

Taylor M. Rault

PhD

Staff Consultant



Dr. Taylor Rault is a Staff Consultant at ESi, where he specializes in the engineering analysis of combustion, thermal, and fluid processes, specifically regarding the origin, cause, and propagation of fires and explosions.

Dr. Rault has investigated fires involving residential structures, internal combustion engine- and electric motor-powered vehicles, outdoor maintenance and recreational vehicles, as well as battery packs. These investigations included fire cause and origin determination, burn pattern interpretation, and evaluation of ignition mechanisms.

Dr. Rault has published scientific articles in the areas of rocket fuel, jet fuel, and biofuel combustion chemistry, as well as soot formation, fuel pyrolysis, chemical kinetics, and advanced optical diagnostic development.

Applications of his research include developing more powerful, efficient, and low-pollution propulsion and energy systems, specifically through improved characterization of primary and secondary fuel decomposition pathways.

Dr. Rault has held a graduate research assistant (GRA) position in the Hanson Research Group at Stanford University, and GRA and research associate positions in the Combustion and Propulsion Laboratory at the University of Toronto Institute for Aerospace Studies (UTIAS). Dr. Rault has also held positions at Stantec Consulting Ltd. and JV Driver Group.

Education

PhD, Mechanical Engineering. Stanford University. 2026

MASc, Aerospace Engineering. University of Toronto Institute for Aerospace Studies (UTIAS). 2020

BSc, Mechanical Engineering, Minor in Mathematics. University of Alberta. 2018

Licenses & Certifications

- Private Pilot License, 2021

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Areas of Specialization

- Combustion
- Thermal Sciences
- Fluid Processes
- Fire Cause and Origin Investigation
- Residential Fire Investigation
- Vehicle Fire Investigation

Languages

- English (fluent)
- French (limited working proficiency)

Positions Held

Engineering Systems Inc., Scottsdale, Arizona

- Staff Consultant, 2026 — Present

University of Toronto Institute for Aerospace Studies, Toronto, Ontario

- Research Associate, July 2020 — June 2021

Continuing Education

- **Fire Investigation 1A: Fire Origin and Cause Determination** — California State Fire Marshal, 2026

Professional Affiliations/Honors

Natural Sciences and Engineering Research Council of Canada (NSERC)

- Recipient, Postgraduate Scholarship — Doctoral program award, 2022–2025

Stanford University

- Co-Leader, Rising Fellows Graduate Student Group, Hoover Institution, 2023–2025

University of Toronto

- Vice President, Communications, UTIAS Aerospace Students' Association, 2019–2020

University of Alberta

- Vice President, Internal, Canadian Aeronautics and Space Institute U of A Branch, 2017–2018
- Recipient, Mec E 260 Design Award for the most effective robot in the design competition, 2014
- Recipient, Commendation Letter from Prof. and Chair, Dept. of Physics for excellent performance, 2014

Memberships

- International Association of Arson Investigators (IAAI) – Member
- National Association of Fire Investigators (NAFI) – Member
- National Fire Protection Association (NFPA) – Member
- Society of Automotive Engineers (SAE) – Member

Publications

"Neat ammonia, ammonia-hydrogen, and ammonia-methane blend oxidation-II: Kinetic modeling," P. Prasanna Simha, **T.M. Rault**, O.R. Trimble, J.W. Streicher, and R.K. Hanson, *Combustion and Flame*, In Preparation, 2026.

"Neat ammonia, ammonia-hydrogen, and ammonia-methane blend oxidation-I: Multi-species measurements," P. Prasanna Simha, **T.M. Rault**, O.R. Trimble, J.W. Streicher, and R.K. Hanson, *Combustion and Flame*, In Preparation, 2026.

"Simultaneous multi-species measurements during hydrazine pyrolysis behind reflected shock waves," P. Prasanna Simha, **T.M. Rault**, O.R. Trimble, and R.K. Hanson, *The Journal of Physical Chemistry A*, In Preparation, 2026.

"Carbon black and hydrogen co-production from methane pyrolysis: measured and modeled insights from integrated gas-phase and particle diagnostics in shock tubes," G.I. Clark, M. Adib, C. Li, **T.M. Rault**, J.W. Streicher, R. Kholghy, and R.K. Hanson, *Carbon*, Accepted for Publication, July 18, 2026.

