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Utah Science, Technology, and Research (USTAR)
Economic Development Initiative
Executive Summary

Representatives of the Utah business community are championing an economic development initiative that invests in the State’s research universities to create:

1. more technology-based start-up firms in Utah;
2. more high-paying job opportunities; and
3. more business activity in Utah with an associated expansion of the tax base.

Senate Bill 192 allocated funding to Utah State University and the University of Utah to hire research teams, acquire critical research equipment at the University of Utah, and develop an investment prospectus for USTAR. This is a summary of the investment prospectus.

Opportunity

The mapping of the human genome was announced in articles in Science and Nature magazines in April 2003, opening an age of discovery that may rival the voyages of 1492. Utah’s research universities were involved in this project from its inception and Utah scientists developed key technologies critical to the project’s success. As a result, Utah can claim scientific leadership in areas like gene manipulation, cellular processes, scientific instrumentation, information technologies, and bioengineering that will be the basis for billion dollar companies in areas like regenerative medicine, infectious disease treatments, bio-defense, and agriculture.

In addition, the involvement of the State’s research universities in the human genome project was the genesis of the Utah Population Database (UPD), which is built on merged medical records and The Church of Jesus Christ of Latter-day Saints’ genealogical records. This database is a tool for medical discovery that is unique in the world. It is the critical resource in the development of personalized medicine, which is already starting to revolutionize healthcare, medical diagnostics, and drug discovery. It is a resource that has the potential to foster companies in billion-dollar emerging industries and secure Utah’s economic future.

More than 180 Utah companies were founded on university technologies over the past twenty years, and over 120 are prospering in Utah, including major employers like Myriad Genetics, HyClone Laboratories, Sorenson Communications, NPS Pharmaceuticals, Watson Laboratories, and Evans and Sutherland. This history of success is evidence Utah State University and the University of Utah can successfully commercialize technologies that create new businesses and jobs that strengthen Utah’s economy. The objective of USTAR is to bolster Utah's research strengths and significantly increase technology commercialization to create many more high-caliber jobs throughout the state.

Proposed USTAR Investment

The proposed USTAR investment is:

1. *Innovation Teams.* $21 million in additional ongoing funding (for a total of $25 million per year) to hire 50 premier innovation teams at Utah State University and the University
of Utah over the next ten years. These innovation teams, which average 50 researchers and support personnel on each team, additionally require 10,000 gross square feet (6,500 net square feet) of laboratory space and advanced equipment, which will cost $5 million per team ($500 per square foot) in one-time funding. The detailed proposal suggests three options for financing these infrastructure costs, which are as necessary to the teams’ success as the base funding for start-up costs and salaries.

2. Business Innovation Outreach Program. $3 million is proposed to support a technology innovation outreach program with five offices located around the State to ensure all Utah businesses can access technology resources located at the research universities. This program will be fully integrated with the State’s business development infrastructure and will coordinate its information technology infrastructure with the Governor’s Office of Economic Development.

In addition to investment amounts, the proposal recommends a governing board for USTAR comprised of representatives appointed by the Legislature and Governor, key business community representatives, and university representatives. It is further suggested that this body appoint a national science advisory board to provide ongoing advice on emerging technologies and commercially viable areas for innovation investments. This governing board will report annually to the Legislature on the USTAR initiative’s economic development effectiveness.

**Expected Return on Investment**

An economic analysis completed by the Bureau of Economic and Business Research (BEBR) documents these economic returns for the USTAR initiative (see Appendix A for details).

- $4,990,818,201 in Federal and commercial contracts and grants generated by an investment of $25 million per year in research teams and $250 million in research infrastructure.
- The creation of 422 firms and 123,406 jobs over the thirty-year period the USTAR initiative will contribute to the expansion of the Utah economy.
- A cumulative increase of $66.6 billion in business activity as USTAR grows Utah’s economy.
- The net present value of taxes returned to the State in new tax revenues generated by USTAR after accounting for the costs of USTAR is $769,827,782. The cumulative new tax revenues generated over the 30 year investment period is $4.97 billion.

**USTAR Return on Investment**

<table>
<thead>
<tr>
<th>State Investment</th>
<th>$4.9 Billion New External Research Funds</th>
<th>422 New Companies</th>
<th>123,406 New Jobs paying $9.4 Billion annually</th>
<th>$5 Billion in new tax revenues for Utah</th>
</tr>
</thead>
<tbody>
<tr>
<td>$973 Million over 30 years</td>
<td>$4.9 Billion New External Research Funds</td>
<td>422 New Companies</td>
<td>123,406 New Jobs paying $9.4 Billion annually</td>
<td>$5 Billion in new tax revenues for Utah</td>
</tr>
</tbody>
</table>
The USTAR economic impact is initially driven by investments in the innovation teams hired by the research universities, but the most significant returns — jobs created, business activity, and tax funding generated — occur as businesses are formed and technologies are commercialized. The cycle of commercialization takes time to develop because innovation teams must be hired, technologies developed, and companies founded and grown. The ultimate impact on the Utah economy is decades of exponential growth in jobs, incomes, and taxes returned to the State.

