

# Thomas Stastny

## SENIOR RESEARCHER

Autonomous Systems Lab, ETH Zürich

LEE J 314, Leonhardstrasse 21

8092 Zürich, Switzerland

✉ [tstastny@ethz.ch](mailto:tstastny@ethz.ch) | ☎ (+41) 79 883 7765

Date of Birth: 22, May, 1990



Grants: Authorship of **successful** research proposals with funding totaling **>1.7M USD**

Publications: As of November 6, 2020, publication count: **31**, h-index: **11**, i10-index: **14**, citation count: **488** (source: [Google Scholar](#))

Teaching: **Supervision** of **2** PhD students and **50+** Masters and Bachelors theses. **Lecturer** for 2 Masters courses. **TA** for 2 Bachelors courses.

Field experience: Organization/participation of/in aerial-robotic field-campaigns to the Arctic, Antarctic, Amazon, and Swiss/Italian Alps

Research interests: Environment-aware control and planning, autonomous aerial-robotic payload transport, novel airflow sensing and perception techniques, system identification of the post-stall regime, safe experiment-based reinforcement learning for modeling and/or control of complex aerodynamic effects on hybrid aerial robots.

## EDUCATION

2014 - 2020 **ETH Zürich, Switzerland** | DOCTOR OF SCIENCE IN ROBOTICS

Supervised by Prof. Roland Siegwart in the *Autonomous Systems Lab*

Dissertation: *Low-Altitude Control and Local Re-Planning Strategies for Small Fixed-wing UAVs*

2012 - 2014 **University of Kansas, USA** | MASTER OF SCIENCE IN AEROSPACE ENGINEERING (*with Honors*)

Thesis: *Collision and Obstacle Avoidance for Fixed-wing UAVs using Morphing Potential Field Navigation with Robust and Predictive Control*

GPA: 4.0/4.0

2012 **TU Delft, Netherlands** | STUDY ABROAD

Coursework in Systems & Control and Aerospace Engr. M.Sc. Programs.

2008 - 2012 **University of Kansas, USA** | BACHELOR OF SCIENCE IN AEROSPACE ENGINEERING

GPA: 3.7/4.0

## RESEARCH EXPERIENCE

Since 10/2020 **Autonomous Systems Lab (ASL), ETH Zürich** | SENIOR RESEARCHER

- **Team lead** for research activities related to control of fixed-wing and hybrid, tilt-wing UAVs. Additional research related to: measurement, modeling, system identification, and control of partially and fully stalled fixed-wing and hybrid VTOL UAVs; autonomous vision-based, environment-aware operation of UAVs beyond visual line-of-sight (BVLOS).

2014 - 2020 **Autonomous Systems Lab (ASL), ETH Zürich** | PHD RESEARCHER

- Research on control, modeling, system identification, state estimation, and planning for UAVs operating in extreme environments. Core researcher on EU FP7 search-and-rescue (SaR) robotics projects *SHERPA* and *ICARUS*, the *AtlantikSolar* solar-powered UAV, the ESA precision-farming project *SOLAR3*, and several Armasuisse S+T contracts.

Research / Project Milestones:

