NUCLEAR WEAPONS AND IRAN

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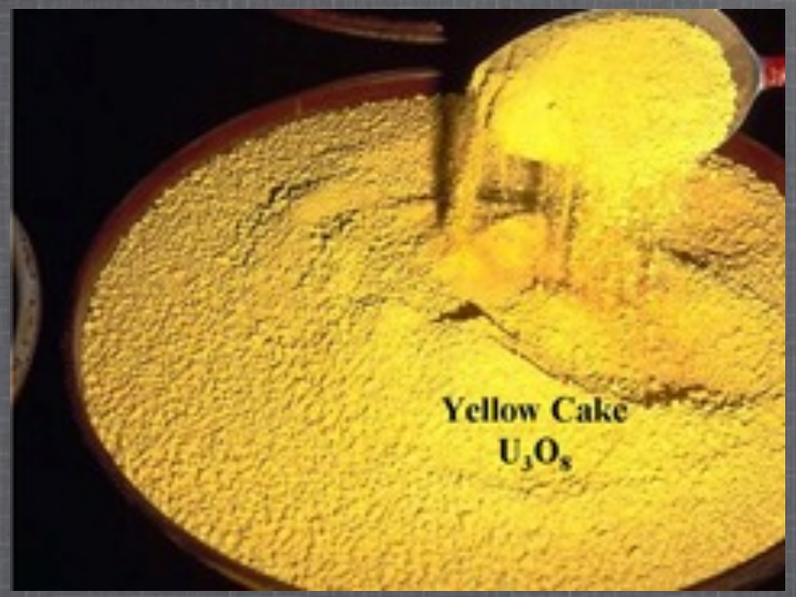
- Uranium enrichment
- Nuclear weapons technology
- Nuclear forensics
- NPT & IAEA
- History of Iran’s nuclear programme
- What do we actually know about Iran’s nuclearisation?
- Pre-emptive strike & regional war
- Can we deter Iran?

GRADES OF ENRICHED URANIUM



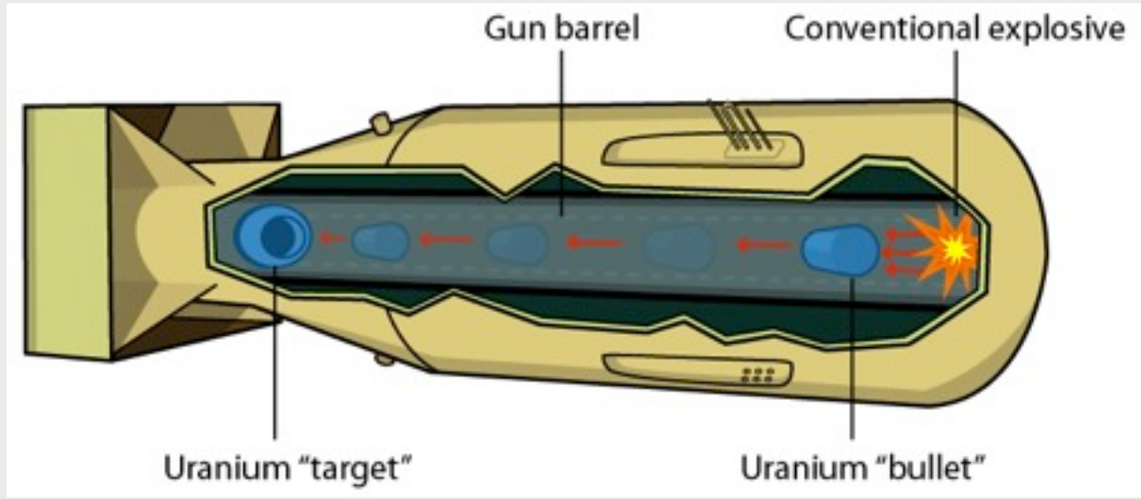
- **NATURAL URANIUM - ~0.7%**
- **SLIGHTLY ENRICHED URANIUM (SEU):**
  - **^{235}U concentration of 0.9% to 2%**
  - **most commonly used as a substitute to natural uranium in heavy water reactors**
- **LOW ENRICHED URANIUM (LEU)**
  - **^{235}U concentration <20%**
  - **the core of a civilian nuclear reactor (LWR) typically required between 3.5 and 5%**
- **HIGH ENRICHED URANIUM (HEU)**
  - **^{235}U concentration >20%**
  - **20-85% weapons-usable grade**
  - **>85% weapons grade**
  - **modern nuclear warhead typically between 85-90%**

