



EXECUTIVE BRIEFING

Auto-ID Center of 2003

Steps Towards Delivering the Future

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ABSTRACT

The Auto-ID Center (the Center) is quickly entering its next generation, and is simultaneously facing the challenges of cross industry adoption, commercialization and globalization, while still engaged with a full research agenda. A Future Committee has been established to study these needs and provide recommendations for means to address them. In a series of meetings, the Future Committee, in conjunction with representatives from MIT's senior administration, determined that the EAN.UCC appears to be a natural partner for advancing the Center globally into the commercial world. In recognition of their contributions to the Center, existing Center members, which have been an invaluable resource thus far, should receive favorable treatment as the Center goes forward to facilitate implementation of the Center-developed technology and system.

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Biographies



Carol T. Carr
OSP Counsel

Carol received her law degree from University of Richmond T.C. Williams School of Law and since then has worked her interest in science into her professional life as a Patent Examiner in the USPTO, a Patent Attorney and Director of Technology Transfer at Georgetown University. In 1999, she joined MIT as the in-house counsel for the Office of Sponsored Programs where she provides legal counsel to the Office of Sponsored Programs and is a member of the OSP Industrial Agreements Team. Carol has been involved with the Auto-ID Center from its beginning and continues to participate in its activities and to provide an interface between the Center and the MIT administration.

Stephen A. Brown

Stephen A. Brown is Senior Vice President & General Counsel of the Uniform Code Council, Inc. (UCC). He has been involved with the UCC since its formation in 1971, and is the author of **Revolution at the Checkout Counter**, a history of the development of the U.P.C. He has served as Secretary to the Auto-ID Center Board of Overseers since its inception.

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1. BACKGROUND OF FUTURE COMMITTEE

At the June, 2001 Board of Overseers Meeting, Kevin Ashton raised the issue of the Center's future, and a "Future Committee" was established. The Committee's first meeting was held in October 2001 in Atlanta, where it was agreed that research into strategies for future growth and evolution of the Center should be conducted.

At the February 7, 2002 Board of Overseers Meeting in Palo Alto, CA, Kevin Ashton presented an Executive Briefing entitled **The Auto-ID Center from 2001–3: Delivering the Future**. This document recounted the history of the Center from its creation on October 1, 1999 to the present time, and made clear that, with the Center's expansion to Europe, its steady increase in members, and the initial successes of the Field Tests, the future of the Center is close at hand and concrete steps must be taken to enable its delivery.

In 2002, the Future Committee was expanded to study the needs of this implementation and included Board representatives from the following companies and institutions: Alien, Gillette, Invensys, Johnson & Johnson, Kimberly-Clark, Procter & Gamble, Sun Microsystems, Unilever, Walmart, Westvaco, UCC and MIT, including Sanjay Sarma and Kevin Ashton.

2. ACTIVITIES OF THE FUTURE COMMITTEE AND THE SUB-TEAM

On April 17, 2002, the Future Committee met in Boston, MA hosted by Gillette under the direction of the Center. There was considerable discussion regarding the future expectations of the members. It was recognized that the Center now needs to conceptualize and establish the form of a new entity that will be responsible for managing the implementation of the technology in the commercial world. It was recognized that the UCC and EAN have been important participants in the activities of the Center and have expressed their interest in working collaboratively with the Future Committee and the Center in establishing and/or managing the new entity, that they have a thirty-year history of providing infrastructure for establishment and implementation of industry standards, and that their expertise, coupled with the research capabilities of MIT, could be an advantageous collaboration towards the success of the future implementation. The point was further made that, moving forward, the UCC and the EAN stand as one united entity, and any future reference to the UCC or the EAN should be interpreted to mean the EAN.UCC.

It was also recognized that MIT's principal areas of interest include future research to be performed by the Center that will continue to build on Center-developed technology owned by MIT and transfer of Center-developed technology to the public, primarily by licensing the technology.

When the breadth of the issues was realized, creation of a Sub-Team charged with taking the next steps was proposed. This Sub-Team included:

- Dirk Heyman (Sun, representing the Technology Board)
- Dick Cantwell (Gillette, representing the Board of Overseers)
- Steve Brown (UCC)
- Mike DiYeso (UCC)
- Kevin Ashton
- Sanjay Sarma
- Carol Carr (MIT)
- Tom Henneberry (MIT)

On April 30, 2002, the Sub-Team met and focused on the respective strengths and capabilities of the EAN.UCC and the Center and what elements of the Center need to be “spun off” at this time to a new organization that will relieve the Center of its non-research activities and begin implementing the technology into the commercial world.

The Sub-Team identified the following skills, expertise and capabilities to transfer this system to the commercial world:

- **The EAN.UCC:** consistent with its core competencies, number distribution administration; standards development; certification processes; market development and a marketing organization; education and implementation (support) services; management of intellectual property and other legal issues; global registry and data synchronization; and interface with other standards organizations, and the ability to raise funds in support of perceived needs for on-going basic research.
- **MIT:** with sufficient continued funding of the existing Auto-ID Centers, ongoing basic research leading towards creation and innovation and further development of open standards and technology; primary graduate and undergraduate education of students; access to the existing and future Auto-ID technology through licenses and other deployment activities; and an interface with other research institutions as well as a conduit for them to contribute to research in the RFID area.

