SCIENCE of AUDIO

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AMATEUR RADIO HAD NO DEDICATED MICROPHONE

- We only had microphones designed for public address or home recording.
- We were trying to cut pileups and noise with flat response, mushy sounding microphones

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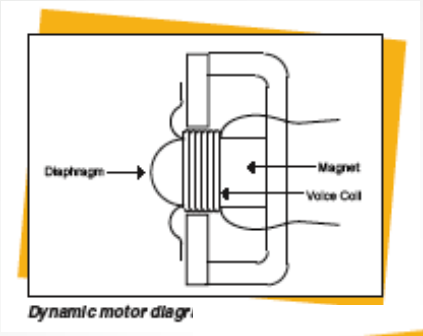
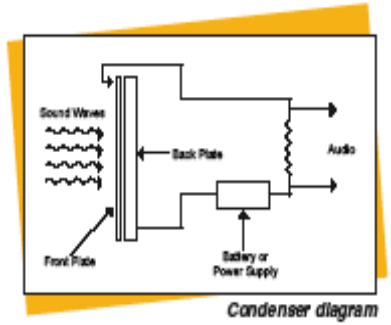
TYPES of MICROPHONES

- Dynamic
- Electret
- Condenser
- Ribbon



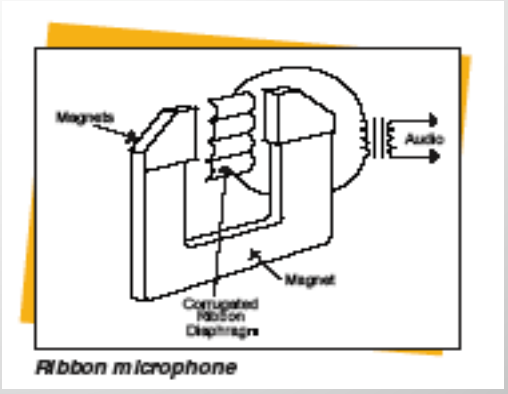
Dynamic motor diagr

Dynamic



Condenser diagram

Condenser



Ribbon microphone

Ribbon

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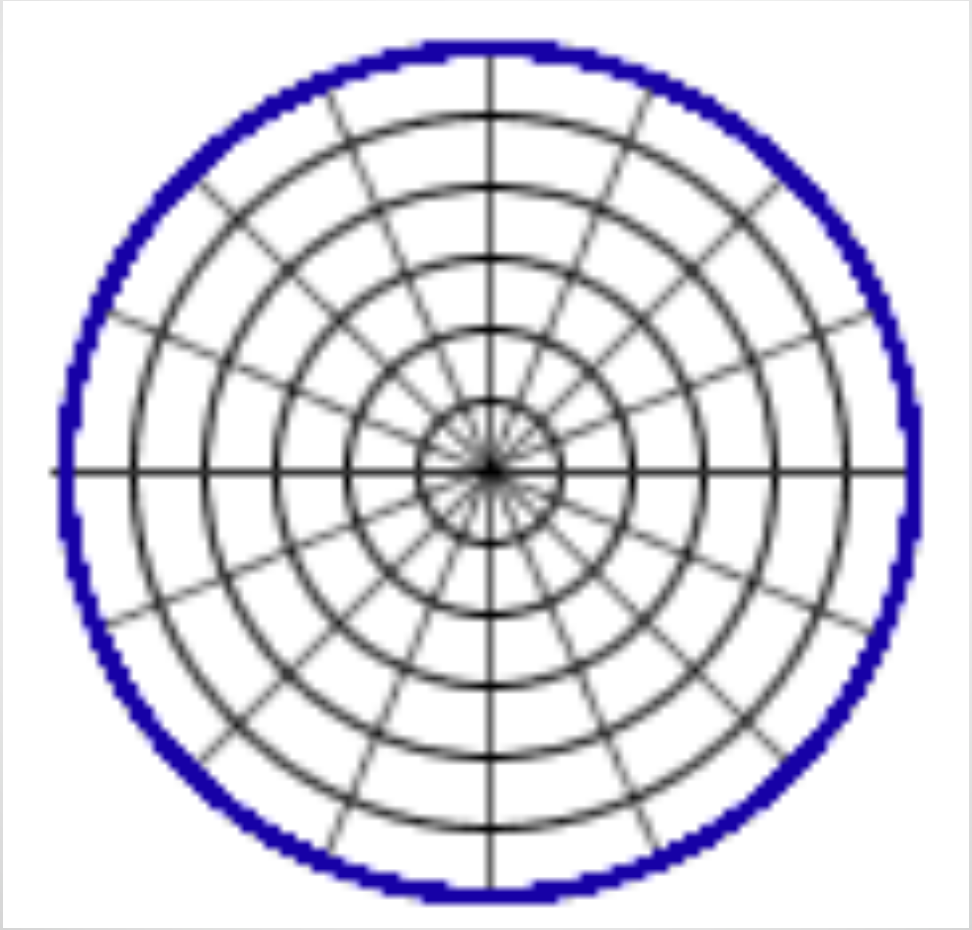
MICROPHONE CHARACTERISTICS

