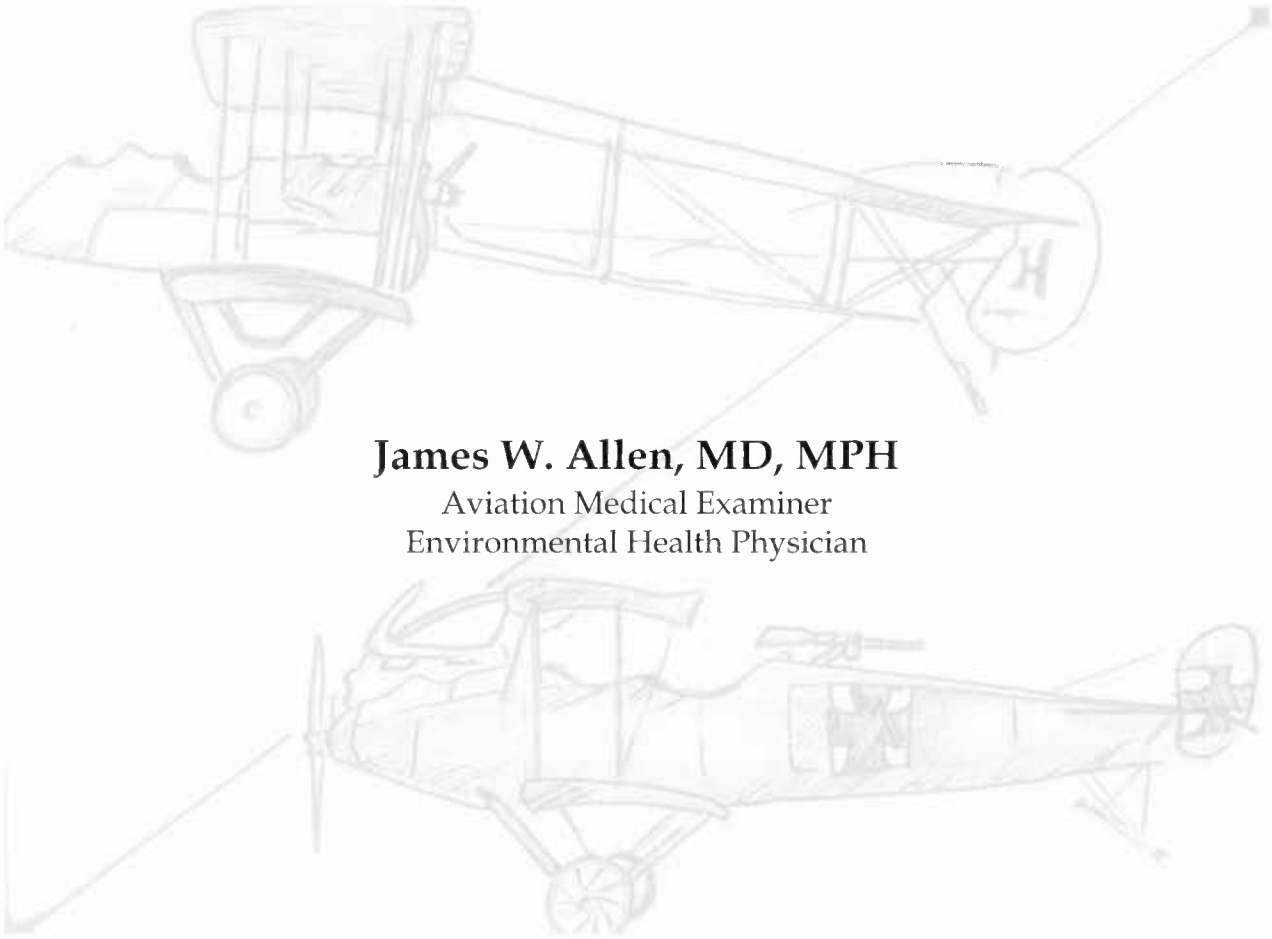
Working Healthy:

A Manual on Health Techniques for ***Aviators****,*
Maintainers *and* ***Aircraft*** *Builders*



James W. Allen, MD, MPH
Aviation Medical Examiner
Environmental Health Physician

BRUNDAGE PUBLISHING

TABLE OF CONTENTS

Aircraft Technical Book Company
PO Box 270
Tabernash, CO 80478
http://www.ACTechbooks.com

CHAPTER 3

Good Advice: BeeBee tells me how to fit an earplug.

