A note to the students:

Congratulations on your entry and participation in the Conrad *Spirit of Innovation* Challenge!! I am happy and excited to review your business plan and provide you with detailed feedback to help improve your future efforts.

In reviewing your proposal, I do not dwell on whether or not I think the product described is a good or bad idea. I try examine the proposal as a potential investor for your fledgling company might; to determine if you have done a good job:

- Describing the product concept,
- Identifying and justifying a need,
- Researching potential offerings which attempt to satisfy that need,
- Providing references and citing sources for materials used in decision making,
- Proposing a new and more innovative solution,
- Developing metrics for evaluating the capabilities of the proposed solution against the needs of the target users,
- Validating and refining the solution to achieve optimal outcomes, and
- Developing a viable plan for further development, testing, production, and deployment.

Even as a reviewer, my primary goal is to assist you in understanding what is good and bad about your BUSINESS PLAN. Expressing my opinion of the proposed product is a secondary concern, and I will almost always do that in the form of a question – a question which will hopefully allow you to step back from where you are and to explore your product from a different angle.

I use this document template for my convenience since it allows me to edit and format my comments to you in ways that the Judge's Portal does not permit. I believe that it provides significantly better feedback than I would otherwise be able to give. Each section in this document exactly matches the criteria given in the Judge's Handbook with one exception noted in the document. In prior years, the final section included commenting on the graphical concept and your video proposal. As indicated in the section, I will use that space to provide feedback on these elements but that feedback is not used as part of the scoring for that section.

I have provided comments for each section which I hope you will read and use constructively in improving this product proposal, but also in helping you to better understand and apply STEM principles and methodology to all your undertakings.

Again, I congratulate you on your submission and hope you will continue to strive for excellence in everything you do.

Scoring Summary Category	Points	Awarded
Technical Innovation	20	**16**
Technical Practicality	20	**16**
Marketability	10	**7**
Costs	10	**8**
Industry Relevance	15	**10**
Funding Mechanisms	10	**8**
Team Story	15	**14**
	Total:	**79**

Technical Innovation (20 Points): ***How new or unique is the idea? Does the product already exist?***

We look for innovation in any of 3 forms:

- The technology itself
- A combination of existing technologies into a new system
- Innovative business concepts - The team should show how their product uses one or more of these types of innovation.

V-Fly appears to be a microprocessor based, motion triggered imaging system with image recognition and playback of specific audio based on the recognized image. It would be deployed on high-rise buildings, towers, and in other places where the deterrent of avian presence is desired.

A web search for bird deterrent devices produced a wide variety of visual, sonic, and ultra-sonic devices although none that used imaging to select the proper sounds for the targeted species. In that regard, V-Fly seems unique.

The proposal and the video presentation explained the problem, current approaches, the emerging need, and finally how V-Fly would be developed to satisfy those requirement. Throughout this discussion, the proposal quoted a wide variety of numbers and statistics but only provided a single reference to the source of this data – the CBS Sports article about the cost of decals for Viking Stadium. The lack of citing credible sources to substantiate the numbers used for product justification and making design choices brings into question the validity of those decisions. In addition, some of the statistical data seems out-of-place or misleading. For example, we are warned that 37% of all North American bird species need urgent conservation action, but how many of those species are waning due to infrastructure collisions in unclear. It would be interesting to understand how many of those species are in a position to be helped by V-Fly.

The combination of image recognition to identify the inbound species and playing a species-specific deterrent sound is an innovation, as is using the IBM Watson engine to perform the analysis and manage the database. This combines a variety of existing technologies in a new way to achieve a desired outcome.

Score: 16

Technical Practicality (20 Points): ***Will this product work technically?***

- The team must show that its product does not break any physical laws.
- The team does not have to show proof that the product will work, but should show an understanding of what research or experiments are needed to prove that it will work.

The fundamentals of image recognition followed by database look-up to find an appropriate sound file are well understood and technically feasible. Where things got a little questionable was the implication that the IBM Watson engine would be run on the Raspberry Pi. I am not sure that the Raspberry Pi has the chops to run Watson.