- Frequency Response - Most Important
- Proximity Effect - A blessing or a curse
- Pattern - Pick up pattern is important
- Rear Rejection - Most important but seldom discussed

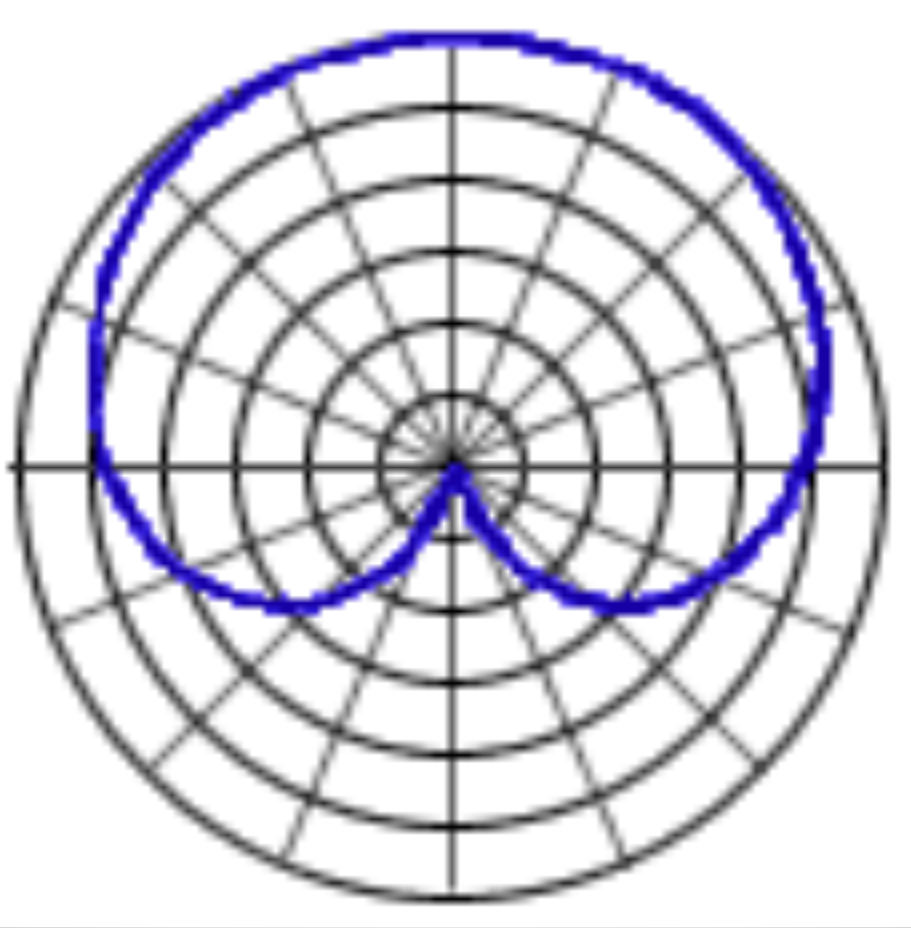
Microphone Pick Patterns

- All microphones pick up audio
- But not all the same
- Some pick up from all angles
- Others favor sound from one angle
- Omni, Cardioid, Supercardioid patterns