URANIUM ENRICHMENT METHODS

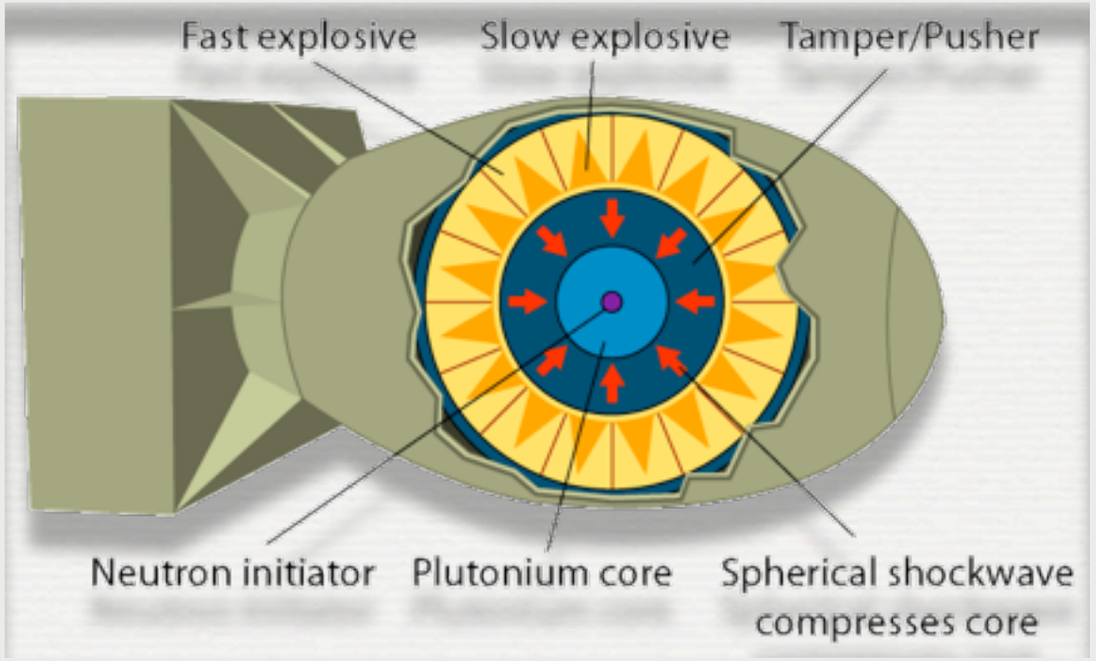
- Expensive & technologically challenging process
- Rely on tiny mass difference between ^{235}U and ^{238}U in gaseous UF_6. Process must be repeated many times.
- **Diffusion** techniques:
  - forcing gaseous UF_6 through semi-permeable membranes
  - Diffusion process very energy-intensive - heat dissipation observed from satellites
- **Centrifuge** techniques:
  - 50 times more energy efficient
  - Centrifuge cascading
  - Precision engineering: rotates at speed of sound.
- **Laser** separation
  - Not licensed for commercial use
  - Even more energy efficiency and lower capital costs
- Enrichment process is same for 5% or >20%. Thus enrichment can always be used for arms programmes...

NUCLEAR WEAPONS TECHNOLOGY

- **Gun type** design:
  - Two masses of fissile material are fired together
  - Create supercritical mass
  - Initiator provides neutron pulse to initiate chain reaction
  - Easier to create, but larger masses required for given energy output



- **Implosion** design:
  - Subcritical fissile material surrounded by explosives
  - Explosion compresses fissile material to supercritical state
  - Initiator is fired providing initial neutron pulse
  - Requires precision to create supercritical state
  - Less fissile material required for given energy



NUCLEAR FORENSICS

- Searching for covert weapons programme is difficult.
- States must notify IAEA of new nuclear projects and designs, or new radioactive material.

- Heavy construction work - underground facilities
- Look for specialised equipment for precision gas centrifuges
- Look for huge thermal power output from gas diffusion enrichment
- Look out for procurement of high grade steel and components
- Site inspections look for radioactive contaminants - can test purity of UO_2 ore (i.e. abundance of ^{235}U)
- Ground penetrating radar - look for hidden structures / equipment
- Examine seismic data - clear signature of nuclear test (e.g. Pakistan 1998)

- Established independently through an international treaty, but reports to the United Nations General Assembly (UNGA) and the United Nations Security Council (UNSC).
- Mission:
  - Peaceful use
  - Safeguards
  - Nuclear Safety
- IAEA Comprehensive Safeguards Agreement - inspection of nuclear sites that handle fissile material (but not military facilities)
- Additional Protocols

TREATY ON THE NON-PROLIFERATION OF NUCLEAR WEAPONS (NPT) - A/RES/2373 (1970)

- *'the dual-use nature of materials and technologies associated with nuclear energy underlies all of the difficulties in regulating nuclear energy'*

  Joyner, D.H. (2011), *Interpreting the Nuclear Non-Proliferation Treaty* (Oxford: OUP), 3.

