Tighe Costa

Professional Experience

Second Order Effects | El Segundo, CA   Jan. 2022 - Current

Staff Mechatronics Engineer, Special Projects. Hybrid systems architect and technical leader, specializing in complex projects with ambiguous goals in extreme environments. Leading mechatronic architecture of commercial, human-rated spacecraft docking system compatible with ISS, and high-mix low-volume production of digitizers for power-plant scale plasma diagnostics at CFS. Designed pointing, acquisition, and tracking system for space-based power beaming including control architecture and actuator/sensor selection. Supported system design for star trackers including radiometry, link budgets, and optomechanical integration. Driving root-cause training and integration of RAG-based LLM tools to democratize program context.

Founded 7-person cross-disciplinary R&D team tackling high-novelty, high-uncertainty engineering programs. Owned technical roadmaps for developments ranging from 6 months to 5 years. Led turnaround of ~$6M in at-risk projects through realignment of technical execution and business goals. Recruited multiple senior technical and people leaders.

Mechanical Engineering Manager. Stabilized and matured mechanical discipline during leadership transition. Developed 3-year roadmap, and foundational review processes. Architected SCARA-type robotic arm for autonomous EV fleet charging at scale: mechanism trade studies, actuator/sensor/camera selection, integration and test, and roadmapping. Performed due-diligence on novel electrostatic end effector and developed low profile, ultra-sensitive capacitive sensors for semiconductor clients.

Senior Systems Engineer. Hands-on technical contributor across diverse early-stage programs. Invented novel high bandwidth temperature sensor (patent pending). Developed a museum-quality digital display for interactive and generative art from concept to low volume production. Architected modular powertrain control systems and wavefront correction actuators for a telescope.

Honeybee Robotics | Exploration Technologies Division in Altadena, CA   Sept. 2017 - Nov. 2021

Lead, Robotic Systems Group. Systems engineer for LAMPS, a Phase A NASA GCD program to design a 10kW vertically deployable solar array for lunar habitation. Led development of KArLE, a TRL6 sample handling system for lunar exploration with NASA GSFC. Invented novel methods for solid-state sample analysis and manipulation for integration into robotic sampling systems for Europa with JPL. Directed knowledge sharing and processes improvement efforts.

Robotics Engineer III / Project Engineer. Led design of pneumatic sampling system for Dragonfly (New Frontiers 4 mission); won NASA mission selection, matured novel architecture from TRL1 to TRL5 in 16mo. Developed piezo-pneumatic drilling approach for CLPS payload LISTER. Led SBIR, PICASSO, SESAME work on cryogenic thermo-mechanical drilling.

Independent Consulting

The Choreodaemonic Platform (2025). Art/technology project exploring relationship of archival process and memory through data embodiment. Created 14-DOF robotic marionette in spare time over 4 weeks, including design, actuator selection, kinematics, and control software. Successfully installed during week-long intensive for live performance including projections and dance.

Lind Art & Technology (2023-2024). Designed custom modular connector for 2x BLDC + CAN interface for 20kW electric surfboard, balancing extreme environment requirements with unique need for user serviceability (patent pending). Owned mechanicals for handheld remote from prototype to DFM/DFA, working with EE, FW, and CM. 2025 reddot winner.

Alta Motors (2016-2017). Developed robotic fixtures and controllers for assembly of custom, high-energy-density batteries including QA instrumentation and PLM-compatible technician tools for electric motocross bike.

Internships

Alta Motors (2016). Developed instrumented mechanisms for battery assembly during production ramp.

SpaceX (2015). Designed and qualified coaxial connectors and supported enclosure architectures for point-to-point avionics.

Columbia University (2013, 2014). Developed high-throughput neuron injury device and flexible cell culture plates.

Max-Planck Institute (2012). Built diagnostic tools and fixtures for plasma wakefield accelerator research.

Education

University of Pennsylvania | Philadelphia, PA

M.S.E. in Robotics, GRASP Lab. Research in mobile robot base optimization; developed ADA-compliant prototype for Quori.
B.S.E. in Mechanical Engineering and Applied Mechanics. Focus on mechatronics and product design.

Technical Skills

Software	SolidWorks, Inventor, SolidCAM, Altium, COMSOL, Confluence/Jira, github
Actuator types	BLDC, BDC, stepper, piezo MLA, solenoid, distributed-mode loudspeakers, paraffin/SMA, pneumatic
Sensor types	TC/RTD, pressure, encoder, potentiometer, Hall effect, accelerometer/gyroscope, ultrasonic/laser distance, capacitive/inductive proximity, phototransistor, strain gauge, camera, fluid mass flow
Programming	Prefer Linux environment, Python/MATLAB for prototyping or analysis, C++ for low-level controllers
DFM	GD&T, Machine tools, 3D printing (FDM, SLA, SLS), laser cutting, waterjet, urethane casting, injection molding, sheet metal, PCB/PCBA, EB welding, harnessing, electroforming, wire-EDM, optical alignment, woodworking
Embedded	STM32, RBPi, Particle IoT, Arduino, LabJack, NI-DAQ, Copley, Elmo
Other	Customer interfacing, technical documentation/writing, industrial design, graphical illustration

Tighe Costa

Publications

Full-text and more available at tighecosta.com/publications

Solid State Sample Handling with Amplified Piezo Actuators. Costa JT, Ridilla A, Sanasarian L, Zacny K. *Proceedings of the 2022 IEEE Aerospace Conference*, Big Sky, MT. March 2022.

