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# Necessity Is the Mother of Innovation

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# The Importance of Innovation



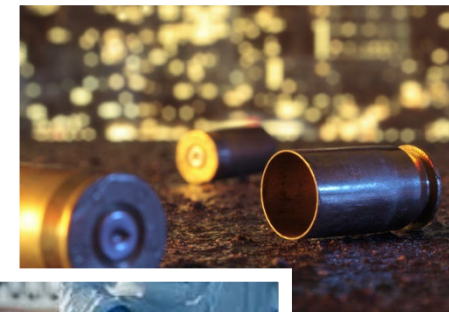
I don't think necessity is the mother of invention. Invention, in my opinion, arises directly from idleness, possibly also from laziness - to save oneself trouble.

— *Agatha Christie* —

AZ QUOTES

# Motivation by Internal or External Sources

- Sometimes a problem is identified internally
  - Difficulty in the lab requires a creative solution
  - Opportunity for improvement (e.g., in efficiency, effectiveness, quality)
- Sometimes a problem is presented from external sources
  - Open solicitation from the government
  - Request from client or stakeholder





## 4 Unique Challenges with 4 Innovative Solutions

- Optimizing tape evidence handling and testing for LP processing and DNA
- Handling of fired cartridge casings in the DNA laboratory
- Devising a realistic and safe canine scent training tool for explosives
- Reducing the exposure to Fentanyl at the crime scene



# CHALLENGE



## LP and DNA on Tape

Innovation Initiated Externally  
(Federal Contract)

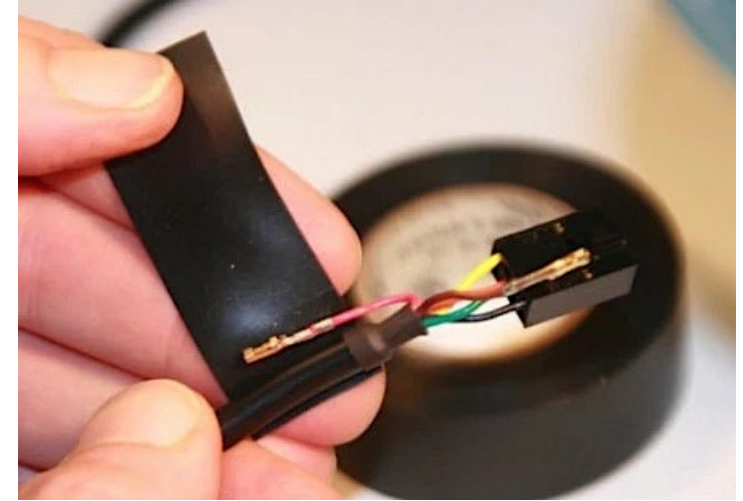
### Acknowledgement

This research was supported by the Combating Terrorism Technical Support Office (CTTSO) of the US Department of Defense, now known as the Irregular Warfare Technical Support Directorate (IWTSD)

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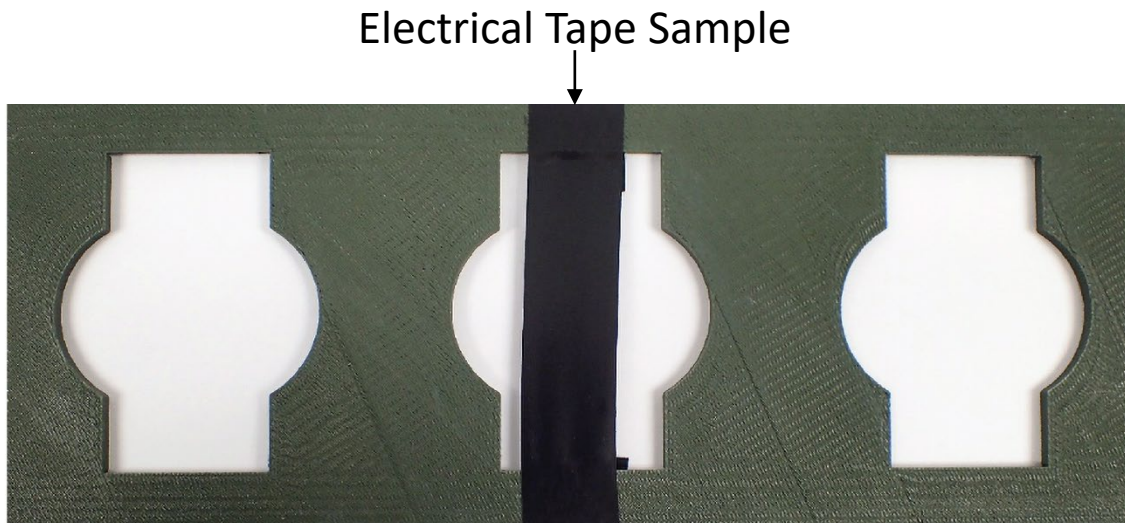
# Tape Handling and Testing Difficulties

