Chemical defoliants including Agent Orange were used during the Vietnam War, in an ARPA programme.

by exploding nuclear weapons high in the atmosphere. Early in the Kennedy administration, ARPA redoubled its efforts on anti-ballistic missile defence in schemes such as BAMBI, the Ballistic Missile Boost Intercept programme. Ultimately dismissed as a “mad scientist’s dream” by Herbert York, ARPA’s first chief scientist, BAMBI was meant to drop huge nets from orbiting space platforms, ensnaring Soviet missiles soon after launch. Nothing close to operational ever came from it, but the expensive failure illustrated the kind of high-concept originality, bordering on science fiction, championed by some at ARPA.

The agency could claim clearer success with Project Vela, part of a broad programme to detect nuclear-weapons tests. ARPA-funded efforts like the World-Wide Standardized Seismograph Network — designed to detect underground nuclear explosions — helped to catalyse major advances in seismology, providing data on oceanic earthquakes, for example, that shored up the new theory of plate tectonics. Early test results from the network provided compelling evidence that minor earthquake-like tremors could be distinguished from underground nuclear explosions. The ARPA findings had a crucial role in the success of Kennedy’s 1963 Limited Test Ban Treaty with the Soviet Union.

Like much of the Kennedy administration, ARPA became embroiled in Vietnam long before the conflict escalated into war. Beginning in 1961, its officials were building secret field stations in the jungles of Vietnam and Thailand. Some, such as William Godel, dreamt up ambitious counter-insurgency programmes. Under the expansive Project AGILE, researchers experimented with manipulating village food supplies by destroying rice crops, engineering population resettlement and, most notoriously, deploying chemical defoliants including Agent Orange.

To understand the roots of resistance among enemy forces (the National Liberation Front, or Vietcong), ARPA researchers even sent a psychoanalyst to administer Rorschach ink-blot tests to a handful of people in Saigon. These projects unfolded alongside experiments with precision weapons and other hardware. As Weinberger documents, the agency’s involvement in Vietnam proved much more transformative than its work on space or nuclear technology.

Many of ARPA’s secret counter-insurgency efforts were revealed to the US public in June 1971, after defence analyst Daniel Ellsberg leaked an internal report on them to *The New York Times*. In the controversy sparked by publication of these ‘Pentagon papers’, Congress pressured ARPA to eliminate Project AGILE. But, as Weinberger reports, the programme never really died. Rather, public backlash against the Vietnam War “drove ARPA’s weapons out of the jungle and onto the modern battlefield”.

AP/REX/SHUTTERSTOCK

MILITARY SCIENCE

Masters of war

David Kaiser appraises a chronicle of the US agency that spawned technologies from drones to the Internet.

On 4 October 1957, the Soviet Union launched Sputnik, the first artificial satellite. Four months later, the United States kick-started a new venture: the Advanced Research Projects Agency (ARPA). Nestled within the Pentagon, just steps from the office of defence secretary Neil McElroy, ARPA was the nation’s first space agency. But its writ was much broader. As Sharon Weinberger describes in her fascinating and absorbing history *The Imagineers of War*, this team of experts was tasked with anticipating “the unimagined weapons of the future”. Weinberger’s account, based on extensive and meticulous research, reveals surprising twists in the recent history of the age-old entanglement between knowledge and power.

Today, DARPA (the D for ‘Defense’ was added in 1972) is best known for a series of high-tech devices, including stealth aircraft that can evade radar, and ARPANET, one of the earliest working computer networks that anticipated the Internet. Behind the glistening space-age gadgetry, however, Weinberger reveals a much more complicated history, of an agency often buffeted by large shifts in geopolitics, federal policy and old-fashioned turf battles. Most importantly, she uncovers surprisingly low-tech roots for

The Imagineers of War: The Untold Story of DARPA, the Pentagon Agency that Changed the World

SHARON WEINBERGER
Alfred Knopf: 2017.

some of DARPA’s most famous tools of war.

Within months of the agency’s founding, it was caught up in a scramble over who should take the lead in US efforts in the space race. The civilian NASA was founded less than half a year after ARPA. Soon, some of President Dwight Eisenhower’s advisers transferred much of ARPA’s space programme to NASA. Although ARPA continued to pursue a

handful of classified projects on spy-satellite technology, by early 1960, agency leaders found themselves with no clear mission. That changed, in a big way, when President John F. Kennedy took office the following year.

