

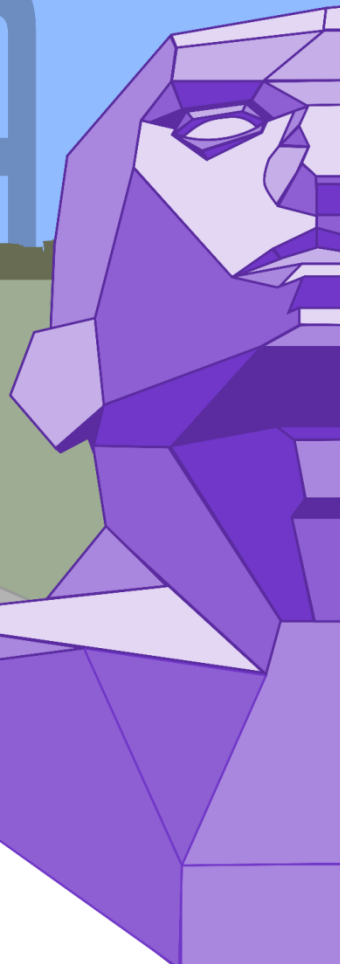
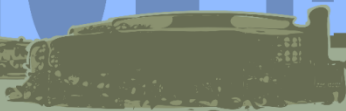
**THE 2012 IEEE INTERNATIONAL CONFERENCE ON ROBOTICS  
AND AUTOMATION**

# ICRA 2012

**Robots and Automation:  
Innovation for Tomorrow's Needs**

**MAY 14-18**

ST. PAUL MN. USA





# Foreword

It is a great honor to welcome you to the 2012 IEEE International Conference on Robotics and Automation (ICRA 2012), which is being held in the great city of Saint Paul, Minnesota. This year, ICRA 2012 continues to be the flagship conference in robotics and automation by focusing on technical excellence and innovation on many different fronts. The ICRA theme is "Robots and Automation: Innovation for Tomorrow's Needs." Robotics and automation are at the crossroads of new developments in algorithms, hardware, and software that pave new routes in technological innovation. Saint Paul is the vibrant capital of Minnesota, known as the "Land of 10,000 Lakes." St. Paul and Minneapolis constitute a large metropolitan area known as the "Twin Cities." Many companies like 3M, Cargill, Target, Best Buy are headquartered in the Twin Cities.

This year, we have received an unusually large number of submissions – 2032 papers from over 50 countries. Due to the record number of submissions, the Conference Editorial Board (CEB) and the Senior Program Committee were forced to make difficult decisions in selecting papers to maintain the quality and balance of the technical program. We regret that many excellent papers could not be accommodated. The use of iThenticate was introduced with the goal of reducing overlap with previous paper submissions. A very aggressive approach was followed in order for each paper to receive at least two meaningful and constructive reviews. A total of 818 papers were selected, which resulted in one of the lowest acceptance rates in the history of ICRA. Some of these papers are presented in interactive sessions, a first for an ICRA. All the presentations, with the author's approval, will be videotaped and archived, another first for our conferences. The objective is to create new methods for promoting our community and serving our members. Having the proceedings in a USB thumbdrive is another innovative step. The technical sessions are accompanied by special tutorials where we invited some world experts to share their knowledge. The tutorials are free to all the participants and cover various robotics/automation topics of current research interest. It should be noted that 18 workshops will be organized, all of them supported/proposed by the corresponding RAS Technical Committees (another first for our conferences). ICRA 2012 will have one of the largest exhibitions in our recent history with systems from industry, research institutions, and national laboratories. The video proceedings include 18 video submissions that cover topics ranging from ground robots to computer vision. Supplementing the technical presentations, the program is highlighted by plenary talks delivered by distinguished scholars – Professor Bradley Nelson on "Robotics in the Small," Professor Harry Asada on Bio-Bots, and Professor Jun-Ho Oh on the humanoid robot HUBO II.

We would like to express our sincere appreciation and thanks to the entire Organizing Committee, the CEB, the reviewers, and the local arrangements staff for their contributions and tireless efforts towards the success of ICRA 2012. In particular, we like to express our sincere thanks and appreciation to Lynne Parker for being the organizer of this long and intensive review process as the Editor-in-Chief of the CEB, Volkan Isler and his local staff for the smooth operation of the conference, and Max Meng for the digest creation. We also like to extend our sincere thanks to Raj Mahdavan for a superb exhibitions organization, Venkat Krovi who worked tirelessly to make sure that we are financially sound, and Bert Tanner who handled our registration. Numerous individuals, in particular Dan Lofaro, Alison Amundson, Kathy Colabaugh, Becky Helgeson and Keisha Carr

enabled us to execute such a complex process. Finally, our special thanks go to all the authors for contributing their research work, the participants and the exhibitors for making the 2012 IEEE International Conference on Robotics and Automation a memorable event. Enjoy Minnesota and its more than 10,000 lakes!!!



Nikos Papanikolopoulos

General Chair

A handwritten signature in black ink, appearing to be 'N/P' followed by a stylized flourish.

Paul Oh

Program Chair

A handwritten signature in black ink, appearing to be 'P. Oh'.

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Burkhard, Corves	Caputo, Barbara	Chatzigeorgiou, Dimitris	Choi, Dongil
Burrus, Nicolas	Carballo, Alexander	Chaumette, Francois	Choi, Han-Lim
Burschka, Darius	Carbone, Giuseppe	Checchin, Paul	Choi, Hee-Byoung
Buschmann, Thomas	Carfang, Anthony	Checchin, Paul	Choi, Jaesoon
Busoniu, Lucian	Carignan, Craig	Chellali, ryad	Choi, Jinwoo
Butail, Sachit	Carloni, Raffaella	Chemori, Ahmed	Choi, Jongeun
Butler, Zack	Carlson, Tom	Chen, Bor-rong	Choi, Jongsuk
Butterfass, Jörg	Carnegie, Dale Anthony	Chen, Diansheng	Choi, Junho
Butz, Martin Volker	Carneiro, Gustavo	Chen, Fang	Choi, Seungmoon
Butzke, Jonathan	Caro, Stéphane	Chen, Fei	Choi, Youngjin
Buys, Koen	Caron, Guillaume	Chen, Haoyao	Chopra, Nikhil
Byl, Katie	Carpaneto, Jacopo	Chen, Heping	Choset, Howie
Büschges, Ansgar	Carpin, Stefano	Chen, I-Ming	Choti, Michael
Byun, Doyoung	Carreras, Marc	Chen, Jian	Choukroun, Daniel
Bäumli, Berthold	Carrozza, Maria Chiara	Chen, Jun	Christensen, Anders Lyhne
Caballero, Fernando	Casadio, Maura	Chen, Liguu	Christensen, Henrik Iskov
Cabecinhas, David	Casalino, Giuseppe	Chen, Pei	Chugo, Daisuke
Caccavale, Fabrizio	Casals, Alicia	Chen, Qijun	Chung, Jaeheon
Cadena Lerma, Cesar Dario	Caselli, Stefano	Chen, Shih-Feng	Chung, Mike
Cadenat, Viviane	Cassinis, Riccardo	Chen, Weidong	Chung, Soon-Jo
Cai, Binghuang	Castillo, Pedro	Chen, Weihai	Chung, Timothy H.
Cai, Yueri	Castrillón, Modesto	Chen, Wenhua	Chung, Wan Kyun
Caiti, Andrea	Catalano, Manuel	Chen, Wenjie	Chung, Wing Kwong
Cajigas, Iahn	Caurin, Glauco Augusto de	Chen, Xiang	Chung, Woojin
Cakmak, Maya	Paula	Chen, XiaoQi	Churchill, Winston
Calabro', Vincenzo	Cavallo, Giuseppe	Chen, Yongquan	Cianchetti, Matteo
Calado, Pedro	Cavanough, Gary	Chen, Zhaopeng	Ciaravella, Gaetano
Calafiore, Giuseppe	Cazorla, Miguel	Chen, Zheng	Ciocarlie, Matei
Caldwell, Darwin G.	Cederborg, Thomas	Chen, Zhiyong	Cipriani, Christian



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Clark, Jonathan	Cui, Jinshi	Dellaert, Frank	Dogar, Mehmet Remzi
Clavel, Reymond	Cui, Lei	Dellen, Babette	Doh, Nakju
Clayton, Garrett	Cui, Rongxin	Demeester, Eric	Doi, Miwako
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Clerentin, Arnaud	Cummins, Mark Joseph	Demircan, Emel	Dolan, John M.
Clévy, Cédric	Cunningham, Alexander	Demiris, Yiannis	Dolgov, Dmitri
Coates, Adam	Curtis, Sean	Demiroglu, Cenk	Dombre, Etienne
Cobzas, Dana	Cutkosky, Mark	Denny, Jory	Dominey, Peter Ford
Codol, Jean-Marie	Cutti, Andrea Giovanni	Denzler, Joachim	Dong, Hao
Cohen, Benjamin	Dahiya, Ravinder S.	Derbakova, Anna	Dong, Shuonan
Coimbra, A. Paulo	Dahl, Torbjorn	Derenick, Jason	Dong, Wei
Colas, Francis	Dai, Jian	Dertien, Edwin	Dong, Wenjie
Coleman, Sonya	Dalamagkidis, Konstantinos	Desai, Jaydev P.	Dong, Yongkun
Colla, Valentina	Dalibard, Sebastien	Deschaud, Jean-Emmanuel	Dong, Zhuxin
Colledani, Frédéric	Dalley, Skyler	Deshpande, Ashish	Doniec, Marek
Collet, Alvaro	Daly, John Michael	DeSouza, Guilherme	Donlin, Regina Kathleen
Collewet, Christophe	Dame, Amaury	Detry, Renaud	Donzé, Alexandre
Collier, Jack	Dang, Hao	Devasia, Santosh	Dopfer, Andreas
Colorado, Julian	Dani, Ashwin	Devy, Michel	Dornaika, Fadi
Colton, Mark	Daniali, Hamid	Dewanto, Vektor	Doshi, Prashant
Company, Olivier	Daniel, Christian	Deyle, Travis	Dotoli, Mariagrazia
Comparetti, Mirko Daniele	Daniilidis, Kostas	Di Palma, Federico	Douillard, Bertrand
Comport, Andrew Ian	Dantam, Neil	Di Paola, Donato	Doulgeri, Zoe
Conceição, André G. S.	Dantu, Karthik	Diamanti, Olga	Dragan, Anca
Conconi, Michele	Darbha, Swaroop	Diao, Xiumin	Drenner, Andrew
Cong, Yang	Dariush, Behzad	Dias, Jorge	Drew, Benjamin
Conner, David	Darzi, Ara	Dias, M. Bernardine	Drews Jr, Paulo
Connette, Christian Pascal	Das, Aditya	Diaz, James	Droeschel, David
Contreras-Vidal, Jose Luis	Das, Aveek	Diftler, Myron	Drumwright, Evan
Controzzi, Marco	Das, Jnaneshwar	Dille, Michael	Druon, Sebastien
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Cooney, Martin D.	David, Pynadath	Dillmann, Rüdiger	Du, Jingli
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Coros, Stelian	De la Torre, Fernando	Ding, HuaFeng	Duchaine, Vincent
Corso, Jason	De Luca, Alessandro	Ding, Jerry	Duckett, Tom
Cortesao, Rui	De Mathelin, Michel	Ding, Liang	Dudek, Gregory
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Couceiro, Micael	De Momi, Elena	Ding, Xu Chu	Dune, Claire
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Coursey, Kino	De Rossi, Stefano Marco	Diosi, Albert	Durham, Joseph W.
Courteille, Eric	Maria	Dissanayake, Gamini	Durrie, Jason
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Cowley, Anthony	Debenest, Paulo	Dixon, Warren	Dzul, Alejandro
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Crespi, Alessandro	Deguchi, Koichiro	Djoudi, Dalila	Echigo, Tomio
Crick, Christopher	Dehghan, Ehsan	Djugash, Joseph	Edan, Yael

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El Houry, Antonio	Fearing, Ronald	Fofi, David	Fukai, Hironobu
Elara, Mohan Rajesh	Featherstone, Roy	Fogel, Efi	Fukao, Takanori
Elbassioni, Khaled	Fedder, Gary K.	Foix, Sergi	Fukuda, Toshio
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Elinas, Pantelis	Felekis, Dimitrios	Follador, Maurizio	Fukuoka, Yasuhiro
Ellekilde, Lars-Peter	Felfoul, Ouajdi	Fontana, Marco	Fumagalli, Matteo
Elnagar, Ashraf	Fenelon, Michael Angelo	Forbes, James Richard	Funakoshi, Kotaro
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Emami, M. Reza	Ferguson, Dave	Forssen, Per-Erik	Gabel, Thomas
Emaru, Takanori	Fernandes, Leandro Carlos	Foskey, Mark	Gabiccini, Marco
Endo, Gen	Fernandes Martins, Murilo	Fossati, Andrea	Gaiser, Immanuel
Englot, Brendan	Fernandez-Lopez, Gerardo	Foster, Mary Ellen	Galambos, Péter
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Erdogan, Ahmetcan	Ferré, Etienne	Frahm, Jan-Michael	Galvan, Stefano
Erdogan, Gurkan	Ferreira, Antoine	Fraisse, Philippe	Galvez Lopez, Dorian
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Erez, Tom	Ferreira, João	Franch, Jaume	Gan, Dongming
Erickson, Lawrence H	Ferreira, João Filipe	Franchi, Antonio	Gan, Seng Keat
Erinc, Gorkem	Ferreira, Ricardo	Frank, Barbara	Gangloff, Jacques
Erkmen, Aydan	Ferrer, Gonzalo	Frank, Heinz	Gans, Nicholas
Erkmen, Ismet	Ferretti, Gianni	Frank, Jordan	Gao, Bingtuan
Erol Barkana, Duygun	Ferrier, Nicola	Frank Bolton, Pablo	Gao, Haibo
Escande, Adrien	Ferrigno, Giancarlo	Fraundorfer, Friedrich	Gao, Peng
Esden-Tempski, Piotr	Ferrin, Jeffrey	Frazzoli, Emilio	Gao, Zhan
Espiau, Bernard	Ferris, Daniel	Freidovich, Leonid	Garcia, Elena
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Estrada, Carlos	Fiazza, Maria-Camilla	Freitas Jr., Robert A.	Garcia, Nicolas
Evans, Mathew	Fichtinger, Gabor	Fremont, Vincent	Garcia, Rafael
Even, Jani	Ficuciello, Fanny	Frew, Eric W.	Garcia Hernandez, Nadia
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Fabri, Simon G.	Filippidis, Ioannis	Frisoli, Antonio	Garcia-Morales, Isabel
Fagiolini, Adriano	Fillatreau, Philippe	Frisoli, Antonio	Garcia-Vega, Virginia
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Faigl, Jan	Fink, Jonathan	From, Pål Johan	Garulli, Andrea
Fainekos, Georgios	Finucane, Cameron	Frommberger, Lutz	Gas, Bruno
Fairfield, Nathaniel	Fischer, Gregory Scott	Frontoni, Emanuele	Gaspar, Jose
Fakhari, Amin	Fischer, Markus	Fruchard, Matthieu	Gasparini, Simone
Falconi, Riccardo	Fischer, Nic	Fränti, Pasi	Gasparri, Andrea
Fallon, Maurice	Fischer, Peer	Fröhlich, Florian Alexander	Gauthier, Michael
Falotico, Egidio	Fisher, John W.	Fu, Chenglong	Gautier, Maxime
Falquez, Juan	Fitch, Robert	Fu, Li-Chen	Gavrilova, Marina

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Ge, Yunjian	Goodin, Chris	Guizilini, Vitor	Hatton, Ross
Gedikli, Suat	Goodwine, Bill	Gunes, Hatice	Hauert, Sabine
Gee, Andrew	Gorb, Stanislav N	Guo, Chunzhao	Hauser, Kris
Gehrig, Dirk	Gorman, Jason	Guo, Feng	Havlena, Michal
Geib, Christopher	Gosline, Andrew	Guo, Meng	Havoutis, Ioannis
Geiger, Andreas	Gosselin, Clement	Guo, Shuxiang	Hawasly, Majd
Geraerts, Roland	Gosselin, Frederick P.	Guo, Yi	Hayet, Jean-Bernard
Geyer, Christopher	Goswami, Ambarish	Gupta, Kamal	Haynes, Galen Clark
Geyer, Hartmut	Gouaillier, David	Gupta, Megha	Hayward, Vincent
Ghaffari Toiserkan, Kamran	Gould, Stephen	Gupta, Nikhil	He, Hu
Gharpure, Chaitanya	Goulette, François	Gupta, Satyandra K.	Hebert, martial
Gherardi, Luca	Gouttefarde, Marc	Guralnik, Dan	Hebert, Paul
Ghidoni, Stefano	Gowal, Sven	Gustafson, Joakim	Heger, Frederik W.
Ghorbani, Reza	Grabe, Volker	Gustafsson, Fredrik	Hehn, Markus
Ghose, Debasish	Grady, Devin	Gutmann, Jens-Steffen	Heidarsson, Hordur K
Ghrist, Robert	Graham, Rishi	Guy, Stephen J.	Heidrich-Meisner, Verena
Giampaolo, Conte	Grainger, Steven	Gyan, Philippe	Heinen, Milton
Gielniak, Michael Joseph	Grand, Christophe	Haar, Stefan	Hemachandra, Sachithra
Gienger, Michael	Granström, Karl	Hachiya, Hirotaka	Madhawa
Giglio, Davide	Grant, Edward	Haddadin, Sami	Hemakumara, Madu Prasad
Giguere, Philippe	Grassi Junior, Valdir	Hadsell, Raia	Hendrich, Norman
Gil, Jorge Juan	Gray, Steven	Haffele, Celina	Hennes, Daniel
Gil, Stephanie	Gregg, Robert D.	Hafner, Verena Vanessa	Henrich, Dominik
Gillespie, Brent	Greggio, Nicola	Hager, Gregory	Henry, Peter
Gillet, Denis	Greytak, Matthew	Hagita, Norihiro	Herbst, Evan
Gillula, Jeremy	Gribovskaya, Elena	Hamel, Tarek	Herder, Just
Jimenez, Antonio	Gribovskiy, Alexey	Hammer, Patrick	Herd, Andrei
Gini, Giuseppina	Griffin, Brent Austin	Hammer, Peter	Herrisse, Bruno
Gini, Maria	Griffiths, Paul	Hammond III, Frank L.	Hermans, Tucker
Giralt, Xavier	Griffiths, Sascha	Han, Chang-Soo	Herranz, Luis
Girdhar, Yogesh	Grimes, Matthew Koichi	Han, Jeakweon	Hershberger, Dave
Girgin, Sertan	Grindle, Garrett	Han, Jianda	Hertkorn, Katharina
Gitlin, Richard	Grizzle, J.W	Han, Jonghui	Hertzberg, Christoph
Glas, Dylan F.	Groeger, Martin	Han, Kyung Min	Hesch, Joel
Glover, Arren	Groff, Richard	Han, Li	Hesselbach, Juergen
Gnemmi, Alberto	Grollman, Daniel	Han, Long	Hester, Todd
Gning, El Hadji Amadou	Grosch, Patrick	Hanazawa, Yuta	Heuer, Herbert
Gobbalipur Ranganath,	Gross, Horst-Michael	Handroos, Heikki	Heyneman, Barrett
Jayanth	Grossmann, Etienne	Hanheide, Marc	Higashi, Toshimitsu
Goedeme, Toon	Groten, Raphaela	Hansen, Peter	Higashimori, Mitsuru
Gofuku, Akio	Grothues, Thomas	Hao, Lina	Hill, Andrew John
Goldberg, Ken	Gruppen, Rod	Harada, Kensuke	Hillier, Nick
Goldenberg, Andrew	Gruyer, Dominique	Harada, Tatsuya	Hilsenstein, Volker
Goldman, Roger E.	Grzes, Marek	Harata, Yuji	Hines, Lindsey
Gonçalves, Eder M.	Grzonka, Slawomir	Harkins, Richard	Hirai, Shinichi
Goncalves, Nelson	Gräser, Axel	Harrison, Alastair	Hirata, Yasuhisa
Gonzalez, David	Gu, Hong	Hart, Stephen	Hirose, Toshinori
Gonzalez, Felipe	Gu, Jason	Hartley, Richard	Hirschmüller, Heiko
Gonzalez, Javier	Guan, Yisheng	Haschke, Robert	Hirzinger, Gerd
Gonzalez, Juan Pablo	Guarnieri, Michele	Hasegawa, Osamu	Ho, Van
Gonzalez de Santos, Pablo	Guerreiro, Bruno J. N.	Hasegawa, Yasuhisa	Hoburg, Warren

