Society of U. S. Naval Flight Surgeons

Naval Aerospace Medical Institute, Code 10
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PRESIDENT'S COLUMN

A few years ago the Manual of the Medical Department contained a section of Chapter 2 entitled "Functions of the Flight Surgeon." It was a long list, and anyone who read it would wonder "Who are these supermen?" Today, Chapter 2 has no such list, our ranks have been depleted, and our professional time is mainly spent in patient care. Does the future look any brighter, or are we destined to live out our careers as totally frustrated supermen?

On the 25th and 26th of October VADM. Jim Zimble held what can best be described as the Surgeon General's Pep Rally. This meeting was meant to give the leaders of Navy Medicine a status report on where we stood, where we were headed and what each of us could do to improve our situation. I would like to use this column to present a similar report on Aerospace Medicine.

* The draft OPNAVINST on "Functions of Flight Surgeons" is alive and well. It will authorize you to spend up to 50% of your work week in the pursuit of your aeromedical duties. It will also define what some of those duties should be.

* 33 flight surgeons were selected for Navy residency training in 1988, with 6 additional selected as alternates.

* The Aerospace Medicine Specialists who are in designated billets were included on the Incentive Special Pay list.

* The Aerospace Medicine Residency program now has 5 slots for each year. The goal is to have all CV/CVN Senior Medical Officer billets filled by residents by 1990.

* The new Director of Operational Medicine will be RADM Bob Halder who was previously the Commanding Officer at Naval Hospital Naples. He wears Navy Flight Surgeon wings, and I expect him to carryon the same strong support of Aerospace Medicine as did his predecessor, CAPT. Dick Nelson.

* Currently, we have 297 flight surgeon (0045) billets of which 46 are not filled. The number of billets will grow to 304 by 1990, and possibly to 347. In 1987 we trained 84 new flight surgeons, and in 1988 we should train close to 90. We need to train 100+ if we are ever to close the gap because we lose 60-70 each year to GME and RAD. We all need to RECRUIT. Also, there are about 50 flight surgeons eligible for release from active duty who have not yet made NMPC aware of their plans for next year. If you are in the group I encourage you to call your detailer, find out what billets are available, and stick around for another tour.

So much for facts. What can we do? We can all communicate. Tell yoursquadron C.O. what is going on in Navy Medicine. Tell, or show, your SMO/OinC (if not a flight surgeon or physician) what is going on in your squadron. We need to convince the non-aviation medical department that we indeed have non-clinic based duties, and we need to establish rapport with our squadron mates in order to build credibility and become more effective in oursupport. We need to demonstrate to both sides (yes, there generally are two sides and we are usually in the middle) our competence, professionalism, maturity, sensitivity and involvement. We need to stay together and support one another. I doubt if there is a more united and dedicated organized labor group in the Navy. Let's keep it that way.

R. K. OHSLUND
CAPT MC USN
NAVMEDCOM-23

SECRETARY-TREASURER NOTES

Hi! The past few months have been very hectic with TAD and Board preparation. If any problems exist with addresses, orders, etc., please contact me as soon as possible and they will be remedied.

The Society was honored to assist in presenting the

recently successful problems course and will continue to support this emerging tradition (our very own "Fall Classic").

Wings and things are still available for those interested (please allow 4-6 weeks for delivery), as are Newsletter volumes.

CDR DAVE YACAVONE
NAMI CODE 32
NAS PENSACOLA FL 32508-5600

NAMI NOTES

SATFAC Q/A

The SATFACT inspection results have led to a request by some of the "inspectees" for guidance on specific areas inspected. The following addresses some of the items most commonly found wanting.

