

Leap-Frogging Current R&D 100 Award Technologies

R&D Magazine is well-known for identifying leading edge research that has a clearly defined path for development into new technologies that will be highly beneficial to society. This is reported annually through their annual R&D 100 Award winners.

At the same time, the U.S. Patent and Trademark Office exists to not only provide a method for inventors to harvest value from their inventions, but to make them public so that other individuals may learn from that new idea – and indeed jump beyond those ideas to create even more advantageous inventions.

You are the Chief Technology Officer of a company that has made their reputation through groundbreaking research inspired by and leaping beyond ideas found in such sources as the R&D 100 Awards and newly issued patents. Your CEO is interested in using your company's expertise in micro to nanoscale materials, processing, and devices to define a research and development path for a new innovative technology inspired by the 2014 R&D 100 Award winners (The list of award winners is attached; go to this webpage for the online list with links to all the winners - <http://www.rdmag.com/award-winners/2014/08/2014-r-d-100-award-winners>). This technology must be clearly independent of the inspiring awards to avoid any chance of intellectual property infringement claims, and must show a clear path leading to commercial products. The CEO will place high priority on your identification of a technology that would be a key player in some rapidly expanding emergent market in the next five years, so developing cost competitive and practical technologies to create high return on investment for the company is required.

For your proposal to be considered you must start by clearly identifying the specific R&D 100 Award (or combination of awards) that inspired your new idea. Within the proposal you must also clearly identify why the award(s) would not be an intellectual property barrier to commercialization of your new idea.

Your job as CTO is to deliver a complete proposal with your plan for the company to compete in this area to your CEO by your Monday morning, March 30th deadline.

YOUR DELIVERABLE

Your task is to write an internal proposal for your corporate officers describing your idea for research and development. The proposal should include the following:

- Executive summary (one page)
- Risk assessment roadmap form (one page)
- Full proposal (15 pages maximum)
- Appendix A: List of references (no page limit)
- Appendix B: Ranked list of intellectual property documents examined (no page limit)

Most Importantly – The significance and novelty of your creative solution, one that moves the boundaries of knowledge outward, will be the primary assessment focus of your review panel. The list below is just a minimum list of issues you might consider. There may be many more. The point is that your proposal *should contain the evidence* needed to make an effective and compelling case to your CEO in order to insure that she/he makes the right decision.

At a minimum, be sure you address all of the following:

Current Science and Technologies - What is already being done in this area by other researchers, companies and governmental institutions? Describe the current state-of-the-art for both the science and the implementation. Use diverse resources such as science literature, journals, conference proceedings, the internet, patents or other sources of existing public knowledge. **Cite all references you use and use quotes for any word-for-word transfer to your report.**

Your Design Approach – What is the basis for your design approach to the problem? Why is your product better than existing products? What product attribute(s) allow market penetration to achieve profitability? Address scientific *and* engineering aspects of these questions.

Testing and Qualification - Describe a set of tests you will use to demonstrate that your approach is effective and that your implementation of the solution will launch successfully.

Cost Analysis – Identify cost and market issues that will impact the pricing strategy of the solution you have proposed. Consider such things as: the major cost items that would impact the implementation; which elements of your implementation solution would be handled in-house versus externally-sourced; major risk elements that could drive up costs if the primary path item fails; costs of IP licensing needed, etc. Provide justification and/or reasoning behind your decisions. Estimate manufacturing cost for the total system as the product reaches mature product stage, so the marketing team can determine potential market size. Avoid subcontracting manufacture or assembly of any proprietary component outside the company, because the CEO is concerned with potential IP leakage.

Intellectual Property – In Appendix B, list in rank order of importance **all** commercial, academic, and governmental IP sources that were consulted while formulating the answer, including reference data. For instance, include the patent number; title; inventor name; and assignee name for a patent. Discuss the 3 most significant IP documents affecting your approach to your solution in the 15-page document. Compare strengths and weaknesses of these approaches relative to your own. Recommend how these IP threats should be handled.

Hint – Clearly state your hypothesized solution. Identify its innovation(s) and advantages relative to state of the art. Describe both existing data, and work needed to support each aspect of the hypothetical solution. Consider theoretical, fabrication, and characterization aspects: for each, identify software/equipment and methods to use, parameters to vary, anticipated outcomes, and possible alternatives in the event of unsatisfactory results. Discuss material, process, device, and systems aspects of your solution. *Refine* your hypothesized solution as you accumulate information and prepare the manuscript. **Remember:** clearly distinguish what is known from what is hypothesized or not known. What is needed to distinguish the important things to know?