**Summary**

The USTAR Economic Development Initiative leverages the proven success of Utah’s research universities in creating and commercializing innovative technologies. The proposed plan is a refinement of similar programs funded in 32 other states, which puts Utah in a position to pursue a more cost-effective investment by avoiding the mistakes made by other states. One aspect of the cost effectiveness of the USTAR proposal is its focus on core areas of technology where Utah has a competitive advantage and billion-dollar industries are going to emerge: personalized and regenerative medicine, genetically-linked cancer and neurological treatments, biotechnology applications for bio-defense, and microbial biotechnology.
## Appendix A. Total USTAR Economic Impact on Utah's Economy*

<table>
<thead>
<tr>
<th>Fiscal Year</th>
<th>State Funding</th>
<th>Universities Research Grants</th>
<th>USTAR Companies</th>
<th>Jobs</th>
<th>Employment Earnings</th>
<th>State Taxes</th>
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<tr>
<td>FY 06</td>
<td>$4,000,000</td>
<td>$0</td>
<td>0</td>
<td>232</td>
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<td>$25,000,000</td>
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<td>0</td>
<td>2,699</td>
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<td>FY 10</td>
<td>$26,530,200</td>
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<td>4</td>
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<td>3,906</td>
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<td>FY 12</td>
<td>$27,602,020</td>
<td>$55,214,481</td>
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<td>3,856</td>
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<td>FY 13</td>
<td>$28,154,060</td>
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<td>14,705</td>
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<td>FY 29</td>
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<td>FY 32</td>
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<td>FY 33</td>
<td>$41,835,453</td>
<td>$290,061,524</td>
<td>380</td>
<td>101,349</td>
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<td>FY 34</td>
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<tr>
<td>FY 35</td>
<td>$43,525,605</td>
<td>$307,726,266</td>
<td>422</td>
<td>123,406</td>
<td>$9,357,861,986</td>
<td>$748,783,531</td>
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<tr>
<td>Totals</td>
<td>$973,805,863</td>
<td>$4,990,818,201</td>
<td></td>
<td></td>
<td>$62,190,302,067</td>
<td>$4,979,386,931</td>
</tr>
</tbody>
</table>

| Present Value Tax Revenues | $1,498,809,905 |
| Present Value State Funding | -$455,051,639 |
| Present Value Infrastructure | -$273,930,484 |

Net Present Value New Tax Revenues from USTAR $769,827,782

Discount rate is 5.00%
Internal Rate of Return is 9.79%

* All analysis by the Bureau of Economic and Business Research, University of Utah, 2005. The complete economic impact study is included in the Economic Analysis section of the full report and at www.ustaredi.org.
October 18, 2005

Mr. Scott Anderson  
Dr. Dinesh Patel  
Mr. Frazier Bullock  
Mr. Jack Sunderlage  
Dr. Jack Brittain  
c/o P.O. Box 581016  
Salt Lake City, Utah 84158

Dear Sirs:

Thank you for the opportunity to have open access to materials, reports, analytical data, and individuals in confidential settings to examine and remark on the Utah Science, Technology and Research (USTAR) Initiative with regard to its fiscal, economic, and technological impact. I must commend the business, civic, and industry representatives throughout Utah that have taken the goals and mission of USTAR to heart and have been a powerful advocate for this necessary step in the State’s competitiveness. The winning recipe for any country, state, or region with whom we have been engaged has always included the civic stewardship evident in and around the USTAR agenda.

Over the past three weeks, I have had an opportunity to examine the good work of Jack Brittain and his team at the Bureau of Economic and Business Research (BEBR) in their endeavors to quantify the ‘return-on-investment’ from a state legislative appropriation towards the specific elements of the USTAR objective in targeted research and development. With minor calibration of the numbers to reflect additional resources sparked by the state appropriation, we believe that the BEBR impact numbers might actually be higher. Currently the conservative approach, and taken appropriately so, does not include the substantial impact derived by industry research and philanthropic support that will be attracted to USTAR’s targets of opportunity.

Thus, let me state unequivocally that, after our initial review of the USTAR return-on-investment analysis, and based on our work around similar projects in over 30 regions and communities throughout the U.S., executive branch and legislative interests are receiving an accurate assessment of the financial and fiscal outcomes from the intended resource allocation.

