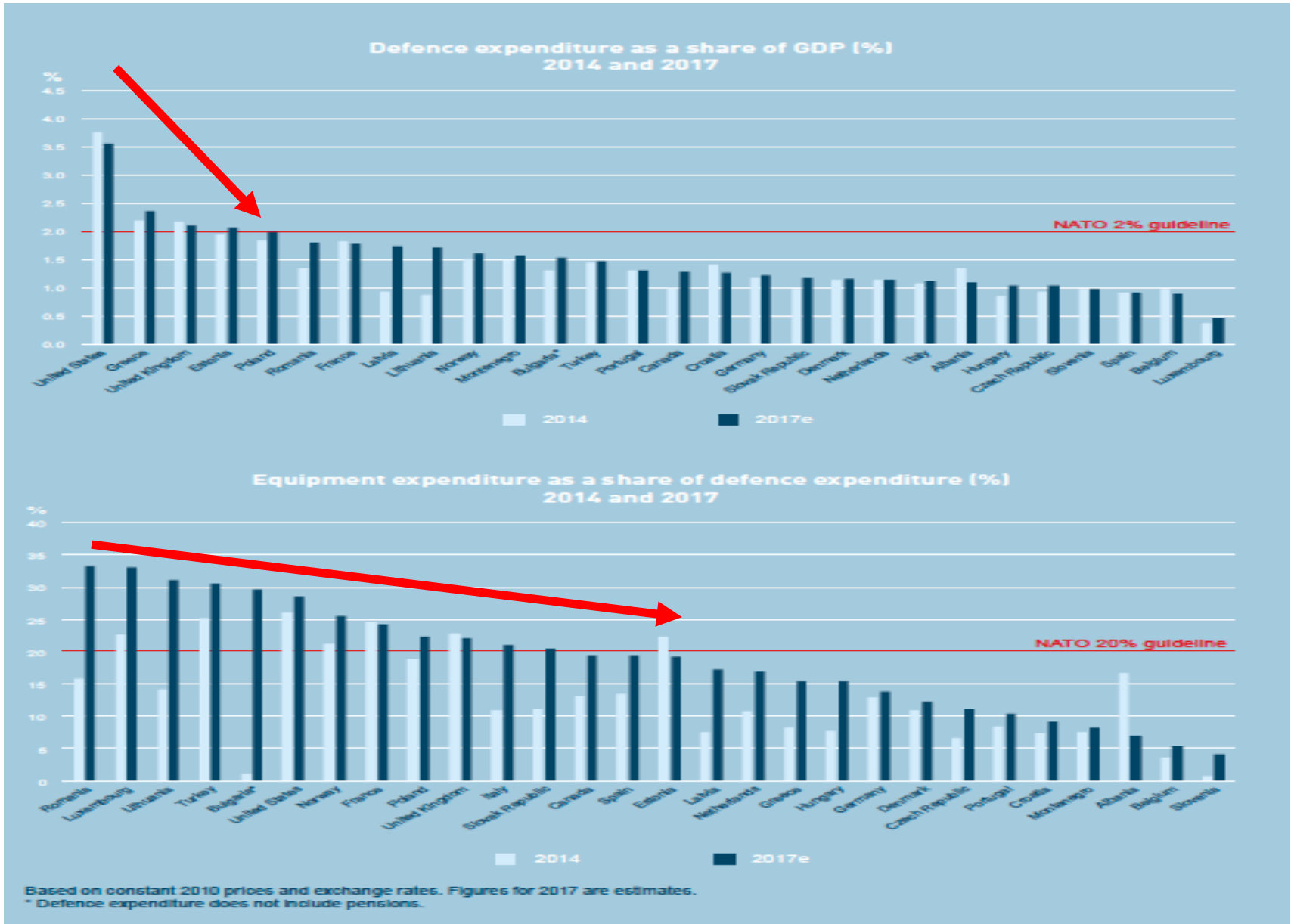
Photo: JACK GUEZ/AFP/Getty Images

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Cross-Domain Cooperation and Competition

