

## Team Members



**Jacob Ames**

**MIT, Class of 2014 (Graduate Program)**  
Major: Aeronautical Engineering  
**Investor Relations and Project Management**



**Cole Houston**

**MIT, Class of 2015**  
Major: Mechanical Engineering  
**Interface Optimization and New-Features Implementation**



**Paul Folino**

**MIT, Master’s Student**  
Major: Naval Architecture & Marine Engineering  
**Quality Assurance and 3-D Modeling**



**Catherine Fox**

**MIT, Class of 2015**  
Major: Mechanical Engineering  
**Product Design and Development**



**Corliss Lee**

**Berklee College of Music, Class of 2015**  
Major: Music Business/Management & CWP  
**Customer Service**

## The Founders

Our team is a diverse group of students from both MIT and Berklee College of Music. The team has experience in user-based design and human factors, as well as marketing, management and new product development. We are well equipped to handle the challenge of designing and new product and bringing it to market.

**Jacob Ames** is a second year master’s student at MIT pursuing a degree in aeronautical engineering, with a passion for improving efficiency in industry. He has had a few years of experience with startups, having been directly involved with the inception and operation of a cleaning company in 2009. Additionally, he has some prior experience in entrepreneurship and is familiar with market research and sizing, assessing lifetime value and acquisition cost of customers, and constructing business plans. His experience will be helpful in facilitating project workflow and maintaining relationships with current and potential investors.

**Cole Houston** is a Junior at MIT studying Mechanical Engineering concentrating in Product Design. His particular area of interest within product design is interaction and interface design. Previous experience includes creating interactive activities for the Museum of Science, Boston and helping design an indoor, technologically-enhanced gardening system. Cole has also had experience in fundraising and making connections in industry.

**Paul Folino** is a master’s candidate at MIT focusing on naval architecture and marine engineering. His past experience includes a two-month internship with NASA, as well as three years in the United States Coast Guard. He’s well-versed in quality control requirements, and has experience with 3D modeling programs such as Solidworks.

**Catherine Fox** is a mechanical engineer focusing on sustainable product design. She has past experience working with user based design and in bringing new products to market in the startup environment.

**Corliss Lee** is a junior at Berklee College of Music majoring in Music Business/Management and has basic knowledge in several aspects of business, including marketing and finance. Corliss has a lot of interest and some experience in customer service and enjoys dealing with people.

**Commented [CH1]:** We do an ok job of describing who we are. However, we don’t pitch ourselves as the perfect team.

## The Idea

Fatigue and tiredness plague people every day. Overworked college students fall asleep during important classes and while struggling to complete homework. Night shift workers and young professionals in demanding jobs, such as investment banking, often struggle to stay awake in order to successfully complete their jobs. Young parents often have to carry on their already busy lifestyles while dealing with the added burden of sleep deprivation. Doctors combat sleepiness on a regular basis both in the clinic and while commuting (<http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2078416/>). Around 20% of all fatal car crashes involve driver fatigue and total costs of fatigue related accidents total around \$3 billion annually (<http://www.tac.vic.gov.au/road-safety/statistics/summaries/fatigue-statistics>). In the workplace, productivity lost due to fatigue is estimated to cost \$1967 per employee annually (<http://www.ncbi.nlm.nih.gov/pubmed/20042880>).



Our vision is to create a wearable device that will monitor the user’s alertness and notify them when they are starting to nod off. The device will be inconspicuous, allowing the user to wear the device in any scenario without signaling that they are struggling with fatigue. Use of the device will help keep people more awake and alert. College students will be able to get more out of their classes and professionals will be able to be more productive in the workplace. Young parents and doctors will be able to go throughout their days with an aid to help them combat encroaching fatigue and the number of car accidents involving tiredness will be reduced. Because of our device, the world will be more awake and productive.

## The Product

Our team’s slate of potential product designs includes a variety of wearable devices that monitor various physiological data, with an emphasis on heart rate variability. These designs include an elastic wristband, a headband, an over-the-ear device, and a ring, among others. Quality and reliability testing of these prototypes will determine which devices are most reliable and accurate, and allow our team to proceed into the manufacturing phase. Maintaining a variety of products of identical function will allow us to capture a larger market share by letting consumers choose the device that fits most comfortably into their lifestyle.

