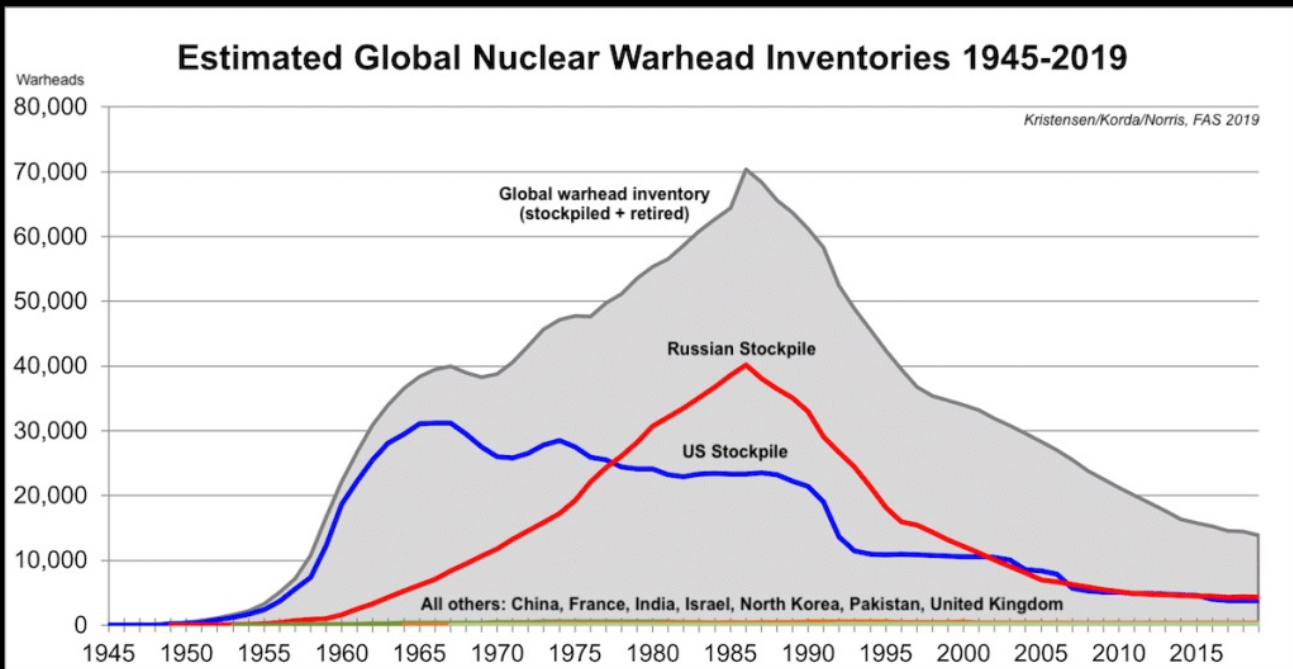

Nuclear Weapons Today

1960 1965 1970 1975 1980 1985 1990 1995 2000 2005 2010 2015 2020

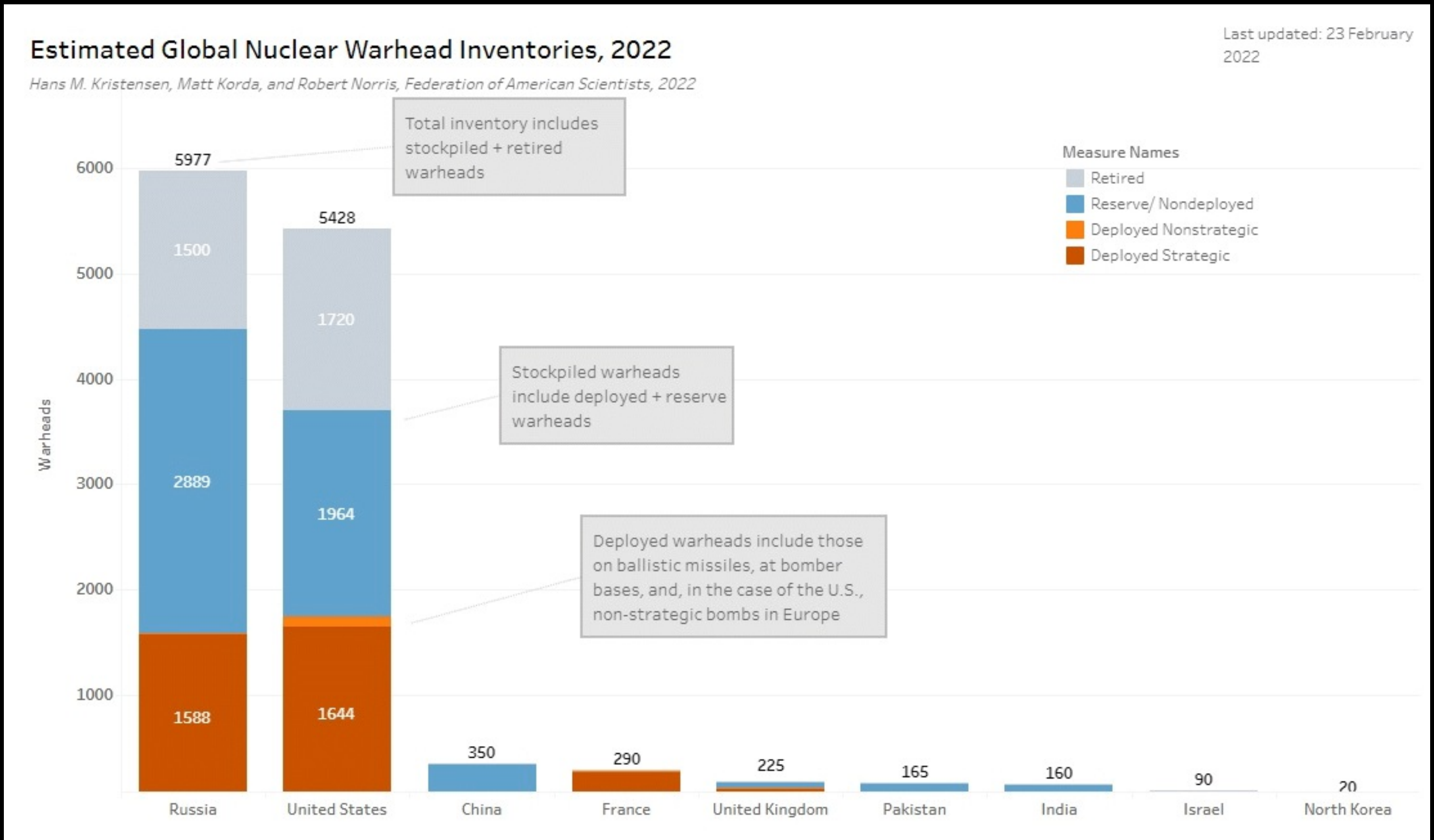
LNTBT 1963	NPT 1970	SALT I ABM 1971	SALT II 1979	INF 1988	START I 1991	CTBT 1996	START II 2000	SORT 2002	New START 2010



From 1971 to 2010 a series of nuclear arms control agreements led to a reduction in the number of warheads from a high of about 70,000 around 1996 to about 30,000 warheads by 2005, with approximately 3,2000 of those warheads deployed, the rest in stockpiles.

http://www.johnstonsarchive.net/nuclear/nwhdet.html

Current World Nuclear Stockpiles.



Source: Federation of American Scientists
http://fas.org/issues/nuclear-weapons/status-world-nuclear-forces/

US Nuclear Capability

The bulk of our nuclear force consists of 228 Trident SLBMs each carrying six or so warheads with yields of either 100 Kt or 400 Kt, about 1,200 warheads in total.

Approximately 500 warheads, each with a yield of up to 150 Kt, are mounted on cruise missiles or other tactical delivery vehicles.

Minuteman III MIRV bus. Each warhead has a yield of ca. 300 Kt. We now deploy 450 of these missiles with about 500 warheads. Minuteman III is expected to be operational through 2025.

Source: The Center for Arms Control and Non-Proliferation

The US also has the nuclear capable B-52H Stratofortress, B-2A Spirit, and B-1 Lancer strategic bombers. All three can carry a variety of nuclear warheads, most with yields in the 200-400 Kt range.

The B-52H

The B-2A

The B-1

One fruit of the "modernization" of our nuclear arsenal was the depolyment in February 2020 of a new line of low-yield warheads, with a yield of under 10 Kt. In order to do this, the United States unilaterally withdrew from the INF, the Intermediate-Range Nuclear Forces Treaty, on August 2, 2019. The theory is that this gives us a more flexible array of options, but critics argue that the introduction of these weapons is inherently destabilizing.