- Developed and deployed Nonlinear Model Predictive Control (NMPC) algorithms for/on fixed-wing UAVs considering actuator faults, stall prevention, wind, and vision-based terrain measurements.
- Developed and deployed efficient wind-aware guidance logic for small, fixed-wing UAVs. <https://youtu.be/oM690L029kM>
- **Drop & Recovery Drones:** Supervised/Managed student/engineering work on platform and payload development towards a fully automatic BVLOS dropping of GNSS monitoring stations on the **Gorner Glacier**, Switzerland, from a multi-rotor UAV. (2019) <https://youtu.be/1tvYj1aGEUc>
- Contributed to the *first* networked (via Swisscom), BVLOS flight in Switzerland over Lake Neuchatel. (2019) <https://youtu.be/ks-TiJP3dxs>
- **Sun2Ice:** Organized/Lead UAV operations in Qaanaaq, **Northwest Greenland** for a 2017 glacier monitoring field campaign, resulting in *first-ever* autonomous, BVLOS, solar-powered flights of a UAV in a polar region. website: <http://sun2ice.ethz.ch>, video: [https://youtu.be/wyS6W1t\\_ryQ](https://youtu.be/wyS6W1t_ryQ)
- **Adventura AtlantikSolar@Brazil:** Co-Organized/Lead (with Swissnex Brazil) field operations resulting in *first-ever* solar-powered flights of a UAV over the **Amazon rainforest** and the aerial monitoring/mapping of an oil spill on the Rio Pará. (2015) <http://www.swissnexbrazil.org/atlantiksolar/>
- **AtlantikSolar:** Contributed performance optimization and automatic take-off, landing, and cruise control design to the *AtlantikSolar* UAV, resulting in an **81.5 hour endurance world record** perpetual, solar-powered flight for aircraft <50kg (2015) <http://www.atlantiksolar.ethz.ch/index.html%3Fp=670.html> and 26 hour, fully autonomous, payload equipped SaR flight (2016) <http://www.atlantiksolar.ethz.ch/index.html%3Fp=931.html>

2012 - 2014

## Center for Remote Sensing of Ice Sheets (CREGIS), University of Kansas | RESEARCH ASSISTANT

- Conducted research on control and planning for fixed-wing UAVs including multi-agent avoidance and formation strategies and contributed to the design, integration, and deployment of a UAV outfitted with a dual-frequency ground-penetrating radar.

Research / Project Milestones:

- Participated in **8-week deployment** as mission planner and ground station operator for autonomous operations of a radar-integrated UAV in **Western Antarctica**, resulting in *first-ever* bed-rock sounding via a UAV. <https://cresis.ku.edu/content/research/field-programs/antarctica#2013>

## GRANTS

---

### Proposals Under Review

- 2021 Autonomous Deployment of GNSS Stations on Polar Outlet Glaciers Using a Long-Range, Tilt-Wing UAV  
PI: **T. Stastny**. *Swiss Polar Institute (SPI) Technogrants*. CHF 50,000 (USD 55,559)
- 2021 Safe Self-Calibration of Hybrid Aerial Vehicles  
Role: **Co-Author**. PI: R. Siegwart. *Amazon Research Awards (ARA)*. USD 100,000

### Funded Proposals

- 2021-2023 AvalMapper: Remote Avalanche Mapping with Long Flight Duration UAVs  
Role: **Lead author**. PI: R. Siegwart. *ETH Research Grants*. CHF 392,900 (USD 436,582)
- 2019-2020 Drop & Recovery Drones  
Role: **Lead author**. PI: R. Siegwart. *Armasuisse S+T*. CHF 300,000 (USD 333,354)
- 2018 Sensory Enhanced Perception and Control for Autonomous Operation of Fixed-Wing UAVs in Unstructured Environments  
Role: **Lead author**. PI: R. Siegwart. *Armasuisse S+T*. CHF 150,000 (USD 166,677)
- 2018 Predicting the Weather: On-board Forecasting of Local 3D Wind Fields for Autonomous and Environment-aware Operation of Unmanned Aerial Vehicles  
Role: **Lead author**. PI: R. Siegwart. *Intel University-Industry Research Corporation (UIRC)*. USD 150,000 (USD 166,677)
- 2017-2019 Sun-to-Ice: Monitoring the Fracturing of Calving Glaciers from Solar-Powered UAVs in Polar Regions  
Role: **Co-Lead author**. PI: R. Siegwart. *ETH Research Grants*. CHF 426,500 (USD 473,918)
- 2014-2016 Multi-Agent Airborne Laboratory for Cryospheric Remote Sensing  
Role: **Co-author**. PI: S. Keshmiri. *Paul G. Allen Family Foundation*. USD 200,000

## PUBLICATIONS

---

<https://scholar.google.ch/citations?user=R5Fs1A4AAAAJ&hl=en>

Drafts of papers *in preparation* available on request. Topics including stability and robustness analysis of wind-aware guidance logic, vision-based, high-speed local re-planning using nonlinear MPC, and in-flight, post-stall characterization of fixed-wing UAVs using span and chord-wise in-wing pressure sensing.