The Sub-Team agreed to prepare a Position Paper for presentation at the June 2002 Board Meetings in Cambridge, UK and on June 4 and 5, 2002, the Position Paper was presented to the Board of Overseers and Technology Board, respectively.

Discussions then commenced between EAN.UCC and MIT with all necessary negotiating parties present. On June 25, 2002 Mike DiYeso made a presentation of EAN.UCC’s interests and capabilities to representatives of MIT’s Office of Sponsored Programs (OSP) and Technology Licensing Office (TLO). At the end of the meeting, EAN.UCC was seen as a viable partner by MIT’s TLO for implementation of the Center’s technology and, subject to the recommendation of the Future Committee, would be invited to commence negotiations with MIT once the form of the entity that would be responsible for the future work to be assumed by the EAN.UCC under this collaboration was identified. The MIT OSP and TLO are prepared to negotiate appropriate contracts, i.e., a research agreement, license agreement, or any other agreement, as needed.

On July 29, 2002, the Sub-Team met to discuss the needs of the Center and how they could be addressed by the EAN.UCC, and the form of the entity the EAN.UCC would use to address these needs. Section 4 below contains a summary of the consensus reached by the group that, in the opinion of the EAN.UCC and MIT, would provide a workable model for the next stage, assuming that the necessary agreements are negotiated.

3. FUTURE RESEARCH AGENDA

The future needs of the Auto-ID Center at MIT relate primarily to its ability to continue to perform research to advance the technology that has been developed thus far by the Center.

The research strategy for the next years can be described as follows:

Years 1–3

As the systems are deployed in the supply chain, immediate implementation challenges will emerge which will need to be addressed rapidly. A research “swat team” will be needed to address these challenges with the same purity and systemic view that went into the rest of the system. Patchwork solutions will

surely vitiate the system and compromise interoperability in the future. Interoperability is a delicate balance that we must carefully preserve in coming years, so that later researchers will be able to continue to plug in newer and better solutions.

Years 3+

Being at the cusp of a new direction in computation and information management, the applications of Auto-ID technology will likely go far beyond retail and CPG. This expansion will be of general benefit: the greater the number of users, the more research and creativity which will be directed at it; and the greater the volumes, the lower costs will be driven. We will need to embrace and encourage these new directions of research so that new applications can continue to be built on our platform.

A number of areas that will benefit from further research in coming years are:

- **Tag anti-collision:** although tag anti-collision has been studied for over a decade, there is little by way of scholarly understanding of the different trade-offs between Aloha and tree-walking protocols. The trade-offs that need particular attention are those pertaining to inter-reader jamming and collision and the performance of the protocol in the face of asymmetric bandwidths and different noise characteristics.
- **Reader anti-collision:** reader collision will likely be a critical and fundamental problem in wide-spread RFID deployment. To date the Center is the only source of research on the topic. An anti-collision scheme called Colorwave is being developed at the Center. A scheme like Colorwave will likely be a central part of reader development and reader management. Reader collision, combined with antenna multiplexing and field agitation, will likely be the most beneficial areas of research in the extraction of performance from RFID in the future.
- **Security and privacy:** as RFID becomes widespread in use, and as more individuals use the system for personal applications, security and privacy will become increasingly important requirements on RFID systems. The implications of new security and privacy algorithms on tags will be increased cost unless research in these areas remains close to the Center and carefully organized.
- **Advanced sensor networks:** the RFID systems the Center has developed will be able to grow seamlessly into sensor applications. Sensors can be placed on the tags themselves, in the form of Class III and Class IV tags, and on the readers. These developments are currently underway, and will need to be carefully coordinated with research in other areas like security and reader collision.
- **Data routing and handling:** the massive amounts of data under collection from the reader network will need to be handled and fused carefully. The Savant™ platform has been designed for this purpose. In the coming years, there will be an increased requirement for edge-computing and flexible data routing. The Savant™ has been designed to adopt new strategies as they become available. New security paradigms will need to be incorporated as we move from the current retail-oriented software to more general and diffuse applications.
- **IC Design:** there are flourishing research communities in the areas of IC design, electronic design assistance (EDA), circuit verification, low-power circuit design, and advanced RF circuit design which have not entered the RFID area in a formal way. It will be necessary to draw these communities into our research to enable more functionality like sensing and security on the chips. Several new ideas like silicon-on-insulator and strained-silicon await exploration.