I am aware of the IBM Watson IoT *Service*, including the toolkits for the Raspberry Pi, but this is a cloud-based service which would require V-Fly to connect to the cloud. The proposal does indicate that an IBM Expert stated that the Watson Model would run on the Raspberry Pi, but I am not certain what this means in terms of performance capabilities or the demands placed on the Pi itself. The Pi has a scant 1GB of memory (and Watson likes memory), the SD card interface is slow, and you've only got 4-ARM/7 32-bit cores running at 900Mhz.

If, in operation, V-Fly needs to connect to the cloud-based Watson service, there is no discussion of the amount of bandwidth that would be needed to support this link. Given V-Fly units placed on a 20' by 20' grid on all four sides of a high-rise building, that's going to be a lot of data.

I think the combination of these two factors is where the proposal's term "Watson Latency" comes from. Either we are waiting on the Pi to figure out what the inbound bird is, or we are waiting for the data to go to and from a cloud service before we can sound the appropriate deterrent.

There are environmental challenges (ie: weather) this product will need to meet as well, although little of this is addressed by the proposal. Given the deployment on building exteriors, the unit is going to need to be environmentally sealed against the elements and be capable of running through a wide range of temperature conditions. Getting the heat out of a sealed unit which is sitting in the hot southern sun for 14 hours is not trivial. A speaker to work in these conditions is also required. One wonders if any maintenance to the installed units will be necessary (such as lens cleaning or removing a spider nest from deep inside the speaker's horn) on a periodic basis and how that will be performed. How is the unit powered? Batteries are suggested by the proposal but it is unclear how much battery is required, if they will be recharged in some fashion, and how long the product can operate before battery replacement is necessary. Are there environmental factors that will affect the operation of the motion detector and the quality of imaging?

Nothing is technically impractical, but a detailed requirements analysis of the entire system is needed to identify and address all of these issues. They will no doubt have an impact on unit costs and deployment costs.

There are also two other concerns which should be addressed by the proposal. The first looks for any data regarding the effectiveness of species-specific predator call playback (via the kinds of speakers necessary for the weather conditions). The second looks for any predictive information regarding the potential noise pollution aspects of having an urban canyon with multiple V-Fly installations all playing predator calls. One wonders if there will be the audio equivalent of Hitchcock's *The Birds*.

Score: 16

Marketability (10 Points): ***Understanding of the key markets for their product must be demonstrated.***

- Who is the buyer?
- Will the team pursue government Research & Development (R&D) grants, licensing to another company, or create an entrepreneurial startup?
- Is there data showing how similar products have been successful?

The proposal clearly defines the target markets although it does not discuss how the unit will need to be modified for the different application settings. Market sizes are stated (using uncited data), and modest sales estimates are provided.

The team looks to create a startup to produce and market their product.

While there are no products on the market today that use visual species recognition to trigger specific predator responses, there are a variety of other optical, sonic, and ultra-sonic products available. Most of the sonic product can be configured to play the common predator sounds for the installed region. It would be very welcome to see some sales and effectiveness information for these products as a gage to the potential market acceptance of V-Fly.

Score: 7

Costs (10 Points): ***The team should break down estimated costs of taking this product to the chosen market.***

- Costs should include any material estimates, R&D (including grants), market studies, and labor costs.
- Teams should including costs for the team to participate at Innovation Summit.
- Teams should be as detailed as possible.

The proposal outlines additional development costs as well as the production costs for the V-Fly unit. Some of the dollar amounts may be under-estimated, especially where environmental testing as well as for regulatory safety and compliance is involved.

The cost estimate for the finished product ($30) is unrealistic and no detailed breakdown for this figure is provided. Various items seem missing from the product cost discussion including the housing and the suggested use of IR LED Lighting to provide night-vision capabilities. The unit cost of the Raspberry Pi does not drop significantly in quantities and the volumes necessary to use their customization service may not be feasible during the early stages of product deployment. It is unclear if there is a per-unit 'license' fee for the use of the Watson engine (should it be embedded in the unit) or a fee for using the Watson cloud-based service which would need to be added to the product costs.