Reference the 2015 PhD Candidacy Exam Guidelines document for general instructions.

The following article was copied from the R&D magazine website:

<http://www.rdmag.com/award-winners/2014/08/2014-r-d-100-award-winners>

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R&D Magazine

2014

R&D 100 Winners

Press release: [R&D Editors Announce 2014 R&D 100 Awards](#)

The 2014 R&D 100 Award Winners are listed below in alphabetical order by the name of the primary developer company.

Primary Developer	2014 R&D 100 Winning Technology (Category)	Co-developers/Contributors
AdValue Photonics	All-Fiber Isolator (Lasers/Photonics)	
Agilent Technologies	Agilent Technologies N2820A Series High-Sensitivity, High Dynamic Range Current Probes (Electronic Instrumentation)	
Agilent Technologies Australia (M) Pty Ltd	Agilent Cary 7000 Universal Measurement Spectrophotometer (UMS) and Universal Measurement Accessory (Analytical Instrumentation)	
Alcoa Inc.	Alcoa 951 (Chemicals)	
American Standard	The SaTo Hygienic Toilet Pan (Consumer Products)	
Applied NanoStructures Inc. (AppNano)	Vertisense Scanning Thermal Microscopy Module (Imaging Technologies)	
Argonne National Laboratory	SIS Lithography (Thin Film & Vacuum Technologies)	
Argonne National Laboratory	NanoFab Lab...in a Box! (Thin Film & Vacuum Technologies)	EChem Nanowires Educational Foundation Inc.

Argonne National Laboratory	Argonne's Advanced Redox Shuttle Additive for Overcharge Protection of Lithium-Ion Batteries Used in Electric Vehicles (Energy)	
Arkansas Power Electronics International Inc. (APEI)	High-Performance Silicon Carbide-based Plug-In Hybrid Electric Vehicle Battery Charger (Energy)	Oak Ridge National Laboratory Univ. of Arkansas Toyota Research Institute of North America Cree Inc. Advanced Research Projects Agency - Energy
Brookhaven National Laboratory	GammaScout (Beam Instruments)	Korea Univ.
Bruker Nano Surfaces	LumiMap (Thin Film & Vacuum Technologies)	
Carl Zeiss Microscopy LLC	ELYRA P.1 with 3D PALM (Imaging Technologies)	
CEM Corp.	Liberty Blue Automated Microwave Peptide Synthesizer (Laboratory Equipment)	
Clean Filtration Technologies LLC, a Dow Chemical Company	TEQUATIC PLUS Fine Particle Filter (Environmental Technologies)	The Dow Chemical Company
Crystal Solar Inc.	Direct Gas to Wafer Epitaxial System (Thin Film & Vacuum Technologies)	National Renewable Energy Laboratory
Daimler AG	NANOSLIDE (Process Science)	Gebr. Heller Maschinenfabrik GmbH
Dow AgroSciences LLC	Transform WG Insecticide and Closer SC Insecticide with Isoclast Active (Chemicals)	
Dow Europe GmbH	BETAMATE 1630 Structural Adhesive (Chemicals)	The Dow Chemical Company Dow Automotive Systems

EMD Millipore	Clarisolve (Laboratory Equipment)	
EMD Millipore	SmartFlare RNA Detection Probes (Life Sciences)	
Excellims Corporation	IA3100 HPIMS HPLC Detector (Analytical Instrumentation)	
Filter Sensing Technologies Inc.	RF-DPF Diesel Particulate Filter Sensor (Environmental Technologies)	Massachusetts Institute of Technology Oak Ridge National Laboratory
Green Theme Technologies LLC	The ChemStik Technology (Chemicals)	Under Armour Inc.
Hitachi Research Laboratory, Hitachi Ltd	Hitachi Cs-Sr simultaneous adsorbent (Environmental Technologies)	Hitachi-GE Nuclear Energy Ltd.
Hysitron Inc.	xSol (Mechanical Systems)	
Hysitron Inc.	Hysitron Biomechanical Test Instrument (Confocal TriboScope) (Imaging Technologies)	
Idaho National Laboratory	Advanced Electrolyte Model (AEM) (Software)	
Idaho National Laboratory	Multiphysics Object Oriented Simulation Environment (MOOSE) (Software)	
Industrial Technology Research Institute (ITRI)	HECLOT: High-efficiency calcium looping technology (Environmental Technologies)	
Industrial Technology Research Institute (ITRI)	ICTA: In-Line Compact Thermal Analyzer (Imaging)	
Industrial Test Systems Inc.	eXact iDip photometer (Laboratory Equipment)	
INFICON	Micro GC Fusion (Laboratory Equipment)	
INFICON	Stripe CDG (Thin Film & Vacuum Technologies)	