OMNIDIRECTIONAL
pick up pattern

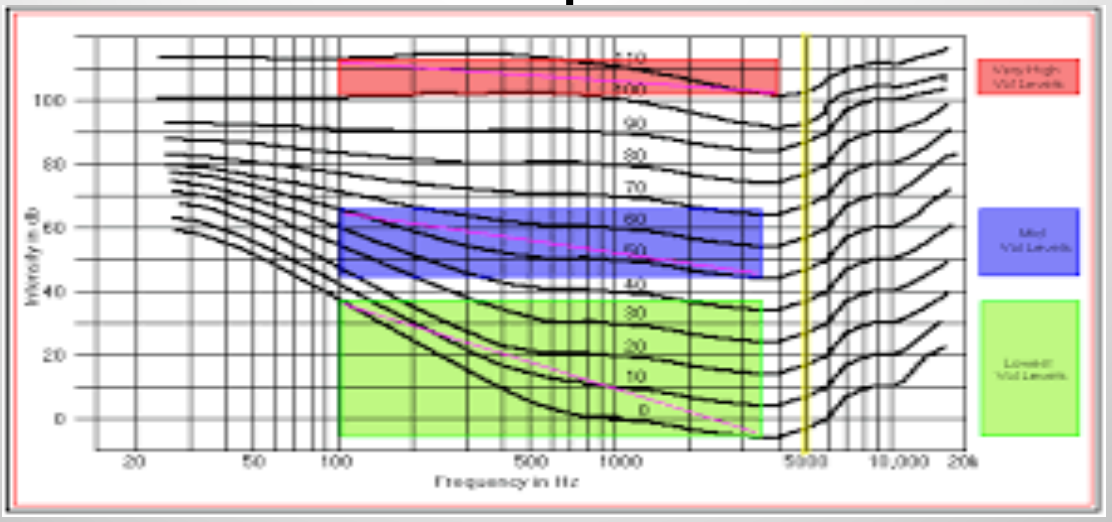


CARDIOID
pick up pattern



FLETCHER MUNSON CURVE

- Humans do not hear all frequencies at the same sound level. Our ears are more sensitive to some frequencies than others.
- In the 1930's Dr. Fletcher and Dr. Munson of Bell Labs made this important discovery



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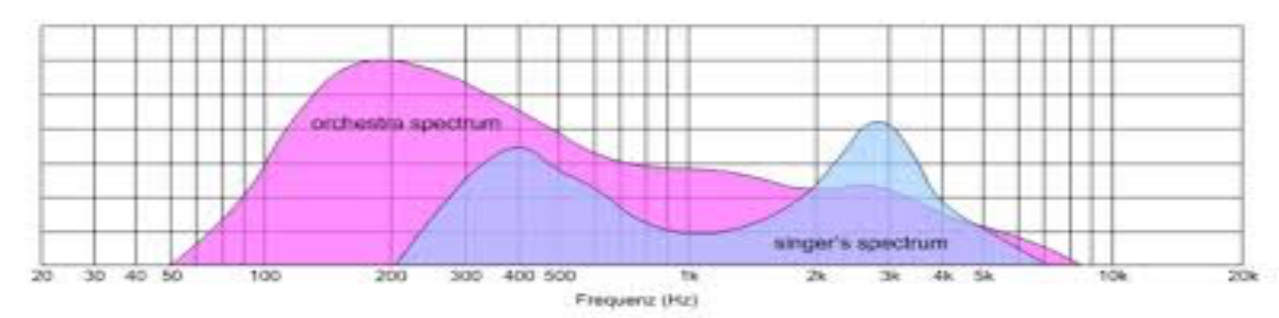
Tailored Response Audio
WHY ?

- In studying the Fletcher Munson curves and their many papers written at the early Bell Labs about what voice frequencies are most important, it was evident a tailored response audio was needed for Amateur Radio



Choose your frequency response requirement

- Flat is NOT always (if ever) the ‘preferred’
- Your ears certainly are not flat
- A ‘shaped response’ with a boost in the correct place is the best for speech. Most microphones do NOT have this shaping
- Heil Sound figured it out and did it

HEIL EQ 200 forever changed Amateur Radio audio

- In 1982, Heil Sound changed the Amateur Radio industry with the introduction of the very first equalization system, the EQ 200.
- It appeared in a DIY feature article in the July 1982 QST and received the cover award for that issue
- It brought awareness to the importance of speech articulation
- It was apparent that it should become a feature product for Heil Sound. Thousands were built and sold during the 80s

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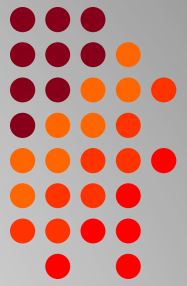
Amateur Radio Needed a Dedicated Microphone



