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Case Study

Google and Project Maven (A):

Big Tech, Government and the AI Arms Race

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This case was written by Jaimie Stettin, Research Associate, and Gianpiero Petriglieri, Associate Professor of Organisational Behaviour at INSEAD, exclusively from public sources. It is intended to be used as a basis for class discussion rather than to illustrate either effective or ineffective handling of an administrative situation.

It was a mild April morning in London. Laure sipped pensively on her first coffee of the day as she read a Google Doc that a co-worker in California had passed along. An engineer and a newly-minted MBA, Laure had worked hard at business school to get her dream job: Project Manager at Google. It felt like "home" for someone like her, talented and enthusiastic about the potential of technology to make the world better, but not naïve about the questions surrounding many tech innovations. It was three months since she had joined the company. So far, working there had lived up to her expectations.

The document was an internal memo addressed to Google's CEO, Sundar Pichai,[1] signed by over 3,000 employees (nearly 5% of the company's global workforce) asking him to terminate Google's involvement with Project Maven. Gizmodo, a tech, design, science, and sci-fi site, had recently reported that Google was among the firms working with the US Department of Defense on Project Maven, an initiative exploring artificial intelligence (AI) technologies that could analyse drone's surveillance footage.[2] The *New York Times* had picked up the story and published the memo on April 4th, 2018.[3] It began sharply:

> *Dear Sundar, We believe that Google should not be in the business of war.*

Letting Google's AI enhance the capacity of military drones, it argued, went against the company's original ethos and would harm its ability to attract talent. The text continued:

> *Amid growing fears of biased and weaponized AI, Google is already struggling to keep the public's trust. By entering into this contract, Google will join the ranks of companies like Palantir, Raytheon, and General Dynamics. The argument that other firms, like Microsoft and Amazon, are also participating doesn't make this any less risky for Google. Google's unique history, its motto Don't Be Evil, and its direct reach into the lives of billions of users set it apart.* [4]

The memo concluded with two requests:

> *Recognizing Google's moral and ethical responsibility, and the threat to Google's reputation, we request that you:*
>
> *1. Cancel [Project Maven] immediately*
> *2. Draft, publicize, and enforce a clear policy stating that neither Google nor its contractors will ever build warfare technology.*[5]

It was the first time Laure had heard of Project Maven and of Google's involvement in it. Wondering whether she should add her name to the shared document and click 'Save', she opened a new tab on her browser. As Google's iconic homepage came up, she began a search.

The US Department of Defense, Drones and Project Maven

In 1947, President Harry Truman established the Department of Defense (DoD),[6] an executive branch of the United States Government, "to defend the security of [the US] and to sustain American influence abroad,"[7] with the US President, the Secretary of Defense, and the National Security Council at its helm. In 2018, an introductory section of its website compared the DoD to a corporation:

> *If the President is our CEO, and the Congress is our Board of Directors, then our stockholders are the American people. … We exist to protect these citizen stockholders, for without their support we would be out of business.*[8]

Since the terrorist attacks of September 11th, 2001, the DoD had seen a shift in focus, from traditional warfare to more sophisticated transnational operations, including vastly expanded intelligence collection.[9] These operations frequently made use of unmanned aerial vehicles, commonly known as drones. The CIA, under the jurisdiction of the DoD, first used an armed drone to carry out a targeted airstrike in Afghanistan on February 4th, 2002.[10] The intended target was Osama bin Laden, but another similarly built man was killed.

Eleven years and hundreds of drone strikes later, a DoD report concluded:

> *Unmanned systems will be critical to U.S. operations in all domains across a range of conflicts, both because of their capability and performance advantages and because of their ability to take greater risk than manned systems. … The potential for improving capability and reducing cost through the use of technology … presents great promise for a variety of DoD improvements. However, it also raises challenging questions ... The question, "When will systems be fielded with capabilities that will enable them to operate without the man in the loop?" is often followed by questions that extend quickly beyond mere engineering challenges into legal, policy, or ethical issues. How will systems that autonomously perform tasks without direct human involvement be designed to ensure that they function within their intended parameters? More broadly, autonomous capabilities give rise to questions about what overarching guiding principles should be used to help discern where more oversight and direct human control should be retained.* [11]