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Hoffman, Judy	Huang, Yihua	Islam, Md Nurul	Johnson, David
Hoffmann, Frank	Huber, Daniel	Isler, Volkan	Johnson, David
Hoffmann, Gabriel	Huebner, Kai	Itkowitz, Brandon	Johnson, Miles
Hofmann, Andreas	Huerta, Ivan	Ito, kazuyuki	Joho, Dominik
Hogan, Neville	Hugel, Vincent	Ito, Satoshi	Jones, Bryan
Hogue, Andrew	Hulin, Thomas	Iturrate, Iñaki	Jones, Edward Gil
Hoinville, Thierry	Humbert, James Sean	Ivanescu, Mircea	Jonker, Pieter
Holgate, Matthew	Hung, Calvin	Iwahashi, Naoto	Joseph, Joshua
Holl, Mark R.	Hunt, Andres	Iwai, Yoshio	Joseph, Samleo L.
Hollerbach, John	Huntsberger, Terry	Iwase, Masami	Jouffrais, Christophe
Hollinger, Geoffrey	Hurst, Jonathan	Iwashita, Yumi	Joung, Sanghyun
Hollis, Ralph	Hussain, Moazzam	Iwatani, Yasushi	Ju, Zhaojie
Holm, Jonathan K.	Hutchinson, Seth	Iyengar, Sitharama S	Julià, Carme
Holz, Dirk	Hutter, Marco	Jafari, Amir	Julian, Brian
Holzer, Stefan	Huynh, Van	Jafari, Rouhollah	Jun, Jae Yun
Hong, SeongHun	Huynh, Vu Anh	Jagersand, Martin	Jung, Boyoon
Hong, Tsai	Hwang, Gilgueng	Jaillet, Leonard	Jung, Changbae
Hoover, Aaron	Hwang, Inseok	Jain, Abhinandan	Jung, Eui-jung
Horan, Ben	Hwang, Jung-Hoon	Jain, Advait	Jung, Hee-Tae
Horiguchi, Yukio	Hyodo, Kazuyuki	Jain, Dominik	Jung, Min Yang
Hornung, Armin	Hyon, Sang-Ho	Jakubiak, Janusz	Jung, Seul
Hosoda, Koh	Hypki, Alfred	Janabi-Sharifi, Farrokh	Jäntschi, Michael
Hover, Franz	Hyun, Baro	Janiak, Mariusz	K, Sridharan
Hovland, Geir	Hyun, MyungOok	Janot, Alexandre	Kaelbling, Leslie
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Hsu, David	Iizuka, Kojiro	Jensen, Elizabeth	Kalakrishnan, Mrinal
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Hu, Chao	Ila, Viorela	Jeon, Jeong hwan	Kallmann, Marcelo
Hu, Hesuan	Ilhan, Berkay Deniz	Jeong, Hyunhwan	Kalmar-Nagy, Tamas
Hu, Huosheng	Ilies, Horea	Jeong, Jay	Kamamichi, Norihiro
Hu, Jwu-Sheng	Ilonen, Jarmo	Jeong, Mun-Ho	Kamarainen, Joni-Kristian
Hu, Wenqi	Inamura, Tetsunari	Jesus, Tales	Kamegawa, Tetsushi
Hu, Xiaoming	Ince, Gokhan	Jetchev, Nikolay	Kamgarpour, Maryam
Huaman, Ana	Infantes, Guillaume	Ji, Sang Hoon	Kaminaga, Hiroshi
Huang, Albert S.	Ingrand, Francois Felix	Jia, Yan-Bin	Kammel, Sören
Huang, Chih-Fang	Inoue, Kenji	Jian, Ping	Kamnik, Roman
Huang, Chintien	Inoue, Roberto S.	Jiang, Guangying	Kamper, Derek
Huang, Han-Pang	Inoue, Takahiro	Jiang, Yong	Kanakia, Anshul
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Huang, Jian	Iordachita, Iulian	Jiang, Zhaoliang	Kaneko, Makoto
Huang, Ke	Isern-González, Josep	Jiang, Zhe	Kang, Hongwen
Huang, Qiang	Ishibashi, Ryota	Jiménez, Pablo	Kang, Sang Hoon
Huang, Shoudong	Ishida, Hiroshi	Jin, Jiyong	Kang, Taesam
Huang, Tian	Ishigami, Genya	Jin, Tao	Kano, Takeshi
Huang, Weiwei	Ishiguro, Akio	Jin, Yaochu	Kanoun, Oussama
Huang, Wes	Ishihara, Abraham	Johannsson, Hordur	Kantor, George

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Karumanchi, Sisir	Kim, Jung	Koku, Bugra	Kuehnlenz, Kolja
Katayama, Yasuhiro	Kim, Kangjin	Kollar, Thomas	Kuemmerle, Rainer
Katic, Dusko	Kim, Keehoon	Kolling, Andreas	Kuffner, James
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Katz, Roman	Kim, Soohwan	Komma, Philippe	Kuipers, Benjamin
Kavraki, Lydia	Kim, Whee Kuk	Komoriya, Kiyoshi	Kulchenko, Paul
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Kawamura, Sadao	Kimball, Peter	Konidaris, George Dimitri	Kumar, Vijay
Kawasaki, Haruhisa	Kimmel, Andrew	Konietschke, Rainer	Kummert, Franz
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Kawashima, Kenji	Kimura, Shinichi	Kontolatis, Ioannis	Kunz, Clayton
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Kearney, Michael	Kinsey, James	Kormushev, Petar	Kuratate, Takaaki
Keith, François	Kinugasa, Tetsuya	Korrapati, Hemanth	Kurazume, Ryo
Keller, Thierry	Kirby, Brian	Kortsmit, Jeroen	Kurita, Yuichi
Kelly, Jonathan	Kirchner, Frank	Kosa, Gabor	Kurniawati, Hanna
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Kendoul, Farid	Kjellstrom, Hedvig	Kosuge, Kazuhiro	Kuwata, Yoshiaki
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Kernbach, Serge	Klaptocz, Adam	Kottege, Navinda	Kweon, In So
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Khorasani, Khashayar	Kleiner, Alexander	Kovecses, Jozsef	Kwon, Tae-Bum
Khwaja, Asim	Klesh, Andrew	Koziol, Scott	Kühnlenz, Kolja
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Kikuchi, Takehito	Klodmann, Julian	Kragic, Danica	Kyrki, Ville
Killpack, Marc	Kloetzer, Marius	Krainin, Michael	La, Hung
Kim, Bong Keun	Klotzbuecher, Markus	Kratochvil, Bradley	Labonte, Daniel
Kim, Byeong-Sang	Kneip, Laurent	Krichmar, Jeffrey	Lacevic, Bakir
Kim, Chang Young	Knepper, Ross A	Krishna, Madhava	Lacroix, Simon
Kim, ChangHwan	Knoll, Alois	Kristan, Matej	Ladický, Lubor
Kim, Doik	Knox, W. Bradley	Kroeger, Torsten	Laffranchi, Matteo
Kim, Donghyeon	Kobayashi, Etsuko	Kroemer, Oliver	Lahijanian, Morteza
Kim, Gon-Woo	Kobayashi, Hiroaki	Krohs, Florian	Lahr, Derek
Kim, H. Jin	Kobayashi, Jun	Kronander, Klas	Lai, Chun C.
Kim, Hong Seok	Kobayashi, Ryo	Krontiris, Athanasios	Lai, Kevin
Kim, Hwa Soo	Kobayashi, Yo	Krovi, Venkat	Lakaemper, Rolf
Kim, Hyoung-Rock	Kober, Jens	Krueger, Volker	Lakemeyer, Gerhard
Kim, Hyun-Jung	Kobilarov, Marin	Krug, Robert	Lakemond, Ruan
Kim, Jinhyun	Kobilarov, Marin	Krupa, Alexandre	

Laksanacharoen, Pudit (Sathaporn)	Lee, Kiju	Li, Weifeng	Liu, Jingtai
Lalonde, Jean-Francois	Lee, Kwang Wee	Li, Wen	Liu, Jinguo
Lam, Siew Kei	Lee, Kyoungmin	Li, Xiang	Liu, Lantao
Lam, Tin Lun	Lee, Minhyung	Li, Xiang	Liu, Ming
Lambert, Alain	Lee, Sangyoon	Li, Xiaobo	Liu, Ming-Yu
Lambert, Pierre	Lee, Se-Jin	Li, Y.F.	Liu, Rongqiang
Lamon, Pierre	Lee, seung-ik	Li, Yanbo	Liu, Shih-Yuan
Lampariello, Roberto	Lee, Sooyong	Li, Yangmin	Liu, Xin-Jun
Lan, Chao-Chieh	Lee, Sukhan	Li, Yaoyu	Liu, Xinyu
Lanz, Oswald	Lee, Sung-Hee	Li, Yonggang	Liu, Yang
Larus, Diane	Lee, Suwoong	Li, Yuanping	Liu, Yen-Chen
Larson, Amy	Lee, Tae-Eog	Li, Yuwen	Liu, Yong
Larsson, Thomas	Lee, Woosub	Li, Zhenning	Liu, Yonghuai
Laschi, Cecilia	Lefaudeaux, Benjamin	Liarokapis, Minas	Liu, Yunhui
Lau, Boris	Lefeber, Dirk	Liaw, Hwee Choo	Livingston, Scott
Lau, Manfred	Legnani, Giovanni	Liemhetcharat, Somchaya	Lizarralde, Fernando
Lau, Nuno	Lehman, Amy C.	Lien, Jyh-Ming	Llarena, Adalberto
Lau, Tak Kit	Lehnert, Christopher	Lightcap, Chris	Lobo, Jorge
Lauer, Martin	Leibe, Bastian	Lilienthal, Achim, J.	Loc, Vo-Gia
Lauffenburger, Jean-Philippe	Leishman, Alexander	Liljebäck, Pål	Lodi Rizzini, Dario
Laugier, Christian	Leite, Antonio C.	Lim, Bokman	Loeb, Gerald
Laumond, Jean-Paul	Lemaignan, Séverin	Lim, Gi Hyun	Loizou, Savvas
Laurel, Benjamin	Lenaghan, Scott	Lim, Hun-ok	Long, Xiaolin
Lauzier, Nicolas	Lengagne, Sebastien	Lima, Pedro	Lopes, Gabriel
Lawitzky, Andreas	Lennartson, Bengt	Lin, Hai	Lopes, Manuel
Lawitzky, Martin	Lenz, Ian	Lin, Pei-Chun	López-Franco, Carlos
Lawrence, Dale	Lenzo, Basilio	Lin, Wei	Alberto
Lazaro, Maria Teresa	Leonard, John	Lin, Yun	Lopez-Nicolas, Gonzalo
Lazewatsky, Daniel	Leonard, Simon	Lin, Zhiyun	Lopez-Padilla, Rigoberto
Le, Quoc	Leonetti, Matteo	Linderöth, Magnus	Lou, Yunjiang
Le Marchand, Olivier	Lerasle, Frederic	Lindhé, Magnus	Low, K. H.
Le Ny, Jerome	Lermusiaux, Pierre F.J.	Lindsey, Quentin	Low, Tobias Daniel
Lebesnerais, Guy	Lesire, Charles	Lindzey, Laura	Lowe, David
Leblebicioglu, Kemal	Leviñ, Martin	Lippi, Vittorio	Lozano-Perez, Tomas
LeCun, Yann	Levine, Daniel S	Lippiello, Vincenzo	Lu, David V.
Lee, Beom-Hee	Lewis, Jeremy	Lister, Kevin	Lu, Yanyan
Lee, Bryce	Lewis, Michael	Listmann, Kim Daniel	Lu, Yi
Lee, C. S. George	Lhuillier, Maxime	Little, James J.	Luber, Matthias
Lee, Chil-Woo	Li, Baopu	Littlefield, Zakary	Lubrano, Emanuele
Lee, Choon-Young	Li, Bin	Litus, Yaroslav	Lucas, Charles
Lee, Daniel D.	Li, Hao	Liu, Bingbing	Lueth, Tim C.
Lee, Dongheui	Li, Hongyi	Liu, Caishan	Luo, Dingsheng
Lee, Dongjun	Li, Howard	Liu, Changchun	Luo, Fayi
Lee, Doo Yong	Li, Jianmin	Liu, Chao	Lupashin, Sergei
Lee, Hyoung-Ki	Li, Lin	Liu, Chengju	Lutz, Philippe
Lee, Hyunsuk	Li, Ming	Liu, Guangjun	Lutz, Philippe
Lee, Jae Hoon	Li, Ming	Liu, Hong	Lynch, Kevin
Lee, Jangmyung	Li, Peng	Liu, Hong	Lyon, Caroline
Lee, Jiehung	Li, Qinchuan	Liu, Hongbin	Lyons, Daniel
Lee, Jihong	Li, Shigang	Liu, Honghai	Lyu, Siwei
Lee, Jongwon	Li, Tiemin	Liu, Hugh H.T.	Lösch, Martin
Lee, Joon-Yong	Li, Tsai-Yen	Liu, Jindong	Ma, Jeremy
Lee, Ju-Jang	Li, Wai Ho	Liu, Jing-Sin	Ma, Lili
	Li, Wei	Liu, Jingen	Ma, Ou



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Ma, Xianghong	Markelic, Irene	Mazurek, Gustaw	Mihaylova, Lyudmila
MacDonald, Bruce	Marques, Jorge S.	Mazza, Edoardo	Miklic, Damjan
Machado, Luis	Marques, Lino	Mazzolai, Barbara	Miksik, Ondrej
Macharet, Douglas	Marra, Steven	McCarthy, Chris	Miller, Stephen
Guimarães	Marshall, Joshua A.	McDermott, Erik	Mills, James K.
Maciejewski, Anthony A.	Martel, Sylvain	McGinnity, Martin	Milner, Theodore Edgar
Maddern, William	Marthi, Bhaskara	McInroy, John	Milstein, Adam
Maeda, Guilherme Jorge	Martin, Patrick	McIsaac, Ken	Milutinovic, Dejan
Maeda, Yusuke	Martin, Philippe	McKee, Gerard	Minato, Takashi
Magnenat, Stéphane	Martin, Steven Colin	McKinnon, David	Minor, Mark
Magnusson, Martin	Martinelli, Francesco	McLurkin, James	Miossec, Sylvain
Mahdizadeh, Amin	Martinez, Jorge L.	McManus, Colin	Miranda Neto, Arthur,
Mahmud, Hassan	Martinez, Sonia	Medeiros, Adelardo	Arthur
Mahony, Robert	Martinez Mozos, Oscar	Medina Ayala, Ana Ivonne	Mirats Tur, Josep M.
Mahvash, Mohsen	Martinez Salazar, Harold	Medrano-Cerda, Gustavo	Mirisola, Luiz Gustavo
Maier, Daniel	Roberto	Meeussen, Wim	Missura, Marcell
Mair, Elmar	Martinez-Cantin, Ruben	Meger, David Paul	Mistry, Michael
Maire, Frederic	Martinez-Carranza, Jose	Meghjani, Malika	Mita, Seiichi
Maitin-Shepard, Jeremy	Martinez-Gomez, Jesus	Mei, Christopher	Mitchell, Julie C.
Majdik, Andras	Martínez-Otzeta, José María	Mei, Deqing	Mitobe, Kazuhisa
Majoe, Dennis	Martínez-Rosas, Juan C.	Mei, Jiangping	Mitsou, Nikos
Majumdar, Anirudha	Martins, Ricardo	Mei, Tao	Mitsugami, Ikuhisa
Majumder, S	Marton, Zoltan-Csaba	Meier, Franziska	Mitsukura, Yasue
Majure, Lydia	Maruyama, Hisataka	Meier, Lorenz	Mitsunaga, Noriaki
Maki, Kevin	Masamune, Ken	Meijas, Luis	Mittendorfer, Philipp
Maldonado, Alexis	Mashimo, Tomoaki	Mekonnen, Alhayat Ali	Miura, Jun
Malek, Lukasz	Masia, Lorenzo	Melchiorri, Claudio	Miura, Kanako
Malhotra, Mark	Mason, Julian	Mellinger, Daniel	Miwa, Hiroyasu
Malmirchegini, Mehrzad	Masone, Carlo	Menciassi, Arianna	Miyake, Yoshihiro
Malvezzi, Monica	Masory, Oren	Mendoza Garcia, Ricardo	Miyakoshi, Seiichi
Malysz, Pawel	Masoud, Ahmad A.	Franco	Miyashita, Takahiro
Manchester, Ian	Mastrogiovanni, Fulvio	Menegatti, Emanuele	Miyoshi, Takanori
Mandel, Christian	Masuda, Taisuke	Menezes, Paulo	Mizukawa, Makoto
Mann, George K. I.	Matabosch, Carles	Meng, Qing-Hao	Moberg, Stig
Manocha, Dinesh	Mather, T, William	Menon, Carlo	Modayil, Joseph
Manolakis, Dimitris	Mathis, Frank	Merici, Cetin	Mohan, San
Manoonpong, Poramate	Matos, Vítor	Merici, Tekin	Mohta, Kartik
Mansley, Chris	Matsubara, Takamitsu	Merino, Luis	Molfino, Rezia
Mao, Zhi-Hong	Matsuhira, Nobuto	Merlet, Jean-Pierre	Moll, Mark
Marani, Giacomo	Matsuno, Takayuki	Mermoud, Gregory	Mombaur, Katja
Marantos, Panos	Matsuura, Daisuke	Merryweather, Andrew	Monin, Andre
Marble, James	Matteo Zoppi, zoppi	Mertz, Christoph	Monroy, Raúl
Marchand, Eric	Matthews, Iain	Merz, Torsten	Montambault, Serge
Marconi, Lorenzo	Matuszek, Cynthia	Mettin, Uwe	Montano, Luis
Marder-Eppstein, Eitan	Maufroy, Christophe	Meyer, Wolfgang	Montes, Hector
Marfil, Rebeca	Maus, Horst Moritz	Meyer-Delius, Daniel	Montesano, Luis
Marhamati, Nina	Mavroidis, Constantinos	Mezouar, Youcef	Montijano, Eduardo
Marin, Raul	Maxon, Sean	Micaelli, Alain	Moon, Chang-bae
Marin-Hernandez, Antonio	May, Stefan	Micera, Silvestro	Moon, Jae-Sung
Marin-Jimenez, Manuel J.	Maycock, Jonathan	Michalek, Maciej, Marcin	Moore, Joseph
Marinakakis, Dimitri	Maye, Jerome	Michael, Nathan	Moore, Richard James
Marino, Alessandro	Mayer, Christoph	Michaud, Francois	Donald
Mariottini, Gian Luca	Mayol, Walterio	Michel, Olivier	Mora, Andres

