

Dr. Enric Galceran, Senior Researcher at ETH Zürich

CONTACT INFORMATION

ETH Zürich
Autonomous Systems Lab
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ACADEMIC HISTORY

ETH Zürich, Zürich, Switzerland

Senior Researcher, June 2015 – present

- Research on decision making and motion planning for micro aerial vehicles and other autonomous robots at the Autonomous Systems Lab, led by Prof. Roland Siegward.

University of Michigan, Ann Arbor, Michigan

Postdoctoral Researcher, January 2014 – June 2015

- Research and development for self-driving cars (University of Michigan and Ford Motor Company alliance). Postdoctoral advisors: Prof. Ryan Eustice and Prof. Edwin Olson.

University of Girona, Girona, Spain

Ph.D. in Robotics, February 2011 – April 2014

- Ph.D. Thesis: Coverage Path Planning for Autonomous Underwater Vehicles.

M.S., Computer Vision and Robotics, September 2010 – September 2011

- M.S. Thesis: Towards Coverage Path Planning for Autonomous Underwater Vehicles.

M.S., Computer Engineering, September 2008 – September 2010

- Graduation Project: Design and Implementation of a Programming Framework for Autonomous Robots. Project awarded by the University of Girona, see below *Honors and Awards*.

B.S., Computer Engineering, September 2005 – September 2008

- Graduated with honors (best GPA, see below *Honors and Awards*).
- Graduation Project: Motion Reference Unit and Fiber-optic Gyro Integration in an AUV and Development of a Localization System for a Swimming Pool Environment. Project awarded by the University of Girona, see below *Honors and Awards*.

HONORS AND AWARDS

- 2015. Finalist (1 out of 3) of the Best Robotics PhD Dissertation in Spain Award by the Spanish Automation Committee (CEA).
- 2011. Team leader of the SAUC-E* competition runner up team.
- 2011. *Patronat* Award for the best M.S. graduation project by University of Girona's Escola Politecnica Superior.
- 2011 – 2014. FI PhD Scholarship awarded by the Catalan Government.
- 2010. Software manager of the SAUC-E competition champion team.
- 2010. Mentor for the ENGINYCAT program of the Catalan Government.
- 2010. Collaboration Scholarship from the Spanish Ministry of Science and Innovation.

**Student Autonomous Underwater Challenge - Europe*

- 2009. BTI (Technology Transfer and Innovation) Scholarship from the University of Girona.
- 2009. Special Graduation Award for the best B.S. GPA by University of Girona's Escola Politecnica Superior.
- 2009. *Patronat* Award for the best B.S. graduation project by University of Girona's Escola Politecnica Superior.
- 2008. Educational Collaboration Scholarship from the University of Girona.

RESEARCH
EXPERIENCE

Senior Researcher at ETH Zürich. Research on decision making and motion planning for autonomous robots at the Autonomous Systems Lab, led by Prof. Roland Siegward. **June 2015 – present.**

- Vice-coordinator of H2020 EU-funded project Flourish—ground and aerial robot collaboration for precision agriculture.
- Research on integrated perception and motion planning under uncertainty.

Postdoctoral Researcher at the PeRL and APRIL labs of the **University of Michigan**. Working with professors Ryan Eustice and Edwin Olson in the Next Generation Vehicle project about autonomous cars. **January 2014 – June 2015.**

- Decision-making algorithms under uncertainty.
- Smooth steering control of car-like vehicles.

Visiting Researcher at the Biorobotics lab at **Carnegie Mellon University**. Host advisor: Prof. Howie Choset. **May 2012 – October 2012.** Developed planning algorithms for coverage and snake robot locomotion.

Visiting Researcher at NATO Undersea Research Centre (NURC), now **Centre for Maritime Research and Experimentation** (CMRE), La Spezia, Italy. Host advisor: Dr. Vladimir Djapic. **August 2011 – November 2011.** Developed target detection algorithms for forward-looking sonar imagery deployed on unmanned surface and underwater vehicles.