"Sensitive, multi-species, variable-pathlength laser absorption measurements in shock-tube studies of ammonia pyrolysis and oxidation," P. Prasanna Simha, **T.M. Rault**, J.W. Streicher, and R.K. Hanson, *Proceedings of the Combustion Institute*, Vol. 42, pp. 106274, 2026. doi: [10.1016/j.proci.2026.106274](https://doi.org/10.1016/j.proci.2026.106274)

"An improved pyrolysis model for N_xH_y species based on pathlength-amplified laser absorption measurements in shock tubes," **T.M. Rault**, Doctoral Dissertation, Stanford University, 2026. doi: [10.25740/br578pc7373](https://doi.org/10.25740/br578pc7373)

"Ammonia pyrolysis behind reflected shock waves: Multi-species measurements and modeling," **T.M. Rault**, P. Prasanna Simha, O.R. Trimble, S. Clees, and R.K. Hanson, *The Journal of Physical Chemistry A*, Accepted for Publication, July 16, 2026, in press. doi: [10.1021/acs.jpca.6c01857](https://doi.org/10.1021/acs.jpca.6c01857)

"Sensitive, multi-species, variable-pathlength laser absorption measurements in shock-tube studies of ammonia pyrolysis and oxidation," P. Prasanna Simha, **T.M. Rault**, O.R. Trimble, J.W. Streicher, and R.K. Hanson, *41st International Symposium on Combustion*, Kyoto, Japan, July 26–31, 2026.

"Direct laser absorption measurements of NH_3 -relevant pyrolysis reactions," **T.M. Rault**, S. Clees, D.P. Merrell, and R.K. Hanson, *The Journal of Physical Chemistry A*, Vol. 130, pp. 1700–1712, 2026. doi: [10.1021/acs.jpca.5c08194](https://doi.org/10.1021/acs.jpca.5c08194)

"Applications of hydrazine for the study of NH_2 kinetics-II: self-reaction of NH_2 radicals," **T.M. Rault**, P. Prasanna Simha, J.W. Streicher, C.L. Strand, and R.K. Hanson, *Combustion and Flame*, Vol. 288, pp. 114969, 2026. doi: [10.1016/j.combustflame.2026.114969](https://doi.org/10.1016/j.combustflame.2026.114969)

"Applications of hydrazine for the study of NH_2 kinetics-I: N_2H_4 pyrolysis reactions," **T.M. Rault**, P. Prasanna Simha, J.W. Streicher, C.L. Strand, and R.K. Hanson, *Combustion and Flame*, Vol. 288, pp. 114968, 2026. doi: [10.1016/j.combustflame.2026.114968](https://doi.org/10.1016/j.combustflame.2026.114968)

"A shock tube study of chaperon efficiencies for the $\text{NH}_3 + \text{M} \rightarrow \text{NH}_2 + \text{H} + \text{M}$ reaction during ammonia pyrolysis," P. Prasanna Simha, **T.M. Rault**, S. Clees, J.W. Streicher, C.L. Strand, and R.K. Hanson, *Proceedings of the Combustion Institute*, Vol. 41, pp. 105797, 2025. doi: [10.1016/j.proci.2025.105797](https://doi.org/10.1016/j.proci.2025.105797)

"A combined multi-speciation, particulate formation, and particulate morphology study of methane pyrolysis in shock-tubes," G.I. Clark, **T.M. Rault**, C. Wei, L.T. Zaczek, N. Mishra, C. Li, J.W. Streicher, and R.K. Hanson, *14th U.S. National Combustion Meeting — Eastern States Section of the Combustion Institute*, Boston MA, March 16–19, 2025.

"High-temperature shock tube investigation of propargyl recombination using UV laser absorption spectroscopy," C. Wei, **T.M. Rault**, G.I. Clark, and R.K. Hanson, *14th U.S. National Combustion Meeting — Eastern States Section of the Combustion Institute*, Boston MA, March 16–19, 2025.

"A shock tube study of chaperon efficiencies for the $\text{NH}_3 + \text{M} \rightarrow \text{NH}_2 + \text{H} + \text{M}$ reaction during ammonia pyrolysis," P. Prasanna Simha, **T.M. Rault**, S. Clees, J.W. Streicher, C.L. Strand, and R.K. Hanson, *14th U.S. National Combustion Meeting — Eastern States Section of the Combustion Institute*, Boston MA, March 16–19, 2025.

"A shock tube and pathlength-amplified laser absorption study of hydrazine pyrolysis," **T.M. Rault**, P. Prasanna Simha, J.W. Streicher, C.L. Strand, and R.K. Hanson, *14th U.S. National Combustion Meeting — Eastern States Section of the Combustion Institute*, Boston MA, March 16–19, 2025.