- Handling is awkward, the sample can stick to itself
  - Stretching or creasing during handling can alter fingerprints
  - Getting poor contact between the substrate and extraction buffer can leave valuable DNA behind
- Testing pathways incompatible between LP and DNA
  - LP methods tend to not be aseptic
  - DNA methods are destructive to evidence



# Innovative Handling Solution

- Handling tape during LP processing
  - Create a 3-D printed plastic holder to facilitate handling during cyanoacrylate fuming/dye application
  - Allows for LP development on both sides of tape



**Prevents wrinkles, allows processing with minimal handling**



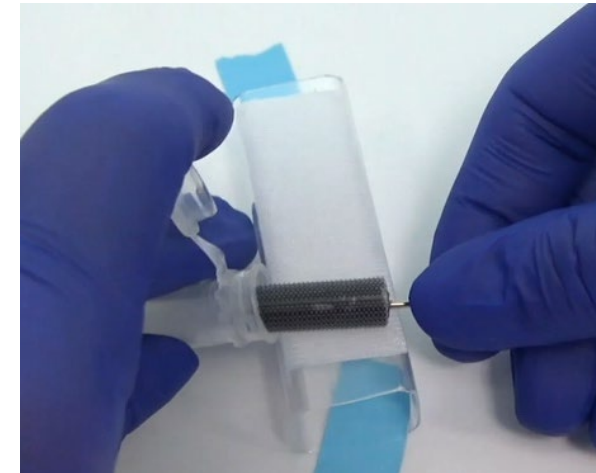
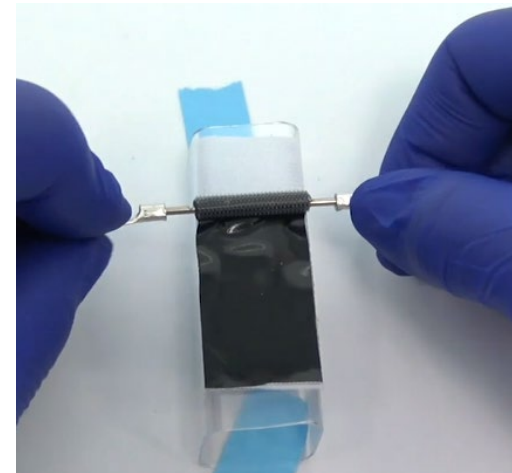
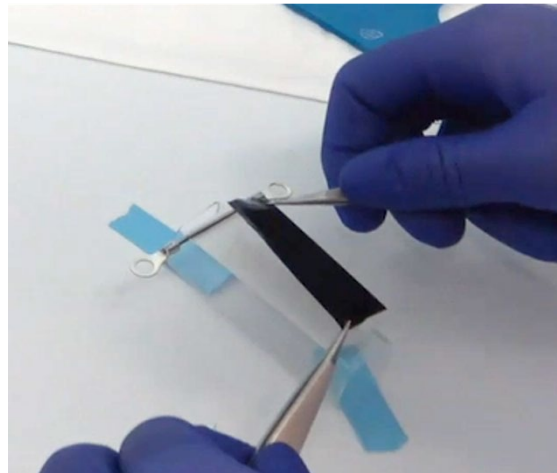


# Innovative Handling Solution

- Handling tape during DNA processing
  - Create a stippled backer to attach the tape to
  - Platform facilitates rolling tape/backer using the affixed handles
  - Backer's stippling creates space for lysis buffer to enter when tape/backer is rolled



Backer with rollers on platform



Electrical tape sample rolled and placed in extraction tube

# Innovative Testing Solution

- Develop a single workflow for developing prints and extracting DNA off the same sample
  - Optimize custom fluorescent dye solutions for common tape types
  - Apply dye using a commercial nebulizer to avoid direct contact with the sample