In this chapter, I will examine two issues often overlooked by those who want to protect their hearing. The first issue is that exposures are cumulative. All noise sources, from the aircraft cockpit to the flight line to home activities, add to your total noise exposure. The ear does not have a threshold, below which noise exposure doesn't matter. The second issue is the importance of fitting an earplug, even a simple, formable foam plug. Poor fit is a major cause of Noise Induced Hearing Loss (NIHL).

I first met BeeBee when I asked for some air to inflate the leading gear strut on my Cherokee. I immediately noticed that he wore huge hearing aids, with the amplifier running into each ear. Noting my gaze, BeeBee said, "During the war I flew a lot of hours in a B-25. It's a great airplane, rock stable, good on one engine, but it's noisy as hell." He gestured to his hearing aids. "I also spent a lot of time in hangars and on flight lines." As we inflated the strut, I learned that BeeBee had a wealth of experience in both flying and aircraft maintenance. Over the next year, I returned to his shop as often as I could.

On one trip, I helped him finish installing a recently overhauled engine. Just before we started the engine, he handed me a small packet of foam earplugs. "Wear 'em," he ordered. I opened the packet, removed the foam blobs, and pushed them into my ears. This brought another quick comment, "Those aren't a wad that you ram into the barrel of a musket." He proceeded to roll the foam into a thin, tight cylindrical shape. No creases should appear on the cylinder, since any crease provides an air channel for noise to enter. BeeBee then showed me how to insert the cylinder into my ear canal **(Figure 3-1, left)**. When done correctly, the plug should completely fill the entrance to the ear canal, with just a small amount of the plug visible in the external ear **(Figure 3-1, right)**.

Foam earplugs work by blocking sound in the ear canal. They are much less effective if they only cover the entrance to the ear canal. When correctly inserted in the canal, the plugs are comfortable and less likely to fall out.

Although BeeBee didn't show me these, pre-molded earplugs and ear muffs also have fitting procedures. The reference below describes the appropriate fit for these hearing protection devices.

BeeBee's flying and maintenance experiences taught him the importance of proper fit for hearing protection devices. He offered good advice.

Aircraft Technical Book Company
PO Box 270
Tabernash, CO 80478
http://www.ACTechbooks.com

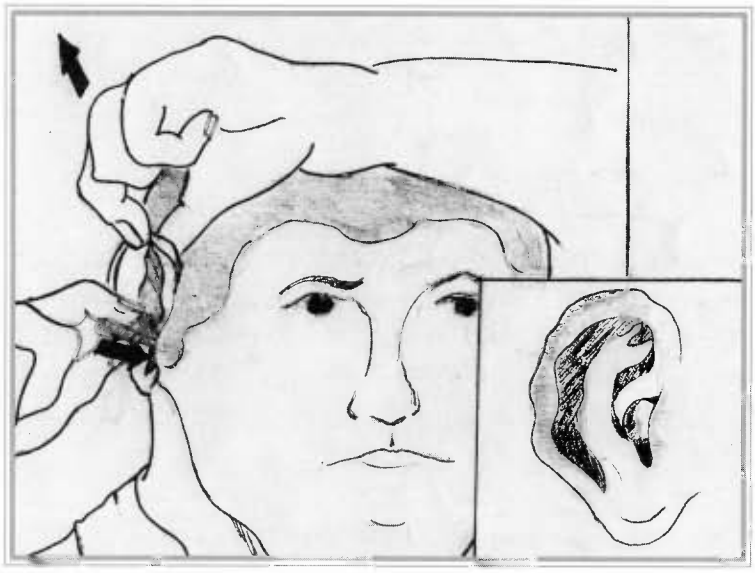


Figure 3-1: Correct Use of Foam Earplugs. Shape into a cylinder to insert into the ear (left). When properly inserted, the earplug shows *minimal* protrusion in the external ear (right).

For More Information, READ:

BeeBee is a living example of NIHL. Don't let this happen to you.

- Chapter 24 describes the physiologic basis for Noise-Induced Hearing Loss, and offers prevention methods.
- For more details on fitting a foam earplug, use the following reference:
  Aearo Technologies, Hearing Conservation Department . "Tips and Tools for Fitting and Using E.A.R Foam Earplugs." March 27, 2006. <*http://*www.e-a-r.com/pdf/hearingcons/tipstools.pdf>
- For details on fitting pre-molded earplugs and earmuffs, use the following reference:
  Aearo Technologies, Hearing Conservation Department. "Tips for Fitting Hearing Protectors E*A*Rlog19." April 5, 2006. <http://www.e-a-r.com/pdf/hearingcons/earlog19.pdf>

CHAPTER 4
Power Tools in Your Hands

Case Study: Hand-Arm Vibration syndrome at Chrysler Corporation, Aircraft Division, WWII

Blanching, numbness and tingling of the hand and fingers are symptoms first studied by a French physician in 1862. In 1911, an Italian physician associated these symptoms with the use of vibrating tools. In a famous 1918 study at the Oolitic Limestone Queries of Bedford, Indiana, Dr. Alice Hamilton noted blanching of fingers and numbness of the hand when stone cutters used air hammers. The condition became know as Hand-Arm Vibration Syndrome (HAV).