### Journal Papers

- 2020 Long-duration Fully Autonomous Operation of Rotorcraft Unmanned Aerial Systems for Remote-sensing Data Acquisition  
D. Malyuta, C. Brommer, D. Hentzen, **T. Stastny**, R. Siegwart, and R. Brockers  
*Journal of Field Robotics (JFR)*. Vol. 37(1). pp. 137–157.
- 2019 Attitude and Cruise Control of a VTOL Tiltwing UAV  
D. Rohr, **T. Stastny**, S. Verling, and R. Siegwart  
*IEEE Robotics and Automation Letters*. Vol. 4(3). pp. 2683–2690.  
[https://drive.google.com/file/d/17KuRJ5tZ2-2HdHv2\\_iPJ2gaeiFHIKkkH/view?usp=sharing](https://drive.google.com/file/d/17KuRJ5tZ2-2HdHv2_iPJ2gaeiFHIKkkH/view?usp=sharing)
- 2018 Free LSD: Prior-free Visual Landing Site Detection for Autonomous Planes  
T. Hinzmann, **T. Stastny**, C. Cadena, R. Siegwart, and I. Gilitschenski  
*IEEE Robotics and Automation Letters*. Vol. 3(3). pp. 2545–2552.  
<https://youtu.be/SOpYirBwHtQ>

- 2018      **Robotic Technologies for Solar-powered UAVs: Fully Autonomous Updraft-aware Aerial Sensing for Multiday Search-and-rescue Missions**  
P. Oettershagen, **T. Stastny**, T. Hinzmann, K. Rudin, T. Mantel, A. Melzer, B. Wawrzacz, G. Hitz, and R. Siegwart  
*Journal of Field Robotics (JFR)*. Vol. 35(4). pp. 612–640.  
<https://youtu.be/8m76Mx9m2nM>
- 2017      **Design of Small Hand-launched Solar-powered UAVs: From Concept Study to a Multi-day World Endurance Record Flight**  
P. Oettershagen, A. Melzer, Mantel, K. Rudin, **T. Stastny**, B. Wawrzacz, T. Hinzmann, S. Leutenegger, K. Alexis, and R. Siegwart  
*Journal of Field Robotics (JFR)*. Vol. 34(7). pp. 1352–1377.  
[https://youtu.be/8m4\\_NpTQnOE](https://youtu.be/8m4_NpTQnOE)
- 2015      **Collision and Obstacle Avoidance in Unmanned Aerial Systems Using Morphing Potential Field Navigation and Nonlinear Model Predictive Control**  
**T. Stastny**, G. Garcia, S. Keshmiri  
*Journal of Dynamic Systems, Measurement, and Control*. Vol. 137(1).
- 2015      **Nonlinear Model Predictive Controller Robustness Extension for Unmanned Aircraft**  
G. Garcia, S. Keshmiri, **T. Stastny**  
*International Journal of Intelligent Unmanned Systems*. Vol. 3(2/3). pp. 93–121.
- 2014      **Robust and Adaptive Nonlinear Model Predictive Controller for Unsteady and Highly Nonlinear Unmanned Aircraft**  
G. Garcia, S. Keshmiri, **T. Stastny**  
*IEEE Transactions on Control Systems Technology*. Vol. 23(4). pp. 1620–1627.