- **Budgets and resources – from competition and/or cooperation at tactical level to total budget to percentage of GDP**
 - **“Full spectrum: ”Political, influence, asymmetric, tactical, strategic**
 - **Missile defense vs. readiness, personnel, modernization**
 - **“Joint warfare: ” Missile defense/offensive versus air defense missiles, land forces, air forces, NBC**
 - **Technology and RDT&E – defense vs. offense and competing weapons systems from land/sea/air-based missiles to aircraft, “smart mines,” SAMs, and other systems**
 - **Cyber, electronic warfare, hard kill, EMP**
 - **Civil-military, civil aid**
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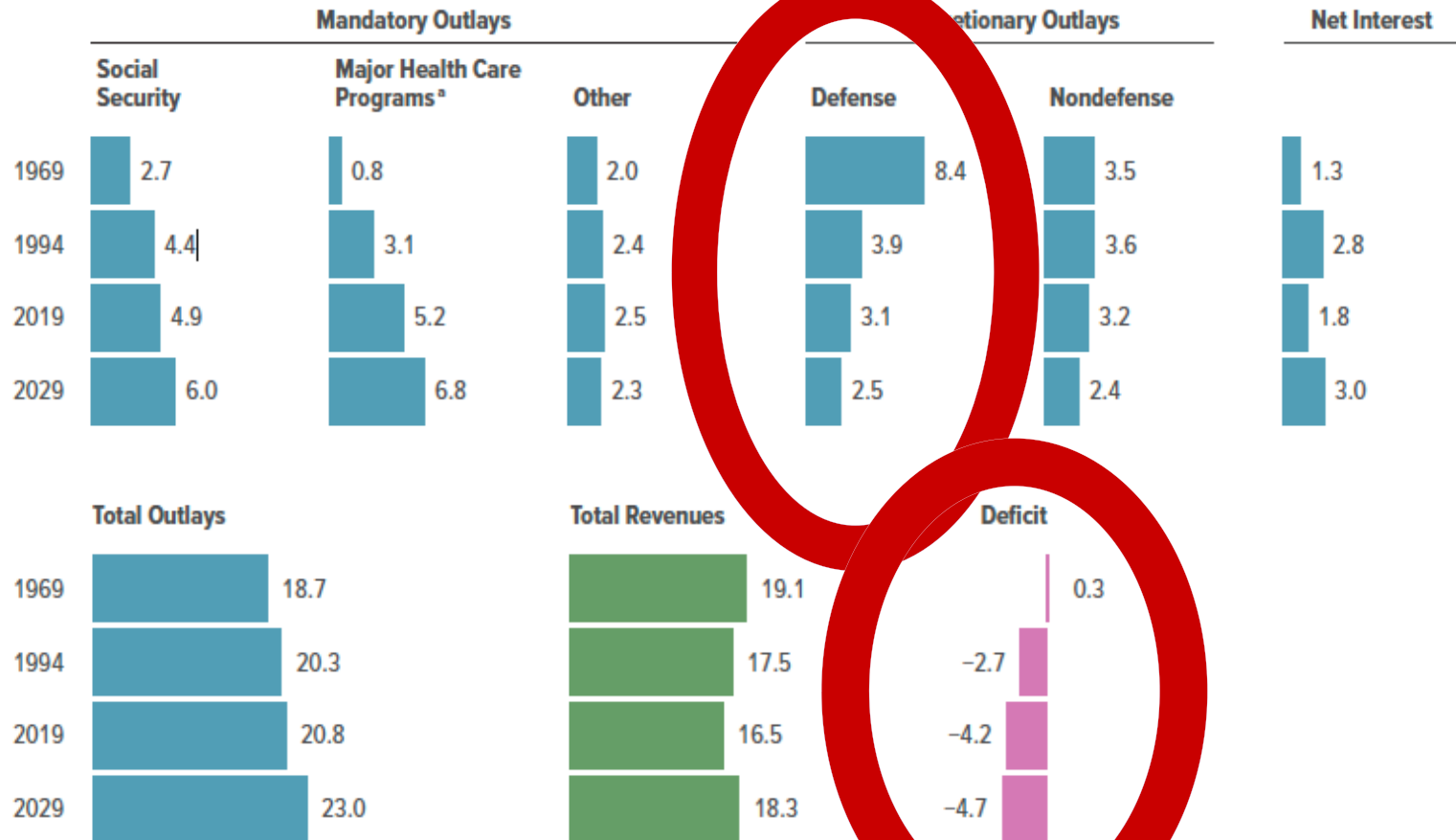
NATO: Less Than 2% Solution



U.S. Budget Squeeze – with No New Post-2019 Contingencies

CBO's Baseline Projections of Outlays and Revenues, Compared With Actual Values 25 and 50 Years Ago

