**A Timely Example of Fusion of Dynamics, Control, Big Data and Artificial Intelligence**

[*Presented by* Prof. Sherman to AERE & STAT classes 11/15 & 11/16]

<https://www.theguardian.com/science/2017/nov/13/ban-on-killer-robots-urgently-needed-say-scientists>

“In August, more than 100 of the world’s leading robotics and AI pioneers called on the UN to [ban the development and use of killer robots](https://www.theguardian.com/technology/2017/aug/20/elon-musk-killer-robots-experts-outright-ban-lethal-autonomous-weapons-war). The [open letter](https://futureoflife.org/autonomous-weapons-open-letter-2017/), signed by Tesla’s chief executive, Elon Musk, and Mustafa Suleyman, the founder of Alphabet’s Deep Mind AI unit, warned that an urgent ban was needed to prevent a “third revolution in warfare”, after gunpowder and nuclear arms.”

# An Open Letter to the United Nations Convention on

# Certain Conventional Weapons

# [See Appendix for the list of signatories.]

<https://futureoflife.org/autonomous-weapons-open-letter-2017/>

As companies building the technologies in Artificial Intelligence and Robotics that may be repurposed todevelop autonomous weapons, we feel especially responsible in raising this alarm. We warmly welcome the decision of the UN’s Conference of the Convention on Certain Conventional Weapons (CCW) to establish a Group of Governmental Experts (GGE) on Lethal Autonomous Weapon Systems. Many of our researchers and engineers are eager to offer technical advice to your deliberations.

We commend the appointment of Ambassador Amandeep Singh Gill of India as chair of the GGE. We entreat the High Contracting Parties participating in the GGE to work hard at finding means to prevent an arms race in these weapons, to protect civilians from their misuse, and to avoid the destabilizing effects of these technologies. We regret that the GGE’s first meeting, which was due to start today (August 21, 2017), has been cancelled due to a small number of states failing to pay their financial contributions to the UN. We urge the High Contracting Parties therefore to double their efforts at the first meeting of the GGE now planned for November.

Lethal autonomous weapons threaten to become the third revolution in warfare. Once developed, they will permit armed conflict to be fought at a scale greater than ever, and at timescales faster than humans can comprehend. These can be weapons of terror, weapons that despots and terrorists use against innocent populations, and weapons hacked to behave in undesirable ways. We do not have long to act. Once this Pandora’s box is opened, it will be hard to close. We therefore implore the High Contracting Parties to find a way to protect us all from these dangers.

Translations: [*Chinese*](http://futureoflife.org/open-letter-united-nations-convention-certain-conventional-weapons-chinese) *[http://futureoflife.org/wp-content/uploads/2016/06/china_flag-e1464798319604.png?x56934](https://futureoflife.org/open-letter-united-nations-convention-certain-conventional-weapons-chinese/)* [*Japanese*](https://futureoflife.org/open-letter-united-nations-convention-certain-conventional-weapons-japanese/) ***[http://futureoflife.org/wp-content/uploads/2016/02/red_circle.jpg?x56934](https://futureoflife.org/open-letter-united-nations-convention-certain-conventional-weapons-japanese/)***  [*Russian*](https://futureoflife.org/open-letter-united-nations-convention-certain-conventional-weapons-russian/) *[http://futureoflife.org/wp-content/uploads/2016/02/Russian_Flag.jpg?x56934](https://futureoflife.org/open-letter-united-nations-convention-certain-conventional-weapons-russian/)*

**The video:** Slaughterbots YouTube: <https://www.youtube.com/watch?v=HipTO_7mUOw>

**WARNING**: **This video includes elements of graphic violence.** **For this reason, the video will be stopped @ 1:22.**