## Book Chapters

- 2017      **Model Predictive Control for Trajectory Tracking of Unmanned Aerial Vehicles Using Robot Operating System**  
M. Kamel, **T. Stastny**, K. Alexis, R. Siegwart  
*Robot Operating System (ROS), The Complete Reference (Volume 2)*. pp. 3–39.

## Conference Papers

- 2021      **Full Envelope System Identification of a VTOL Tailsitter UAV**  
C. Olsson, S. Verling, **T. Stastny**, and R. Siegwart  
*AIAA Guidance, Navigation, and Control (GNC) Conference*. Accepted for publication
- 2020      **Differential Sweep Attitude Control for Swept Wing UAVs**  
M. Harms, N. Kaufmann, F. Rockenbauer, N. Lawrance, **T. Stastny**, and R. Siegwart  
*International Conference on Unmanned Aircraft Systems (ICUAS)*.
- 2019      **On Flying Backwards: Preventing Run-away of Small, Low-speed, Fixed-wing UAVs in Strong Winds**  
**T. Stastny** and R. Siegwart  
*IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*.  
<https://youtu.be/oM690L029kM>
- 2019      **Disturbance Estimation and Rejection for High-Precision Multirotor Position Control**  
D. Hentzen, **T. Stastny**, R. Siegwart, and R. Brockers  
*IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*.
- 2019      **Locally Power-optimal Nonlinear Model Predictive Control for Fixed-wing Airborne Wind Energy**  
**T. Stastny**, E. Ahbe, M. Dangel, and R. Siegwart  
*American Control Conference (ACC)*.
- 2019      **Fault-tolerant Flight Control of a VTOL Tailsitter UAV**  
S. Fuhrer, S. Verling, **T. Stastny**, and R. Siegwart  
*IEEE International Conference on Robotics and Automation (ICRA)*.
- 2018      **Towards Autonomous Stratospheric Flight: A Generic Global System Identification Framework for Fixed-Wing Platforms**  
J. Lee, T. Muskardin, C. Pacz, P. Oettershagen, **T. Stastny**, I. Sa, R. Siegwart, and K. Kondak  
*IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*.

