



THE CENTER FOR SPACE
ENTREPRENEURSHIP
MISSION UPDATE

2011

INTRODUCTION

It is said that objects move at incredible speeds in space. In the absence of friction to slow an object on the move, extraordinary velocities are possible.

Our experience of 2010 indicates that these same things appear to be true for eSpace: the Center for Space Entrepreneurship. In the course of a single year, thanks in part to a Congressional grant of \$1.4 million through the United States Air Force Research Laboratory, we have accelerated from start-up to light speed at an astonishing rate.

“eSpace is getting attention at very high levels. NASA is watching closely, as are the large aerospace companies. They’re all interested in what we’re doing because it really is all about the future of aerospace.”

Scott Tibbitts,
Vice Chairman of the eSpace Board of Directors; Founder of Starsys Research


Consider some of the highlights you’ll read about inside:

- Since 2009, the eSpace Incubator received applications from 45 fledgling aerospace companies. Nine of those we invited into the program and are already doing amazing work. Two of the 2009 companies that participated in the eSpace Incubator graduated in 2010, yet they continue to engage with eSpace in an alumni capacity. Their successes—measured in multiple Small Business Innovation Research (SBIR) grants awarded—are helping our newest companies find their way in the world of aerospace.
- This year, the Venture Design program has expanded to support 66 University of Colorado (CU) students and four student and faculty research projects. The funding and mentoring that we have been able to bring to these projects has enabled these students and faculty members to move forward when other funding was largely unavailable, and one of the student/faculty projects we sponsored early on has moved into the eSpace Incubator as an independent company in which numerous larger aerospace organizations are showing great interest.
- The Straight to Space (S2S) program pumped additional new blood into entrepreneurial space companies, for a net economic impact of more than \$1.8 million, as measured by annual salaries.

Nor is that all:

- eSpace has moved into new offices in the University of Colorado Research Park, where we have space not only for our administrative activities, but also for housing the companies in the eSpace Incubator.
- NASA Ames has renewed its Space Act Agreement (SAA) with eSpace, which enables us to continue to facilitate beneficial relationships between NASA and the individuals and companies working with eSpace.





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THE eSPACE INCUBATOR

The original vision for eSpace included a suite of business incubation resources designed to support the unique needs of entrepreneurs developing new businesses in aerospace. We wanted to provide start-up grants and office infrastructure, access to industry-approved manufacturing and testing facilities, connections to government and private funding, and inroads to a network of successful space entrepreneurs and advisors.