- Following the scientific studies of Dr. Fletcher and Dr. Munson
- After two years of experimenting and using the EQ 200 equalizer it was easy to determine the exact response we needed to cut through the pileups and noisy conditions
- Heil tailored response elements were born

It Changed the audio world

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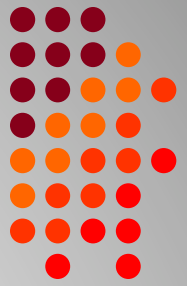
The Heil GOLDLINE



- The dual element Goldline has brought great audio performance to ham radio – worldwide
- The first microphone designed for Amateur Radio
- Each element addresses the importance of speech articulation with a rise at 2K to 3K
- The full range element 50 Hz – 16 kHz with a 4 dB rise in the 2K – 3K region.
- The Narrow (dx) element has a response of 200Hz to 8k with a 10 dB rise at 2 to 3K
- ……with great rear rejection to reduce room and blower noise

Then Joe suggest something better - The PR 40 was born

- Two hams with good ears and a soldering
- iron figured it out

The specifications

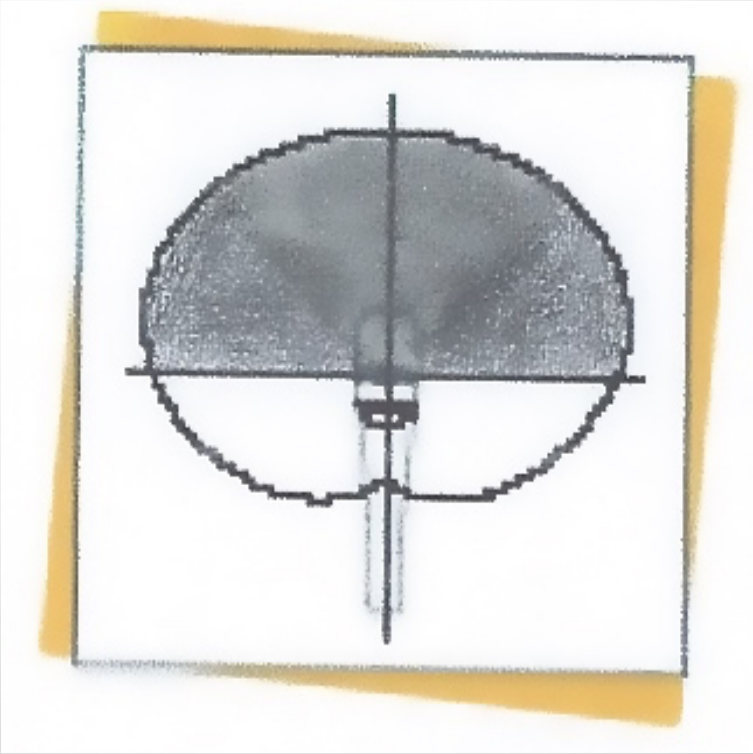
- Widest frequency range 28Hz. To 18kHz. with a + 4dB rise at 2.4 kHz- 5kHz producing great articulation.

- trademarked Heil rear rejection of -40dB.

