Global Modular Course (MGMT 897)
Technology, Innovation and Entrepreneurship in the New Space Era
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Instructors: Rahul Kapoor (kapoorr@wharton.upenn.edu) and Ignacio Peña (pena.ignacio@icloud.com)

COURSE DESCRIPTION

Over the past five years, humanity has taken a massive leap into a new Space Era made possible by powerful enabling technologies and private sector entrepreneurs from around the world in collaboration with the public sector. What used to be the exclusive domain of two superpowers is now being democratized and made accessible to established organizations and entrepreneurs from both developed and emerging countries. The cost of escaping Earth's gravity is expected to fall by more than two orders of magnitude by innovations in reusable rockets and business models.

The objective of the course is to provide students with an extraordinary exposure to this exciting global business domain in the new space era and the opportunities for value creation it unfolds. Immersion into the new space age will provide students with several unique learning opportunities because:

- it departs from the traditional mindset of superpowers, arms race and nation defense
- it is a "green field" in terms of use cases and business models; Hence, it presents significant opportunities for creativity and experimentation
- it is a challenging technological domain with long periods of development and commercialization with high uncertainty in terms of which/whose technological solution will emerge as an eventual winner
- it also presents significant challenges in terms of financing of innovation because the costs and the returns are not a good fit with the tradition VC and internal or external capital markets models

The course will consist of a series of panel discussions and lectures focusing on the historical evolution of the space sector, global trends in technologies, markets and business models, strategies of emerging start-ups and established organizations, financing models and the role of the public sector in different global regions. The panels would involve some of the leaders of the new space age (entrepreneurs, investors, space agencies from around the world). The course will culminate with a team project in which students will have to ideate, design and present a pitch for a new business related to the opportunities the new space era will create on our planet and beyond. In so doing, the course would provide students with a rare stimulating intellectual journey to stretch their thinking and provide fresh perspectives that can be applied to any nascent industry context encompassing emerging technologies and business models.

Through this course, students would be exposed to the new space age as an emerging context with exciting possibilities for technological innovation and entrepreneurship at a global-level. It would also help broaden the horizon in terms of opportunities and challenges around technology commercialization and entrepreneurship in a complex technological and institutional landscape

PREPARATION & GRADING

Students will be evaluated based on their active participation throughout the course in terms of attendance, and engagement. They would also be evaluated through a market analysis assignment and the final project presentation:

- Participation (50%)
- Market Analysis Assignment (20%)
- Final presentation (30%)

SUGGESTED READINGS

- Adner, Ron and Kapoor, Rahul (2016), "Right Tech, Wrong Time: How to Make Sure that Your Ecosystem is Ready for the Newest Technologies," Harvard Business Review, 94(11): 60-67.
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- Bryce Space and Technology. 2020. "Start-Up Space: Update on Investment in Commercial Space Ventures."
- Christensen, Clayton M. "The Innovator's Dilemma: When New Technologies Cause Great Firms to Fail." Harvard Business School Press, 1997.
- Furr, Nathan and Kapoor, Rahul "Capabilities, Technologies, and Firm Survival during Industry Shakeout: Evidence from the Global Solar Photovoltaic Industry." Strategic Management Journal. 2017.
- Ghosh, Shikhar, and Sarah Mehta. "Elon Musk: Balancing Purpose and Risk." Harvard Business School Case 817-040, October 2016.
- Gladwell, Malcom. "David and Goliath: Underdogs, Misfits, and the Art of Battling Giants", April 2015.
- Goldman Sachs. 2020. "Space: The Next Investment Frontier."
- Kapoor, Rahul and Furr, Nathan and (2015), "Complementarities and Competition: Unpacking the Drivers of Entrants' Technology Choices in the Solar Photovoltaic Industry," Strategic Management Journal, 36(3): 416-436.
- Kapoor, Rahul and Klueter, Thomas (2020), "Progress and Setbacks: The Two Faces of Technology Emergence," Research Policy, 49(1): 103874.
- Kapoor, Rahul and Klueter, Thomas (2020), "Unbundling and Managing Uncertainty Surrounding Emerging Technologies," Strategy Science.
- Kapoor, Rahul and Klueter, Thomas. "Innovation's Uncertainty Factor", MIT Sloan Management Review, Fall 2020.
- Menon, Anoop and Huang, Laura. The Final Frontier: How Entrepreneurs Cracked the Aerospace Industry. (https://knowledge.wharton.upenn.edu/article/how-entrepreneurs-cracked-the-aerospace-industry/)
- Rahul Kapoor. "Ecosystems: Broadening the Locus of Value Creation." Journal of Organization Design. 2018.
- Stalk, George Jr. and Steward, Sam. "Avoiding Disruption Requires Rapid Decision Making" Harvard Business Review, April 2019.
- Teece, David. "Profiting from technological innovation: Implications for integration, licensing and public policy" Research Policy, December 1986.
- Weinzierl, Matthew C., and Alissa Haddaji. "Space Angels, Multiple Equilibria, and Financing the Space Economy." Harvard Business School Case 719-070, March 2019. (Revised May 2019.)
- Weinzierl, Matthew C., Kylie Lucas, and Mehak Sarang. "SpaceX, Economies of Scale, and a Revolution in Space Access." Harvard Business School Case 720-027, April 2020. (Revised June 2020.)
- Weinzierl, Matthew. 2018. "Space, the Final Economic Frontier." Journal of Economic Perspectives, 32 (2): 173-92.