The state legislative appropriations will surely spark the necessary multiplier effect desired – for instance the ratios of dollar invested in the acquisition of research teams resulting in additional federal dollars from direct and indirect cost-recovery – it is, however, the leverage that will emerge in the next 24-36 months around these teams’ capacities to discover and develop in collaboration with industry, entrepreneurs and investors for a bench-to-market strategy. Therefore this spark will ignite a vital research investment from several non-state
sources – ensuring that future appropriations are limited and ever-bound to increased attention from beyond your own borders.

From a programmatic perspective, the USTAR initial focus on genomics and proteomics discoveries from the demographic population database is a critical national resource to address diseases and illnesses that have long-plagued Utah’s own citizens and the world’s people. The expected consequences from genomic and proteomic research discovery and development will have an immediate result for the National Cancer Institute, the Institute of Allergy and Infectious Diseases and ultimately on emerging neuro-science treatments. As Corporate Utah and businesses face annual health care cost increases of 18-22%, the role of population database will surely be attractive for increasing the quality of care while seeking to more effectively deliver care at a more affordable cost through prevention and early detection.

While USTAR’s attraction to the life sciences is obvious, the agenda has not settled on one target but rather a balanced portfolio of knowledge derived from both academic and industry sources. This portfolio includes the capacities of Utah’s long-standing role in software and information technologies, engineering, and a rich understanding of agricultural biology. These underlying capacities will, if further vested by state and federal grants and contracts, lead to vital interdisciplinary opportunities demanded by global industries in competitive markets worth billions of new products and services. As noted in our assessment and contribution of market-size analysis, USTAR has identified markets and products that – if captured in Utah – could lead to increased and sustainable employment for a wide range of the State’s citizens, and not just those in major urban centers.

While the impact report on wages and overall employment identifies these opportunities for Utah residents, the drill-down into occupations and job characteristics in the selected USTAR projects indicates a powerful result for a broader stakeholder group of employment – from high-school, community and technical colleges, four-year institutions, and post-doc graduate programs. This pathway for career development is a best principle metric from our examination of other states and regions in the U.S. and internationally. What Utah wants most from the USTAR experience is the continuous expansion of opportunities for the broadest range of occupations – not just those working in lab-coats but individuals contributing to the nearly 78 different roles in many mid-size technology-based firms and enterprises. The spill-over effect on engineering, computational, business, legal, marketing and regulatory affairs attracts individuals that will build the linkages between discovery, innovation and manufacturing-production.

I would be remiss in not suggesting that the USTAR agenda creates additional demand for a broader economic development program for Utah. In our discussions and review of the State’s economic development strategy, several elements are vital and uniquely contribute to the return-on-investment scenarios sought by the Legislature. To achieve these ROIs, it will be necessary to create the conditions and environment – what we term the innovation eco-system – to exploit and leverage knowledge with investments, technologists, and innovators seeking to build new companies as well as have globally-competitive firms remain on the cutting-edge of product development and refinement. In our work for the U.S. Council on Competitiveness, a
recent survey we conducted of 350 CEOs across the country suggested that innovation is the
practice of expanding existing product and service lines rather than wholesale new creative
product development. In its application to Utah and USTAR, these CEOs further suggest that
discovery must be organized in settings that foster accelerated delivery.

Therefore, I strongly encourage that the USTAR agenda be complemented by the investment in
a handful of strengthened programs under the guidance of the State economic development
initiative – including further resources for the Centers of Excellence, the soft-infrastructure

counsel and guidance of business centers that leverage the technological capacities of the
universities and research institutions to a wide geography of the State, and mechanisms for
attracting additional federal funds including SBIR (Small Business Innovation Research) grants
for proof-of-concept and early-stage product development. In our best practice analysis of the
50 states, those USTAR-like initiatives that have adopted side-by-side commercialization and
innovation elements have in turn produced results for attraction and retention, positioning their
states and regions with major industry research and development, and ultimately catalyzed a
sustainable model of entrepreneurial and venture capital reinvestment.

Finally, our assessment would not be complete without comment on the general nature of the
Utah mindset and competitive environment for innovation. The recent national identification of
Utah as a leader in entrepreneurial startups and growth indicates what many internally have
known – your state and its citizens have a long-tradition of risk-taking and dedication to hard-
work. While many states and regions talk about these qualities as a ‘commodity to be
exploited’, my sense is that these characteristics are vital to the demographic base of Utah and
thus are a competitive benchmark that must not be taken for granted.