I would also like to offer the team a bit of advice: there is a difference between 'cost' and 'price'. Cost is what it takes you to produce each unit; Price is what the market will bear. If alternate sonic devices which use a generic, non-species specific predator sound as a deterrent sell for $200 and have low effectivity, a device which targets the inbound species to achieve greater effectiveness should not be offered for 65% less. Remember, your perceived competitors have set the market price. It could make sense to determine the projected area that a single unit of a competitive offering can protect (or the projected volume if you want to work in three dimensions) and divide that by the per unit cost to obtain a 'coverage-per-dollar' value. Then compare the coverage range of V-Fly to that baseline.

Cost estimates for attending the Innovation Summit are detailed including reasonable estimates for travel and housing, but may be a little light on food.

Score: 8

Industry Relevance (15 Points): ***How important is the idea to the industry?***

- Does the product represent a substantial improvement in its industry or are there already products on the market that fill the need?
- The team should list examples of similar products, including patent searches or other examples of technology on the market, and explain how its product is an improvement of what already exists.

The proposed product would appear to be a significant improvement over current state-of-the-art offerings although no evidence of studies showing its superiority are presented. As a means of protecting bird populations and minimizing the impact[1] of bird damage to structures, the product is relevant.

The proposal does not include any information relative to existing patents or license requirements for these technologies used in this fashion.

Score: 10

Funding Mechanisms (10 Points): ***Does the team understand the basics of how its product could be funded?***

- If it is relatively simple, can the team raise money for prototypes and begin sales through friends and family?
- Does the team need to consider grants, loans, or bringing on investors or partners in their efforts?

The proposal examines a variety of funding sources from social crowdfunding and grants to some partnership opportunities and private philanthropic donors. There is also a suggestion of selling subscription services to bird enthusiasts, providing notification when selected species are detected in their locales.

Since the development costs to reach production release may be understated, the team should take a closer look at realistic funding expectations from these sources, when they are needed, and at what levels. The proposal should include a simple estimated monthly *cash-flow statement* for the development cycle and the first year of production, with forward projections to profitability. This will give you and potential investors a better idea of the solvency of the company.

Score: 8

[1] Pun not intended.

Team Story (15 Points): ***Introduce your team to the potential investors.***

- How did the team form?
- What roles did each member play?
- What barriers or hurdles did the team overcome to develop its idea and complete its business plan?

Note: In previous years, this section also included the following items. Comments relative to these items will not be included in the scoring but are provided as feedback to the team.

- Graphic Concept - Is the product design clear and easy to understand visually? Did the team produce quality graphics in professional manner? Did the graphic representation enhance the overall business plan?
- Product Video - Did the video clearly explain the product and need? Was the video engaging for future investors? Did the team's video enhance the overall business plan?

The team story is well presented including formation and roles assumed by each member. Obstacles to development were not highlighted in the proposal.

The product video was well organized and presented. The progression of defining the need through the product concept development enhanced comprehension and provided and excellent background into the product. The one negative comment I would make towards the video is that the pacing was a bit hurried in some places. I am sure that this is due to the time restrictions imposed by the competition's guidelines, but one wonders if there was content that could be eliminated without diluting the message to provide more time to better pace the important parts.

Graphics provided in the proposal included many that were in the video presentation and were well generated and easy to understand. There were some additional graphics used in the video that I would like to examine further but were not in the proposal. The one overriding comment to all of these graphics is *site your sources*. Information without understanding the context within which it was generated is useless. As an example, consider the exotic tree shown below:

Without knowing the context of this image (including the scale), you do not know that this is actually a microscopic mold spore.

Overall, this proposal is one of the best that I have reviewed in many years of judging competitions of this sort. Well done!

Score: 14