US Deploys New Low-Yield Nuclear Submarine Warhead

By Hans Kristensen · January 29, 2020

By William M. Arkin* and Hans M. Kristensen

The USS Tennessee (SSBN-734) at sea. The Tennessee is believed to have deployed on an operational patrol in late 2019, the first SSBN to deploy with new low-yield W76-2 warhead. (Picture: U.S. Navy)

Another major new development is work on hypersonic delivery vehicles. They can fly at speeds that are many multiples of the speed of sound, reportedly as high as Mach 20 or roughly 15,000 miles per hour. They are maneuverable and can deliver a warhead with pinpoint accuracy halfway around the world in minutes. A Mach 20 hypersonic vehicle could go from New York to Moscow in eighteen minutes. The speed and manueverability of hypersonic vehicles make defense against them more or less impossible.

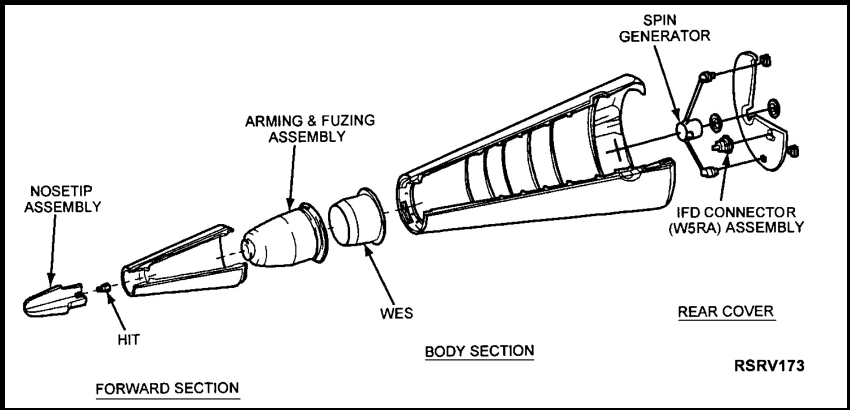

The Pentagon Plans to Deploy An Arsenal Of Hypersonic Weapons In The 2020s

Sebastien Roblin Contributor
Aerospace & Defense
I cover international security, conflict, history and aviation.

Source: *Forbes*, 30 April 2020

In October of 2020, construction began on a new generation of nuclear powered Columbia class of SSBNs, with the first ship, the USS District of Columbia entering service in 2031. It will carry the same Trident II D5LE missle that is in use on our existing Ohio class SSBNs, but it will be upgraded to the D5LE2 missile starting in 2039. Foremost among the many innovations in the Columbia class SSBNs is stealth. For example, the old mechanical drive train will be replaced by electric motors.

Starting in 2029, our 400 existing LGM-30 Minuteman III ICBMs will be replaced by the new LGM-35 Sentinel ICBM. In addition, the W78 warhead, with a yield of 335–350 Kt, will be replaced by the 300 Kt W87-0 warhead, and that, in turn will eventually be replaced by the 475 Kt W87-1.



The W87 re-entry vehicle

Russian Nuclear Capability

It is estimated that Russia has roughly 306 strategic ICBMs that carry up to 1,185 nuclear warheads. Most notable among these ICBMs are the SS-27-1 (Topol-M) and the SS-27-2 (Yars), both capable of carrying multiple nuclear warheads (MIRVs). Additionally, Russia is currently developing the Sarmat (SS- X-30) missile that is advertised as larger and more capable than previous designs. Alongside the Sarmat, Russia is also developing a hypersonic glide vehicle known as Avangard. The SS-27-1 carries a single 500Kt warhead. The SS-27-2 carries multiple, 150-200 Kt warheads. Both missles can be launched either from silos or mobile launchers.

The SS-27-2 (Yars)

Russia’s operational nuclear force consists of 11 nuclear-powered ballistic missile submarines (SSBNs), separated into three classes. The Delta and Borei, the current active classes, can carry up to 16 SLBMs (the SS-N-23 “Skiff” and the Bulava SS-N-32) that are capable of delivering up to 624 nuclear warheads. Russia’s strategic naval force is currently constructing up to 10 additional and improved Boreii class nuclear submarines, all of which are expected to be completed by 2027 but face severe resource constraints. The Borei class submarines carry a modified version of the SS-27-1 (Topol-M) ICBM.

