Three Elements of “Fast Pitch”…

- Summarize the challenge/problem/issue in one sentence. Explain why it matters.
- Describe two or three most interesting parts of the concept/business. Explain why it is innovative/cool/attractive.
- Name two of three biggest impacts of the business plan. Explain why your customers will care.

Quantum Data Defender

Team: Joseph Lee and James Borovilas

Data is moving around us all the time. From simple emails, to high frequency quantitative trading - there is always some data moving, and at times, even close to the speed of light. In the case of high frequency trading, for example, while speed is a major factor, security is another. In fact, though we have fiber optics to transmit data quickly, some highly classified data needs extra security. Encoding data can be time costly, but what if we could transmit data close to the speed of light, while strengthening our security.

Our plan is to create a novel data transmission scheme, using quantum entanglement as our tool to send data. Photons have a unique quantum property that effectively allows us "teleport" data. These photons will be prepared using cesium based quantum repeaters, entangling separate photons and encoding the data simply and safely. Unlike traditional methods of sending data, there are no bits or waves that can be intercepted, as entanglement sends information with no regard to what else is happening around it.

Security agencies and government agencies will greatly benefit from this highly secure data transmission. We intend to license this technology to the military and other private industries in order to strengthen their security.

Quantum Data Defender
What is the challenge/problem/issue in one sentence? Explain why it matters.
What are two or three most interesting parts of the concept/ business? Explain why it is innovative/cool/attractive.
What are two of three biggest impacts of the business plan? Explain why your customers will care.

Drone Zone

Team: Alex Herron, Marco Andrés Miller, Xuxin Zhang, and Isaac Ruble

Student 1: Have you ever thought about water?! What an idea. I think about water more than my family. What about drones? I think about those too. I once had a dream about drones. My family was not there. Put those two big ideas together, and you get either water that observes drones, or drones that observe water. Although I like both ideas, the second is far more compelling from an aesthetic standpoint.

Successful water resource management depends on an accurate understanding of water. For something to be managed it must be known. For something to be known it must first be loved. Our drones will deposit their loving gaze upon snowbanks in order to collect water data. As we all know, data=money. This data can be sold to local government, water resource management firms, and hundreds of snow/water volume data enthusiasts.

Student 2: Wow, *student 1*, I think I am ready to buy whatever you are selling right now!!! Here is five million dollars!!! *turns to camera* And you should give us millions too!!!

Drone Zone
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HyperGlass

Team: Sunand Raghupathi, Zicheng Liu, and Unique Divine

The size and shape of our phones, tablets, and laptops are entirely dictated by their screens. But the reality is that screens are becoming obsolete. Virtual and Augmented reality technology provide a compact, and high quality alternative to conventional screens. Current innovation leverages AR/VR to improve the experience of using existing devices, for example glasses that mirror a phone screen.

However, we can go a step further. Rather than leveraging AR/VR as a mere accessory, we can integrate this technology into the design of our systems. Rather than improving existing paradigms, we can change the paradigm.

Enter the HyperGlass. We plan to build a highly portable, highly functional, full-fledged computer with one key difference: there is no screen. Instead, paired AR glasses provide the display. The hypersphere is a small, paperweight-like device with a novel touch registration surface that emulates a trackpad. We call it the HyperGlass because it is characteristically simple, yet intrinsically complex. Every feature available in your phones, tablets, and laptops will be available in the HyperGlass but at an unprecedented level of portability, convenience, and elegance.

HyperGlass
What is the challenge/problem/issue in one sentence? Explain why it matters.
What are two or three most interesting parts of the concept/ business? Explain why it is innovative/cool/attractive.
What are two of three biggest impacts of the business plan? Explain why your customers will care.

Backup Materials

- Quantum entanglement for fast and secure trading
- Smaller Floats for Inexpensive and Accurate Ocean Floor Mapping
- Portable, Lightweight Computer with Augmented Reality Glasses

Quantum entanglement for fast and secure trading

FOREWORD NOTE:

I spoke to one of Prof. Lipson's grad students and it seems that this method of information transfer is more secure than current methods, but not necessarily faster. I am starting to this that this would be a better pitch for high security trading or government agencies, as for HFT it might only provide security and not speed.