- 2018      **Nonlinear Model Predictive Guidance for Fixed-wing UAVs Using Identified Control Augmented Dynamics**  
**T. Stastny** and R. Siegwart  
*International Conference on Unmanned Aircraft Systems (ICUAS).*
- 2017      **Gone with the Wind: Nonlinear Guidance for Small Fixed-wing Aircraft in Arbitrarily Strong Windfields**  
L. Furieri, **T. Stastny**, L. Marconi, R. Siegwart, and I. Gilitschenski  
*American Control Conference (ACC).* **Best Paper Award**
- 2017      **Model-based Transition Optimization for a VTOL Tailsitter**  
S. Verling, **T. Stastny**, G. Bättig, K. Alexis, and R. Siegwart  
*IEEE International Conference on Robotics and Automation (ICRA).*
- 2017      **Model-based Wind Estimation for a Hovering VTOL Tailsitter UAV**  
Y. Demitri, S. Verling, **T. Stastny**, A. Melzer, and R. Siegwart  
*IEEE International Conference on Robotics and Automation (ICRA).*
- 2017      **Nonlinear MPC for Fixed-wing UAV Trajectory Tracking: Implementation and Flight Experiments**  
**T. Stastny**, A. Dash, and R. Siegwart  
*AIAA Guidance, Navigation, and Control (GNC) Conference.*
- 2016      **Perpetual Flight with a Small Solar-powered UAV: Flight Results, Performance Analysis and Model Validation**  
P. Oettershagen, A. Melzer, T. Mantel, K. Rudin, **T. Stastny**, B. Wawrzacz, T. Hinzmann, K. Alexis, and R. Siegwart  
*IEEE Aerospace Conference.*
- 2016      **Collaborative 3D Reconstruction Using Heterogeneous UAVs: System and Experiments**  
T. Hinzmann, **T. Stastny**, G. Conte, P. Doherty, P. Rudol, M. Wzorek, I. Gilitschenski, E. Galceran, and R. Siegwart  
*International Symposium on Experimental Robotics (ISER).*
- 2016      **A Collaborative Framework for 3D Mapping Using Unmanned Aerial Vehicles**  
P. Doherty, J. Kvarnström, P. Rudol, M. Wzorek, G. Conte, C. Berger, T. Hinzmann, **T. Stastny**  
*International Conference on Principles and Practice of Multi-Agent Systems.*
- 2015      **Long-Endurance Sensing and Mapping using a Hand-Launchable Solar-Powered UAV**  
Oettershagen, **T. Stastny**, T. Mantel, A. Melzer, K. Rudin, P. Gohl, G. Agamennoni, K. Alexis, and R. Siegwart  
*Field and Service Robotics (FSR).*
- 2015      **Victim Detection from a Fixed-Wing UAV: Experimental Results**  
A. Vempati, G. Agamennoni, **T. Stastny**, and R. Siegwart  
*International Symposium on Visual Computing (ISVC).*
- 2015      **Robust Three-Dimensional Collision Avoidance for Fixed-Wing Unmanned Aerial Systems**  
**T. Stastny**, G. Garcia, S. Keshmiri  
*AIAA Guidance, Navigation, and Control (GNC) Conference.*
- 2013      **Nonlinear Parameter Estimation of Unmanned Aerial Vehicles in Wind Shear Using Artificial Neural Networks**  
**T. Stastny**, R. Lykins, S. Keshmiri  
*AIAA Guidance, Navigation, and Control (GNC) Conference.*
- 2012      **Flight Testing and Evaluation of the Structural Response to Flight Loads of a Small Scale Unmanned Aerial System**  
J. Sebes, W. Vanskike, M. Williams, S. McCandless, **T. Stastny**, G. Worden, N. Brunkhorst  
*AIAA Infotech@ Aerospace.*
- 2011      **Hawkeye UAV Dynamic Analysis**  
W. Vanskike, M. Williams, **T. Stastny**, A. Ghate, S. McCandless, T. Peckman  
*AIAA Modeling and Simulation Technologies Conference.*

## Magazine Articles

- 2013      **Mars Exploration? Unleash the Swarms!**  
**T. Stastny**  
*Ruimtevaart. Vol. 2013(1), pp. 8–11. Netherlands Space Society (NVR).*

## Patents

- 2019 Vehicles Configured For Navigating Surface Transitions  
M. Arigoni, R. Simpson, S. Fuhrer, P. Beardsley, D. Mammolo, M. Burri, M. Bischoff, **T. Stastny**, L. Rodgers, D. Krummenacher, and R. Siegwart  
*US Patent 10,464,620.*

## TEACHING

---

- 2015 - Present **Institute for Robotics and Intelligent Systems, ETH Zürich** | LECTURER  
Masters Course – Robot Dynamics (151-0851-00L)
  - Developed lecture notes, exercises, and presentation material and gave lectures related to fundamentals of aerodynamics, performance, aircraft design, flight mechanics, and flight control. Designed and graded final examinations.<https://rsl.ethz.ch/education-students/lectures/robotdynamics.html>
- 2014 - Present **Autonomous Systems Lab, ETH Zürich** | STUDENT SUPERVISION
  - Supervised **2** PhD Students (ongoing), **24** Masters Theses (30 ECTS), **18** Masters Semester Theses (8 ECTS), and **14** Bachelor Theses (24 ECTS)
  - Coached Focus Projects (teams of 8-12 Bachelors Students develop and product from A-Z – <https://asl.ethz.ch/research/focus-projects.html>):
    - Dipper* – a flying, diving, swimming, and re-emerging, swept-wing robot.  
webpage: <https://dipper.ethz.ch/index.html> video: [https://youtu.be/q\\_9tSHTW1xE](https://youtu.be/q_9tSHTW1xE)
    - ftero* – a VTOL UAV for airborne wind energy (year 1 and 2). <https://www.ftero.ch/>
    - VertiGo* – a wall-riding robot. video: <https://youtu.be/KRYT2kYbgo4>
- 2013 **Department of Aerospace Engineering, University of Kansas** | GUEST LECTURER  
Masters Course – Optimal Controls (KU-AE750)
  - Gave two guest lectures on optimal output feedback control.
- 2010 – 2012 **Department of Mathematics, University of Kansas** | UNDERGRADUATE TEACHING ASSISTANT  
Bachelors Courses – Introduction Topics in Mathematics (KU-MA105), Elementary Statistics (KU-MA365)
  - Conducted tutor sessions three times a week for class section (ca. 20-30 students), held office hours, and graded tests, quizzes, and homework.