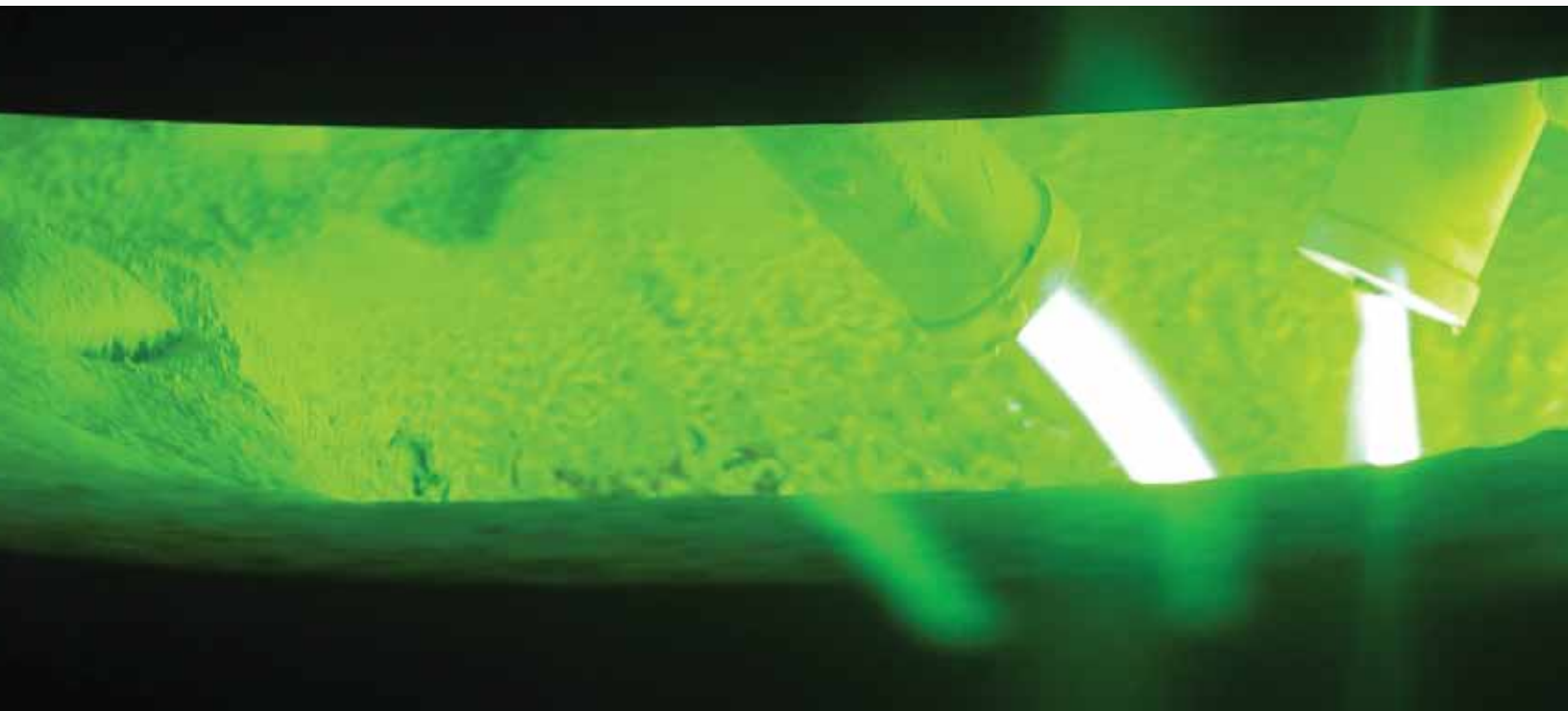
During 2010, we have accomplished all this—and more.

During the past year, 15 new aerospace companies applied for entry into the eSpace Incubator program. Each company was promising in its own way, but six companies stood out. Over the course of 2010, these six have joined the Incubator, and four have taken up residence in the new eSpace Center offices in the University of Colorado Research Park.

We have teamed each of these small companies with mentors, provided research grants of \$20,000 in four cases, and catalyzed strong relationships with established aerospace organizations ranging from NASA and the Air Force to a long list of large and small non-governmental companies.

“eSpace really is facilitating the work we’re doing. They’ve made connections for us with the Laboratory for Atmospheric and Space Physics, AFRL, and with people at the University, where we can access both faculty and student resources to help us execute.”

— George Stafford, President, Blue Canyon Technologies



What’s astonishing, too, is the scope of the work in which these small companies are engaged—from technologies that offer new ways to eliminate heat from spacecraft to new attitude control systems and newly patented hybrid propulsion technologies.

• One of the new eSpace Incubator participants, Next Giant Leap, is one

of the top three contenders for the \$30 million Google Lunar X PRIZE, a challenge that involves landing a small spacecraft on the moon, maneuvering it, and sending back data.

• ACTA has received a \$150,000 Phase 1 SBIR award from the National Science Foundation and an \$80,000 Phase 1 SBIR award from the EPA for its work