- 'Atoms for Peace' - US President Dwight Eisenhower
- One of the fundaments of the international legal system
- Only 3 non-signatory states (India, Israel, Pakistan) and 1 withdrawal (North Korea)
- The intended life-time - approx. 25 years, however extended indefinitely in 1995
- Has it failed?

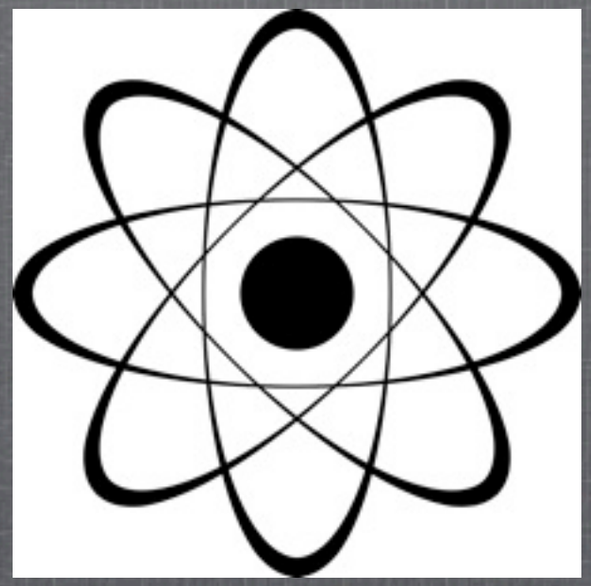
QUESTION…

- **What are the three fundamental pillars of the Nuclear Non-Proliferation Treaty (NPT)?**

THREE PILLARS OF NPT

1. **Encouragement of the peaceful uses of atomic energy**
2. **Prevention of proliferation of nuclear weapons**
3. **Disarmament of existing stockpiles of nuclear weapons**

inherently linked, and presumptively equal



'Nothing in this Treaty shall be interpreted as affecting the inalienable right of all the Parties to the Treaty to develop research, production and use of nuclear energy for peaceful purposes without discrimination and in conformity with Articles I and II of this Treaty'.

NPT, Art. IV (1)

QUESTION...

- **Is the use of nuclear weapons legal under international law?**

LEGALITY OF NUCLEAR WEAPONS USE

- *'the threat or use of nuclear weapons would generally be contrary to the rules of international law applicable in armed conflict, and in particular the principles and rules of humanitarian law. However, ... the Court cannot conclude definitely whether the threat or use of nuclear weapons would be lawful or unlawful in an extreme circumstance of self-defence, in which the very survival of a State would be at stake'*

(ICJ 1996, 44: para. 105E)

- Mere possession of nuclear weapons does not constitute a threat to international peace and security

- Use of nuclear weapons - **legal lacuna**

- Proportionality principle:

'It is scurrilous to argue that it is still forbidden to kill a single innocent enemy civilian with a bayonet, or want only to destroy a single building or enemy territory by machine-gun fire - but that it is legitimate to kill millions of enemy non-combatants and want only to destroy entire enemy cities, regions and perhaps countries (including cities, areas or the entire surface of neutral States) by nuclear weapons'