In the late 1970s and 1980s, Utah became a hot-bed of software and information technologies
leading to companies such as WordPerfect, Pixar, Sarcos. One challenge that Utah continues to
face is the growth of these companies in-state versus relocation to either U.S. coast. Therefore,
resting on laurels is no way to create a continuous cycle of innovation for economic and societal
purposes – and thus I commend the Governor, Legislature, and the civic stewards to use their
leadership resources (time, reputation, then money) to ensure that a sustainable competitive
environment emerges from the initial $7 million seed investment into the larger USTAR agenda.
In turn, I encourage this same leadership base to identify ways to better communicate, market
and therefore position USTAR, the larger economic development initiatives, and the unique
Utah entrepreneurial culture to the broadest set of interests – and thus create the value position
answering why “you need to be present to win in Utah…”

Richard S. Seline
CEO and Principal
New Economy Strategies, LLC
Washington D.C.
About New Economy Strategies (NES): NES is a national consultancy and strategic implementation firm focused on answering the question ‘What do we do on Monday?’ NES works with community, academic, and entrepreneurial leadership to develop and implement strategies in support of innovation-focused regional development and technology-based economies. The firm has surveyed over 25,000 stakeholders across twenty communities, interviewed 3500 top leaders from academia-industry-government-philanthropy, and engaged over 500 individuals in six national forums around commercialization, investment, and capacity building throughout the innovation process.

Seven staff members based in Washington, D.C with a national board of advisors from civic stewards to former federal officials guides NES in its breakthrough approach to implementation. Through some 30 engagements at the international, national, and regional levels, NES has become widely regarded for its approach to leverage technology assets with capital, workforce, and infrastructure to create sustainable economic and societal benefit. NES has assisted in organizing over $300 million in federal, state, local, industry and philanthropic resources to address immediate demands and long-term plans for ensuring the sustainability of the engagement process beyond the initial analyze-prioritize-target steps.

The CEO and Founder of NES is the former Deputy Assistant Secretary of the U.S. Department of Commerce for Economic Development, the former Special Assistant to the President of the University of Texas M.D. Andersen Cancer Center, and a participant in several national boards and organizations including the U.S. Council on Competitiveness’ National Innovation Initiative, the Association of University Technology Manager’s New Metrics and Performance Working Group, senior advisor to American Society of Mechanical Engineers’ Institute for Engineering Innovation and Entrepreneurship, and co-founder of the National Institute for Strategic Technology Acquisition and Commercialization focused on rural economies and technology. For more information, review www.new-econ.com, www.bioeconomies.com, and www.bioeconomy.org.
University Science, Technology and Research (USTAR)
Economic Development Initiative

Summary Proposal

1) State Advisory Board

Establish a State Advisory Board for USTAR with oversight responsibility for the implementation of the USTAR Economic Development Initiative and for generating an annual report documenting USTAR’s effectiveness in meeting its economic development objectives. This State Advisory Board will consist of business community representatives selected by the Speaker’s Office, the Senate President’s Office, Governor’s Office of Economic Development, two business community representatives chosen by the research university presidents, and representatives from the commercialization offices at Utah State University and the University of Utah. It is recommended $25,000 in ongoing funding be allocated to the Bureau of Economic and Business Research at the University of Utah to gather annual USTAR performance data for this Board.

One function of the State Advisory Board is to recruit a national science advisory board made up of individuals who can provide guidance on emerging areas of science, evaluate the potential for translational research in key USTAR areas, and suggest areas of potential focus for USTAR’s commercialization efforts.

2) Research Funding

$21 million in new ongoing funding (in addition to the $4 million allocated in FY06) to enable the University of Utah and Utah State University to hire innovation teams in areas where there is a high potential to commercialize technologies. This $25 million per year will be used to bring 5 innovation teams per year to Utah, two at Utah State University ($10 million per year) and three to the University of Utah ($15 million per year). The University of Utah will eventually hire 30 innovation teams with this funding and Utah State will hire 20. Once the teams are hired, the continuing funding will be used to pay the portion of salary that federal grants will not, about 25% of the total personnel costs for a fully developed team averaging 50 individuals.

$25 million a year over ten years to fund the laboratory infrastructure needed to house the USTAR innovation teams. Averaging 50 individuals per innovation team, there will be 1,500 new lab members at the University of Utah and 1,000 at Utah State University once the USTAR Initiative is fully implemented. The average team will require 10,000 gross square feet (6,500 net square feet) for its lab/center, which means Utah State University will need 200,000 square feet of new laboratories and the University of Utah will need 300,000 square feet to house the USTAR teams.

Three funding options are proposed for this infrastructure:

i. Fully fund the facilities starting in FY07 with a schedule for building over six years. This is a traditional building plan option. It is suggested that $4 million in FY06 funds be allocated so the initial planning can begin this fiscal year.
ii. Link the infrastructure funding to specific innovation teams, providing the infrastructure funding as ongoing funding over ten years. This approach maintains the universities accountability for hiring while at the same time providing the institutions with the flexibility to pursue options in addition to research buildings (e.g., additions, remodeling) to maximize the effectiveness of the infrastructure development. It is suggested the universities partner with business and the State’s financial advisor to develop a financing plan for this option using tax credits.

iii. Fund “infrastructure” for research using a mix of one-time and ongoing funding. Under this funding model, the amount of funding is equivalent to the other requests, but this approach allows the financing to stretch over time, which allows the new tax revenues to be realized as the infrastructure is paid off. This approach also has the advantage of giving the institutions the flexibility to accommodate the USTAR teams in a variety of ways (remodeling, new construction, lease-buy arrangements, etc.).

