

# Thomas Stastny

## Aerial-Robotics Controls 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 | 🇺🇸 US Citizen | 🏠 [tstastny.github.io](https://tstastny.github.io)

## Summary

Aerial-robotics controls researcher with 8+ years experience in aerodynamic modeling, simulation, system identification, state estimation, control, planning, and flight-testing of fixed-wing, multi-copter, and hybrid vertical take-off and landing (VTOL) unmanned aerial vehicles (UAVs).

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

**Publications:** As of November 27, 2020, peer-reviewed publication count: **31**, h-index: **11**, citation count: **492** (source: [Google Scholar](#)).

**Mentorship:** **Supervision** of **2** Ph.D. students and **50+** M.Sc. and B.Sc. theses. **Lecturer** for 2 M.Sc. courses. **TA** for 2 B.Sc. courses.

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

## Education

- 2014 - 2020 **ETH Zürich**, Zürich, Switzerland  
Ph.D. 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**, Lawrence, KS, USA  
M.Sc. in Aerospace Engineering (*with Honors*), GPA: 4.0/4.0
- 2012 **TU Delft**, Delft, Netherlands  
Coursework in Systems & Control and Aerospace Engr. M.Sc. Programs
- 2008 - 2012 **University of Kansas**, Lawrence, KS, USA  
B.Sc. in Aerospace Engineering, GPA: 3.7/4.0

## Research Experience

- Since 6/2020 **Autonomous Systems Lab (ASL), ETH Zürich** – Post-Doctoral Researcher
- Supervise and coordinate PhD and Masters student research activities related to measurement, aerodynamic modeling, system identification, and control of fixed-wing and hybrid, tilt-wing, VTOL UAVs, results including:
    - automatic tilt-wing control – video: [https://youtu.be/pSXEnHUY2\\_4](https://youtu.be/pSXEnHUY2_4)
    - stabilized deep stalled flight – video: <https://drive.google.com/file/d/1JpexWpThE5TOmXN10g9uz9aQ5ysgh-m/view?usp=sharing>
  - Lead a team of PhD and Masters students on an (ongoing) project for autonomous, high-speed, aerial, vision-based payload recovery.
- 2014 - 2020 **Autonomous Systems Lab (ASL), ETH Zürich** – PhD Research Assistant
- Core researcher on EU search-and-rescue robotics projects *SHERPA* and *ICARUS*, organizing multiple university and industry partners in collaborative multi-robotic field demonstrations. <https://www.euronews.com/2016/05/23/dealing-with-danger-busy-geniuses-and-watchful-robots>
  - Interfaced with customers and industry partners within the ESA precision-farming project *SOLAR3* to deliver a reliable automatic, multi-hour endurance, surveying drone solution to non-expert end-users.
  - Developed and deployed efficient wind-aware guidance and control algorithms for fixed-wing, multi-copter, and VTOL tailsitter UAVs in extreme weather conditions safely stabilizing and preventing run-away of the aircraft. (see [Publications](#))
  - Developed and deployed Nonlinear Model Predictive Control (NMPC) algorithms for/on fixed-wing UAVs which mitigate actuator faults, prevent stall, exploit wind, and utilize vision-based terrain measurements for obstacle avoidance.
  - Conducted performance optimization and developed automatic take-off, landing, and cruise control design for the *AtlantikSolar* UAV, resulting in an **81.5 hour endurance world record** solar-powered flight for aircraft <50kg (2015) <http://www.atlantiksolar.ethz.ch/index.html%3Fp=670.html> and 26 hour, fully autonomous, search-and-rescue payload equipped flight (2016) <http://www.atlantiksolar.ethz.ch/index.html%3Fp=931.html>
- 2012 - 2014 **Center for Remote Sensing of Ice Sheets (CRENIS), University of Kansas** – Masters Research Assistant
- Conducted research on control and planning for fixed-wing UAVs including multi-agent avoidance and formation strategies.
  - Contributed to the design, integration, and **Antarctic deployment** of a polar-conditioned fixed-wing UAV with integrated dual-frequency ground-penetrating radar.