**Discussion in relation to FUSION TECHNOLOGY:**

* **System Dynamics: [System = 1 drone + drone swarm + inanimate objects + animate objects + human intellectual/emotional traits + societal traits + economic traits + political traits (+ more).] The dynamics are in relation to multiple space/time scales.**
* **Sensing: cameras (visual, thermal-imaging), microphones, GPS, accelerometers.**
* **Dynamics State Estimation/Prediction: Kalman filtering, neural networks, fuzzy sets.**
* **Open and Closed Loop Control of Dynamics: [For command, disturbance, and noise inputs].**
* **Big Data: How to compress very high-dimensional data into lower dimensions suitable for state estimation, command, and control. [Sensors, situational awareness, confounding variables.**
* **Artificial Intelligence (AI): Self-learning algorithms for survival, optimal task management, and creation of new command/control strategies.**
* **Fusion of all of the above.**

# Summary: The technology demonstrated in the video is on the shelf today. However, previous incarnations of it have been applied for many decades; each reincarnation being progressively more sophisticated than the past. The accelerating pace of technology will lead to dramatic and rapid changes, not only in relation to its uses, but to economic, societal, and political changes, as well. We, as engineers, generally have a penchant for restricting our focus on contributing to advances in technology. We defer to others in relation to how it will be used. The above list of signatories to the Open Letter to the United Nations Convention on Certain Conventional Weapons suggests that we must become more aware of how this technology might be used, even as we develop it. For, once it is developed, it is out of our hands. There is an old adage: *History repeats itself*. However, the repetition is spiral rather than circular, in nature. Each time it repeats, its impact is broader, greater, and more enduring. Yes, we are engineers. However, we are, first and foremost, human beings. Unless we more fully integrate our humanity into our work, we will be willfully ignorant accomplices of any potential malevolent uses of our technological contributions.

**Some References in Relation to How Technology Influenced History:**

1.Howard Zinn “A People’s History of the United States

<http://192.168.1.1:8181/http://library.uniteddiversity.coop/More_Books_and_Reports/Howard_Zinn-A_peoples_history_of_the_United_States.pdf>

2.Noam Chomsky “Understanding Power: The Indispensable Chomsky”

<http://www.chomskylist.com/book_page.php?book_id=316>

3. Alfred McCoy “In the Sadows of the American Century”

<https://www.haymarketbooks.org/books/1068-in-the-shadows-of-the-american-century>

**For another example of Fusion Dynamics see:** [**https://www.youtube.com/watch?v=AO4In7d6X-c**](https://www.youtube.com/watch?v=AO4In7d6X-c)

**Appendix FULL LIST OF SIGNATORIES TO THE OPEN LETTER**

To add your company, please contact Toby Walsh at tw@cse.unsw.edu.au.