The HEIL PATTERN
Omni front -40 dB rejection

OMNI front pattern allows you to move about freely

The Heil Pattern hears nothing from the back



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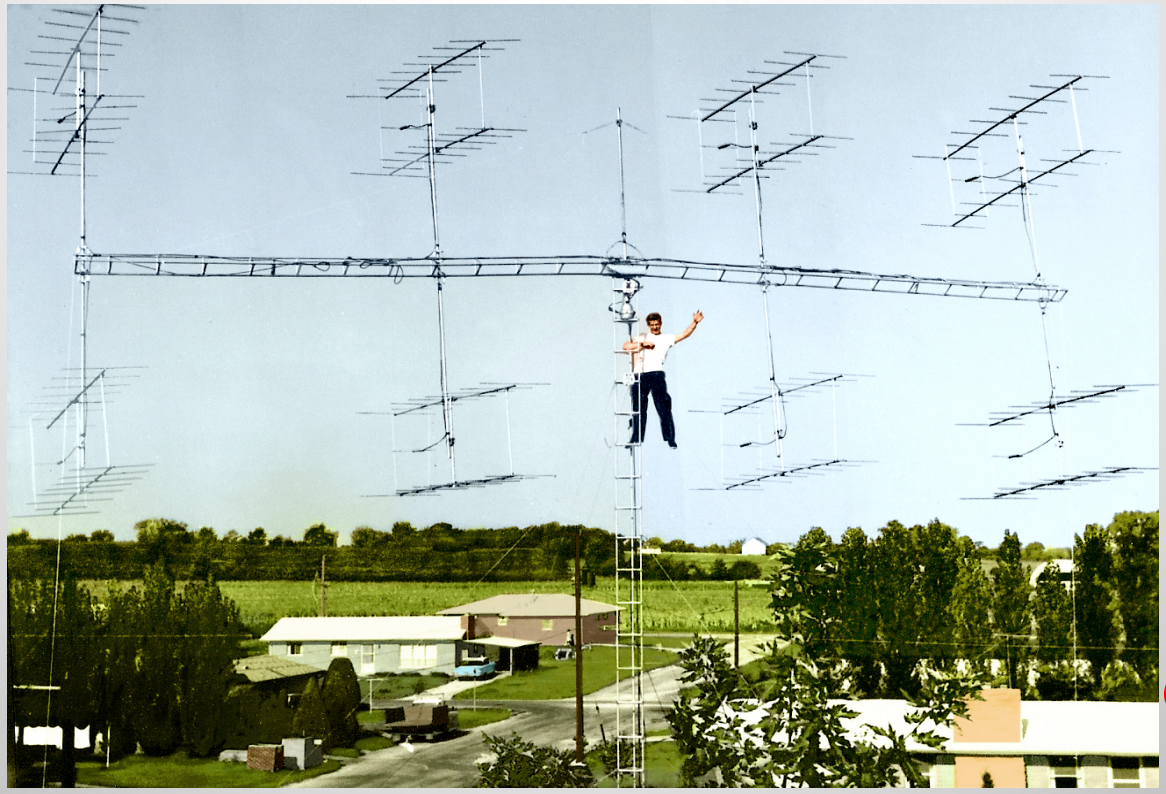
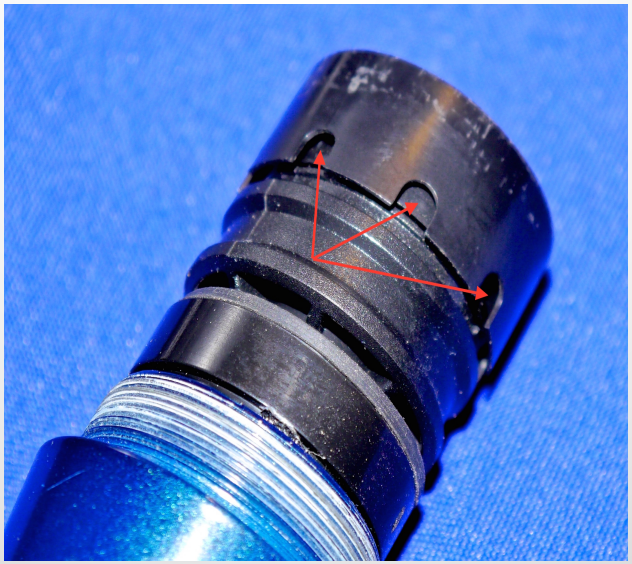
HOW DID WE DID THIS?
It's all about phasing

- …….and I learned it from lots of antenna experiments during me early ham radio days



It's All About the Heil 'Collection Tube'

- While all others have a few small holes around the side to receive unwanted rear info
- That is not enough for good rear rejection



