White Matter Chronicles

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A constituent organization of the Aerospace Medical Association (AsMA)

Inside This Issue

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AsPS President 2022-23
Lt Col Mari "Mars" Metzler, D.O., MSHF, CFII

Greetings from whichever country I happen to be in this week! You can choose from any half dozen on three continents! It's been a great (busy!) few months for me, but I'd like to thank all of you reading this...well, for continuing to read! Hopefully my Disney themed title page piqued your interest! For those of you still reading, the top right nose art adorns a Grumman F7F-3 Tigercat, Shere Kahn from one of my favorite movies, The Jungle Book! Bottom left is an insignia commissioned by Hap Arnold, and the bottom right is STILL the current patch worn by the mighty 309th FS out of Luke AFB, AZ.

You may know that Disney designed patches for over 1,200 different military organizations during and after WWII, but he also designed a few for the Civil Air Patrol (see example to the right), an organization who shares our AsPS values of passing on our scientific knowledge to those young ones! I'm a CAP pilot and have been a member of the organization since 2015, and it's a great way not only to give back to your community, but also to instill STEM passion into the next generation! Oh, and you get to fly airplanes, too! (If you're into that:-) The National Museum of the USAF has a bunch of Disney insignia in its "Disney Pins on Wings" exhibit: https://www.nationalmuseum.af.mil/Visit/Museum-Exhibits/Fact-Sheets/Display/Article/196132/disney-pins-on-wings/. If you want more information on the New Orleans WWII museum, this is a good YouTube video: https://www.youtube.com/watch?v=KQi9FOPOdHs

CAP was established on December 1st 1941 and became an auxiliary of the US air Force in 1948. Since then for over 80 years, it has performed its three missions: 1) Aerospace Education, 2) Cadet Programs and 3) Emergency Services. In 2015, I witnessed a ceremony at Tyndall AFB inducting CAP into the USAF Total Force, joining the regular, guard and reserve forces. Today, CAP has over 34,000 senior members, 24,000 cadets ages 12-18, and flies the largest single-engine fleet in the world (555 aircraft). CAP's Aerospace Education and cadet programs missions include both senior members and cadets, encompassing character development, flight training and leadership. The Emergency Services mission performs fire patrol, disaster relief, and inland search and rescue. In fact, CAP performs over 90% of the US inland SAR, and is responsible for saving hundreds of lives a year! CAP has squadrons in all 50 states, but it's expensive for senior members to join... just kidding, it's about $70/year, and cadets can sign up for free flights! I'm a pilot for cadet orientation flights, and it's great to see the smiles on kids' faces when I tell them "you have the aircraft"! Most of these kids have never even driven a car yet, but they get to (safely) fly an airplane! I encourage everyone to check out CAP in your local community, and together, let's do the impossible! I'll see y'all at AsMA in Nawlins! ~Mars

Nominations for AsPS Awards Due by 15 Mar 2023

Please see the nomination form at the end of this newsletter or the AsPS website for additional details. Self-nominations are encouraged! www.aerospacephysiologysociety.org/

1. The Paul Bert Award recognizes outstanding research contributions in aerospace physiology.

2. The Fred A. Hitchcock Award recognizes career contributions of senior aerospace physiologists for excellence in either operational aerospace physiology or aerospace physiology research.

3. The Wiley Post Award recognizes outstanding contributions in direct operational physiology and aeromedical training and education.

4. The Master Sergeant Lloyd Tripp Award recognizes a technician for outstanding work in the field of aerospace physiology.

Awards will be presented during the AsPS Luncheon at the AsMA Conference in New Orleans Louisiana.

2023 ASMA Education & Training Panel: Taming Virtual Reality for the Next Generation

Have you ever wondered what the metaverse is all about? Are you itching to find out more about virtual reality? Sponsored by Aerospace Physiology Society, this upcoming panel is all about understanding VR technologies, as well as reducing physiological limitations that come with this bold new training frontier. Come and listen about the first steps being made to educate and train the next generation in the approaching metaverse, from the use of VR in biological environments to dramatically increase understanding of cells and substrates “in vivo,” to potential applications in cost and hazard reduction for real world military training and preparedness. This exciting new panel extends from theory to practice the idea of reducing cybersickness events so that the promises of a metaverse might be realized. Anticipate a packed panel line-up with insights from academia to military operations.