During his eight years in office, President Barack Obama authorized 542 drone strikes that killed an estimated 3,797 people, including 324 civilians.[12] By the time President Donald Trump succeeded him, in January 2018, the US military had a fleet of 1,100 drones.[13] While some were armed for combat, most were solely for surveillance and/or reconnaissance, capturing hundreds of hours of video footage daily.[14] They ranged in size from micro or nano devices that could fit in the palm of a hand, to large vessels with wingspans of over 40 metres.[15]

After a decade in which drones had been used exclusively by the American, British, and Israeli militaries, a 2016 New America Foundation report noted that the number of nations equipped with armed drones was increasing rapidly.[16] Countries that had launched drone strikes

included Pakistan, Nigeria, Turkey, Iraq, the U.A.E. and Iran. Many more, including China, India, France, Spain, Sweden and South Africa, had armed drones in their arsenals.[17]

The DoD Innovation Board, Project Maven and the JEDI Bid

Sensing that technological advances were rapidly reshaping the geopolitical landscape, the DoD established an Innovation Board in 2016. It described the Board's purpose as follows:[18]

> *To provide the Secretary of Defense, Deputy Secretary of Defense, and other senior leaders across the Department with independent advice and recommendations on innovative means to address future challenges through the prism of three focus areas: people and culture, technology and capabilities, and practices and operations.*

In the spring of 2018, Eric Schmidt, former Google CEO and board member of Alphabet, Inc. (Google's holding company), served as the Chair of the DoD's Innovation Board. Its members included computer theorist Danny Hillis, Eric Lander of the Broad Institute, Instagram COO Marne Levine, and LinkedIn co-founder Reid Hoffman, among others.[19]

Project Maven, also known as the Algorithmic Warfare Cross-Functional Team, or AWCFT, had been launched a year earlier, in April 2017, in an effort to "accelerate DoD's integration of big data and machine learning."[20] The Pentagon stated that it would spend up to $70 million in the project's first year[21] (see Exhibits 2 and 3). The details of Google's participation in the project were not clear. The company described its role as "non-offensive."[22] Advances in drone video analysis, however, while not overtly offensive, did factor into counterinsurgency and counterterrorism operations, the DoD stated.[23] Visual recognition technology, specifically, had the potential to digitally assist, if not automate, drones' capabilities to verify the identity of targets.

At a hearing of the House Armed Services Committee on April 17, 2018, Eric Schmidt strongly supported the DoD's interest in AI research and its collaborations with tech companies[24] (see Appendix 4). In his statement of support, Schmidt said that Project Maven was "the most successful DoD effort to deliver AI to date." [25] He added:

> *If DoD is to become 'AI-ready,' it must continue down the pathway that Project Maven paved and create a foundation for similar projects to flourish.*[26]

Schmidt was also quoted in *Bloomberg News* reports as saying, "The nature of AI is a long-term technology that will be useful for defensive and perhaps offensive purposes as well." According to those reports, Schmidt specifically added that his statement was neither on behalf of Google nor in his capacity as an Alphabet board member.[27]

Besides Project Maven, Google continued to pitch its technologies and services to the Joint Enterprise Defense Infrastructure (JEDI) programme in response to a DoD call for proposals in AI and cloud implementation.[28] The JEDI programme budgeted over $10 billion to be awarded in a single contract to one provider over 10 years.[29] While Amazon was considered the frontrunner,[30] Google was quietly making a compelling bid.[31] Anonymous DoD officials

revealed to the press that in August 2017, Defense Secretary James Mattis, then head of the DoD, had met with Google founder Sergey Brin and CEO Sundar Pichai.[32] The team presented the company's "multi-year transition to cloud computing and how it was helping them develop into a powerhouse for research and development into artificial intelligence."[33] Brin, according to these reports, highlighted Google's AI and cloud capacities.[34]

The AI "Arms Race"