**Tiberio Caetano**, founder & Chief Scientist at Ambiata, Australia.  
**Mark Chatterton and Leo Gui**, founders, MD & of Ingenious AI, Australia.  
**Charles Gretton**, founder of Hivery, Australia.  
**Brad Lorge**, founder & CEO of Premonition.io, Australia  
**Brenton O’Brien**, founder & CEO of Microbric, Australia.  
**Samir Sinha**, founder & CEO of Robonomics AI, Australia.  
**Ivan Storr**, founder & CEO, Blue Ocean Robotics, Australia.  
**Peter Turner**, founder & MD of Tribotix, Australia.  
**Yoshua Bengio**, founder of Element AI & Montreal Institute for Learning Algorithms, Canada.  
**Ryan Gariepy**, founder & CTO, Clearpath Robotics, found & CTO of OTTO Motors, Canada.  
**Geoffey Hinton**, founder of DNNResearch Inc, Canada.  
**James Chow**, founder & CEO of UBTECH Robotics, China.  
**Robert Li**, founder & CEO of Sankobot, China.  
**Marek Rosa**, founder & CEO of GoodAI, Czech Republic.  
**Søren Tranberg Hansen**, founder & CEO of Brainbotics, Denmark.  
**Markus Järve**, founder & CEO of Krakul, Estonia.  
**Harri Valpola**, founder & CTO of ZenRobotics, founder & CEO of Curious AI Company, Finland.  
**Esben Østergaard**, founder & CTO of Universal Robotics, Denmark.  
**Raul Bravo**, founder & CEO of DIBOTICS, France.  
**Ivan Burdun**, founder & President of AIXTREE, France.  
**Raphael Cherrier**, founder & CEO of Qucit, France.  
**Alain Garnier**, founder & CEO of ARISEM (acquired by Thales), founder & CEO of Jamespot, France.  
**Jerome Monceaux**, founder & CEO of Spoon.ai, founder & CCO of Aldebaran Robotics, France.  
**Charles Ollion**, founder & Head of Research at Heuritech, France.  
**Anis Sahbani**, founder & CEO of Enova Robotics, France.  
**Alexandre Vallette**, founder of SNIPS & Ants Open Innovation Labs, France.  
**Marcus Frei**, founder & CEO of NEXT.robotics, Germany.  
**Kirstinn Thorisson**, founder & Director of Icelandic Institute for Intelligence Machines, Iceland.  
**Fahad Azad**, founder of Robosoft Systems, India.  
**Debashis Das, Ashish Tupate & Jerwin Prabu**, founders (incl. CEO) of Bharati Robotics, India.  
**Pulkit Gaur**, founder & CTO of Gridbots Technologies, India.  
**Pranay Kishore**, founder & CEO of Phi Robotics Research, India.  
**Shahid Memom**, founder & CTO of Vanora Robots, India.  
**Krishnan Nambiar & Shahid Memon**, founders, CEO & CTO of Vanora Robotics, India.  
**Achu Wilson**, founder & CTO of Sastra Robotics, India.  
**Neill Gernon**, founder & MD of Atrovate, founder of Dublin.AI, Ireland.  
**Parsa Ghaffari**, founder & CEO of Aylien, Ireland.  
**Alan Holland**, founder & CEO of Keelvar Systems, Ireland.  
**Alessandro Prest**, founder & CTO of LogoGrab, Ireland.  
**Frank Reeves**, founder & CEO of Avvio, Ireland.  
**Alessio Bonfietti**, founder & CEO of MindIT, Italy.  
**Angelo Sudano**, founder & CTO of ICan Robotics, Italy.  
**Domenico Talia**, founder and R&D Director of DtoK Labs, Italy.  
**Shigeo Hirose, Michele Guarnieri, Paulo Debenest, & Nah Kitano**, founders, CEO & Directors of HiBot Corporation, Japan.  
**Andrejs Vasiljevs**, founder and CEO of Tilde, Latvia.  
**Luis Samahí García González**, founder & CEO of QOLbotics, Mexico.  
**Koen Hindriks & Joachim de Greeff**, founders, CEO & COO at Interactive Robotics, the Netherlands.  
**Maja Rudinac**, founder and CEO of Robot Care Systems, the Netherlands.  
**Jaap van Leeuwen**, founder and CEO Blue Ocean Robotics Benelux, the Netherlands.  
**Rob Brouwer**, founder and Director of Operatins, Aeronavics, New Zealand.  
**Philip Solaris**, founder and CEO of X-Craf Enterprises, New Zealand.  
**Dyrkoren Erik, Martin Ludvigsen & Christine Spiten**, founders, CEO, CTO & Head of Marketing at BlueEye Robotics, Norway.  
**Sergii Kornieiev**, founder & CEO of BaltRobotics, Poland.  
**Igor Kuznetsov**, founder & CEO of NaviRobot, Russian Federation.  