Janssen Research & Development LLC	SIRTURO (bedaquiline) (Life Sciences)	
JFE Steel Corporation	JFE-TF1 (Materials)	
Kansas State Univ., SMART Laboratory	Li-Foil Neutron Detectors (Beam Instruments)	Saint-Gobain Crystals
KEYENCE Corp.	VR-3000 Series One-shot 3-D Measurement Macroscope (Imaging Technologies)	
Lawrence Berkeley National Laboratory	Tissue-Specific Cell-Wall Engineering for Biofuels and Biomaterials (Life Sciences)	
Lawrence Berkeley National Laboratory	BioSig3D (Life Sciences)	
Lawrence Berkeley National Laboratory	Berkeley Lab Multiplex Chemotyping Microarray (Life Sciences)	
Lawrence Livermore National Laboratory	Convergent Polishing: Rapid, Simple, Low Cost Finishing of High Quality Glass Optics (Process Science)	
Lawrence Livermore National Laboratory	Superconducting Tunnel Junction X-Ray Spectrometer (Analytical Instrumentation)	STAR Cryoelectronics LLC
Lawrence Livermore National Laboratory	microTLC (Laboratory Equipment)	Field Forensics Inc.
Lawrence Livermore National Laboratory	Extreme-power Ultra-low-loss Dispersive Element (EXUDE) (Lasers/Photonics)	Lockheed Martin Laser and Sensor Systems Advanced Thin Films

Leica Microsystems CMS GmbH	Leica TCS SP8 STED 3X (Imaging Technologies)	Max Planck Institute for Biophysical Chemistry
Los Alamos National Laboratory	SAFIRE (Environmental Technologies)	Chevron ETC GE Measurement & Control
Los Alamos National Laboratory	Acoustic Wavenumber Spectrometer (AWS) (Analytical Instrumentation)	
Mettler Toledo	XPE205 Excellence Analytical Laboratory Balance (Laboratory Equipment)	
Milliken & Company	ASSIST Silver (Life Sciences)	Milliken Healthcare Products LLC
Milliken & Company	iQ Series Comfort Knit/Amplitude G2 Flame Resistant Fabric (Materials)	Bulwark FR
MIT Lincoln Laboratory	Haystack Ultrawideband Satellite Imaging Radar (HUSIR) (Communications)	Simpson Gumpertz and Heger Inc. Communications & Power Industries
MIT Lincoln Laboratory	Lunar Laser Communication System (LLCS) (Communications)	NASA Goddard Space Flight Center
MIT Lincoln Laboratory	High-Capacitance Radio-Frequency Curled Microelectromechanical Switch (CMEMS) (Communications)	Innovative Micro Technology
MIT Lincoln Laboratory	Wide-Area Chemical Sensor (WACS) (Analytical Instrumentation)	
MIT Lincoln Laboratory	Airborne Sense and Avoid (ABSAA) Radar Panel (Safety & Security)	
MIT Lincoln Laboratory	Localizing Ground Penetrating Radar (LGPR) (Communications)	
Mitsubishi Electric Corporation	Sensor-less Servo Drive Unit FR-E700EX Series & Sensor-less Motor MM-GKR (Mechanical Systems)	

Mitsubishi Electric Corporation	MELFA-3D Vision (Mechanical Systems)	
Monsanto	Genuity DroughtGard Hybrids (Environmental Technologies)	
NASA Glenn Research Center	Therma-Base (Electrical Devices)	Thermacore Inc.
NASA Glenn Research Center	Superelastic Intermetallic Nickel Titanium Alloys and Manufacturing Techniques for Advanced Bearing Applications (Materials)	Abbott Ball Company
National Renewable Energy Laboratory	HP Apollo Platform for High-Performance Computing (Information Technologies)	Hewlett-Packard Company
neoSurgical	neoClose (Life Sciences)	
NinePoint Medical	NinePoint Medical NvisionVLE Imaging System (Life Sciences)	Farm Design Inc.
Novilytic	Noviplex Plasma Collection Card (Life Sciences)	
Novinda Corporation	Amended Silicates HgX (Environmental Technologies)	
Oak Ridge National Laboratory	Portable Aluminum Deposition System (PADS) (Process Science)	United Technologies Research Center (UTRC) Univ. of Mississippi
Oak Ridge National Laboratory	Ionic liquid anti-wear additives for fuel-efficient engine lubricants (Chemicals)	General Motors Research and Development Center Shell Global Solutions (US) Lubrizol Corporation
Oak Ridge National Laboratory	Continuously Variable Series Reactor (CVSR) (Energy)	SPX Transformer Solutions Inc. University of Tennessee

