

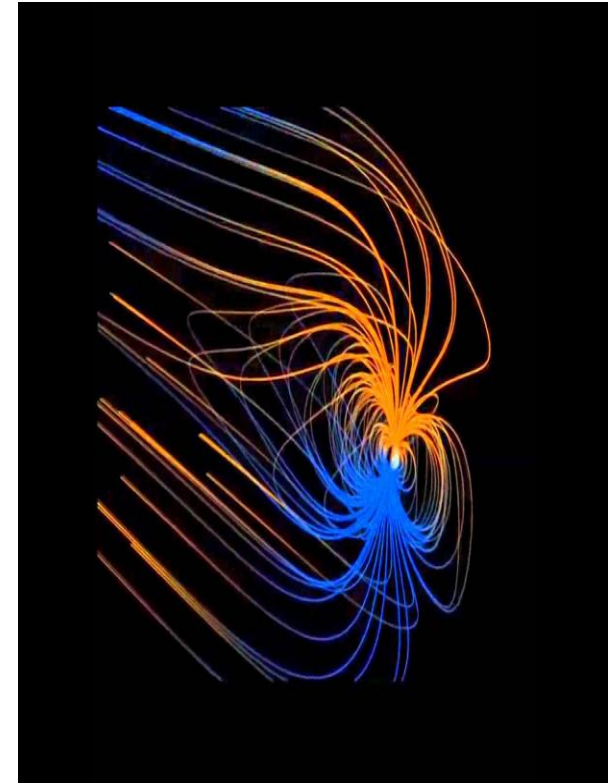
SOUND AS TECHNOLOGY

**Sure there's Ultrasound Diagnostics and Sonar's
but really**

What Else?

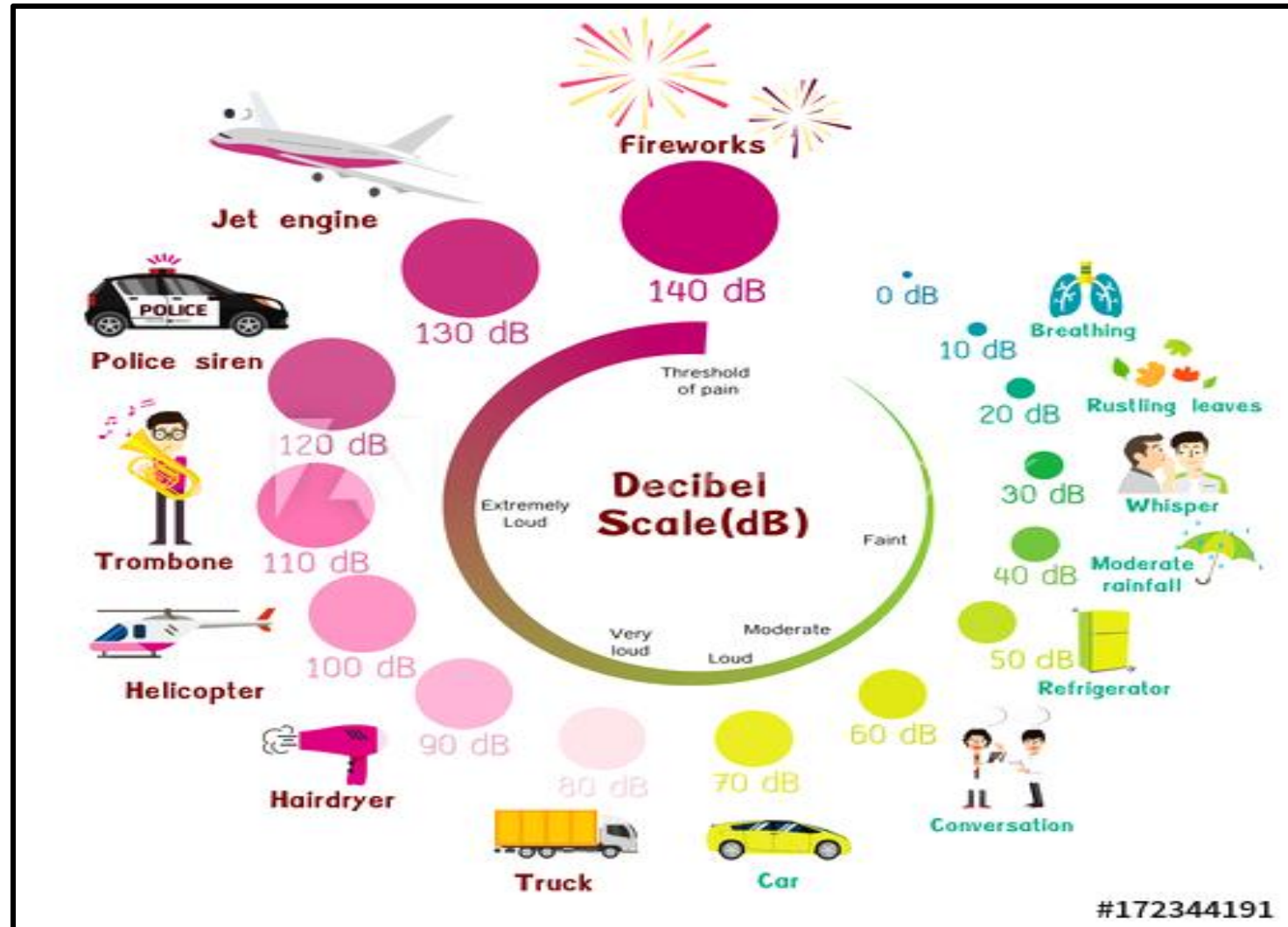
What Is Sound?

In physics, sound is a vibration that typically propagates as an audible wave of pressure, through a transmission medium such as a Gas, Liquid or Solid and Plasma



