MAS.967/Sloan15.393
TECHNOLOGY & ENTREPRENEURIAL STRATEGY: Competing on Technology’s Emerging Frontier

Instructor Information
Fiona Murray
Assistant Professor
Sloan School
Room: E52-551
Email: fmurray@mit.edu

Joe Jacobson
Associate Professor
Media Lab
Room: E15-430
Email: jacobson@media.mit.edu

TA Information
Cyrus Beagley
MBA 2002
MIT Sloan SM Candidate, MIT EE
Email: cyrusb@mit.edu

Joost Bonsen
Email: jpbonsen@alum.mit.edu

Course Perspective and Description

This course provides a strategy framework for managing new, entrepreneurial high-technology businesses. The emphasis throughout is on the development and application of conceptual models, which clarify the interactions between competition, patterns of technological and market change, and the structure and development of internal firm capabilities. The emphasis is on new enterprises in new industries based on emerging technologies.

This is not a course in how to manage product or process development. The main focus is on the acquisition of a set of powerful analytical tools that are critical for the development of a technology strategy. These tools can provide the framework for insightful planning when deciding what strategies to use in exploiting complex emerging technologies, and how to anticipate and respond to the behavior of competitors, suppliers, and customers. The course should be of particular interest to those interested in creating and managing a new enterprise with significant technical content, and to those interested in venture capital, incubation and industry analysis in new sectors.

Course Structure

The course utilizes lectures, case analyses, and team projects in the form of Business Briefs and an extended Business Brief with a working demo as the Final Project. The cases are typically drawn from local start-ups although a few cover classic successful firms. Readings are primarily drawn from research in technological change, organizational theory and entrepreneurship. There are also a series of technical articles, mainly taken from Scientific American. A few of the journal articles may be quite difficult for the non-technical class members. Discussion and evaluation of these readings will be exclusively on the broad ideas and contributions; the aim is to make you comfortable with the broad arenas of emerging technology rather than technical experts. The projects & case studies provide an opportunity to integrate and apply these tools in a practical,
entrepreneurial context.
## Summary Course Outline

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### Creating Value: Emerging technologies & markets

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### Capturing Value: Standards

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### Delivering Value: Organizational Competence

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### Wrap-Up

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Dates in bold to be held in Bartos Theater, Media Lab
All other classes to be held in E51-345, Sloan School
Course Norms and Expectations

Professional conduct is built upon the idea of mutual respect. Such conduct entails (but is not necessarily limited to):

**Name cards:** Please obtain a name card for yourself that contains your first and last names. There are over 80 students in the two sections of this class. We will eventually get to know all of your names but it will take time. The name cards are very helpful to us in this regard. Also they are important for us in keeping track of your class participation.

**Arriving on time:** Class starts 5 minutes after the hour or half hour. Late arrivals are disruptive to both lectures and class discussion. Please try hard to be on time. If you know you are going to be late or will need to leave class early, please let us know in advance, if possible.

**Minimizing disruptions:** All cell phones and pagers should be turned off during class. Please try to avoid engaging in side conversations after the class has begun. Finally, please try to avoid leaving and re-entering class repeatedly.

Class Information:

- **Class Times:** Tuesday/Thursday 4:00-5:30
- **Class Location:** Bartos Media Lab -- 2/5, 2/7, 2/28, 3/3, 12/4, 9, 4/30, 5/9, 5/14
  - MIT 4-270 – 2/12, 2/14, and 2/21, 2/26
  - Sloan E51-345 – all other dates

**Reading Packets**
Assigned readings are available from Copy Tech (basement of E52), with the exception of those cases, which are noted in the syllabus as being distributed in class. When you pick up your course packet, please check to be sure that it is complete.

**World Wide Web**
Written course materials will be available through the course Web site and Sloanspace. The web site is: [http://courses.media.mit.edu/mas967](http://courses.media.mit.edu/mas967)

This will include the transparencies from each lecture, links to points of interest (e.g., company web sites) and critical course information such as due dates. The course list will be tes@media.mit.edu.
Course Requirements & Grading

Grades will be determined by: class participation, two Business Briefs (in the first half of the semester), and a final project (written & presented in the second half of the semester). Both the Briefs and the final project must be undertaken in groups that include both Sloan and non-Sloan students. Details are provided below.