## AWARDS

---

- 2018 O. Hugo Schuck Best Paper Award <http://a2c2.org/awards/o-hugo-schuck-best-paper-award>  
Paper title: “Gone with the wind: Nonlinear Guidance for Small Fixed-wing Aircraft in Arbitrarily Strong Windfields”
- 2014 Awarded United States Department of Defense Antarctica Service Medal
- 2012 - 2013 C&C Chaffee Engineering School Scholarship
- 2012 University of Kansas Aerospace Undergraduate Researcher Award

## ACADEMIC SERVICE

---

- Reviewer** IEEE Transactions on Robotics  
IEEE Transactions on Aerospace and Electronic Systems  
Springer Journal of Intelligent and Robotic Systems  
IEEE Robotics and Automation Letters (RA-L)  
IEEE Control Systems Letters (L-CSS)  
IEEE International Conference on Robotics and Automation (ICRA)  
IEEE/RSJ International Conference on Robots and Intelligent Systems (IROS)  
IEEE International Conference on Unmanned Aircraft Systems (ICUAS)

**Associate Editor** Frontiers in Robotics and AI, Field Robotics (2020)

**Organizer** Co-Organizer of ICUAS Tutorial: *Autonomous Navigation for Aerial Robotics in Extreme Environments: From Subterranean Environments to the Arctic* (2018)

- 2019      **Monitoring Glaciers Beyond the Horizon**  
**T. Stastny**  
Workshop on Informed Scientific Sampling in Large-scale Outdoor Environments  
*International Conference on Robots and Intelligent Systems (IROS).*  
<https://scientific-sampling-robots.github.io/iros-2019-workshop/>
- 2018      **Towards Fully Autonomous Long-range Remote Sensing via Solar-powered Fixed-wing Unmanned Aerial Vehicles**  
**T. Stastny**  
Application of Unmanned Aerial Systems  
*WSL Applied Remote Sensing Lectures. Davos, Switzerland.*
- 2017      **Monitoring Calving Glaciers in the Arctic via Solar-Powered UAVs**  
**T. Stastny**  
UAVs for Agricultural and Multispectral Remote Sensing  
*International Conference on Unmanned Aerial Vehicles in Geomatics (UAV-G). Bonn, Germany.*
- 2017      **From Guidance to Local Planning: Applying NMPC to Small, Fixed-Wing UAVs**  
**T. Stastny**  
IfA Coffee Talk  
*Automatic Control Laboratory (IfA), ETH Zürich. Zürich, Switzerland.*
- 2017      **Monitoring Calving Glaciers in the Arctic via Solar-Powered UAVs**  
**T. Stastny**  
UAVs for Agricultural and Multispectral Remote Sensing  
*International Conference on Unmanned Aerial Vehicles in Geomatics (UAV-G). Bonn, Germany.*
- 2015      **Adventura AtlantikSolar@Brazil**  
**T. Stastny, T. Hinzmann, P. Oettershagen**  
*Drone Show Latin America. São Paulo, Brazil.*