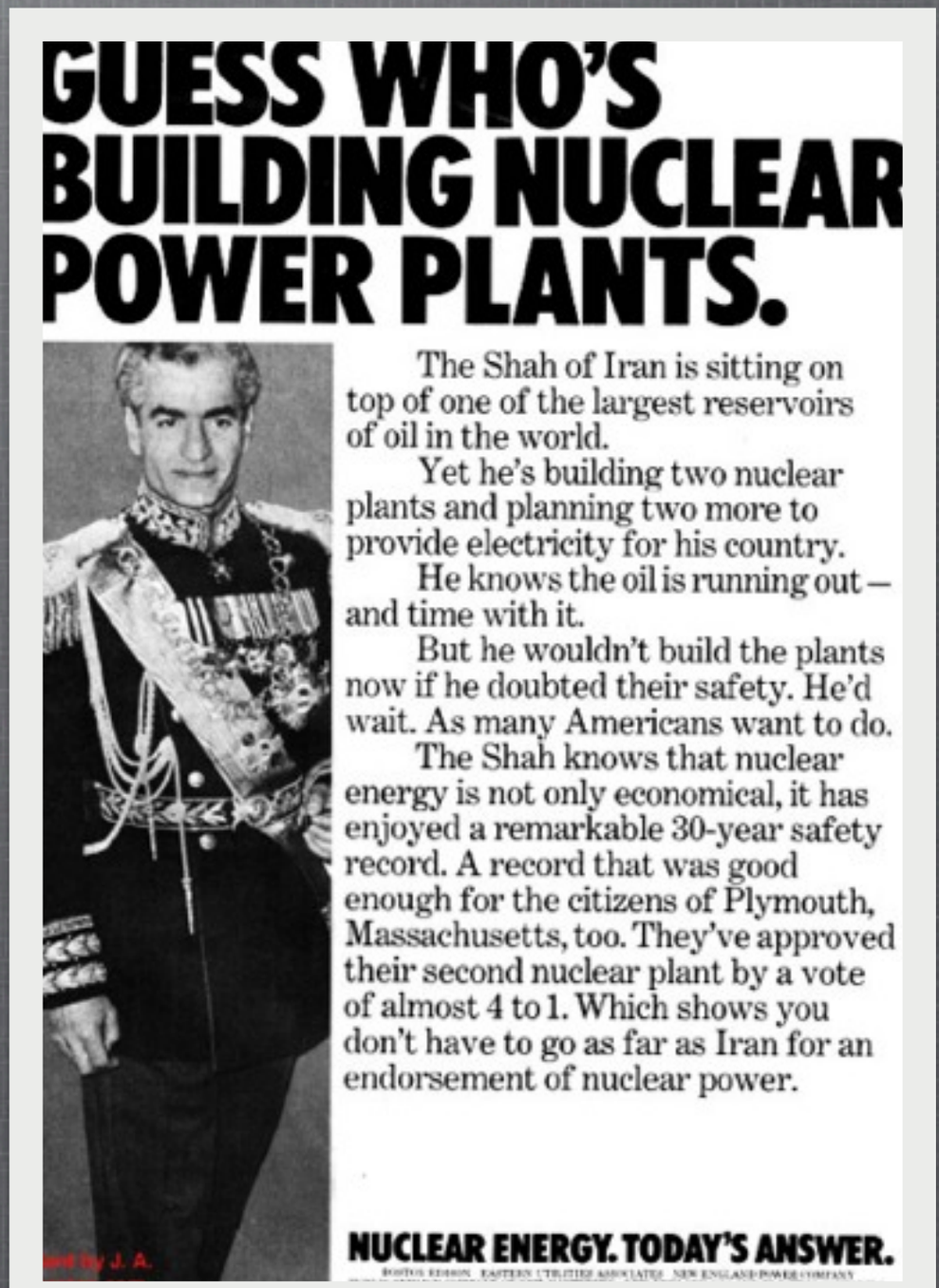
(Fried, J.H.E. (1981), 'First Use of Nuclear Weapons Existing Prohibitions in International Law', Security Dialogue, 12(1): 28)

'… despite the aggravated mutilations we call Hiroshima and Nagasaki ... the world community has yet to enact an explicit treaty or treaty provision prohibiting ... nuclear weapons'.

(Weston, B.H. (1983), 'Nuclear weapons versus international law: A contextual reassessment', *McGill Law Journal*, 28: 542-590, <http://bit.ly/KkElw5>)