Grading Schema

a) Class attendance and participation 30%
b) Two Business Briefs 30%
c) Final project/presentation 40%

a) Attendance & Class Preparation
This is not an easy course, since it provides an in-depth introduction to an extraordinarily complex subject that includes technical and managerial material. Cutting class will affect your grade - and, more importantly, - your own and your classmates' experience in the class. If you do miss a session, it will be your responsibility to find out what materials were covered, what assignments were made, and what handouts you missed. If you miss more than one session without warning us in advance it will severely impact your class participation grade.

b) Emerging Technology Business Briefs
During the first half of the semester you will be asked to prepare two Business Briefs. The briefs are due February 26th and March 12th. They should focus each focus on a different emerging technology area. Business Briefs for Technology Strategy are 3 to 8 PowerPoint slides proposing your best technology venture idea to a potential investor audience. Busy, short-attention-span VCs (and Professors and classmates) quickly decide if you are interesting or not, so hook them in by stating the essence of your idea up front and conveying your proposal succinctly. Only one slide on financials may be included.

The business brief will be completed as a team. For the Brief #1 the teams will be assigned. In Brief #2 you can form a team but there should be no more that two people from the original team and the team must include non-Sloan student(s). For both Brief #1 and #2 a sub-set of the Business Briefs will be chosen for in-class presentation based on a class vote.

c) Final Project
The final project is an extended Business Brief which includes a business plan or no more than 15 pages, and product or service prototype, and a presentation as the deliverables. It is due May 8th. Under general Institute Policy, we may not give extensions to this deadline. It should be completed in groups of five to eight. You do not have to write your final project with the same people with whom you wrote your “business briefs”, but you may if you wish.
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<th>Key Dates</th>
<th>Event Description</th>
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| February 5     | First day of class (Bartos Theatre, Media Lab)  
One-paragraph description due for non-Sloan students  
After class informal mixer!! |
| February 26    | Business Brief #1 (PowerPoint presentation 3-8 slides) due – Submitted to the course web site by midnight.                                          |
| February 27    | Read and vote on your top choice Business Brief #1                                                                                               |
| February 28    | 4-5 Business Brief #1 will be chosen for in-class presentation  
Presenters will be announced in class – please be prepared!!                                    |
| March 12       | Business Brief #2 (PowerPoint presentation 3-8 slides) due – Submitted to the course web site by midnight.                                          |
| March 13       | Read and vote on your top choice Business Brief #2                                                                                               |
| March 14       | 4-5 Business Brief #2 will be chosen for in-class presentation  
Presenters will be announced in class – please be prepared!!                                    |
| April 11       | Final Project proposal due to the course web site by midnight                                                                                     |
| April 18-30    | Final Project teams must complete one meeting with the Instructors & one meeting with the TAs to finalize concept & prototype/demo                   |
| May 8          | Final Project due – plan, presentation to web site by midnight                                                                                  |
| May 9          | Final Project in class presentation including demo                                                                                            |
Purpose of Projects

In 15.393 we survey emerging technologies and consider historical cases of technology commercialization in three sectors: Communications & photonics, Molecular Machines/Silicon Biology, and Chips & Computation. Our intent is to highlight the new technologies which have a high probability of revolutionary impact. The goal is to appreciate (a) the essential advance the researchers are pursuing, and (b) some of the hoped for performance consequences of research success. If you have particular knowledge of, or interest in, an emerging technology not explicitly mentioned in class, please feel free to bring this to bear through your projects and, in general, to share anything worthwhile with us and classmates. To encourage you to map out the implications of these new emerging technologies and to incorporate the lessons-learned from the cases, we ask for two team projects with short Business Briefs as deliverables and one substantial Final Project with a business brief, business plan, and product or service prototype as the deliverables. More details on the final project will be posted on the website.