COLOR VISION

The only acceptable test of color vision for candidates is the Farnsworth Lantern (FALANT). This machine is available on the commercial market and at least one candidate has bought his own machine to practice with. It is rumored that some recruiters have been known to allow candidates to practice with a FALANT. This set of circumstances requires that the presentation of the colors be as close to absolutely random as can be made. The best way to do this is to choose the numerals 1 through 9 in any random order, list them, and present the colors as listed to the candidate. The order of the presentation should be changed weekly (or daily if you are paranoid). Presenting the colors as every other number is not adequate. These people are too smart for that.

DEPTH PERCEPTION

There are two common errors found in the depth perception test, improper distance and non-random presentation. The Verhoff is the proper instrument to use. It should have a string tied to it so that when one end of the string is placed on the individual's forehead, the instrument is one meter (approximately 39 1/3") from the individual's corneas. Note that this is not one yard. Binocular depth perception is largely a function of the angle subtended between the eyes and the target of fixation and just a few inches difference is significant. If a string is measured to be one meter long and then tied to a metal washer and taped to the back of the Verhoff, it may still conceptually be a meter-long string but the distance it measures may be inches less. The test must be given randomly and the target should be covered by the examiners hand while the target is being changed. One source of confusion is the MANMED 15-96 sentence 3 which states: "As a preliminary, target #2 (the second target down when the instruments is upright) is presented at about 40 cm and brought nearer if necessary. This will acquaint the examinee with what is to be observed..... "

VISUAL ACUITY

The visual acuity test for candidates is critical. Historically the majority of serious errors made by outlying dispensaries have occurred during examination of distant visual acuity. A proper 20 foot eyelane must be used. This eyelane is described in the Manual of the Medical Department. The distance must be 20 feet to within plus or minus 2" (bridge of nose to chart surface). The illumination is specifically described. Although it does not so state in the MMD, the letter chart must be a Goodlite chart with randomly changeable letters. A maximum of 2 seconds is allowed for each letter, ten letters are presented. Someone must observe the examinee to determine that he does not squint. Each eye is evaluated as a separate entity. Each member may have 2 trials with each eye and all he must do is to pass once in these 2 trials for each eye, MANMED provides for a reexamination of questionable cases "not less than the day after the initial test," a total of 3 tests. A "Pass" is defined as correctly indentifying 10 of 10 letters on the 20/20 line. It is recognized that this exam protocol makes it possible for a borderline 20/20 to 20/25 to pass and to start class with mildly defective vision. The test is actually somewhat slanted in "favor" of the applicant. In the past we at NAMI have examined members who were previously declared to be 20/20 in the outlying dispensaries but who were acutally 20/30 or even 20/40. These people would have been a clear hazard to flight safety. Prior to the SA TFAC program, these errors were identified at NAMI and, although there was a lot of ill will and hurt feelings, the vision impaired were weeded out prior to flight training. With the SATFAC program, those vision impaired persons who are none the less declared 20/20 are not weeded out and go into aviation training with impaired vision. This is not good. the **de jure** declaration of PQ by Fiat does not change the **de fact** condition of impaired visual acuity. Don't make mistakes or you may cause a tremendous amount of mischief downstream.

The SATFAC program was not the product of close cooperation between the various branches of the U.S. Navy and the results have not been impressive. All indications are that this program is not going to die, either from neglect or directive. The Navy can ill afford errors in this program and the physicals must be done correctly. Quality control must be improved.

CAPT A.F. WELLS
NAMI CODE 42

AERONAUTICAL ADAPTABILTY

1. Aeronautical adaptability has long been recognized as one of the most amibiguous concepts in Naval Avia-

tion Medicine. An ongoing challenge has been to define aeronautical adaptability. A review of the concept was recently presented to the Aeromedical Advisory Council of NAMI. Excerpts are presented here for information dissemination.

2. **Aeronautical Adaptability** as described in MANMED 15.73(1) includes "physical findings and the result of the neuropsychiatric examination". The logical approach would confine physical and psychiatric Axis I diagnoses to the PQ, NPQ arena. Aeronautical Adaptability then would encompass: the personality traits and personality functioning of the individual as it pertains to the three dimensional environment of aviation and the individual's psychological functioning as it impacts on aviation safety.