Cost and Market

in any activity we perform. Although we do value security of the information, it is not financially reasonable to implement this method. As an investor, I would like to see a detailed outline of how much revenue this method can generate to HFT companies versus the cost it brings.

What is the current market for fast and secure trading? How can we compete with the current market?

The cost outline will be hard to predict, but I can say the following. Though not HFT, banks have shown great interest in invested in QC. (Note that this idea is in quantum information, NOT computing, however).

JP Morgan is already prepping for the "quantum leap"

https://www.jpmorganchase.com/corporate/news/stories/jpmc-prepares-fintech-quantum-leap.htm

Goldman is looking for someone to head their Quantum program

https://news.efinancialcareers.com/uk-en/3002303/goldman-sachs-quantum-computing

Banks see the alleged benefits of a quantum future, so I feel like, if pitched properly, the financial industry would be all in for this technology.

As for a competing market, my current knowledge is that traders use fiber-optics for quick speed. (See the foreword note above regarding speed)

How commercially scalable can we foresee entanglement being? Is it something that only governments and companies would have the resources to be able to access, or can it be seen as one day being in the hands of individuals?

Are you seeking to start your own firm that utilizes this technology, or to make a public platform for the entire industry?

In the current state, the tech would definitely be too expensive for individual use. I think this could only be used by the government or companies. I think the investment goal would be to pitch the tech to certain companies or government sectors in order to find a few groups on board, and provide the technology to them.

Technical Implementation

How long would it take to develop this technology? How fast will the technology be developed?

How soon it will be available? The trading scene changes so rapidly that it seems one would need to get this technology up and running quicker than anyone else, because once the technology is widely available, then that will simply be the new standard and the market will stabilize again.

How realistic is this idea in the short-term (3 years)?

(In an investment pitch I would probably say within 10 years, but realistically it is hard to tell. (see the next question))

How much of this technology exists, and how much needs to be invented/developed?

Photonic repeaters already exist (though not at a large scale), and entanglement experiments have already been done. The work that needs to be done will have to be in stability and mass production more so than the technology itself. That being said, improvements in the technology could greatly reduce costs.

I've done some reading on photonic repeaters, and don't quite understand what the limiting factor is yet. My guess is that, for the Cesium repeaters, there is a lot of instability. I found this paper recently: https://www.nature.com/articles/s42005-018-0080-x

I'm not sure if my understanding on this 100% accurate, so I may have some misconceptions here.

It has already been proven to be very difficult to use qubits for quantum computations, so why would secure trading be easier if the technology is almost the same?

Quantum entanglement and quantum computing are not the same thing. We are trying to use entanglement and quantum properties to send data, not encoding superpositions on various qubits for computation. Thus, this technology is actually slightly simpler.

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How can this security feature be developed in actuality, leaving the realm of just mathematical theory? (I would want to see or at least be promised something substantive before investing in this.)

Researchers in quantum photonics are still largely at a loss as to how to do this; what do you plan to do differently from them? Also, how do you know that the increased security will offset the decreased accuracy in measurement?

Can the entangled photons be blocked?

How can we possibly establish proof of concept with little capital to encourage investors to invest in this company?

Do we have an estimate on how long it would take to convert information carried via entangled photons into digital information, and if so, does that number imply the merits of the use of quantum computing for HFT?

Why should I invest in this company now, when the technology is so far from being realizable?