Business Briefs:

1. **Deliverables** – Business Briefs are 3 to 8 PowerPoint slides proposing your best technology venture idea to a potential investor audience. Busy, short-attention-span VCs (and Professors and classmates) quickly decide if you are interesting or not, so be sure to be succinct.

2. **Expectations** – We hope teams apply their time and creativity to appreciating the implications of emerging technologies, in general, and identifying an interesting business opportunity, in particular. We suggest you follow a simple presentation format and spend your time largely on the substantive content. In the two weeks before the Brief is due, we suggest 4-6 hours per person specifically on the project, i.e. beyond your class readings.


4. **Business Concept** – State WHAT your business will do. Start with a compelling company name and summary Elevator Speech, crystallizing your whole proposal in the first 30-60 seconds of your presentation. Outline your overall business model, that is, how and to what degree customers value your technology and/or unique combination of services or products. Help your listener pigeonhole your proposal by choosing the industry category that best describes your company: e.g. Computer Hardware, Molecular Modeling, MEMS Components, NEMS Fabrication Equipment.

5. **Market Opportunity** – Who is the principal customer and what is their problem? State WHY the venture is worth the effort, what problems do customers have, how many of them are there, and how much are they willing to pay for what you've got. Provide data for trends. Ideally, you have evidence people want what you propose.

6. **Technology Solution** – What product or service do you offer? State HOW you propose to solve the problem customers face. Quantify performance benefits, current state of development, and work still to be done. Clarify intellectual property (IP) status, e.g. patents-pending, licensing status. Describe how things work at a high level; avoid too much detail.

7. **Competitive Advantages** – WHO ELSE are your competitors and why are you better?
State risk factors, identify some direct and remote competitors, and spotlight particular things you have – or will build – to your advantage.

Some General Advice

Business Implications — As new technological possibilities emerge, there are often several market or business implications. For example, (1) traditional business practices may become more efficient with the new technology, allowing the same things to be done with considerably less time or money. Alternatively, the new technology may (2) allow a totally new way to solve the same or similar overall business problem. Or, the emerging technology may (3) trigger an entirely novel product or service category, solving problems previously unrealized. Especially in these latter two cases, the nature of an industry, or the relationships between suppliers and customers in a value chain, may transform dramatically, leading to (4) new collateral business opportunities.

Seek Creative New Ideas — As you look at a wide range of emerging technologies in the Computing and Logic sector, and later in the Biotechnology, Communications sectors, you should think, brainstorm, speculate, and even wildly guess about potential business implications, from the more efficient through novel or collateral (i.e. numbers 1-4 above). You are encouraged to speak to anyone you like — inside the class or beyond — about emerging technologies, business idea possibilities, market data, and so forth.

Bolder is Better — Generally speaking, the bolder or more dramatic the idea you think up and present, or the larger the potential market consequences, the more appealing from the perspective of our class. Ultimately, of course, any serious new venture team and their proposal would endure repeated and deep reality-checks, forcing the team to sharpen their assumptions and confirm the appeal of their effort. For our short Business Briefs, however, we necessarily dispense with most of these crucial iterative forces. Even for your Final Project, while our expectations are higher, we still favor bold new venture opportunities over something mundane. By the same token, if you have identified a focused, realistic opportunity that appears modest in comparison to something really crazy, we also encourage you. We can be equally impressed with boldness or practicality, but you must at least be one or the other.

Brainstorming Potential Opportunities — Each emerging technology area is fruitful territory for multiple business opportunities. You should let your imagination reign free in order to speculate thoroughly about the most interesting of these implications.

As just one example, let us take the specific case of Printed Logic. There are at least five or six categories of businesses one might propose grounded in this interesting emerging technology:

1. Underlying Materials and Fabrication Methods — Be the developer and supplier of printable electronic ink, key solvents, substrates and other underlying materials used by device fabricators to make systems.
2. Tools and Capital Goods for Manufacturing — Be the manufacturer and supplier of the ink jet systems and printing subsystems, deposition schemes, and other capital equipment that device fabricators need to make systems.
3. Intellectual Property Designs and Subcomponents — Be the premier designer and licensor of devices, subsystems, and subcomponent designs for purchase, system integration, and fabrication by others.
4. Mass Fabrication Outsourcer — Be the preferred provider of high volume fabrication services house for integrators or IP sources.
5. Integrated Devices and Systems — Be the integrator of subsystems and IP
designs into end-products and systems. For example, printed logic might enable very inexpensive webpads, displays and logic cheaply printed on a plastic substrate.

