COMMERCIAL INTERVIEW

The Pransky interview: Dr Howard Chizeck, founder, Olis Robotics; Professor, Electrical and Computer Engineering, University of Washington

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Abstract

Purpose – The following paper is a "Q&A interview" conducted by Joanne Pransky of *Industrial Robot Journal* as a method to impart the combined technological, business and personal experience of a prominent, robotic industry PhD and innovator regarding his pioneering efforts and his personal journey of bringing a technological invention to market. This paper aims to discuss these issues.

Design/methodology/approach – The interviewee is Dr Howard Chizeck, Professor of Electrical and Computer Engineering and Adjunct Professor of Bioengineering at the University of Washington (UW). Professor Chizeck is a research testbed leader for the Center for Neurotechnology (a National Science Foundation Engineering Research Center) and also co-director of the UW BioRobotics Laboratory. In this interview, Chizeck shares the details on his latest startup, Olis Robotics.

Findings – Howard Jay Chizeck received his BS and MS degrees from Case Western Reserve University and the ScD degree in Electrical Engineering and Computer Science from the Massachusetts Institute of Technology. He served as Chair of the Department of Systems, Control and Industrial Engineering at Case Western Reserve University and was also the Chair of the Electrical and Computer Engineering Department at the University of Washington. His telerobotic research includes haptic navigation and control for telerobotic devices, including robotic surgery and underwater systems. His neural engineering work involves the design and security of brain-machine interfaces and the development of devices to control symptoms of essential tremor and Parkinson's disease.

Originality/value – Professor Chizeck was elected as a Fellow of the IEEE in 1999 "for contributions to the use of control system theory in biomedical engineering" and he was elected to the American Institute for Medical and Biological Engineering (AIMBE) College of Fellows in 2011 for "contributions to the use of control system theory in functional electrical stimulation assisted walking." From 2008 to 2012, he was a member of the Science Technology Advisory Panel of the Johns Hopkins Applied Physics Laboratory. Professor Chizeck currently serves on the Visiting Committee of the Case School of Engineering (Case Western Reserve University). He is a founder and advisor of Controlsoft Inc (Ohio) and also is a founder and Chair of the Board of Directors of Olis Robotics, Inc., which was established in 2013 (under the name of BluHaptics) to commercialize haptic rendering, haptic navigation and other UW telerobotic technologies. He holds approximately 20 patents, and he has published more than 250 scholarly papers.

Keywords Aerospace, Teleoperation, Artificial Intelligence, Simulation, Haptic devices, Subsea robotics

Paper type Case study

Pransky: You have founded several companies. Could you tell us about your journey with your recent startup, Olis Robotics? (Figure 1)

While at the University of Washington, I was working on trying to provide a sense of touch for surgeons performing robotic surgery. With National Science Foundation (NSF) support, we developed technology using the Microsoft Kinect to generate point clouds and render haptic forces.

An opportunity was presented by the Strategic Environmental Research and Development Program (SERDP) – a consortium program of the Department of Defense, Environmental Protection Agency, and Department of Energy – to remove unexploded munitions from lake bottoms. We figured that since we were already remotely manipulating a teleoperated robot for surgery, how could that be so different from underwater munitions? So I started a company, BluHaptics (later changed to Olis Robotics – www.olisrobotics.com) and we wrote a seed grant proposal that got funded. We were then committed to try and make that work. Then, in the development of that technology for underwater munitions, it became apparent that there were a lot of other underwater applications that could use telerobotics (Figure 2).

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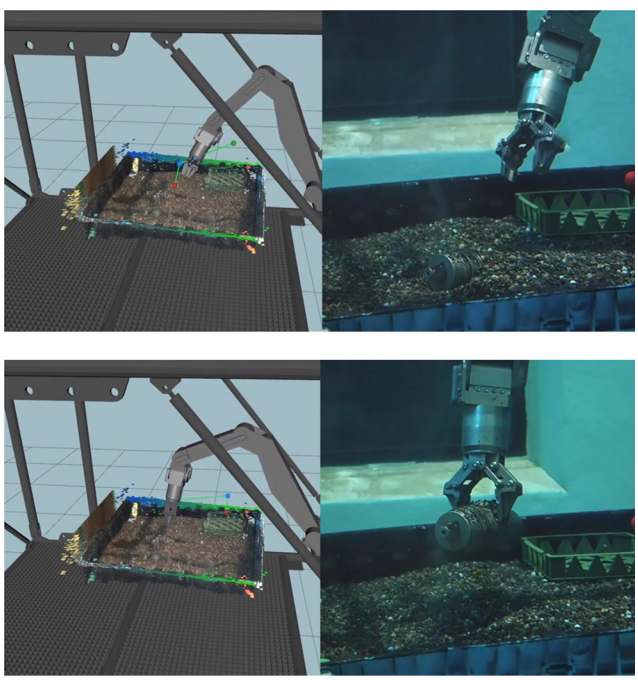
Figure 1 Dr Howard Chizeck, Founder, Olis Robotics; Professor, Electrical & Computer Engineering, University of Washington