3) Innovation Outreach Centers

$3 million per year in ongoing funding to support a statewide network of innovation outreach centers. These centers are complementary to the Office of Economic Development’s business resource centers and provide a mechanism for existing Utah businesses to access the advisory and research capabilities of the research universities. The $3 million per year will support at least five outreach centers around the State. It is suggested these funds come under the management of the Commissioner of Higher Education to ensure they are deployed in a manner consistent with other economic development initiatives proposed by the Utah System of Higher Education.

Supplemental Recommendations

In the course of studying the commercialization process while developing the USTAR proposal, the various teams developed recommendations for programs that will greatly enhance the likelihood that the USTAR Initiative will succeed. Three programs dealing with the commercialization of technologies are of particular note, one that suggests funding to encourage the formation of early stage capital in Utah, a second that suggests enhancing the Centers of Excellence Program with enhanced funding and by eliminating the current 2:1 match requirement and a third that suggests programmatic support to help Utah firms participate more broadly in the Federal Small Business Innovation Research (SBIR) grants program.

1) $3 million per year in ongoing funding to support start-ups based on university technologies. It is recommended this funding provide matching financing to start-ups vetted by private equity and other angel financing entities, that the maximum match for any company be capped at $250,000, and that these funds come under the management of the University Venture Fund, a 501(c)3 non-profit affiliated with the University of Utah’s David Eccles School of Business. The purpose of this program is to incentivize private sector financing of early stage companies and to use financing solutions to assist these companies in acquiring incubation space, licensing
technology, and assembling management teams rather than funding State programs, i.e., this approach gives start-up companies the resources to acquire necessary services and licenses via market transactions. It is suggested accountability for the deployment of these funds rest with the USTAR State Advisory Board.

2) Enhance Centers of Excellence funding so start-ups have the resources needed to launch out of the universities’ laboratories. It is further suggested the Legislature remove the current 2:1 match requirement so the technology teams are focused on commercialization rather than research deliverables and writing additional research grants to cover future match requirements. Centers of Excellence funding is part of the Governor’s Office of Economic Development funding proposal. The USTAR planning process has identified this program, with the changes suggested to improve effectiveness, as critical to the future success of the USTAR effort.

3) Small Business Innovation Research grants are a Federal program that supports innovation by small business and can be an important contribution of early-stage capital for technology-based start-ups. SBIR grants are only available to small businesses, but these firms frequently do not have the expertise to write grants and to do all the tracking and research necessary to identify opportunities. The Governor’s Office of Economic Development is recommending the creation of a SBIR support program. The USTAR commercialization assessment study has identified this program as a key addition to the State’s programs to support the commercialization of technologies.
Planning Process Summary

The Utah Science, Technology and Research (USTAR) Economic Development Initiative planning process was completed with contributions from 119 individuals representing 49 different companies, government agencies, industry associations, and universities. The extensive background research and data gathering was done by task teams that completed studies of research university economic development programs in other states, evaluated the commercialization histories of Utah’s research universities, evaluated Utah’s potential economic clusters, and evaluated technology outreach programs around the country. The findings of these task teams were reviewed at multiple meetings by a broad cross-section of the business, financial, and entrepreneurship support program communities. It was through this review process that the report’s recommendations emerged and were refined.

The planning process was guided by an Executive Committee that put tremendous effort into ensuring the work of the task teams was thorough and the recommendations were honed by spirited debate. The Executive Committee members are:

- Scott Anderson, Zion’s Bank and Economic Development Corporation of Utah
- Lane Beattie, Salt Lake Chamber of Commerce
- Jack Brittain, University of Utah (Co-Chair)
- Fraser Bullock, Sorenson Capital (Co-Chair)
- Lorris Betz, University of Utah Health Sciences
- Martin Frey, Governor’s Office of Economic Development
- Brent Miller, Utah State University
- Richard Nelson, Utah Information Technology Association

As the preliminary research work was completed, a variety of groups around the State gathered to learn about the USTAR Initiative and to share their thoughts on what was proposed and what Utah’s economic development needs are. The following groups gave valuable feedback:

- Economic Development Corporation of Utah
- Cache Valley business leaders
- Murray Chamber of Commerce
- Utah Technology Industry Association Board
- Utah Technology Forum
- Council of Presidents, Utah System of Higher Education
- Orem-Provo Chamber of Commerce Government Relations Committee
- Orem-Provo Chamber of Commerce
- Ogden Chamber of Commerce
- Utah Board of Regents
In addition to these organized groups, many business leaders around the State have expressed an interest in the USTAR Initiative and taken the time to talk to those involved with the planning process about their hopes for Utah’s future. This culminated in the Salt Lake Chamber of Commerce’s Technology Forum on October 11 that drew over 200 participants for presentations and a panel discussion.