6. High Level Applications — Be the premier provider of new, maybe "killer" applications built on top of new types of integrated end-products and systems.
Readings & Questions

Class 1: Emerging Technologies & Opportunities


*Questions for Discussion*

- What are the key trends in nanotechnology that are emerging? What are their most interesting business implications?
- What are the key challenges still associated with these technologies? What technologies might they replace?

Class 2: Entrepreneurial Opportunities & Industry Life Cycles


*Questions for Discussion*

- How does the industry lifecycle provide a useful model for thinking about the evolution of e.g. PDAs, cell phones?
- Sketch out as an industry evolves, i) the number of firms in an industry, ii) relative investment in product and process innovation, iii) average margins in the industry as an industry evolves over time.
- What are the factors that lead to the emergence of a new population of organizations? Is a firm likely to be successful if it is an early member of new population?

Class 3: Emerging Technology I – Photonics & Communications


*Questions for Discussion*

- What are the key trends in photonics?
- What bottlenecks do you anticipate in the adoption of photonics?
- What are the key commercial opportunities?

Class 4: Case: Iridium

“Rise and Fall of Iridium”, *Harvard Business School* (9601040)
Questions for Discussion

- Sketch out the nature of technological evolution as described by Foster. Where is Iridium on this curve?
- Who was to blame for Iridium's failure? AT what point could you have known that Iridium would fail?
- What is your evaluation of Iridium's system design? What impact did the choices that were made have on the subsequent evolution of the venture?
- What is your evaluation of Iridium's organizational design? What changes would you have made to make the probability of success higher?

Class 5: Case: IDEO & Handspring    February 21

“IDEO Product Development”, Harvard Business School (9600143)

Questions for Discussion

- Referring back to the PDA, how did IDEO get the design right with Palm?
- What does Rodgers have to say about the way markets evolve? Does this help IDEO?
- What problems does a new enterprise encounter in why trying to manage market dynamics?
- How would you characterize IDEO’s process, organization, culture and management?
- Should IDEO accept the Visor project as is (on a dramatically reduced schedule)? Should they try to persuade Handspring’s management to change its aggressive launch schedule? Or should they simply decline the project? In your discussions, please consider the IDEO and Handspring perspectives.

Class 6: Sycamore    February 26

“Sycamore Networks”, Harvard Business School (9801076)

Questions for Discussion

- In what way do standards and network externalities create value for firms and consumers?
- How should sycamore attempt to manage the needs of different types of customers with different generations of their products?

Class 7: Case: Wildfire Communications Inc.    February 28

“Wildfire Communications Inc. (A)”, Harvard Business School (9396305) (to be distributed)
Questions for Discussion
• Assess each of Wildfire’s three lines-of-business? Which do you feel should be Wildfire’s top priority? Why? Why not?
• What should Warner and Lassiter do?

Class 8: Emerging Technology II - Molecular Machines & Silicon Biology March 5


Questions for Discussion
• What are the key trends in molecular machines?
• What bottlenecks do you anticipate in the adoption of these concepts?
• What are the key commercial opportunities?

Class 9: Can you profit from your ideas? March 7

Stern, S., and J. Gans (2000) “Profiting from the Gales of Creative Destruction”, Mime, Massachusetts Institute of Technology

Questions for Discussion
• What is the difference between the market for ideas and the product market?
• How can you make money from a new technical idea? What are the key pieces of information that might shape your choice of strategy?
• When does it make sense for a team of entrepreneurs to 1) Enter the market directly 2) Attempt to sell their ideas?