3. Present working definitions of the concept:

- **Aeronautically Adaptable** (students and candidates).

Having the ability to adapt to the rigors of the aviation environment by: possessing the temperament, flexibility, and appropriate defense mechanisms necessary to suppress anxiety, maintain a compatible mood and devote full attention to flight and successful completion of a mission.

- **Aeronautically Adapted** (designated aviators and aircrew).

Those having demonstrated the ability to utilize long term appropriate defense mechanisms and displaying the temperament and personality traits **necessary to** maintain a compatible mood, suppress anxiety and devote full attention to flight safety and mission completion.

4. It is recognized that persons genuinely not psychologically adaptable to the aerospace environment as manifested by behavior, inability to adjust or inability to suppress anxiety are usually removed from aviation training programs early on. From this observation comes the concept that aeronautical adaptability, as evidenced by earning one's wings, is "permanent" in a designated Naval Aviator. Using this concept, all problems thereafter relating to his flight performance should be of an administrative vice a medical nature. As a general statement, this could be true. The confounding variable is that utilizing the dynamic concept of personality structure, prolonged stressors, significant life events, or psychotherapy can result in a changing of life goals, changing of life philosophy, and changed coping mechanisms. The revised pattern of personality traits may result in an individual being not aeronautically adapted. Conversely, persons through maturity,through learning experience, through behavioral modification over time may go from a condition of not aeronautically adaptable to one of aeronautical adaptability.

It is this more subtle but profound change in personality structure after being designated as a Naval Aviator that probably is in the domain of experienced psychiatrists with a broad knowledge of the psychological factors of the aerospace environment and the unique psychological and physical factors of the Naval aviation community.

5. PQ and AA status would relate to DSMIII-R multiaxial diagnosis in this way:

a. Axis I diagnoses (other than V Codes) by definition are considered disorders that warrant treatment and have some hope of resolution and therefore are considered to be an NPQ status for Naval aviation. Long term prognosis and return to flight status would depend upon diagnosis and response to treatment.

b. Axis II diagnoses of a personality **disorder** would be unequivocally NAA.

c. Personality **traits** not constituting a disorder manifested by a stress induced pattern of maladaptive behavior or loss of mature defenses resulting in anxiety, depression, or poor judgment (i.e. loss of suppression) would be considered not aeronautically adaptable if safety of flight were impacted.

d. V Code diagnoses exhibiting significant occupational or social dysfunction would have to be evaluated in terms of an underlying personality dysfunction (NAA) or true Axis I Mental Disorder (i.e. adjustment disorder) (NPQ).

e. Axis III disorders would be not physically qualified as determined by appropriate authority.

6. Further recommendations to utilize the concept of aeronautical adaptability are as follows:

a. When appearing before a Field Naval Aviation Evaluation Board (FNAEB) designated Naval aviation personnel would usually be considered aeronautically adapted as evidenced by past performance. The Field Naval Aviator Evaluation Board would be the mechanism for handling adminstrative difficulties encountered with (a) aviator motivation, (b) performance, (c) attitude, or (d) technical ability.

b. In selected cases, those aviators presenting with situational stress, anxiety, poor coping, or other problems of a perceived psychological/psychiatric nature would initially be deemed temporarily not physically qualified while appropriate investigations and/or specialty consultations were made. The FNAEB process should be ongoing during this evaluation. The AA/NAA determination would impact only on his future flight status.

c. Designated aviators presenting with repetitive maladaptive behavior, inappropriate anxieties or unexplained discomfort with flight could be re-evaluated for their aeronautical adaptability. Those persons demonstrating life changes or stresses of such a magnitude, over time, that personality changes have occurred may indeed be not aeronautically adapted. This should initially be investigated by a Local Board of Flight Surgeons. Results of that evaluation should then be submit-

ted to Naval Aerospace Medical Institute (NAMI), Code 42, for Departmental Review and Psychiatry review.

d. The diagnosis of Not Aeronautically Adapted in a designated aviator with a large time investment in his career has significant consequences. This diagnosis should not be taken lightly and should at the minimum have NAMI Psychiatry review and written concurrence.

e. These criteria should be applicable to Naval aviation personnel regardless of geographic location i.e. AIRPAC/AIRLANT.