## Skills

- Programming** C++, Python, Matlab/Simulink
- Software** GNU Linux, Robotic Operating System (ROS), Git, Jenkins CI, Unigraphics NX (CAD)
- Hardware** 3D Prototyping, Radio controlled (RC) piloting of small fixed-wing aircraft and multi-copters

# Field Projects

- **Supervised/Managed** student/engineering work on platform and payload development towards autonomous, beyond visual line-of-sight (BVLOS), drone-based deployment of GNSS monitoring stations on the **Gorner Glacier**, Switzerland. (2019) video: <https://youtu.be/1tvYj1aGEUc>
- Contributed regulatory documentation and flight-stack verification for the *first* networked (via industry partners Swisscom, INVOLI, and v2sky), BVLOS flight in Switzerland over Lake Neuchâtel. (2019) video: <https://youtu.be/ks-TiJP3dxs>
- **Organized/Lead** UAV operations in **Northwest Greenland** for a glacier monitoring field campaign, resulting in *first-ever* autonomous, BVLOS, solar-powered flights of a UAV in a polar region. (2017) website: <http://sun2ice.ethz.ch>, video: [https://youtu.be/wyS6W1t\\_ryQ](https://youtu.be/wyS6W1t_ryQ)
- **Organized/Lead** field operations together with Swissnex Brazil and Brazilian Civil Aviation Authorities 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.
- **8-week deployment** as mission planner and ground station operator for autonomous, BVLOS flights of a radar-integrated UAV in **Antarctica**, resulting in *first-ever* glacial bed-rock sounding via a UAV. (2014) <https://cresis.ku.edu/content/research/field-programs/antarctica#2013>

# Publications

Metrics found on Google Scholar: <https://scholar.google.ch/citations?user=R5Fs1A4AAAAJ&hl=en>.

## Journal Papers

1. D. Malyuta, C. Brommer, D. Hentzen, **T. Stastny**, R. Siegwart, and R. Brockers. “Long-duration Fully Autonomous Operation of Rotorcraft Unmanned Aerial Systems for Remote-sensing Data Acquisition”. In: *Journal of Field Robotics (JFR)*. (2020).
2. D. Rohr, **T. Stastny**, S. Verling, and R. Siegwart. “Attitude and Cruise Control of a VTOL Tiltwing UAV”. In: *IEEE Robotics and Automation Letters*. (2019). [https://youtu.be/pSXEnHUY2\\_4](https://youtu.be/pSXEnHUY2_4)
3. T. Hinzmann, **T. Stastny**, C. Cadena, R. Siegwart, and I. Gilitschenski. “Free LSD: Prior-free Visual Landing Site Detection for Autonomous Planes”. In: *IEEE Robotics and Automation Letters*. (2018). <https://youtu.be/SOpYirBwHtQ>
4. P. Oettershagen, **T. Stastny**, T. Hinzmann, K. Rudin, T. Mantel, A. Melzer, B. Wawrzacz, G. Hitz, and R. Siegwart. “Robotic Technologies for Solar-powered UAVs: Fully Autonomous Updraft-aware Aerial Sensing for Multiday Search-and-rescue Missions”. In: *Journal of Field Robotics (JFR)*. (2018). <https://youtu.be/8m76Mx9m2nM>
5. P. Oettershagen, A. Melzer, Mantel, K. Rudin, **T. Stastny**, B. Wawrzacz, T. Hinzmann, S. Leutenegger, K. Alexis, and R. Siegwart. “Design of Small Hand-launched Solar-powered UAVs: From Concept Study to a Multi-day World Endurance Record Flight”. In: *Journal of Field Robotics (JFR)*. (2017). [https://youtu.be/8m4\\_NpTQn0E](https://youtu.be/8m4_NpTQn0E)
6. **T. Stastny**, G. Garcia, S. Keshmiri. “Collision and Obstacle Avoidance in Unmanned Aerial Systems Using Morphing Potential Field Navigation and Nonlinear Model Predictive Control”. In: *Journal of Dynamic Systems, Measurement, and Control*. (2015).
7. G. Garcia, S. Keshmiri, **T. Stastny**. “Nonlinear Model Predictive Controller Robustness Extension for Unmanned Aircraft”. In: *International Journal of Intelligent Unmanned Systems*. (2015).
8. G. Garcia, S. Keshmiri, **T. Stastny**. “Robust and Adaptive Nonlinear Model Predictive Controller for Unsteady and Highly Nonlinear Unmanned Aircraft”. In: *IEEE Transactions on Control Systems Technology*. (2014).

## Book Chapters

1. M. Kamel, **T. Stastny**, K. Alexis, R. Siegwart. “Model Predictive Control for Trajectory Tracking of Unmanned Aerial Vehicles Using Robot Operating System”. In: *Robot Operating System (ROS), The Complete Reference (Volume 2)*. (2017).