The DoD's focus on AI was neither unusual nor unique. At the time of Project Maven's launch, AI research and applications were on the rise.[35] The 2017 AI Index report, a project of the *One Hundred Year Study on AI at Stanford University*, cited increases in every AI-related field—including research, industrial, and consumer applications, jobs requiring AI skills, and general media coverage.[36] A Belfer Center study suggested that "rapid progress in AI [was] likely to impact national security," [37] and several governments were becoming interested and involved.[38] In an interview with *Wired*, French President Emmanuel Macron was quoted as saying:[39]

> *When you look at artificial intelligence today, the two leaders are the US and China. In the US, it is entirely driven by the private sector, large corporations, and some start-ups dealing with them… On the other side, Chinese players collect a lot of data driven by a government whose principles and values are not ours.*

According to some estimates, China already had over two fifths of the world's AI scientists. And with the size of its population, it offered an unrivaled data pool.[40] Robert Silvers, partner at legal firm Paul Hastings and former Assistant Secretary for Cyber Policy at the Department of Homeland Security, noted that the contest to lead in AI was more than economic:

> *It's clear that the US government sees itself in a tech arms race with the Chinese government … The US is taking the view that these kinds of technologies are so transformative that the country that gets the lead is going to have not just economic or tech advantage but also national security advantage.*[41]

A briefing released ahead of the Aspen Institute's 2018 Security Forum, elaborated*:*

> *No technological competition seems more pressing than the global struggle for artificial intelligence superiority. While the US once dominated AI research, China has made it clear in recent years that they are aggressively working to catch up to (and then eclipse) its rival in the West. China has official plans to achieve general dominance in AI innovation by 2030, and the government recently announced that it will build a $2.2 billion industrial park dedicated to AI research and development.*
>
> *In a surprising turn, French President Emmanuel Macron announced France's own pledge to become a world leader in AI and plans to allocate €1.5 billion in funding to support their new national strategy. In a major public commitment to the national AI*

> *strategy, he also called for the opening of France's vast databases of citizen data for use in AI.*
>
> *Meanwhile, Russia is prioritizing its AI research efforts and funding on more martial ends, focusing on the creation of autonomous weapons systems. The military recently set a target of making 30 percent of military equipment robotic by 2025, and Russian defense firm Kalashnikov claims to be developing a line of weapons that will target and engage enemies based on neural network decision-making.*
>
> *America currently has no national AI strategy, and concerns about recent immigration policy are reportedly impacting the private sector's ability to attract foreign talent to the US.* [42]

Drew Cukor, chief of Project Maven, pointed at a historic shift in Google's focus to impress upon attendees at the 2017 Defense One Tech Summit the strategic importance of AI.

> *We are in an AI arms race… It's happening in industry [and] the big five internet companies are pursuing this heavily. Many of you will have noted that Eric Schmidt is calling Google an AI company now, not a data company.* [43]

Around the same time, at a conference hosted by the US Geospace Intelligence Foundation, Lt. Gen. John Shanahan, Director for Defense Intelligence overseeing Project Maven, jokingly implied that the company's capability in AI exceeded the US government's.

> *On the far end of the scale, you see Google. They don't tell us what they have, unless anyone from Google wants to whisper in my ear later…* [44]

At the time of these remarks, Google was approaching the 20th anniversary of its founding.

From Google to Alphabet, Inc.

Larry Page, born in 1973 in East Lansing, Michigan, graduated from the University of Michigan with a BSc in computer engineering, and then attended Stanford University, where he met Sergey Brin, a fellow PhD student in computer science. Born in Moscow in 1973, Brin moved to the US with his family at the age of 6, and studied mathematics and computer science at the University of Maryland. The two friends dropped out of the PhD programme to co-found Google in 1998.[45] Page and Brin created the algorithm at the base of the eponymous search engine, out of which they built a company with the aim to "organize the world's information and make it universally accessible and useful."[46]

Their first founders' letter, released before Google's IPO in 2004, recited:

> *Google is not a conventional company. We do not intend to become one.*
>
> *Our goal is to develop services that significantly improve the lives of as many people as possible. In pursuing this goal, we may do things that we believe have a positive impact on the world, even if the near term financial returns are not obvious… We are*