Figure 2 Assisted grasping of semi-submerged unexploded ordnance (UXO)



Notes: Olis software with 3d sensor data registered to the robot arm (left). Real robot arm and ordnance pictured on right

The company is really software as a service. If someone makes a good robot arm, for instance, we'll team with them. Our technology either gets packaged with an existing robot manufacturer's kit or we sell or license to the folks who rent equipment and they include our software as an aftermarket product. We are trying to avoid manufacturing hardware since that is high risk and expensive. Our products at this point are really 100 per cent software and our algorithms are in there. That was the beginning of the company (Figure 3).

For dynamic environments where the robot and/or target may be moving or drifting, and objects may be swimming, floating, or flying by, we needed to bring in artificial intelligence to recognize and avoid these obstacles.

To help do this we acquired a small two-person company that had the technology patents and now they're employees and stockholders of the company.

Pransky: What makes your haptic feedback technology so different from anything else that exists?

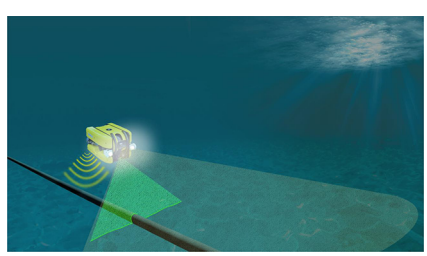
Chizeck: We're fast. Much of our intellectual property actually depends on some very fast algorithms. It's not only the haptic technologies. Using a haptic device that lets the human control a remote robot and feel forces, the human operator and our algorithms achieve precision control. We're basically taking advantage of human judgment and then coupling that with capabilities that let the system be faster or have capabilities that the human operator alone can't do.

Our intellectual property is good for noncontact situations. Avoiding collision is really hard if you have sensors in the robot itself because you actually have to make contact to know you've had the collision. But if you're using noncontact sensors like radar, sonar, or Lidar, you can see the object coming and prevent the collision before it happens.

There's also a time delay in the traditional robot control loop in that you have to wait for the robot and thus the sensor to hit and get that information back to the operator to make a decision. We can get rid of that time delay because we're predicting what's going to happen next based on velocity, trajectory and distance. We're also building what we call virtual fixtures – force fields – that keep you away from what you don't want to touch or guide you to where you want to grasp. Thus we can actually accomplish tasks while preventing bad things from happening.

Most robot companies are busy working on fully autonomous systems. We're using what we call progressive autonomy. At one extreme is total human control; at the other extreme is full autonomy. We're integrating autonomy of the robot by combining human control with different levels of autonomy, including autonomy augmentation locally for the robot's end effector (gripper or other tool).

Figure 3 Olis Robotics' underwater robotic pipeline scanner (on a remotely operated vehicle)



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And we're not just working in dangerous or remote environments, like underwater or on orbit – places where you can't put humans – but also in scale. We're manipulating things on a really small scale where the human hand is too big, or a very large scale, say in construction, where the objects you're moving are really huge compared to the human hand. Distance, danger and scale are the three driving influences.

Pransky: How's the company doing financially?

Chizeck: We formed the company in 2013 with a different name, BluHaptics. The University of Washington was key to the company start. Initially they gave me a grant for transferring the technology (out of the lab). They provided a post-doctoral fellowship for my PhD student Fredrik Rydén (co-founder of the company) until we received a Small Business Innovative Research (SBIR) grant. In addition, BluHaptics licensed my patents from the university, which received a small bit of company stock in return. Also, for almost a year, the company was housed in incubator space at the university.

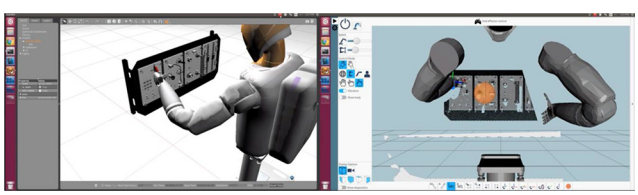
Growth obviously requires external resources. We obtained angel funding. We did do a Series A round of financing. We did demonstrations at trade shows and then on-site with the customers. Customers' feedback turned out to be critical for product development – they suggested changes and improvements that, once done, drove initial sales (because you can't make a company out of investment alone). We decided to change the company name from BluHaptics because that didn't capture all of our new products. We hired experts to help us get a name that wasn't a name that anyone else was using and they came up Olis which is silo spelled backward.

We've just moved into new quarters and we're looking to double our employees to about 30, by mid-2020.