A study by Malcangi and Smirne in 2012 has concluded that heart rate variability, in particular, can be processed using fuzzy logic to determine if an individual is in the biological phase of sleep onset. Considering these results, our team plans to develop a smartphone application for both Android

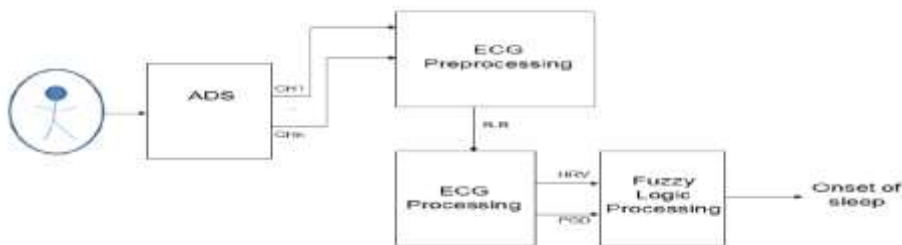
**Commented [CH2]:** Here we describe the problems we are trying to fix.

**Commented [CH3]:** The idea behind our product. Notice it doesn’t describe how the product works particularly. It simply describes how it would combat the problem. Although we could have said it more concisely.

**Commented [CH4]:** Lots of detail here. However, we aren’t decisive on what exactly we want the product to look like. This weakens our argument.

and iOS which will accept heart rate variability data from the user’s wearable device wirelessly via Bluetooth and run a short computation to determine whether the user is awake or in a sleep onset phase. Both devices will communicate continually, and once sleep onset has been detected, an electric shock or vibration stimulus will be delivered to the user until the application confirms that the user is no longer in the sleep onset phase. Safety features will be incorporated into the device if an electrical shock is used to insure that the shock will not be harmful. Users will also be able to choose the intensity of the alert and whether the alert will increase in intensity if they do not wake up immediately. A vibration or shock-based stimulus was chosen over audible or visual stimuli to prevent causing problems for users who are prone to migraines.

The following diagram describes the inputs received by a fuzzy logic processor - once a certain “truth” threshold has been reached, a stimulus is delivered to the user:



Other sensory options that we will consider in testing to determine whether users are in the phase of sleep onset include head movement, body temperature<sup>1</sup>, and EEG sensors. These would likely be used in addition to heart rate monitoring to add a layer of redundancy and improve accuracy.

In an attempt to remain out of competition with existing wristband-type technologies such as FitBit or FuelBand, our devices will remain focused on preventing sleep, without implementing unnecessary features such as fitness feedback, time, etc.

Our device will be different in that it will be easy to incorporate into everyday life. It will not be conspicuous that the device is monitoring the user’s alertness, and the alerts will be subtle so that only the user is disturbed by them. Feedback from potential users has guided this design decision. Most people do not want everyone around them to know that they are barely managing to stay awake, especially in professional situations. The device will also not be tied to one location, such as the car, since it is wearable and meant to go wherever the user goes, provided that they take their smartphone with them.

<sup>1</sup> <https://shine.yahoo.com/healthy-living/10-bizarre-things-happen-while-sleep-181800737.html>, <http://www.dailymail.co.uk/health/article-90598/What-happens-body-youre-asleep.html>



This is a very general concept sketch of how the wristband device would look. The color and style could change, but the wristband would remain tight fitting and have a low profile.



This is a general concept sketch of how a behind the ear device would look. It would be small and almost completely concealed behind the ear. It would also stay tight against the head.

Product advice from an advisor:

One of our teammates took the time to talk to a friend who is narcoleptic. As a result, she often suffers from the problem of falling asleep during the day. Her feedback was that the device had to be very subtle. She did not want other people to know when she was struggling to stay awake. The device had to be easy to incorporate into her life and not stand out from the other accessories that she would wear. Additionally, she was concerned about the intensity of the wake-up alert. She wanted to ensure that it would be powerful enough to wake her up. Hence, she suggested an electrical shock instead of just a vibration. She counseled against using lights or sounds, since that type of stimuli can bring on migraines.

