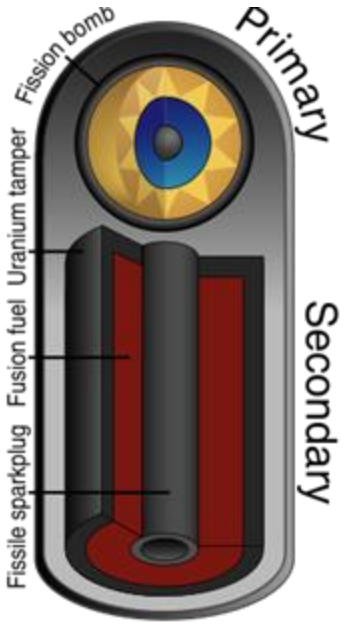
elective

Nuclear weapons, disarmament, and nuclear proliferation.

(6 CFU, II Semester) Prof. F.Forti



The course will provide competence on the structure and working principle of nuclear weapons, on the current state of their deployment, on the treaties that regard nuclear weapons and on the risks that humanity is taking as a consequence of the presence of nuclear weapons.

1. Physical principles of nuclear weapons. Various types of nuclear weapons.
2. Effects of nuclear explosions. Consequences of the use and testing of nuclear weapons.
3. Deployment of nuclear weapons and delivery systems. Treaties to limit the proliferation of weapons and the development of nuclear tests.
4. Relationship between nuclear developments for civilian purposes and nuclear weapons. Possibility of nuclear terrorism. International systems of control.
5. Risks of nuclear use and proliferation. Areas of high nuclear risk.

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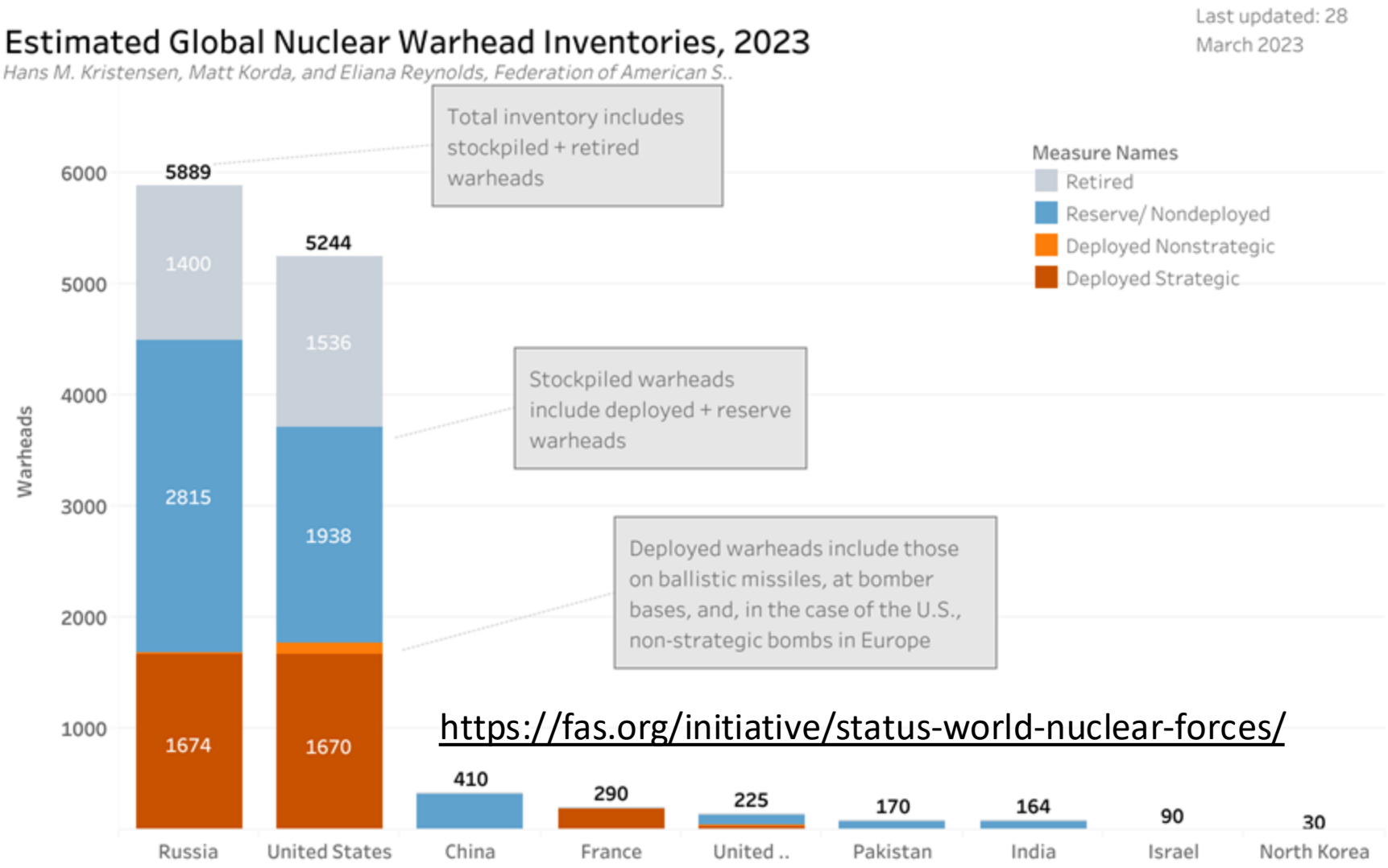
Where are the nuclear weapons