We moved into space as the next domain for satellite inspections and repair, International Space Station (ISS) operations and some of the lunar outpost and landing activities. Our patented technology lets us do things with unprecedented speed and in situations where there's a lot of latency (Figure 4).

At this point, we're looking to other applications where it's too hot, too radioactive, too bio-hazardous, too far away, or too cold to put humans in, such as rescue, mining, firefighting, cleaning of chemically hazardous equipment, and a variety of other conditions. We've tried to keep the technology sufficiently general so that the software will just need different drivers and some shaping in order to work with a wide variety of robots and sensors. We're also now expanding into the terrestrial market as well, because that's where the scaling is. I think these various markets are growing hugely.

Figure 4 Olis Robotics expanded into space applications including controlling the Robonaut (in simulation) for the International Space Station



Pransky: What did you have to do to get interest from the National Aeronautics and Space Administration (NASA)? Did they find you or did you go knocking on doors?

Chizeck: We saw requests for proposal (RFP) for NASA projects and submitted proposals. Funding for these allowed us to transfer our undersea telerobotic technology to space applications. This process included visits and interactions with larger company and team partners, and communications with NASA folks. So, yes, we did knock on doors (Figure 5).

Pransky: What are some of lessons you've learned?

Chizeck: Lessons learned [. . .] Technology is actually a small part of a company. I've learned that you have to have a Chief Executive Officer (CEO) who knows what he or she is doing. The robot company is only at most half robot engineers and software developers. You have to have specialized salespeople who talk to customers to learn what the customer really wants in order to deliver a product that people will buy or lease. Tremendous numbers of robot companies have gone under because although they had wonderful ideas, they didn't actually meet a need that was economically viable or that people would pay for.

Also choose your boards and your investors if you can, as people who can help you with both connections and experience; not just money. You really need to see where your product will be in the future and how to make it cost effective and useful and what the competition will be. Having other people with experience and knowledge is a very effective way to do that.

Pransky: Did you ever think of leaving academia and working full-time for your companies?

Chizeck: No. I have fun coming up with ideas and I really like working with graduate students. I have been a department chair for eight years in two different places. I thought I wouldn't be an administrator again and then I went and started a company, but I have more fun teaching and doing the research, though it is nice to get one of these ideas and to see it come into practice.

Figure 5 Olis Robotics was selected as part of the NASA FabLab prototype project to demonstrate orbital recycling and reuse capabilities aboard the ISS

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Pransky: How much time do you spend in your role as on the board and founder?

Chizeck: I spend very little time now - board meetings, advice to the CEO and CTO and occasionally intervening if there's something that needs it, but the company's really running on itself.

Pransky: In terms of all the amazing things you've accomplished in your career, what has been your proudest moment?

Chizeck: The best thing is the students, the things they've accomplished, and launching them off. In particular, I'm talking about PhD students because you're sort of developing the next generation and sending them off.

Pransky: And what do you think is the single most important thing we can be doing for our PhDs to prepare them for the commercial side of robotics?

Chizeck: First they have to decide if they want to be academic or commercial. Most new graduate students really don't know what they want to do or haven't found the passionate thing that they're in love with and want to spend the next four or five years on. I tend to let my students wander in the wilderness, trying things in the lab and teaming up with other people until they focus. After about six months to a year, they find something that excites them and know what they really want to do. I don't believe in the "Do this, do this, do this" micromanagement instruction.

Pransky: What about the PhD student that says, "I definitely want to start a company". What would you recommend?

Chizeck: Then I would say to them, we have a program at the University that gives courses in stock allocation and finance for business, so get that certificate as well. Go to the workshops, make good connections, so by the time you're ready, you've got connections and support. The University of Washington is very good at helping companies develop. They have an outfit called CoMotion https://comotion.uw.edu. It's tech transfer, but it's also incubator space and assistance with small companies. They'll team people with mentors. The law school will help in patent searches and domain analysis and the business school can help with business startup.

Pransky: What do you think you'll be doing ten years from now?

Chizeck: I have no idea. Every five or seven years, my direction is to change some throughout my whole career.

About the author

Joanne Pransky has been an Associate Editor for Industrial Robot Journal since 1995. Joanne was also one of the co-founders and the Director of Marketing of the world's first medical robotics journal, The *International Journal of Medical Robotics and Computer Assisted Surgery*. Joanne served as the Senior Sales and Marketing Executive for Sankyo Robotics, a world-leading manufacturer of industrial robot systems, for more than a decade. Joanne, also known around the globe as the World's First Robotic Psychiatrist®, has consulted for some of the industry's top robotic and entertainment organizations including Robotic Industries Association, Motoman, Staubli, KUKA Robotics, STRobotics, DreamWorks, Warner Bros., as well as for Summit Entertainment's film "Ender's Game" in which she brought never-seen-before medical robots to the big screen Joanne Pransky can be contacted at: joannepransky@gmail.com