The K-550 Borei class Alexander Nevsky

Russia has approximately 68 heavy bombers in its nuclear air fleet. They consist of two divisions: the Tu-160 (Blackjack) and the Tu-85MS (Bear H). The Bear H class makes up the majority of its fleet, each of which can carry up to 16 AS-15 missiles, or roughly 700 nuclear warheads when combined. Current modernization efforts aim to equip their fleet with nuclear cruise missiles.

The Tu-85MS (Bear H)

The Tu-160 (Blackjack)

Chinese Nuclear Capability

The Department of Defense estimates that China has approximately 300 nuclear-capable land-based missiles which may launch as many as 400 warheads. Many of these are silo-based DF-5A and DF-5B as well as the more modern and road-mobile DF-31 and DF-41 class missiles. The PRC is establishing additional nuclear units and increasing the number of launchers in mobile ICBM units from 6 to 12. DF-5 class missiles have a range of 13,000 km whereas DF-31 and DF-41 rockets range from 7,000 to 15,000 km. The most powerful, the D F-41, can carry either three 400 Kt or eight 600-750 Kt warheads.

The DF-41

The DF-5

China conducts near-continuous at-sea deterrence patrols with its six Jin-class nuclear powered ballistic missile submarines (SSBN). Each SSBN can carry up to 12 submarine-launched ballistic missiles (SLBMs) known as JL-2 and JL-3 missiles. The range limitations of the JL-2 would require the PLA to operate near Hawaii to target the east coast of the United States, but JL-3 missiles may successfully reach the east coast from China's littoral waters. The PRC is also developing Type 096 SSBNs with the ability to launch SLBMs with multiple independent reentry vehicles (MIRVs). The JL-2, the only missle currenty in operation on Jin class submarines can carry either a single 1 Mt or 1-3 warheads with yields of 20, 90, or 150Kt.

The Type 094 Jin class submarine

The Peoples’ Liberation Army supports its air-based component of the Chinese triad through the H-6N bomber. The bomber has an air-to-air refueling mechanism to extend its range of 1,800 km as well as recessed fuselage modifications to enable its carrying of air-launched nuclear missiles. China is also expected to develop a new strategic bomber and air-launched ballistic missiles. This includes the development of the nuclear-capable subsonic strategic stealth bomber, the Xian H-20, which could enter service as early as 2025. This would be very similar to the U.S. B-2 bomber and would wield a global range of over 10,000 km with aerial refueling capabilities. The H-6N is capable of carrying the DF-21 ballistic missle with warheads having yields of between 200 and 500 Kt. But it is reported that it normally is used for delivering conventional, non-nuclear weapon.

The H-6N bomber

North Korean Nuclear Capability

Not much is known about the details of North Korea’s nuclear capabilities. Their first known test of a plutonium fission bomb happened in 2006. Since then development has continued on both fission and low-yield fusion bombs. They have developed a wide variety of short, medium, and long range ballistic missiles. The most powerful, the Hwasong-17, which was first tested in March 2022, has a reported range of 15,000 km, making it possible for it to reach most of the US.

The Hwasong-17

Iranian Nuclear Program

In the early 2000s, concern began to grow about possible Iranian efforts to develop nuclear weapons. It was known that they were developing ultracentrifuge isotope separation capabilities, ostensibly to fuel nuclear power plants, but the implications for nuclear weapons were obvious. Eventually in July 2015, an agreement was concluded between Iran and the so-called P5+1 group (the five permanent members of the UN Security Council – China, France, Russia, the United Kingdom, and the United States – plus Germany. Called the Joint Comprehensive Plan of Action, it obligated Iran to limit drastically its enrichment activities and to accept international inspection of nuclear facilities. In May 2018, President Trump announced that the US was withdrawing from the agreement, effectively killing it.

The Announcement Ceremony
July 2015

Throughout, Iran has continued the development of ever longer ranged ballistic missles. Among the more concerning is the Sejjil series of intermediate range missles, capable of traveling between 2,000 and 4,000 km, which brings most of Europe and the Middle East within range.

The Sejjil ICBM

My Tenuous Connection to the Iranian Bomb Program

Who Is This?

B.Sc., 2006, Applied Physics and Mechanical Engineering, Sharif Institute of Technology, Tehran

2010, M.Sc., Photonics, Institute of Photonic Sciences, University of Catalonia, Barcelona

Former Ph.D. Student, Physics, University of Texas

His name is Omid Kokabee

In January of 2011, as he was leaving Iran to resume his studies at UT, he was arrested at the airport, charged with "colluding against national security"

Eventually he was convicted of "communicating with a hostile government (USA)" and "illegitimate/illegal earnings"

Who Is This?