Class 10: Case: Materials Technology Corporation March 12

“Materials Technology Corporation”, Harvard Business School (9694075)

Questions for Discussion
• Was Quinn's initial strategy of diving into the substrate business a good or bad thing for the company? If he had it to do over again, what would you suggest that he do differently?
• How does Quinn's view of what business MTC is in differ from Bennett's view? Who is right in this case? Under what sorts of circumstances would Quinn's and Bennett's different definitions of the business be appropriate?
• How would you recommend that MTC proceed?

**Class 11: Changing IP System**  
March 14

Readings to be distributed

**Class 12: Case: Surface Logix**  
March 21

“Surface Logix”, *Harvard Business School* (N9802050, Lassiter & Roberts)  

(Further recommended readings)  

*Questions for Discussion*
- How should Surface Logix decide what type of product markets to enter? What are the crucial variables that will determine the future of the firm? Can Surface Logix shape any of them?
- How does the relative importance of appropriability and complementary assets vary with Surface Logix’s options?

**Class 13: Case: e-Ink**  
April 2

“E-ink”, *Harvard Business School* (9800252)  

*Questions for Discussion*
- Can the tension between creativity and commercialization be managed to creating a win-win situation or will there always be a tradeoff?
- What type of portfolio of projects should e-Ink develop? And how can such a portfolio be financed? When should they shift to the next generation and category of products?

**Class 14: Case: Millennium**  
April 4

“Strategic Deal-making at Millennium Pharmaceuticals”, *Harvard Business School* (9800032)  

(Further recommended reading)  
Questions for Discussion

- How does Millennium best exploit its technology platform?
- What are the key challenges of the alliances it forms?

Class 15: Emerging Technology III - Chips & Logic  
April 9


Questions for Discussion

- What are the key trends in chips & logic?
- What bottlenecks do you anticipate in the adoption of new chip architectures?
- What are the key commercial opportunities?

Class 16: Value Capture in Standard Driven Markets  
April 11


Questions for discussion

- Why do some markets "tip" to a single standard? What are the elements of a successful strategy in winning a standards war?
- Can you list the sources of the externalities that led to tipping in the case of VHS vs. Beta? Do you think the handheld market will tip to Windows CE or to Palm? Why or why not?

Class 17: Case: Nintendo  
April 18

“Power Play (A): Nintendo in 8-bit Video Games”, Harvard Business School (9795102)

Questions for Discussion

- What steps did Nintendo take to establish its standard as the standard in video games? How much money is Nintendo making? How much money are other players in the value chain making?
- If you were attempting to displace Nintendo, what would you do? Why?

Class 18: Case: Rambus  
April 23

“Rambus”, Harvard Business School (Not yet released)

(Further recommended readings)

Questions for Discussion
• How does Rambus attempt to create value? Is it likely that the market will “tip” to a Rambus standard? Why or why not?
• How is Rambus attempting to capture value? Could they set a standard alone? What would you recommend that Rambus do next?

Class 19: Case: tba April 25

Class 20: Universities and New Ventures April 30
Reading to be distributed.

Class 21: Case: Intel Photolithography May 2
Intel Labs (A): Photolithography Strategy in Crisis, Harvard Business School (960032)

Questions for Discussion
• What is Intel’s view of basic research? Why is it so different from IBM’s view?
• What are the strengths of Intel’s approach to R&D? Do you see any weaknesses?
• What would you recommend that Sandy Wilson do? Of the three options outlined on page 10 of the case, which do you think makes the most sense and why?

Class 22: Case: Lucent NVG May 7
“Lucent Technologies New Ventures Group”, Harvard Business School (9600143)

(further recommended readings)

Questions for Discussion
• Why do established companies have trouble negotiating discontinuities?
• What are the pros and cons of the various organizational mechanisms available to “deal with
discontinuities”?

• For the case of Lucent what, if anything, can Socolof and the NVG do to increase the advantages and minimize the tensions, to ensure speedier and easier development of ventures within Lucent?

• What should Steve Socolof recommend to upper management about the next phase of the New Ventures Group? What has the NVG done well, what has it done poorly? In light of problems at Lucent, should the NVG continue in its present form, change its form, or disband?

Class 23: FINAL PROJECTS

Class 24: FINAL PROJECTS