Percentage of Gross Domestic Product



Source: CBO, *The Budget and Economic Outlook: 2019 to 2029*, 1/2019, p. 11

Operational Environments

- **Political leverage, military influence, “countervailing power.**
- **Arms sales and exports**
- **Tactical, strategic, and extended deterrence, containment**
- **Area risk and denial**
- **Low-level asymmetric warfare**
- **Medium intensity conventional conflict**
- **Large-scale theater level “counterforce” exchanges**
- **Large scale- countervalue exchanges**
- **Nuclear, Biological, and/or chemical armed**
- **Strategic counter-force/limited**
- **Strategic all out-countervalue**

Illustrative Wild Cards: Now and When? - I

- **Cost breakthrough – e.g. combined SAM/BMD**
- **“Countervailing power:” low cost and destabilizing counter-deployments, asymmetries, pressures, systems.**
- **Hypersonic**
- **Directed energy/lasers/HEP/rail guns**
- **Space-based sensors/interceptors**
- **Post INF Treaty**
- **Precision**
- **Hand-offs/3rd party transfers**
- **Cruise, UCAV**
- **Pen aids/countermeasures**
- **Volleys/saturation/exchange ratio/stockpile exhaustion**
- **Sabotage, in place covert, special forces raids (Iraqi oil loading points)**

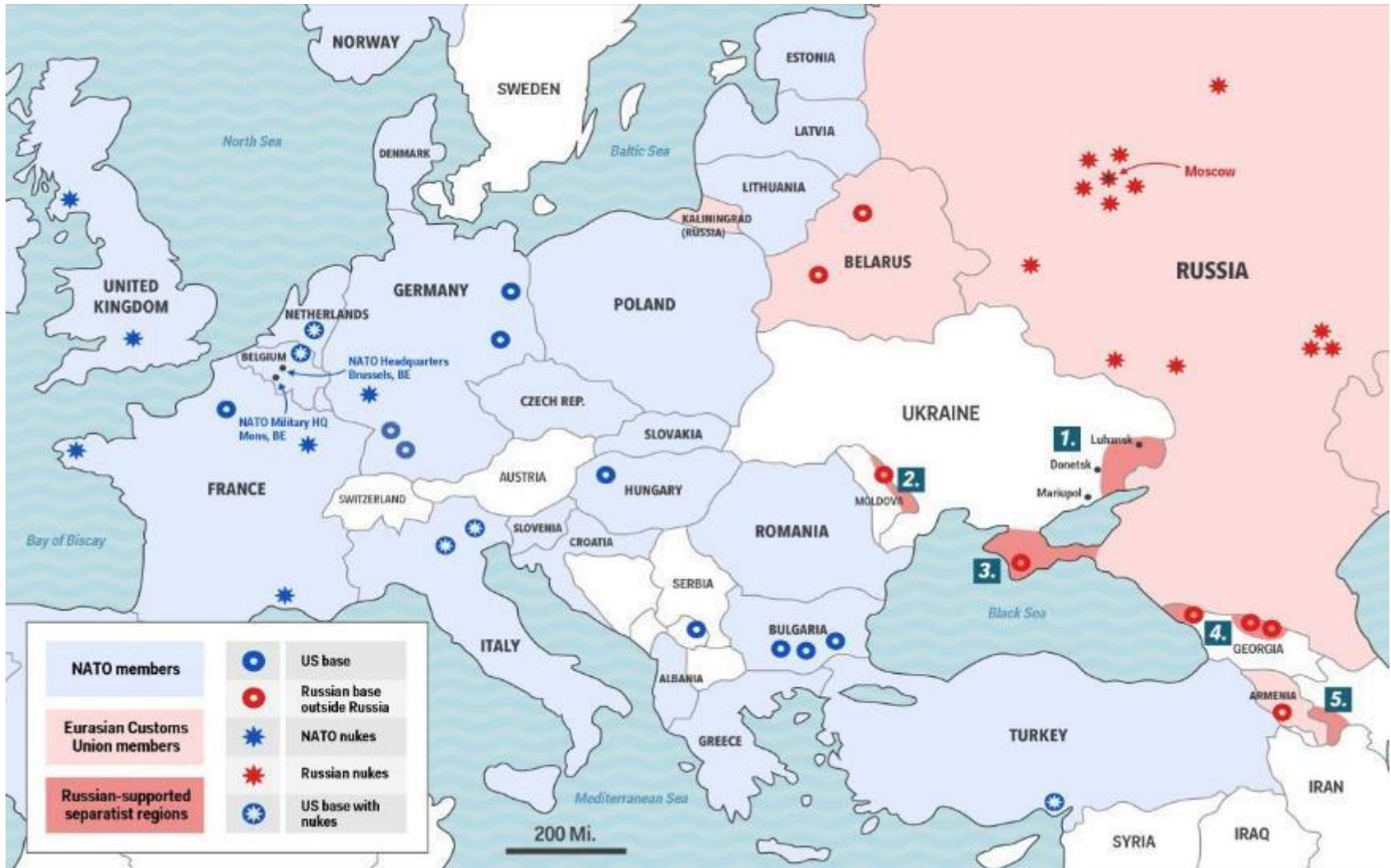
Illustrative Wild Cards: Now and When? - II