He was sentenced to a ten-year term in the infamous Evin prison in Tehran.

So why was Kokabee arrested and jailed in the first place?

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Physics quiz: What might laser isotope separation be used for?

Answer: Uranium enrichment

OPINION

30 JULY 2012

SILEX and proliferation

R. Scott Kemp

In July, the US Nuclear Regulatory Commission (NRC) held its final hearing to license the world's first facility to enrich uranium on a commercial scale using lasers. For years, experts have warned that laser enrichment, known as SILEX (separation of isotopes by laser excitation), would be particularly good at making highly enriched uranium -- the ingredient needed to make nuclear weapons -- and that a commercial venture could stimulate proliferation. That's why the Federation of American Scientists, the American Physical Society, the American Association for the Advancement of Sciences, a former US nuclear-weapons lab director, at least two congressmen, and dozens of others have called on the NRC to perform a proliferation assessment before licensing the proposed plant. In response, the NRC claims that nonproliferation assessments are outside the scope of their statutory responsibilities. Turning the cheek to such a grave matter of national security is not sound governance. If Congress or the NRC fails to act in the next few weeks, the new license will be issued, ushering in a watershed moment for nuclear proliferation.

R. SCOTT KEMP

Kemp is assistant professor of nuclear science and engineering at MIT and an affiliate of Princeton's Program on Science and Global...

American Physical Society - Committee on International Freedom of Scientists

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Committee on International Freedom of Scientists

The membership of the Committee on International Freedom of Scientists consists of nine (9) persons selected by the Committee on Committees and appointed by the President-Elect to staggered three-year terms. The President-Elect appoints the Chair from among the members. This Committee is responsible for monitoring concerns regarding human rights for scientists throughout the world. It apprises the President, the Board and Council of problems encountered by scientists in the pursuit of their scientific interests or in effecting satisfactory communication with other scientists and may recommend to the President and Council appropriate courses of action designed to alleviate such problems.

Chair: Shelly R. Lesher (01/18 - 12/19)
University of Wisconsin - La Crosse

Past Chair: Don A Howard (01/18 - 12/19)
University of Notre Dame

Member: Ian Jauslin (01/19 - 12/21)
Institute for Advanced Study

Member: Athena S. Sefat (01/19 - 12/21)
Oak Ridge National Laboratory

Member: Robert S French (01/17 - 12/19)

Member: Christopher Watson (01/18 - 12/20)
Northrop Grumman

Fundamental Human Rights & Freedoms
Learn about the principal guaranteed rights and freedoms. This guide was prepared by CIFS member The Hon. Robert French AC.
Human Rights & Freedoms

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Learn about the Committee's work
CIFS Poster

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Read about some of the human rights cases that CIFS monitors.
CIFS Human Rights Cases

APS Committees

The American Physical Society is a volunteer-driven organization. Since 1899, physicists have contributed their time and resources to running the APS in cooperation with a minimal full-time staff. Volunteers are the backbone of the Society. They form the character and direct the Society's progress and development. All APS committees operate on a calendar year basis and committee terms run from January 1 through December 31.

View Full Committee Listing

Information for Committee Members

- APS Guiding Principles
- Nominations for APS Committees
- Committee Chair Responsibilities
- Committee Meetings
- Committee Member Responsibilities

The case that received the greatest attention from CIFS from 2011 to 2016 was that of Omid Kokabee

APS NEWS

APS Protests Iranian Jailing Of UT Austin Physics Student

APS's Committee on International Freedom of Scientists issued a letter calling on the Grand Ayatollah of Iran to release an imprisoned physics student. The committee believes that he has committed no crime, and his arrest will discourage future scientific collaboration.

Omid Kokabee, a first-year graduate student at the University of Texas at Austin, and an APS member, has been imprisoned in Iran since January or February and is currently awaiting trial. For the first month of his arrest he was held in solitary confinement. He has been jailed in Evin prison in northwest Tehran, where the Iranian government holds many of its political prisoners. The government of Iran is accusing him of leaking Iranian nuclear secrets to the United States, accepting "illegal earnings" and "communicating with a hostile government."

"Mr. Kokabee has no training in nuclear physics, is not politically active, and is not associated with any political movement in Iran. Rather his primary concerns were his science studies in the field of optics. This area of physics has essentially no overlap with nuclear technology," the letter read, adding that they believe the arrest came as a misunderstanding of his science.