> *proud of the products we have built, and we hope that those we create in the future will have an even greater positive impact on the world.* [47] *(See Exhibit 5)*

The pair pledged to take turns writing a founders' letter each year, and have done so since. Google's original code of conduct explained its "Don't Be Evil" motto as follows:

> *Googlers generally apply those words to how we serve our users. But "Don't be evil" is much more than that. Yes, it's about providing our users unbiased access to information, focusing on their needs and giving them the best products and services that we can. But it's also about doing the right thing more generally—following the law, acting honourably and treating each other with respect.* [48]

Page was Google's first CEO. While the company grew quickly, his management practices were controversial.[49] He did not like the idea of non-engineers supervising engineers and in July 2001 fired a handful of project managers. Marissa Mayer, a talented early Google employee who would leave to take the post of CEO at Yahoo! in 2012, reminisced about those early days in a 2018 interview with the *New York Times*:

> *Larry and Sergey just yelled at us until we became what they needed us to become, and got done what they needed to be done.*[50]

Google began as a data company but saw meteoric growth, becoming a tech giant and a household name. Page stepped down as CEO in 2001, and Eric Schmidt oversaw Google's global expansion and broadening of ambitions over the next decade. By the end of Schmidt's tenure as CEO, Google was a public company with more than $25 billion in revenue per year and over 20,000 employees worldwide.[51] Years later, Schmidt recalled being puzzled by the "Don't Be Evil" motto. "When I showed up," he said, "I thought this was the stupidest rule ever, because there's no book about evil except maybe, you know, the Bible or something."[52]

Page reclaimed Google's CEO position in 2011. A more seasoned manager by then, he continued to invest heavily in Google's management practices. The company was an early leader in "people analytics". Project Oxygen, launched in 2008, used internal "big data" to determine what made a great manager and encourage Google engineers to be such managers.[53] Internal initiatives also evolved around fostering psychological safety, after Project Aristotle, an elaborate study of Google teams, found it to be the factor which distinguished the best performing teams from the rest.[54]

On August 10th, 2015, Page made a surprise announcement in a lengthy blog post, revealing that Google would become a wholly owned subsidiary of a new entity, Alphabet, Inc.:

> *As Sergey and I wrote in the original founders' letter 11 years ago, "Google is not a conventional company. We do not intend to become one." As part of that, we also said that you could expect us to make "smaller bets in areas that might seem very speculative or even strange when compared to our current businesses." From the*

> *start, we've always strived to do more, and to do important and meaningful things with the resources we have.*[55]

The new entity, with Page as CEO and Brin as President, aimed to make the company more fiscally accountable and transparent. The Alphabet structure separated Google, its most profitable subsidiary, from other entities pursuing promising "bets". These included Deep Mind, working on cutting edge AI, Waymo, developing self-driving cars, and Calico, working to "cure death".[56] (Around the same time, Google sold off Boston Dynamics, a company that made robots for the US army, that it had acquired two years earlier).[57] In the new structure, Sundar Pichai, former Google Senior Vice President of products, replaced Page as CEO of Google. Alphabet also replaced the "Don't Be Evil" motto with "Do the right thing."

In 2016, Alphabet briefly pushed past Apple as the world's most valuable public company.[58] January 2018 saw Alphabet outperform Apple on the stock market, so much so that it cut Apple's market capitalization lead to just under $30 billion.[59] (See Exhibit 6)

The establishment of Alphabet marked a historical shift. Brin and Page henceforth saw Alphabet companies, including Google, as AI companies, not data companies. In a 2017 interview at the World Economic Forum, Brin acknowledged that they had not foreseen AI's rise and relevance at first. "I didn't pay attention to it at all, to be perfectly honest," he said. By early 2017, however, things had changed. As he put it, "[AI] touches every single one of our main projects, ranging from search to photos to ads … everything we do!"[60] A year later, speaking at an event in San Francisco, Pichai put it even more starkly:

> *AI is one of the most important things humanity is working on. It is more profound than, I dunno, electricity or fire.* [61]

However, debate about those who were building the 21st century fires was heating up.