**Nebulizer  
application**



**Developed print  
prior to DNA extraction**

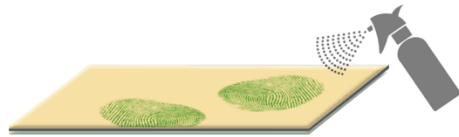


# Innovative Testing Solution

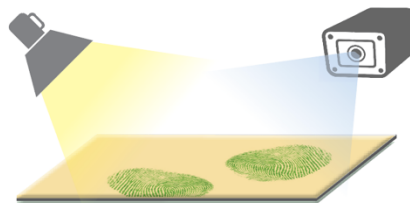
## Steps 1 – 4: Visualization



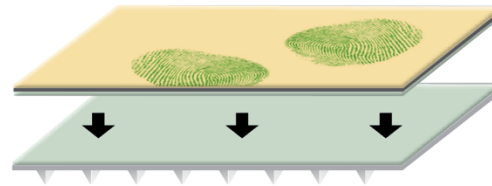
**Step 1:**  
Fume both sides  
of tape with  
cyanoacrylate





**Step 2:**  
Spray fluorescent dye/  
solvent onto tape



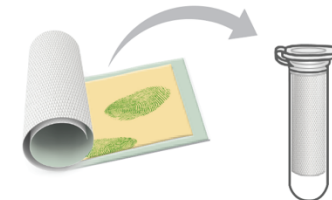
**Step 3:**  
Using special wavelength  
light, visualize dye-stained  
prints (on one or both sides  
of the tape as applicable)  
and capture the digital  
image



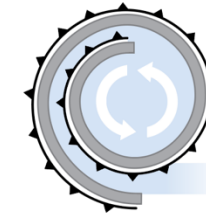
**Step 4:**  
Affix non-adhesive side  
of tape to adhesive side of  
backing strip. Alternatively, if  
visualized print is on the  
non-adhesive side, then  
adhesive side of tape can be  
adhered to backing strip.

 = Tape Adhesive  
 = Backing Strip Adhesive

## Steps 5 – 7: DNA Analysis



**Step 5:**  
Roll up tape and  
backing strip and  
insert into spin basket



**Step 6:**  
Embossed surface  
permits free circulation  
of DNA extraction  
reagent within spin  
basket



**Step 7:**  
Recover extracted DNA

# CHALLENGE



## Handling of Fired Cartridge Casings

Innovation Initiated in Response  
to an Internal Need



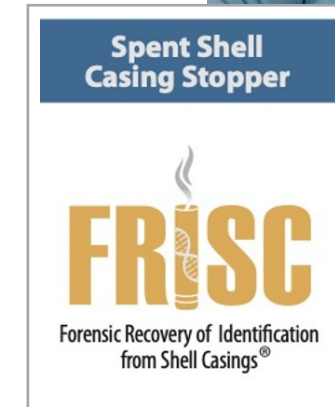
# Risks with Manipulating Fired Cartridge Casings

- Manipulating the casing is tricky whether extracting by swabbing, dunking, or rinsing (or a combination of the above)
  - Introduces risk of dropping when manipulating the sample (e.g., with tweezers)
  - Tweezers can add to or alter marks that could affect ballistics analysis
  - Gun shot residue entering into the lysis buffer (e.g., for dunking methods) can introduce DNA inhibition



# Innovative Solution

- Engineer a device to facilitate handling and stopper the cartridge opening
  - Tapered silicon plug fits multiple casing sizes
  - Flexible material works with bent or damaged casings
  - Plug prevents GSR from entering lysis buffer
  - Allows damage-free handling of the casing



**Device inserted into a shell casing**

## Key FRISC™ Advancements

1

Special seal to stop gunpowder residue on inside of casing from contaminating sample



2

Streamlined sample manipulation to avoid DNA loss



3

Damage-free handling to avoid affecting ballistics testing



# CHALLENGE



## Safely Training Canines on HME Detection

Innovation Initiated in Response  
To an External Driver

Problem Identified by Military Working Dog Group  
at Lackland AFB → Project (Prototype Development) →  
Internal R&D (Market Ready)

# Challenges with Explosive Training Aids for K-9s

- Most training tools for homemade explosives use pseudo scents
  - Safe because they are simulants, but the chemicals are found in many everyday products
- Training on actual explosives is more realistic but adds risk
  - Can jeopardize safety of the K-9 and human
  - Adds challenges with storage and transport of the material





