



**Figure 1.** From left: Raj Madhavan, awards chair and IEEE RAS vice president, Industrial Activities Board; Tom Lipinski of Q-Bot Limited; François Boucher of Kinova Inc.; and Raja Chatila; IEEE RAS president. (Photo courtesy of ICRA 2015.)

As witnessed by the joint award, the judges had a difficult time coming up with a single winner. The six-member judging panel consisted of Dominik Bösl (KUKA, Germany), Werner Kraus Jr. (Fraunhofer IPA, Germany), Raj Madhavan [awards chair and vice president, IEEE Robotics and Automation Society (RAS) Industrial Activities Board], Mario Munich (iRobot, United States), Erwin Prassler (runfun, Germa-

ny) and Nicola Tomatis (Bluebotics, Switzerland). Both Rainer Bischoff (KUKA, Germany) and Alexander Verl (Fraunhofer IPA, Germany) served as judges in the first phase to determine the three finalists.

The panel wrote the following citations in announcing the two winners:

- “for providing an easy-to-use robotic solution that enhances the autonomy of disabled people” (Kinova)

- “for developing a simple robotic solution for insulating homes, thus positively impacting lives of people and protecting the environment by reducing energy consumption” (Q-Bot).

More details on the winning entries are described in “From Need to Innovation” and “Q-Bot—A Robotic Solution for Insulation of Homes”

In its 11th year, the IERA award is jointly sponsored and organized by IEEE RAS and the International Federation of Robotics. It highlights and honors the achievements of inventors with value-creating ideas and entrepreneurs who propel those ideas into world-class products. The entries are evaluated based on criteria that give equal consideration to both innovation and entrepreneurship. The winners were awarded a plaque and a US\$2,000 cash prize, which will be shared by the joint winners this year. For additional details on the award and a list of the winners from the previous ten years, see <http://www.ieee-ras.org/industry-government/ifr-forum/>.

## From Need to Innovation

By François Boucher

**T**he story of JACO is that of a man who yearned to be productive. Jacques Forest’s inventiveness was matched only by his desire to be independent. One of three brothers from Quebec, Canada, afflicted with muscular dystrophy, Jacques was confined to a power wheelchair and could only control his left thumb. But Jacques had something that could not be defined by a mere disease or the limits of his body—he had a vision he was determined to see realized.

A passionate and lifelong inventor, Jacques, known to his family and friends as Jaco, devised and built from 1984 to 1997, a robotic arm that was attached to his power wheelchair and allowed him to perform simple tasks previously rendered impossible by his physical state. Jaco’s first act with his new arm was to

fulfill his vision. He went outside to the family garden, picked a rose, and brought it back inside, where he presented it to his sister. This simple act of affection, borne of his creativity and persistence, inspired a nation and began the journey that has led to JACO.

Although Jaco died in 1999, Charles Deguire, motivated and inspired by his inventive Uncle Jaco, took up his robotic arm idea and elaborated on it by cofounding Kinova in 2006 to build an assistive robot arm for people with upper-body disabilities. He named the robot, JACO, after his uncle.

Launched in 2010, JACO is a six-axis robotic manipulator arm with a three-fingered hand. This little marvel of engineering significantly improves the lives of persons with reduced mobility. Lightweight, very quiet, unobtrusive, safe, and even weatherproof, JACO assists anyone with an upper-body mobility impairment

to perform complex actions. Many everyday activities, such as picking up glasses, holding a fork, or opening a door, which most people do without thinking, can become insurmountable for people who have a disability, and they have to ask someone else to do it for them. The JACO arm makes life easier for these people by giving them greater freedom and independence.

### Arm

JACO moves smoothly and silently around six degrees of freedom, with unlimited rotation on each axis. The joints are modular aluminum compact actuators of a unique design that integrates a dc brushless motor, harmonic drive, slip rings, microcontroller, and sensors for torque, current, position, temperature, and acceleration. Its main structure, entirely made of carbon fiber, delivers optimal robustness and durability as well



**Figure 1.** The JACO arm can provide those with upper-body disabilities more independence, enabling them to perform everyday tasks, such as eating, on their own.

as a cutting-edge look and feel. The arm is mounted on a standard aluminum extruded support structure attached to the wheelchair seat frame.

### Gripper

The gripper consists of three under-actuated fingers that can be individu-

ally controlled. Their unique bi-injected plastic structure endows them with great flexibility and unrivalled grip. The JACO technology allows the fingers to adjust to any object, whatever its shape; as a result, they can gently pick up an egg or firmly grasp a jar.

### Control

JACO is controlled with the same interface that the person is using to control his or her wheelchair. Control is intuitive and allows users to navigate using three different modes: 1) translate, 2) rotate, and 3) grip. In addition, Kinova's intelligent singularity-avoidance algorithm always keeps JACO safely away from unwanted locations.

### Exporting Freedom

But the vision of Kinova in assistive robotics is not about a machine, no matter how brilliant, important, or useful it may be. Kinova is committed to advancing the state of the art and science of mobility and is developing a new category of products that share a common objective. It is the same vision that, 20 years ago, inspired Jacques Forest to develop a robotic arm from a discarded lamp, some wood, and some spare electrical parts: to enable the spirit by giving you the power and the freedom to do for yourself (Figure 1).

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