Changing Public Sentiment

At the time the Project Maven memo circulated among Google employees, the culture and impact of the tech industry and its largest players were under increasing scrutiny. Major questions involved privacy, gender discrimination, and political influence.

Computer analyst Edward Snowden set off the global debate on privacy and government surveillance of technology in the summer of 2013.[62] Snowden revealed classified information to the *Guardian* and the *Washington Post*, which made public that the US National Security Administration (NSA) used various platforms to collect data from the servers of companies like Microsoft, Yahoo, Facebook, and Google.[63] [64]

The last internal Google document to have made the mainstream news, a year before the Project Maven memo, had been a screed by a male employee titled "Google's ideological echo-chamber."[65] Its author contended that women were underrepresented at the company because of psychological differences, not discriminatory practices. He also alleged that "Google's left[wing] bias created a politically correct monoculture that maintain[ed] its hold

by shaming dissenters into silence." Published in the press while Google was being investigated by the US Department of Labor for wage discrimination, that memo had ignited a firestorm of negative press coverage and social media controversy. Pichai had promptly fired the author, and a court case ensued.[66]

At Uber, the ride-sharing giant, investors had pushed founder Travis Kalanick out of the CEO position for, among many other complaints, dismissing a user's claims that she had been raped. The company faced multiple legal inquiries "involving gender discrimination, complaints from drivers, and a large data breach in 2016," the *New Yorker* reported. The Uber board replaced Kalanick with Dara Khosrowshahi, giving him a mandate to turn the company culture around.[67] At a 2018 World Economic Forum panel on the future of the tech industry, Khosrowshahi sat near Salesforce CEO Marc Benioff, as the latter observed:

> *The signs are pointing to more regulation. […] We have been clear of those regulations for the entire lifespan of the industry and we are seeing signs, especially this year, especially with the elections, especially with social networks, and especially when you see CEOs who abdicate their responsibility and say 'I didn't know.'*[68]

The week that reports about the Project Maven memo appeared in the *New York Times*, another tech giant dominated the news cycle. Facebook founder and CEO Mark Zuckerberg appeared before the US Senate to explain the company's role in the 2016 US Presidential Election.[69]

In April 2018, Facebook attracted government scrutiny after reports that a political consultancy, Cambridge Analytica, had accessed the personal data of over 87 million users.[70] The UK-based consultancy and analytics firm was linked to the Trump campaign, leading to questions not only of breach of privacy, but also of whether this data was used to manipulate voters in the 2016 election, as a Cambridge Analytica employee alleged.[71] According to Facebook VP & Deputy General Counsel, Paul Grewal, Cambridge Analytica had gained access to the data in legitimate ways, but had not followed the platform's rules.[72] During the hearings, Zuckerberg admitted:[73]

> *It's clear now that we didn't do enough to prevent [Facebook's] tools from being used for harm. That goes for fake news, foreign interference in elections, and hate speech, as well as developers and data privacy.*

The Facebook breach brought up again questions about the government's role in regulation technology, and about the relationship between big tech and government in general. As CNET reported, reflecting on the hearings:[74]

> *For three decades, Silicon Valley has more or less escaped regulation as the government looked to nurture a new industry. The information age was ushering in jobs up and down the economy. And it wasn't just about selling nifty gadgets, either. The internet brought another boom, with Google, Netflix and Facebook needing*

> *engineers and coders to build search engines, email programs and video streaming used by billions of people.*

Zeynep Tufekci, a sociologist studying the practices and impact of tech companies, then Associate Professor at the University of North Carolina, had a more provocative theory. She wrote and spoke publicly suggesting that the US government allowed big tech to grow in order to allow a readily available global surveillance infrastructure to develop.[75] If not "too big to fail," she suggested, these companies were "too useful to slow down."