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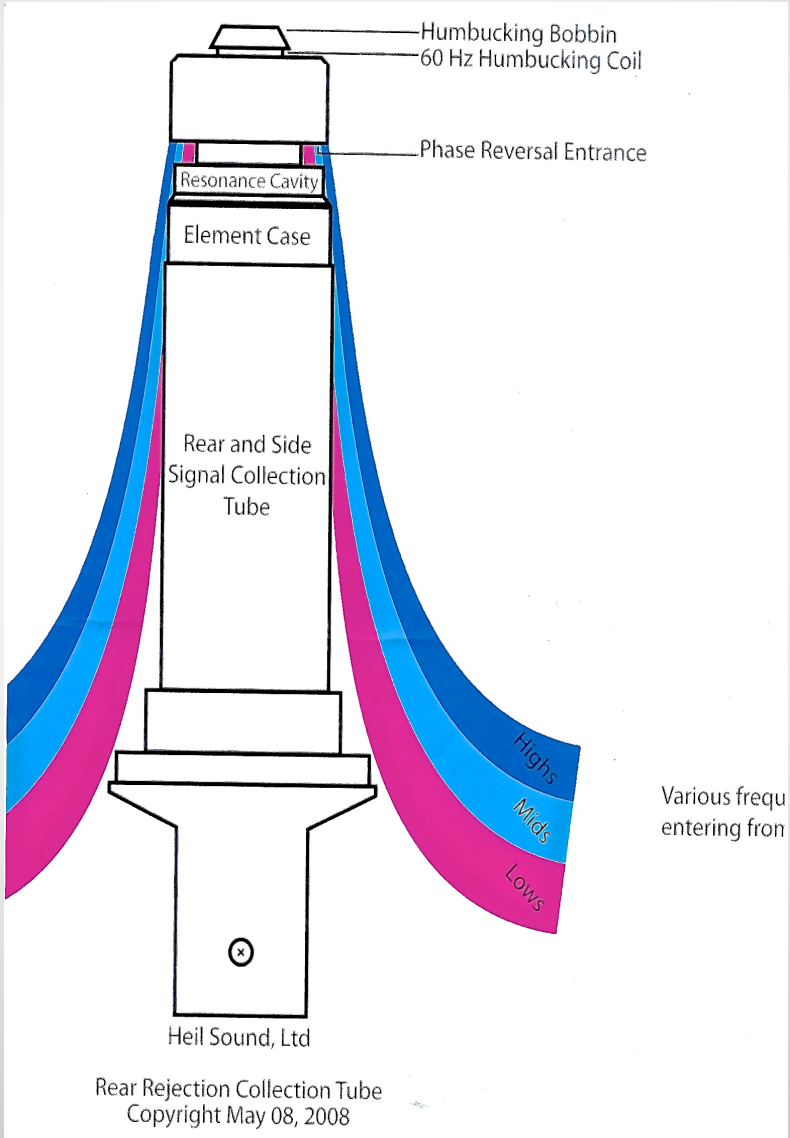
HEIL SOUND developed their 'COLLECTION TUBE'



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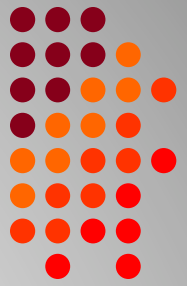
What is a ‘Humbucking coil’ ?

- A coil of wire, tuned to 60Hz is wired across the voice coil – out of phase so if the microphone is passed in front a monitor screen that emits noise, it cancels.
- A necessity for broadcast studios

DESIGN DETAILS



- All Heil microphones are much more than a ‘matching’ (painted same color) microphone
- Attention is paid to Transient Response – the ability to respond to rapidly changing speech levels and response.
- Better dynamic range – being able to handle SPL (sound pressure) of 145 dB.
- Serious -40 dB rear rejection

It all starts at the Microphone !

- **An audio chain is only as good as its weakest link.**
- **We start with a properly designed microphone for the proper application**
- Apply Proper microphone technique