7. The material presented here is necessarily brief. It is part of a continuing effort to validate the concept of Aeronautical Adaptability and qualify and quantify diagnostic criteria. A copy of the original presentation can be obtained by writing CAPTAIN JAMES C. BAGGETT in care of the Psychiatry Department, Naval Aerospace Medical Institute. Whenever questions arise feel free to call autovon 922-4238.

CAPT JAMES BAGGETT MC USN
PSYCHIATRY DEPARTMENT
NAMI CODE 21

SECOND ANNUAL AEROMEDICAL PROBLEMS COURSE THE IMPORTANCE OF CRITIQUES

In October, NAMI conducted the Second Annual Aeromedical Problems Course which was attended by over 140 fleet Flight Surgeons and Aerospace Physiologists. According to critiques filled out by the attendees, highlights *of* the four-day continuing medical education program were the keynote address by Navy Surgeon General Vice Admiral James A. Zimble, presentations on medical effects *of* lasers, HIV update, current research issues, aviation physical qualifications, and the banquet address by Major General Dailey. The course was designed by the NAMI Academics Department headed by Captain Don Angelo. Course Directors were Commanders Gary Reams and Bob Bason. Those who remarked favorably on their critiques about the ease of registration, BOQ check-in, and NALO support owe their thanks to Lieutenant Lefferts, who handled these administrative aspects.

At the same time as the Aeromedical Problems Course was being presented in the NAMI auditorium, 75 Aerospace Medicine Technicians from fleet units and MTF's were attending, in another building several blocks away, the first ever refresher training course designed exclusively for Aerospace Medicine Techicians.

Both courses shared a single goal—the dissemination of up-to-date practical information which would enable each attendee to more effectively support naval aviation. Although NAMI "puts on" each course and makes all the necessary arrangements, each year's program is based in large measure on the comments contained in the critiques of the previous year's attendees. I would be less than candid if I failed to tell you that the NAMI staff also exercises its academic prerogative by scheduling presentations which may not have been specifically requested, but which we feel will be interesting and timely or which will improve proficiency in areas where we have observed additional training may be indicated. Each critique is studied in detail and represents an important part of the course planning.

The preceding covers the formal and organized aspects of the courses. No less important is the informal and spontaneous interactive exchange of information which transpires during the week while on the airlift, or at meals, or over drinks, or during breaks. The professional progression from student flight surgeon to fleet experienced aeromedical practitioner is logarithmic, and although we are all inclined to joke about "sea stories," much can be learned from anecdotal material, particularly when the central theme is professional. Each flight surgeon practices in a slightly different milieu even if within the same subwarfare specialty community. Frequently there are similar problems or problems with a common thread. An individual flight surgeon's approach to, or solution to, these problems are invariably worthy of sharing with his colleagues just as are emerging trends, interesting case studies, disposition of problem cases, etc. It is this sort of information exchange which converts a good CME course into an outstanding one, and this is what NAMI hopes to achieve each year.

This year's attendees made some very good suggestions, some of which appeared with such frequency that they are worthy of discussion.