Moradi, Hadi	Nabeshima, Cota	Neuhaus, Peter	Oh, Yonghwan
Moradi Dalvand, Mohsen	Naffin, David	Neuman, Bradford	Ohbuchi, Ryutarou
Morales, Antonio	Nagahara, Hajime	Neumann, Gerhard	Ohmura, Yoshiyuki
Morales, Marco	Nagai, Yukie	Newcombe, Richard	Ohno, Kazunori
Morales Saiki, Luis Yoichi	Nagakubo, Akihiko	Newman, Paul	Ohta, Aaron
Morbidi, Fabio	Nagamune, Ryoza	Newman, Wyatt	Oishi, Meeko
Mordohai, Philippos	Nagano, Akinori	Ng, Teck Chew	Okada, Masafumi
Moreira, Pedro	Nagaoka, Kenji	Nguyen, Minh Hoai	Okada, Nobuhiro
Morén, Jan	Nagarajan, Umashankar	Ni, Kai	Okamoto, Jun
Moreno, Juan Camilo	Nagasaka, Kenichiro	Nia Kosari, Sina	Okamoto Junior, Jun
Moreno, Plinio	Nagatani, Keiji	Niccolini, Marta	Okuda, Kenji
Moreno-Valenzuela, Javier	Nageotte, Florent	Nieto-Granda, Carlos	Olague, Gustavo
Morgansen, Kristi	Nagy, Zoltan	Niiyama, Ryuma	Oliveira, Paulo
Morgul, Omer	Nahon, Meyer	Nijboer, Femke	Oliver, Gabriel A.
Mori, Greg	Naish, Michael D.	Nikolakopoulos, George	Ollero, Anibal
Morikawa, Yasushi	Nakadate, Ryu	Nili Ahmadabadi, Majid	Olson, Edwin
Morin, Pascal	Nakajima, Masahiro	Nilsson, Klas	Onal, Cagdas Denizel
Morisawa, Mitsuharu	Nakamura, Keisuke	Nilsson, Martin	Onda, Kazuhisa
Moro, Federico Lorenzo	Nakamura, Ryoichi	Nishide, Shun	Onishi, Masaki
Morton, Peter	Nakamura, Taro	Nishioka, Yasutaka	Ono, Masahiro
Moshkina, Lilia	Nakamura, Tomoaki	Nishiwaki, Koichi	Opdenbosch, Patrick
Moshtagh, Nima	Nakamura, Yoshihiko	Nisky, Ilana	Orin, David
Mosteo, Alejandro R.	Nakamura, Yutaka	Nitsch, Verena	Oriolo, Giuseppe
Mouaddib, Abdel-Ilah	Nakanishi, Hiroki	Noda, Tomoyuki	Orkin, Jeff
Mountney, Peter	Nakanishi, Jun	Nohmi, Masahiro	Orteu, Jean-José
Mouri, Tetsuya	Nakanishi, Yuto	Nokleby, Scott	Ortmaier, Tobias
Mourikis, Anastasios	Nakazawa, Atsushi	Nonaka, Kenichiro	Osentoski, Sarah
Mousset, Stéphane	Naldi, Roberto	Noonan, David	Osório, Fernando
Mueller, Andreas	Namvar, Mehrzad	Noori, Narges	Ota, Yusuke
Muelling, Katharina	Nanayakkara, Thrishantha	Nori, Francesco	Otaduy, Miguel A.
Mugler, Emily	Napier, Ashley	Norrlöf, Mikael	Otake, Mihoko
Muja, Marius Constantin	Napp, Nils	Nourani Vatani, Navid	Otsuki, Masatsugu
Mukai, Toshiharu	Narayanan, Krishna Kumar	Novalés, Cyril	Ott, Christian
Mukhopadhyay, Shayok	Nardi, Daniele	Nuechter, Andreas	Ott, Lionel
Mullane, John	Narioka, Kenichi	Nuevo, Jesus	Ottaviano, Erika
Munih, Marko	Naroditsky, Oleg	Nuno, Emmanuel	Otte, Michael W.
Munoz, Daniel	Narukawa, Terumasa	Nuske, Stephen	Ottensmeyer, Mark
Munoz, Luis Alberto	Nascimento, Erickson	O'Brien, John	Oudeyer, Pierre-Yves
Munoz-Gomez, Lourdes	Nashashibi, Fawzi	O'Callaghan, Simon Timothy	Ouyang, Gaoxiang
Muradore, Riccardo	Natale, Ciro	O'Kane, Jason	Overett, Gary Mark
Murakami, Kenichi	Natale, Lorenzo	O'Malley, Marcia	Owaki, Dai
Murakami, Kouji	Navarro-Serment, Luis E.	Ocaña, Manuel	Owen-Hill, Alexander
Murakami, Toshiyuki	Nawaz, Sarfaz	Odakura, Valguima	Oyama, Eimei
Murillo, Ana Cristina	Nayar, Hari	Odashima, Shigeyuki	Ozawa, Ryuta
Murphey, Todd	Nebot, Eduardo	Odhner, Lael	Ozay, Necmiye
Murphy, Chris	Necsulescu, Dan	Ogasawara, Tsukasa	Ozsoyeller, Deniz
Murphy, Elizabeth	Nedevschi, Sergiu	Ogata, Tetsuya	Oztop, Erhan
Murray, David	Negre, Amaury	Ogino, Masaki	Pac, Muhammed Rasid
Murrieta-Cid, Rafael	Nelson, Bradley J.	Ognibene, Dimitri	Padir, Taskin
Muscato, Giovanni	Nelson, Carl	Ogura, Yu	Padois, Vincent
Muszynski, Robert	Nenchev, Dragomir	Oh, Sang June	Pagala, Prithvi sekhar
Mut, Vicente	Neo, Ee Sian	Oh, Sang Min	Paik, Jamie
Myung, Hyun	Nestinger, Stephen	Oh, Se-Young	Palli, Gianluca
Mörtl, Alexander	Neubert, Jonas	Oh, Sehoon	Pallottino, Lucia



Palmer III, Luther R.	Pelrine, Ron	Popovic, Marko	Ramos, Fabio
Palunko, Ivana	Peltason, Julia	Porez, Mathieu	Rand, Omri
Pan, Jia	Pepy, Romain	Porfiri, Maurizio	Randelli, Gabriele
Pangercic, Dejan	Peralta Cabezas, José Luis	Porta, Josep M	Ranganathan, Ananth
Panin, Giorgio	Perdereau, Véronique	Posner, Ingmar	Rasmussen, Christopher
Panousopoulou, Athanasia	Pereira, Fernando	Possani Espinosa, Andre	Rasolzadeh, Babak
Paoli, Andrea	Pereira, Guilherme	Pott, Andreas	Rastgaar, Mohammad
Paolini, Robert	Perez, Patrick	Poulakis, Pantelis	Ratliff, Nathan
Papadopoulos, Evangelos	Perez-del-Pulgar, Carlos	Pounds, Paul	Ravindran, Balaraman
Papadopoulos, Georgios	Perrin, Nicolas Yves	Prabhakaran, B	Redon, Stephane
Papageorgiou, Xanthi	Perrollaz, Mathias	Pradalier, Cedric	Reed, Brooks
Papaleo, Eugenia	Peschel, Joshua	Prado, José Augusto	Reed, Kyle Brandon
Papanikolopoulos, Nikos	Pessin, Gustavo	Prankl, Johann	Reggiani, Monica
Paparoditis, Nicolas	Peters, Steven	Prasser, David	Régnier, Stéphane
Papazov, Chavdar	Petillot, Yvan R.	Prats, Mario	Reina, Giulio
Paprotny, Igor	Petit, Antoine	Pratt, Jerry	Reishus, Dustin
Park, Chung Hyuk	Petrack, Ron	Prattichizzo, Domenico	Reiter, Austin
Park, Frank	Petrovskaya, Anna	Prestes, Edson	Reitmayr, Gerhard
Park, Hae Won	Pettre, Julien	Pretto, Alberto	Rekleitis, Georgios
Park, Hae Won	Pezzementi, Zachary	Prieto, José Carlos	Rekleitis, Ioannis
Park, Hyungju Andy	Pfaff, Patrick	Prime, Zebb	Remy, C. David
Park, In-Won	Pham, Minh Tu	Prisacariu, Victor	Remy, Sekou
Park, Jae Byung	Pham, Quang-Cuong	Pronobis, Andrzej	Ren, Hongliang
Park, Jaeheung	Phee, Louis	Prorok, Amanda	Ren, Lei
Park, Jong Hyeon	Philippsen, Roland	Provancher, William	Ren, Ping
Park, Jong Jin	Phillips, Mike	Provatidis, Christoforos	Ren, Wei
Park, Wooram	Phung, Tri Cong	Provost, Julien	Ren, Xiaofeng
Park, Yong-Jai	Piater, Justus	Pryor, Mitch	Rentschler, Mark
Park, Yong-Lae	Piccigallo, Marco	Przybylski, Markus	Reynolds, Matthew
Parker, Chris	Pickup, Lyndsey	Puangmali, Pinyo	Ribnick, Evan
Parker, Lonnie	Pimenta, Luciano	Pugeault, Nicolas	Richa, Rogerio
Parra, Carlos	Pinies, Pedro	Puig, Luis	Richtsfeld, Andreas
Parra Vega, Vicente	Piovesan, Davide	Putze, Felix	Richtsfeld, Mario
Parsley, Martin Peter	Pipe, Tony	Qian, Huihuan	Ridao, Pere
Pascoal, Antonio	Pippin, Charles	Qiu, Quan	Rieffel, John
Pashkevich, Anatol	Pitzer, Benjamin	Quadros, Alastair James	Riek, Laurel D.
Pasqualetti, Fabio	Pivtoraiko, Mihail	Quaglia, Davide	Riener, Robert
Passenberg, Carolina	Pizarro, Oscar	Quek, Boon Kiat	Rigatos, Gerasimos
Patel, Rajnikant V.	Plaku, Erion	Quigley, Morgan	Righetti, Ludovic
Pathak, Kaustubh	Plank, Markus	Quigley, Steven	Rimon, Elon
Patil, Sachin	Plante, Jean-Sebastien	Quinn, Roger, D.	Ringwood, John
Patoglu, Volkan	Platt, Robert	Rabaud, Vincent	Riskowski, Jody L.
Patron-Perez, Alonso	Plonski, Patrick	Raczowsky, Joerg	Ristic-Durrant, Danijela
Patronik, Nicholas	Plöger, Paul G.	Radkhah, Katayon	Ritter, Helge Joachim
Paul, Rohan	Pochyly, Ales	Raducanu, Bogdan	Riviere, Cameron
Pavone, Marco	Poduri, Sameera	Rahn, Christopher	Rizzi, Alfred
Paxman, Jonathan	Poignet, Philippe	Rahwan, Talal	Roa, Maximo A.
Payandeh, Shahram	Polat, Ilhan	Rai, Piyush	Roberti, Flavio
Payton, David	Pollard, Nancy S	Rakotondrabe, Micky	Roberts, Jonathan
Paz, Lina María	Polushin, Ilia G.	Ramachandran, Deepak	Robertsson, Anders
PB, Sujit	Pomerleau, Francois	Raman, Vasumathi	Robuffo Giordano, Paolo
Pchelkin, Stepan	Pon, Aura	Ramirez-Amaro, Karinne	Rocchi, Fabrizio
Peijie, Zhang	Ponda, Sameera	Ramisa, Arnau	Rocha, Rui Paulo
Pellegrini, Stefano	Popa, Dan	Ramos, Ander	Rocon, Eduardo

Rodemann, Tobias	Ruml, Wheeler	Sariola, Veikko	Sekiyama, Kosuke
Rodrigues de Campos, Gabriel	Rummel, Juergen	Saripalli, Srikanth	Semini, Claudio
Rodriguez, Alberto	Rus, Daniela	Sartori, Massimo	Senoo, Taku
Rodriguez, Samuel	Rusu, Radu Bogdan	Sasaki, Daisuke	Sensing, Jonathon
Rodríguez Tsouroukdissian, Adolfo	Ryde, Julian	Sathia Narayanan, Madusudanan	Sentis, Luis
Rodriguez y Baena, Ferdinando	Rydén, Fredrik	Sato, Jun	Seo, Keehong
Rodriguez-Angeles, Alejandro	Ryll, Markus	Sato, Jun	Seo, TaeWon
Rodriguez-Losada, Diego	Ryu, Dongseok	Sato, Katsunari	Seo, Young-Woo
Rodriguez-Seda, Erick J.	Ryu, Jeha	Sato, Takahide	Seok, SangOk
Roehrig, Christof	Sa, Inkyu	Satoh, Satoshi	Sequeira, Joao
Roennau, Arne	Saad, Maarouf	Sattar, Junaed	Service, Travis
Rogers, Alex	Saal, Hannes Philipp	Sattar, Tariq	Seyfarth, Andre
Rogers III, John G.	Sabattini, Lorenzo	Sausser, Eric	Sfakiotakis, Michael
Rogge, Jonathan	Sabourin, Christophe	Savage, Jesus	Sgorbissa, Antonio
Roh, Se-gon	Sadegh, Nader	Savla, Ketan	Shacklock, Andrew
Rolland, Luc	Sadowska, Anna	Scandaroli, Glauco Garcia	Shademan, Azad
Rollinson, David	Saeedi Gharahbolagh, Sajad	Scaramuzza, Davide	Shah, Rajat
Roman, Chris	Saegusa, Ryo	Scerri, Paul	Shah, Shridhar
Romano, Joseph M.	Saerbeck, Martin	Schaal, Stefan	Shahbazi, Hossein
Rombokas, Eric	Saffiotti, Alessandro	Scharstein, Daniel	Shakhmardanov, Azamat
Romero, Javier	Saga, Satoshi	Schauß, Thomas	Shames, Iman
Ros, Lluís	Sagawa, Ryusuke	Scheggi, Stefano	Shammas, Elie
Rosa, Lorenzo	Saglia, Jody Alessandro	Scheidig, Andrea	Shang, Weiwei
Rosecrance, John	Sahbani, Anis	Scheidt, Robert	Shao, Xiaowei
Rosell, Jan	Sahin, Erol	Scherer, Sebastian	Shao, Zhufeng
Rosen, Jacob	Sakagami, Norimitsu	Scheuer, Alexis	Shapiro, Amir
Rosenthal, Stephanie	Sakai, Satoru	Scheutz, Matthias	Shapiro, Justin Adam Scott
Roser, Martin	Sakar, Mahmut Selman	Schiavone, Giuseppina	Sharf, Inna
Rosman, Benjamin	Sakka, Sophie	Schiebener, David	Sharma, Rajnikant
Ross, Stephane	Salaris, Paolo	Schill, Felix	Sharma, Sanjay
Rossini, Luca	Salas, Joaquin	Schlegel, Christian	Shayganfar, Mohammad
Rottmann, Axel	Salsedo, Fabio	Schoellig, Angela	Shell, Dylan
Rouanet, Pierre	Salvi, Giampiero	Schroeter, Derik	Shen, Jinglin
Roudet, Céline	Salvi, Joaquim	Schuerle, Simone	Shen, Shaojie
Roulet-Dubonnet, Olivier	Salvietti, Gionata	Schuller, Björn	Shen, Wei-Min
Roumeliotis, Stergios	Samadani, Ali-Akbar	Schulman, John	Shen, Xiangrong
Roy, Debanik	Samur, Evren	Schulz, Dirk	Shen, yajing
Roy, Pritam	Sanan, Siddharth	Schuresko, Michael	Shen, Yantao
Roy, Rajarshi	Sánchez, Emilio	Schwab, Arend L.	Shende, Apoorva
Royer, Eric	Sanchez Plazas, Oscar	Schwager, Mac	Sheng, Weihua
Rubenstein, Michael	Sanchez-Ante, Gildardo	Schwertfeger, Sören	Sheridan, Patricia Kristine
Rublee, Ethan	Sankaranarayanan, Ganesh	Schäfer, Bernd-Helge	Shi, Fei
Ruepp, Oliver	Santana, Pedro	Schöler, Florian	Shi, Lei
Ruesch, Jonas	Santana, Pedro Henrique de	Schöner, Gregor	Shi, Zhenwu
Ruffaldi, Emanuele	Rodrigues Quemel e Assis	Scilingo, Enzo Pasquale	Shibata, Mizuho
Rufli, Martin	Santos, Cristina	Se, Stephen	Shibata, Tomohiro
Ruggiero, Fabio	Santos, Veronica J.	Sebastian, Jose Maria	Shih, Ching Long
Ruhnke, Michael	Santos, Vitor	Sebe, Nicu	Shiller, Zvi
Ruiz, Ubaldo	Sanz, Pedro J	Secchi, Cristian	Shilpiekandula, Vijay
Ruiz-Ugalde, Federico	Sanz-Merodio, Daniel	Seegmiller, Neal Andrew	Shim, David Hyunchul
	Sarakoglou, Ioannis	Seet, Gim Lee, Gerald	Shimizu, Masahiro
	Saranli, Afsar	Seibold, Ulrich	Shimoda, Shingo
	Sardellitti, Irene	Seipel, Justin	Shimojo, Makoto
	Sargeant, Ramon	Sekimoto, Masahiro	Shin, Dongjun

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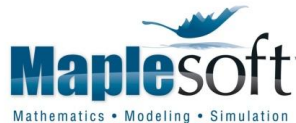
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# Plenary Sessions

## Robotics in the Small

**Tuesday May 15, 2012, 13:15-14:15, Ballrooms A, B, C, E, F, and G**  
**Chair: Shigeki Sugano, Waseda University**

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**Professor Brad Nelson**

Department of Robotics and Intelligent Systems,  
ETH-Zürich, Zürich, Swiss

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### Abstract

While the futuristic vision of micro and nanorobotics is of intelligent machines that navigate throughout our bodies searching for and destroying disease, we have a long way to go to get there. Progress is being made, though, and the past decade has seen impressive advances in the fabrication, powering, and control of tiny motile devices. Much of our work focuses on creating systems for controlling micro and nanorobots in liquid as well as pursuing applications of these devices. Larger scale microrobots for delivering drugs to the retina to treat eye diseases such as age related macular degeneration and retinal vein and artery occlusion are moving towards clinical trials. As size decreases to the nanoscale, we have been inspired by motile bacteria, such as *E. coli*, and have developed nanorobots that swim with a similar technique. Applications we pursue at these scales are for the treatment of breast cancer and cerebral infarctions.

The potential impact of this technology on society is high, particularly for biomedical applications, though many challenges remain in developing micro and nano robots that will be useful to society. An overarching requirement for achieving breakthroughs in this area is the need to bring together expertise from a wide variety of science and engineering disciplines. Robotics brings expertise in the planning and control of mechanisms with many degrees of freedom in uncertain environments. Nanotechnology teaches innovative approaches to fabricating nanoscale machines. In addition, biomedical imaging advances are needed, as is fundamental insight into the nature of fluid dynamics at very small scales. Medical professionals must be tightly integrated into the development cycle, and experts in developing business models and intellectual property must be closely consulted.

As systems such as these enter clinical trials, and as commercial applications of this new technology are realized, radically new therapies and uses will result that have yet to be envisioned.

## Biography

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**Brad Nelson** is the Professor of Robotics and Intelligent Systems at ETH Zürich. His primary research focus is on microrobotics and nanorobotics with an emphasis on applications in biology and medicine. He received a B.S.M.E. from the University of Illinois at Urbana-Champaign and an M.S.M.E. from the University of Minnesota. He has worked as an engineer at Honeywell and Motorola and served as a United States Peace Corps Volunteer in Botswana, Africa, before obtaining a Ph.D. in Robotics from Carnegie Mellon University in 1995. He was an Assistant Professor at the University of Illinois at Chicago (1995-1998) and an Associate Professor at the University of Minnesota (1998-2002). He became a Full Professor at ETH Zürich in 2002.

Prof. Nelson has received a number of awards including more than a dozen Best Paper Awards and Award Finalists at major robotics conferences and journals. He was named to the 2005 "Scientific American 50," Scientific American magazine's annual list recognizing fifty outstanding acts of leadership in science and technology from the past year for his efforts in nanotube manufacturing. His laboratory won the 2007 and 2009 RoboCup Nanogram Competition, both times the event has been held. His lab appears in the 2012 Guinness Book of World Records for the "Most Advanced Mini Robot for Medical Use." He serves on the editorial boards of several journals, has chaired several international workshops and conferences, has served as the head of the ETH Department of Mechanical and Process Engineering, the Chairman of the ETH Electron Microscopy Center (EMEZ), and is a member of the Research Council of the Swiss National Science Foundation.

## Bio-Bots: Bio-Integrated Robotics Using Live Cells As Components

Wednesday May 16, 2012, 13:15-14:15, Ballrooms A, B, C, E, F, and G  
Chair: Rüdiger Dillmann, The Karlsruhe Institute of Technology

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**Professor H. Harry Asada**

Department of Mechanical Engineering,

Massachusetts Institute of Technology (MIT), Cambridge, MA, USA

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### Abstract

Live cells and tissues cultured in microfluidic in vitro environment can be used as components of a robot. Skeletal muscles, for example, have the potential to be effective actuators for powering a micro-robot or an artificial “animal”. Muscle strips can be formed from their precursory cells, myoblasts, by guiding them through multi-stage myogenic process. Muscle strips self-assembled together with a robotic structure can activate a high DOF micro mechanism, for which there is no actuator technology currently available. Such live biological materials will be a game-changing technology in designing robotic systems and extending their applications to broader fields. This talk will introduce the state-of-the-art of bio-artificial muscles and other key biological components, and address potentials and challenges of bio-integrated robots. Three thrusts of bioengineering and control technologies will be highlighted. First, skeletal muscle cells are genetically altered so that each muscle strip can be controlled individually with high spatiotemporal resolution: Optogenetics. When exposed to a light beam, a group of light-sensitive muscle strips contract locally and dynamically, creating multi DOF motion in a compact body. Second, a new culturing technique is developed for creating 3-D fascicle-like muscle constructs, which is a key step for scaling up the bio-artificial muscles to a large-scale functional muscle. Finally, a new stochastic control method for controlling a population of cells and micro-tissues will be discussed. While individual cells and tissues are inevitably heterogeneous and stochastic, their population behaviors are stable and functional in a wide range. A new approach is needed for in vitro control of cells and tissues to assure robust, reliable behaviors. The talk will conclude with future research agenda on Bio-Bots at the NSF Science and Technology Center, Emergent Behaviors of Integrative Cellular Systems, where the speaker’s group has been participating.