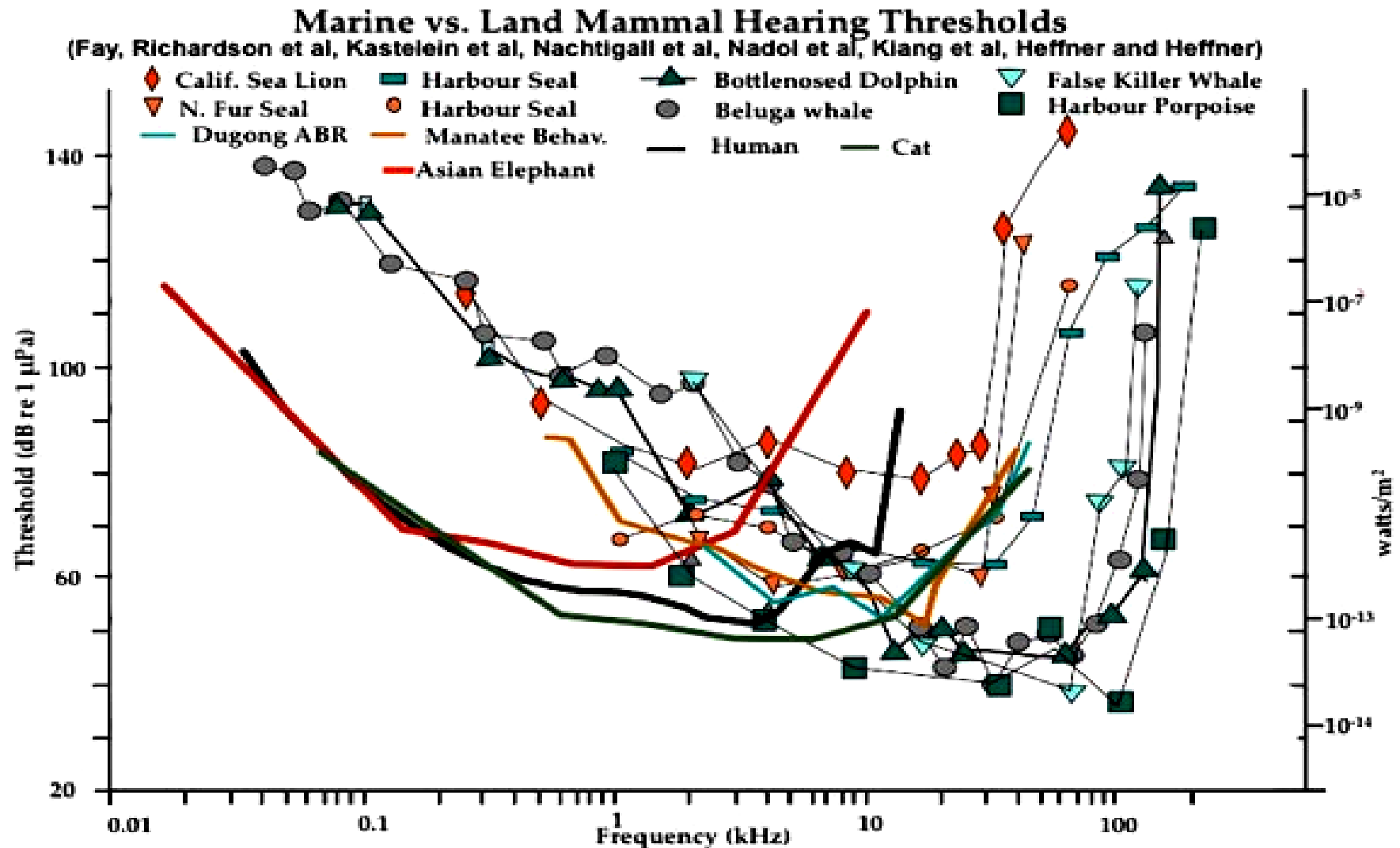
<https://www.youtube.com/watch?v=At32mpvw5i0>

Sound levels dB

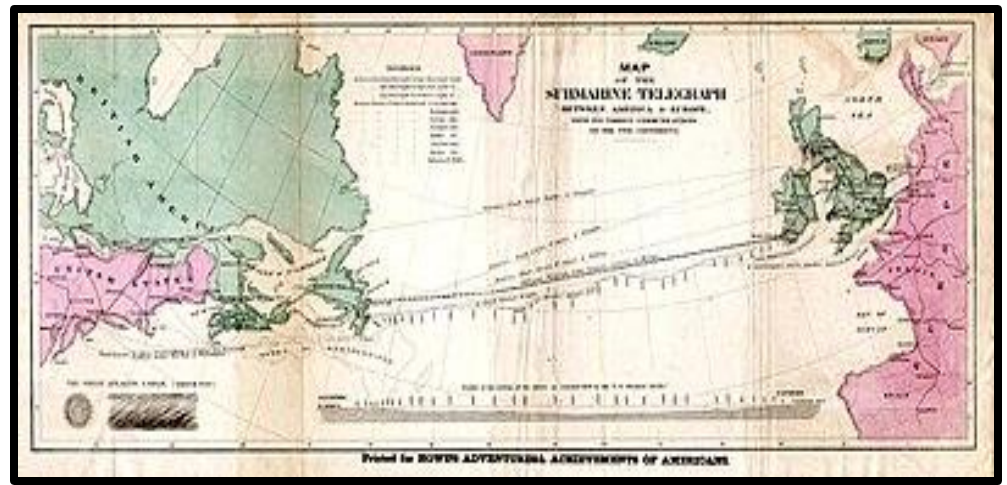


Marine & Land Mammals

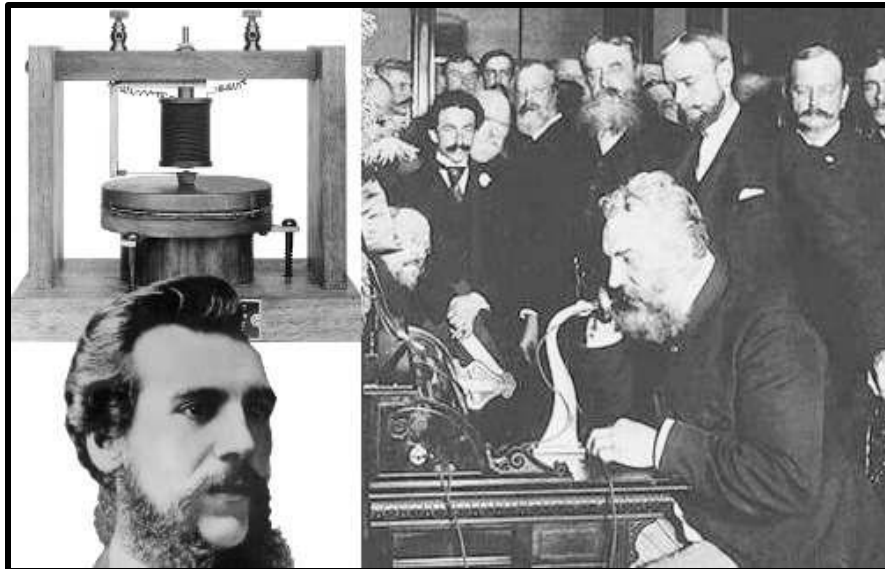
dB (thresholds) kHz (Frequency)



Looking back to the Science behind modern communication devices



Between what 2 cities was first telegraph sent? Year?
Trans Atlantic Telegraph Lines: 1854-58 1860
Year transcontinental Telegraph lines completed?



Alexander Graham Bell 1876



Gramophone: patented 1887

Have you Considered What Sound Waves Can Do?

Inform

Harm

Protect

Monitor

Amaze

How monitoring Sound Waves can Inform & Protect

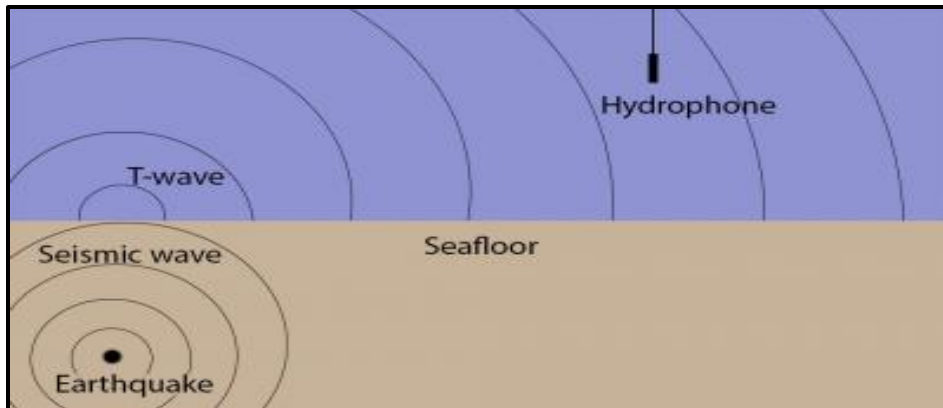
- **Earthquake warnings**
Oceans, Land ('Natural' & **Manmade**)
- **Bridges structural integrity**
- **Forest vulnerability**
- **Deterrent for Invasive Species**

Examples of Earthquakes from Human Activities?