Kokabee had returned to Iran during winter break to visit his family. When he stopped responding to emails, officials at the university started getting concerned. At first, word came through an acquaintance who also hailed from Iran that he had had an accident in Iran and wouldn't be returning the following semester. Later the same acquaintance revealed that he had in fact been arrested. Initially Kokabee's family had wanted to keep the matter quiet so as not to provoke the Iranian government.

"There's no rational reason for his arrest. He's not a political person," said John Keto, the advisor for graduate students at the University of Texas at Austin. "He was a serious dedicated scientist who was mostly interest in his science."

The trial for Kokabee was originally slated for July 15th, but was unexpectedly postponed.

Kokabee first tried coming to the United States to pursue his masters degree a few years ago, but he could not secure a visa to travel to the country as a student. Instead he received his masters at the Universitat Politecnica de Catalunya in Spain then enrolled in the University of Texas at Austin's PhD program after a concerted effort on the part of the university. Keto described Kokabee as a "remarkable" student, who had already produced a number of scientific papers and traveled to many conferences across Europe.

The arrest has also worried other Iranian students studying in the United States. "The Iranian students are very concerned about whether they should ever go home again," Keto said.

In 2014, APS awarded Kokabee its Sakharov Prize, to honor his refusal to do classified, weapons research for Iran

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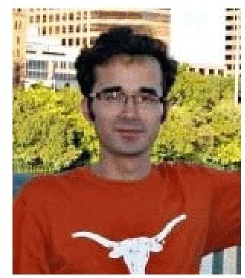
2014 Andrei Sakharov Prize Recipient



Omid Kokabee
Evin Prison, Tehran, Iran

Citation:

"For his courage in refusing to use his physics knowledge to work on projects that he deemed harmful to humanity, in the face of extreme physical and psychological pressure."

Background:

Omid did his bachelors in Sharif University of Technology in Tehran, Iran known as MIT of Iran. He ranked 29 out of about 400 thousand participants in a nationwide university entrance exam. He studied Applied Physics and Mechanical Engineering and graduated in 2005. He received a scholarship to pursue his graduate research and studies in Photonics from Institute of Photonic Sciences (ICFO) in Barcelona, Spain in a joint program with three local universities there. He worked experimentally on Optical Parametric Oscillators. After obtaining his master he continued to finish his courses and research work for his PhD dissertation in ICFO and before defending, he moved to University of Texas at Austin to pursue his PhD studies in Physics mainly on Laser-Plasma Interaction, a resourceful place known for its professors and high power laser facilities. Omid is proudly a member of APS, OSA, SPIE and IEEE.

In 2015, AAAS gave Kokabee its Scientific Freedom and Responsibility Award

AAAS

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2014 AAAS Scientific Freedom and Responsibility Award Goes to Omid Kokabee, Iranian Physicist and Prisoner of Conscience

27 October 2014 Kat Zambon

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AAAS NEWS ASSOCIATION AFFAIRS AWARDS

Omid Kokabee, an Iranian graduate student in physics at the University of Texas at Austin who was imprisoned for refusing to contribute to weapons research in his home country, has been awarded the 2014 Scientific Freedom and Responsibility Award from AAAS.

Kokabee, the first doctoral student to win the award, was honored by AAAS "for his courageous stand and willingness to endure imprisonment rather than violate his moral stance that his scientific expertise not be used for destructive purposes and for his efforts to provide hope and education to fellow prisoners."

OMID KOKABEE

"It is uncommon that scientists risk their freedom in defense of the principle of scientific freedom for all scientists, and yet this 32-year old physicist, at the beginning of a promising career, has done just that," the award's selection panel said.

From a young age, Kokabee demonstrated an aptitude for science. He ranked 29th on the Iranian college admission exam and earned a degree in applied physics and mechanics from Iran's Sharif University of Technology. Next, he completed a master's degree in photonics at the University of Catalonia in Barcelona. After studying at the Institute of Photonic Sciences, ICFO, Kokabee enrolled in a doctoral program at the University of Texas at Austin in 2010 to study optics

In October of 2015, CIFS published an op-ed in the Washington Post on the Kokabee case