## Biography

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**H. Harry Asada** is Ford Professor of Engineering and Director of the Brit and Alex d'Arbeloff Laboratory for Information Systems and Technology in the Department of Mechanical Engineering, Massachusetts Institute of Technology (MIT), Cambridge, MA. He received the B.S., M.S., and Ph.D. degrees in precision engineering in 1973, 1975, and 1979, respectively, all from Kyoto University, Japan. He specializes in robotics, biological engineering, and system dynamics and control. His current research in the biological engineering area includes bio-artificial muscles, angiogenesis, modeling and control of cell migration, and cell tracking image processing. His current robotics research includes wireless micro underwater robots for direct inspection of nuclear reactors, aircraft manufacturing robotics, wearable supernumerary robotic limbs for assisting factory workers and astronauts, and cellular PZT actuators. He won the Best Conference Paper Award at the IEEE International Conference on Robotics and Automation in 1993 and 1999, its Best Automation Paper Award in 1997, and 2010, the O. Hugo Schuck Best Paper Award from the American Control Council in 1985, and Best Journal Paper Awards from the Society of Instrument and Control Engineers in 1979, 1984, and 1990. He received the Rufus Oldenburger Medal from ASME in 2011, and the Henry Paynter Outstanding Researcher Award from ASME Dynamic Systems and Control in 1998. He also received the Ruth and Joel Spira Award for Distinguished Teaching from the School of Engineering, MIT, for his contribution to robotics education. Dr. Asada is a Fellow of ASME.

## Development Outline of the Humanoid Robot: HUBO II

Thursday May 17, 2012, 13:15-14:15, Ballrooms A, B, C, E, F, and G  
Chair: Henrik Iskov Christensen, Georgia Institute of Technology



**Professor Jun Ho Oh**

Department of Mechanical Engineering,  
Korea Advanced Institute of Science and Technology (KAIST), Korea

### Abstract

Hubo II is a 40-DOF full size Humanoid Robot with 1.3m of height and 45Kg of weight. Hubo II which was originally developed at KAIST is now in commercial production stage by Rainbow Co., an enterprise licensed by KAIST. Nine Hubo II have successfully been delivered to universities and research institutes in Singapore and the US.

The full size humanoid robot differs from the toy size small ones in many aspects. It should have a very stable and well-designed structure with little uncertainties. It must be strong enough to move its body weight, but not so heavy to minimize the torques to drive the body parts. All the electrical parts and sensors including force/torque sensors, inertia sensors, the driver circuits, and decentralized control must be designed and fabricated compact enough to be fit in the enclosure of the body.

Another important task is to design a walking algorithm. The walking algorithm is composed with two parts: off-line gait pattern design and real time stabilization control. Gait pattern design is to find a periodic function for each joint of leg such that humanoid robot is to walk with desired velocity keeping a certain level of stability. We suggested a simple function connected with cubic spline and sine functions with minimal number of parameters. This approach simplifies the parameter adjustment procedure. Play back of gait pattern found from the former process, however, does not guarantee the robot walks in real practice since there are number of uncertainties involved in real situations. The uncertainties include ground inclination, friction, and un-modeled vibration of the body. The stabilization algorithm should deal with these kinds of problems. Hubo's walk algorithm has eight levels of hierarchical control architecture to cope with the general circumstances in the walking environment.

The general issues mentioned above will be presented.

## Biography

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**Professor Jun Ho Oh** (57) received his B.S. and M.S. degree from Yonsei University, Seoul, Korea in 1977 and 1979, respectively. After working at Korea Atomic Energy Research Institute as a researcher from 1979 to 1981, he received Ph.D. degree in mechanical engineering in the field of automatic control at U.C., Berkeley in 1985. He is now a distinguished professor of mechanical engineering and the director of Humanoid robot research center (Hubo Lab) at Korea Advanced Institute of Science and Technology (KAIST).

He has performed many industry and government research projects in motion control, sensors, microprocessor applications, robotics, etc. He is especially interested in mechatronics and system integration. In the past ten years, he completed unique humanoid robot series KHR-1, KHR-2, Hubo and Hubo 2 and he also developed Albert Hubo and Hubo FX-1. He is currently studying to improve the performance of humanoid robot for faster and more stable walking, robust robot system integration and light weight design. He is a member of ASME and IEEE. He is also a member of the National Academy of Engineering of Korea.





# Workshops and Tutorials

The workshops and tutorials are scheduled on Monday and Friday of the conference week. They are listed here for your consideration. More detailed information and all workshops and tutorials proceedings can be found on the conference website <http://www.icra2012.org/program/workshop.php> and <http://www.icra2012.org/program/tutorials.php>. All events take place in the RiverCentre meeting rooms 1-12.

### Monday May 14, 2012 Workshops/Tutorials (08:30-17:30)

Room	ID	Title	Organizers
1	Workshop 1	<b>Variable Impedance Actuators Moving the Robots of Tomorrow</b>	Raffaella Carloni, Bram Vanderborght, Alin Albu-Schäffer, Antonio Bicchi
2	Workshop 2	<b>Bio-Bots</b>	H. Harry Asada
3	Workshop 3	<b>Many-Robot Systems: Crossing the Reality Gap</b>	Donald Sofge, Volkan Isler, Ani Hsieh, Frank Ehlers
4	Workshop 4	<b>New Design Principles and Frontiers for Wearable Robotics</b>	Maria Chiara Carrozza Dino Accoto
5	Workshop 5	<b>Seventh Full-day Workshop on Software Development and Integration in Robotics (SDIR-VII)</b>	Davide Brugali Bruce A. Mac Donald Issa A.D. Nesnas
6	Workshop 6	<b>Haptic Teleoperation of Mobile Robots: Theory, Applications and Perspectives</b>	Cristian Secchi, Domenico Prattichizzo, Antonio Franchi, Paolo Robuffo Giordano
7	Workshop 7	<b>Robotics and Performing Arts: Reciprocal influences</b>	Pericle Salvini Daniela Rus
8	Workshop 8	<b>Robotic Satellite Servicing</b>	Craig Carignan Giacomo Marani Wendell Chun
9	Workshop 9	<b>2nd Workshop on Semantic Perception, Mapping and Exploration (SPME)</b>	Dirk Holz, Zoltan-Csaba Marton, Andreas Nuechter, Andrzej Pronobis, Radu Bogdan Rusu
10-11	Tutorial 1	<b>Motion Planning for Dynamic Environments</b>	Steve LaValle
12	Tutorial 2	<b>Industry Track</b>	Bonnie Yue Carlos Osorio

**Friday May 18, 2012 Workshops/Tutorials (08:30-17:30)**

Room	ID	Title	Organizers
1	Workshop 10	<b>The Future of HRI - Paving the Way to Next Generation of HRI</b>	Pericle Salvini Monica Nicolescu Iroshi Hishiguro
2	Workshop 11	<b>Bio Assembler for 3D Cellular System Innovation</b>	Tatsuo Arai
3	Workshop 12	<b>Conditions for Replicable Experiments and Performance Comparison in Robotics Research</b>	Fabio P. Bonsignorio, Angel P. Del Pobil, John Hallam, Raj Madhavan,
4	Workshop 13	<b>Workshop on Long-term Autonomy II</b>	Paul Furgale Gabe Sibley Tim Barfoot
5	Workshop 14	<b>Pathways to Clinical Needle Steering: Recent Advances and Future Applications</b>	Cameron Riviere Robert Webster
6	Workshop 15	<b>Stochastic Geometry in SLAM</b>	Martin Adams Ba-Ngu Vo
7	Workshop 16	<b>Modular Surgical Robotics: How Can We Make It Possible?</b>	Paolo Fiorini Giancarlo Ferrigno Elena De Momi
8	Workshop 17	<b>Industry-Academia Collaboration in the ECHORD Project: a Bridge for European Robotic Innovation</b>	Alois Knoll Bruno Siciliano Norberto Pires
9	Workshop 18	<b>Semantic Perception and Mapping for Knowledge-enabled Service Robotics</b>	Michael Beetz, Patric Jensfelt, Alper Aydemir, Dejan Pangercic, Ben Pitzer, Bhaskara Marthi
10	Tutorial 3	<b>Advanced 3D Point Cloud Processing with Point Cloud Library (PCL)</b>	Radu Rusu
11	Tutorial 4	<b>Reinforcement Learning for Robotics and Control</b>	Pieter Abbeel Jan Peters
12	Tutorial 5	<b>Robot Operating System (ROS): Core and Advanced Topics</b>	Christopher Crick



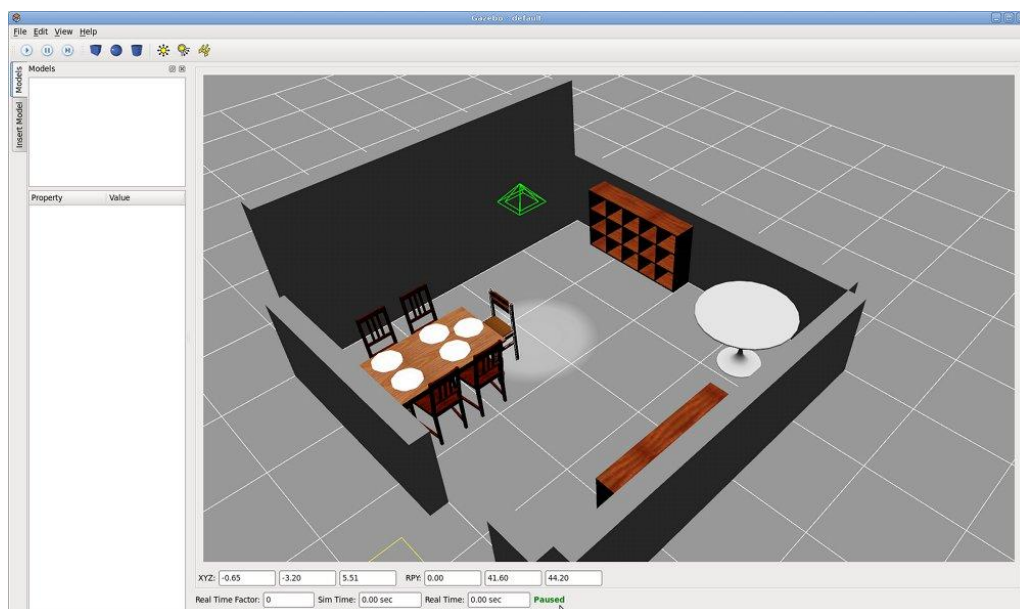
# ICRA Robot Challenge 2012

This year's ICRA Robot Challenge will be held at ICRA 2012. Our goal is to make the Challenge accessible to all members of the ICRA community, to integrate it tightly with the technical aspects of the conference, and to encourage as many participants as possible to bring their teams and participate. This year's challenge will consist of six events:

- The Mobile Manipulation Challenge
- The Modular Robotic Challenge
- The Mobile Microrobotics Challenge
- The DARwIn-OP Humanoid Application Challenge
- The Manufacturing Challenge

Each challenge is organized individually, but all will be co-located at the conference. The Robotic Challenges are being held in the Roy Wilkins Auditorium of RiverCentre in Saint Paul. To participate in any of the challenges, use the contact information below.

### The Mobile Manipulation Challenge (AKA Sushi Boat Challenge)



This year a new Mobile Manipulation Challenge will show off the state of the art in integrated perception and manipulation. The challenge models a set of "sushi boat" restaurant tasks: clearing a table, setting a table, and serving from a rotating table.

We will run this challenge at two scales: human and mini. The human scale will use real tables and chairs and dishes. The mini scale will be suited for smaller robots.

Participants are welcome to bring their own robots and software, or to make use of Willow Garage's PR2 robots (human scale) or Kuka's YouBot robots (mini scale) for the challenge. Simulations of the space at both scales will be available in advance.

More information will be available at [MobileManipulationChallenge.org](http://MobileManipulationChallenge.org).

## **Indoor Robotic Contingency (formerly Planetary Robotic Contingency, AKA the modular robot competition)**

This challenge simulates an unexpected problem where a robotic solution must be quickly developed and deployed, using only existing resources. The intent of this event is to develop versatile robotic systems and software that can be adapted quickly to address unexpected events. Since humans are present, a natural solution to realistic unexpected events would exploit human creativity and human-robot interaction.

The competition drives not only the development of versatile robotic hardware and on-board software, but also the design and development of programming and assembly tools capable of rapidly implementing a wide variety of capabilities. Since tele-operation is not precluded for this event, the development of effective user interfaces is another expected outcome.

### **The Environment and Event Parameters**

The environment for this event will consist of two areas: a green zone and a red zone. The green zone will represent the human-occupied area from which the robots will be "launched" onto the red zone (where humans may not enter). Robots must be placed in an airlock chamber and drive (or be driven) out onto the red zone. If a robot needs to return to the green zone, it must do so through the airlock chamber. The airlock will be 1.5m long, 1m wide, and 1m tall, with 1m by 1m doors at each end of the long dimension.

Teams will be allowed to use only what they can carry within one airline suitcase. This may be any container that weighs less than 50lbs (23kg) and with outside dimensions summing to less than 62 inches (157cm), and weighing 25kg or less. For example, a container 70cm long, 50cm wide and 30cm tall has a total dimension of  $70+50+30 = 150\text{cm}$ , and would be within the size limits. For convenience, we will also allow access to six standard domestic AC power outlets (United States standard NEMA 5-15, 110v, 15A, 60Hz).

The actual unexpected problem to be solved will be announced on the day of the competition. The problems will be constrained to have likely robotic solution that fit the spirit of the competition. For example, you will not be required to have the robot travel 100km to the site of the problem, or to construct a 10-person emergency habitat from freshly-mined regolith. The scope of the task might vary from a short 10 minute task, to one taking several hours. Specific tasks will be announced to all teams simultaneously, and they will work on their solutions independently.

### **Example Scenarios**

To give an idea of the sorts of tasks, here are a few examples. In the past the competition had a space theme where tasks simulated Martian or lunar habitat emergencies. See: <http://modlabupenn.org/icra/>.

### **Antenna recovery**

An antenna outside the habitat has been knocked over during a Martian storm. The antenna is crucial to the guidance of a resupply transport, which is scheduled to arrive in 4 hours and an EVA is not safe. The team must develop a robot that can reach the antenna, grasp it and reattach it to its receptacle. The antenna is 10 m from the habitat, sitting on top of a 1m by 2m rectangular base that is 1m tall. The base is visible from the habitat. The antenna is a 1cm cylindrical rod 1m long that fits as a peg into a hole 2cm deep in the base. You have a spare antenna and base in the habitat that can be used for testing purposes.

### Base station repair

Sensors have discovered a tear in a thermal covering on the top of a storage shed which contains the habitat's store of liquid nitrogen. The team has 4 hours before the Martian morning arrives and starts to dangerously heat the nitrogen. The team must develop a robot that can crawl on top of the structure, use the supplied patching material, and patch the hole by dispensing a supplied glue. Unfortunately, the structure was not designed to support heavy weights, so the robot must weigh less than 5kg or risk collapsing the structure, with disastrous consequences.

### Nuclear power plant repair

You must send a robot into a nuclear power plant and shut off a valve before the power plant explodes. The valve is standard 1/2" pipe ball valve shut off by rotating a 3" lever 90 degrees. The amount of torque required to shut off the valve is not trivial. Access to the critical areas has size constraints - e.g. going through pipes or small channels to reach the lever.

For more details, please contact Mark Yim ([yim@grasp.upenn.edu](mailto:yim@grasp.upenn.edu)).

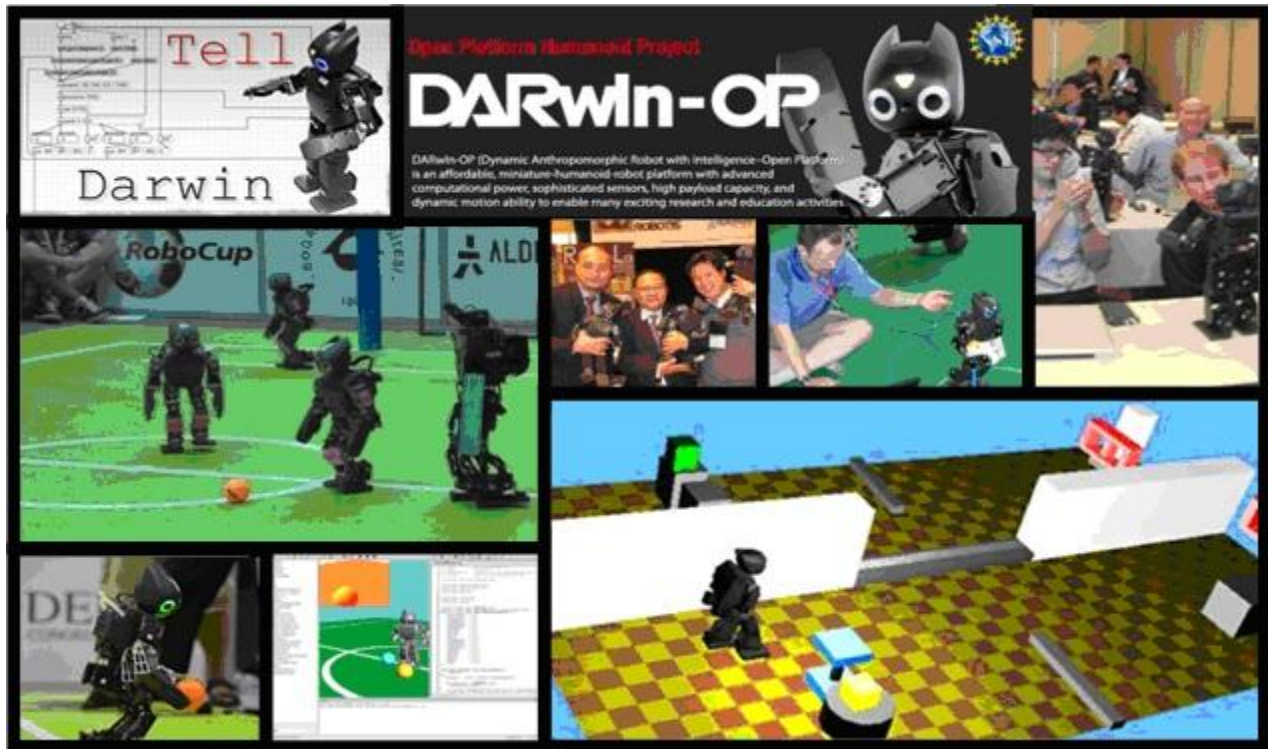
## Mobile Microrobotics Challenge

Recent advances in the design and fabrication of microelectromechanical systems (MEMS) have enabled the development of mobile microrobots that can autonomously navigate and manipulate in controlled environments. It is expected that this technology will be critical in applications as varied as intelligent sensor networks, in vivo medical diagnosis and treatment, and adaptive microelectronics. However, many challenges remain, particularly with respect to locomotion, power storage, embedded intelligence, and motion measurement. As a result, NIST has organized performance-based competitions for mobile microrobots that are designed to: 1) motivate researchers to accelerate microrobot development, 2) reveal the most pressing technical challenges, and 3) evaluate the most successful methods for locomotion and manipulation at the microscale (e.g., actuation techniques for crawling). This year's event will include two challenge tasks (mobility and micro assembly), a freestyle demo, and a poster session.

More details can be found at <http://www.nist.gov/el/isd/mmc> or by contacting Jason Gorman ([jason.gorman@nist.gov](mailto:jason.gorman@nist.gov)).