The contributions of all those involved were critical to an effort that was completed prior to the original commitment of November and within budget. All the contributors are listed on the pages that follow this summary. All documents generated by the planning process are available electronically on the web at www.ustaredi.org. A special thanks is owed to Kathy Hajeb, Teresa Wright, and Launa Turnbow in the Technology Venture Development Office at the University of Utah. They coordinated dozens of meetings, handled all the document preparation, and managed to keep a sense of humor through the entire project while still handling their full-time responsibilities.
Contributors to the USTAR Study

Oren Phillips  ATK Thiokol
Guy Letendre  Autoliv, VP Engineering
Rod Linton  Battelle & Utah Technology Industry Council
Lynn Astle  Brigham Young University
Gary Hooper  Brigham Young University
Ned Hill  Brigham Young University, Marriott Business School
Steve Mecham  Callister Nebeker & McCullough
Lou Callister  Callister Nebeker & McCullough
Paul Campbell  Campbell Scientific
Suzanne Winters  Canyon Concepts LLC
Lane Beattie  Chamber of Commerce
Jack Sunderlage  ContentWatch/ UITA/ UTIC
Jeff Edwards  Economic Development Corporation of Utah
Dick Bradford  Governors Office of Economic Development
Martin Frey  Governors Office of Economic Development
Linda Muir  Governors Office of Economic Development
Nicole Toomey-Davis  Governors Office of Economic Development
Greg Jones  Governors Office of Economic Development
AK Khandkar  Governors Science Advisory Council
Kirk Ririe  Idaho Technology
Bill Champion  Kennecott - President
Troy D'Ambrosio  Lassonde New Venture Development Center
Dianne Walker  Launch Pad
Linda Archibald  Miller Business Innovation Center
Glen Hawkins  Moog Aircraft Group
Lori Nielson  Moog Aircraft Group
Brent Lawrence  Mountain America Credit Union
Terry Holmes  NanoCoat, Inc.
Paul Clayson  NanoCoat, Inc.
Dave Bailey  RappidMapper, Inc.
James Jensen  RappidMapper, Inc.
Contributors to the USTAR Study

Michael Degroote       Salt Lake Chamber of Commerce
Robin Riggs            Salt Lake Chamber of Commerce
Heidi Ballif           Salt Lake Chamber of Commerce
Landon Huber           Salt Lake Chamber of Commerce
Steve Jacobsen         Sarcos
Richard Koen           Sentrx Surgical, Inc.
Jerry Atkin            Skywest - President
Rudy Ortiz             SLCC/ Salt Lake Regional Small Business Development Center
Cheryl Snapper Conner  Snapp Norris Group
Jeremy Kartchner       Snapp Norris Group
Fraser Bullock         Sorenson Capital
Bill Shaw               SP Communications
Rex Spendlove          Spendlove Research Foundation
Bruce Law              Sprout Marketing
Peter Leeman           Sprout Marketing
Rick Mandahl           The Brain Institute
LaVarr Webb            The Exoro Group
Jim Henderson          U.S. Small Business Administration, Office of Advocacy
Lorris Betz            University of Utah
Fred Esplin            University of Utah
Kevin Huber            University of Utah
Jun Lu                 University of Utah
Arindam Sarkar         University of Utah
Scott Wiscombe         University of Utah
Mark Woodland          University of Utah
President Michael Young University of Utah
Dave Pershing          University of Utah
Ray Gesteland          University of Utah Vice President of Research
Tresha Kramer          University of Utah, David Eccles School of Business
William Hesterly       University of Utah, David Eccles School of Business
Tom Parks              University of Utah, Neurobiology & Anatomy
Leonard Black          University of Utah, UTec
Contributors to the USTAR Study

Jan Crispin-Little University of Utah/ BEBR
Jim Wood University of Utah/ BEBR
Dan Hannon University of Utah/ Center for Public Policy
Janice Houston University of Utah/ Center for Public Policy
Trisha Jack University of Utah/ Center for Public Policy
Levi Pace University of Utah/ Center for Public Policy
Dave Patton University of Utah/ Center for Public Policy
Jordan Robertson University of Utah/ Center for Public Policy
Angie Stefaniak University of Utah/ Center for Public Policy
Owen Tenby University of Utah/ Center for Public Policy
Anthony Morgan University of Utah/ College of Education
Richard Brown University of Utah/ College of Engineering
Doug Christensen University of Utah/ College of Engineering
Chris Johnson University of Utah/ College of Engineering
Rick Rabbitt University of Utah/ College of Engineering
Patrick Tresco University of Utah/ College of Engineering
Nancy Lyon University of Utah/ Government Relations
Kim Wirthlin University of Utah/ Government Relations
Kaye Clark University of Utah/ Government Relations
Brian Cummings University of Utah/ Technology Commercialization Office
Jack Brittain University of Utah/ Technology Venture Development
Launa Turnbow University of Utah/ Technology Venture Development
Kathy Hajeb University of Utah/ Technology Venture Development
Ted McAleer University of Utah/ Technology Venture Development
Teresa Wright University of Utah/ Technology Venture Development
Brent Brown University of Utah/Technology Commercialization Office
Richard Nelson Utah Information Technologies Association (UITA)
Jenny Young Utah Information Technologies Association (UITA)
Stan Albrecht Utah State University
John Devilbiss Utah State University
Anne McEntire Utah State University
M. Scott Mietchen Utah State University
Contributors to the USTAR Study

