8.DARPA - nanotechnology

1.Military Defense Robotics Machines Will Rise: Becoming Self Aware The Department of Defense is building robots for the Pentagon. It has been seen as a move that could advance AI research and move the Defense robotics industry into the New Age. As viewed in our Exoskeleton section one of the leading manufactures in the exoskeleton arena is a company called Cyberdyne Technologies. Industry experts are already predicting that when the soldier steps out of this unit the exoskeleton will be able to operate autonomously. 2.NANO SOLDIERS A New Industrial Revolution In January 2000, U.S. President Bill Clinton requested a $227-million increase in the government's investment in nanotechnology research and development, which included a major initiative called the National Nanotechnology Initiative (NNI). This initiative nearly doubled America 's 2000 budget investment in nanotechnology, bringing the total invested in nanotechnology to $497 million for the 2001 national budget. In a written statement, White House officials said that “nanotechnology is the new frontier and its potential impact is compelling.” About 70 percent of the new nanotechnology funding will go to university research efforts, which will help meet the demand for workers with nanoscale science and engineering skills. The initiative will also fund the projects of several governmental agencies, including the National Science Foundation , the Department of Defense , the Department of Energy , the National Institutes of Health , NASA and the National Institute of Standards and Technology. Much of the research will take more than 20 years to complete, but the process itself could touch off a new industrial revolution. Nanotechnology is likely to change the way almost everything, including medicine, computers and cars, are designed and constructed. Nanotechnology is anywhere from five to 15 years in the future, and we won't see dramatic changes in our world right away. 21 A Short History of Nanotechnology 1959 Feynman gives after-dinner talk describing molecular machines building with atomic precision 1974 Taniguchi uses term “nano-technology” in paper on ion-sputter machining 1977 Drexler originates molecular nanotechnology concepts at MIT 1981 First technical paper on molecular engineering to build with atomic precision STM invented 1985 Buckyball discovered 1986 First book published AFM invented First organization formed 1987 First protein engineered First university symposium 1988 First university course 1989 IBM logo spelled in individual atoms First national conference 1990 First nanotechnology journal Japan's STA begins funding nanotech projects 1991 Japan''s MITI announces bottom-up “atom factory” IBM endorses bottom-up path Japan's MITI commits $200 million Carbon nanotube discovered 22 1992 First textbook published First Congressional testimony 1993 First Feynman Prize in Nanotechnology awarded for modeling a hydrogen abstraction tool useful in nanotechnology First coverage of nanotech from White House “Engines of Creation” book given to Rice administration, stimulating first university nanotech center 1994 Nanosystems textbook used in first university course US Science Advisor advocates nanotechnology 1995 First think tank report First industry analysis of military applications Feynman Prize in Nanotechnology awarded for synthesis of complex three- dimensional structures with DNA molecules 1996 $250,000 Feynman Grand Prize announced First European conference NASA begins work in computational nanotech First nanobio conference 1997 First company founded: Zyvex First design of nanorobotic system Feynman Prize in Nanotechnology awarded for work in computational nanotechnology and using scanning probe microscopes to manipulate molecules 1998 First NSF forum, held in conjunction with Foresight Conference First DNA-based nanomechanical device Feynman Prize in Nanotechnology awarded for computational modeling of molecular tools for atomically-precise chemical reactions and for building molecular structures through the use of self-organization 1999 First Nanomedicine book published First safety guidelines Congressional hearings on proposed National Nanotechnology Initiative Feynman Prize in Nanotechnology awarded for development of carbon nanotubes for potential computing device applications and for modeling the operation of molecular machine designs 23 2000 President Clinton announces U.S. National Nanotechnology Initiative First state research initiative: $100 million in

California Feynman Prize in Nanotechnology awarded for computational materials science for nanostructures and for building a molecular switch 2001 First report on nanotech industry U.S. announces first center for military applications Feynman Prize in Nanotechnology awarded for theory of nanometer-scale electronic devices and for synthesis and characterization of carbon nanotubes and nanowires 2002 First nanotech industry conference Regional nanotech efforts multiply Feynman Prize in Nanotechnology awarded for using DNA to enable the self- assembly of new structures and for advancing our ability to model molecular machine systems 2003 Congressional hearings on societal implications Call for balancing NNI research portfolio Drexler/Smalley debate is published in Chemical & Engineering News Feynman Prize in Nanotechnology awarded for modeling the molecular and electronic structures of new materials and for integrating single molecule biological motors with nano-scale silicon devices 2004 First policy conference on advanced nanotech First center for nanomechanical systems Feynman Prize in Nanotechnology awarded for designing stable protein structures and for constructing a novel enzyme with an altered function 2005 At Nanoethics meeting, Roco announces nanomachine/nanosystem project count has reached 300 Feynman Prize in Nanotechnology awarded for for designing a wide variety of single molecular functional nanomachines and for synthesizing macromolecules of intermediate sizes with designed shapes and functions 2006 National Academies nanotechnology report calls for experimentation toward molecular manufacturing Feynman Prize in Nanotechnology awarded for work in molecular computation and algorithmic self-assembly, and for producing complex two-dimensional arrays of DNA nanostructures 24 2007 Feynman Prize in Nanotechnology awarded for construction of molecular machine systems that function in the realm of Brownian motion, and molecular machines based upon two-state mechanically interlocked compounds 2008 Technology Roadmap for Productive Nanosystems released Protein catalysts designed for non-natural chemical reactions Feynman Prize in Nanotechnology awarded for work in molecular electronics and the synthesis of molecular motors and nanocars, and for theoretical contributions to nanofabrication and sensing 2009 An improved walking DNA nanorobot Structural DNA nanotechnology arrays devices to capture molecular building blocks Design 'from scratch' of a small protein that performed the function performed by natural globin proteins Organizing functional components on addressable DNA scaffolds Feynman Prize in Nanotechnology awarded for experimental demonstrations of mechanosynthesis using AFM to manipulate single atoms, and for computational analysis of molecular tools to build complex molecular structures 2010 DNA-based 'robotic' assembly begins Feynman Prize in Nanotechnology awarded for work in single atom manipulations and atomic switches, and for development of quantum mechanical methods for theoretical predictions of molecules and solids 2011 First programmable nanowire circuits for nanoprocessors DNA molecular robots learn to walk in any direction along a branched track Mechanical manipulation of silicon dimers on a silicon surface 25

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