## DARwIn-OP Humanoid Application Challenge





## Objectives

DARwin-OP is an open platform humanoid project supported by NSF. DARwin-OP is a vision-capable humanoid with full functionality and scalability. Researchers are strongly encouraged to join an open source community for cooperative research to encourage creative applications from around the globe and maximize contribution for humanoid research. For more information, see: [www.robotsource.org](http://www.robotsource.org).

## Registration

Teams (1-4 members) who use DARwin-OP robot to develop their own application are eligible. Projects using customized hardware or simulation only are also welcome.

## Participants required to deliver

1 minute video demonstration (for online registration and review)

All participants are entitled to receive Webots Pro 90 day License (1 each)

Please contact [info@robotsource.org](mailto:info@robotsource.org) to get license.

## For Finalists selected to make presentation at ICRA

5 minutes free-style demonstration (within 1 meter x 1 meter square table)

5 minutes presentation of project (PPT explanation of robot's functions and technologies)

All necessary equipment and items must be prepared by each participating team.

## Judging Criteria

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Creative Idea - 40%

Technical Skills - 30%

Overall Completion - 30%

## Judging Committee

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Professor Dennis Hong (Virginia Tech)

Professor Daniel Lee (University of Pennsylvania)

For more details, please visit [www.robotsource.org](http://www.robotsource.org) or contact Kayla Kim (info@robotsource.org)

## The Manufacturing Challenge

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This will be the fourth year of this simulation-based challenge which is designed to stimulate research in robotics dealing with problems related to mixed-palletizing and intra-factory package delivery and logistics.

### CHALLENGE EVENTS

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This year's events will include two challenges. Each challenge will have multiple events and teams can participate in one or more events.

#### (1) Mixed Palletizing Challenge:

This challenge is designed to explore algorithms and techniques to address the three dimensional cutting stock problem, a variant of the combinatorial non-deterministic polynomial-time hard (NP-hard) knapsack problem. Teams will create and evaluate pallet optimal packing plans using XML schemas, a Pallet Viewer application and the USARSim simulation framework.

#### (2) Mobility & Task Completion Challenge:

The events of this challenge are designed to address the need for one or more factory robots to operate in unstructured environments amongst dynamic obstacles. Teams will use the USARSim simulation framework to deliver completed pallets throughout a simulated warehouse environment.

## TEAMS

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Teams of one or more researchers, students and faculty may participate in the competition. Teams have the option to be physically present for the challenge events or, participate remotely from their home institution. New and multi-disciplinary teams that foster collaboration and include researchers from other disciplines (ex. operations research, systems engineering, applied mathematics) are especially encouraged to participate.

If you have any questions, contact George Dimitoglou (dimitoglou@hood.edu).

## Schedule

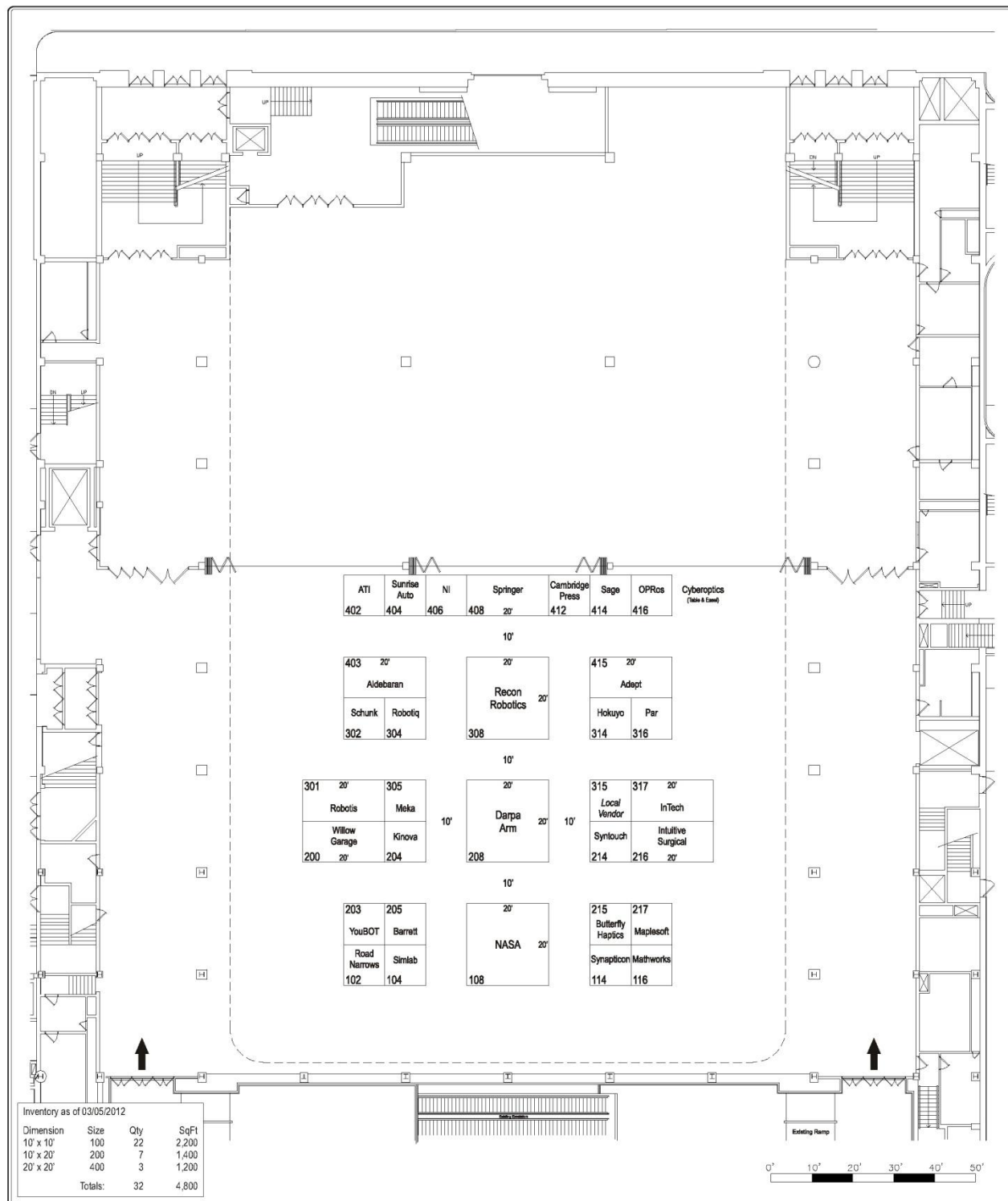
Tuesday May 15	12:00 - 13:30	Indoor Robotic Contingency
	14:30 - 18:00	
	14:30 - 18:00	Mobile Microrobotics Task 1
Wednesday May 16	8:30 - 13:30	DARwin-OP
	14:30 - 18:00	
	8:30 - 13:30	Manufacturing
	14:30 - 18:00	
	8:30 - 12:00	Mobile Microrobotics Task 2
	14:30 - 15:30	
	12:00 - 13:30	Mobile Manipulation
	14:30 - 18:00	
Thursday May 17	8:30 - 11:30	Mobile Manipulation
	9:30 - 11:00	Mobile Microrobotics Demos
	14:30 - 15:30	Robot Challenge Summaries



# Exhibitions

## Floorplan

The exhibitions and Robotic Challenges are being held in the Roy Wilkins Auditorium of RiverCentre in Saint Paul.



## Robot Challenge

Food &amp; Beverage

Food &amp; Beverage

ATI 402	Sunrise Auto 404	NI 406	Springer 408	Cambridge Press 412	Sage 414	OPRos 416	Cyberoptics (Table & Easel)
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403 Aldebaran
Schunk 302
Robotiq 304

Recon Robotics 308
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415 Adept
Hokuyo 314
Par 316

301 Robotis	305 Meka
Willow Garage 200	Kinova 204

Darpa Arm 208
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315 Local Vendor 214	317 InTech Intuitive Surgical 216
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203 YouBOT	205 Barrett
Road Narrows 102	Simlab 104

NASA 108
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215 Butterfly Haptics 114	217 Maplesoft Mathworks 116
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Entrance

Exhibits



Entrance



## 2012 IEEE International Conference on Robotics & Automation

St. Paul, Minnesota, USA May 14-18, 2012

## Schedule

<b>Tuesday May 15</b>	12:00-18:00
<b>Wednesday May 16</b>	08:00-18:00
<b>Thursday May 17</b>	08:00-18:00
<b>Friday May 18</b>	08:00-12:00

## Exhibitors



Aldebaran

[www.aldebaran-robotics.com](http://www.aldebaran-robotics.com)



ATI

[www.ati-ia.com](http://www.ati-ia.com)



Adept

[www.adept.com](http://www.adept.com)



Barrett Technology Inc.

[www.barrett.com](http://www.barrett.com)



Butterfly Haptics

[butterflyhaptics.com](http://butterflyhaptics.com)



Cambridge Press

[www.cambridge.org](http://www.cambridge.org)



Cyberbotics

[www.cyberbotics.com](http://www.cyberbotics.com)





DARPA ARM

[www.theARMrobot.com](http://www.theARMrobot.com)Hokuyo Automatic Co.,  
Ltd.[www.hokuyo-aut.jp](http://www.hokuyo-aut.jp)

Kinova, Inc.

[www.kinovarobotics.com](http://www.kinovarobotics.com)

MEKA

[www.mekabot.com](http://www.mekabot.com)

NASA

[robonaut.jsc.nasa.gov](http://robonaut.jsc.nasa.gov)

National Instruments

[www.ni.com](http://www.ni.com)

OPRos

[www.opros.or.kr](http://www.opros.or.kr)

PaR Systems

[www.par.com](http://www.par.com)

Recon Robotics

[www.reconrobotics.com](http://www.reconrobotics.com)

Road Narrows LLC

[www.roadnarrows.com](http://www.roadnarrows.com)



Robotis

[www.robotis.com](http://www.robotis.com)



ROBOTIQ

[www.robotiq.com](http://www.robotiq.com)



SAGE Publications Ltd.

[www.sagepub.co.uk](http://www.sagepub.co.uk)



Schunk

[www.schunk.com](http://www.schunk.com)



SimLab. Co. Ltd.

[www.rlab.co.kr](http://www.rlab.co.kr)



Springer Publishers

[www.springer.com](http://www.springer.com)



Synapticon, Inc.

[www.synapticon.com](http://www.synapticon.com)



Syntouch LLC

[www.syntouchllc.com](http://www.syntouchllc.com)



Sunrise Auto

[www.dummysensor.com](http://www.dummysensor.com)



youBot

[www.youbot-store.com](http://www.youbot-store.com)

# ICRA 2012 Awards

## **Best Automation Paper Award (sponsored by United Technologies Research Center)**

The IEEE International Conference on Robotics and Automation (ICRA 2012) encourages research in automation by annually recognizing the Best Automation Paper for systems that operate autonomously in predictable environments over extended periods, or the explicit structuring of such environments.

Factors that will be considered are originality, depth, quality, presentation, and significance as related to automation, emphasizing efficiency, productivity, quality, and reliability, focusing on systems that operate autonomously in predictable environments over extended periods, or the explicit structuring of such environments.

## **Best Cognitive Robotics Paper Award (sponsored by CoTeSys)**

This award is established to promote interdisciplinary research on cognition for technical systems and advancements of cognitive robotics in industry, home applications, and daily life.

Factors to be considered are: the significance of cognitive behavior and cognitive capabilities, interdisciplinary work, creativity, technical merits, originality, potential impact in applications in industry and at home, and clarity of presentation.

## **Best Manipulation Paper Award (sponsored by Ben Wegbreit)**

The award wants to highlight innovative efforts in the planning and execution of manipulation tasks which take place in dynamic environments. The integration of humans is also critical. Numerous challenges need to be overcome and new applications are also highly sought after.

## **Best Medical Robotics Paper Award (sponsored by Intuitive Surgical)**

This award will recognize outstanding work in the area of medical robotics and computer-assisted interventional devices and systems. Relevant topics may include the design and development of novel devices and robotic systems, and their integration with navigation and imaging technologies for enhanced clinical efficacy.

## **Best Service Robotics Paper Award (sponsored by KUKA)**

This award promotes between robotics science research and industry R&D advancement in the area of service robotics applications (both professional and domestic).

Factors to be considered are: the significance of the new applications, technical merits, originality, potential impact on the field, and clarity of presentation.

## **Best Vision Paper Award (sponsored by Ben Wegbreit)**

For the best paper relating to Vision presented at the IEEE International Conference on Robotics and Automation.

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### **Best Video Award**

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This award recognizes the most outstanding video in the Video Proceedings of the annual IEEE International Conference on Robotics and Automation.

Factors to be considered are: Technical merit, originality, potential impact on the field, practical significance for applications, and clarity of the video presentation.

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### **Best Student Paper Award (sponsored by United Technologies Research Center)**

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To recognize the most outstanding paper authored primarily by a student at the annual IEEE International Conference on Robotics and Automation.

Factors to be considered are: Technical merit, originality, potential impact on the field, practical significance of the applications, clarity of the written presentation in the proceedings, and quality of the oral presentation at the conference.

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### **Best Conference Paper Award**

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The Best Conference Paper award recognizes the most outstanding paper in the Proceedings of the annual IEEE International Conference on Robotics and Automation.

Factors to be considered are: Technical merit, originality, potential impact on the field, clarity of the written paper, and quality of the oral or other presentation.

# Industry Forum

## Bridging the Gap between Academia, Industry, and Government to Benefit End-Users

**Tuesday May 15, 2012, 08:30-17:30, RiverCentre Rooms 10-11**

**Organizers: Raj Madhavan (University of Maryland, College Park & National Institute of Standards and Technology, USA) & Rainer Bischoff (KUKA Laboratories, Germany)**

The ICRA 2012 industrial forum will focus on bridging the gap between academia, industry and government by bringing together experts, leaders, and practitioners from diverse domains and from across the world to provide a truly global perspective. Similar efforts have been undertaken in the United States, Europe, and Asia with mixed results. You will hear from researchers, vendors, and funding agencies on their experiences and the roadblocks they have encountered. A panel discussion will conclude the forum to foster dialog between participants and speakers. Based on the discussions stemming from the entire day, a white paper will be published with an action plan to go from where we are to where we can. The target audience of the forum is end-users, developers, vendors, and anyone who is interested in robotics and automation technologies.

In addition to the main theme, the following topics will be addressed during the forum:

- How can industry and academia work together by actively collaborating and acknowledging differences in practices, implementations, and mindset?
- What can government agencies do to foster such collaboration and facilitate innovation and technology transfer?
- How can the end-users and the community at-large benefit from the above three groups working as a cohesive whole?
- What are known (and hidden) and not-so-widely discussed barriers and roadblocks?
- What is the role of standardization and ad-hoc standards and best practices?
- Can the support of entrepreneurship address some of the aforementioned problems?
- How can we leverage existing know-how and target the low-hanging fruit as well as long-term issues in a collaborative fashion?

### Agenda

The final list of speakers is yet to be confirmed. Please check the ICRA 2012 website (<http://www.icra2012.org>) and IEEE-RAS IAB website (<http://www.ieee-ras.org/industrial>) for an updated final agenda.

08:30-08:40	Introduction & Welcome: Dr. Raj Madhavan & Dr. Rainer Bischoff
08:40-09:00	Opening Remarks: IEEE-RAS President, Prof. David Orin & IEEE President-Elect, Dr. Peter Staecker

09:00-10:30	Invited Talks (1)
10:30-10:45	Coffee Break
10:45-11:45	Invited Talks (2)
12:00-14:30	Lunch & ICRA 2012 Plenary
14:30-16:00	Invited Talks (3)
16:00-16:15	Coffee Break
16:15-17:15	Panel Discussion
17:30	Adjourn

# NSF Presentation

## Entrepreneurship and Innovation: The Next Decade NSF's Innovation Corps and the Future of Entrepreneurial Education

**Wednesday May 16, 2012, 15:00-17:00, RiverCentre Rooms 10-11**  
**Organizer: Richard Voyles (National Science Foundation, USA)**

In the United States, the National Science Foundation (NSF) is developing a new program to reinvigorate entrepreneurship tied to federally-sponsored research. The Innovation Corps is an aggressive new program to train students and principal investigators in the subtleties of commercializing output of basic research. Researchers with NSF-sponsored research ideas that they believe are nearing commercial potential can apply for funding to help determine the business potential of ground-breaking ideas. To qualify for funding and make a go/no-go decision on commercialization potential, PIs must do two things: assemble an entrepreneurial team and commit the team to enroll in an NSF-supported entrepreneurship course tailored for engineers and scientists.

Education is a key pillar of the NSF mission and entrepreneurship and innovation are key drivers of the United States' and world economies. However, some believe entrepreneurial education has failed to deliver substantive changes in the success rate of technology-based start-up businesses in the United States. NSF has adopted an emerging new curriculum being championed at select universities that formulates business creation as a methodology familiar to engineers and scientists: hypothesis testing. By capturing this methodology and introducing it to educators, engineers and scientists, the Innovation Corps endeavors to construct an innovation ecosystem that more efficiently captures the fruits of government investment in long-term research for job creation and economic development. This bold new program has been garnering deep interest from government agencies and entrepreneurial educators around the world. In an economic climate that presents increasing challenges due to the accelerating pace of technological change, dwindling natural resources, rising unemployment, and spiraling populations, greater efficiency in translating academic advances into meaningful impact on society is relevant to all.

In this presentation, the NSF Innovation Corps for U.S. researchers will be described, as well as personal perspectives on how the program has shaped PI plans.

[http://www.nsf.gov/news/special\\_reports/i-corps/](http://www.nsf.gov/news/special_reports/i-corps/)

## Social Events

### Monday, May 14

Two parallel gatherings will take place at the Crowne Plaza.

- **Student Social:** Students pre-registered for this welcome party will be treated to local food from the MN State Fair, and enjoy a presentation by Jorge Cham.  
Location: Minnesota Ballroom, Lower Level (18:00 – 20:00)
- **ICRA 2012 Reception:** An opportunity for workshop attendees and early arrivals to socialize and network before the start of the conference  
Location: Great River Ballroom, First Level (18:00 – 20:00)

### Tuesday, May 15

- **Women in Engineering Luncheon:** This event is organized by the IEEE Women in Engineering (WIE) and Membership Activity Board (MAB), and sponsored by IEEE. The ICRA "Birds of a Feather" Women Luncheons offer the opportunity to young female researchers to discuss informally with senior faculty members around a free lunch. "Birds of a Feather" Women Luncheon has been held as one of social events during ICRA since 2007, and will be held as part of services served by WIE and MAB since 2011. Free lunch will be available on a first-come, first-served basis to ICRA women attendees.  
Location: Crowne Plaza, Great River Ballroom (12:00 – 13:00)
- **Welcome Reception.**  
Location: Minnesota Science Museum (19:30 – 21:30)

### Wednesday, May 16

- **GOLD Lunch:** A lunch for all Graduates of the Last Decade (GOLD) will be organized at the Continental Ballroom level. This luncheon was initiated within the RAS Technical Activities Board (TAB) as a means to let graduates be aware of what the society has to offer, and to network with each other. The opportunity is also used to present the structure of the society, and introduce the various Technical Committees forming TAB. RAS members will have first priority. If you are not yet a member, you can sign up now at [www.ieee-ras.org](http://www.ieee-ras.org). Pre-registration required.  
Location: Crowne Plaza, Great River Ballroom (12:00 – 13:00)
- **Lunch with the Leaders:** (for 100 RAS student members) This event is organized by the IEEE Robotics and Automation Society (RAS) . Lunch with Leaders (LwL) was initiated by the Student Activities Committee with the aim to provide students with an opportunity to get in contact with leaders and get advice and mentoring on their career and research. Leaders in attendance will include: **Antal Bejczy, T. C. Steve Hsia, Paolo Dario, David Orin, Vincenzo Piuri, Kazuhiro Kosuge, Bruno Siciliano**. Note that this activity is



intended for current students. RAS members will be prioritized. Pre-registration required.