Physiology

HAV is caused when the blood vessels in the hand and fingers contract, reducing blood flow **(Figure 4-1)**. Nerves traveling with the vessels lose their sensitivity, causing the fingers to turn white and workers to experience numbness and tingling

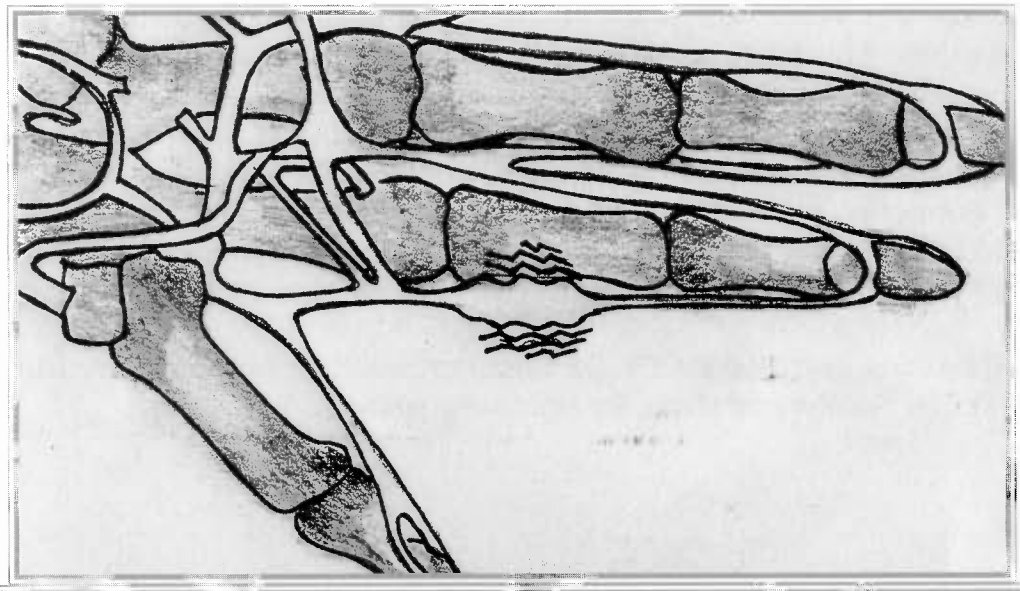


Figure 4-1: Course of Blood Vessel along the Sides of Each Finger. Spasm of the blood vessel (right side of index finger) prevents blood flow along the entire finger, making it cold and numb.

Changing Construction Techniques for Aircraft

Early aircraft construction involved a wire-braced framework that was strong yet light - weight. The Fokker Aircraft, produced during World War I, combined wood wings with a steel-tube fuselage in the DR. 1 Triplane, D-VII biplane and D-VIII parasol. During WWII, sheet metal replaced the stick-and-steel construction. One reason for this change was economics. Aircraft designers learned that with sheet metal construction, fewer people could build more advanced aircraft in less time and with fewer parts. Tools used for construction included the rivet gun, grinder and polisher. Although smaller than the jack hammer used by miners in the Oolitic Limestone Queries, aircraft builders now held rotating tools for long periods of time. Were these construction techniques putting workers at risk of HAV?

Dr. Dart's Study of Aircraft Workers in Sheet Metal Construction

In a classic study of this disease, Edward Dart, M.D., Director of the Medical Department at Chrysler Corporation, examined 112 workers who used vibrating tools and developed HAV symptoms. The study took place from July 1944 to June 1945 at a factory fabricating light metal parts for aircraft. These workers used polishing and burring tools that rotated at 10,000 to 50,000 rpm. While 60% of the vibrating tool operators were male, Dr. Dart noted that males comprised only 22% of the patients complaining of symptoms. The onset of symptoms occurred after a median time of eight months of tool use, but exposures ranged from one week to thirty months. Symptoms described were "white finger," with blanching and numbing occurring mainly on the fingers of the right-hand (in right-handed persons). Dr. Dart observed that symptoms were most likely to occur when the tool was held in a pencil-grip fashion. Cold temperatures aggravated the symptoms, with most cases occurring from January to April 1945.

Based on these observations, Dr. Dart recommended the preventive measures outlined in **(Table 4-1)**. His recommendations are still useful today.