Underwater Microphone Captures Honshu, Japan Earthquake

3-11-2011

- <https://www.youtube.com/watch?v=4rWDrZlucAQ#action=share>



The normal low frequency of the earthquake sound in the water would not be audible to a human swimmer. On this video, the earthquake sound has been sped up so that it plays back at a higher frequency which we can hear.

Smart technologies monitor and maintain the health of bridges

1890 Railway Bridge- Steel

1964-Concrete & Steel hung
from high- tensile steel spun cables

Structural Problems

from increasing levels of traffic and harsh weather conditions leading to corrosion of the tendons buried inside the cables. Inspections to assess structural integrity required closures/disruption, were dangerous, and expensive.

2017 Queensferry Crossing

Acoustic Monitoring built in
24/7 tendon break detection (against
the mayhem of traffic noises) Text
alerts engineer to assess & respond.

Where is this ?



Magic Carbon Sonic Hammer

measures recorded sound waves-the denser the wood, the faster the sound waves travel --potentially revealing decay and inability to sequester carbon

SONIC TOMOGRAPHY



America's forests stored the equivalent of 11 percent of the country's carbon dioxide over a 25 year period (up to 2017)

4th National Climate Assessment

<http://www.wnpr.org/post/how-do-you-measure-amount-carbon-tree>

Stopping the Asian Carp Invasion

in the Great Lakes

Sound-Bubble-Strobe (SBS) Light Barrier



<https://www.popularmechanics.com/science/environment/a6233/how-to-stop-the-carp-invasion/>

Sound Waves as tools for: Monitoring, Tracking, Focusing

- **3-D Printers**
- **Cell Phones-Acoustic Cookies**
- **Sound (Fire) Extinguishers**





Protecting a New World of 3D-Printed Products

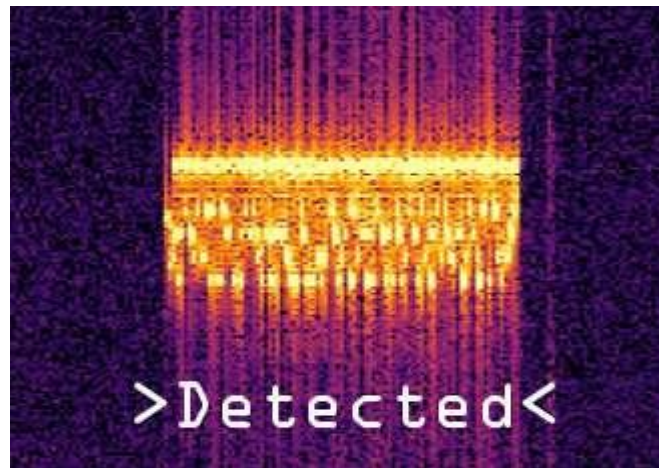
what is: Additive Manufacturing? And Mission Critical Components?

The number of 3D-printed, critical components grows each day. They make their way into vehicles, aircraft, medical devices, prostheses, human bodies, and military applications.

...Using acoustic measurements, printer component tracking, and detectable nanorods to protect the integrity of printed products. <https://www.asme.org/engineering-topics/articles/manufacturing-design/protecting-new-world-3dprinted-products>

ACOUSTIC COOKIES

ULTRA SOUND-FIREWALL FOR MOBILE PHONES




“Acoustic Cookies can be neutralized before operating systems or mobile applications can access them. Users can selectively block cookies without affecting the functionality of the smart phone”

Who's familiar with Sonicontrol? (FYI-access to 'Location' optional)
Comments, recommendations, alternatives??

Using Sound Waves to Extinguish Fire



<https://www.youtube.com/watch?v=kPbHpVbcbrQ>




WAVE EXTINGUISHER

Seth Robertson & Viet Tran Faculty Supervisor: Dr. Brian Mark

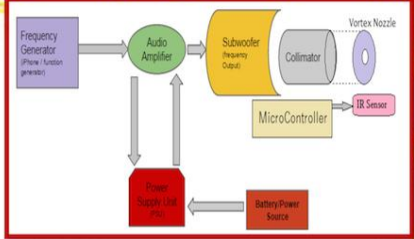
ABSTRACT

The Wave Extinguisher is a device that uses acoustic waves to suppress a flame/fire. Traditional fire extinguishers have proven to be successful at extinguish flames but risk damaging equipment and personal health. The Wave Extinguisher is designed to protect surrounding equipment and personnel.



APPROACH

System Design Breakdown

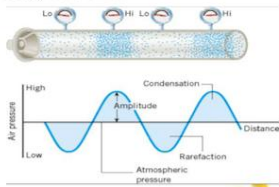


Audio Amplifier - Amplifies the audio signal from 5V to 19 V
Frequency Generator - Selects frequency into the amplifier
Power Supply Unit - Powers audio amplifier (high current)
Acoustic Output - Emits acoustic signal
Collimator/Vortex - Focuses acoustic output to form vortex
IR Sensor - Uses the wavelength of fire to detect a flame

RESEARCH

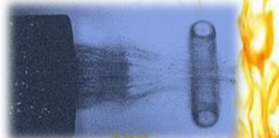
Wave Patterns:

Sound is a **pressure wave** that oscillates between regions of high and low pressure. This oscillation is capable of creating a vacuum that separates air molecules from the source of the flame. Secondly, the system follows the principle of the **Ideal Gas Law** in that the pressure at the flame source decreases which in turn decreases the temperature at the source of the flame to suppress the fire.



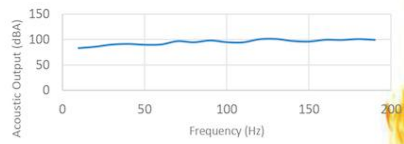
Vortex Ring/Collimator:

In a vortex ring, particles move in circles around the center core. This shape carries the particles further than a jet of particles. This allows the vortex ring to travel far with little loss of mass and kinetic energy while retaining its size and shape.

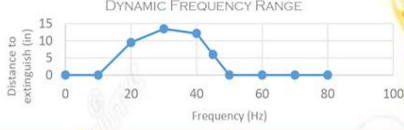


TESTING RESULTS

SINE WAVE SOUND TEST




DYNAMIC FREQUENCY RANGE



CONCLUSION

The device can:

- Extinguish a chemical fire of 12" diameter
- Detect a flame/fire
- Potentially serve as an alternative to traditional fire extinguishers



VIET TRAN & SETH ROBERTSON

How has the military used *Weaponize Sound* and what exists in *Sound Location systems*?