Location: Crowne Plaza, Windows on the River (12:00 – 13:00)

- **Banquet:**

Location: RiverCentre Grand Ballrooms (19:00 – 21:30)

## Thursday, May 17

- **Awards Lunch:**

Location: RiverCentre Grand Ballrooms (12:00 – 13:00)

- **Farewell Reception:**

Location: RiverCentre Roy Wilkins Auditorium (18:30 – 20:30)



## Conference Locations



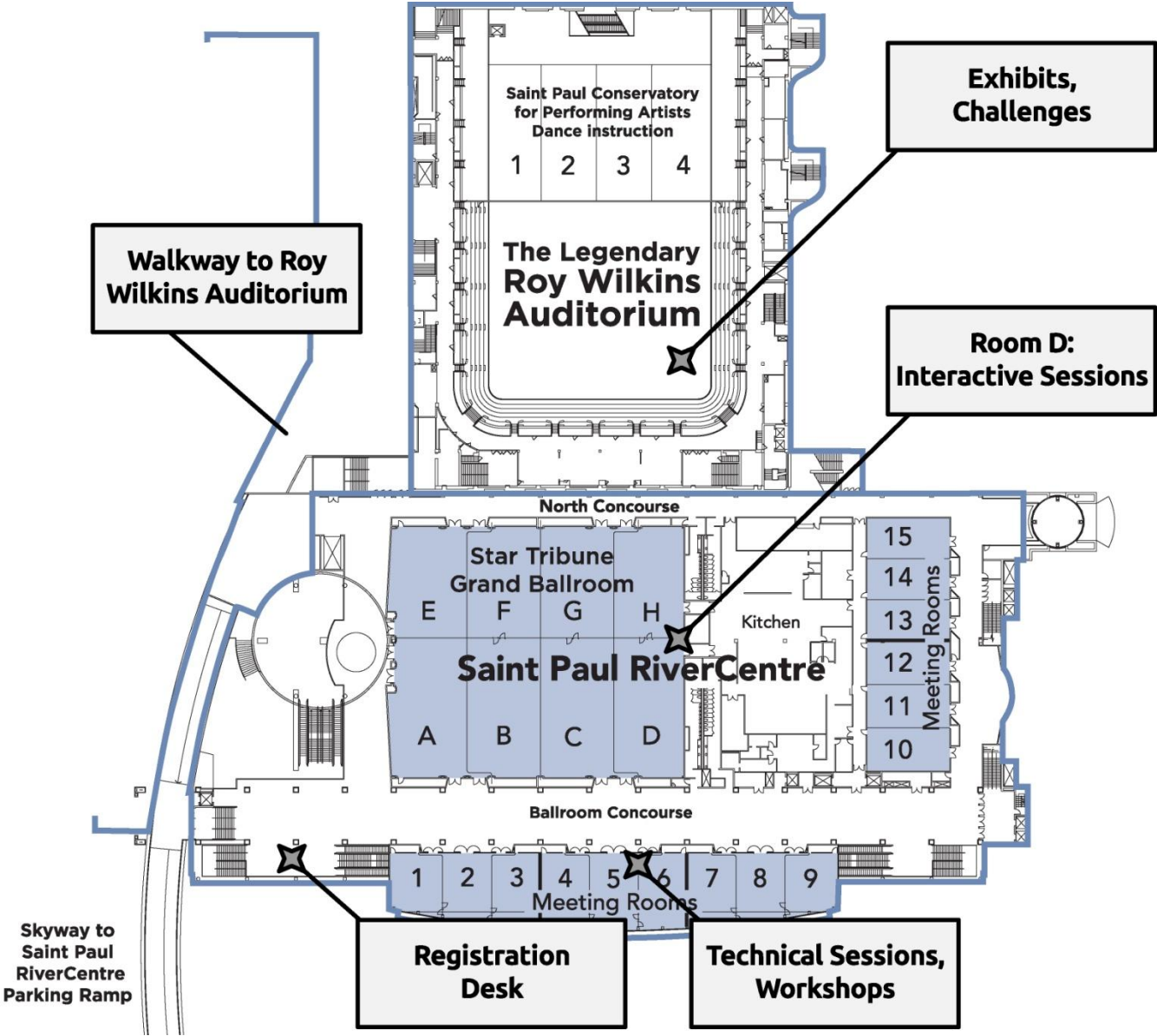
The IEEE International Conference on Robotics and Automation (ICRA) 2012 will kick off on May 14. From May 14 to May 18, the conference will showcase technical sessions, workshops, tutorials, and exhibits reflecting advances in our rapidly developing field.

ICRA 2012 will take place at the RiverCentre in Saint Paul, Minnesota, USA. The convention center is located in downtown Saint Paul overlooking the Mississippi River. The walk from RiverCentre to Crowne Plaza, the main conference hotel, takes about eight minutes along Kellogg Boulevard.

All workshops, technical sessions, exhibits and robotics challenges will be held at the RiverCentre. The Crowne Plaza will host the Robotics and Automation Society (RAS) meetings, as well as some of the social events. On Monday, Tuesday, Wednesday and Friday, lunchboxes will be available for purchase at the Ordway Center.

Minneapolis and Saint Paul constitute a vibrant metro area known as the Twin Cities. The Cities are home to a number of Fortune 500 companies including Target, Best Buy, 3M, Medtronic, and Xcel Energy. The area is also a major hub for arts, sports, education and entertainment. Together with its numerous parks, lakes, biking and hiking trails, the Twin Cities have something fun and exciting for any taste. As the ICRA 2012 Organization Team, we hope that you enjoy your time in the Land of 10,000 Lakes!

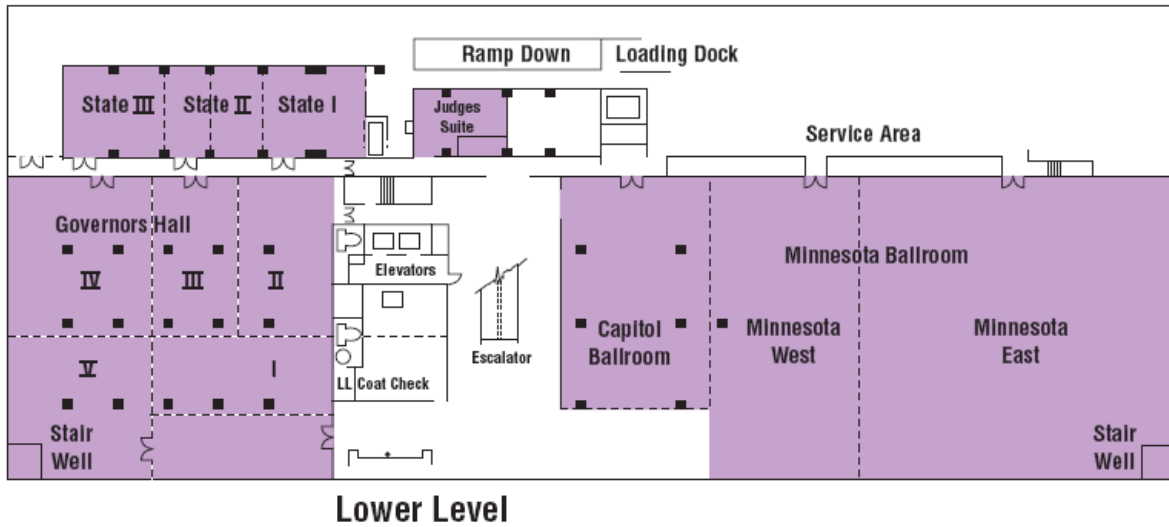
Conference Venue: Saint Paul RiverCentre



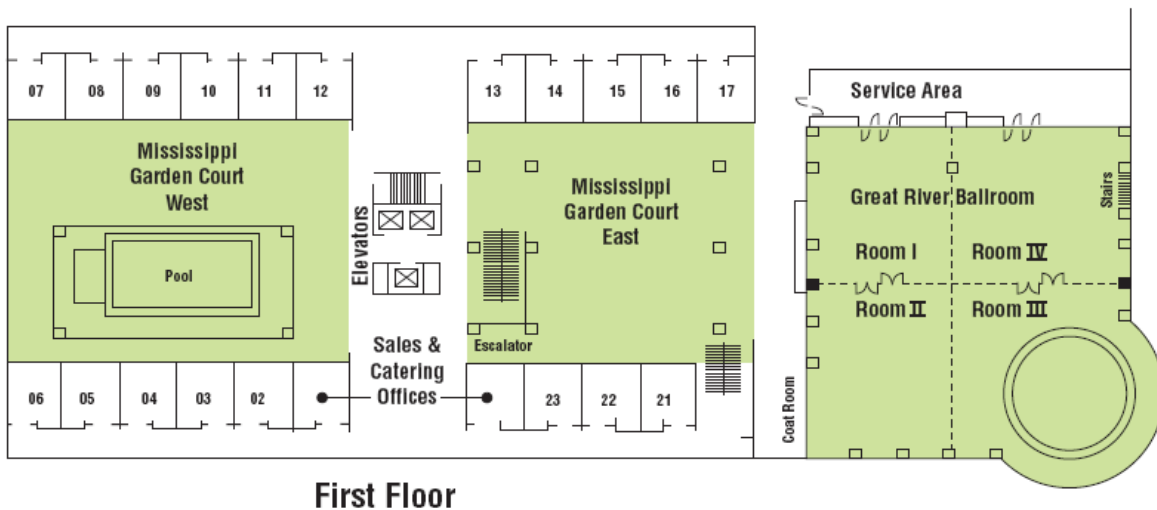
## Meeting Locations at the Crowne Plaza

The events will be spread out across the Lower Level, Lobby Level and the First Floor.

- Lower Level: Minnesota Ballrooms, Governors Hall, State Rooms



- Lobby Level: Kellogg I, II, III (layout not shown)
- First Floor: Great River Ballroom

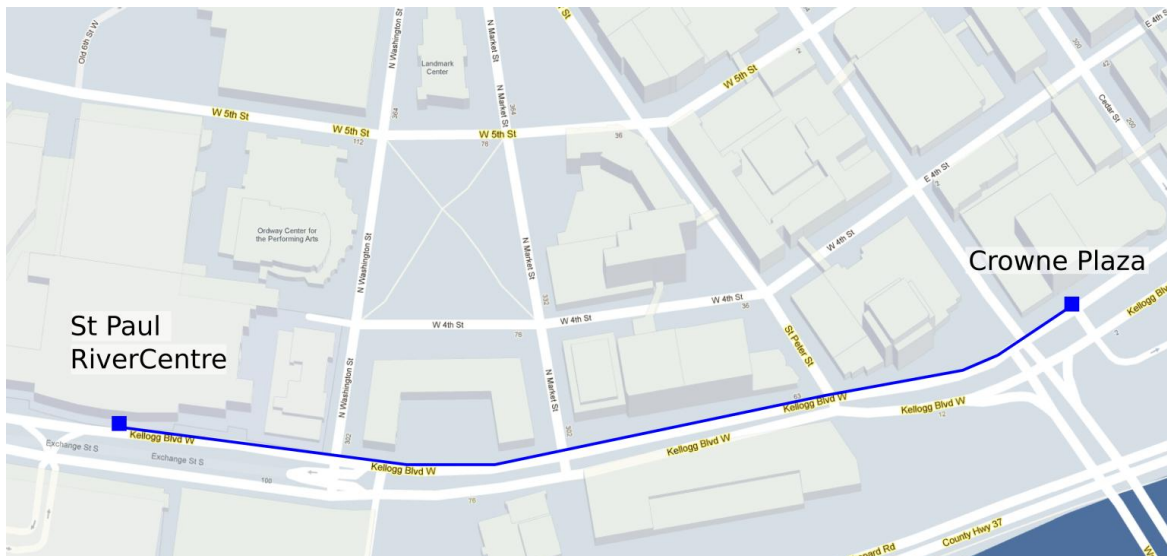


## Accommodations

### Crowne Plaza St. Paul Riverfront Hotel



**Distance from Venue (Walking): ~8min (0.4mi / 0.6km)**





## St. Paul Hotel



**Distance from Venue (Walking): ~5min (0.3mi / 0.5km)**



In case that you have problems with the online reservation system of the Saint Paul hotel, please call or email the hotel and mention the IEEE code 486144.

Phone (Toll Free): 1-800-292-9292 Email: [reservations@saintpaulhotel.com](mailto:reservations@saintpaulhotel.com)



## The Science Museum of Minnesota

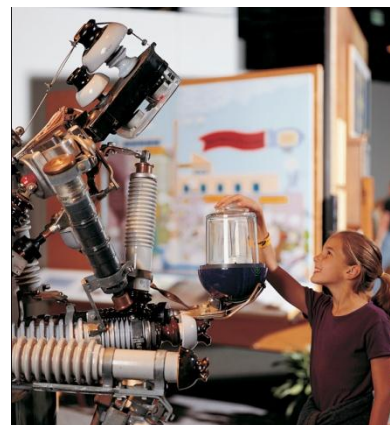


On Tuesday May 15, the ICRA 2012 Welcome Reception will take place at the Science Museum of Minnesota. Located on Kellogg Boulevard and overlooking the Mississippi River, the Science Museum of Minnesota offers guests a unique opportunity to explore all kinds of science learning. With nearly nine acres of indoor space devoted to hands-on science activities, a state-of-the-art giant screen theater, and an outdoor exhibit gallery featuring science-themed mini-golf and a 17,000 square-foot prairie maze, the Science Museum of Minnesota has something for visitors of all ages

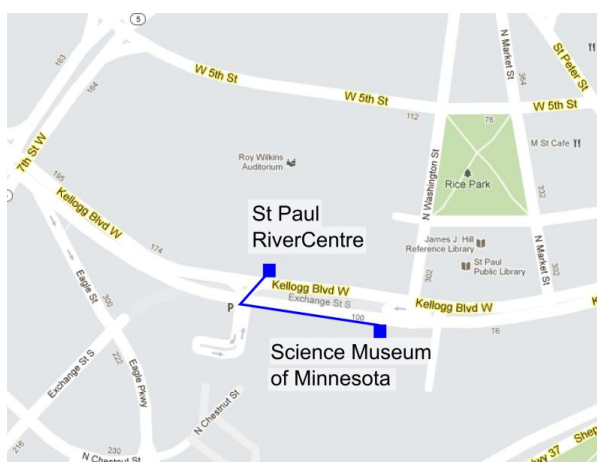
and backgrounds to enjoy.

In the Science Museum of Minnesota's Experiment Gallery, visitors can carry out simple experiments and find the joy of discovery as they uncover the fundamental properties of physical events. They can explore energy transformation, weather, air dynamics, light, waves and resonance, and more. The Science Museum of Minnesota's Cell Lab offers visitors an opportunity to don a lab coat and gloves to explore the world of cells through creative experiments.

One of the highlights of the museum's Dinosaurs and Fossils Gallery is an 82-foot-long **Diplodocus**, a plant-eating dinosaur from the Jurassic



period. With St. Paul's roots originating from the Mighty Mississippi, the Science Museum of Minnesota's authentic towboat, the *Charles E.*, serves as a viewing platform overlooking the river that gave the city its life. A perennial summer visitor favorite, the Big Back Yard features a science-style mini-golf course, a 17,000-square foot prairie maze, gardens, and an award-winning solar-powered building. During the conference, SMM will also feature a Pirates exhibit!



## Local Attractions: Sample Itineraries

Have some time to spare? Try out one of these sample itineraries, as recommended by our volunteers!

### Downtown Saint Paul

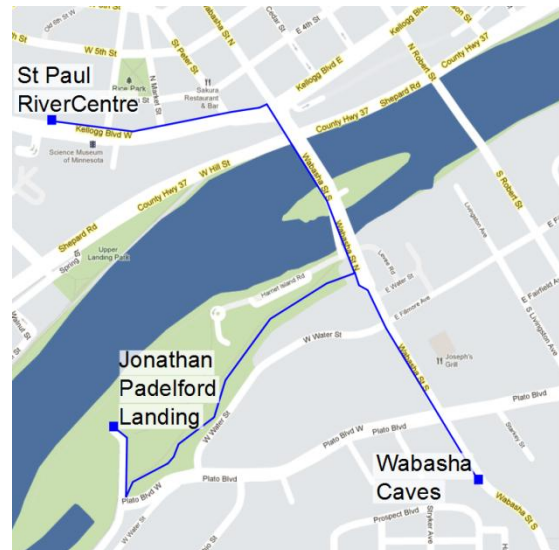
If you will miss the welcome reception, you can visit the **Science Museum of Minnesota** (<http://www.smm.org/>) which is right across from the RiverCentre (be sure to see the pirate exhibit). Alternatively, you can visit the Minnesota History Center: <http://www.minnesotahistorycenter.org/>.

The **Minnesota History Center**, which opened in October of 1992, is home to the Minnesota Historical Society's collections and provides a place for visitors to discover their connections to the past. This landmark building houses a museum, library, classrooms, and conference rooms, the 314-seat 3M Auditorium, two museum stores and a café.

During the conference, a new exhibit featuring a rare, early published version of the U.S. Constitution and an even more rare draft of the Bill of Rights, along with the original editions of the two state of Minnesota Constitutions, will be on display.



**How to get there:** The walk from the RiverCentre takes about ten minutes. We recommend taking the following path which is slightly longer, but includes **Mickey's Dining Car**. Listed on the national register of historic places and featured in several movies, the Food Network and travel TV programs, Mickey's is an authentic 1930's Art Deco diner. The diner has been serving up breakfast, lunch and dinner 24 hours a day for nearly 70 years. For more see [www.mickeysdiningcar.com](http://www.mickeysdiningcar.com).



### Other Saint Paul Activities

**Cathedral of St. Paul:** Take a fifteen minute walk from the RiverCentre to see one of the most prominent attractions of St. Paul.

**Jonathan Padelford:** Enjoy the splendor of the Mississippi with a ride on the Jonathan Padelford, an authentic sternwheeler riverboat. A historically narrated public sightseeing excursion departs at 2P.M. on Saturdays and Sundays beginning May 12. The tour runs for 90 minutes. Sights on the way include: the St. Paul High Bridge, Fountain Cave, Pike Island, and Fort Snelling. Tours depart from Harriet Island, which is directly across the river from the Science Museum. The Jonathan Padelford is a twenty minute walk from the Crowne Plaza (twenty-five from the RiverCentre). Visit <http://www.riverrides.com/pages/public/sightseeing.html>.



**Wabasha Street Caves:** These manmade caves have historically been used for growing mushrooms and for the storage of food. In the 1920s, they were converted into a nightclub, and frequented by gangsters such as John Dillinger (OK, it's just a rumor). The caves are said to be haunted (this one is definitely true). The walk is about fifteen minutes from the Crowne Plaza, and twenty from the RiverCentre.

**Summit & Grand Avenues:** In the mid-1800s, St. Paul was transitioning from a town to a city, and the business leaders of the day used their newfound wealth to build themselves mansions on the hill overlooking their empire. Many of these mansions are still standing today, under the shade of broad trees, stretching from the Cathedral of St. Paul down Summit Avenue for 4 1/2 miles. This is the longest stretch of Victorian houses in the



US. Highlights include the James J. Hill House, the Minnesota Governor's Mansion, and the row house where the author F. Scott Fitzgerald lived. If you get tired of houses and trees you can stop for a bite to eat on Selby Avenue near the Cathedral, or alternatively near the intersection of Grand Avenue and Victoria (a block south of Summit Ave). Both areas were once streetcar stops which allowed commercial districts to build up in mostly residential areas. Though the street car is long gone, the commercial areas remain, and they are popular local destinations.

### Mall of America & Summit Brewery



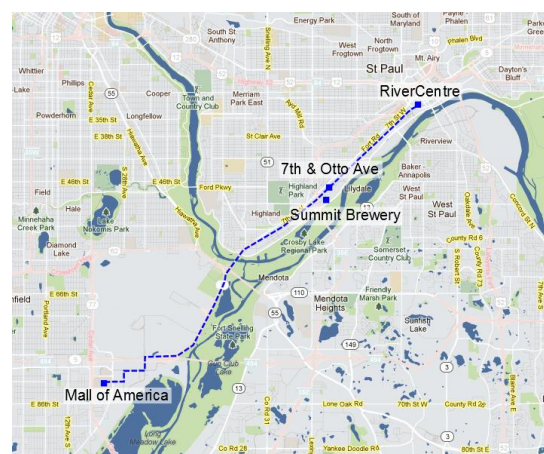
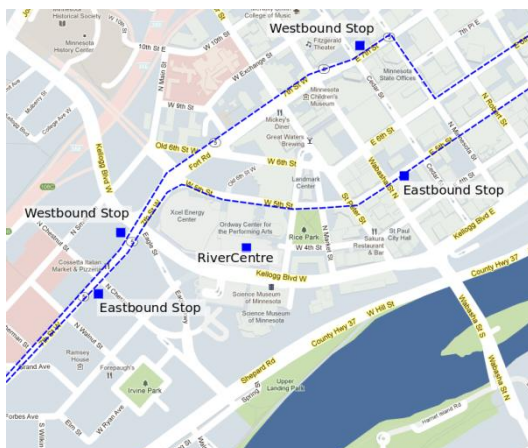
The **Mall of America** features a wide range of dining and entertainment options including an indoor theme park, a water park, a 1.2 million gallon aquarium, 4.3 miles of store fronts, and over 50 restaurants. Visit [www.mallofamerica.com](http://www.mallofamerica.com) for more information.