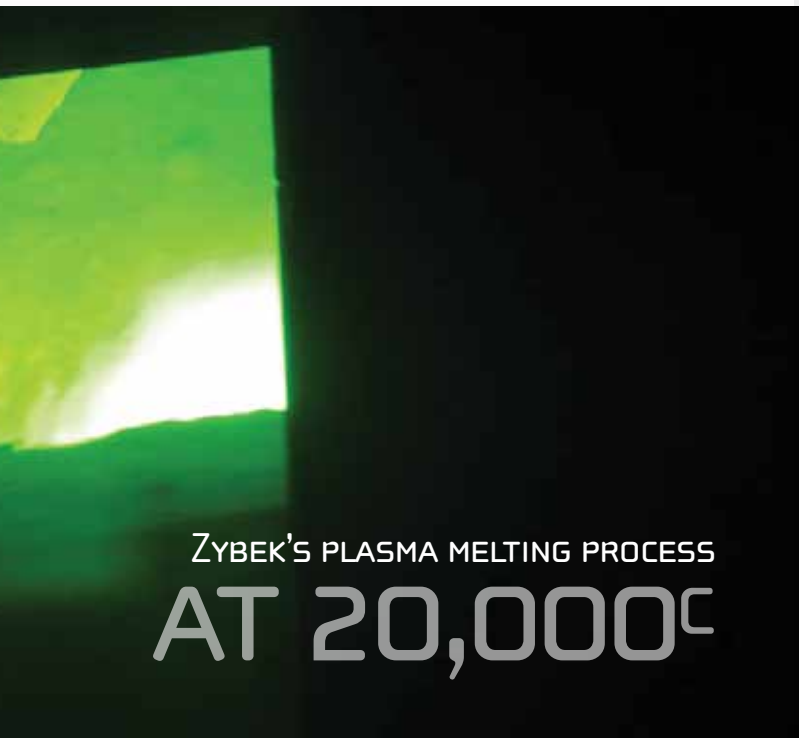
on ways to eliminate heat from spacecraft.

• Blue Canyon Technologies has received two \$100,000 Phase 1 SBIR awards from the Air Force Research Lab for its work with nano-satellite attitude control systems—including an integrated power and attitude control system (IPACS).



Nor is eSpace the only organization to take note of the promise these new companies hold. From among the six companies that joined the eSpace Incubator in 2010, no fewer than six SBIR grant proposals have been submitted. Five of the six proposals have been awarded.

Finally, one of the very exciting developments from two years ago was the Space Act Agreement (SAA) between eSpace and NASA Ames, which formalized the relationship between the two organizations. The exciting news in 2010 is that NASA Ames has renewed that agreement, ensuring that eSpace can provide an unparalleled opportunity for the companies in the eSpace Incubator to showcase their new technologies to NASA for evaluation. SAAs are difficult to earn, and the fact that NASA has renewed this agreement is a very clear signal that eSpace is on the right track.



BLUE CANYON TECHNOLOGIES started in 2008 and joined the eSpace Incubator in 2010 to work on the development of two new technologies: a nano-satellite attitude control system and an integrated power and attitude control system (IPACS). In 2010, Blue Canyon received two AFRL SBIR grants to continue this work. "The key for any small company in aerospace is credibility," says George Stafford, President of Blue Canyon. "Larger companies and organizations like NASA and the Air Force need to know that you can deliver what you've promised. eSpace has been very helpful in helping us gain the credibility we need. Because of the relationships we have through eSpace, we have access to manufacturing and testing facilities as well as to personnel to help us deliver. eSpace teamed us with a great mentor, and he's been instrumental in helping us get the attention we need."

TIGON ENERTec formed after a faculty/student team from CU worked on a hybrid propulsion system in the course of a 2009 Senior Design project. The patented TIGON hybrid propulsion systems deliver between 2 and 450 horsepower, but they are currently the only hybrid solutions that are light enough to be viable for aerospace applications and inexpensive enough to be applied to small engines. "Halfway through the year, when we were writing business plans for one of our entrepreneurial classes, we realized that this really could be a business," says Alec Velazco, a founding member of TIGON. "But one of the things we learned early on from eSpace was the importance of getting the right team. We were fresh out of college and we knew we did not have the kind of experience that would convince people to invest in this company." By working with the eSpace Incubator and the Boulder Innovation Center, though, TIGON has attracted an experienced leadership team and the company is moving forward, much to the interest of the broader aerospace community.

ZYBEK ADVANCED PRODUCTS, INC. (ZAP) is an established woman-owned engineering, system development, and manufacturing company that graduated from the eSpace Incubator in 2010. Initially ZAP wanted to expand its advanced plasma business to include the production of its lunar simulant, a synthetic moon rock that NASA requires for testing space missions. Over the past year, ZAP has expanded even further, finding new commercial uses for its breakthrough plasma technologies—from ground water remediation to thermally extractive metallurgy and commercial furnace systems that can achieve temperatures 10 times higher than natural gas-based furnaces, with no exhausted greenhouse gases. "eSpace provided us with a lot of great help," says Sheryl Genco, President of Zybek, "It really helped us consolidate our thinking about the paths available for commercializing technologies. This was helpful because, well, we're engineers and we'd have just gone on designing forever. eSpace helped frame our efforts and stay focused."