Brent Miller Utah State University
Lorraine Walker Utah State University
Trent Kemp Utah State University
Ann Aust Utah State University
Lee Burke Utah State University
Noelle Cockett Utah State University
Steve Kubisen Utah State University/Technology Commercialization Office
Henry Nowak Utah State University/Technology Commercialization Office
David Doty Utah System of Higher Education
Richard Kendall Utah Systems of Higher Education (USHE)
Stan Lockhart Utah Technology Industry Council Micron Technology, Inc
John Sutherland Utah Technology Industry Council/ Cemaphore Systems
Utah Technology Industry Council/ GenData Research
Michael Paul Corporation
Curtis Brunson Utah Technology Industry Council/ LC Communications
Monte Evans Utah Technology Industry Council/ Riverton City
Brian Moss Utah Technology Industry Council/ Utah Life Sciences Association
Utah Technology Industry Council/ Utah Manufacturers Association
Tom Bingham
Mike Levinthal VC Community
Paul Ahlstrom vSpring Capital
Dinesh Patel vSpring Capital
Brad Bertoch Wayne Brown Institute
Scott Anderson Zions Bank
Meg Holbrook Zions Bank
Alison Weyher Zions Bank
USTAR Economic Development Initiative
Planning Proposal

The objective of the planning process is to develop a prospectus for the Utah Science, Technology and Research (USTAR) Economic Development Initiative that includes:

- An investment strategy for Utah targeting economic development opportunities based on innovations created by the state’s research universities.
- An implementation plan for turning the innovations generated by Utah’s universities into competitive advantages for existing Utah companies and new industries that will fuel future economic growth.
- An analysis of Utah’s return on this investment in science, technology and research, including the funding dollars generated over time by the research teams, new employment, new economic activity, and increased tax revenues.

Participants
The proposed process invites broad participation from the business and technology communities, new venture financing firms, government, the Utah System of Higher Education (USHE), organizations that facilitate entrepreneurship, and the State’s leading experts on economic development. By inviting participation, the process ensures the proposed investment is supported by all the constituencies who will play a role in its success. The participation of many community representatives also establishes a practice of accountability that will be maintained as this initiative is implemented.

Process
The process begins with a review of this plan by the Legislature’s Executive Appropriations Committee. Subsequently, the work will be done concurrently to ensure the planning process is completed in a timely manner. The overall planning process is diagrammed in Figure I (USTAR Project Plan), which is attached. The plan includes the following specific activities and time frames:

1. **Executive Appropriations Committee Review** (April). Comment is invited prior to the Committee’s meeting on April 19. This review will fine tune the planning process to ensure the detailed analyses required by the Legislature before fully funding the USTAR Economic Development Initiative are completed.

2. **Formation of the Planning Oversight Team** (late April). The planning process is coordinated by this team, which has representatives from each of the project teams and key community leaders. The Planning Oversight Team will compile periodic reports tracking the progress of the planning effort and will be responsible for overall project management. All the project teams will report to this team. The Utah Bureau of Economic and Business Research (BEBR) will provide administrative support for the team, including all accounting and reporting.

3. **Research and Analysis Team**. The research and analysis team will supervise three projects. The data from these projects will be used to define promising research investments that benefit current Utah businesses and foster the creation
of new industries in Utah. This supervising team will integrate the results of the industry cluster analysis and innovation opportunity analysis (see details below) to ensure there is a defined plan for research investments that links with economic development opportunities. This team will also complete a policy analysis comparing innovation investment programs in other Western states and documenting opportunities and pitfalls associated with these programs.

a. **Industry Cluster Analysis** (April to August). This project team will document areas where Utah currently has technology companies with comparative competitive advantages. This project team will work closely with industry associations like the Utah Information Technology Association (UITA) and Utah Life Sciences Association (ULSA), the Technology Industry Council, and chambers of commerce to define areas of research that support the growth of existing Utah businesses.

b. **Innovation Opportunity Analysis** (April to August). Simultaneously, the University of Utah and Utah State University will develop plans for leveraging current intellectual assets and building research teams focused on emerging technologies.

c. **Comparative Policy Analysis** (May to October). This team will conduct research on the major initiatives in other states. The team will develop comparative benchmarks detailing accountability programs, program development processes, and compile case studies of successful and unsuccessful commercialization programs.