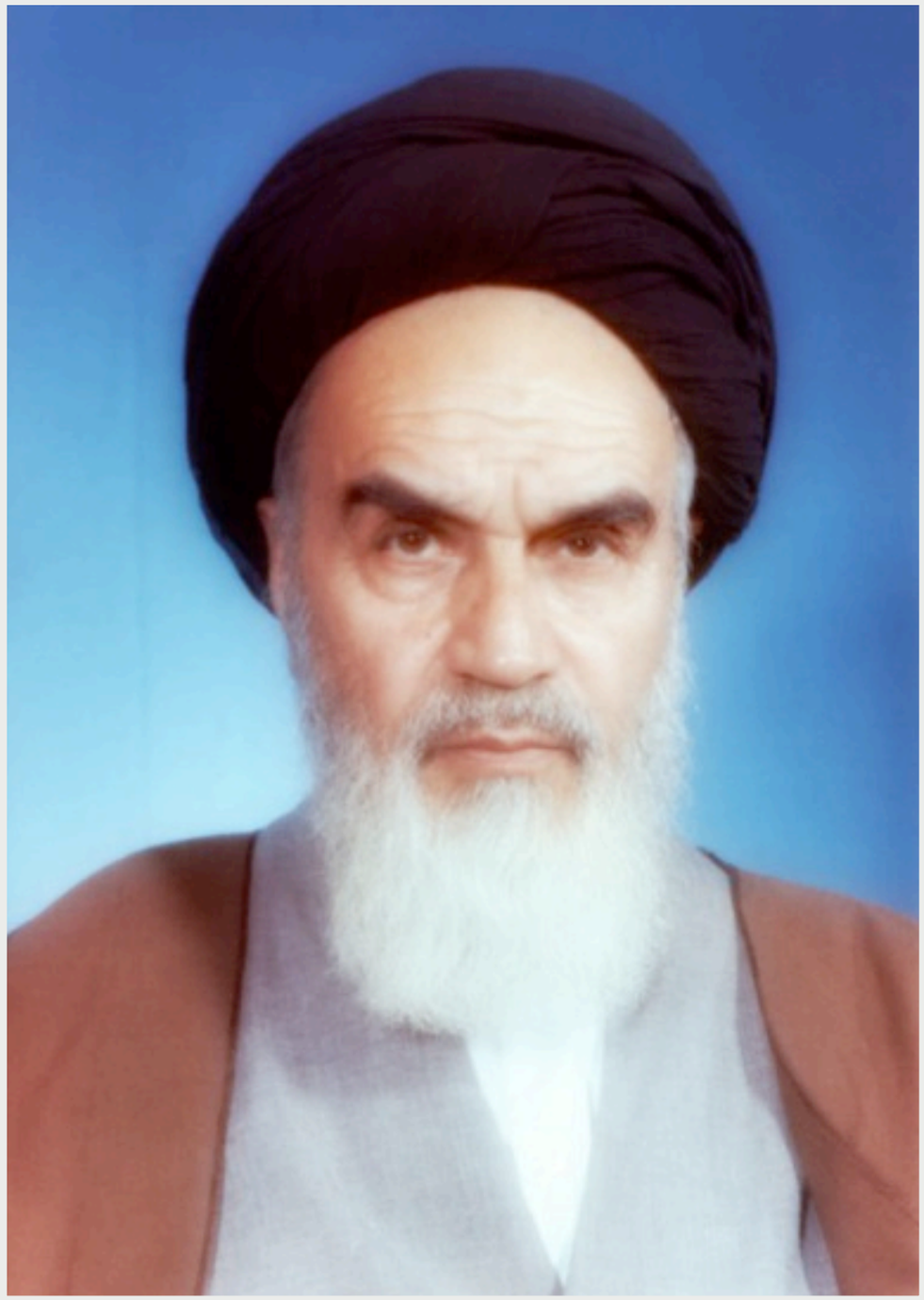
IRAN'S NUCLEAR PROJECT, PART I

- **1957: US-Iran Nuclear Co-Operation Agreement**
- **1959: Groundwork for Tehran Nuclear Research Centre**
- **1970: Signatory of the NPT**
- **1974: Establishment of Atomic Energy Organisation of Iran (AEOI)**
- **June 1974, Paris - M.R. Shah Pahlavi - Iran would acquire nuclear weapons *'without a doubt and sooner than one would think'***
- **1975: Nuclear deals with India, France, Germany**
- **Training in reactor operation agreements with MIT (US), UK, France, Italy, Germany, Canada**
- **Jan/Feb 1979 - Shah overthrown, Imam Khomeini arrives in Tehran**



IRAN'S NUCLEAR PROJECT, PART II

- **1979-1980: The Islamic Revolution of Iran**
- **1979: Suspension of all nuclear projects**
- **1980s: Khomeini's 'neither East nor West'**
- **1980-1988: Iran-Iraq war**
- **mid-1980s onwards: reach out to USSR/Russia, China, Pakistan (A.Q.Khan)**
- **1988: *'We should fully equip ourselves both in the offensive and defensive use of chemical, bacteriological and radiological weapons'* - Hashemi Rafsanjani**
- **2002: clandestine nuclear sites in Natanz and Arak revealed**
- **2003: structured nuclear weapons programme stopped, Iran signs IAEA Additional Protocols**
- **2003-2005: voluntary suspension of uranium enrichment**
- **2006-2011: UNSC Resolutions against Iran (SCR1696, 1737, 1747, 1803, 1835, 1929, 1984)**
- **2010: Tehran Nuclear Declaration**
- **2012: Advanced US/EU Sanctions Regime**