- **Tag manufacturing:** one of the contributions of the Center has been the adoption of new manufacturing technologies in RFID. Advances in IC manufacturing, ranging from silicon fabrication to packaging and testing, will remain a cornerstone in the further reduction of RFID cost. The state-of-the art in industry, combined with new manufacturing ideas developed in research labs, will likely enable the next quantum drop in IC cost.
- **Assembly:** new developments ongoing at the Center, such as vibratory assembly and in-roll assembly, provide further hope for reducing total tag cost. The incorporation of these ideas into roll-to-toll paper manufacturing offers exciting new industrial opportunities such as smart paper and even smart stamps and smart cash.
- **Polymers:** conducting polymers are probably the ultimate target for low-cost RFID manufacturing as envisioned today. It is conceivable that polymer RFID can be printed on an inkjet printer on a personalized basis. The Center has engaged the conducting polymer communities in recent months, and would like to start a concerted research project in the area.
- **Controls/automation:** RFID systems have many applications in controls and manufacturing, and new technologies like holonic systems, control recipes, self-organized factories and object-oriented control are great applications of RFID possibilities in some of these areas.
- **Manufacturing systems:** RFID systems may revolutionize not only manufacturing automation, but also lean manufacturing and system scheduling. Kan-ban systems, for example, will benefit a great deal from RFID.
- **Supply chain issues:** the Center has only scratched the surface on supply chain applications of RFID. The great benefits of RFID, not only in improving current practices, but also for new business practices, await research and offer a multitude of exciting potential.

4. FUTURE STRUCTURE

4.1. New Entity

The Sub-Team proposes that the on-going responsibility for the management and implementation of the work of the Auto-ID Center be vested in a new, non-profit, tax-exempt corporation to be called “Auto-ID Center, Inc.”, which will be a wholly owned subsidiary of the Uniform Code Council. At least initially, the new organization will be located in Cambridge, MA to leverage the MIT relationship and existing personnel.

Auto-ID Center Inc. would be responsible for:

- Administration of the system;
- Commercialization and implementation of the EPC™ system;
- Marketing and promotion of the system;
- Management of the development of technology solutions;
- Management of the relationship with MIT;
- Management of IP and contracts with contributing entities;
- Preparation and securing of grants and government funding;
- Operation of Global Object Name Servers;
- Creation and management of the Auto-ID standards;

- User support (including management of number assignment, registration and licensing systems, and education, help, information);
- Vendor Support (including supply of licenses, specifications, compliance tests and certification, developer forums);
- Market Development (including administration of symposia, other events, licensing of publications, public relations, web site); and
- Other tasks as required.

The new organization, its Board of Directors, and MIT, will also have the joint responsibility for developing metrics by which to evaluate the success or failure of the program in general, and of the new organization in particular.

The University Auto-ID Centers (currently MIT (HQ), Cambridge and Adelaide), under the direction of MIT, would have the following roles:

- Advanced research into Automatic Identification and related technologies;
- System improvement proposals;
- Leadership of system development communities;
- Contribution to policy development, including self-regulation policy;
- Raising national government funding from the start of 2003; and
- Raising private research funding from the start of 2004.

Auto-ID Center, Inc. would have its own dedicated staff, headed by a top executive capable of leading this exciting project. However, as a UCC subsidiary it could lower its administrative costs by sharing common services such as accounting, legal, etc. with the UCC. To support the Cambridge, MA HQ office and ensure global coverage, Auto-ID Center, Inc. will be tasked with developing as soon as possible a globalization plan to accommodate short term goals required for immediate implementation of the existing technology in key markets and long term goals of global coverage.

The revenue model for Auto-ID Center, Inc. has yet to be determined. Presumptively, it would be based upon an annual fee for licensing EPC™ numbers. The revenue model must be robust enough to support marketing and administration of the system, on-going research at MIT and other universities, and whatever costs are incurred in the management of IP issues.

4.2. Oversight

The oversight of Auto-ID Center, Inc. would be initially entrusted to a small group of senior executives, some of whom will be drawn from the current Sponsors, to serve as directors of the new organization. At least one member of the Auto-ID Center, Inc. Board would be added to the Board of Governors of the parent, UCC. The Auto-ID Center, Inc. Board should be:

- Senior level executives
- Globally diverse
- Representative of the multiple industry sectors served by the Center.

There would also be Advisory Boards, as appropriate, drawn from the existing technology companies and end-users.

4.3. License

MIT would grant to Auto-ID Center, Inc. an exclusive license to the intellectual property developed by the current Center. The license would contain performance clauses to ensure the new entity is operating effectively.

As Auto-ID Center, Inc. matures, this model will be adjusted as appropriate.

5. MEMBER'S PRIVILEGES IN THE FUTURE

Companies that are members of the Auto-ID Center by the end of June 2003 would receive favorable consideration with respect to the following:

- Waiver of EPC™ licensing fee;
- Membership in all community development forums;
- Opportunity to be elected to Auto-ID Center, Inc.'s governing body in June 2003;
- Limited number (2-5) of free VIP admissions to symposia for first 5 years;
- Invitation to two members-only update meetings in 2004 and 2005;
- Other privileges and benefits as appropriate for the Vendor Community.

6. NEXT STEPS

Meetings have been scheduled for further talks between representatives of the EAN.UCC and the MIT Office of Sponsored Programs and Technology Licensing Office to commence negotiations of the specific elements to be addressed in the agreements to establish this relationship between the EAN.UCC and MIT. The present working goal is to attempt to complete the necessary agreements so that EAN.UCC will be able to begin a transition period with MIT after the February 2003 Board Meetings, with the new organization assuming its full responsibilities after the November 2003 Board Meetings.