**How to get there:** The conference is planning to provide shuttles to MoA. Please check the information booth by the registration area in RiverCentre for departure information. You can also take Bus 54 Express Route on 5<sup>th</sup> Avenue. The trip there is about half an hour.

**Summit Brewery:** If you are taking public transportation, you can stop by the Summit Brewery along the way. Summit is a uniquely Minnesotan beer, and a local favorite. The Brewery offers free tours and free samples, and has a gift shop on site. Book the tour in advance at: <http://www.summitbrewing.com/culture/tours>.



**How to get there:** Route 54 takes 20 minutes from the Saint Paul River Centre. Disembark on Otto Avenue.

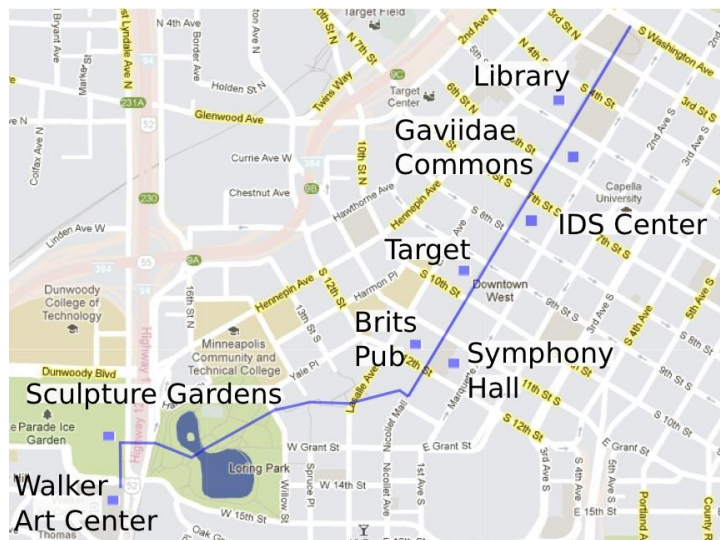


## Minneapolis



Our suggested itinerary for Minneapolis starts from the Minneapolis Central Library (make sure to peek inside!) and ends at the Minneapolis Sculpture Gardens and Walker Art Center. The walk takes about thirty minutes. Our starting point, the Minneapolis Public Library, marks the north end of Nicollet Mall – a pedestrian mall lined with restaurants and shops. You can walk outside or indoors, through the skyways – a complex web of tunnels used by Minnesotans in the winter.

The best place to enter the skyway system is through the Gaviidae Commons home to Nieman Marcus, the premium outlet Saks Off 5th, and other upscale shopping and dining areas. Continuing down the mall you'll encounter the IDS center, the tallest skyscraper in the Twin Cities. The Center is home to a nice indoor plaza and to more affordable lunch options. Between the IDS center and Target flagship store, you can stop by Barnes and Noble (bookstore), go to Panera for quick sandwich, or enjoy Zelo; an upscale restaurant featuring American and Italian fusion cuisine. The next block features the Target flagship store along with a rich selection of bars and restaurants including: The News Room, an American pub and restaurant with decor showcasing news events in Minneapolis' history; Barrio, a tequila bar with Mexican appetizers; and The Local, a famous Irish pub. The Local is a great spot to catch the latest European soccer match on TV. In the following blocks, there is the Minneapolis Symphony Hall, which is separated from the street by a large open plaza, and Brit's Pub, a classic English watering hole complete with the largest rooftop patio in the city and its own lawn bowling pitch. In the middle of the next block, Loring Greenway leads away from the street to the west. The Greenway provides a quick, shady path to Loring Park and the pedestrian bridge over Highway 94 to the Minneapolis Sculpture Garden and Walker Art Center.

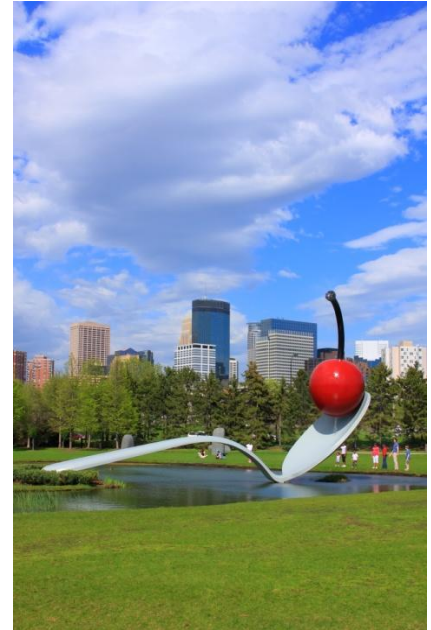


Featuring over 40 permanent art installations, the Minneapolis Sculpture Garden is one of the largest urban sculpture gardens in America. The Walker Art Center is one of the nation's five biggest museums showcasing modern art. It features work by Georgia O'Keeffe, Andy Warhol, Cindy Sherman, and Frank Gaard. The Museum Shop is worth a visit, as is the restaurant 'Gather,' with its inventive, locally-sourced American cuisine. For more information see [www.walkerart.org](http://www.walkerart.org).

**How to get there:** In the evening take one of the conference-provided shuttles (planned – please check the info desk), or catch the 94 bus on the corner of Minnesota and 6th Street. From the Crowne Plaza, walk east along Kellogg Blvd to Minnesota St. (two blocks), then walk along Minnesota St. to 6th (three blocks). There are many other direct buses from Downtown Saint Paul to Downtown Minneapolis (e.g. Route 16 and 50), but 94 is the fastest.

**Other Minneapolis Activities near the Nicollet Mall:**

- Baseball fans can catch a Minnesota Twins game at the new Target Center in Minneapolis:  
May 13 (1:10pm) against the Blue Jays  
May 14 (7:10pm) and 15 (12:10pm) against the Indians
- The Twin Cities support more live theater per capita than any other city in the U.S. with the exception of New York City. There are about one hundred theaters in the Twin Cities. Most are located on Hennepin Avenue in downtown Minneapolis
- **The Minnesota Orchestra**, now in its second century and led by Music Director Osmo Vänskä, ranks among America's top symphonic ensembles, with a distinguished history of acclaimed performances. During the conference, you can catch:
  - Romeo and Juliet - Sat May 12, 2012 8P.M.
  - Vänskä, Sudbin and Mozart -  
Thu May 17, 11A.M.; Fri May 18, 8P.M.; Sat May 19, 8P.M.; Sun May 20, 2P.M.





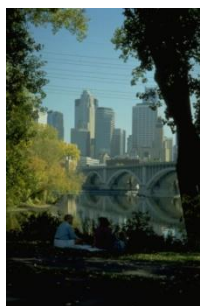
## University of Minnesota Campus & Riverfront District (Minneapolis)

The Mississippi river runs through the University of Minnesota's Minneapolis campus dividing the campus into the East Bank and West Bank. The Washington Avenue Bridge connects the two banks with dedicated pedestrian and bike lanes. The bridge provides excellent views of the Mississippi and of downtown Minneapolis.



The Northrop Mall is the heart of the campus, with the Northrop Memorial Auditorium on one end, and the Coffman Memorial Union at the other. The Union is a hub of recreational student activities. The campus is also home to the **Weisman Art Museum** and the **Bell Museum of Natural History**, both on the East Bank. Notable architecture on campus includes the Weisman building (picture below) and the Armory building. Visit <http://www.umn.edu/> to learn more.

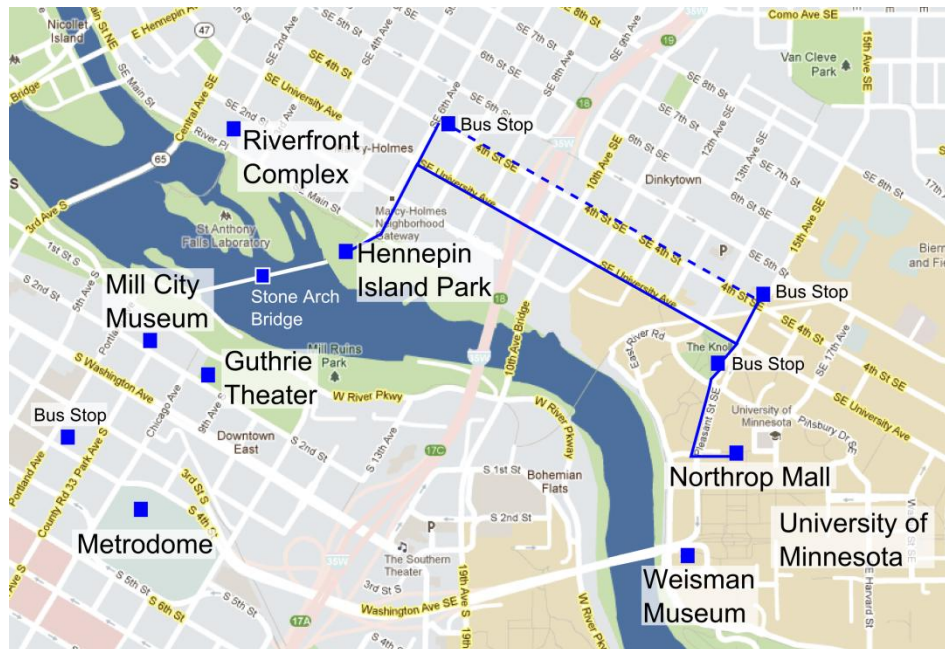
**How to get there:** You can join the campus tours organized by the ICRA committee. You can also take buses Route 3, 16, and 50 from the Crowne Plaza Hotel to the campus (about 55 minutes). Pleasant Street and Eddy Hall (East Bank) is the stop you want. The University operates a regular, free shuttle service around the campus.



**Riverfront District:** Close to the University of Minnesota is the historic Riverfront district featuring a museum, observation decks, restaurants with live outdoor music, jogging and biking trails. The **Guthrie Theater** building features a cantilevered lobby open to all visitors, dubbed "the endless bridge", with an observation site overlooking the Mississippi River and the Minneapolis skyline. The **Mill City Museum**, built into the ruins of what was once the world's largest flour mill, features multimedia shows, movies and self-guided exhibits about the intertwined histories of the flour industry, the river, and the city. The **Saint Anthony Riverfront complex** situated next to the Hennepin Island Park offers numerous sports restaurants and bars with live outdoor music in the summer. Biking trails run across both banks of Mississippi, and rental bikes are available at nearby locations from **Nice Ride MN**. Visit <http://stanthonymain.com/>.



**How to get there:** From St. Paul, you can take Bus Route 94 and get off the bus at 4th Street S and Portland Avenue (about 35 minutes). If you are coming from the university campus, you can walk directly (about 15 minutes), or take bus route 6 at the 4th Street and 15th Avenue SE bus stop and get off at the 4th Street and 4th Avenue SE bus stop (this takes about six minutes).



### Don't want to walk?

- From the St. Anthony Main (near the Riverfront complex above) you can rent bikes, or take a guided Segway tour:
  - <https://www.niceridemn.org>
  - <http://www.humanonastick.com>
- Minneapolis was recently named America's most bike friendly city by Bicycling Magazine



## Other Local Information/Activities

### Conference Registration

A conference registration desk will be set up and opened at the RiverCentre during the following hours:

<b>Monday May 14</b>	07:30-18:00
<b>Tuesday May 15</b>	07:30-18:00
<b>Wednesday May 16</b>	07:30-17:00
<b>Thursday May 17</b>	07:30-17:00
<b>Friday May 18</b>	07:30-13:00

### Conference Hot-Line

During the registration hours, you can reach our information desks by calling +1-651-726-1802

### Wireless Network Access

Wireless network access will be provided for all participants during the conference. There will be two SSIDs (secure and open access):

- ICRA2012 - SSID for open authentication
- ICRA2012-secure - SSID for WPA2 with PSK

To ensure excellent quality of service, we will support 2400 connections in meeting rooms 1-15 and the hall outside these rooms.

### Technical Tours

Technical tours will take place at the University of Minnesota Digital Technology Center (DTC) on the morning of Monday, May 14 and on Friday, May 18 in the morning and afternoon. The tours will give participants the opportunity to visit research exhibits and attend robotics and computer vision demonstrations from the research groups of faculty at the UMN including, among others: Maria Gini, Volkan Isler, Bernice Mettler, Nikos Papanikolopoulos, and Stergios Roumeliotis. The tours are free and include transportation. Pre-registration is required. Please view the conference website for more information after May 1st.

### Children

Minnesota offers some wonderful activity options for families with kids. Both the Science Museum (across from the conference venue) and the Children's Museum (a couple of blocks North) provide all day fun and learning. The Mall of America is a must-see. You might also consider visiting Como Park. Once there, be sure to see the Como Ordway Memorial Japanese Garden – a living symbol of the peace and friendship between Saint Paul and its sister city Nagasaki, Japan. Como Park also houses a small zoo, which is free and open every day of the week. You can catch Bus 3 from downtown Saint Paul to Como Park.

The main zoo is the Minnesota Zoo which is ~20 miles south of the Cities, and has lots of fun exhibits and activities.

### Weather/Time Information

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The average temperature for St. Paul in the middle of May is a high of 70°F (21°C) and a low of 49°F (9.4°C). The weather is highly variable. Temperatures in the mid-80s or the 30s are not unheard of for this time of the year. Most days are sunny but intense rainstorms can arrive with little warning. Humidity ranges from medium to high. Dressing in layers is advisable.

Saint Paul is in the US Central Daylight Time zone (GMT -5).

### The North Country

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Metro Connections will offer tours to Northern Minnesota:

<http://www.metroconnections.com/transportation/tours/>

Check out the information booth at the conference for details.

### More Saint Paul Information

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The City of Saint Paul (<http://www.visitsaintpaul.com/>) will staff an information booth located in the RiverCentre lobby during the core conference hours to answer questions about Saint Paul activities.

### Shuttles

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The conference is planning to provide shuttles to downtown Minneapolis in the evening and the Mall of America during the day. The shuttles will pick up and drop off from the RiverCentre on Kellogg Boulevard. A shuttle to the Minneapolis/St. Paul International Airport is available for a fee (please see below for discount information).

### Discount on SuperShuttle and ExecuCar MSP Airport Transfers

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Online Group Discount Code: QT4QC valid for travel 5/9-5/22, 2012)

To receive your group's discounted rate:

- Make your roundtrip reservation by following this link:  
<https://www.supershuttle.com/default.aspx?GC=QT4QC>
- Provide the requested information your name, flight details (from and to the airport), and your local contact phone number.
- Select your hotel/landmark from the drop-down listing of hotels (type 3-5 letters of name in search box)
- Choose your preferred service and pricing: (additional \$1 per person fuel surcharge may apply)
  - SuperShuttle Shared-Ride (\$13 one way, \$22 round trip per person) savings of \$1 or \$6 RT
  - Exclusive Van Save on Service, up to 10 passengers (\$85 plus 18% gratuity)
  - ExecuCar Sedan Service (\$49 plus 18% gratuity per direction for up to 4 passengers)
  - ExecuCar baggage claim "Meet and Greet" additional \$25
- Provide a credit card for payment and print your confirmation page [or e-mail it to yourself]

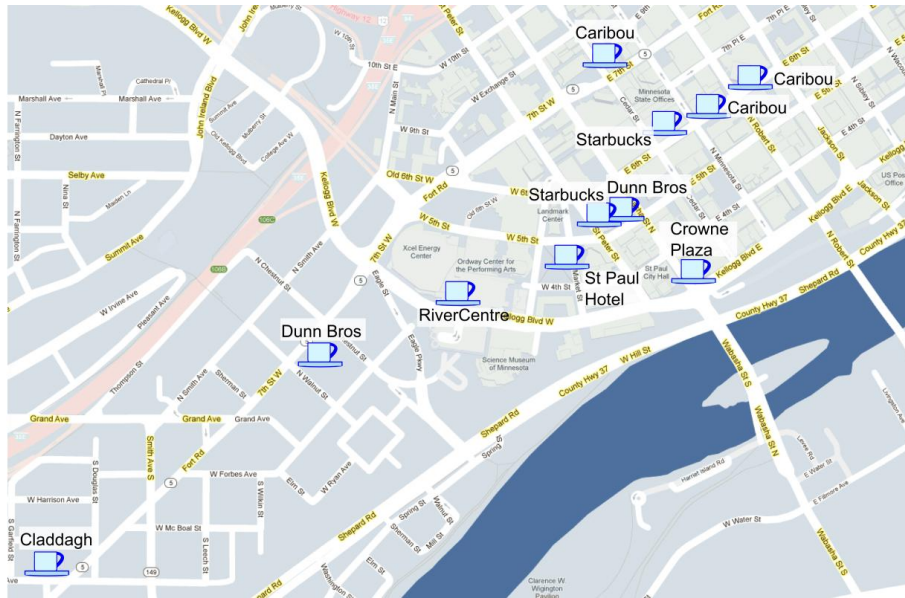
Reservations from MSP are not required for SuperShuttle service, but are recommended. ExecuCar must be reserved and pre-paid in advance.

Terminal #1: Upon arrival to MSP International airport, claim your luggage at Baggage Claim. From “Baggage” follow the signs for Hotel Shuttles and Scheduled Vans to the Ground Transportation Atrium. The SuperShuttle service desk is centrally located and open 24/7.

Terminal #2 (Southwest, Sun Country, Air Tran): Proceed across the street from the terminal; the ground transportation center is located on the ground floor of the parking ramp. Pick up the courtesy phone at the blue and yellow SuperShuttle Kiosk and you will be automatically connected to a local agent.

Please note, these are non-commissionable discount rates. A \$2 fee may be assessed for 1-800# reservations.