"Our programs are capturing the interest of people who really matter in aerospace. NASA is taking note. AFRL is taking note. We're getting more and more interest from prime contractors. When we call and tell them that a company in our Incubator or a project in the Venture Design program looks like something that might interest them, they listen."

—Rick Ward, Director of the eSpace Incubator



VENTURE DESIGN PROGRAM

The Venture Design program works in conjunction with the University of Colorado Aerospace Engineering Sciences department and sponsors student and faculty research leading to potential entrepreneurial opportunities. Now in its second year, the eSpace Venture Design program is even more exciting than ever.

During 2010, eSpace expanded the Venture Design program to sponsor a total of 102 students in eight undergraduate and graduate hands-on design projects. Several of the projects were continued from 2009, including:

- **Colorado Student Space Weather Experiment (CSSWE):** Designing a nano-satellite that can help forecast "space weather" and help predict how solar storms will impact the earth's magnetic field.
- **Mini Jet Engine for Unmanned Aerial Systems:** Developing a family of advanced biofuel- capable small afterburning turbojet engines with thrust vectoring capabilities to power small Unmanned Aerial Systems.
- **LIDAR Wind-Temperature Aerosol Sensor:** Developing an airborne or space-borne laser ranging system for the simultaneous measurement of wind, temperature, and aerosol content of the atmosphere with high resolution and long duration.
- **The Hyperion Blended Wing Body (BWB) aircraft** is a UAV system that uses the latest in aircraft design, aerodynamic efficiency, hybrid power, fly-by-wire controls, and improved acoustics. The BWB aircraft uses the hybrid engine that the Solstice Project is refining as well as other "green" aircraft technologies. Jean Koster, the faculty advisor on the Hyperion project, was named CU Inventor of the Year in 2010.
- **The Hybrid Sounding Rocket (HySoR) project** is striving to build a reliable, safe, inexpensive, and easily launched sounding rocket for meteorological applications. The rocket is expected to be a single-stage HTPB/Nitrous Oxide hybrid capable of carrying a 2 kg payload to an apogee of 100 km.

eSpace continues to help CU develop the entrepreneurship component of the curriculum offered in the Venture Design course and provided lectures and advising on entrepreneurship, strategy, and market analysis. In 2010, we established two \$5,000 graduate fellowships for aerospace entrepreneurship. We have also been working to support CU in the creation of the FAA Center of Excellence for Commercialization of Space Transportation. The University, and its partners Stanford University and University of Texas Medical Branch, received a \$10 million award from the FAA to create this center, and eSpace is leading the efforts to help commercialize the work developed within the center.

Finally, eSpace continues to engage with established local and national aerospace companies, fostering a greater level of industry involvement at an early stage. We're working to connect the ivory tower to the concrete launch pad and to every organization working on every step in between.

Additionally, in 2010 the eSpace Venture Design program brought several new projects onboard, including:

- **The Solstice Project** is a design project focusing on refining the hybrid engine designed at CU in 2009, which was the basis of a patent and the incorporation of TIGON EnerTec. TIGON EnerTec itself is involved in the eSpace Incubator this year.



Masters students Eric Serani, Cody Humbarger, Alec Velazco, and Derek Hillery (kneeling), of eSpace's Tigon EnerTec, working on the Hyperion BWB student project.

"From our research and from the conversations we have with faculty members and students, we're discovering that CU is becoming known as the place to be for aerospace start-ups. More and more graduate students are applying to CU because of the resources that eSpace can provide. When I talk to students about the entrepreneurial aspects of research and innovation, they're like sponges. They just soak it up."

— Diane Dimeff, Executive, Director of eSpace

"In 2010, one of the CU Senior Design projects transitioned from a student/faculty project to a bona fide start-up company supported by the eSpace Incubator. That's exactly the kind of evolution we had envisioned when we started eSpace. The only surprise here is that we succeeded as early as we did. We had thought it would take longer to get to this place. It's happening now, and everyone is very excited."