**Aleksey Yuzhakov & Oleg Kivokurtsev**, founders, CEO & COO of Promobot, Russian Federation.  
**Junyang Woon**, founder & CEO, Infinium Robotics, former Branch Head & Naval Warfare Operations Officer, Singapore.  
**Jasper Horrell**, founder of DeepData, South Africa.  
**Onno Huyser and Mark van Wyk**, founders of FlyH2 Aerospace, South Africa.  
**Toni Ferrate**, founder & CEO of RO-BOTICS, Spain.  
**José Manuel del Río**, founder & CEO of Aisoy Robotics, Spain.  
**Victor Martin**, founder & CEO of Macco Robotics, Spain.  
**Angel Lis Montesinos**, founder & CTO of Neuronalbite, Spain.  
**Timothy Llewellynn**, founder & CEO of nViso, Switzerland.  
**Francesco Mondada**, founder of K-Team, Switzerland.  
**Jurgen Schmidhuber, Faustino Gomez, Jan Koutník, Jonathan Masci & Bas Steunebrink**, founders, President & CEO of Nnaisense, Switzerland.  
**Satish Ramachandran**, founder of AROBOT, United Arab Emirates.  
**Silas Adekunle**, founder & CEO of Reach Robotics, UK.  
**Steve Allpress**, founder & CTO of FiveAI, UK.  
**John Bishop**, founder and Director of Tungsten Centre for Intelligent Data Analytis, UK.  
**Joel Gibbard and Samantha Payne**, founders, CEO & COO of Open Bionics, UK.  
**Richard Greenhill & Rich Walker**, founders & MD of Shadow Robot Company, UK.  
**Nic Greenway**, founder of React AI Ltd (Aiseedo), UK.  
**Daniel Hulme**, founder & CEO of Satalia, UK.  
**Bradley Kieser**, founder & Director of SMS Speedway, UK.  
**Charlie Muirhead & Tabitha Goldstaub**, founders & CEO of CognitionX, UK.  
**Geoff Pegman**, founder & MD of R U Robots, UK.  
**Demis Hassabis & Mustafa Suleyman**, founders, CEO & Head of Applied AI, DeepMind, UK.  
**Donald Szeto, Thomas Stone & Kenneth Chan**, founders, CTO, COO & Head of Engineering of PredictionIO, UK.  
**Antoine Biondeau**, founder & CEO of Sentient Technologies, USA.  
**Steve Cousins**, founder & CEO of Savioke, USA.  
**Brian Gerkey**, founder & CEO of Open Source Robotics, USA.  
**Ryan Hickman & Soohyun Bae**, founders, CEO & CTO of TickTock.AI, USA.  
**John Hobart**, founder & CEO of Coria, USA.  
**Henry Hu**, founder & CEO of Cafe X Technologies, USA.  
**Zaib Husain**, founder & CEO of SparkCognitin, USA.  
**Alfonso Íñiguez**, founder & CEO of Swarm Technology, USA.  
**Kris Kitchen**, founder & Chief Data Scientit at Qieon Research, USA.  
**Justin Lane**, founder of Prospecture Simulation, USA.  
**Gary Marcus**, founder & CEO of Geometric Intelligence (acquired by Uber), USA.  
**Brian Mingus**, founder & CTO of Latently, USA.  
**Mohammad Musa**, founder & CEO at Deepen AI, USA.  
**Elon Musk**, founder, CEO & CTO of SpaceX, co-founder & CEO of Tesla Motor, USA.  
**Rosanna Myers & Dan Corkum**, founders, CEO & CTO of Carbon Robotics, USA.  
**Erik Nieves**, founder & CEO of PlusOne Robotics, USA.  
**Steve Omohundro**, founder & President of Possibility Research, USA.  
**Jeff Orkin**, founder & CEO, Giant Otter Technologies, USA.  
**Greg Phillips**, founder & CEO, ThinkIt Data Solutins, USA.  
**Dan Reuter**, founder & CEO of Electric Movement, USA.  
**Alberto Rizzoli & Simon Edwardsson**, founders & CEO of AIPoly, USA.  
**Dan Rubins**, founder & CEO of Legal Robot, USA.  
**Stuart Russell**, founder & VP of Bayesian Logic Inc., USA.  
**Andrew Schroeder**, founder of WeRobotics, USA.  
**Stanislav Shalunov**, founder & CEO of Clostra, USA  
**Gabe Sibley & Alex Flint**, founders, CEO & CPO of Zippy.ai, USA.  
**Martin Spencer**, founder & CEO of GeckoSystems, USA.  
**Peter Stone, Mark Ring & Satinder Singh**, founders, President/COO, CEO & CTO of Cogitai, USA.  
**Michael Stuart**, founder & CEO of Lucid Holdings, USA.  
**Madhuri Trivedi**, founder & CEO of OrangeHC, USA.  
**Massimiliano Versace**, founder, CEO & President, Neurala Inc, USA.  
**Reza Zadeh**, founder & CEO of Matroid, USA.