PhD Candidate at the **Underwater Robotics Research Center** (CIRS), Computer Vision and Robotics Institute (VICOROB), University of Girona. **February 2011 – April 2014.**

- Uncertainty-aware path planning algorithms for ocean inspection using underwater vehicles.
- Regular field testing on AUVs at sea.

Research Engineer at the **Underwater Robotics Research Center** (CIRS), Computer Vision and Robotics Institute (VICOROB), University of Girona. **February 2008 – February 2011.**

INVOLVEMENT IN
RESEARCH
PROJECTS

As a senior researcher at the Autonomous Systems Lab, ETH Zurich:

H2020 EU project **FLOURISH**: Ground and aerial robots collaboration for precision agriculture. Served as vice-coordinator.

FP7 EU project **TRADR**: Long-Term Human-Robot Teaming for Robot-Assisted Disaster Response.

FP7 EU project **EUROPA2**: European Robotic Pedestrian Assistant 2.0, aiming at the development of service robots designed to autonomously navigate in urban environments to provide services like guidance, delivery, and transportation.

As a postdoctoral researcher at the PeRL and APRIL robotics labs, University of Michigan:

Next Generation Vehicle Project. A collaboration with the PeRL and APRIL labs at the University of Michigan and Ford Motor Company and State Farm. The project involves the development of an automated research vehicle that will be used to make progress on future automated driving and other advanced technologies.

As a PhD student at the Underwater Robotics Research Center (CIRS), Computer Vision and Robotics Institute (VICOROB), University of Girona:

- 2011-2015. FP7 EU project “**MORPH**: Marine robotic system of self-organizing, logically linked physical nodes”.
- 2011-2014. FP7 EU project “**PANDORA**: Persistent autonomy through learning, adaptation, observation and re-planning”.
- 2010-2013. FP7 EU project “**TRIDENT**: Marine robots and dexterous manipulation for enabling autonomous underwater multipurpose manipulation”.

PUBLICATIONS IN
PEER-REVIEWED
JOURNALS

1. [AURO'16a] **Enric Galceran**, Alexander G. Cunningham, Ryan M. Eustice, and Edwin Olson. *Multipolicy Decision-Making for Autonomous Driving via Change-point-based Behavior Prediction: Theory and Experiment*. Autonomous Robots. Special Issue on the 2015 Robotics: Science and Systems Conference (invited paper). 2016 (under review).
2. [AURO'16b] Stephen M. Chaves, Ayoung Kim, **Enric Galceran**, and Ryan M. Eustice. *Opportunistic Sampling-based Active SLAM for Underwater Visual Inspection*. Autonomous Robots. Special Issue on Towards Long-Term Autonomy in Marine Robotics. 2016 (under review).
3. [JFR'14] **Enric Galceran**, Ricard Campos, Narcís Palomeras, David Ribas, Pere Ridao, and Marc Carreras. *Coverage Path Planning with Realtime Re-planning and Surface Reconstruction for Inspection of 3D Underwater Structures using Autonomous Underwater Vehicles*. Journal of Field Robotics. 2014 (in print).
4. [JBR'13] **Enric Galceran**, Narcís Palomeras, and Marc Carreras. *Profile Following for Inspection of Underwater Structures*. Paladyn Journal of Behavioral Robotics. Volume 4, Issue 4, December 2013, Pages 209-220.
5. [RAS'13] **Enric Galceran** and Marc Carreras. *A Survey on Coverage Path Planning for Robotics*, Robotics and Autonomous Systems. Volume 61, Issue 12, December 2013, Pages 1258-1276.

PUBLICATIONS IN
PEER-REVIEWED
CONFERENCES
AND WORKSHOPS
(FULL-PAPER-
REVIEWED)

1. [IROS'15WS] Raghav Khanna, Joern Rehder, Martin Moeller, **Enric Galceran**, and Roland Siegwart. *Studying Phenotypic Variability in Crops using a Hand-held Sensor Platform*. IROS Workshop on Agrifood Robotics. Hamburg, Germany. October 2015.
2. [IROS'15a] **Enric Galceran**, Edwin Olson, and Ryan M. Eustice. *Augmented Vehicle Tracking under Occlusions for Decision-Making in Autonomous Driving*. Intelligent Robots and Systems (IROS). Hamburg, Germany. October 2015.
3. [IROS'15b] Jeffrey M. Walls, Stephen M. Chaves, **Enric Galceran**, and Ryan M. Eustice. *Belief Space Planning for Underwater Cooperative Localization*. Intelligent Robots and Systems (IROS). Hamburg, Germany. October 2015.