Boomerang
Gunfire
Detection
System
DARPA with
BBN 2008



<https://hackaday.com/2015/12/16/rubber-tanks-and-sonic-trucks-the-ghost-army-of-world-war-ii/>

the Ghost Army

Inflatable Tanks & Sound Trucks WW 2



<https://www.theatlantic.com/technology/archive/2013/05/ghost-army-the-inflatable-tanks-that-fooled-hitler/276137/>

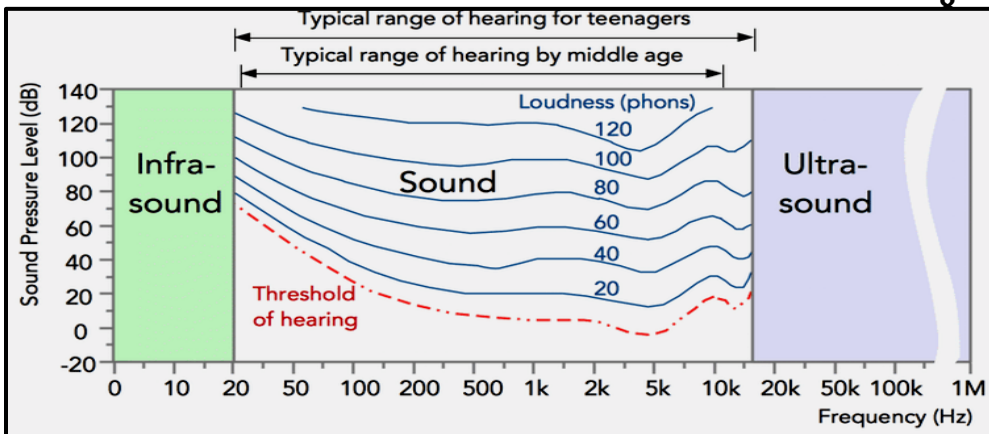
Were US Diplomats in Cuba and China Victims of a Sonic Attack?

or from a byproduct of poorly engineered multiple ultrasonic (covert) transmitters (intermodulation distortion)?
or from “conversion disorder” (mass hysteria)

Sonic weapons fall into two categories:
those that involve audible frequencies, and those that are either ultrasonic or infrasonic and so are inaudible.

The U.S. government is consulting with outside experts to determine what happened to American diplomats [in 2016] in the Havana embassy who returned home complaining about hearing loss and nausea 8-2017

...a U.S. government employee in China “recently reported subtle and vague, but abnormal, sensations of sound and pressure 5-23-2018

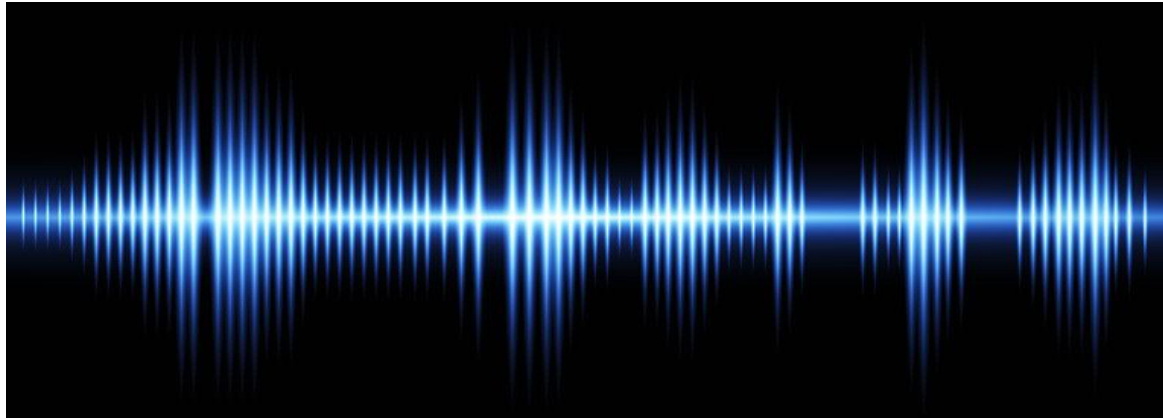


<https://theconversation.com/sonic-attacks-in-china-and-cuba-how-sound-can-be-a-weapon-97380>

https://www.vanityfair.com/news/2019/01/the-real-story-behind-the-havana-embassy-mystery?utm_source=pocket&utm_medium=email&utm_campaign=pockethits

<https://thediplomat.com/2018/05/is-china-really-targeting-us-diplomats-with-a-sonic-attack>

Most have heard of mysterious Sound attacks at Embassies



Audio Recordings from Cuban Embassy Sounds Incidents

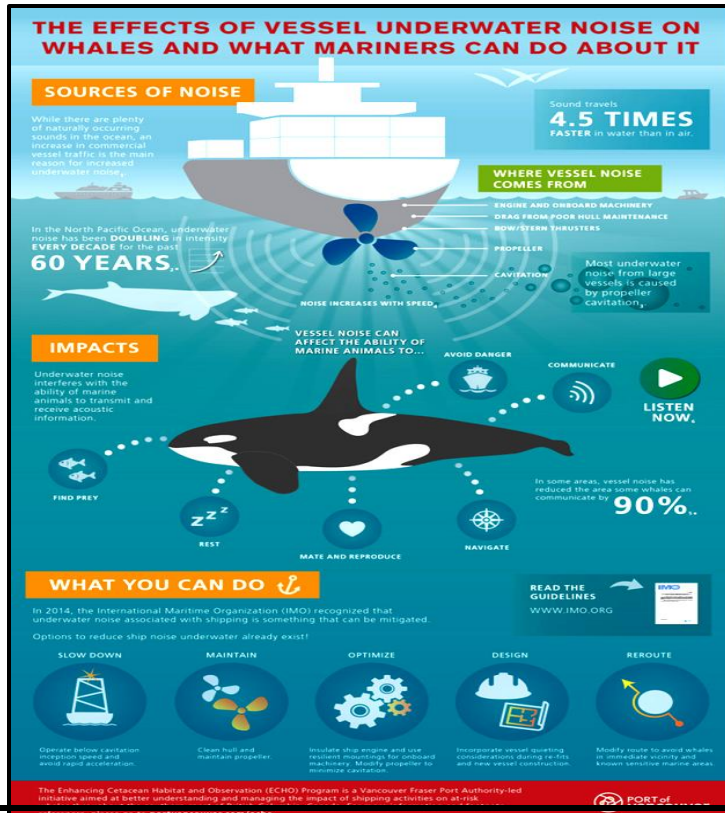
<https://www.youtube.com/watch?v=rgbnZG85IRo> 1:58

AP obtains a recording of what some U.S. embassy workers heard in Havana as they were attacked by what investigators initially believed was a sonic weapon. The recording of a high-pitched noise is one of many taken in Cuba since attacks started.