While Google employees like Laure were seeking information and debating on internal discussion boards and meetings, co-founder Sergey Brin's annual letter made the news. In late April 2018, two weeks after the Zuckerberg testimony and the reports about Project Maven, he wrote:[76]

> *Technology companies have historically been wide-eyed and idealistic about the opportunities that their innovations create. And for the overwhelming part, the arc of history shows that these advances, including the internet and mobile devices, have created opportunities and dramatically improved the quality of life for billions of people. … However, there are very legitimate and pertinent issues being raised, across the globe, about the implications and impacts of these advances.*

Exhibit 1

The Google Memo, Full Text

Dear Sundar,

We believe that Google should not be in the business of war. Therefore we ask that Project Maven be cancelled, and that Google draft, publicize and enforce a clear policy stating that neither Google nor its contractors will ever build warfare technology.

Google is implementing Project Maven, a customized AI surveillance engine that uses "Wide Area Motion Imagery" data captured by US Government drones to detect vehicles and other objects, track their motions, and provide results to the Department of Defense.

Recently, Googlers voiced concerns about Maven internally. Diane Greene responded, assuring them that the technology will not "operate or fly drones" and "will not be used to launch weapons." While this eliminates a narrow set of direct applications, the technology is being built for the military, and once it's delivered it could easily be used to assist in these tasks.

This plan will irreparably damage Google's brand and its ability to compete for talent. Amid growing fears of biased and weaponized AI, Google is already struggling to keep the public's trust. By entering into this contract, Google will join the ranks of companies like Palantir, Raytheon, and General Dynamics. The argument that other firms, like Microsoft and Amazon, are also participating doesn't make this any less risky for Google. Google's unique history, its motto *Don't Be Evil*, and its direct reach into the lives of billions of users set it apart.

We cannot **outsource the moral responsibility of our technologies to third parties**. Google's stated values make this clear: *Every one of our users is trusting us. Never jeopardize that. Ever.* This contract puts Google's reputation at risk and stands in direct opposition to our core values. **Building this technology to assist the US Government in military surveillance – and potentially lethal outcomes – is not acceptable.**

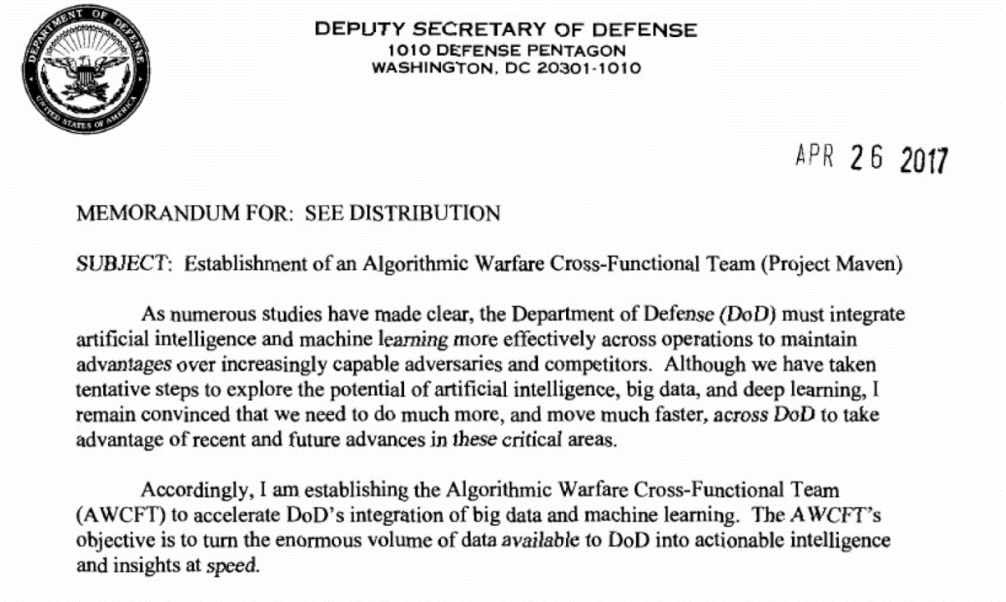
Recognizing Google's moral and ethical responsibility, and the threat to Google's reputation, we request that you:

1. Cancel this project immediately
2. Draft, publicize, and enforce a clear policy stating that neither Google nor its contractors will ever build warfare technology

Source: *New York Times*, Google memo, https://static01.nyt.com/files/2018/technology/googleletter.pdf

Exhibit 2

Establishment of Project Maven (excerpt)



DEPUTY SECRETARY OF DEFENSE
1010 DEFENSE PENTAGON
WASHINGTON, DC 20301-1010

APR 26 2017

MEMORANDUM FOR: SEE DISTRIBUTION

SUBJECT: Establishment of an Algorithmic Warfare Cross-Functional Team (Project Maven)

As numerous studies have made clear, the Department of Defense (DoD) must integrate artificial intelligence and machine learning more effectively across operations to maintain advantages over increasingly capable adversaries and competitors. Although we have taken tentative steps to explore the potential of artificial intelligence, big data, and deep learning, I remain convinced that we need to do much more, and move much faster, across DoD to take advantage of recent and future advances in these critical areas.

Accordingly, I am establishing the Algorithmic Warfare Cross-Functional Team (AWCFT) to accelerate DoD's integration of big data and machine learning. The AWCFT's objective is to turn the enormous volume of data available to DoD into actionable intelligence and insights at speed.

Source: The US Department of Defense, 2017.
http://dodcio.defense.gov/Portals/0/Documents/Project%20Maven%20DSD%20Memo%2020170425.pdf

Exhibit 3

DoD Blog Post about Project Maven (excerpt)

The effort to help a workforce increasingly overwhelmed by incoming data, including millions of hours of video, began in April when then-Deputy Defense Secretary Bob Work announced in a memo that he was establishing an Algorithmic Warfare Cross-Functional Team, overseen by the undersecretary of defense for intelligence, to work on something he called Project Maven.

"As numerous studies have made clear, the department of defense must integrate artificial intelligence and machine learning more effectively across operations to maintain advantages over increasingly capable adversaries and competitors," Work wrote.

"Although we have taken tentative steps to explore the potential of artificial intelligence, big data and deep learning," he added, "I remain convinced that we need to do much more and move much faster across DoD to take advantage of recent and future advances in these critical areas."

Project Maven focuses on computer vision -- an aspect of machine learning and deep learning -- that autonomously extracts objects of interest from moving or still imagery, Cukor said. Biologically inspired neural networks are used in this process, and deep learning is defined as applying such neural networks to learning tasks.

"This effort is an announcement … that we're going to invest for real here," he said.

Source: Pellerin, Cheryl, 2017. "Project Maven to Deploy Computer Algorithms to War Zone by Year's End." The US Department of Defense, July 21.
https://www.defense.gov/News/Article/Article/1254719/project-maven-to-deploy-computer-algorithms-to-war-zone-by-years-end/

Exhibit 4

Eric Schmidt's Statement (excerpts)

Statement of Dr Eric Schmidt House Armed Services Committee April 17, 2018

Today, the private sector, not government, is developing the most critical technologies from which modern weapons systems are deriving the most significant advantage. Software and processing speed drive the leading edge of complex weapons systems today, including electronic warfare, cyber, space-based systems, algorithms and machine learning for sensor fusion, the proliferation of unmanned systems and autonomy, and so forth.

With this in mind, everyone in the world - including U.S. competitors - has equal access to this technology. But a slow-moving requirements process intended to maximize consensus among users and drive precision into the defense industrial base does more to hinder rapid adoption of commercial technologies than it does to facilitate it. Improved software engineering and a focus on artificial intelligence (AI) will accelerate DoD's speed, but only if the Department invests enterprise-wide resources towards this effort.

[…]

Other groundbreaking efforts include *Project Maven*, which is the most successful DoD effort to deliver AI to date; the *Joint Improvised-Threat Defeat Organization (JIDO),* which enabled the rapid collection, fusion, and dissemination of operational data by building a classified DevOps-enabled cloud computing environment; the *Defense Digital Service (DDS)*, which brings in the nation's top technical talent to work on problems of significant impact where technology fails the mission of national defense.