Survey, Evaluation, and Advancement of Sample Sensing Techniques for Future Missions. Costa JT, Sanasarian L, Sanigepalli V, Lam S, Stolov L, Palmowski J, Kancans R, Tosi LP, Roberts E, Kriechbaum K. *Proceedings of the 2022 IEEE Aerospace Conference*, Big Sky, MT. March 2022.

Development and Testing of a Sample Handling System for In-Situ Lunar Geochronology with KArLE. Costa JT, Lang CT, Corrigan P, Emery JW, Thompson LA, Jensen NA, Rideout HT, Indyk S, Yen B, Zacny K, Mullin M, Cattani F, Frese E, Stysley P, Cohen BA. *Proceedings of the 2022 IEEE Aerospace Conference*, Big Sky, MT. March 2022.

Dragonfly Mass Spectrometer Boldly Goes Where No Other Ion Trap Mass Spectrometer Has Gone Before: Saturn's Moon Titan. Grubisic A, Trainer M, Brinckerhoff W, Van Amerom F, Li X, Danell R, Kaplan D, Malespin C, Costa JT, Rehnmark F, Zacny K, Lorenz R, Barnes J, Turtle E. *Proceedings of the 2020 ASMS Conference on Mass Spectrometry and Allied Topics*, June 2020.

Development and Testing of a Sample Cup for Laser-Based Instruments. Costa JT, Grubisic A, Sparta J, Li X, Castillo M, Holmes V, Crandall C, Yen B, Rehnmark F, Trainer M, Lorenz R, Zacny K. *Proceedings of the 2019 Astrobiology Science Conference (AbSciCon)*, June 2019.

SLUSH: Search for Life Using Submersible Heated Drill. Zacny K, Hand K, Sotin C, Howell S, Cwik T, Mueller J, Ehlmann B, Nagihara S, Tipton M, Liller S, Rehnmark F, Costa JT, Bergman D, Hovik W. *Proceedings of the 2019 Astrobiology Science Conference (AbSciCon)*, June 2019.

Sampling the Ocean Worlds: Drilling and Pneumatic Transfer. Sparta J, Costa JT, Sanigepalli V, Yu D, Ng P, Bailey J, Yen B, Rehnmark F, Zacny K, Lorenz R. *Proceedings of the 2019 Astrobiology Science Conference (AbSciCon)*, June 2019.

Application of Pneumatics in Delivering Samples to Instruments on Planetary Missions. Zacny K, Lorenz R, Rehnmark F, Costa JT, Sparta J, Sanigepalli V, Yen B, Yu D, Bailey J, Bergman D, Hovik W. *Proceedings of the 2019 IEEE Aerospace Conference*, March 2019.

SLUSH: Search for Life Using Submersible Heated Drill. Zacny K, Costa JT, Rehnmark F, Mueller J, Cwik T, Zimmerman W, Chow P. *Proceedings of the 49th Lunar and Planetary Science Conference*, August 2018. #2083

Drilling Into Titan Cryogenic Materials: Water-Ammonia Ice and Paraffin Wax. Sparta J, Lorenz R, Costa JT, Rehnmark F, Zacny K. *Proceedings of the 49th Lunar and Planetary Science Conference*, August 2018. #3008

Cryogenic Sample Acquisition and Delivery System (CryoSADS) for Titan and Europa. Zacny K, Lorenz R, Rehnmark F, Costa JT, Bailey J, Traeden N, Mank Z, Sparta J. *Proceedings of the 42nd COSPAR Scientific Assembly*, July 2018.

Pneumatic Sample Acquisition and Transfer for 'Ocean Worlds' Landers. Lorenz R, Zacny K, Costa JT, Rehnmark F, Sparta J, Traeden N, Mank Z. *Proceedings of the 15th International Planetary Probe Workshop (IPPW)*, June 2018.

Surface and Subsurface Sampling Drills for Life Detection on Ocean Worlds. Rehnmark F, Zacny K, Costa JT, Mank Z, Bailey J, Sparta J, Chow P, Traeden N. *Proceedings of the 15th International Planetary Probe Workshop (IPPW)*, June 2018.

Pneumatic Sample Transport for Ocean Worlds. Sparta J, Zacny K, Lorenz R, Rehnmark F, Costa JT, Mank Z, Bailey J, Traeden N. *Proceedings of the 15th International Planetary Probe Workshop (IPPW)*, June 2018.

SLUSH: Europa Hybrid Deep Drill. Zacny K, Mueller J, Costa JT, Zimmerman W, Gray A, Cwik T, Chow P, Rehnmark F, Adams G. *Proceedings of the 2018 IEEE Aerospace Conference*, June 2018. DOI: 10.1109/AERO.2018.8396596

Designing for Uniform Mobility Using Holonomicity. Costa JT, Mark Y. *Proceedings of the 2017 IEEE International Conference of Robotics and Automation (ICRA),* June 2017. DOI: 10.1109/ICRA.2017.7989285

Stretch Injury of Human Induced Pluripotent Stem Cell Derived Neurons in a 96 Well Format. Sherman SA, Phillips JK, Costa JT, Cho FS, Oungoulian SR, Finan JD. *Scientific Reports,* September 2016. DOI: 10.1038/srep34097