References

"Playing by quantum rules," by Erica Klarreich, Nature, 414, pp. 244–245 (2001); https://www.nature.com/articles/35104702

"Unconditionally secure bit commitment with flying qudits," by Adrian Kent, 2011 New J. Phys. 13 113015; https://doi.org/10.1088/1367-2630/13/11/113015

"When Finance Meets Physics: The Impact of the Speed of Light on Financial Markets and Their Regulation," by James J. Angel, Financial Review, (May 2014); https://doi.org/10.1111/fire.12035

"Quantum computing for finance: Overview and prospects," by Román Orús, Samuel Mugel, and Enrique Lizaso, Reviews in Physics, Volume 4, November 2019, 100028; https://doi.org/10.1016/j.revip.2019.100028

Answering Questions Assignment

Smaller Floats for Inexpensive and Accurate Ocean Floor Mapping

Cost and Market

1. Even if the floats are cheaper, is the sonar technology accessible enough to significantly reduce the costs?

The sonar technology would indeed significantly reduce the costs. The question really revolves around how realistic it would be to implement the sonar within the floats without tapping too much energy from other functions of the float.

2. How much does each instrument cost?

Not sure.

3. As an investor, I can see the market potential for this product. However, I would like to know the current research and engineering progress on this product before I can make an investment.

Current research: I personally can't speak to the entire scope of oceanographers using Argo floats. However, I'm well aware of a portion of those scientists, namely those studying flow of salty and freshwater throughout the world using the Argo floats as a basis for their datasets.

4. Who will pay for this product?

The idea is that researchers, militaries, deep sea drillers, and those concerned with deep-sea specifics would be the primary target market.

5. Would this be a private endeavor, or would you seek to work with NOAA or a consortium of universities conducting similar research?

Unsure. There is certainly a higher earning potential with targeting militaries or deep-sea drillers, with a hefty moral payoff.

Technical Implementation

1. Would smaller floats use the same technology as the large-scale research vessels? What new technology is needed for smaller floats?

The technology is the same in theory, different in practice. It's all sonar, just on a different scale.

2. What are the drawbacks of using smaller floats? Why are large-scale vessels still being used?

Smaller floats (in general) have a finite battery life. This could potentially be balanced out by using solar panels, which would allow for recharging in between dives. Large-scale vessels are often required for missions that require actual manpower. For example, certain Antarctic expeditions required the setup of current measuring stations that needed to be setup from sea ice. This couldn't be done autonomously, so actual research vessels with researchers on it were required to determine current in sections of Antarctica.

3. How difficult is this technology to develop? And are there any even more viable alternatives? For example, would it be significantly more expensive for an organization to develop and deploy their own devices that aren't necessarily dependent on the Argo floats?

I like this idea a lot! This reduces the reliance on Argo floats that are being used by other researchers. I think this could be a really helpful step to maintaining the independence of the project.

4. How can you build the add on measuring devices to so many floats at a reasonable cost?

The cost is reasonable regardless when you compare it to a research vessel that moves extremely slowly, takes a massive amount of manpower, and requires millions of dollars a day to operate.

5. Would equipping these floats with the measurement technology change their float pattern/depth (would they require more buoyancy)?

No, the bladders are quite powerful, and almost certainly would not require altering.

6. How powerful would this sonar technology need to be to reach the bottom of the ocean?

Not sure.

7. Why is it so helpful to map the topology of the bottom of the ocean?

That information is valuable to the military, which currently uses less than modern methods of mapping areas of potential docking. That information is also extremely valuable to deep-sea drillers, who clearly have a vested interest in ocean-floor-topography.

8. What are the absolutely essential instruments for this rover to remain operational whilst achieving its goal of mapping the ocean floor? In other words, what is the MELS ("Minimum Equipment List")?

Not sure. I'm unaware of just how much battery would be sapped by adding sonar. More importantly, permission needs to be given by other researchers using the Argo floats in order for them to be used. No instruments aside from sonar, bladder function, and GPS would be necessary for mapping. The bigger issue is that it'd be tough to convince other researchers to give up their ability to get data.

9. What is the TRL of these instruments (Technology Readiness Level)?

Not sure.