## Peer-Reviewed Conference Papers

1. C. Olsson, S. Verling, **T. Stastny**, and R. Siegwart. “Full Envelope System Identification of a VTOL Tailsitter UAV”. In: *AIAA Guidance, Navigation, and Control (GNC) Conference*. (2021).
2. M. Harms, N. Kaufmann, F. Rockenbauer, N. Lawrance, **T. Stastny**, and R. Siegwart. “Differential Sweep Attitude Control for Swept Wing UAVs”. In: *International Conference on Unmanned Aircraft Systems (ICUAS)*. (2020).
3. **T. Stastny** and R. Siegwart. “On Flying Backwards: Preventing Run-away of Small, Low-speed, Fixed-wing UAVs in Strong Winds”. In: *IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*. (2019). <https://youtu.be/oM690LO29kM>
4. D. Hentzen, **T. Stastny**, R. Siegwart, and R. Brockers. “Disturbance Estimation and Rejection for High-Precision Multirotor Position Control”. In: *IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*. (2019). <https://youtu.be/-1PvZ5YBluw>
5. **T. Stastny**, E. Ahbe, M. Dangel, and R. Siegwart. “Locally Power-optimal Nonlinear Model Predictive Control for Fixed-wing Airborne Wind Energy”. In: *American Control Conference (ACC)*. (2019).
6. S. Fuhrer, S. Verling, **T. Stastny**, and R. Siegwart. “Fault-tolerant Flight Control of a VTOL Tailsitter UAV”. In: *IEEE International Conference on Robotics and Automation (ICRA)*. (2019).
7. J. Lee, T. Muskardin, C. Pacz, P. Oettershagen, **T. Stastny**, I. Sa, R. Siegwart, and K. Kondak. “Towards Autonomous Stratospheric Flight: A Generic Global System Identification Framework for Fixed-Wing Platforms”. In: *IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*. (2018).
8. **T. Stastny** and R. Siegwart. “Nonlinear Model Predictive Guidance for Fixed-wing UAVs Using Identified Control Augmented Dynamics”. In: *International Conference on Unmanned Aircraft Systems (ICUAS)*. (2018).
9. L. Furieri, **T. Stastny**, L. Marconi, R. Siegwart, and I. Gilitschenski. “Gone with the Wind: Nonlinear Guidance for Small Fixed-wing Aircraft in Arbitrarily Strong Windfields”. In: *American Control Conference (ACC)*. (2017).

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

## Magazine Articles

1. **T. Stastny**. “Mars Exploration? Unleash the Swarms!”. In: *Ruimtevaart*. (2013).

## Patents

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

## Manuscripts in Preparation

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

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.

## Mentorship & Teaching

---

- **Supervised 2** PhD Students (ongoing), **24** Masters Theses, **18** Masters Semester Theses, and **14** Bachelor Theses at ETH Zürich. (2014 – Present)
- **Coached 3** ETH Zürich Focus Projects – teams of 8-12 B.Sc. students who develop a robotic product from A to Z:
  - *Dipper* – a flying, diving, swimming, and re-emerging, swept-wing UAV. video: [https://youtu.be/q\\_9tSHTW1xE](https://youtu.be/q_9tSHTW1xE)
  - *ftero* – a VTOL UAV for airborne wind energy (year 1 and 2)
  - *VertiGo* – a wall-riding robot. Resulted in a patent. video: <https://youtu.be/KRYT2kYbgo4>
- **Co-Lecturer** for ETH Zürich M.Sc. course “Robot Dynamics” (2015-Present).
- **Guest Lecturer** for University of Kansas Aerospace M.Sc. course “Optimal Control” (2013).
- **Teaching assistant** for University of Kansas B.Sc. courses “Introductory Topics in Mathematics” and “Elementary Statistics”. (2010 – 2012)

## Awards

---

- **O. Hugo Schuck Best Paper Award** (2018) for American Control Conference (ACC) paper: “Gone with the wind: Nonlinear Guidance for Small Fixed-wing Aircraft in Arbitrarily Strong Windfields”. <http://a2c2.org/awards/o-hugo-schuck-best-paper-award>
- **United States Department of Defense Antarctica Service Medal** (2014)
- **University of Kansas Aerospace Undergraduate Researcher Award** (2012)