* Extend course to five days. NAMI would like to comply with this recommendation. However, we feel that a large measure of success of preceding courses is based on availability of airlift, and NALO advises us that the best travel days are Monday and Saturday. Therefore, for the foreseeable future it looks like we'll continue the four-day course.
* Provide time for meetings, discussions or presentations for special interest groups such as TACAIR, Maritime, FMF, etc. As all attendees are acutely aware, both day and evening hours are heavily committed. The FMF flight surgeons under Captain Charlie Bercier's aegis had a successful noontime meeting. At this writing, it looks like the only available time slots would be luncheon or Wednesday night.
* Open meeting to attendees from sister services. Space, both in the auditorium and BOO, is the limiting factor here. Next year we may invite selected participation by U.S. Army and Air Force.
* More presentations, panels and/or forums addressing specific problems with greater participation by junior flight surgeons. We welcome this suggestion.

However, a great deal of advance planning with locked-in-concrete commitment to attendance by participants will be required. Suggested topics and volunteer's names should be forwarded to CDR Gary Reams (AV 922-4558) as soon as possible.

Remember, the NAMI Aeromedical Problems Course is **your** course, and we solicit your imput and comments.

CAPT. R.A. MILLINGTON
C.O. NAMI

FIRST ANNUAL AVIATION MEDICINE TECHNICIAN SEMINAR

Another first ever seminar of the above name was held at NAMI at the same time as the Aeromedical Problems Course this year. Considered a terrific success, a total of 75 corpsmen from around the country were able to attend. Lots of good discussion was had and some problems were uncovered. First, it should be noted that the consensus of the group was that this conference be held annually. Second, funding should be provided and support for attendance at this conference given by the command. Some of the attendees (can you believe this) had to come to the conference in leave status out of their own pocket! Some of the attendees only found out about the conference at the very last minute. So, these are some problems that we as Flight Surgeons can help resolve next year. You should make every effort to have your A VT attend. The course, again, will be at the same time as the Aeromedical Problems Course. As a Flight Surgeon, you can intercede to make certain that your AVT can get away on TAD and is paid for it. The cost is minimal and the training invaluable, both from a didactic standpoint and from the opportunity to have dialogue with AVTs from around the country.

Some of the points brought up:

1.) **The AVTs would like a newsletter**. We will work on this here. 2.) They feel some things could make their life easier. Such as, **FAA certificates**. These take up an awful lot of the AVT's time. Please look at it in your area. Necessary? 3.) **PQ/NPQ Items**. This really caused a lot of discussion, some of which was not very complimentary to the Flight Surgeon. We all need to understand that the Flight Surgeon and the AVT are partners in providing quality examinations and accurate documentation to higher authority. It seems that sometimes the AVT will note a problem on the history or on the physical which is disqualifying but is subsequently told by the Flight Surgeon to either change it or ignore it and send it in as qualifying. **This** does no one a service. If you tell your AVT to do something which violates what he knows is a requirement of NAMI, orthe MMD, without explanation, you have lost your credibility as a knowledgeable, competent Flight Surgeon, and his or her respect for you as their superior, who is supposed to make the system work. One of the ways you can both get on the same track and understand that you are on the same team is to read the same newsletter. Of the 75 Techs at the seminar, two admitted to having occasionally seen this newsletter! **So how about passing it around!**

Also, there was some confusion over who can do candidate exams. Any aviation exam room with a Flight Surgeon or AMO may perform a candidate physical examination. If it is a **certified satellite facility exam,** it will not be repeated at NAMI. If it isn't, it will be. For those not examined at NAMI for entrance into Aviation, their next physical will be on their birthday in the training cycle.