# Innovative Solution

- Formulate peroxide-based homemade explosive K-9 training materials that are safe to handle
  - Created in the laboratory using authentic explosives
  - Manufactured into a non-explosive form by desensitizing the explosives with an odorless filler material
  - Can be stored without degradation of the explosive material, and without obtaining an ATF permit
  - Approved for shipment by the Dept of Transportation



**TrueScent**<sup>®</sup>  
K-9 TRAINING AIDS

# CHALLENGE



## Simplified Fentanyl Assay

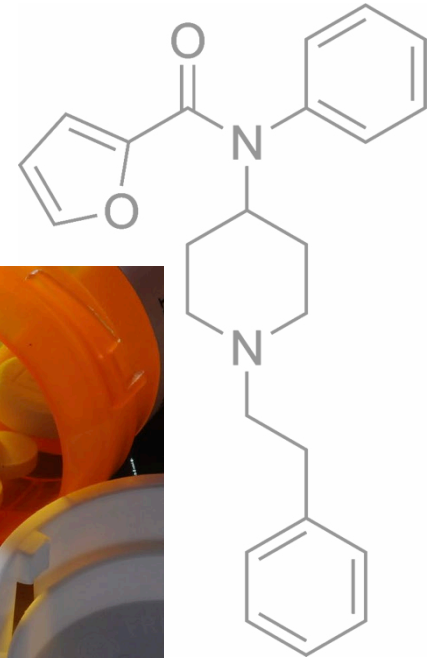
Innovation Initiated Externally  
(Federal Contract)

White Paper Concept → Project (Prototype  
Development) → Internal R&D (Market Ready)

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# Crime Scene Safety and the Fentanyl Crisis

- Per the US Drug Enforcement Administration, law enforcement seized 'more than 360 million deadly doses' of fentanyl in 2023
  - Creates a health risk for crime scene technicians and law enforcement
- Test strips require the technician to collect a portion of the substance in question
- Water must be added to create a solution that the test strip goes into



## Innovative Solution

- Create a pocket-size field screening tool for qualitative detection of fentanyl
  - Self contained to eliminate the need to carry water or do any processing
  - Sampling tip keeps technicians from having to collect and manipulate the substance of interest
  - Leak proof to safely contain the substance after sampling
  - Results are visible on the test strip within 1 to 3 minutes

# FENT<sup>ALERT</sup>

### Detection limits:

- Down to 100 ng for pure fentanyl
- From 110 to 500 ng for fentanyl containing mixtures