[…]

Any military that fails to pursue enterprise-wide cloud computing isn't serious about winning future conflicts. AI is not achievable without modern commercial cloud computing that can store and secure the data DoD regularly collects. This volume of data will only increase in the years to come as the use of sensors proliferates and DoD's ability to collect data expands – while its ability to process it deteriorates due to a reliance on outdated data centres with limited data storage and transport capacity. This urgent need to address DoD's lack of compute and storage was the focus of one of the Board's official recommendations announced in October 2016.

Source: Statement of Dr. Eric Schmidt, House Armed Services Committee, April 17, 2018
https://docs.house.gov/meetings/AS/AS00/20180417/108132/HHRG-115-AS00-Wstate-SchmidtE-20180417.pdf

Exhibit 5

Google's First Founders' Letter (excerpts)

"An Owner's Manual" for Google's Shareholders

Introduction

Google is not a conventional company. We do not intend to become one. Throughout Google's evolution as a privately held company, we have managed Google differently. We have also emphasized an atmosphere of creativity and challenge, which has helped us provide unbiased, accurate and free access to information for those who rely on us around the world.

[…]

Sergey and I founded Google because we believed we could provide an important service to the world-instantly delivering relevant information on virtually any topic. Serving our end users is at the heart of what we do and remains our number one priority.

Our goal is to develop services that significantly improve the lives of as many people as possible. In pursuing this goal, we may do things that we believe have a positive impact on the world, even if the near term financial returns are not obvious.

[…]

We will not shy away from high-risk, high-reward projects because of short-term earnings pressure. Some of our past bets have gone extraordinarily well, and others have not. Because we recognize the pursuit of such projects as the key to our long-term success, we will continue to seek them out. For example, we would fund projects that have a 10% chance of earning a billion dollars over the long term. Do not be surprised if we place smaller bets in areas that seem very speculative or even strange when compared to our current businesses. Although we cannot quantify the specific level of risk we will undertake, as the ratio of reward to risk increases, we will accept projects further outside our current businesses, especially when the initial investment is small relative to the level of investment in our current businesses.

We encourage our employees, in addition to their regular projects, to spend 20% of their time working on what they think will most benefit Google. This empowers them to be more creative and innovative.

[…]

Our employees, who have named themselves Googlers, are everything. Google is organized around the ability to attract and leverage the talent of exceptional technologists and business people. We have been lucky to recruit many creative, principled and hardworking stars. We hope to recruit many more in the future. We will reward and treat them well. …

The significant employee ownership of Google has made us what we are today. Because of our employee talent, Google is doing exciting work in nearly every area of computer science. ... Talented people are attracted to Google because we empower them to change the world; Google has large computational resources and distribution that enables individuals to make a difference. Our main benefit is a workplace with important projects, where employees can contribute and grow. We are focused on providing an environment where talented, hardworking people are rewarded for their contributions to Google and for making the world a better place.

[…]

We aspire to make Google an institution that makes the world a better place. In pursuing this goal, we will always be mindful of our responsibilities to our shareholders, employees, customers and business partners.

Source: Alphabet website https://abc.xyz/investor/founders-letters/2004/ipo-letter.html (Access date: May 17, 2018)

Exhibit 6

Summary of Alphabet Inc.'s 2017 Q4 and Fiscal Year Results

Alphabet Announces Fourth Quarter and Fiscal Year 2017 Results

MOUNTAIN VIEW, Calif. – February 1, 2018 – Alphabet Inc. (NASDAQ: GOOG, GOOGL) today announced financial results for the quarter and fiscal year ended December 31, 2017.

"Our business is driving great growth, with 2017 revenues of $110.9 billion, up 23% year on year, and fourth quarter revenues of $32.3 billion, up 24% year on year. Our full year operating income growth continues to underscore our core strength, and on top of this, we continue to make substantial investments for the long-term in exciting new businesses," said Ruth Porat, CFO of Alphabet.

Source: https://abc.xyz/investor/pdf/2017Q4_alphabet_earnings_release.pdf (Accessed May 17, 2018)

Endnotes

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