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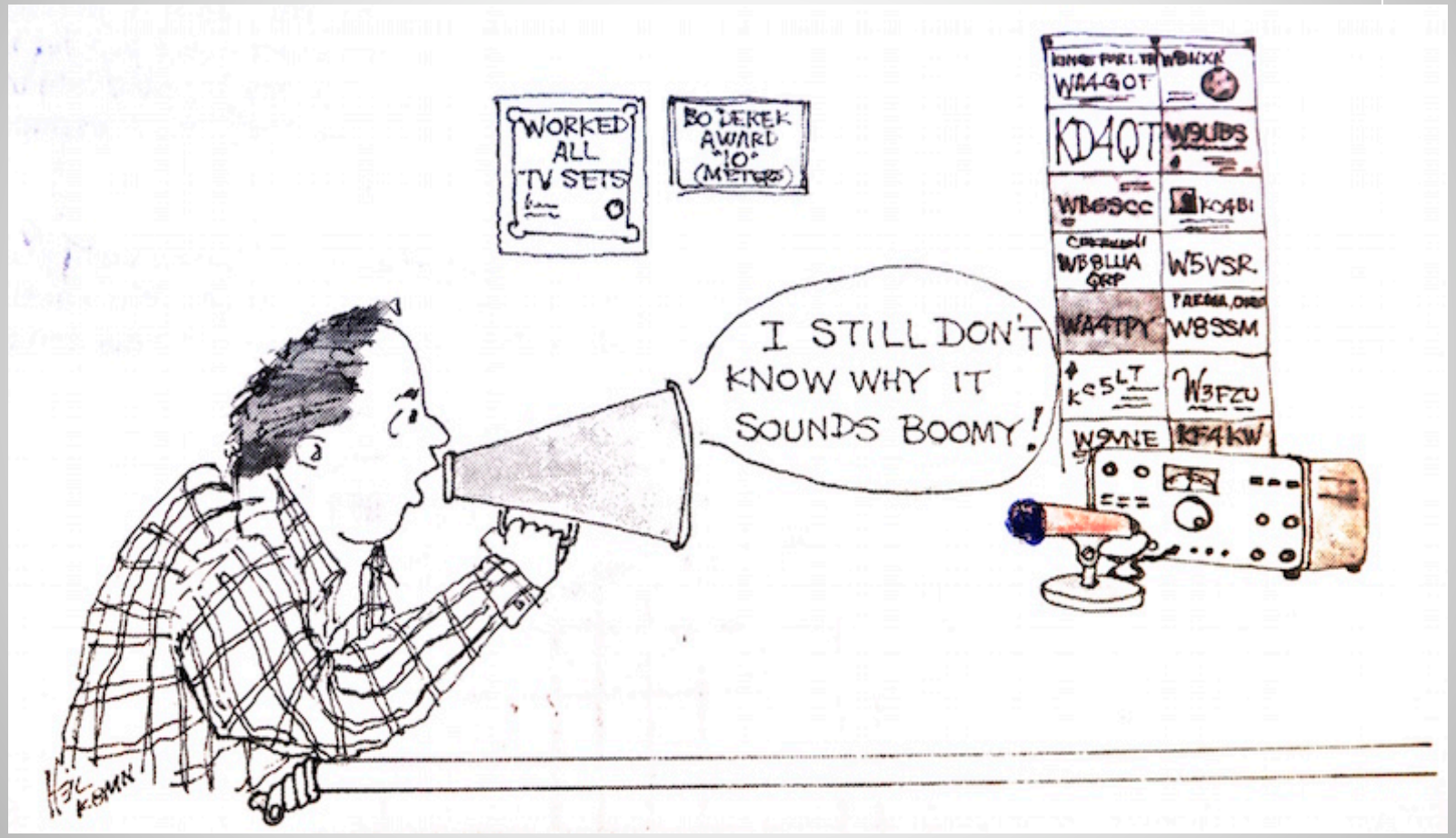
NEVER BE MORE THAN 2” FROM THE MICROPHONE



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Place that microphone correctly

- Forget the usual desk stand that you sit back three feet and address the microphone…no!
- Oh, I forgot – it's "matching"
- Desk stands allow you to be too far away.
- Never be more than 2"
- **Booms** are the answer
- ….or desk stands WITH booms ! PR 10

So Many Reasons……

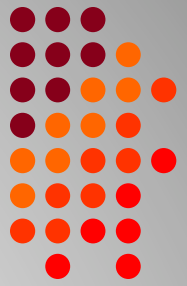
- You loose dynamic range
- You loose transient response
- You loose speech articulation
- **Scientific fact** – every time you double the distance from your microphone you loose SIX dB! Think about that.
- To ‘try’ and make that up you ‘crank up’ the gain
- The result ? You sound like you’re in a barrell

The answer -

- The Heil PR 10 package

HB-1 or PL2 T boom

PROPER ADJUSTMENTS are crucial



- Each transmitter has a different mic input.
- Different pre amp gains and audio response.
- Different types of operation requires very different equalization. Rag Chew, DX, nets
- Full Response mics don’t make it for DX
- Narrow (DX) mics are not ‘ragchew’ popular
- Monitor yourself through a second receiver

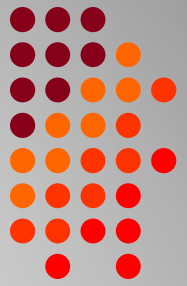
And then there is iCOM !