## Coffee



**Dunn Bros Coffee**  
367 Wabasha St  
St Paul, MN 55102  
(651) 767-0567

**Caribou Coffee**  
56 6<sup>th</sup> St E  
St Paul, MN 55101  
(651) 225-0844

**Starbucks**  
411 Cedar Street  
St Paul, MN 55101  
(651) 292-5187

**Caribou Coffee**  
444 Cedar Street  
St Paul, MN 55101  
(651) 222-3130

**Dunn Bros Coffee**  
242 7<sup>th</sup> St W  
St Paul, MN 55102  
(651) 222-3445

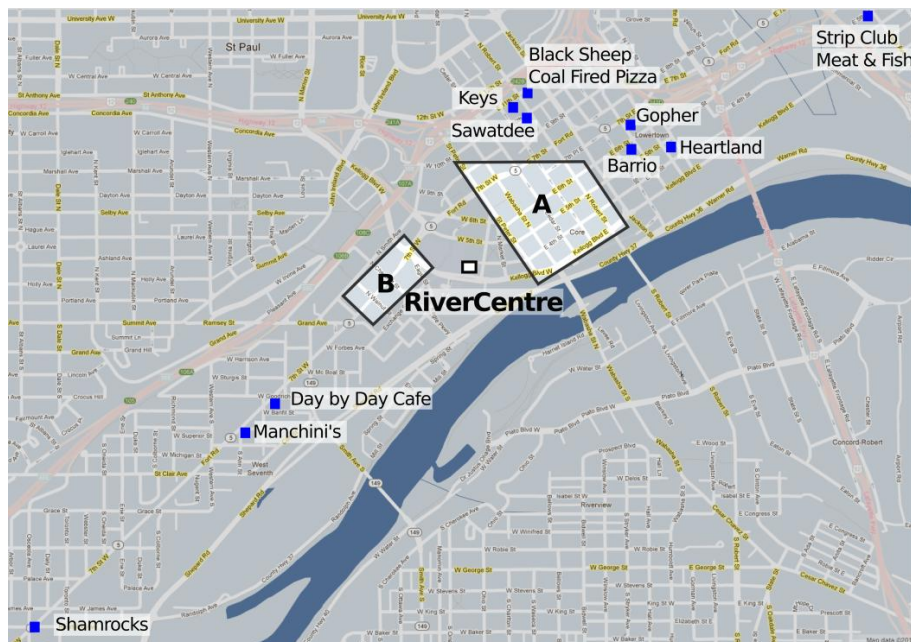
**Caribou Coffee**  
401 Robert Street  
St Paul, MN 55101  
(651) 295-8686

**Starbucks**  
380 St Peter St  
St Paul, MN 55101  
(651) 222-7118

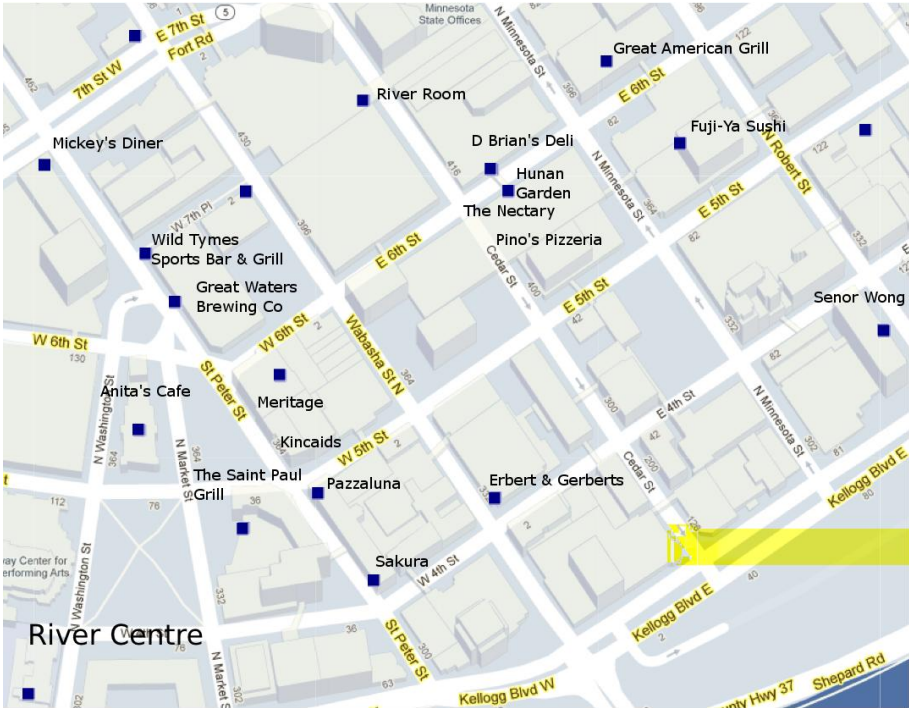
**Claddagh Coffee**  
459 7<sup>th</sup> St W  
St Paul, MN 55102  
(651) 600-3400

**Other places to get a cup of Joe:** St Paul RiverCentre, Crowne Plaza Riverfront Hotel (has a Starbucks on site), St Paul Hotel

## A Map of Area Restaurants (Locations Approximate)



Area A Close-Up



Area B Close-Up



## Where to eat in Saint Paul (\$)

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The Twin Cities are home to many great restaurants, theaters, and bars. This is just a small sampling of what Saint Paul has to offer. The places listed below are perfect for those on a student budget:

### American Cajun Grill

56 6th Street East, Suite 210

(651) 222-3738

Cajun/Creole; Open for lunch on weekdays.

### Anita's Cafe

75 5th Street West, Suite 101

(651) 292-4160

For \$7.25, Anita's offers lunch in a box: a deli sandwich, and homemade side salad. Dine-ins are also welcome.

### Black Sheep Coal Fired Pizza

512 North Robert Street

(651) 227-4337

Minnesota's first coal fired pizza place. Simple, good food.

### Burger Moe's

242 West 7th Street

(651) 222 - 3100

Patio seating. Sixty beers from around the world - forty of them on tap. Just two blocks from the Xcel Energy Center.

### Cossetta's Italian Market & Pizzeria

211 7th Street West

(651) 222-3476

Generous portions. Kid-friendly. Cafeteria-style Italian deli and pizzeria. Rooftop seating offered.

### D. Brian's Deli

444 Cedar Street

(651) 223-7979

Fast service. Across the street from Bruegger's Bagels and Potbelly Sandwich Shop. Emphasis on healthy, natural ingredients.

### Day by Day Cafe

477 7th Street West

(651) 227-0654

Locally renowned breakfast served until close at 3PM. Patio seating. Soups/sandwiches/salads.

### Erberts & Gerberts

334 Wabasha Street North

(651) 298-1919

Soups and sandwiches. Erberts is a Wisconsin-based chain.

### The Four Inns

101 East 5th Street, Suite 220

(651) 291-7939

Skyway diner. Around since 1970. Lots of character.

### Gastrotruck

(763) 607-6055

A food truck, serving pub-style treats including sliders, crudo, and tacos. Call to find out where they are parked!

### Jimmy John's

5 7th Place West

(651) 291-5000

Sandwich chain, headquartered in Champaign, Illinois.

### Maison Darras

401 Robert Street North

(651) 379-2770

Open Monday - Friday until 2P.M. A French bistro in the sky(way)! All sandwiches are under \$6.

### Meritage Crepe Stand

410 St. Peter Street

(651) 222-5670

Check Twitter (@meritage\_stpaul) daily to see what's on the menu. The Stand is open Tuesdays - Fridays, 11A.M. to 2 P.M. Both sweet and savory crepes are available.



**Mickey's Diner**

36 7th Street West

(651) 222-5633

Serving St. Paul around-the-clock since 1939. A classic diner experience.

**The Nectary**

56 E 6th Street, Suite 211

(651) 292-9963

Skyway location. Quick service. The salads are recommended.

**Pinos Pizzeria**

55 E 5th Street, Suite 1400

(651) 228-0673

NY-style pizza. Food court location.

**Potter's Pasties and Pies**

(612) 819-3107

Parks weekdaily in downtown St. Paul. Both sweet and savory pies offered.

## Where to eat in Saint Paul (\$\$)

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The eateries listed here are perfect for those looking for a fine dining experience that won't break the bank.

**Barrio**

235 6th Street East

(651) 222-3250

Latin American street food. Small plates. Great bar. Lively atmosphere.

**Mancini's**

531 7th Street West

(651) 224-7345

Char house and lounge.

**Downtowner Woodfire Grill**

253 West 7th Street

(651) 228-9500

American bistro. Signature dishes include fire-roasted meats, fish cooked in the Persian tradition.

**Eagle Street Grille**

174 W 7th Street

(651) 225-1382

Across the street from the Xcel Energy Center. American fare. Free wireless. Sixteen TV screens.

**Fuji Ya Japanese Restaurant**

465 Wabasha Street

(651) 310-0111

Full bar. Most award-winning sushi restaurant in the Twin Cities.

**Great Waters Brewery**

Hamm Building

426 St. Peter Street

(651)221-BREW

Brewpub. Handcrafted beer. Patio dining. Very close to Xcel Energy Center.

**Keys Cafe & Bakery**

500 Robert Street North

(651) 222-4083

One of nine Twin Cities locations. "Created-from-scratch" recipes that "you grew up with."

**Meritage (for lunch)**

410 Saint Peter Street

(651) 222-5670

Open for lunch Tuesday - Friday with Happy Hour 3-6 on those days. Urban bistro. French.

**Pazzaluna Urban Italian Restaurant & Bar**

360 Saint Peter Street

(651)223-7000

Trattoria. Dinner Only.

**Sakura Restaurant & Sushi Bar**

350 Saint Peter Street, Suite 195

(651) 224-0185

Can get crowded on weekend nights. Newly remodeled. Full-length sushi bar.

**Sawatdee**

486 Robert Street North

(651) 528-7106

Voted "Best Thai 2011" by MPLS St Paul Magazine Readers' Poll. Happy Hour everyday, 4-6P.M.

**Senor Wong**

111 East Kellogg Boulevard

(651) 224-2019

Asian/Latin fusion.

**The St. Paul Grill**

350 Market Street

(651)224-7455

Exceptional bar. New American. Grill.

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**Where to eat in Saint Paul (\$\$\$)**

For a memorable Saint Paul-fine dining experience try:

**Heartland Restaurant**

289 E 5th Street

(651) 699-3536

Sustainable, locally raised and grown ingredients used. Organic. Menu changes nightly. Two pre fixe options. Dining room opens at 5P.M., with last seating at 9:30P.M. Closed Mondays. Executive chef is a 2010/2011 James Beard Award nominee. Reservations are recommended.

**Kincaid's Fish, Chop & Steak House**

380 Saint Peter Street

(651) 602-9000

Steak (USDA prime-aged), seafood, and chop house. Classic American dining.

**The Strip Club (It's not what you think!)**

378 Maria Avenue

(651) 793-6247

Specializing in seasonal fare (especially meats), they boast excellent service and a cozy atmosphere. Open for dinner only, reservations recommended.

**Meritage (for dinner)**

410 Saint Peter Street

Open for lunch Tuesday - Friday with Happy Hour 3-6 on those days. Urban bistro. French.

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**Pubs and Bars in Saint Paul**

**Eagle Street Grille**

174 7th Street West

(651) 225-1382

Located right across from the RiverCentre. Traditional American. Full bar. Outdoor seating.

**Shamrocks**

995 7th Street West

(651) 228-9925

Live music. Great burgers.

**The Artist Quarter**

408 Saint Peter Street

(651) 292-1359

A favorite for local and professional musicians. They specialize in jazz, and have a small cover charge, but the 7P.M. shows on Monday, Tuesday



and Wednesday are free. Located in the heart of downtown Saint Paul.

#### **Gopher Bar**

241 7th Street East  
(651) 291-9638

Cheap beer, Coney dogs, and a dive bar-crowd. A Red State-bar in a state that is Blue!

#### **The Hat Trick Lounge**

134 E 5th Street  
(651) 228-1347

Inexpensive bar food. A true Saint Paul 'dive' bar. Drinks are cheap. Service is not fussy.

### **Where to eat in Minneapolis**

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A nightly shuttle service will be offered to transport ICRA participants to downtown Minneapolis. The shuttle will pick up and drop off on Nicollet Mall and 9th Street. This is a very small sampling of what Minneapolis has to offer:

#### **Hell's Kitchen**

80 South 9th Street  
(612) 332-4700

Unique underground, chef-owned restaurant. Open for breakfast, lunch, dinner and drinks 7 days a week. Live (free) music most evenings and during brunch on weekends. Late night "rock-the-house" shows offered on Thursdays, Fridays and Saturdays until 2A.M.

#### **MASA**

1070 Nicollet Mall  
(612) 338-6272

Contemporary Mexican. Voted Best Mexican Restaurant by Minneapolis St. Paul Magazine for two years running.

#### **Solera**

900 Hennepin Avenue  
(612) 338-0062

Spanish. Locally-sourced ingredients. One of the largest collections of Spanish wine in the U.S. Solera is in the heart of the Minneapolis Theater District.

#### **Vincent A**

1100 Nicollet Mall  
(612) 630-1189

New American. Tasting menus offered. Reservations recommended.

#### **Zelo**

831 Nicollet Mall  
(612) 333-7000

Neo-Italian. Offers late-night seating. White linen. Large and small plates. Emphasis on sustainable ingredients.

#### **Saffron**

123 N 3rd Street  
(612) 746-5533

A contemporary presentation of Mediterranean cuisine, inspired by Moroccan, Spanish, and French flavors.

#### **112 Eatery**

112 N 3rd Street  
(612) 343-7696

New American. Winner: Best Chef, Midwest (James Beard Award). Late night dining.

#### **Fogo de Chao**

645 Hennepin Avenue  
(612) 338-1344

Brazilian steakhouse chain.

## Acknowledgments and Credits

- **Cover Art:** Nikhil Karnad
- **Digest Volunteer:** Jimmy Chen
- **Images:** City of Saint Paul (“Visit Saint Paul”), City of Minneapolis (“Meet Minneapolis”), Google Maps and Street View, Paul Robertson, Dan Anderson; Crowne Plaza, Hotel Saint Paul, RiverCentre and the Science Museum of Minnesota

## Program at A Glance

<div>ICRA 2012 Technical Program</div> <div>Monday May 14, 2012</div>											
	Room 1	Room 2	Room 3	Room 4	Room 5	Room 6	Room 7	Room 8	Room 9	Room 10-11	Room 12
08:30 - 17:30	Workshop 1 Variable Impedance Actuators	Workshop 2 Bio-Bots	Workshop 3 Many-Robot Systems	Workshop 4 Wearable Robotics	Workshop 5 Software Development SDIR-VII	Workshop 6 Haptic Teleoperation	Workshop 7 Robotics and Performing Arts	Workshop 8 Robotic Satellite Servicing	Workshop 9 Semantic Perception - Service	Tutorial 1 Motion Planning	Tutorial 2 Industry Issues
18:00 - 20:00	<div>ICRA 2012 Reception</div> <div>Crowne Plaza Great River Ballroom First Level</div>					<div>Student Social</div> <div>Crowne Plaza Minnesota Ballroom, Lower Level</div>					

<p align="center"><b>ICRA 2012 Technical Program</b>  <b>Tuesday May 15, 2012</b></p>
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	Room 1	Room 2	Room 3	Room 4	Room 5	Room 6	Room 7	Room 8	Room 9	Room 10-11	Ballroom D	Auditorium	
08:30 - 10:00	TuA01  Estimation and Control for UAVs	TuA02  Bipedal Robot Control	TuA03  Learning and Adaptive Control of Robotic Systems	TuA04  Under- actuated Robots	TuA05  Path Planning and Navigation	TuA06  Applied Machine Learning	TuA07  Robust and Adaptive Control of Robotic Systems	TuA08  Redundant Robots	TuA09  Collision	Industry Forum	TuA10  Interactive Session		
	Coffee Break												
	10:30 - 12:00	TuB01  Control and Planning for UAVs	TuB02  Human Like Biped Locomotion	TuB03  Grasp Planning	TuB04  Pose Estimation	TuB05  Sensor Networks	TuB06  Minimally Invasive Interventions	TuB07  Micro and Nano Robots	TuB08  3D Surface Models, Point Cloud Processing		TuB09  Localization		TuB10  Interactive Session
12:00 - 13:00	Women in Engineering Luncheon  <												

ICRA 2012 Technical Program Wednesday May 16, 2012													
	Room 1	Room 2	Room 3	Room 4	Room 5	Room 6	Room 7	Room 8	Room 9	Room 10-11	Ballroom D	Auditorium	
08:30 - 10:00	WeA01 Learning and Adaptation Control of Robotic Systems II	WeA02 Multi-Legged Robots	WeA03 Medical Robotics I	WeA04 Novel Robot Designs	WeA05 Embodied Intelligence - Icub	WeA06 Trajectory Planning and Generation	WeA07 SLAM I	WeA08 Motion Path Planning I	WeA09 Surveillance		WeA10 Interactive Session		
	Coffee Break												
10:30 - 12:00	WeB01 Parallel Robots	WeB02 Hybrid Legged Robots	WeB03 Grasping: Learning and Estimation	WeB04 Networked Robots	WeB05 Rehabilitation Robotics	WeB06 Micro and Nano Robots II	WeB07 Sampling Based Motion Planning	WeB08 Parts Handling and Manipulation	WeB09 Localization II		WeB10 Interactive Session		
12:00 - 13:00	GOLD Lunch					Crowne Plaza Great River Ballroom		Lunch with the Leaders			Crowne Plaza Windows on the River		
13:15 - 14:15	Plenary Lecture: Bio-Bots: Bio-Integrated Robotics Using Live Cells As Components Professor Harry Asada, Massachusetts Institute of Technology (MIT), USA Chair: Rüdiger Dillmann										RiverCentre Ballrooms A, B, C, E, F, and G		<i>Exhibits And Challenges</i>
14:30 - 16:00	WeC01 Micro/ Nanoscale Automation II	WeC02 Compliance Devices and Control	WeC03 Underactuated Grasping	WeC04 Stochastic Motion Planning	WeC05 Image-Guided Interventions	WeC06 Mobile Manipulation: Planning & Control	WeC07 Environment Mapping	WeC08 SLAM II	WeC09 Visual Tracking		WeC10 Interactive Session		
										15:00-17:00 NSF Presentation			
Coffee Break													
16:30 - 18:00	WeD01 Non- Holonomic Motion Planning	WeD02 Grasping and Manipulation	WeD03 Modular Robots & Multi-Agent Systems	WeD04 Embodied Intelligence - Compliant Actuators	WeD05 Minimally Invasive Interventions II	WeD06 Space Robotics	WeD07 Results of ICRA 2011 Robot Challenge	WeD08 Visual Learning	WeD09 Video Session	NSF Presentation	WeD10 Interactive Session		
19:00 - 21:30	Conference Banquet												
RiverCentre Ballrooms A, B, C, E, F, and G													

# ICRA 2012 Technical Program

## Thursday May 17, 2012

	Room 1	Room 2	Room 3	Room 4	Room 5	Room 6	Room 7	Room 8	Room 9	Room 10	Room12	Ballroom D	Auditorium
<b>08:30 - 10:00</b>	ThA01 Data Based Learning	ThA02 Medical Robotics II	ThA03 Novel Actuation Technologies	ThA04 Simulation and Search in Grasping	ThA05 Octopus-Inspired Robotics	ThA06 Intelligent Manipulation Grasping	ThA07 Physical Human-Robot Interaction	ThA08 Calibration and Identification	ThA09 Motion Planning II	Youth Outreach		ThA10 Interactive Session	
<b>Coffee Break</b>													
<b>10:30 - 12:00</b>	ThB01 Mechanism Design of Mobile Robots	ThB02 Grasping: Modeling, Analysis and Planning	ThB03 Biologically Inspired Robotics II	ThB04 Stochastic in Robotics and Biological Systems	ThB05 Teleoperation	ThB06 Continuum Robots	ThB07 AI Reasoning Methods	ThB08 Range Imaging	ThB09 Vision-Based Attention and Interaction	Youth Outreach		ThB10 Interactive Session	
<b>12:00 - 13:00</b>	<b>Awards Lunch</b>										<b>RiverCentre Ballrooms A, B, C, E, F, and G</b>		
<b>13:15 - 14:15</b>	<b>Plenary Lecture: Development Outline of the Humanoid Robot: HUBO II</b> Professor Jun Ho Oh, Korea Advanced Institute of Science and Technology (KAIST), Korea Chair: Henrik Iskov Christensen										<b>RiverCentre Ballrooms A, B, C, E, F, and G</b>		
<b>14:30 - 16:00</b>	ThC01 Micro/Nanoscale Automation III	ThC02 Control of UAVs	ThC03 Soft Tissue Interaction	ThC04 Formal Methods	ThC05 Robotic Software, Programming Environments, and Frameworks	ThC06 Compliant Nano-positioning	ThC07 Multi Robots: Task Allocation	ThC08 Navigation and Visual Sensing	ThC09 Marine Robotics I	Youth Outreach	<b>14:30 - 15:30</b> Challenge Summaries	ThC10 Interactive Session	
<b>Coffee Break</b>													
<b>16:30 - 18:00</b>	ThD01 Animation & Simulation	ThD02 Semiconductor Manufacturing	ThD03 Biomimetics	ThD04 Hand Modeling and Control	ThD05 High Level Robot Behaviors	ThD06 Localization and Mapping	ThD07 Industrial Robotics	ThD08 Embodied Soft Robots	ThD09 Marine Robotics II	Youth Outreach		ThD10 Interactive Session	
<b>18:30 - 20:30</b>	<b>Farewell Reception</b>										<b>RiverCentre Roy Wilkins Auditorium</b>		

**08:00  
-  
18:00**

Exhibits  
And  
Challenges

## ICRA 2012 Technical Program Friday May 18, 2012

	Room 1	Room 2	Room 3	Room 4	Room 5	Room 6	Room 7	Room 8	Room 9	Room 10	Room 11	Room 12	Ballroom D	Auditorium
<b>08:30 - 17:30</b>	Workshop 10 Future of HRI	Workshop 11 Bio Assembler	Workshop 12 Replicable Experi- ments	Workshop 13 Long-term Autonomy	Workshop 14 Clinical Needle Steering	Workshop 15 Stochastic Geometry in SLAM	Workshop 16 Modular Surgical Robotics	Workshop 17 ECHORD Project	Workshop 18 Semantic Perception Exploration	Tutorial 3 Point Cloud Processing	Tutorial 4 Reinforce- ment Learning	Tutorial 5 Robot Operating System	<b>13:00 - 15:30</b> Fukushima Workshop	<b>08:00 - 12:00</b> <u>Exhibits And Challenges</u>