The Washington Post

Opinions

Free Omid Kokabee, another Iranian prisoner of conscience

By Herbert L. Berk October 30, 2015

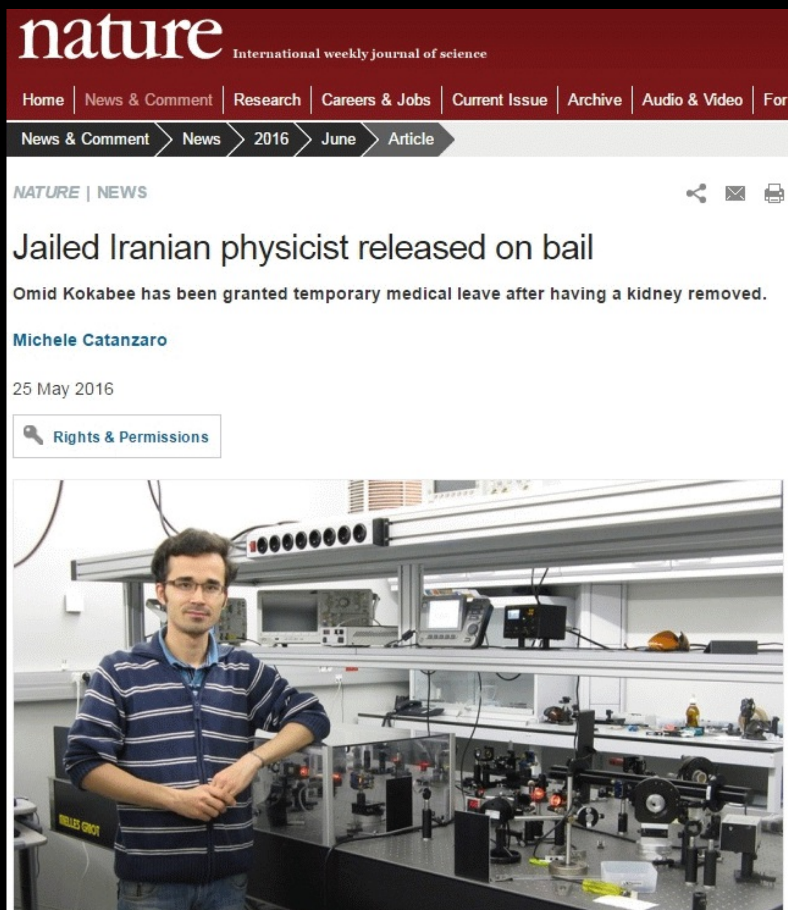
Herbert L. Berk is chairman of the American Physical Society's Committee on International Freedom of Scientists.

As the Iran nuclear deal has marched forward from negotiations to agreement to implementation, a University of Texas graduate student in physics named Omid Kokabee has sat in Tehran's Evin Prison, where he has languished for nearly five years for the crime of refusing to engage in scientific research that he deems harmful to humanity.

As an engineering physics student in Iran, Kokabee worked in the rapidly expanding field of laser technology. After obtaining his bachelor's degree and several years of industrial laboratory experience, he was accepted into the physics graduate program at the University of Texas but was unable to attend due to visa issues. Instead, he enrolled in the Catalan Institution for Research and Advanced Studies in Barcelona, under the tutelage of Majid Ebrahim-Zadeh, an Iranian scientist working on laser development and the president of Radiantis, a company manufacturing state-of-the-art infrared lasers. One possible application of this technology is the enrichment of uranium to produce the high-grade fissile material necessary for nuclear reactors and weapons.

In 2010, after completing his master's degree in Barcelona, Kokabee sought to pursue his doctorate at the University of Texas, and this time he was able to enter the United States. During winter break in December 2010, he traveled to Iran to visit his ailing mother. While there, government scientists offered him a position working on security and military research, something Kokabee had repeatedly turned down before. He again refused. Then, while attempting to return to Texas in January 2011, he was detained by Iranian authorities, who offered him freedom from incarceration if he agreed to work for the government. Once again, he said no. Subsequently, Kokabee was convicted in the Islamic Revolutionary Court of collaborating with an enemy of Iran and sentenced to a 10-year prison term.

Happily, in May of 2016, after a letter from APS President Homer Neal to the Ayatollah Khomeini asking him to show mercy to Kokabee and after surgery to remove a cancerous kidney, Kokabee was released on bail. In the summer of 2016, it was announced that he was paroled permanently.



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NATURE | NEWS

Jailed Iranian physicist released on bail

Omid Kokabee has been granted temporary medical leave after having a kidney removed.

Michele Catanzaro

25 May 2016

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The Day After