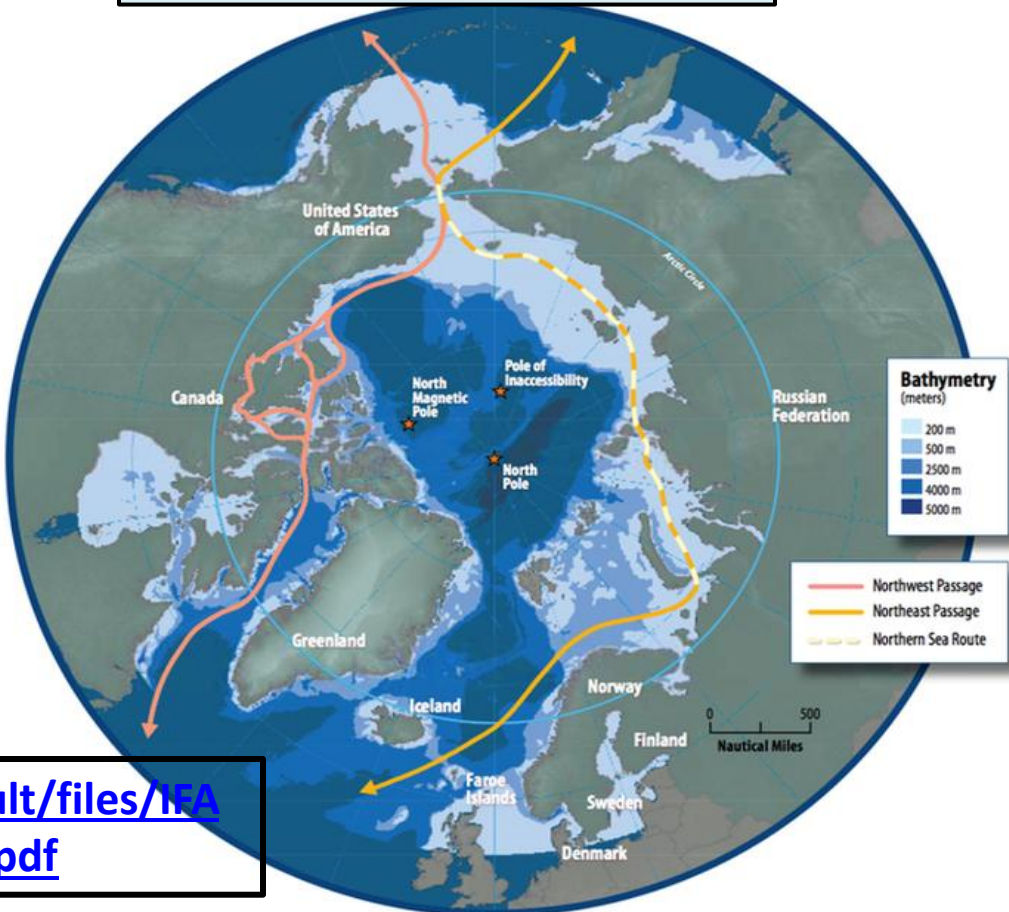
commercial
Sound Waves that Harm:
in our Oceans
at the Gym
from a Wind Farm near you
during Crowd Control situations

**What are other sources of
damaging sound waves?**

Arctic Ship Traffic Threatens Narwals & other Extraordinary Animals



Northwest Passage



https://www.sonicsea.org/sites/default/files/IEAW_OceanNoiseReport_WEB_spreads.pdf

What do marine animals use sound for ?
Are these vessel noises the only sources of harmful Sound Waves?



WHAT IS THIS? <https://www.ecowatch.com/seismic-testing-right-whales-2631281881.h>

How are they used? How often? For how long?
Distance covered? Decibel range? Short Term Effects?
Long Term Effects? <https://dosits.org/animals/effects-of-sound/anthropogenic-sources/seismic-airguns/>



SEISMIC SURVEYS- HARMFULL? But what about jobs?

How are seismic ocean surveys conducted ?

How are permits acquired?

https://www.ecowatch.com/seismic-testing-right-whales-2631281881.html?utm_source=EcoWatch+List&utm_campaign=59d206ffdf-EMAIL_CAMPAIGN_COPY_01&utm_medium=email&utm_term=0_49c7d43dc9-59d206ffdf-86076853

from under the seas to land-

Does living near wind turbines negatively impact human health?



What has research reported? Would you have a 'not in my back yard objection'?

https://phys.org/news/2018-06-turbines-negatively-impact-human-health.html?utm_source=nwletter&utm_medium=email&utm_campaign=daily-nwletter

Indoor cycling can be great for your heart — and toxic for your ears VOX

Some classes have nine times the recommended noise exposure dose for an entire day.



Hearing loss affects 1 in 4 adults in the US. Is our noisy world to blame?

If you work out at an exercise studio, you should speak to your management about the federal guidelines or file a complaint with OSHA. (To reach your regional or area OSHA office, go to the [OSHA Offices by State](#) webpage or call 1-800-321-6742.)

Is Sound Better?

Crowd Management



**Commercial
& Military Shipping Safety**



Listening:

from **Outer space**

in **Nature**

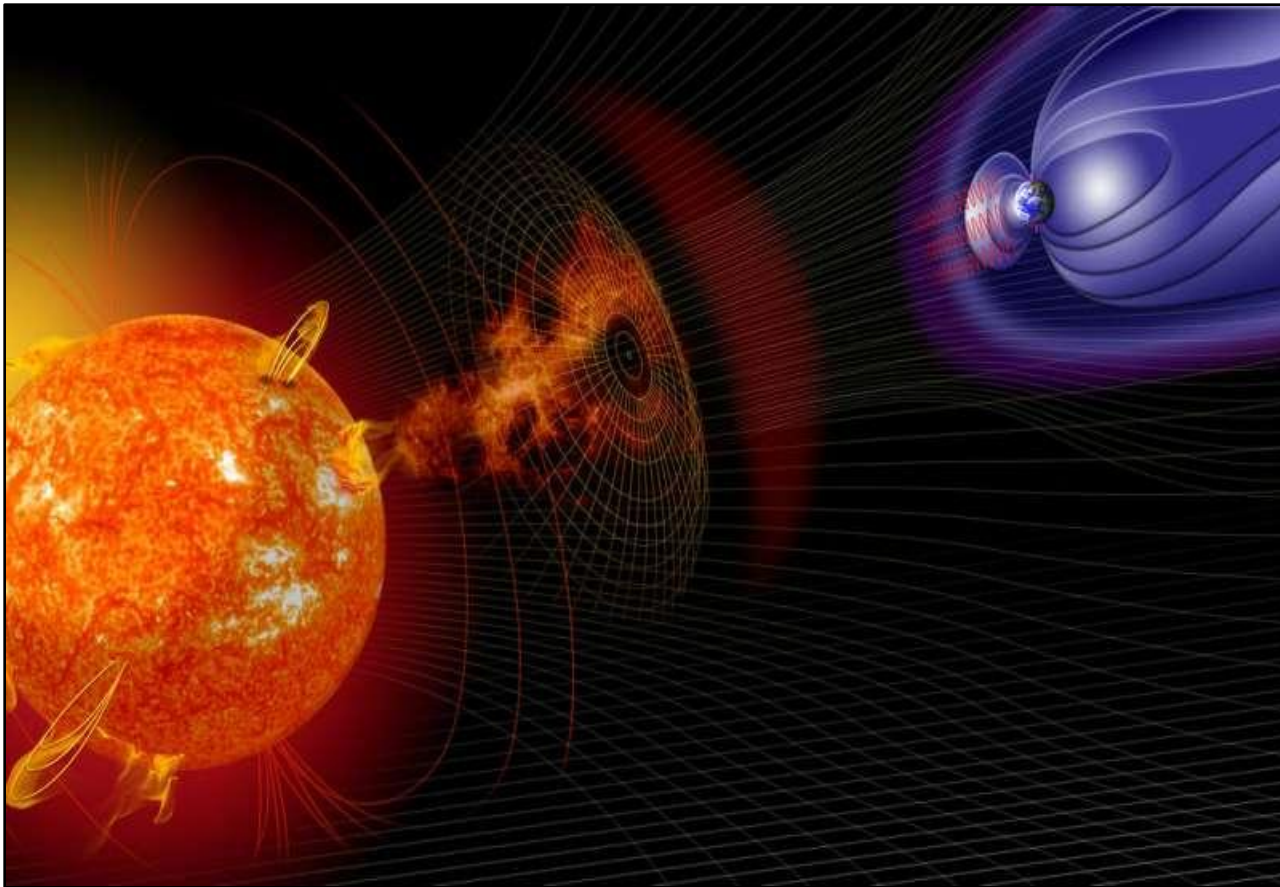
at **Research Labs**

at **Extended Care facilities**

and in **Therapeutic settings**

What Geomagnetic Storms Sound Like

<https://www.youtube.com/watch?v=At32mpvw5i0>



Listen to the Cosmic Sound of Sandstone Arches in Utah



https://www.ecowatch.com/bears-ears-earthjustice-sound-recordings-2622465104.html?utm_source=EcoWatch+List&utm_campaign=e85534d650-EMAIL_CAMPAIGN_COPY_01&utm_medium=email&utm_term=0_49c7d43dc9-e85534d650-86076853

Are Plants Listening?



Plants exposed to 5 Sound Treatments

Silence

Recordings of a honeybee 4" away (0.2 to 0.5 kHz)

Low frequencies (0.05 to 1 kHz)

Mid frequencies (34 to 35 kHz)

High frequencies (158 to 160 kHz)

Within three minutes of exposure to these recordings, sugar concentration in the plants increased by an astounding 20 percent. **What Sound Treatments elicited the response?**
Looking at the shape of the petals...note concave or bowl-shape making the petals perfect for receiving and amplifying sound waves, much like a satellite dish

Can Sound Change Our Behavior, our Brain?

How and where is Sound used in our neighborhoods and cities, and in research institutions?



**Residential Care
Facilities
for Mood
Modification &
Calming Effects**

**Mass Transit
Stations**



Reductions in Crimes

In 2004 in London, England, the British Transport Police piped classical music into London Underground stations in some of the area's most dangerous neighborhoods.

After playing the music for six months: Robberies were cut by 33 percent,
Staff assaults decreased by 25 percent, Vandalism went down 37 percent

(US cities using sound to change misbehavior: Seattle and West Palm Beach)

Is Barry Manilow Music a deterrent to teen mischief?

https://www.outsidethebeltway.com/barry_manilow_deployed_against_loud_teens

Brain wave stimulation may improve Alzheimer's symptoms

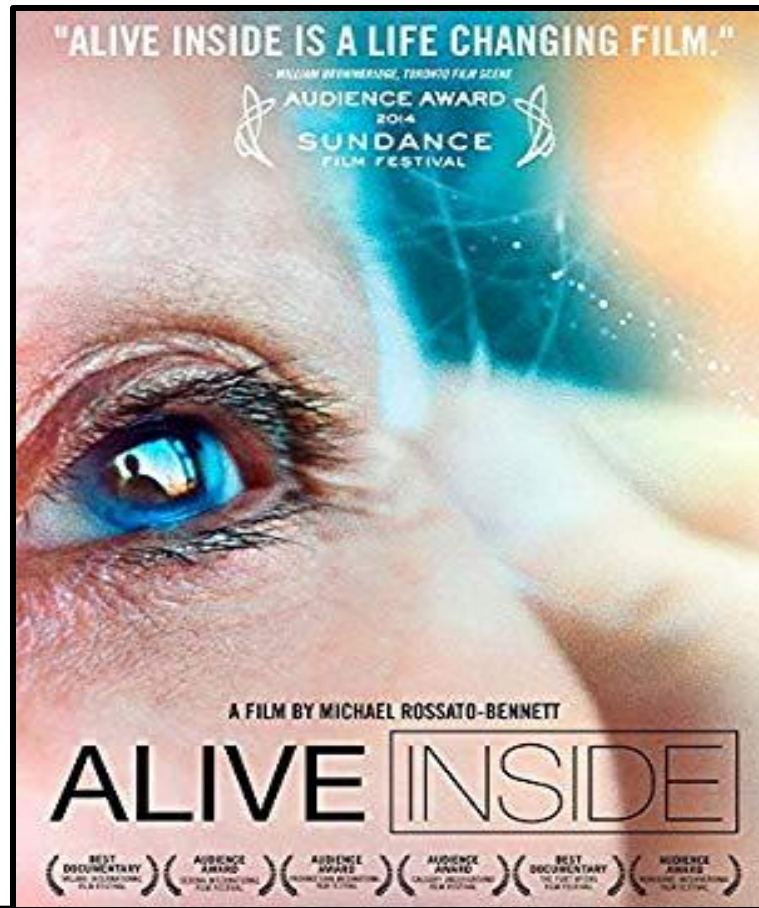
Could an hour's exposure every day to a specifically calibrated flickering light and droning sound help clear your brain of the toxic proteins that cause Alzheimer's disease?

An intriguing new MIT study raises this possibility after successful mouse experiments showed marked neurological improvements through simple visual and auditory stimulation.

How long before positive effects fade? Side effects? Invasive vs. non-invasive? But the big question in Alzheimer's research: Can improvements in brains of mice translate to human subjects?