IRAN'S NUCLEAR FACILITIES

- **NUCLEAR POWER PLANTS:**
  - **Bushehr**:
    - 1st construction started in 1975 (Siemens, Germany)
    - 2,000MW (915MWe), VVER-1000 PWR (Russian)
    - Commissioned - 3 Sept 2011, full capacity - 30 Aug 2012
  - **Darkhovin**:
    - pre-Revolution $2bn contract for two 910MW PWR reactors with Framatome (France) - cancelled
    - 1992 contract with China for two 300MW reactors - cancelled
    - Scheduled for operation in 2016 - the 1st indigenously designed and built nuclear power plant

- **NUCLEAR RESEARCH REACTORS:**
  - **Tehran TNRC** - US-built 1967
  - **Isfahan** - 4 reactors (incl. HWR) supplied mainly by China
  - **Arak IR-40** - Iranian design - HWR - planned commissioning in 2014

QUESTION...

- **Iran's continued interest in Heavy Water Reactors (HWR) has attracted a great deal of concern among the international society.**

- **In what ways does HWR constitute greater proliferation threat than other types of commercially used nuclear reactors?**

NUCLEAR WEAPONS STATE (NWS), OR NOT?

- **1984:**
  - **Jane's Weekly - 'two years away'**
  - **US Sen A. Cranston - 'by 1991'**
- **1992:**
  - **B. Netanyahu - 'by 1995-1997'**
  - **S. Peres - 'by 1999'**
  - **US House of Representatives Rep. Research Committee - '98 per cent certainty that Iran already had all (or virtually all) of the components required for two or three operational nuclear weapons'**

- **1995: US' and Israel's officials - 'by 2000'**
- **2005: Israel's Defence Minister - 'point of no return within 2 years'**
- **2007: Mossad - 'by 2009'**
- **2012: Meir Dagan (fmr chief of Mossad) - '2015, the nearest viable date'**

INTELLIGENCE

- ***'no definitive evidence found to disprove Iran's use of nuclear energy for solely peaceful purposes'***

  Salama, S. & H. Weber (2006) The Emerging Arab Response to Iran's Unabated Nuclear Program, (NTI), http://bit.ly/LzbeaT.

- ***'The information indicates that, prior to the end of 2003 the activities took place under a structured programme; that some continued after 2003; and that some may still be ongoing'* (IAEA 2012, 8).**

- **NIEs from the past few years all confirm the IAEA reports' findings**

- **It is clear the Iranian regime, incl. the Supreme Leader Ali Khamene'i, has not reached a decision to weaponise.**

SITES OF CONCERN 2012

1. **PARCHIN:**

   - Suspicious clean-up operation at the military facility
   - large explosives containment vessel for hydrodynamic experiments
   - site associated with ex-USSR's Vyacheslav Danilenko

2. **FORDOW FUEL ENRICHMENT PLANT (FFEP):**

   - Iran's 2nd enrichment site
   - deep underground facility
   - installed 16 cascades of 174 IR-1 centrifuges and 1 cascade with 52 IR-1 centrifuges (production in only 4 cascades of 174 IR-1 centrifuges enriching up to 20% ^{235}U)
   - IR-1 centrifuges - design from 1970s

PRE-EMPTIVE STRIKE 2012/2013?

But... The war is already happening...

- Iran has not attacked another state for the past two centuries
- 2012 - missed opportunity - strategically too difficult
- Israel to attack independently?
- Surgical strike won't kill the know-how
- The 'Osiraq Effect'
- Iran's own *She'yorim shotkim* doctrine
- No longer just 4/5 remote nuclear sites
- Israeli domestic opposition to pre-emption
- Iran would retaliate against the American bases in the Arabian Peninsula emirates and the Gulf's offshore oil and gas installations risking major global recession.
- Pre-emption risk an all-out regional war

WHAT HAPPENS THE DAY AFTER?

- Nuclear Arms Race? (Saudi Arabia, Turkey)
- Conventional Arms Race
- Nuclear deterrence theory and the ‘new world disorder’
- Stability vs Instability Paradox
- Iran’s support for terrorism

QUESTIONS?