### Who cares?

**A)** Joe is a 25 year old who has an inconsistent work schedule. Some weeks he works day shifts, other weeks he works night shifts with a second job in the afternoons. As a result, he is often sleep deprived and struggles to stay awake through his shifts and the drive home. He wishes that there was something that could help him stay awake when he is starting to nod off.



**Commented [CH5]:** This should be our persona. We failed here and this is does not have anywhere close to an acceptable level of detail. Instead it’s more a user profile.

**B)** Our target market includes college students, shift workers, young parents, professionals, and anyone suffering from sleep deprivation. In 2013, there were over 17 million students enrolled in colleges across the nation (<http://www.statisticbrain.com/college-enrollment-statistics/>). Almost 15 million Americans work at full time shift jobs (<http://www.cdc.gov/niosh/topics/workschedules/>) out of about 110 million Americans who work full time (<http://www.statista.com/statistics/192361/unadjusted-monthly-number-of-full-time-employees-in-the-us/>). Overall, about one third or 40.6 million Americans are sleep-deprived (<http://www.medicaldaily.com/nearly-third-americans-are-sleep-deprived-240273>). Any of all of these markets would provide a large customer base. To begin with a more realistic beachhead market, our team will focus marketing efforts on the greater Boston area, which boasts a significant population fraction of college students and commuters.

**Commented [CH6]:** Should be Total Addressable Market. However, we don’t do enough detailed research. (Notice we say we’ll launch in Boston, but don’t give the number of potential users in Boston. Also, we don’t say how much people are spending on staying awake already.)

Wearable devices are relatively new to the market, but demand for them is growing. There is a lot of uncertainty as to how much growth there will be in the near future, but some estimates say that the 100 million units shipped milestone will be crossed this year, with up to 171 million units shipped by 2016 (<http://www.businessinsider.com/wearable-devices-create-a-new-market-2013-8>). If the wearables market reaches \$6 billion in the next few years as is predicted by some businesses (<http://wearabletechwatch.net/2014/02/13/market-sizing-how-big-is-the-wearables-market-today/>) and our device captures even 0.01% of the market, we have a potential market size of \$600,000.

**C)** Our device would be targeted at people ages 18 and older who suffer from sleep deprivation and need to function in school, while going about their daily lives, and in a professional setting. The product will be specifically designed to fit into the daily lives of these users. We will perform extensive user testing while designing the product and constantly seek feedback along the way. If the product needs to be changed to better fit the market, it will be.

**Commented [CH7]:** Nice user profile.

**D)** To find our first users, the founding team members’ networks will be searched. Many of our friends

**Commented [CH8]:** This should have been our first 10 users. We are far too vague here.

or associates are potential users of the product. After pitching the idea to those in our network and attempting to sell them stage one prototypes, we will receive feedback and make modifications to the device. For the next stage, we will attempt to use the networks of our stage one users to expand our reach. We will also attempt to attract media attention to spread the word of our product beyond what we can accomplish locally. A well-made video showing off the product could attract the attention of and draw in potential users. We can also begin to pitch the device to local businesses, emphasizing how this device could increase productivity.

### The Competition

#### Vigo ([www.wearvigo.com](http://www.wearvigo.com))

Vigo is new startup that just successfully completed a Kickstarter campaign to start selling their first production run of a wearable device designed to help you stay more awake and invigorated. The device is a combined Bluetooth headset and eye-tracker. It uses a blink detection and tracking module combined with an accelerometer to detect head dropping to determine your level of alertness. When you reach a certain amount of tiredness, the device will buzz, blink a light, or play a song depending on your preferences. In addition, the app that comes with the device tracks your alertness over time and gives you suggestions on how you can be more awake. Vigo has one specific advantage: they are first to market. However, their form factor could be a disadvantage to them. Reviews point out that currently Vigo is not a device you would want to wear all day. In addition, wearing Vigo lets people know that you are struggling with fatigue. Even if you’re able to pass off Vigo as a Bluetooth headset, there are many scenarios -- such as a business meeting or a party -- where it is not acceptable to wear a headset. By creating a less conspicuous device, we can gain an edge over them.