HMC (AW) KAPEGHIAN
NAMI CODE 42

ASSIGNMENTS FOR STUDENT FLIGHT SURGEON CLASS 87003

GRADUATES 4 FEBRUARY 1988

LT Armstrong, Neil C.	VP-8 Brunswick, ME
LT Andros, Thomas G.	Naval Hospital, Guam
LT Baker, Bruce C.	3rd MAW, Yuma, AZ
LT Barth, Joseph J.	1st MAW, Okinawa
LCDR Bauer, Frederick V.	1st Marine Brigade, Kaneohe Bay, HI
LT Berndt, Steven D.	Naval Hospital, Memphis, TN
LT Boggs, Ralph B.	2nd MAW, Cherry Point, NC
LT Bone, William D.	3rd MAW, Yuma, AZ
L T Box, James B.	Marine Aircraft Group-26, Jacksonville, NC
LT Brownsberger, Robert J.	3rd MAW, EI Toro, CA
LT Chambers, David W.	3rd MAW, Yuma, AZ
LCDR Clark, Jonathan B.	NAMI
LT Craven, James M.	VXN-8, Patuxent River, MD
LT Davies, Evan J.	2nd MAW, Cherry Point, NC
LT Fleming, Timothy W.	3rd MAW, EI Toro, CA
LT Foreman, Daniel S.	CVW-15, Miramar, CA
LT Gould, R. Clay	Marine Aircraft Group-31 , Beaufort, SC
LT Lamers, Carla A.	HM-15, Alameda, CA
LCDR Lees, Joel A.	3rd MAW, EI Toro, CA
LT Lippincott, Tyler B.	Naval Station, Diego Garcia
LT Matthews, Robert D.	1st MAW, Okinawa
LT Mattson, Stephen D.	CVW-9, Miramar, CA
LT Moorhead, John A.	VP-9 Moffett Field, CA
LT Netherland, Donald E.	CVW-3 Cecil Field, FL
LT Nightengale, Christopher J.	VP-40 Moffett Field, CA
LT O'Malley, Donald E.	VP-10 Brunswick, ME
LCDR Padilla, John F.	Naval Reserve, Norfolk, VA
LT Smitherman, Kenton O.	VP-17 Barbers Point, HI
LT Steele, Stephen R.	3rd MAW, Yuma, AZ
LT Tandy, Thomas K. III	VP-16 Jacksonville, FL
LT Tanner, Gary A.	Marine Aircraft Group-29, Jacksonville, NC
LT Underwood, Reed S.	Marine Aircraft Group-26, Jacksonville, NC
LT Wilson, James S.	2nd MAW, Cherry Point, NC
LT Kidwell, Walter M.	NAS Dallas, TX

RESIDENT'S CORNER

BAROTRAUMA IN NAVAL AVIATION

The Naval Safety Center maintains a file of physiological episodes reports. Review of those reports for the past 5 years notes a total of 20 cases of barosinusitis and barotitis media as follows:

AIRCRAFT TYPE	NUMBER OF REPORTED INCIDENTS
P-3	7
S-3	4
C-9	3
H-60	2
H-2	1
TA-4J	1
C-12	1
C-130	1
INFLIGHT DUTIES	**NUMBER OF INCIDENTS**
AIRCREWMAN	14
NA/SNA	4
NFO	1
PASSENGER	1

The analysis of this limited data impacts operational aviation medicine. The patrol/transport aircraft account for most of the cases (12 of 20 reports or 60%). The S-3 accounts for the only carrier based aircraft reports, with one additional report from the TA-4J. The helicopter community has reported cases, which occurred during autorotative descents below 5,000 feet MSL. Few of the cases resulted from unexpected cabin depressurization, most occurred at cabin altitudes below 10,000 feet MSL.

Enlisted aircrewman accounted for 14 of 20 cases (70%). This is probably related to the transport/patrol aircraft involved in the reports (and vice versa). However, it may also indicate that aircrewman are not getting adequate medical screening or briefings concernig these hazards. Flight crew communications problems for developing medical conditions may be apparent. Episodes of barosinusitis or barotitis media may not be reported to the Safety Center as physiological episodes, therefore not enter this reporting system. A flight surgeon's inputs are important to initiate those reports, though ultimately the command is responsible. Similarly, flight surgeons must be involved in pilot/aircrew medical surveillance and briefings for these problems.