10. Why will mapping the deeper parts of the ocean floor (a place we really don't interact with) help anyone?

That information is valuable to the military, which currently uses less than modern methods of mapping areas of potential docking. That information is also extremely valuable to deep-sea drillers, who clearly have a vested interest in ocean-floor-topography.

11. Could some sort of low tech "swarm" AI be introduced to these devices? (If these things could be produced as clusters and programed to sweep the oceans in teams we could introduce an interesting dynamic with the goal of reducing the need for their production downline.)

I like this idea a lot! This reduces the reliance on Argo floats that are being used by other researchers. I think this could be a really helpful step to maintaining the independence of the project.

12. How are we going to make sure we get a complete map of the ocean floor with these drones, when there's a strong chance they'll all congregate along the same path due to current-action?

If you look at a map of these floats, there are 3,000 of them across the world's oceans. They do not end up in one spot. If the ocean worked that way, all debris would end up in a single spot in the ocean.

13. How much battery power would added sonar add?

Sonar would *detract* battery power rather than adding battery power. How much? I'm not sure.

14. Would the researchers currently in charge of the Argo floats be willing to sacrifice that energy for research unrelated to theirs?

That is unclear. I've spoken to a few Argo researchers, and they seem skeptical about how willing other scientists would be to sacrifice their share of battery.

15. Could solar panels be attached to the floats such that they could charge their batteries when they are floating in between dives?

Yes! I was thinking about this exact idea and I think it could certainly help solve the problem of battery life.

References

"A innovative semi-immergible USV (SI-USV) drone for marine and lakes operations with instrumental telemetry and acoustic data acquisition capability," by F. M. Raimondi, et al. , OCEANS 2015 - Genova; https://doi.org/10.1109/OCEANS-Genova.2015.7271595

Hydrography and Environmental Measurements from Mobile Platforms, by Anders Tengberg, et al., 2018 OCEANS - MTS/IEEE Kobe Techno-Oceans (OTO); https://doi.org/10.1109/OCEANSKOBE.2018.8559097

"Aquatic environment monitoring using a drone-based fluorosensor," Duan, Z., Li, Y., Wang, J. et al. Appl. Phys. B (2019) 125: 108. https://doi.org/10.1007/s00340-019-7215-y

"Reef Rover: A Low-Cost Small Autonomous Unmanned Surface Vehicle (USV) for Mapping and Monitoring Coral Reefs," by George T. Raber and Steven R. Schill, Drones 2019, 3(2), 38; https://doi.org/10.3390/drones3020038

"Portable, Lightweight Computer with Augmented Reality Glasses"

Answers to questions:

Cost and Market

1) The technology exists independently. For example, there are companies working on AR to mirror phone screens, and there are very small computers (Mac mini). The novelty of this idea is the combination of these technologies. Additionally, we are proposing a novel touchpad-like device that coats the surface of the computer.

2) The technical challenges are entirely feasible today. The main challenges are design ones.

3) Google Glass is a full computer on your face. This is different, in that the glasses themselves do not need to be advanced. They are simply for display purposes.

4) Google Glass was simply too ambitious. We are at the point in history where AR technology is becoming worthwhile. AR technology will inevitably be adopted in the near future.

5) Someone could be working on it. I don't really have an answer for this one.

6) This will be as affordable as a standard laptop/tablet.

Technical Implementation

1) The efficiency of working with AR glasses should be very similar to working with standard display.

2) There will still be the option to use a keyboard, but yes, presumably one would have to get used to the glasses.

3) Perhaps, but the technology is inevitable. The same argument could be made for phones.

4) The glasses are just displays.

5) 1 year

6) 1 year

7) I don't really understand this question

8) The computer is a separate device that can be connected via (bluetooth/wifi)

9) The battery life should be reasonably long for this idea to work.

10) Carrying around a small pod that can fit into, say, a jacket pocket is more convenient than carrying a full laptop

11) I wonder about marketing this as a "collaborative device." That definitely seems interesting. But what does it mean to "connect" in this case?

12) There are tons of AR glasses that are light enough to wear on one's face.