Partnership in Education Award

The Partnership in Education Award is awarded to a teacher in a school district of the host city for the current year’s AsMA Annual Scientific Meeting.

The 2022 Partnership in Education Award of the Aerospace Physiology Society was presented 25 May at the annual Society Luncheon in conjunction with the AsMA Annual Scientific Meeting in Reno, NV.

Mr. James Young, of Reno North Valley High School accepted the PiE Award at the annual Society Luncheon. Mr. Young is a teacher of Advanced Physics and Astronomy. He is a designated Master Educator for Washoe Schools, who contributed to his district beyond the classroom in cybersecurity and computer skills. He was part of an elite 2022 NASA Airborne Astronomy Ambassadors (AAA) program for his students. Mr. Young originated and wrote curriculum for the first astronomy instruction and has inspired students through innovation.

Mr. James Young has a MS in Mathematics Education [Western Governors University], a MS in Human Resources [Central Michigan University], a BS in Physics [University of Illinois], and Teacher Certification from the State of Nevada. Congratulations and Bravo Zulu to Mr. Young.

Nominations for the 2022 Partnership in Education are being accepted.

Learn more at www.aerospacephysiologysociety.org/

Thanks to Constance Ramsburg, Ilene Wheaton, and David Welge for your work on this award!

The USAAF Aero Medical Lab's 40,000-footer, B-17E #13, a.k.a., NEMESIS of AEROEMBOLISM (1941-1945)

BY Jay B. Dean, PhD
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Dr. Major Sir Frederick Grant Banting (RCAF)[1] predicted in 1940 the side that lifted the heaviest weapons to 40,000-ft would be the eventual victor in World War II (WWII). Safely flying and fighting at 40,000-ft would be a tremendous challenge given that prior to WWII airplanes rarely flew above 15,000-ft due to lack of reliable oxygen equipment, pressurized cabins, and flight suits. Thus, beginning in January 1941, the U. S. Army Air Corps (USAAC)[2] Materiel Command and Aero Medical Laboratory at Wright Field in Dayton, OH, initiated a collaboration with Boeing's Flight Test Laboratory in Seattle, WA, to pioneer "altitude flying" safely above 35,000-ft in the stratosphere.

Fight tests were based at Boeing Field and used three B-17 Flying Fortresses identified in technical reports as B-17C #1 (AF 40-2042), B-17E #7 (AF 41-2399), and B 17E #13 (AF41-2407; **Fig. 1A**)[3]. The three heavy bombers were designated as models C #1, E #7, and E #13 because they were the 1st, 7th, and 13th aircraft of that production model built and delivered to the USAAC. These three aircraft, however, remained in Seattle and were converted into "flying laboratories" capable of reaching, initially, 25,000 to 35,000-ft and eventually 40,000-ft with dreams of 50,000-ft! Case in point. B-17E #13, stripped of its heavy gun turrets, flew to an altitude of 42,399-ft on 1 Nov 1942 flight testing the prototype of the pressure breathing oxygen mask. As depicted in **Fig. 2,** the 3-man crew included two Boeing test pilots, Allen C. Reed and James A. Fraser, and chief of the USAAF Aero Medical Lab at Wright Field, Dr. Col. Wm. Randolph "Randy" Lovelace II. The three aviators remained above 40,000-ft for 90 minutes without suffering any ill effects of "anoxia" or "aeroembolism". Upon landing and debriefing with aviation experts from Boeing and Lockheed, the aeronautical engineers and physiologists predicted "*…that the new pressure breathing oxygen equipment makes it possible for the first time to extend the current engineering test program of the B-17 series well up into the 40,000 to 50,000 feet range of altitudes without awaiting the development and production of pressure cabins*".[4]