Commented [CH9]: Very thorough and detailed, but forgot the obvious competitor – coffee.

#### Phone apps (<https://play.google.com/store/search?q=anti%20drowsy&c=apps>)

The Google Play store has several phone apps that claim to be able to help you monitor your alertness and help you to stay awake longer. The methods used range from somewhat silly to possibly useful. Anti Sleep Driver is one of the simplest ones. Based on a study produced by a team of French researchers, it uses a solid blue light to help you gain energy and stay awake. It doesn’t have any way of detecting when you are feeling drowsy or a way to alert you. Dozing Off (Stay Awake) has a red button on a green field. The moment you stop pushing the red button, your phone will start vibrating. While this approach could be effective in keeping you awake, you must keep your focus on the phone. As a result, you can’t use this while driving or in a classroom or meeting due to both social protocol and the need to focus somewhere else. Anti Sleep is also incredibly simple. It will activate an alert on a regular basis according to user specified settings. It also has no way



of detecting if you’re falling asleep or not. In addition, using could be socially unacceptable because you would need to have your phone out. Eye Up is the best app on the market. It uses the front camera of your phone to detect when your eyes are closed. Once you reach a certain threshold, an alarm will sound and the app may suggest that you find a way get more energy, such as buying a coffee. Its drawback is that it must be placed in such a way as to be able to see your eyes. Thus, it can only be used while driving or at a desk. It also is not very popular on the market, having only slightly more than a thousand downloads. By making a device that can be used in any situation, is not tied to interacting with your phone, and tracks and notifies you of your alertness level we can gain an edge over these phone apps.

#### **No Nap/Driver Nap Alert Alarm ([www.amazon.com](http://www.amazon.com))**

Both the No Nap and the Driver Nap Alert Alarm use accelerometers to detect head droop and either a buzzer or a vibrating motor to alert the wearer. Both are available inexpensively on [amazon.com](http://amazon.com), but both have very mixed reviews. Some people claim that they work, while others pan them. Biggest complaints are that they are not adjustable and often don’t fit, are uncomfortable and ugly, often simply don’t work, and that they are activated only by a sudden head drop. While the concept behind these products is sound, the execution seems to be flawed.



#### **In-car eye trackers**

Several companies are working on developing eye tracking devices that would be integrated into automobiles. These devices would track blink rate and alert the driver when they are reaching a critical level of fatigue. These will no doubt be highly accurate and reliable. However, they will be limited to being used in the car.



#### **FitBit / Nike Fuelband / Jawbone Up**

While companies such as FitBit, Nike, and Jawbone are not currently in the market for fatigue tracking, they are the leaders in wearable health trackers. As such, it could be fairly easy for them to add an alertness feature if they desired. Currently, they are not competitors, but are included because that could become the case in the near future.





### How will our competition react?

The companies that make the cell phone apps, the No Nap, and the Driver Nap Alert Alarm will probably not react once we launch our product. All of those products function on either a very limited scale or appear to have stopped their development cycle. These products also don't have the capability to add features that we will incorporate.

Makers of eye tracking systems integrated into automobiles will probably not react as well. They have a specialized niche they fill and that they can profit from. Their technology won't scale well to a device that a user can carry with them throughout the day. They will most likely not be a threat.

FitBit, Nike, and Jawbone could react in a couple different ways. Either they would stay with the fitness market or they could expand into the alertness market as well. Both could be viable strategies for each company, especially Jawbone which already has experience in head mounted wearable devices. If any company tries to move into the alertness space, they would pose a large threat since they are already established names.

Vigo will probably be our largest immediate threat. They have already released an SDK for Vigo and envision it being used to perform functions such as controlling your powerpoint slides with your blinks. When we release our device and focus on its versatility and social acceptability, they will probably respond by emphasizing the other uses Vigo can be put to. In essence, they will probably market Vigo as a Google Glass-like device.

### Ongoing Advantage

Our ongoing advantage will be that our device will be subtle so that it can be used in any situation. It won't stand out like Vigo does and mark you as someone fighting fatigue. Unlike phone apps, it will be socially acceptable to use our device all the time. While it may be later to market than other devices, its flexibility will be its strong point.