4. [IROS'15c] Stephen M. Chaves, Jeffrey M. Walls, **Enric Galceran**, and Ryan M. Eustice. *Risk Aversion in Belief-space Planning under Measurement Acquisition Uncertainty*. Intelligent Robots and Systems (IROS). Hamburg, Germany. October 2015.
5. [IROS'15d] Arash Ushani, Nicholas Carlevaris-Bianco, Alexander G. Cunningham, **Enric Galceran**, and Ryan M. Eustice. *Continuous-Time Estimation for Dynamic Obstacle Tracking*. Intelligent Robots and Systems (IROS). Hamburg, Germany. October 2015.
6. [RSS'15] **Enric Galceran**, Alexander G. Cunningham, Ryan M. Eustice, and Edwin Olson. *Multipolicy Decision-Making for Autonomous Driving via Change-point-based Behavior Prediction*. Robotics: Science and Systems. Rome, Italy. July 2015.
7. [IV'15] **Enric Galceran**, Ryan M. Eustice, and Edwin Olson. *Toward Integrated Motion Planning and Control using Potential Fields and Torque-based Steering Actuation for Autonomous Driving*. Intelligent Vehicles Symposium (IV). Seoul, South Korea. June 2015.
8. [ICRA'15a] Alexander G. Cunningham, **Enric Galceran**, Ryan M. Eustice, and Edwin Olson. *MPDM: Multipolicy Decision Making in Dynamic, Uncertain Environments for Autonomous Driving*. International Conference on Robotics and Automation (ICRA). Seattle, WA, USA. May 2015.
9. [ICRA'15b] Juan David Hernández, Eduard Vidal Garcia, Guillem Vallicrosa, **Enric Galceran**, and Marc Carreras. *Online Path Planning for Autonomous Underwater Vehicles in Unknown Environments*. International Conference on Robotics and Automation (ICRA). Seattle, WA, USA. May 2015.
10. [ICRA'14] **Enric Galceran**, Ricard Campos, Narcís Palomeras, Marc Carreras, and Pere Ridao. *Coverage Path Planning with Realtime Replanning for Inspection of 3D Underwater Structures*. International Conference on Robotics and Automation (ICRA). Hong Kong, China. June 2014.
11. [IROS'13] **Enric Galceran**, Sharad Nagappa, Marc Carreras, Pere Ridao, and Albert Palomer. *Uncertainty-driven Survey Path Planning for Bathymetric Mapping*, in Intelligent Robots and Systems (IROS). Tokyo, Japan. November 2013.
12. [ICRA'13a] **Enric Galceran** and Marc Carreras. *Planning Coverage Paths on Bathymetric Maps for In-Detail Inspection of the Ocean Floor*, in International Conference on Robotics and Automation (ICRA). Karlsruhe, Germany. May 2013.
13. [ICRA'13b] Ross Hatton, Ross A. Knepper, Howie Choset, David Rollinson, Chaohui Gong, and **Enric Galceran**. *Snakes on a Plan: Toward Combining Planning and Control*, in International Conference on Robotics and Automation (ICRA). Karlsruhe, Germany. May 2013.
14. [IROS'12] **Enric Galceran** and Marc Carreras. *Efficient Seabed Coverage Path Planning for ASVs and AUVs*, in Intelligent Robots and Systems (IROS). Vilamoura, Portugal. October 2012.
15. [NGCUV'12] **Enric Galceran**, Vladimir Djapic, Marc Carreras, and David P. Williams. *A Real-time Underwater Object Detection Algorithm for Multi-beam Forward Looking Sonar*, in IFAC's workshop on Navigation, Guidance, and Control of Underwater Vehicles (NGCUV). Porto, Portugal. April 2012.