- **Layered offense/defense – land, air, sea**
 - **High energy endo/exo weapons**
 - **Weapons of Mass Effectiveness:**
 - **Critical civil targets and weapons of mass effectiveness – desalination/war, power, LOC, refinery, long-lead**
 - **Critical military targets: Carriers (\$6-11 billion), C4I centers**
 - **SMART low-cost systems – mines, torpedoes, air launch, prepo, MANPADs, ATGMs,**
 - **Peacetime targeting/covert GPS lists**
 - **Target long lead-time replacements – Energy, critical systems**
 - **ASAT, dual capable civil satellites (\$billion?) holes in space**
 - **Covertly deployable short-range UCAVs**
 - **Line-source CW/BW cruise missiles and UCAVs**
 - **Third party actors – Terrorist, rebel, hostile state or non-state**
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Key Theaters of Operations

- **NATO – Europe, Atlantic, Mediterranean – *the hard 2%***
- **US-Britain-France and Russia –Key nuclear powers of the past**
- **Asia: Korea, Northeast Asia, Taiwan, South China Sea, 1st and 2nd Island Chain**
- **Arab-Israel (Israel-Hezbollah/Iran, Syria, Iran, Iran (Egypt, other Arab))**
- **Gulf – Air/Naval/Land between Iran and Gulf Arab states, US, UK, France**
- **US, Russia, China – MAD, Counterforce, Countervalue**
- **Space**
- **High technology asymmetric: Missile/ Cyber/ EMP/ Bio/ information**

Forward NATO – Russia - Other



Source: <https://migflug.com/jetflights/nato-and-russia-conflict-map/>

Arab/Persian Gulf Desalination

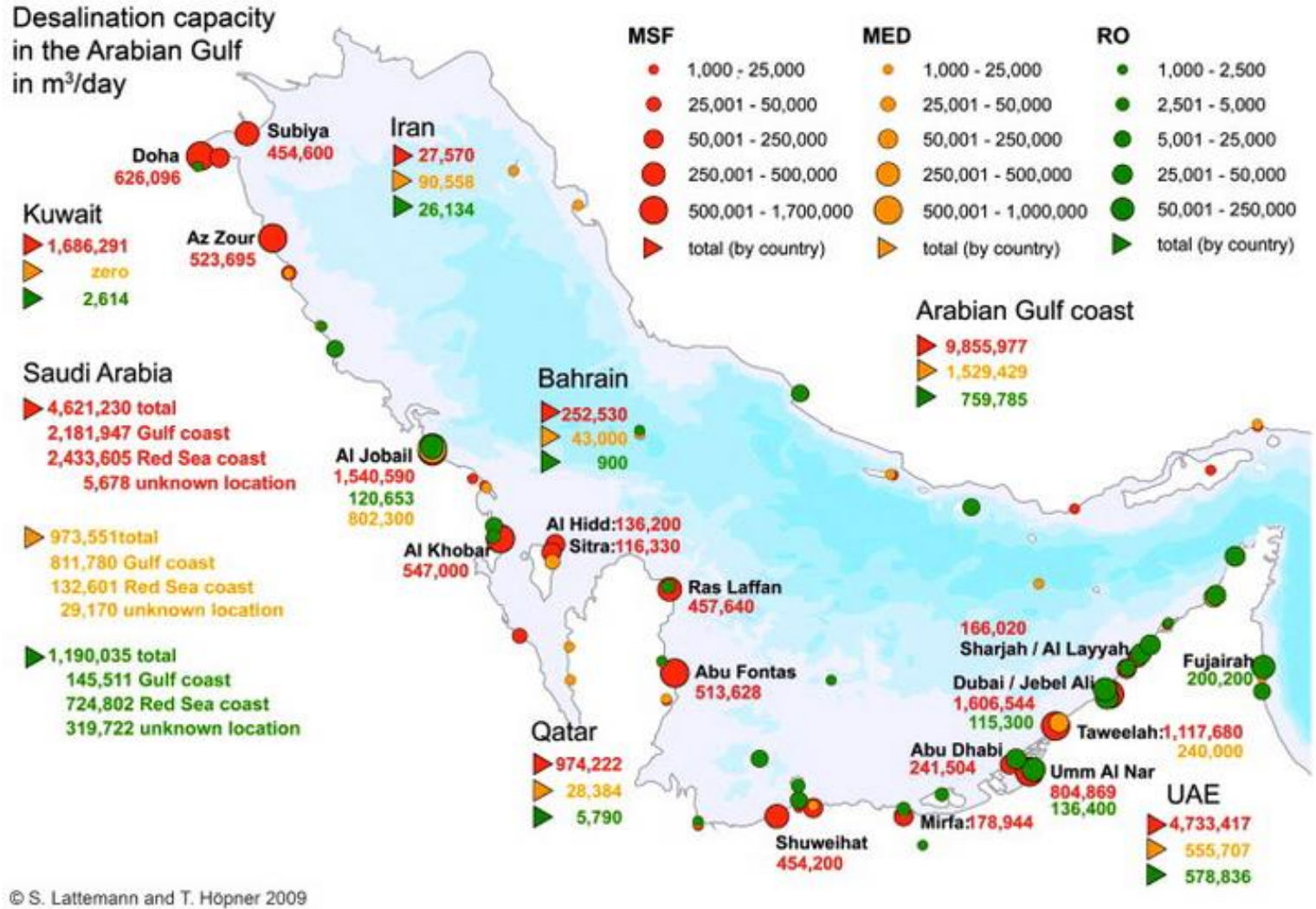
1,483 water processing units or 57.9% of global capacity