**Commented [CH10]:** Is this actually strong enough?

### Why Now?

Now is a perfect time to launch our product. The market for wearables is growing and has been primed by devices such as the Galaxy smartwatches, FitBit, and Google Glass. Fatigue is a recognized issue and is increasing as people try to get more done in the same amount of time. Technology has reached the point where sensing and computing power can be put into a small, discreet package. Design, one of our team's strong points, has become a buzzword in the consumer products industry. Launching our product

**Commented [CH11]:** Good argument.

now will allow us to enter the market riding the wave of previous wearable devices while still being early enough to make an impact.

### Who Pays?

Since we will be focusing our marketing efforts on the greater Boston area and target college students in the beginning, we will initially use a B2C model. We will focus on online marketing and sales as college students tend to be more tech-savvy. Logistics companies such as UPS will be used to deliver the product. Focusing on online sales will allow us to rake in more revenue as there is no middleman, except for the logistics company.



**Commented [CH12]:** Good detail. The specific strategies and pricing could use some development in the future.

An informal survey was done with college students in the area, asking them what they believed would be a reasonable price for a device with this functionality. Responses varied from \$40-\$100. Those who said that they thought that the concept was good, but that they did not have a personal need for the product placed the price closer to the \$40 range. Potential users who stated an interest to purchase the device and use it for themselves placed the price closer to the \$100 range.

As the business grows, we can start targeting companies that hire many night-shift employees such transportation companies. More specific examples would include airlines and bus and taxi companies. The reason we target these transportation companies is because many accidents occur due to drowsiness and fatigue in this field, and these accidents will undoubtedly give them a bad reputation. If we can secure deals with big transportation companies such as MetroBus and Southwest Airlines, we will be able to offer discount with bulk orders, and collaboration with these companies for marketing purposes such as endorsement deals may be worked out later on.



### Keys to Success and Risks

#### Macroscopic

1. Design team is comprised of members with diverse backgrounds and experiences (two mechanical engineers, one aeronautical engineer, one music major, one naval architect). This environment fosters unique input and creativity, while also addressing the need for product design expertise. Additionally, there is human factors engineering experience in the group, which benefits the quality and ergonomics of the product.
2. Also, being in MIT’s innovative environment, we have multiple resources at our disposal including facilities, tools, and knowledge for little to no cost.

#### Microscopic

1. **Developing a framework for successfully identifying the potential market.** There are many different sources of information that lend themselves to the benefit of the product. For instance, police accident reports provide tangible information on fatigue related accidents, but how do we effectively measure the amount of cars that DO NOT crash due to driver fatigue? A simple survey will not necessarily address

**Commented [CH13]:** Good realization. Except we should have given how we would solve it.

our inquiry as most will likely say that they have driven fatigued; we need a metric to measure the amount of “near-misses” that fatigue has caused.

2. Developing a minimally viable product (MVP) that is both functional and addresses the shortcomings of other competitors’ products. This will be integral in gaining investors to fund further product development.

#### Potential Risk

There are many risks associated with this start up. Among them, the 2 primary ones are: existing competition in the market and convincing investors that our version of the product is better than the competition’s. These risks, consequently, are our team’s biggest cause for concern, but they can be mitigated.

The competition risk poses a very serious concern. The market for this type of device is easily distinguishable, but the importance of creating a different product than what is already out there is crucial. Although we are only in the fatigue market and not really fitness and calorie counting, our company still gets lumped into that category.

#### Mitigation Strategy-

Most complaints and criticisms of competitors such as Nike FuelBand and Fitbit are about the pains people have in syncing their data and also the ease with which consumers lose their data. The inside hardware of our product versus others would likely be the same (except that the FuelBand does not indicate heart rate data) and include accelerometers, altimeters, and also be waterproof (FitBit is not).

Where we would differentiate from the competition is by combining several physiological data such as heart rate, body temperature and EEG to ensure a higher accuracy. We would also create more reliable firmware which would improve the user-device interface. This would be done by essentially taking an already simple, minimalistic device, and making it even simpler. We would accomplish this by rolling out additional features in our device on new product releases. We would start with a fatigue monitoring device and once perfected, then start looking at integrating other options instead of giving the user a multitude of poor options.