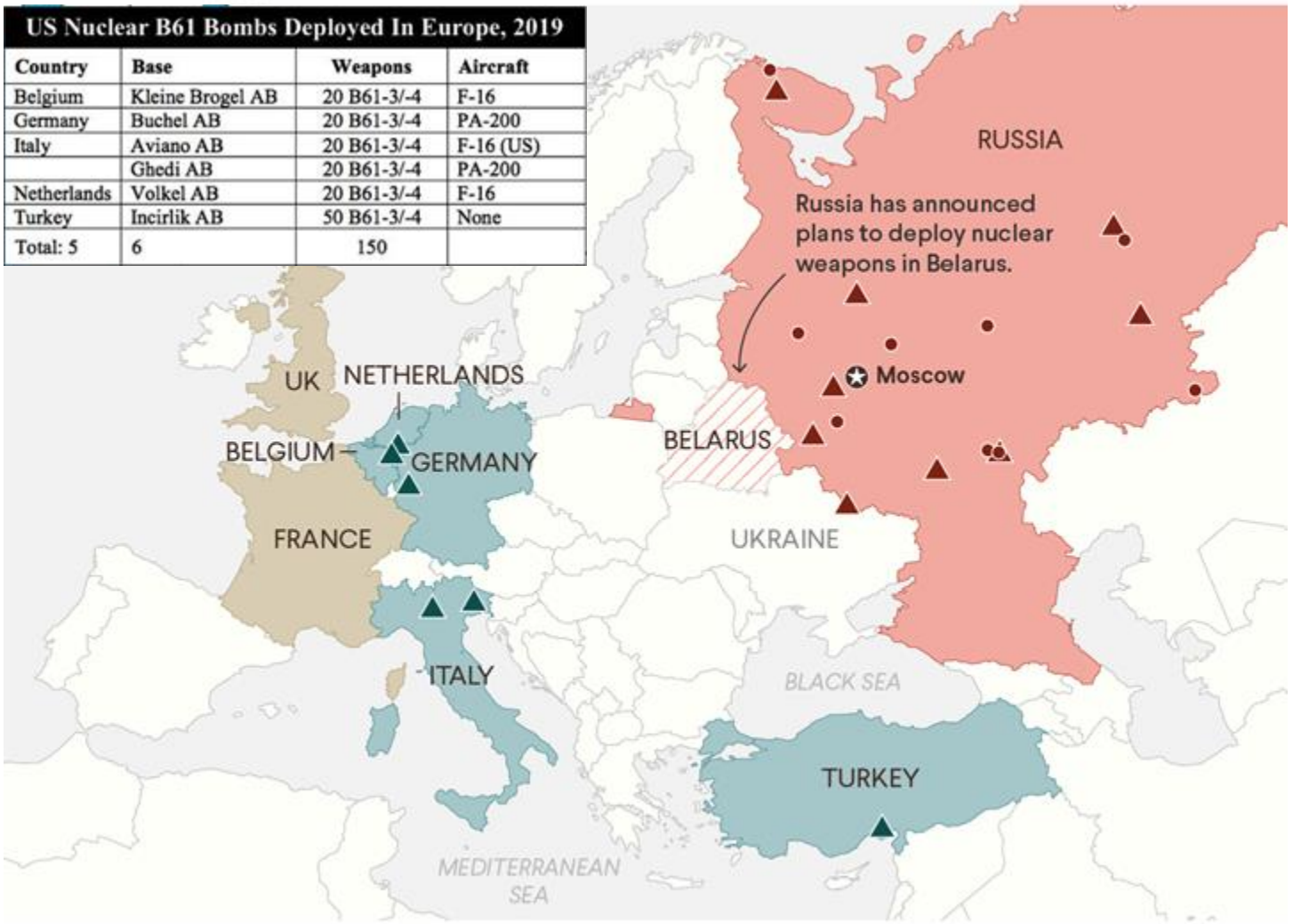
https://fas.org/initiative/status-world-nuclear-forces/