85%+ pf Kuwait's supply

"Riyadh would have to evacuate within a week... the current structure of the Saudi government could not exist without the Jubail Desalination Plant."

30%+ of UAE

75% of Qatar's use



Multi-stage flash distillation (MSF) is a water desalination process that distills sea water by flashing a portion of the water into steam. **Multiple-effect distillation (MED)** is a distillation process often used for sea water desalination. It consists of multiple stages or "effects". In each stage the feed water is heated by steam in tubes, usually by spraying saline water onto them. Some of the water evaporates, and this steam flows into the tubes of the next stage (effect), heating and evaporating more water. Each stage essentially reuses the energy from the previous stage, with successively lower temperatures and pressures after each one. Additionally, between stages this steam uses some heat to preheat incoming saline water. **RO** is reverse osmosis

Taiwan Straits

CIA Factbook

Population is 23,545,963 (July 2018 est.)

Urban population is 78.2% of total population (2018)

4.325 million New Taipei City,
2.706 million TAIPEI (capital),
2.19 million Taiyuan, 1.532 million Kaohsiung, 1.283 million Taichung, 836,000 Tainan (2018)



South Korea

CIA Factbook

Population is 51,418,097 (July 2018 est.) Urban population is 81.5% of total population (2018)

...with approximately 70% of the country considered mountainous, the country's population is primarily concentrated in the lowland areas, where density is quite high; Gyeonggi Province in the northwest, which surrounds the capital of Seoul and contains the port of Incheon, is the most densely populated province; Gangwon in the northeast is the least populated.

... 9.963 million SEOUL (capital), 3.467 million Busan, 2.763 million Incheon, 2.221 million Daegu (Taegu), 1.558 million Daejon (Taejon), 1.518 million Gwangju (Kwangju) (2018)



Key Tools

- **RDT&E – Research, development, test and evaluation**
- **Full operational testing – Statistically valid results**
- **Net Assessment with 10-year plus time lines**
- **Gaming and simulation of full spectrum of conflicts – Leverage- asymmetric to full-scale combat**
- **Lifecycle cost modeling – engineering and regression**
- **Force trade-off sensitivity**
- **PPB development**
- **Contract requirements**
- **System architecture development and testing**
- **Exchange ratio sensitivity modeling**
- **Timeline analysis**