FOOTNOTES:
[1]F.G. Banting shared the 1923 Nobel Prize in Physiology/Medicine with John MacLeod for their discovery of insulin.
[2]USAAC was reorganized as the USAAF on 20 June 1941.
[3]Boeing Flight Engineering Training Course, 1st day – January 19, 1942; General Procedures and Flight Test Forms, p. 20-21, by W. P. Talbott (author's collection)
[4]Lovelace II, W.R., Gagge, A.P., Molomut, N. (10 Dec 1942) Pressure breathing. USAAF Aero Med Lab report no. EXP-M-49-695-1E

Continued: The USAAF Aero Medical Lab's 40,000-footer, B-17E #13, a.k.a., NEMESIS of AEROEMBOLISM (1941-1945)

BY Jay B. Dean, PhD
Professor of Molecular Pharmacology & Physiology

Above: Fig. 1.A) April 1944. NEMESIS of AEROEMBOLISM preparing to takeoff from Muroc Field, CA (photo courtesy of the Lindquist family). **B**) B-17E #13's resident Strato-Gremlin painted on the ship's rear door (at 'B' in panel A; from a Letter to the Editor, LIFE Magazine, 7 Dec. 1942). **C**) B-17E #13's contrail as it climbs to 37,500-ft in April 1943 (image from Don Erchinger's scrapbook, former Boeing flight engineer, author's collection).

Below: Fig. 2. 1 Nov. 1942, on the flight deck of B-17E #13 preparing to ascend to the stratosphere to test a prototype design of the pressure breathing demand type oxygen mask developed at Wright Field Aero Medical Laboratory. Boeing test pilot Allen C. Reed (left), co-pilot James A. Fraser (right), and Dr. Col. Randy Lovelace II, chief of the USAAF Aero Med Lab (middle); image from footnote 4.

Seven months later, on 24 June 1943, B-17E #13 flew again up to the stratosphere to test whether the bailout O2 equipment used by the USAAF would sustain a flyer's consciousness during a 24.5-minute floating descent from 40,000-ft (**Fig. 3**). Col. Randy Lovelace II, once again, was the guinea pig who would make a static line drop from 40,200-ft. Copiloting B-17E #13 again was Jim Fraser, this time accompanied by Boeing test pilot Richard deHart Williams and flight engineer Donald B. Erchinger. Randy Lovelace, who had never made a parachute jump before, stated while recovering from injuries sustained during his jump that "…*struggling through the bomb bay…there is a feeling of apprehension; …and then they started to open the bomb bay. Then I looked down* (**Fig. 4A**), *and it is so much further looking straight down than it is looking out the side! So I knew it was a hell of a long ways.*[5]" As Randy Lovelace dropped through the open bomb bay the static line jerked his 'chute from the its backpack and it quickly billowed into full-squid causing an unanticipated rapid deceleration so severe that he was rendered unconscious. The unexpected jolt to his body dislodged both gloves from his left hand resulting in frostbite. B-17E #13 slowly circled Lovelace as he hung limply in his harness, swinging through an arc of nearly 90 degrees in each direction. Jim Fraser observed that *"at no time during the descent…was any sign of life detected in Dr. Col. Lovelace…".* Lovelace, however, came to at 8,000-ft and "*…one arm moved in a feeble gesture of recognition and then fell limp again."* He landed in a wheat field in shock, nauseated, with a painful frostbitten left hand (**Fig. 4B**). Physiologists from Wright Field and the Mayo Aero Medical Unit later determined in a separate study[6] during the spring/summer of 1944 that Lovelace's body had likely been hit with 33 Gs of deceleration in less than 0.5 second!

Above: **Fig. 3.** 24 June 1943, prebreathing 100% oxygen ("denitrogenizing") to avert "aeroembolism" at altitude before ascent to 40,200-ft in B 17E #13 for Randy Lovelace's static line parachute jump. Left-to-right: Pilot Richard deHart Williams, flight engineer Donald B. Erchinger, co-pilot James A. Fraser, and jumper Col. Randy Lovelace, II. After this photograph was made the four men played catch with a baseball and gloves as their way to exercise during denitrogenation (image comes Erchinger's Boeing report, footnote 5).