Nuclear Weapons in Europe

- U.S. nuclear weapons storage site
- U.S. ally with U.S. nuclear weapons storage site
- U.S. ally with its own nuclear weapons
- Russian nuclear weapons storage site
- Russian base for strategic nuclear forces

US Nuclear B61 Bombs Deployed In Europe, 2019

Country	Base	Weapons	Aircraft
Belgium	Kleine Brogel AB	20 B61-3/-4	F-16
Germany	Buchel AB	20 B61-3/-4	PA-200
Italy	Aviano AB	20 B61-3/-4	F-16 (US)
	Ghedi AB	20 B61-3/-4	PA-200
Netherlands	Volkel AB	20 B61-3/-4	F-16
Turkey	Incirlik AB	50 B61-3/-4	None
Total: 5	6	150	



Note: Locations of Russian storage sites and bases are estimates based on available information.

Sources: Federation of American Scientists; UN Institute for Disarmament Research; Congressional Research Service.

https://www.cfr.org/in-brief/nuclear-weapons-europe-mapping-us-and-russian-deployments

COUNCIL on FOREIGN RELATIONS

A bit more detail

- Module 1 (6 hours). Principles of operation of nuclear weapons. Various types of nuclear weapons (fission bombs, thermonuclear bombs). Effects of nuclear weapons. Hiroshima and Nagasaki. Damage resulting from nuclear tests on the surface or in the air (Marshall Islands, Semipalatinsk test site in Kazakhstan).
- Module 2 (6 hours). Global distribution of nuclear weapons. The first treaties regulating (or prohibiting) the possession and testing of nuclear weapons. The NPT (Non-Proliferation Treaty) and treaties that prohibit nuclear tests. The historical excursus that led to the first treaties on nuclear weapons will also be briefly discussed, including the peculiar role of the Cuba crisis.
- Module 3 (6 hours). Ballistic missiles and other nuclear weapon delivery systems. Outline of anti-missile defense systems. The ABM Treaty. Evolution of nuclear strategies of countries possessing nuclear weapons.

- Module 4 (4 hours). Different types of nuclear reactors and the relationship between civilian and military use of nuclear energy. Methods of uranium enrichment and plutonium separation. Notes on the safety of nuclear plants, on the risks and related accidents (Mayak, Three Miles Island, Chernobyl, Fukushima).
- Module 5 (4 hours). Nuclear safety and institutions that control the nuclear activities of various countries (in particular the IAEA in Vienna). Structure of the agreements between individual member countries of the IAEA (and of the NPT) and the IAEA itself. The particular role of the additional protocol.
- Module 6 (4 hours). The most important controversies on the nuclear issue (including the Iranian nuclear issue). Countries that possess nuclear weapons and that are not parties of the non-proliferation treaty: (Israel, India, Pakistan, North Korea). Current risks of nuclear proliferation, Nuclear Weapon Free Zones.
- Module 7 (6 hours). The recent treaties between the USA and the USSR/Russia for the control of nuclear weapons. The problem of general nuclear disarmament, the role of the UN. International law issues concerning nuclear disarmament. The particular problem of nuclear sharing. Analysis of current risks associated with nuclear weapons. Prospects for the elimination of nuclear weapons.

Expert seminars

Department of Physics
University of Pisa
Dipartimento di Eccellenza, 2023-2027

- If possible seminars on specific topics will be organized.
- Last year →

Ciclo di Seminari

Dipartimento di Fisica - Università di Pisa

Armi Nucleari, Disarmo, e Proliferazione

Sala Galilei, Edificio C, Dipartimento di Fisica & INFN

Lunedì 6/05/2024, 16:30 - 18:30
Climate Consequences of a Limited Nuclear Exchange
Venance Journé, Laboratoire de Météorologie Dynamique, Paris
https://agenda.infn.it/event/41357/

Lunedì 13/05/2024, 16:30 - 18:30
L'intelligenza artificiale nel sistema di comando, controllo e comunicazione nucleare.
Alice Saltini, European Leadership Network
https://agenda.infn.it/event/41361/

Lunedì 20/05/2024, 16:30 - 18:30
La militarizzazione dell'intelligenza artificiale e i sistemi di arma autonomi
Guglielmo Tamburrini, ex- Università di Napoli Federico II
https://agenda.infn.it/event/41362/

This activity is performed in the framework of the project '*Nano-Meta-Materials and Devices: New Frontier Concepts for Particle and Radiation Detection*, (Grant '**Dipartimento di Eccellenza**, **2023-2027 from the Italian Ministry of University**, CUP I57G22000720004) at the Department of Physics of the University of Pisa

Course style

- Lectures – introduction to issue
- Discussion – Q&A sessions
- Research – for unresolved questions
- Presentation of found material
- Technical level will be adapted to the kind and level of students

- Oral exam: prepare a report on a specific theme. Discussion on all the course topics.