— Diane Dimeff, Executive Director of eSpace



STRAIGHT TO SPACE: THE WORKFORCE DEVELOPMENT PROGRAM

As more and more Apollo- and Shuttle-era employees retire, employers in every sector of aerospace are wondering where to find personnel who are qualified to fill tomorrow's aerospace jobs. To facilitate this transition, eSpace has developed Straight to Space (S2S), a workforce replacement initiative that encourages individuals to consider the aerospace industry as a career path.

The S2S program supports the placement of high school, community college, and college graduates into Colorado entrepreneurial space companies, providing an onramp to a professional career that might never have been thought possible by these individuals. By providing training grants to companies for on-the-job training, the S2S program encourages a corporate behavior that hires from outside the industry, thereby rebuilding the aerospace workforce at a critical time when attrition threatens the continuity of the industry.

Since 2009, the S2S program has supported over 40 individuals in 15 entrepreneurial

aerospace companies. eSpace has provided each company with training grants of between \$1,000 and \$4,000—and for many of the smaller aerospace companies in Colorado, this grant has made it possible to hire and train these new workers.

The economic impact of these placements on the broader community is not hard to see. When measured in terms of annual salaries, the economic value of these positions tops \$1.8 million annually. The people we have supported are bringing exciting new blood to the aerospace community, even as they're infusing the communities in which they live with an income derived from some of the best jobs in the country. From any perspective, those are real benefits.



"For a small company like AdamWorks, the Straight to Space grants we've received from eSpace have been critical to funding the training that our new employees need. Each of the individuals for whom we received training grants have become productive members of our company, and the eSpace grants have helped enable us to build our employee base."

—Kim Burquest, President and CEO, AdamWorks, Inc.

"Straight to Space is filling a crucial niche. We pull people into aerospace who might not have thought of this first. They used to think aerospace was a lot of old guys firing Apollo rockets and the space shuttle. Now, they look at aerospace and see nimble, inventive, exciting companies. That brings a lot of new interest and new talent into aerospace, and that's exciting for everyone."

— Scott Tibbitts, Vice Chairman of the eSpace Board of Directors; Founder, Starsys Research







LOOKING FORWARD

When we launched eSpace, we envisioned an organization that would, in time, be able to help new entrepreneurial companies take shape and help them plug into the broader aerospace industry. The one thing we did not envision was the speed at which we would achieve those goals.

At this time last year, we were encouraged. The eSpace Incubator was up and running; the Venture Design program was advancing several exciting projects; and the Straight to Space program was helping people find good jobs in aerospace even while other parts of the economy were reeling.

Today, we're far more than merely encouraged. eSpace is at the center of something very large, very dynamic, and very exciting. We're at this amazing intersection of space, startup companies, and boundless possibilities. We're surrounded by young, passionate entrepreneurial people who

might once have thought they would have to leave the area to find their niche.

Today, they're finding that niche in Colorado. The Rocky Mountain Region has become a hotbed of aerospace activity, and the role that eSpace has taken on is one from which everyone in this industry benefits. We look forward to helping new entrepreneurial organizations take flight. We look forward to fostering the efforts of faculty and students at CU and connecting them with organizations in the aerospace sector that need new ideas and new breakthroughs. We look forward to helping the next generation of aerospace employees see and seize the opportunities that this exciting industry has to offer.

As we grow, so grow the people with whom we engage—and as they grow, so grows the aerospace industry. And as the industry grows, so grows the nation.

“eSpace is fostering the evolution of a thriving entrepreneurial aerospace industry in the Rocky Mountain region. This is becoming the Silicon Valley of aerospace, with dozens of new entrepreneurial aerospace companies, astonishing commercialization efforts involving student and faculty research, and hundreds, even thousands, of new aerospace jobs—direct and related—being created. And this is just the start. What eSpace is doing in Colorado it can do Texas, California, Massachusetts, and many other states. People say that the sky's the limit, but even that's not true anymore.”

— Mark Sirangelo, Chairman of the eSpace Board of Directors;
Executive Vice President, Sierra Nevada Corporation

eSPACE: The Center for Space Entrepreneurship is a 501(c)(3) non-profit organization formed from a partnership of the University of Colorado, a national leader in aerospace engineering, and the Space Systems Group of Sierra Nevada Corporation, a leading entrepreneurial space company located in Louisville, Colorado. eSpace is dedicated to creating new entrepreneurial space companies, commercializing aerospace technologies created within these companies, and developing a passionate aerospace workforce to support these companies. Visit us online at eSpacecenter.org.