In October 1943, B-17E #13 was reassigned from Boeing Field to the USAAF Aero Med Lab in Dayton to be used as a high-altitude testing platform for the remainder of the war. B-17E #13 was christened the NEMESIS of AEROEMOBLISM (41-2407). Col. Randy Lovelace reported in March 1944 that "*during the past 5 months, the following types of tests have been carried out in a series of ~40 flights, the majority of which were at altitudes from 30,000 to 35,000. (an indicated altitude of 40,000 ft has been exceeded on 7 occasions)*[7]". In general, flight tests included the following: a) tests on all items of O2 equipment; b) vibration tests on all O2 equipment; c) time to temperature equilibration at various altitudes; d) studies of heat loss by radiation; e) freezing temperatures at each crew position; f) wind velocity measurements with bomb-bay doors & gunner's windows open; g) flight testing of goggles and all items of clothing; h) indoctrination of civilian representatives of various industries so they can better appreciate conditions their equipment will be used under; and i.) parachute drop tests to determine time & force of deceleration.

Footnotes:

[5]Erchinger, D.B. (7 Aug 1943) Parachute jump from 40,000 feet by Lt. Col. W.R. Lovelace II (B-17E, #13, AF 41-2407), Boeing Aircraft Co., Seattle, WA, Document No. D-5057, p. 12-0-7

[6]Hallenbeck, G.A., Penrod, K.E., MacCardle, R. (8 July 1944) The magnitude and duration of parachute opening shock at various altitudes and air speeds. USAAF Aero Med Lab report no. ENG-49-696-66, 46 pp.

[7]Lovelace II, W.R. (20 Mar 1944) High altitude flight testing of flyers' personal equipment in specially engineered B-17E number 41-2407. USAAF Aero Med Lab report no. ENG-49-697-1H, 35 pp.

Regarding item i (On previous page), the parachute opening shock G-force study was done at Muroc Field (a.k.a., “Wright Field West")[8] beginning the spring of 1944 using the NEMESIS of AEROEMOBLISM. As indicated above, aviation physiologists from Wright Field and the Mayo Aero Medical Unit in Rochester, MN conducted the research.[6] Two devices called the Ryan-Lindquist tensiometer were attached in series with a parachute riser to measure the magnitude and duration of parachute opening shock; one tensiometer set at high gain and one at lower gain. Parachute drop tests were made using hard rubber parachute dummies weighing 145 and 200-lbs. For purposes of comparison, a living non-human test subject was needed—enter, “Major the parapooch”. Major was a 124-lb. St. Bernard purchased for $3.00 from the Dayton dog pound on 30 Dec 1943. The physiologists fattened Major up to 145 lbs and, as was military tradition, gave the big dog the rank of “Major” so that his handler, Dr. Lt. Kenneth E. Penrod, was outranked and thus respected his charge (**Fig. 5**). Major made drops ranging from 7,000 up to 26,000-ft but plans to drop him from 33,000 and 40,000-ft (he had a fur-lined flight suit and O2 mask) were canceled after his jump jacket ripped from the opening shock during his second 26,000-footer, nearly spilling him out of his ‘chute (**Fig. 4D**)! Results of this research was the basis for recommending a high-altitude, low opening jump to reduce the magnitude of parachute opening shock (and avoid enemy gunfire)[9].

(Left) Fig. 4. A) 24 June 1943, Col. W.R. Lovelace II tests out his plywood jump platform in the bomb bay of B 17E #13 prior to ascent. **B)** Boeing test pilot Robert T. Lamson, pilot of the chase plane that followed Lovelace down at low altitude, administers first aid to Randy who lies in shock after experiencing 33 Gs of parachute opening shock at 40,200-ft. **C)** “Major the Parapooch” hangs in the bomb bay of the NEMESIS of AEROEMBOLISM waiting for the doors to open and the “bombardier” to release him, April 1944. **“T”** = Lindquist-Ryan tensiometers used to measure opening shock force. **D)** Major after his 2nd jump from 26,000-ft. The opening shock ripped Major’s jump jacket horizontally over the big dog’s right rear flank, April 1944. Images are from: **A)** Lovelace, W.R., Allen, S.C. (9 July 1943) Parachute descent from a pressure altitude of 39,750 (density altitude, 40,200 Feet). USAAF Aero Med Lab report no. ENG-49-695-1K; **B)** footnote 5; **C)** Mayo Historical Unit Archives; **D)** Lindquist family.