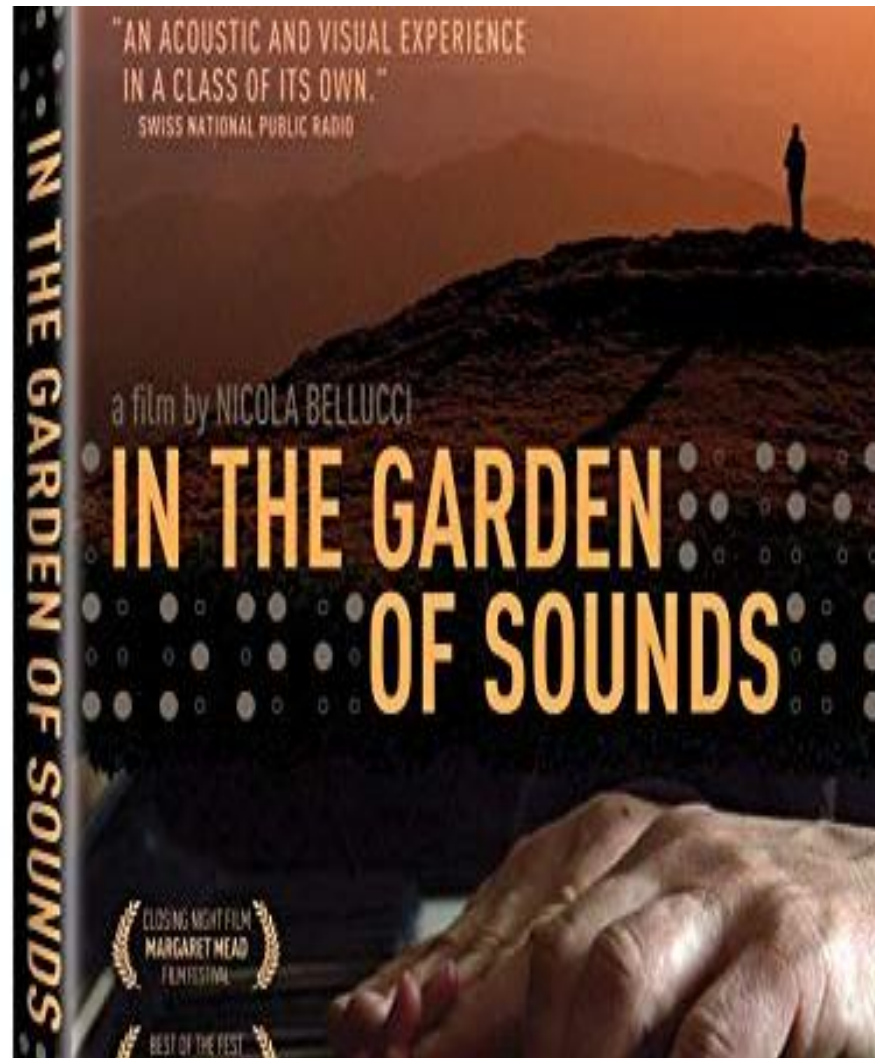
<https://news.mit.edu/2019/brain-wave-stimulation-improve-alzheimers-0314>

https://www.sciencefriday.com/segments/on-the-frontier-of-an-alzheimers-cure/?_sft_topic=brain



Alive Inside is a joyous cinematic exploration of music's capability to reawaken our souls and uncover the deepest parts of our humanity. Filmmaker Michael Rossato-Bennett chronicles the astonishing experiences of individuals around the country whose minds have been revitalized and awakened by the simple act of listening to the music of their youth. steam on Amazon Prime

<https://www.youtube.com/watch?v=laB5Egej0TQ>



Stream (free) from Amazon Prime. Libraries also has this DVD.

“With quiet reverence, it allows audiences to witness a remarkable journey into new sensory worlds, as children are given an indispensable key to improve their daily lives.”

Ahhhhhhhhh





**Thank you for experiencing many of the ways the sciences use
SOUND**

<https://www.youtube.com/watch?v=Q3oltPva9fs>

Cymatics Video 5:52

10 Of The Most Incredible Things Science Is Doing With Sound

[https://listverse.com/2015/02/05/10
-of-the-most-incredible-things-
science-is-doing-with-sound/](https://listverse.com/2015/02/05/10-of-the-most-incredible-things-science-is-doing-with-sound/)



<https://www.youtube.com/watch?v=jaPCqtck3Vs>

5 STRANGEST RADIO STATIONS & MOST MYSTERIOUS TRANSMISSIONS

[HTTPS://WWW.WIRED.COM/2011/09/FF-UVB76/](https://www.wired.com/2011/09/ff-uvb76/)

Sound Changes Behaviors



**“Music as a crime-fighting tool
is a simple but ingenious concept...”**

[https://www.seattletimes.com/entertainment/
businesses-using-music-to-deter-crime-and-loitering/](https://www.seattletimes.com/entertainment/businesses-using-music-to-deter-crime-and-loitering/)

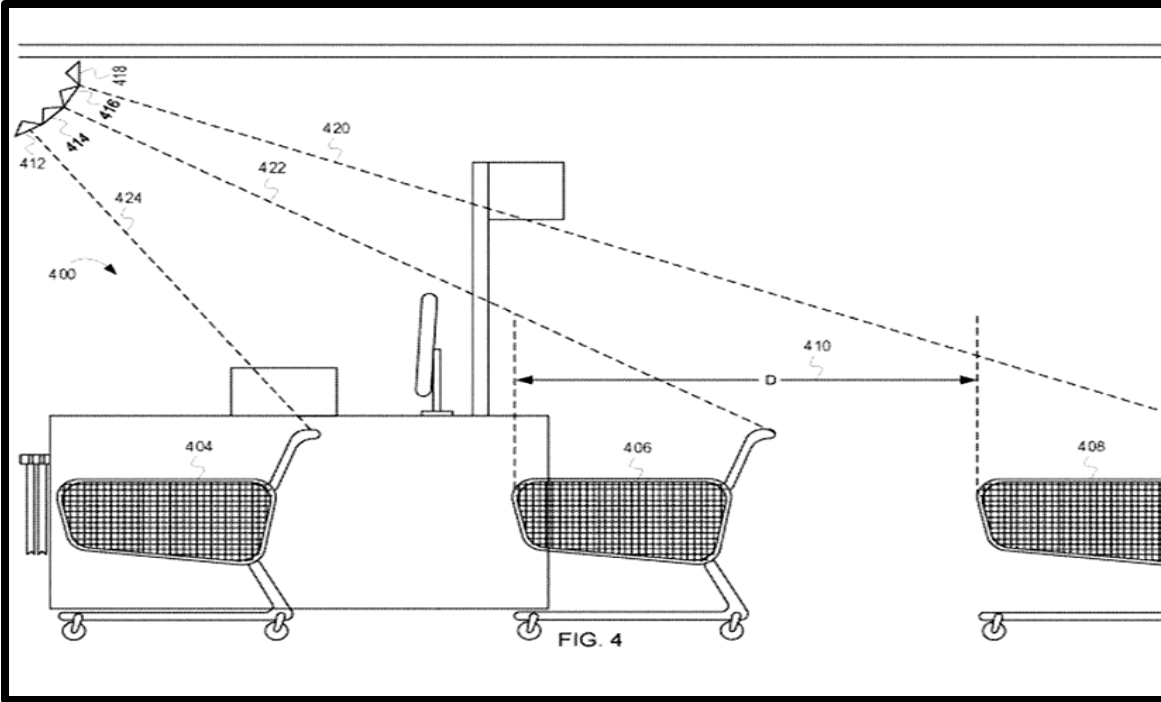


Is Barry Manilow music a deterrent for teen mischief?

https://www.outsidethebeltway.com/barry_manilow_deployed_against_loud_teens/

12/2018

What are the privacy concerns for customers & employees?



Anti-Theft monitoring? Or monitoring employee interactions with customers, or what customers are saying in real time about products, or where you are in the store by the sounds emitted....

WOULD YOU AVOID SHOPPING IN A STORE WITH THIS KIND OF SURVEILLANCE???

Tracking shoppers movements, gait, physical appearance, and monitoring items taken off shelves already exists in cashier-less Go retail stores and now at Fry's you can get hand held device, shop, & click to pay.

Smarter, Safer Bridges



In 2016, more than 54,000 bridges in the U.S. were classified as "structurally deficient" by the Federal Highway Administration's National Bridge Inventory.

Read more at: <https://phys.org/news/2018-07-smarter-safer-bridges-sandia-sensors.html#jCp>



The [sound tube](#) in [Melbourne](#), [Australia](#), designed to reduce roadway noise without detracting from the area's aesthetics.