Although we are not well versed in computer science, this task can be accomplished by hiring more employees to help with the software design. Initial figures assuming a programmer costs \$80/hr would indicate a conservative added price tag of about \$76,800 for 6 months of work (120 days).

Although there is still significant risk in trying to penetrate an already existing market, our vision of reliability and simplicity should give us a good foothold in a saturated market.

#### Key Milestones

The milestones surrounding the company are the following:

1. Determine company hierarchy, administration, and personal roles in company (Week 1).
2. Enlist help of human-factors engineer (faculty) that can serve as consultant for product (Week 2).

3. Conduct market research, specifically addressing fatigue induced traffic accidents, and uncover any existing information on accidents where an anti-fatigue device was used (Weeks 2-26) **(All will help with research until week 8, then we will divide team into designers and researchers).**
4. Purchase existing anti-fatigue devices (Vigo) and distribute among close friends and family that do a lot of long travelling. Determine methods to improve current devices. (Weeks 2- ??)
5. Start networking with potential investors. Basic introductions, let them know the product we have in mind (Week 26- ??)
6. Determine plan to implement web Application (passive) in addition to device (active). (Week 26)
7. Start developing crude product and app using personal money and investments (Week 8-52)
8. Provide presentation to potential investors or venture capitalists, demonstrating the efficacy of product, receive first round funding (Week 52)
9. Beta test product by releasing to small amount of people for as much as they are willing to pay (Week 52-72)
10. Network with transportation industry, implement technology in transportation sector after results come back and changes have been made. (Week 92-102).
11. Make changes according to industry feedback (Week 102-110)
12. Enter second round of investor funding (Week 110)
13. Mass produce, release product to the public (Week 112)
14. Iterate

Nothing will ever be de-risked, per se. Risk is an inevitable part of every company, and it will be identified, managed, and mitigated before every major milestone of the business. Effective risk management relies on having a lot of information and making the right decisions according to a decision-making matrix like a Pugh Chart or using the weighted sum method. The metric to measure the quantity and quality of the information we have is by getting unanimous company approval before a decision is made. There is never enough information to make a no-risk decision, so implementing decision-making methodologies and acquiring information through research is our best way to make informative decisions.



**Commented [CH14]:** This is fluff that should be cut. It doesn't help with anything.

### Financing Requirements

Based on development cost data from similar products, we expect our initial development costs in **Q1Y1** to be on the order of **\$50,000** for a first draft prototype. Since our team already possesses the necessary design software that will be used in modeling the product, the majority of this initial capital will be used to recruit and finance outside talent, purchase materials/components, and facilitate solutions to any complications in the prototype development phase. Additionally, it will finance a lease on a product development and headquarters space, which is expected to be located in southern Massachusetts.



After design and testing, which is expected to take three months, we will need enough money to file for at least two patents, at around \$25,000 each. Our initial angel investment is expected to cover this cost, in addition to marketing costs of roughly \$300,000 and manufacturing costs of \$200,000 over the next nine months, totaling **\$550,000** of investment at the beginning of **Q2Y1**. In **Q1Y2**, we expect to raise at least **\$3.0 million** in order to continue marketing and manufacturing for the next year, after which we expect to reach cash flow breakeven and become self-sustaining. Total investment requirements for product development, promotion, manufacturing, and miscellaneous expenses are expected to be around **\$3.6 million**.

### What’s Missing?

A major missing component in our team is someone who is very familiar with patent law and other legal concerns – we will have to compensate by enlisting a very capable lawyer on our team in order to protect our investments. Another major player that is missing is a good programmer or software engineer. The product will require good algorithms for it to function properly, something that our current team will not be able to produce. Additionally, we will need to hire a manufacturing consultant, as our team is relatively unfamiliar with manufacturing processes. We may also need to hire an individual or a small team to assist with marketing, as we expect it to be too much of an undertaking for a single one of our team members to take on alone. Finally, we’d like to recruit a mentor who is familiar with fitness and/or technology startups, and who can offer advice and continually point us in the right direction, in addition to introducing us to potential vendors of our product.