Footnotes:

[8]Today, Muroc Field is known as Edwards AFB.

[9]Your Body in Flight. USAAF Aero Med Lab, Wright Field, Dayton, OH; T.O. No. 30-105-1, pp. 74 (30 Sept 1944)

[10]How it Feels to Fly Seven Miles High, Girl Reporter in the Stratosphere, by Margaret Kerodle, The Bee, Danville, VA, March 2, 1944

[11]Lovelace II, W.R., Carlson, L.D., Wulff, V.J. (1945) Oxygen consumption of aircrews. Air Surgeon’s Bulletin. Vol. II, No. 9: 303-304.

[12]Strato-Gremlins are sky terrors. Boeing News. Vol. XII, No. 11: p. 7 (Nov 1942).

Above: Fig. 5. April 1944, Muroc Field, CA. Lt. Ken E. Penrod (left) and unidentified airman lace up Major's jump jacket in preparation for his next leap from the belly of the NEMESIS of AEROEMBOLISM, which is visible in the background. In the rich tradition of military aviators, Major's jacket bares the logo of the USAAF Aero Medical Lab: a golden medical caduceus atop the silver star and chevrons of the air force. Ken Penrod's son told me that Major always dog-paddled while floating earthwards (photo courtesy of the Lindquist family).

The physiologists had a special way of commemorating each flight in the NEMESIS of AEROEMBOLISM that reached 40,000-ft according to a newspaper reporter who flew on the aircraft in March 1944: *"…the NEMESIS, one of the rarest Flying fortresses in the world, full of super thises and thats destined to remain military secrets until after the war… This is the experimental ship for the Aero-Medical laboratory of the Army Air Forces. It gets a new gremlin painted on it every time it goes up to 40,000 feet with its dare-devil crew of scientists, whose daily work helps wipe out hazards of cold and altitude for combat crews[10]".* Thus, after each successful 40,000-foot flight another Strato-Gremlin was painted on the starboard side of NEMESIS' nose—notice the six small figures in **Fig. 1A (See pg 5)**. By 1945, at least 25 Strato-Gremlins adorned the entire starboard side of the ship's nose[11]. A large Strato-Gremlin was also painted on the starboard rear door of the NEMESIS of AEROEMBOLISM, which served as a popular site for photographic poses (**Fig. 1B, see pg 5**).[5,12]

According to the test pilots at Boeing's Flight Test Lab, *"Strato-Gremlins…usually are found above 35,000 feet. They are larger than ordinary Gremlins, probably because of expansion in the rarefied air, and evolution has developed their noses into a bulb resembling an O2 mask breather bag* (**Fig. 1B vs. 3, pg. 5**). *It also has given them fuzzy ears and long, light blue fur, with which they are lined inside and out in order to withstand the cold… Strato-Gremlins carry an O2 tank on their backs…because Strato-Gremlins are very fond of pure oxygen and often sneak into the oxygen supply of a plane to suck the tanks dry! …observers on the ground, seven miles below, can see the Strato-Gremlins even when they can't see the Fortress—that is, if you are watching from the ground, you can tell that Strato-Gremlins are riding around up there because you can see their icy breath making a trail across the sky"* (**Fig. 1C, pg. 5**).