When were sound barriers to road noise first built?

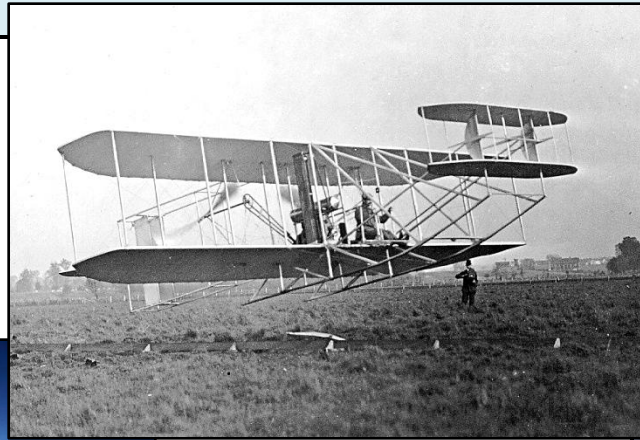
Do they work? Unintended Consequences?

Incentives to research improvements?

What year did the US military first contract for planes? From whom??

Supersonic Flights Returning??

Creating a supersonic aircraft that doesn't produce sonic booms would be a game-changer for aviation



NASA orders a supersonic X-Plane, easy on the boom



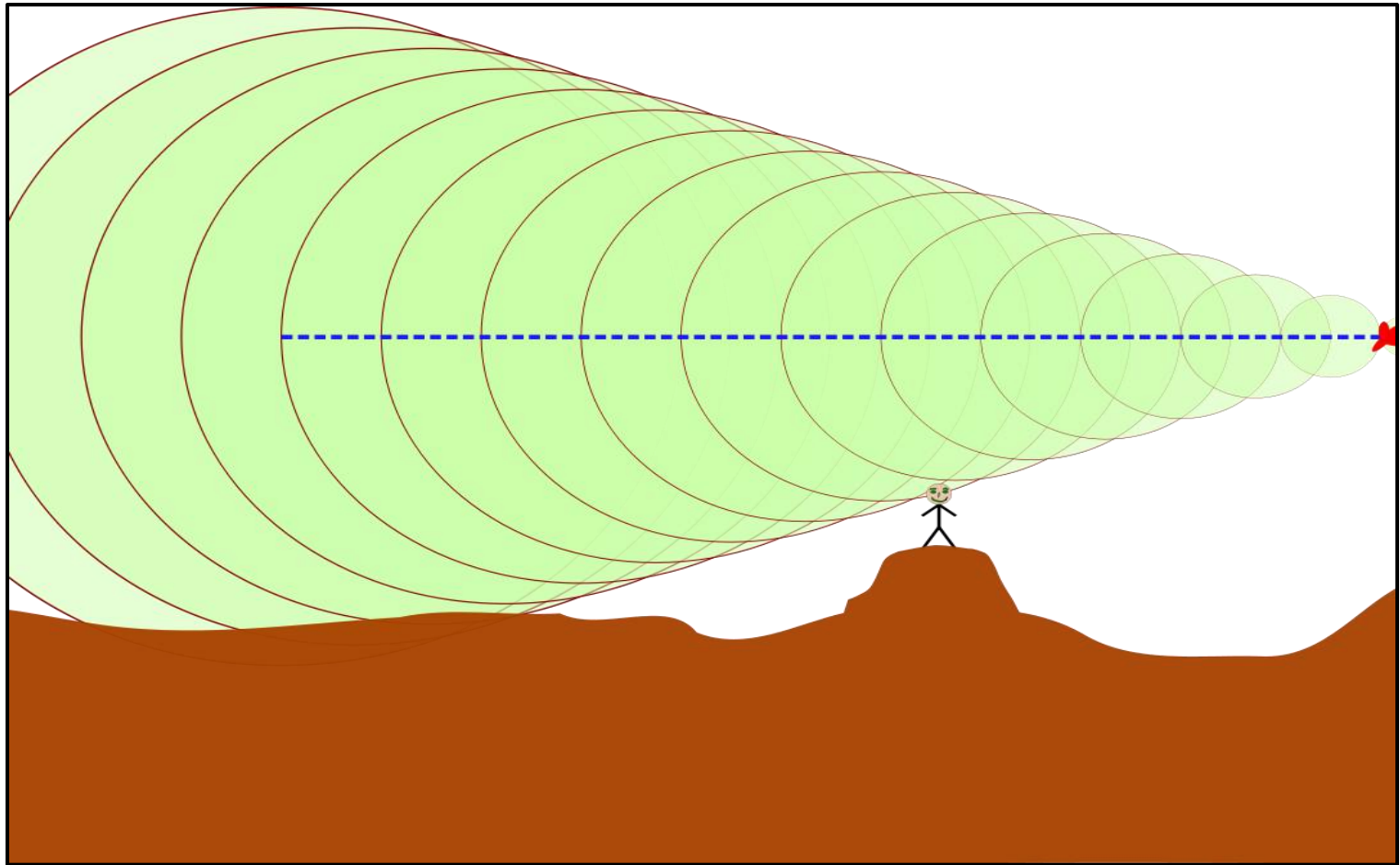
The 'Baby Boom' Charts a Return to Supersonic Flight

Contractors?

Was Sound an issue before development of SST'S??

Creating a supersonic aircraft that doesn't produce sonic booms would be a game-changer for aviation.





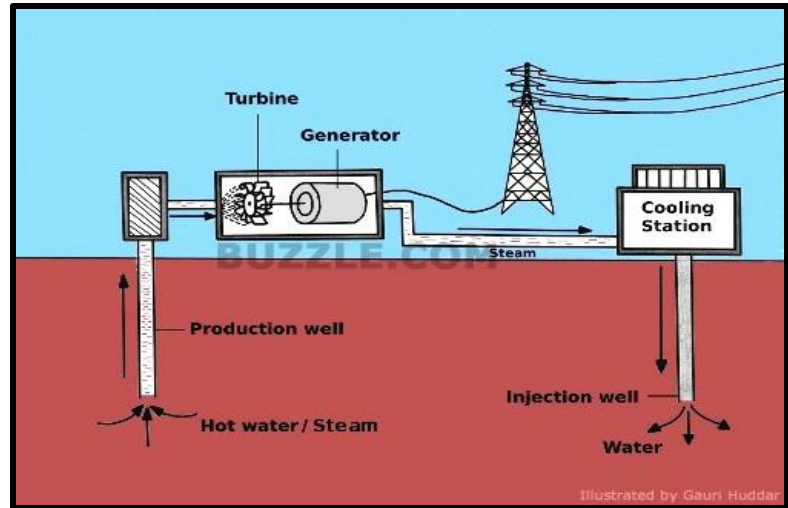
Anyone here heard a sonic Boom?

A sonic boom produced by an aircraft moving at $M=2.92$, calculated from the cone angle of 20 degrees. Observers hear nothing until the shock wave, on the edges of the cone, crosses their location.

Machine Listening for Earthquakes

Algorithms pick out hidden acoustic signals

- that could boost geothermal energy production
- help reduce the likelihood of triggering larger earthquakes including at fracking-fluid disposal sites
- could help identify the warning signs of a big one on its way



?

Where
Year?