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BOARD OF DIRECTORS

- **Chairman Mark N. Sirangelo**, Executive Vice President, Sierra Nevada Corporation. Mr. Sirangelo is responsible for the company's Space Systems Group and is chairman of the SNC Space Systems Board. He is also the current chairman of the Commercial Spaceflight Federation and board member of the California Space Authority.
- **Frank Backes**, Chief Executive Officer, Braxton Technologies, LLC. As CEO, Mr. Backes has been instrumental in expanding Braxton's presence in the Command and Control (C2) market, leveraging new products and services that support the entire lifecycle of a C2 system. Mr. Backes received the Ernst & Young Entrepreneur of the Year® 2009 Award for the services category in the Rocky Mountain region.
- **Daniel N. Baker**, Director, Laboratory for Atmospheric and Space Physics, University of Colorado at Boulder. Dr. Baker is also professor of astrophysical and planetary sciences and professor of physics. His primary research interest is the study of plasma physical and energetic particle phenomena in planetary magnetospheres and in the earth's vicinity.
- **Jeffrey M. Forbes**, Professor and Chair, Department of Aerospace Engineering Sciences, University of Colorado at Boulder. Retired as Lieutenant Colonel, U.S. Air Force Reserves, Mr. Forbes earned his BSEE from the University of Rhode Island (1968), his MSEE from the University of Illinois, and his Ph.D. in applied physics from Harvard University.
- **Henrik Hofvander**, President and CEO of Zolo Technologies. Mr. Hofvander has more than 20 years of senior management experience in the laser, optics, and electro-optics field. He received his BSEE and MSEE from the Lund Institute of Technology in Sweden; as a Fulbright Scholar at Columbia University, he developed novel image processing algorithms.
- **Cary W. Ludtke**, Vice President and General Manager, Civil and Operational Space division, Ball Aerospace & Technologies Corp. As vice president, Mr. Ludtke is responsible for the acquisition and execution of space programs for civil and commercial customers, as well as technology development to enable and implement those programs. Mr. Ludtke is also a board member of the Space Science Institute.
- **R.C. "Merc" Mercure**, Founder and CEO, CDM Optics; and President, University Corporation for Atmospheric Research Foundation. After graduating from the University of Colorado with a Ph.D. in physics in 1957, Dr. Mercure helped start the Ball Brothers Research Corporation, which later became Ball Aerospace and Technologies Corporation.
- **Mark H. Owen**, Brigadier General, USAF (ret). General Owen has 30 years of experience in the Department of Defense and Air Force, focusing on in-depth planning, programming, policy-making, and strategy development. General Owen graduated from the U.S. Air Force Academy and the University of New Mexico with undergraduate degrees in biochemistry and electrical engineering, respectively, has an MS in systems management from USC and in national security strategy from the National War College.
- **Merri Sanchez**, Senior Director for Space Exploration Systems, Sierra Nevada Corporation. Dr. Sanchez earned a BS in aerospace engineering from Texas A&M University as well as an MME in mechanical engineering and a Ph.D. in industrial engineering from the University of Houston.
- **George Sowers**, Vice President of Business Development, United Launch Alliance. Dr. Sowers is responsible for strategic planning, advanced technology development, advanced concept development, and new business acquisition efforts.
- **Scott Tibbitts** is the Founder of Starsys Research, which developed thermal actuator technology for the spacecraft industry. Mr. Tibbitts received a BS in Chemical Engineering from the University of Wisconsin. He holds three patents for spacecraft products and was the 1998 recipient of the "Esprit Entrepreneur of Distinction" award.
- **M. Scott Trimboli**, Director of the Center for Space Studies (CSS) within the National Institute of Science, Space, and Security Centers (NISSSC) at the University of Colorado at Colorado Springs (UCCS). Dr. Trimboli also serves as associate dean of the College of Engineering and Applied Science, where he directs master's degree programs in space operations, systems engineering, and engineering management.

We welcome visitors! Please feel free to contact us.



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