In 1940, the Allies' goal had been to safely lift an aircrew to 40,000-ft, which they achieved using pressure breathing equipment in B-17 "fortress research labs" and P-38 Lightnings used in photographic reconnaissance missions[13]. By war's end, the Boeing Flight Test Unit had made 792 high-altitude flights above 25,000-ft, and of these, 149 exceeded 35,000-ft, and 20 passed through 40,000-ft.[14] Additionally, physiologists at the USAAF Aero Med Lab made numerous flights to 35,000-ft and at least 25 flights above 40,000-ft in the NEMESIS of AEROEMBOLISM. The wartime altitude record for a 4-engine heavy bomber was set on 12 July 1945 when another fortress research lab, a B-17G named "The SHADOW", reached 43,499-ft in the skies over Seattle, WA, remaining above 40,000-ft for 2 hours, 21 minutes. The SHADOW's pilot, of course, was Jim Fraser, and the co-pilot was Scott Osler who described their ship's slow spiraling climb to the stratosphere like that of a "home-sick Angel"[15]. In the end, most high-altitude operations during WWII were flown at 20,000 to 35,000-ft; however, preparing for a 40,000-foot air war during 1941-45 provided the USAF and USN the protective flight equipment for a smooth transition into the postwar jet age with its higher operational altitudes and airspeeds.

Footnotes:

[13] Molomut, N. and Allen, S. (29 May 1943) Pressure breathing. USAAF Aero Med Lab report no. ENG-49-695-1J, pp. 3; and A report of high-altitude data and medical problems of the northwest African photographic reconnaissance wing. Headquarters Northwest African Photographic Reconnaissance Wing, Army Air Forces, Office of the Surgeon (1 Sept 1943), 14 pp.

[14] Behind an Air Victory (undated, post-WWII). Case History of One Company's Contribution to the Winning of World War II. Boeing Aircraft Co., Seattle, WA, Document No. D-8112, p. 21 of 33.

[15] Newspaper: The Independent Record. Vol. 2, No. 233, p. 1 (13 July 1945), Helena, MT.

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AEROSPACE PHYSIOLOGY SOCIETY
AWARD NOMINATION FORM

SEND COMPLETED FORM to:
Attn: Awards Committee Chair at
aerophyzsociety@gmail.com

NOMINEE: _____

NOMINEE E-MAIL: _____

AWARD: (check one)

- ☐ Paul Bert Award
- ☐ Fred A. Hitchcock Award
- ☐ Wiley Post Award
- ☐ Master Sergeant Lloyd Tripp Award

AsPS and AsMA Member (Y/N): _____

PROPOSED CITATION:
Summarize in your own words the specific achievement or contribution which inspired the nomination. Limit is 80 words.

BACKGROUND: Succinctly describe the reason for the nomination, including dates and significance of relevant accomplishments, their impact in the larger world, and the ways in which they meet the requirements of the specific award. Use complete sentences without abbreviations. Limit is 300 words. Additional biographical material may be attached.

AEROSPACE PHYSIOLOGY SOCIETY
AWARD NOMINATION FORM

BACKGROUND (continued)

NOMINATOR INFORMATION

Date: _____

Name: _____

Title: _____

Email Address: _____

AWARD RULES

Nominations may be submitted by anyone, regardless of AsMA or AsPS membership. Nominations for these awards must follow the rules below. Award recipients are selected by vote of the AsPS Awards Committee. Each committee member reviews the nomination forms and ranks the candidates based on the significance of the accomplishments cited, their relevance to the specific award, and the timeliness of the nomination. The Awards Committee chairperson does not vote and is not eligible for an award during his/her tenure.

Rules:

1. The nominee ***must*** be a member in good standing of both the Aerospace Medical Association (AsMA) and the Aerospace Physiology Society (AsPS). ***For the Master Sergeant Lloyd Tripp Award the nominee does not need to be a member of AsMA or AsPS.***
2. Deceased members may be nominated.
3. An individual can only receive one award in any one year.
4. The form is available on the AsPS websites. http://www.aerospacephysiologysociety.org *You may download the nomination form into your computer for e-mailing as a Word document attachment. Nomination forms should be sent via e-mail (preferred) to the attention of the Awards Committee Chair at aerophyzsociety@gmail.com. This email may also be used to address any inquires about the nomination process.*
5. Nominations are due by 15 Mar of the award year. Late submissions will NOT be accepted.