4. **Infrastructure Master Planning** (May to August). Additional laboratory infrastructure is necessary to house the research clusters funded by the USTAR Economic Development Initiative. Space planning is needed to define the activities that will be generated by the focused research clusters, plan for the equipment and facilities necessary to support these clusters, and develop cost estimates for purchasing and installing this scientific infrastructure.

5. **Technology Commercialization Planning** (May to August). Two aspects of commercialization will be studied by this planning team: (1) current and best commercialization practices by the research universities; and (2) outreach efforts through the Technology Innovation Centers that extend access to commercialization and innovation support to the business communities throughout the state. The Technology Innovation Centers are intended to create a technology commercialization backbone for the state, encouraging companies around the state to take advantage of the technologies developed by the research universities and feeding technology application opportunities to the research universities. This planning process will include broad participation by all the constituents involved in the planning process.

6. **Economic Impact Analysis** (August to November). As key pieces of analysis are completed, an overall investment prospectus will be developed for presentation to the Executive Appropriations Committee in November. This effort will be led by the Planning Oversight Team and supported by the Bureau of Economic and Business Research.
7. **External Research Validation** (April to June and September to November). This will involve soliciting an external consulting firm to validate the basic economic assumptions at the outset of the project, review the completed economic and industry analyses, and provide a critical review before the project is finalized. If possible, the consulting firm will also participate in the public dissemination of the planning results.

8. **USTAR Economic Development Initiative Conferences** (September to October). The planning process will include hosting multiple constituency discussion conferences in key spots around the state to review initial recommendations and encourage public comment. The Planning Oversight Team will determine how many of these conferences will be held and what the format will be.

9. **Executive Appropriations Committee Review** (November). The Executive Appropriations Committee will be updated periodically throughout the planning process and will review a draft report before the November meeting.

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**Budget**

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### Figure I. USTAR Economic Development Initiative Project Plan

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<th>1 &amp; 9. Executive Appropriations Review</th>
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<tbody>
<tr>
<td>2. Planning Oversight Team Formed</td>
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<td>3 a&amp;b. Research and Analysis Team-Cluster Definition</td>
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<td>3 c. Comparative Policy Analysis</td>
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<td>4. Infrastructure Planning</td>
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<td>5. Technology Commercialization Plan</td>
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<td>6. Economic Impact Analysis</td>
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<td>7. External Research Validation</td>
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<td>8. USTAR Review Conferences</td>
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<table>
<thead>
<tr>
<th>April</th>
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<th>July</th>
<th>August</th>
<th>September</th>
<th>October</th>
<th>November</th>
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Plan  
Actual
The Scientific Computing and Imaging Institute (SCI Institute) is one of the permanent research institutes at the University of Utah. The Scientific Computing and Imaging Institute has established itself as a leader in engineering and research in the areas of scientific computing, scientific visualization, and imaging. The overarching research goal of the SCI Institute is to create new scientific computing techniques, tools, and systems with which to solve problems affecting various aspects of human life.

Photo: Neurological Bioelectric fields

Photo: Simulated Tornado Dataset

Photo: 2d model of cat sciatic nerve

Photo: BioTensor/Tensorlines and superquadric glyphs

Photo: l³ Stick and Fakespace Pinch glove to manipulate a dataset in SCIRun/BioPSE

School of Computing at the University of Utah research can be grouped into seven broad areas, though many individual research groups do work spanning multiple areas.

- **Graphics and visualization**: Modeling, CAD/CAM, rendering, scientific visualization.
- **Virtual Environments**: Novel systems allowing manipulation of virtual objects, locomotion through virtual worlds, and basic perceptual investigations.
- **Systems and programming languages**: Operating systems, parallel distributed systems, programming languages, compilers, security, networks, software engineering.
- **Architecture**: VLSI, and verification methods Innovative memory and communication architectures, asynchronous circuits and systems, formal verification of computing systems.
- **Scientific computation**: Methods for solving and visualizing large-scale scientific problems.
- **Robotics**: Artificial Intelligence Natural language processing and Computer Vision.
- **Educational software environments**: Applications of computing, communications, and connectivity to education.

**Nanotechnology:**

In 2000 the semiconductor industry began producing "nanochips"--chips with the ability to measure less than 100 nanometers (roughly one thousandth the thickness of a human hair). Significant gains have accrued from several new forms of technology, including improved materials and methods to correct for distortions that occur from optical diffraction when patterning the chips.
Images reflect current work from the University of Utah, SCI Institute, Brain Institute and various Microbe Biotechnology programs at Utah State University.