Finally, it is important for flight surgeons to be involved in training and monitoring of all aircrewmen, officer and enlisted. We spend a lot of time with the officer fliers. We may be ignoring the aircrewman, who are at more risk for these problems judging from this data. The aircrewman may be flying with more medical problems than the pilots because they view their function as less critical for safety of flight. They may not be aware of potential problems. Perhaps they don't have ready access to medical care. Possibly peer pressure or command influence cause them to avoid seeking medical evaluations in order to not be grounded. But it still affects safe mission accomplishment.

LCDR BRUCE K BOHNKER
Resident in
Aerospace Medicine
MPH Program,
Emory University

LASERS and the FLIGHT SURGEON

My interest in lasers was stimulated at the recent NAMI Problems Course and this article is the result. In it I hope to review some of the applications of lasers in the military, discuss the basic operation of lasers, describe the possible biological effects of lasers on humans, and finally discuss what a flight surgeon's response might be to a patient presenting with a possible laser injury. Sources of further information will be presented.

There is much current interest on the future uses of lasers in space in connection with a ballistic missile defense system. As discussed in Defense Electronics (July 1985), however, lasers are being extensively employed presently in the military. Applications include range finders, illuminators and target designators, ring laser gyros (replacing mechanical gyroscopes), and laser communication devices for space, air to air and submarine use. Using lasers as offensive weapons is also being developed.

LASER is an acronym for "light amplification by stimulated emission of radiation." The laser requires three components:

1. a lasing medium (eg, gas, liquid or solid) that produces the light,
2. a method of pumping energy into the lasing medium (eg, high voltage, light energy from an arc lamp, or chemical energy from a chemical reaction), and
3. an optical resonator (eg, two parallel mirrors at opposite ends of the chamber enclosing the lasing medium) that amplifies the light and transmits the light beyond the laser as a beam.

When energy is "pumped" into the lasing medium electrons of the medium are excited to higher energy levels. As they spontaneously decay to lower energy levels they give off light in the form of photons. If one of these spontaneously emitted photons strikes another atom in the lasing medium which is still "excited" that atom will be "stimulated" to emit a photon which will be equal in wavelength, phase, and direction to the "incoming" photon. If each of these 2 identical photons then "stimulate" other "excited" atoms there will be 4 then 8, 16, etc. photons produced. This "chain reaction" will continue as long as there are "excited atoms" to be stimulated.

The light created by lasers has unique properties compared to ordinary light.

1. It is "coherent" ie, all waves are exactly in phase with

each other.

2. It is highly "collimated", meaning that all rays are virtually parallel to each other. Even over long distances the laser beam only slightly diverges. In comparison with the sun (whose light rays are considered "nearly" parallel because of its distance) the image of the sun upon the human retina is ten times the diameter of the image produced by the virtually parallel rays from a laser source.
3. It is "monochromatic", meaning that all waves have virtually the same wavelength and thus the same energy.
4. It is "intense". Its brightness exceeds all known natural and man-made light sources.

The frequency of the light emitted from a laser depends on the type of lasing medium used. The carbon dioxide laser emits light with a wavelength of 10.6 microns. This radiation is in the far infrared range, is thus invisible to the eye, and produces predominately thermal effects. The neodymium yittrium aluminum garnet (Nd:YAG) laser operates in the near infrared range (1064 nm) but by frequency doubling or tripling can be made to emit visible or ultraviolet light. Lasers producing visible light include the argon laser (which emits blue and green light) and the ruby laser (producing red light).

Relatively new developments in laser technology include the dye laser and the excimer laser. The output from dye lasers may be "tunable" by selecting any of several available dyes as the lasing medium. Excimer (from "excited dimer") lasers emit intense energy in the ultraviolet range.