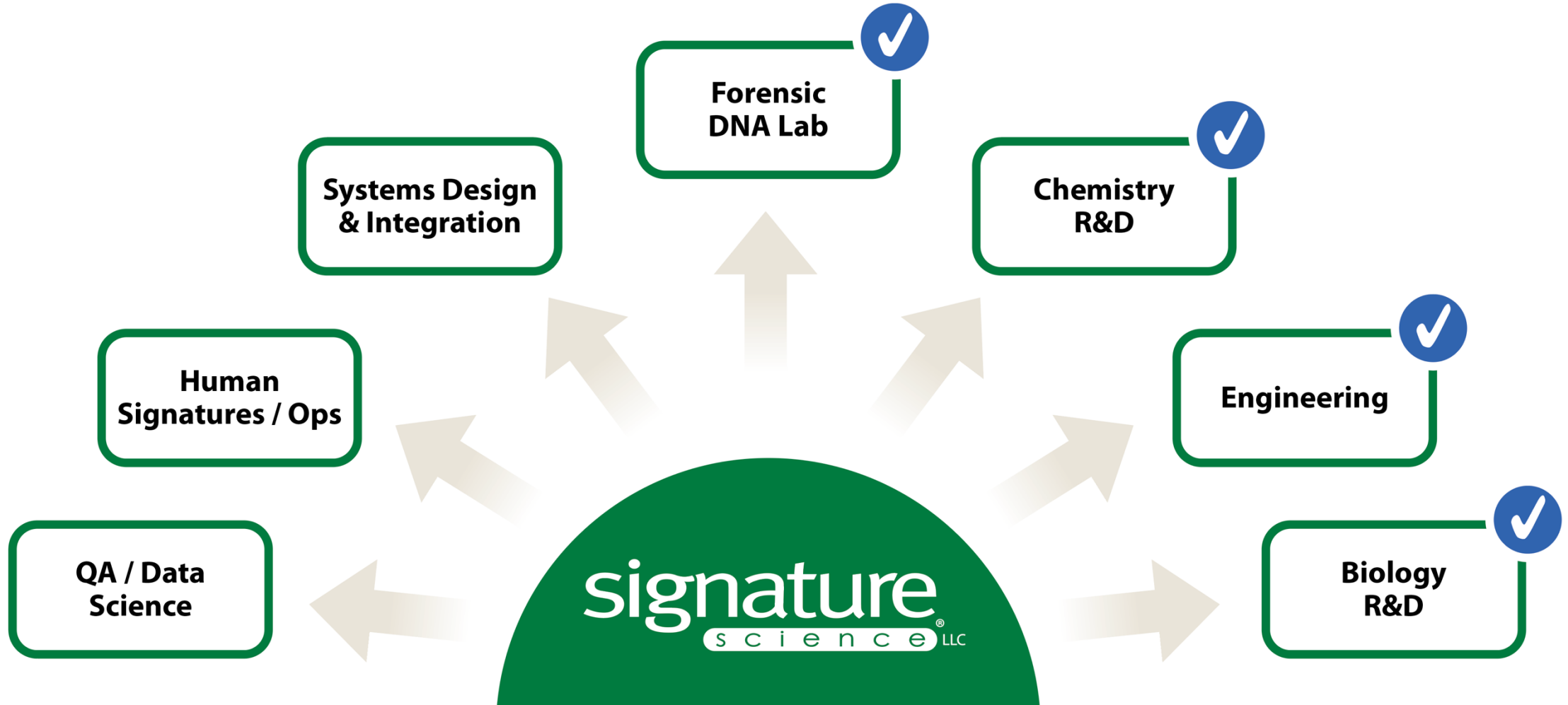


# INNOVATION

**How Can Your Lab  
Innovate Better?**



# Innovation as a Group Effort



## Be Open to Try

**Our job as leaders is to judge when to push and when to maintain the status quo, but we must always be willing to consider both options.**

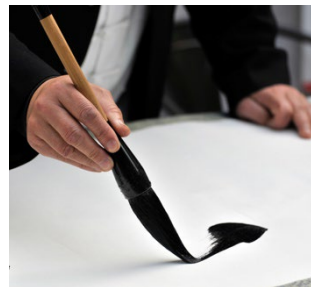


"Finding opportunity is a matter of believing it's there"

**– Barbara Corcoran**

"When the winds of change blow, some people build walls and others build windmills"

**– Ancient Chinese Proverb**

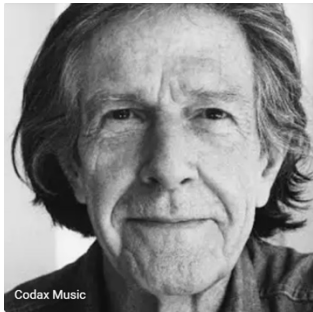


"The riskiest thing we can do is just maintain the status quo"

**– Bob Iger**

# Don't Be Afraid to Fail

**Leadership must set the example for confidently embracing opportunities for improvement/innovation.**



"I can't understand why people are frightened of new ideas. I'm frightened of the old ones"

**– John Cage**

"You miss 100 percent of the shots you never take"

**– Wayne Gretzky**



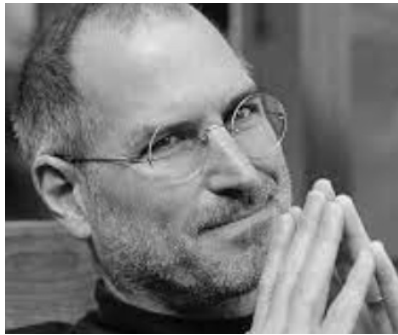
"If I have a thousand ideas and only one turns out to be good, I am satisfied"

**– Alfred Nobel**



# Trust Your Staff

**Great leaders surround themselves with great people, they must be empowered to create the next great improvements.**



"Innovation has nothing to do with how many R&D dollars you have. When Apple came up with the Mac, IBM was spending at least 100 times more on R&D. It's not about money. It's about the people you have, how you're led, and how much you get it"

– **Steve Jobs**

"Great ideas come from everywhere if you just listen and look for them. You never know who's going to have a great idea"

– **Sam Walton**



# Strive to Listen (to the right people)

**Leadership is about mentoring the next generation to be great listeners.**



**"You can expect no influence if you are not susceptible to influence"**

**– Carl Jung**

**"Seek first to understand, then to be understood"**

**– Stephen Covey**







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