Oak Ridge National Laboratory	Diagnosis Using the Chaos of Computing Systems (DUCCS) (Information Technologies)	
Oak Ridge National Laboratory	iSPM: Intelligent Software Suite for Personalized Modeling of Expert Opinions, Decisions, and Errors in Visual Examination Tasks (Software)	
Oak Ridge National Laboratory	Super-hydro-tunable HiPAS membranes (Materials)	
OSRAM GmbH	ITOS PHASER 3000 Light Module (Lasers/Photonics)	OSRAM SYLVANIA T.Q. Technology Co. Ltd.
Pacific Northwest National Laboratory	SALVI: System for Analysis at the Liquid Vacuum Interface (Analytical Instrumentation)	
Pacific Northwest National Laboratory	Solar Thermochemical Advanced Reactor System (STARS) (Energy)	DiverSolar LLC
Pacific Northwest National Laboratory	Glyph (Consumer Products)	Avegant Corporation
PTT Public Company Ltd	PTT DIESEL CNG (Energy)	
Sandia National Laboratories	Triplet-Harvesting Plastic Scintillators (THPS) (Beam Instruments)	Radiation Monitoring Devices Inc. Univ. of California, Riverside
Sandia National Laboratories	GOMA 6.0 (Software)	Gillette/P&G Drexel Univ. Google 3M Corporate Research Process Lab Univ. of New Mexico Prism Software
Sandia National Laboratories	BaDx (Life Sciences)	Univ. of New Mexico

Siemens Corporation	syngo.CT Bone Reading (Imaging Technologies)	Siemens AG H IM CR
Singapore Institute of Manufacturing Technology	Flexure-based Electromagnetic Linear Actuator (Mechanical Systems)	
SolidEnergy Systems	Solid Polymer Ionic Liquid (SPIL) Rechargeable Lithium Battery (Energy Systems)	
Southwest Research Institute (SwRI)	Dedicated-EGR (D-EGR) (Mechanical Systems)	
Stanford Univ.	Foldscope (Imaging Technologies)	
Stratos Product Development	Passive Vaccine Storage Devices (Life Sciences)	Intellectual Ventures Labs/Global Good
Texas Instruments	LDC1000 Inductance-to-Digital Converter (Electrical Devices)	
Texas Instruments	bq25570 nanopower boost charger with integrater buck (Electrical Devices)	
The Dow Chemical Company	NEPTUNE subsea insulation system (Materials)	Dow Infrastructure Comfort Energy Efficiency Dow Oil, Gas and Mining
The Dow Chemical Company	Preferred RCS Garnet 2.0 resin coated sand utilizing Dow's TERAFORCE technology (Materials)	Preferred Sands Dow Polyurethanes
Thermo Fisher Scientific	Thermo Scientific Delta Ray Isotope Ratio Infrared Spectrometer (Analytical Instrumentation)	
Thermo Fisher Scientific	Thermo Scientific Dionex ERS 500 Electrolytically Regenerated Suppressor (Analytical Instrumentation)	
Thermo Fisher Scientific	Thermo Scientific RIIDEyeX (Beam Instruments)	

Toyota Technical Center	Automotive Phased Array Radar (Communications)	Univ. of California, San Diego Toyota Motor Corp. Michigan Technological Research Institute Fujitsu-Ten
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TruTag Technologies Inc.	TruTag Product Authentication Solution (Communications)	
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United Technologies Research Center (UTRC)	EcoTuff (Chemicals)	Pratt & Whitney 3M Corp.
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Univ. of Central Florida	Intellipigment (Safety & Security)	HySense Technology LLC NASA John F. Kennedy Space Center
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Waters Corporation	CORTECS Columns (Laboratory Equipment)	
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Yokohama Research Laboratory, Hitachi Ltd	Plasmon-Excitation Optical Scanning Probe Microscope (Optical SPM) (Imaging Technologies)	
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Award Year

2014