"A laser-absorption diagnostic for O_2 concentration and temperature using a portable, tunable UV laser system," S.C. Barnes, S. Clees, J.A. Vandervort, **T.M. Rault**, J.W. Streicher, C.L. Strand, and R.K. Hanson, *Applied Physics B*, Vol. 131, No. 4, pp. 82, 2025. doi: [10.1007/s00340-025-08444-9](https://doi.org/10.1007/s00340-025-08444-9)

"A rapidly tunable laser system for measurements of NH_2 at 597 nm behind reflected shock waves," S. Clees, S.C. Barnes, **T.M. Rault**, C.L. Strand, and R.K. Hanson, *Sensors*, Vol. 24, pp. 7920, 2024. doi: [10.3390/s24247920](https://doi.org/10.3390/s24247920)

"Simultaneous OH and OH* measurements during NH_3 oxidation in a shock tube," S. Clees, **T.M. Rault**, L.T. Zaczek, and R.K. Hanson, *Proceedings of the Combustion Institute*, Vol. 40, pp. 105286, 2024. doi: [10.1016/j.proci.2024.105286](https://doi.org/10.1016/j.proci.2024.105286)

"Multi-speciation and ignition delay time measurements of ammonia oxidation behind reflected shock waves," **T.M. Rault**, S. Clees, M. Figueroa-Labastida, S.C. Barnes, A.M. Ferris, N. Obrecht, C. Callu, and R.K. Hanson, *Combustion and Flame*, Vol. 260, pp. 113260, 2024. doi: [10.1016/j.combustflame.2023.113260](https://doi.org/10.1016/j.combustflame.2023.113260)

"A shock tube and laser absorption study of NH_3 oxidation," S. Clees, **T.M. Rault**, M. Figueroa-Labastida, S.C. Barnes, A.M. Ferris, and R.K. Hanson, *13th U.S. National Combustion Meeting — Central States Section of the Combustion Institute*, College Station TX, March 19–22, 2023.

"Soot, flow field, and spray structure in turbulent swirl-stabilized spray flames of Jet A-1/biofuel blends in a model gas turbine combustor," **T.M. Rault**, Master's Thesis, University of Toronto, 2020. doi: <http://hdl.handle.net/1807/101367>

“Soot formation in turbulent swirl-stabilized spray flames in a model combustor fueled with *n*-butanol/Jet A-1 blends,” **T.M. Rault**, R. Vishwanath, and Ö.L. Gülder, *Fuel*, Vol. 287, pp. 119452, 2021. doi:

[10.1016/j.fuel.2020.119452](https://doi.org/10.1016/j.fuel.2020.119452)

“Impact of ethanol blending on soot in turbulent swirl-stabilized Jet A-1 spray flames in a model gas turbine combustor,” **T.M. Rault**, R. Vishwanath, and Ö.L. Gülder, *Proceedings of the Combustion Institute*, Vol. 38, pp. 6431–6439, 2021. doi: [10.1016/j.proci.2020.05.021](https://doi.org/10.1016/j.proci.2020.05.021)

“Influence of *m*-xylene addition to Jet A-1 on spray structure, flow field and soot production in turbulent swirl-stabilized spray flames in a model combustor,” **T.M. Rault**, R. Vishwanath, and Ö.L. Gülder, *Combustion and Flame*, Vol. 219, pp. 258–267, 2020. doi: [10.1016/j.combustflame.2020.05.025](https://doi.org/10.1016/j.combustflame.2020.05.025)

Presentations

“A shock tube study of chaperon efficiencies for the $\text{NH}_3 + \text{M} \rightarrow \text{NH}_2 + \text{H} + \text{M}$ reaction during ammonia pyrolysis,” P. Prasanna Simha, **T.M. Rault**, S. Clees, J.W. Streicher, C.L. Strand, and R.K. Hanson, 14th U.S. National Combustion Meeting — Eastern States Section of the Combustion Institute, Boston MA, March 16–19, 2025.

“A shock tube and pathlength-amplified laser absorption study of hydrazine pyrolysis,” **T.M. Rault**, P. Prasanna Simha, J.W. Streicher, C.L. Strand, and R.K. Hanson, 14th U.S. National Combustion Meeting — Eastern States Section of the Combustion Institute, Boston MA, March 16–19, 2025.

“Soot formation in turbulent swirl-stabilized spray flames of Jet A-1 blended with 10% ethanol,” **T.M. Rault** and Ö.L. Gülder, Proceedings of Combustion Institute — Canadian Section Spring Technical Meeting, The University of British Columbia, Kelowna B.C., May 13–16, 2019.