With respect to the acute biological effects of lasers on humans, injury to the eye is of greatest concern. Laser energy if intense enough may affect any or all of the structures of the eye regardless of the laser wavelength. However, the retina is relatively less sensitive to laser radiation in the ultraviolet (100 to 400 nm) or far infrared (1400nm and greater) range. Most of the ultraviolet and far infrared energy is absorbed in the cornea or lens. Experiments with CO2 lasers (with outputs in the far infrared) have resulted in corneal damage (eg, loss of transparency or a surface irregularity) caused by heating as the incident energy is absorbed by tears and tissue water in the cornea. Ultraviolet exposure may produce photophobia, redness, tearing, etc (eg, the painful corneal injury in "welders flash burn"). Damage to the corneal epithelium from ultraviolet laser exposure probably results from photochemical denaturation of proteins rather than from thermal effects.

Electromagnetic radiation within the visible and near infrared (ie, 400 to 1400 nm) has been designated the "retinal hazard region" as retinal effects are more likely to occur in this range. Local heating (with subsequent protein denaturation, coagulation, etc) of the retina, occurs as laser energy is absorbed by the melanin granules in the retinal pigment epithelium. Patients with more melanin in the retina may be at greater risk for laser injury because of increased energy absorption. The resulting functional vision loss from retinal damage depends on where the damage occurs. Retinal damage to the fovea or the remainder of the macula may cause significant vision loss while damage to the peripheral retina may go unnoticed by the patient.

The April 1985 issue of Military Medicine contains a review of 23 cases of accidental exposure to laser radiation along with the individual patient's signs, symptoms and eventual outcome. Immediate symptoms of laser injury included none, a bright afterimage, central or paracentral scotoma, sharp pain, and hearing a "pop" or "snap" at the time of injury. Degradation in visual acuity was correlated with the closeness of the retinal lesion to the fovea. Patients who reported "sounds" during the accidental exposure were found to have severe retinal injury.

How should one approach a patient who presents with a suspected overexposure to laser radiation? A detailed procedure is listed in NAVMEDCOM INSTRUCTION 6470.2 (Laser radiation health hazards). The examination protocol includes a medical history, visual acuity, external ocular and slit lamp examination, examination of the fundus with an ophthalmoscope, skin exam, amsler grid, and referral to an ophthalmologist. The ophthalmoscopic exam is especially important because (as stated in the Military Medicine article) there are no reports of alleged accidental laser exposures where there is a reduction in vision that is not explained by an ophthalmoscopically detectable lesion.

If you are stuck in the IO and forgot to bring your amsler grid you can manufacture one by first drawing a square with 10cm sides. Vertical and horizontal lines should then be drawn at 5 mm spacings to produce a grid. In the center of the grid place a dot as a fixation point. The grid is presented to the patient at 28 -30 cm from the eye. While looking at the central dot, the patient is asked to describe and draw any distortion he/she notes in the grid pattern.

Incidents of exposure to laser radiation are required to be reported to NAVMEDCOM and to the Naval Safety Center as discussed in SPAWARINST 5100.12A. As discussed in this instruction near misses are also reportable and the reporting procedures are different if the incident is classified.

An excellent reference on lasers in general is Safety With Lasers and Other Optical Sources, Sliney and Wolbarsht, Plenum Press. With respect to the military aspects of lasers a classified threat briefing video tape produced by Naval Air Development Center, Warminster, will soon be available at the physiology training units and from AMSOs. LCDR Wayne Dickey (AIRLANT AMSO) at 564-7028 can give you more information on the current status of the tape.

CDR MYRON ALMOND
RESIDENT IN AEROSPACE MEDICINE

Happy New

-- EDITORIAL POLICY--

The views expressed are those of the individual authors and not necessarily those of the Society of U.S. Naval Flight Surgeons.

This Newsletter is published quarterly by the Society on the first of January, April, July and October. Material for publication is solicited from the membership and should be typed **double spaced,** reaching the Editor at least one month prior to the scheduled date of publication. Unsigned material will not be considered.

Correspondence should be addressed to:

CAPT D.S. ANGELO, MC, USN
Editor, SUSNFS Newsletter
Naval Aerospace Medical Institute
Code 32
NAS Pensacola, FL 32508