16. [ICRA'10] Andres El-Fakdi, Marc Carreras, and **Enric Galceran**. *Two Steps Natural Actor Critic Learning for Underwater Cable Tracking*, in International Conference on Robotics and Automation (ICRA). Anchorage, AK. May 2010.

PUBLICATIONS IN
PEER-REVIEWED
CONFERENCES
AND WORKSHOPS
(ABSTRACT-
REVIEWED)

1. [MARTECH'13] **Enric Galceran**, Ricard Campos, and Marc Carreras. *Automating Seafloor Inspection using Autonomous Underwater Vehicles*, in Fifth International Workshop in Marine Technology (MARTECH). Girona, Spain. October 2013.
2. [OCEANS'13] **Enric Galceran**, Marc Carreras, Narcís Palomeras, and Pere Ridao. *Complex Structure Profile Estimation and Following with the GIRONA500 AUV*, in MTS/IEEE OCEANS'13. Bergen, Norway. June 2013.
3. [OCEANS'12] **Enric Galceran** and Marc Carreras. *Coverage Path Planning for Marine Habitat Mapping*, in MTS/IEEE OCEANS'12. Hampton Roads (VA), USA. October 2012.
4. [OCEANS'11] Emili Hernández, Marc Carreras, and **Enric Galceran**. *Path Planning with Homotopy Class Constraints on Bathymetric Maps*, in MTS/IEEE OCEANS'11. Santander, Spain. June 2011.

INVITED TALKS

1. [AAAI'16] Enric Galceran. *Multipolicy Decision-Making for Autonomous Driving*. The Thirtieth AAAI Conference on Artificial Intelligence, special invited technical session on AI & Robotics. Phoenix, AZ, USA. February 2016.
2. [AUTOMAR'12] Enric Galceran. *Coverage Path Planning for In-Detail Seafloor Inspection*. Jornadas AUTOMAR workshop. Girona, Spain. December 2012.
3. [AUVSI'10] Natàlia Hurtós and Enric Galceran. *Team VICOROB-UdG Wins the 2010 SAUC-E Competition*. AUVSI's Unmanned Systems North America. Denver, CO, USA. August 2010.

PROFESSIONAL
SERVICE AND
MEMBERSHIPS

Associate Editor (AE) for ICRA 2016.
Session co-chair for IROS 2015.
Reviewer for IEEE Transactions on Robotics (T-RO).
Reviewer for The International Journal of Robotics Research (IJRR).
Reviewer for Journal of Field Robotics (JFR).
Reviewer for Autonomous Robots journal (AURO).
Reviewer for IEEE Transactions on Automation Science and Engineering (T-ASE).
Reviewer for IEEE Transactions on Industrial Informatics (T-II).
Reviewer for RSJ Advanced Robotics.
Reviewer for ICRA.
Reviewer for IROS.
Session co-chair for OCEANS'13 conference.
Member, IEEE Robotics and Automation Society (RAS).

STUDENT
MENTORING

PhD Students under Prof. Roland Siegward: Thomas Stastny, Mark Pfeiffer, Gregory Hitz, Mina Kamel, Helen Oleynikova, Sebastian Verling, Ulrich Schwesinger, Philipp Oettershagen, Marija Popovic, Michael Burri, Tejaswi Digumarti, Timo Hinzman, Renaud Dube, Abel Gawel, Jorn Rehder, and Raghav Khanna.

M.S. Students under Prof. Roland Siegward: Rik Baehnemann and Alessio Zanchettin.

PhD Students under Prof. Ryan Eustice: Jeff Walls and Stephen Chaves.

M.S. Students under Prof. Ryan Eustice: Eric Shin, co-advised his M.S. thesis “A Comparative Study Of Path Following Steering Controllers”.

LANGUAGES

English, Italian: fluent.

Catalan, Spanish: mother tongues.

French, German, Croatian: beginner.