Back-Up Slides



IRAN'S BALLISTIC MISSILES

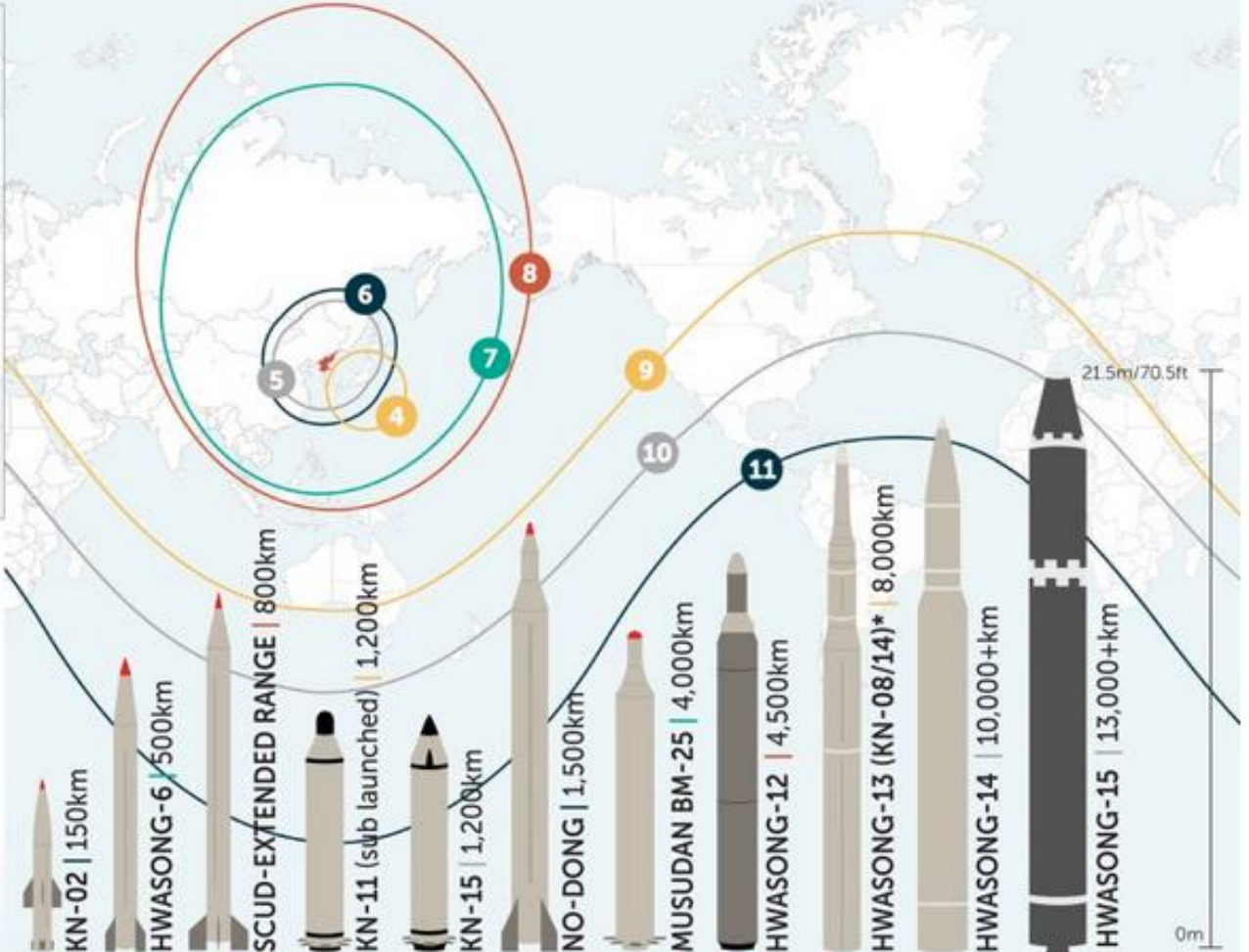


Iran possesses the largest and most diverse missile arsenal in the Middle East, with thousands of short- and medium-range ballistic and cruise missiles capable of striking as far as Israel and southeast Europe. Missiles have become a central tool of Iranian power projection and anti-access/area-denial capabilities in the face of U.S. and Gulf Cooperation Council naval and air power in the region.





NORTH KOREA'S BALLISTIC MISSILES



North Korea's ballistic missile program is one of the most rapidly developing threats to global security. In recent years, an unprecedented pace of missile testing has included new and longer range missiles, sea-launches, and the orbiting of satellites. The most notable of these advances has been North Korea's development of two new intercontinental ballistic missiles, the Hwasong-14 and -15, which can likely reach the continental United States.



*Not yet flight tested.