- Dynamic mics will usually not work. Not enough gain to drive the low level inputs usually found on early models. (pre PRO)
- Dynamic mics work beautifully on all of the Pro series, 7600,7700,7800
- BEWARE ! All iCOM has +8 volts superimposed on mic line
- iCOM has several different mic inputs.
- 'Early' iCOM (pre PRO) mic inputs are -15dB
- Very early iCOM had their mic pre amp inside the microphone, not in the transmitter (720,30,40) Finally put it inside with the iC735

The iCOM ‘fix for low level inputs

- In working with iCOM, we designed the perfect microphone for those low level inputs
- The ‘iCM’

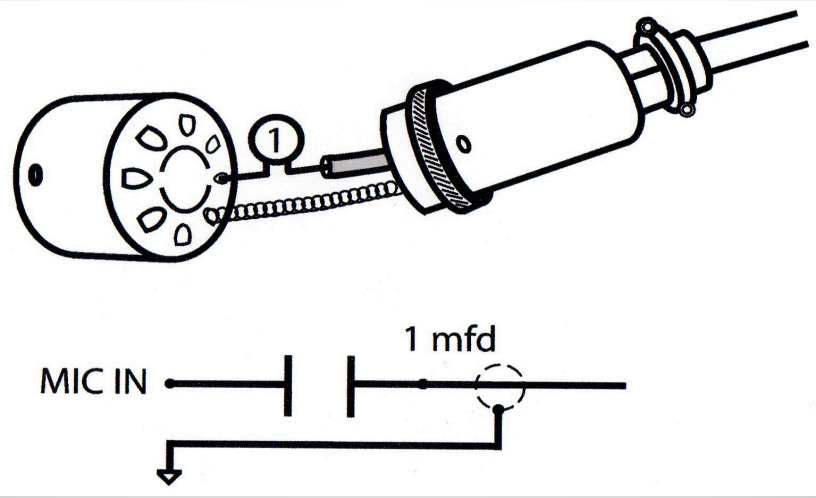
The HEIL ‘iC’ for iCOM only



- Used in our iCM microphone and all headsets built exclusively for low level inputs.
- Works great on all late model iCOM as well on Elecraft K2 and K3 (turn on the phantom power) No other transmitter furnishes phantom power. iCOM and Elecraft.
- It is a full range element but accepts EQ easily to tailor for DX or contest work as well as full range casual rag chew operation

Decoupling the iCOM inputs

- Always beware that every iCOM has +8 volts d.c. superimposed onto the mic line. It's called Phantom Power
- Audio is A.C. and carried down the mic line to the input.
- On the same mic lead, the + 8volts is fed back up that line to power the electret element needed on some iCOM
- Always be sure to decouple that lead with a one mFd capacitor

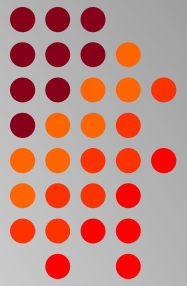


The microphone is only one half of the audio in your station

- Now you have the microphone all set, what about receive audio?
- All of the transceivers have very poor receive audio components and specifications. (yes, even the $10K ones !)
- When have you ever seen ANY receive audio specifications? Nope, they don't publish them
- Why? Most are producing 1 watt @ 10% distortion !
- And then you plug in the 'matching' (painted the same color) 50 cent speaker. True
- The listening fatigue is awful – but you never think of it

A new world is in front of you

THE answer to a great receive system



- Small mixer (many out there) driven from the line out signal in your accessory jack
- The mixer drives the pair of JBL Control 2P
- Most of the mixers have 2, some 3 way EQ
- JBL has two 35 watt @ .5 (point 5) distortion
- So many things you can do with this set up
- Also is one incredible headphone amplifier

All done for under $200.00

- Berhinger UB 802
- JBL Control 2P

Headphones, Headphones, Headphones……..

- Heil Sound continues to lead the headphone industry since 1985
- Many choices for you
- The PRO 7 is the ultimate for serious contest or DX work as well as casual operation
- Comfort is important. The steel band inside the padded top can be adjusted for more or less pressure

PRO 7 The Next Generation of headsets

The choice of serious DX Pedition and contest ops

* Extremely Comfortable
* Specially designed 2” foam Gel ear pads
* -26 dB of outside noise cancelling
* Exclusive Heil speaker Phase reversal
* Two detachable cables…coil or straight
* Military grade fiber reinforced cables
* Interchangeable microphone elements
* Features the HC 7 articulate dynamic or
  Heil ‘iC’ electret for early iCOM
* 40 mil speakers in acoustically tuned cavities*

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The Heil PRO 7
The new Boss in Headsets

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LISTEN, LISTEN!

- Remember this important audio fact:

- LISTENING is a MENTAL process
- HEARING is a PHYSICAL process

- Make sure you are mentally evaluating what you hear when adjusting your station audio