PRELIMINARY COURSE SCHEDULE

The proposed schedule features seven live class sessions and a final showcase session in which students will present their projects. Most classes will have a different format and involve presentations by the instructors as well as industry guests as well as to student led interactions to provide a dynamic and engaging learning experience.

Class One - Welcome to the New Space Era

In this class we will provide a general overview of the course and a brief historical context of the space industry and how it is departing from the traditional mindset of superpowers, arms race and national defense and becoming a thriving industry with private sector leadership. We will evaluate the drivers of the emerging space revolution (inflection points, new technologies, business models, ecosystems, etc.) that are moving the industry from centralized planning to global market-driven innovation. Finally, we will explore the emerging blue ocean market opportunities related to the New Space Era and analyze the role Schumpeterian entrepreneurs play in shaping industries and driving economic growth through creative destruction.
Potential external speakers: Goldman Sachs, Wharton Astronaut, policymaker/historian

Class Two - Technology Trends, Bottlenecks and Business Models

In this class we will analyze the technologies trends, business models, bottlenecks and uncertainties that are shaping each of the key market opportunities arising in the new space. We will start with an overall view of how these forces shape business in general and how exponential technologies and convergence can lead to to predictable patterns of disruption. Student teams will then present their analysis of a specific market opportunity space.
Potential external speakers: Stellar Solutions, Bryce Space, ISpace

Class Three - Disrupting Goliath

Attacking powerful and well-entrenched incumbents and reinventing an industry can seem daunting or even impossible for entrepreneurs. However that is exactly what new space entrepreneurs are doing, even from remote countries. What conditions are necessary to successfully disrupt an industry? What lenses and practices do entrepreneurs to identify disruption opportunities to gain advantage and what prevents incumbents from responding? What partnering strategies do they use to succeed? How do they balance purpose and risk?
Potential external speakers: SpaceX, Satellogic, Rocket Lab

Class Four - Managing technology, ecosystem and business model uncertainty

Startups that are bringing disruptive technologies and concepts to market need to advance the technology readiness levels of their products and capabilities while designing novel business models and enticing customers and investors. How do entrepreneurs manage these issues while walking on a tight rope? What drives them to take the plunge and leave behind opportunities? What options are they faced with and what lenses do they use to make what are often life-or-death decisions?
Potential external speakers: Made in Space, Skyloom, Relativity Space

Class Five - The Space Incumbents

Many of the market segments that are being addressed by new space startups are currently addressed by large corporations. How do they perceive the new entrants? How are they responding to potential disruption? What internal or external barriers may block an adequate response?
Potential external speakers: ULA, INVAP, Boeing, other

Class Six - The Public Sector as An Ecosystem Builder

For decades, the governments of superpowers used to dominate the space industry. But that is not the case anymore. As the cold war drew to an end, public support waned and space budgets were cut. Now private players are taking the lead and taking leadership positions and emerging nations and newcomers are beginning to energize and push forward and bring diversity into what is rapidly becoming a global industry. However, the leading space agencies are redefining their role and continue to play a critical leadership role giving shape

to the emerging ecosystems. How can the private and public sector collaborate and play to their strengths? Can a government agency play an entrepreneurial role? How important are they for startups and investors?
Potential external speakers: Luxembourg Space Agency, NASA, ISRO

Class Seven - Funding disruption: The investor's view
Space companies typically face long valleys of death in which their survival depends on access to capital. For investors that means very high uncertainty and long payback periods. The costs and timeframes apparently do not have a good fit with traditional VC, and yet we are seeing a surge in venture capital entering the sector. What attracts investors to new space? What criteria do they use to evaluate startups considering the levels of technology, market and business model uncertainty they face? How can startups create value through prolonged valleys of death with no revenue in sight?
Potential external speakers: Starlight Ventures, Space Angels, TechStars, Draper, Space Capital, Bryce Tech

Class Eight - Project presentations
In this closing event students will share their final presentations with their classmates. Each team will have 20 minutes to present a sanitized version of their work and 10 minutes for Q&A, with a 20-minute break after the third presentation. The last 20 minutes will be dedicated to wrap-up the course.