ARPA’s first major shift under Kennedy was to reinvest in nuclear projects. The agency had considered a fledgling — and to some, harebrained — effort in the late 1950s to create a defensive shield against Soviet missiles

Descendants of the project include armed drones, remote-sensor technologies, networked battlefield simulations and the Orwellian-sounding Total Information Awareness programme. This was launched by DARPA soon after the World Trade Center attacks in New York on 11 September 2001. The programme sought to combine traditional surveillance with data mining on huge volumes of citizens' private information — another controversial project that, like AGILE, survived under different names long after critics had supposedly shut it down.

Weinberger charts a narrowing of focus — and, perhaps, influence — for DARPA. Technical fixes in recent years include a universal translator based on computational linguistics, developed to help soldiers communicate with locals in Iraq and Afghanistan; this ultimately proved useless. And a glitzy effort to develop driverless cars, even before major tech companies got in on the act, seems emblematic of “Disneyfication”: the pursuit of expensive gadgets with limited potential to meet pressing national-security challenges.

US DOE/SPL

ARPA's Vela Nuclear Detection Satellite in 1967.

Since its founding, DARPA has cultivated scientific and technical capability in the US federal government. Its projects have not always succeeded; indeed, as Weinberger documents so well, some of its spectacular failures reveal the true reach of its leaders' ambitions. The biggest uncertainty now is what role scientific and technical expertise might have in an era of ‘alternative facts’. With basic elements of reality now routinely dismissed as partisan talking points, DARPA may well face its greatest challenge. ■

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Books in brief

All the Boats on the Ocean

Carmel Finley UNIVERSITY OF CHICAGO PRESS (2017)

As the Food and Agriculture Organization of the United Nations reports, 90% of global fish stocks are fully fished or overfished. Science historian Carmel Finley traces that crisis back to the cold war, when the United States, Japan, the Soviet Union and other seafaring nations deployed fishing to stake territorial claims. From the 1970s on, trawling and government subsidies forced an explosion in the industry. Now, with little reduction in subsidized fleets and oceans at risk, Finley sees the future of fisheries hinging on holistic approaches involving fish, fisher and environment.

Irresistible

Adam Alter BODLEY HEAD (2017)

From Facebook to Fitbit, the digital infiltrates life: many people now spend 100 hours a month on their mobile phones. In this superb study of Internet addiction, Adam Alter anatomizes the cynicism of an industry in which compulsive lures are built into products that billionaire bosses avoid like the plague. Drawing on a trove of neuroscience, he isolates six “ingredients” of behavioural addiction, such as unresolved tension. Commendably, he also offers pragmatic preventive solutions for children and techniques for addicted adults, such as stripping numerical feedback from social-media platforms.

Modern Death: How Medicine Changed the End of Life

Haider Warraich ST MARTIN'S (2017)

Daily exposure to death and the agonies of the bereaved prompted cardiologist Haider Warraich to encapsulate the recent transformation in end-of-life care. The result is rich, splicing harrowing cases from the acute admissions ward into medical history and science as he examines everything from the death of a cell to the impact of death on society. Warraich details resuscitation technologies that are redefining death; delves into the debate over dying at home; explores euthanasia and terminal sedation; and advocates greater openness about all this on the part of physicians.

The Evolution Underground

Anthony J. Martin PEGASUS (2017)

As refuges from cataclysm, nurseries or traps for prey, animal burrows have been central to evolutionary history, and have altered ecosystems and planetary chemistry. Palaeontologist Anthony Martin is an amiably erudite guide to burrowing fauna, from the giant sloth *Glossotherium*, which thrived in the Pleistocene epoch, to earthworms, naked mole rats — and star tunnellers such as the gopher tortoise (*Gopherus polyphemus*) and the Patagonian conure (*Cyanoliseus patagonus*), a parrot that nibbles nesting holes in cliffs. Down the rabbit hole with Martin, Earth becomes one vast, “constantly evolving burrow system”.

Mouthfeel: How Texture Makes Taste

Ole G. Mouritsen and Klavs Styrbæk, transl. Mariela Johansen COLUMBIA UNIVERSITY PRESS (2017)

The ‘mouthfeel’ of foods — the jawbone-jarring crunch of a crouton or the voluptuous viscosity of melting chocolate — is a key element of taste. Biophysicist Ole Mouritsen and chef Klavs Styrbæk nimbly explore the interplay of food textures and the mouth's somatosensory system. Inspired recipes (fried cod swim bladder, for instance) mesh with science on milk's “surprisingly complicated inner structure” and the 40,000 varieties of rice. [Barbara Kiser](#)